Commonality in resiliency and its determinants

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Abstract

We provide the first systematic study of commonality in liquidity resiliency and its determinants for euro area sovereign bonds. We document the presence of common factors in resiliency for core and periphery sovereign bond markets focusing on the euro area sovereign debt crisis period. Our findings are consistent with the predictions of supply-side explanations related to funding liquidity constraints, especially for the financially distressed periphery countries during the crisis period. We further show that findings from earlier studies that use conventional spread and depth liquidity proxies carry over to resiliency, indicating that commonality in resiliency is determined by the same demand- and supply-side variables, on average.

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1. Introduction

Market liquidity is multidimensional and is loosely defined as the ease with which transactions occur in the marketplace with little impact on prices. According to Borio (2000) and Lybek and Sarr (2002) among others, liquidity has several dimensions: *tightness*, usually represented by the bid-ask spread, *depth* which relates to the size of transactions in financial markets, *immediacy* which refers to the speed with which transactions are executed, and finally *resiliency* which refers to the ease with which prices revert to their normal levels following a financial shock.

Resiliency is a neglected dimension of liquidity, although extremely important, compared to the other liquidity dimensions with far fewer academic studies at the international level. Being able to measure the speed at which liquidity reverts to its normal levels after a disequilibrium state is important for investors, stock exchanges, and market makers, but also for regulators and policymakers who need to evaluate the resilience of the financial system and make informed decisions especially during periods of stress where liquidity can evaporate quickly and threaten financial stability.

Investors prefer to hold securities that are liquid (Amihud and Mendelson, 1986; Amihud, 2002) and exhibit low exposure to systematic liquidity risk (Pástor and Stambaugh, 2003; Acharya and Pedersen, 2005; Sadka, 2006; Korajczyk and Sadka, 2008; Karolyi et al., 2012; Wu, 2019). To fully understand the liquidity effects on asset prices and investors' preferences we need to examine the liquidity co-movement among individual securities, so called "commonality" in liquidity. Commonality in liquidity refers to the impact of a common or market-wide liquidity factor on an individual security, both in terms of spreads and depths (Brockman et al., 2009). Liquidity uncertainty can be seen as a determinant of liquidity commonality as market uncertainty exerts a large market-wide impact on liquidity, giving rise to co-movements in individual asset liquidity (Chung and Chuwonganant, 2014; Rehse et al., 2019). Along these lines, we select to study the euro area sovereign debt crisis period as a natural experiment, given that commonality in liquidity is affected by market uncertainty and the state of the economy.

Chordia et al. (2000), Hasbrouck and Seppi (2001), and Huberman and Halka (2001) were the first to study commonality in liquidity for NYSE listed stocks. The literature on liquidity commonality in bond markets, and in particular the euro area sovereign bond market, is scarce (Coluzzi et al., 2008; Schneider et al., 2016; O'Sullivan and Papavassiliou, 2020) whilst there are only a couple of studies on commonality in liquidity resiliency (Kempf et al., 2015; O'Sullivan et al., 2024). Kempf et al. (2015) study the presence of common factors in the liquidity of FTSE-100 stocks, and more recently, O'Sullivan et al. (2024) were the first to examine the commonality in resiliency of euro area sovereign bond markets.

Although there have been attempts in recent years to measure commonality in liquidity using different methodological approaches, we know relatively little about the fundamental sources that drive commonality in liquidity. A few studies have supported supply-side sources as significant drivers of commonality in liquidity that are mainly related to the funding constraints of financial intermediaries (Coughenour and Saad, 2004; Brunnermeier and Pedersen, 2009; Hameed et al., 2010; Comerton-Forde et al., 2010) whereas other studies have supported demand-side sources as significant determinants of commonality in liquidity (Chordia et al., 2000; Huberman and Halka, 2001; Kamara et al., 2008; Karolyi et al., 2012; Koch et al., 2016). Almost all of the evidence we have on the determinants of commonality in liquidity focuses on U.S. markets, and in particular the stock market. To the best of our knowledge there are only a couple of studies on the determinants of commonality in bond market liquidity and both focus on euro area sovereign bond markets (Richter, 2022; Panagiotou et al., 2023). Our study is the first to investigate the determinants of commonality in resiliency and that's our main contribution.

Specifically, we contribute to the related literature in the following ways.

First, we provide more robust evidence regarding commonality in resiliency for euro area sovereign bonds of core and periphery countries, focusing on the sovereign debt crisis period. We are motivated by liquidity's role during crisis periods as its deterioration raises significant concerns about global financial stability given that it may result in a systematic market-wide liquidity collapse (Chordia et al., 2000; Vayanos, 2004; Gefang et al., 2011). The euro area sovereign debt crisis period offers a unique and ideal environment to conduct research on liquidity resiliency and its commonality. The euro area sovereign bond market despite being an integrated market as part of the Economic and Monetary Union (EMU), is a diverse and fragmented market (as opposed to the U.S. Treasury market) in terms of the different credit risk characteristics and macroeconomic fundamentals of its constituent markets, and the dispersion of liquidity, thereby the study of liquidity resiliency is increasingly relevant (O'Sullivan et al., 2024).

Our analysis is focused on a comprehensive high-frequency dataset from the MTS markets (Mercato dei Titoli di Stato), Europe's leading inter-dealer fixed-income market for euro-denominated government bonds. The use of high-frequency data enables the construction of more accurate liquidity and volatility measures and offers greater predictive accuracy and statistical gains, thereby is extremely important for constructing accurate resiliency measures (Gargano et al., 2019). We define resiliency as the rate of mean reversion in liquidity following Kempf et al. (2015) and O'Sullivan et al. (2024) and study commonality in resiliency for GIIPS and non-GIIPS countries during calm and crisis periods[1]. GIIPS's liquidity significantly deteriorated during the debt crisis in contrast to the liquidity levels of non-GIIPS countries (Beetsma et al., 2013; Pelizzon et al., 2016; Papavassiliou and Kinateder, 2021), therefore gaining insights on commonality in resiliency between these two groups of countries during crisis and non-crisis periods is

[1]The acronym GIIPS refers to the financially distressed economies of Greece, Ireland, Italy, Portugal and Spain during the euro area sovereign debt crisis.

of great value for market participants and regulators. Using canonical correlation analysis (CCA) we document the presence of statistically significant common factors in resiliency in both non-crisis and crisis periods.

Our second and most important contribution is the evaluation of supply- and demand-side explanations for commonality in resiliency. We regress commonality in resiliency on a number of cross-sectional supply- and demand-side proxies of commonality, and various market and economic control variables that may potentially be impactful determinants of commonality in resiliency. We find that supply-side explanations are more important than demand-side explanations for GIIPS countries, especially during the crisis period, whereas the impact that demand- and supply-side explanations exert on non-GIIPS countries commonality is very similar. This result contradicts findings by Karolyi et al. (2012) and Koch et al. (2016) from the U.S. stock market, but is in agreement with theoretical predictions by Brunnermeier and Pedersen (2009) and with findings by Coughenour and Saad (2004) and Comerton-Forde et al. (2010) from the U.S. stock markets, and by Richter (2022) and Panagiotou et al. (2023) from euro area bond markets. Brunnermeier and Pedersen (2009) find that during times of funding constraints commonality in liquidity strengthens as a result of reductions in the provision of liquidity by financial intermediaries.

Within the supply-side models, resiliency does not appear to be a significant driver for non-GIIPS countries and the results for spread-based resiliency are stronger than those of depth-based resiliency. The fact that the LOIS spread is significant pre-crisis and European Central Bank (ECB) excess liquidity is significant during the crisis, is in line with the supply-side explanations of commonality. Within the demand-side models, resiliency does not appear to significantly drive commonality of non-GIIPS countries, nevertheless, spread-based resiliency is more important than depth-based resiliency, in agreement with the supply-side explanations. Overall, we show that findings from earlier studies that use conventional spread and depth liquidity proxies carry over to resiliency, indicating that commonality in resiliency is impacted by the same supply- and demand-side variables, on average.

The rest of the paper is organized as follows. Section 2 presents the related literature. Section 3 discusses the methods and hypothesis. Section 4 describes the dataset. Section 5 presents the empirical findings. Section 6 offers some concluding remarks.

2. Related literature

The seminal papers on commonality in liquidity are those of Chordia et al. (2000), Huberman and Halka (2001) , and Hasbrouck and Seppi (2001) who document the presence of a systematic, time-varying component of liquidity for NYSE listed stocks. Coughenour and Saad (2004) argue that common market makers on the NYSE induce common liquidity movements indicating that individual stock liquidity co-varies with specialist portfolio liquidity. Kamara et al. (2008) study the evolution of liquidity commonality across U.S. stocks from 1963 through 2005 and find that commonality in liquidity increased significantly for large firms, but declined for small firms. Brockman et al. (2009) document the pervasive role of liquidity commonality within and across stock exchanges around the world, and find evidence for the existence of global commonality in spreads and depths that spills over national borders. Hameed et al. (2010) find large increases in liquidity commonality after large negative market returns that coincide with periods associated with liquidity crises. With regard to foreign exchange markets, Mancini et al. (2013) find significant variation in liquidity across exchange rates and strong commonality in liquidity across currencies and with equity and bond markets.

The literature on liquidity commonality in bond markets is more limited. Fleming (2003) finds strong commonality in liquidity in the U.S. Treasury market across securities and liquidity proxies, while Chordia et al. (2005) study liquidity co-movements across stocks and bonds and argue that liquidity shocks exhibit systemic patterns over time. Cotelioglu (2024) finds a positive and significant relationship between ETF ownership and liquidity commonality in investment-grade corporate bonds. Evidence of commonality in liquidity in the euro area government bond market is provided by Coluzzi et al. (2008), Schneider et al. (2016), and O'Sullivan and Papavassiliou (2020). O'Sullivan and Papavassiliou (2020) provide evidence for the existence of significant commonalities in spread and depth-based measures of liquidity, especially in the periphery countries in which market-wide liquidity risk was high during the sovereign debt crisis.

Research on the commonality in liquidity resiliency is almost non-existent. To the best of our knowledge the only two studies that examine commonality in liquidity resiliency are those of Kempf et al. (2015) (FTSE-100 stocks) and O'Sullivan et al. (2024) (euro area sovereign bonds). Both studies document strong commonality in resiliency especially during crisis periods.

Our study is also related to the literature that examines the fundamental sources that drive commonality in liquidity. There are studies from U.S. stock markets that have provided support for supply-side sources of commonality in liquidity (Coughenour and Saad, 2004; Brunnermeier and Pedersen, 2009; Hameed et al., 2010; Comerton-Forde et al., 2010), and others that have supported demand-side sources of commonality (Chordia et al., 2000; Hasbrouck and Seppi, 2001; Huberman and Halka, 2001; Koch et al., 2016). Karolyi et al. (2012) were the first to take a global perspective and examined how commonality in liquidity varies across countries' stock markets and over time in ways related to supply and demand determinants of liquidity. Their findings mainly support demand-side explanations and document that commonality in liquidity is higher during periods of high market volatility, greater presence of international investors, and more correlated trading activity.

As far as we are aware, there are only a couple of studies on the fundamental sources that drive commonality in liquidity in bond markets. Panagiotou et al. (2023) find stronger evidence in favour of supply-side determinants of liquidity commonality in euro area sovereign bond markets, while the demand-side proxies they use do not help explain time-variation of commonality in liquidity. Richter (2022) finds that liquidity commonality in euro area bonds is mainly driven by supply-side proxies including the number of market makers and local bank returns, suggesting that the drivers of liquidity commonality depend on market design. Our study is the first to investigate the fundamental sources that drive commonality in resiliency.

3. Methods and Hypotheses

Given the presence of common factors in resiliency as documented by Kempf et al. (2015) and O'Sullivan et al. (2024), we use CCA to show whether they are statistically correlated with each other. As resiliency is a neglected liquidity dimension, we deem necessary to provide more robust additional evidence in relation to its commonality. CCA studies the magnitude of correlations between two sets of variables and can be viewed as an extension of multiple regression analysis. CCA derives one or more canonical functions where each function consists of a pair of variates, one representing the independent variables and the other representing the dependent ones. The canonical variates are based on residual variance and their respective canonical correlations, when squared, represent the amount of variance in one canonical variate that is shared with the other canonical variate. Borga (2001) describes the procedure for calculating canonical correlations:

Consider two random variables x and y with zero mean. The covariance matrix

$$C = \begin{bmatrix} C_{xx} & C_{xy} \\ C_{yx} & C_{yy} \end{bmatrix} = E\left[\begin{pmatrix} x \\ y \end{pmatrix} \quad \begin{pmatrix} x \\ y \end{pmatrix}^T \right] \tag{1}$$

represents a block matrix where C_{xx} and C_{yy} are the within-sets covariance matrices of x and y respectively, and $C_{xy} = C_{yx}^T$ is the between-sets covariance matrix. The canonical correlations between x and y are derived by solving the following eigenvalue equations:

$$\begin{cases} C_{xx}^{-1} C_{xy} C_{yy}^{-1} C_{yx} \widehat{w}_x = \rho^2 \widehat{w}_x \\ C_{yy}^{-1} C_{yx} C_{xx}^{-1} C_{xy} \widehat{w}_y = \rho^2 \widehat{w}_y \end{cases} \tag{2}$$

where ρ^2 are the squared canonical correlations and $\widehat{w}_x$, $\widehat{w}_y$ are the normalized canonical correlation basis vectors. To determine the explained variance in each actual variable, one must take into account not only the squared canonical correlations, but also the canonical loadings of the variable. This would help identifying the amount of variance in the independent variate that is explained by the dependent variate, and vice versa. To overcome this uncertainty we also use a redundancy index which serves as a measure of explained variance, similar to the R^2 measure used in multiple regression analysis (see Hair et al., 2018 for a discussion).

In this section, we also develop the hypotheses for our empirical tests. We first set the stage for the supply-side hypothesis. Previous research has shown that commonality in liquidity can be the result of events that are related to the supply of liquidity (Karolyi et al., 2012). Brunnermeier and Pedersen (2009) discuss the funding constraints that financial intermediaries face when markets decline, forcing them to reduce the provision of liquidity in order to minimize their losses. The decrease in market liquidity that comes as a result can persist for a long time due to a "feedback loop" that further restricts the provision of liquidity by intermediaries. This can lead to an increase in commonality in liquidity. Similar findings are obtained by Kyle and Xiong (2001), Gromb and Vayanos (2002), Bernardo and Welch (2004) and Morris and Shin (2004) who emphasize the role of "liquidity black holes", the analogue of a bank run, as a result of mutually reinforcing sales among short-term traders. Vayanos (2004) and Garleanu and Pedersen (2007) show that commonality in liquidity strengthens during periods of market declines or high market volatility as market makers liquidate their positions reducing liquidity supply. Following Karolyi et al. (2012), we also perform tests of more direct proxies for time-variation in funding liquidity, such as short-term interest rates and Credit Default Swap (CDS) spreads.

With regard to demand-side hypotheses, we make use of a wide array of variables that are shown to affect commonality in liquidity. Commonality in liquidity can arise when demand for liquidity is correlated across securities due to investors' low incentives to trade (Karolyi et al., 2012). Another potential demand-side explanation for a rise in liquidity commonality is the correlated trading behavior of institutional investors, put forward by Kamara et al. (2008) and Koch et al. (2016). We include exchange rate changes between the euro and the U.S. dollar as a factor that affects the presence and trading activity of foreign institutional investors and thus, commonality in liquidity (Karolyi et al., 2012). Generally speaking, commonality in liquidity intensifies when the local currency (the euro in our case) depreciates against the foreign currency (the U.S. dollar in our case), as this may attract foreign investors in the local market. It remains to be seen whether this relationship carries over to liquidity resiliency.

We place special emphasis on investor sentiment that is an important source of commonality in liquidity. Many studies have found that commonality in liquidity is affected by the presence of noise traders (Huberman and Halka, 2001), and by country-specific sentiment shocks (Froot and Dabora, 1999; Baker and Wurgler, 2006). Hameed et al. (2010) emphasize the role of sentiment-based panic selling by investors in affecting commonality in liquidity. To test the investor sentiment hypothesis, we include a number of investor sentiment proxies. First, we use the euro area ZEW Economic Sentiment Index which measures the level of optimism that analysts have about the expected economic developments over the next 6 months. It is constructed as the difference between the percentage share of analysts that are optimistic and the percentage of analysts that are pessimistic about the development of the economy. Second, we use the Sentix euro area index and the Sentix U.S. index. The Sentix economic index can be used to forecast the development of a country's or region's gross domestic product. It is based on Sentix's monthly survey of more than 4,000 private and institutional investors on their assessment of the current and future near-term economic situation. It remains to be seen whether investor sentiment is positively or negatively related to commonality in resiliency, as evidence is not clear-cut about the direction of this relationship.

In a third step we use the Economic Policy Uncertainty (EPU) index proposed by Baker et al. (2016) for the euro area (EPU-Euro), U.K. (EPU-UK), and U.S. (EPU-US). The EPU index is based on newspaper coverage frequency and proxies for movements in policy-related economic uncertainty. Baker et al. (2016) show that the index spikes near wars, terrorist attacks (9/11), and systemic corporate failures (Lehman Brothers collapse). We expect to find a positive relationship between the EPU index and commonality in resiliency especially during the crisis period, as liquidity squeezes that occur during periods of increased uncertainty may affect investment decisions and lead to higher correlated demand for liquidity (Bali et al., 2017).

We aim at examining whether the demand- and supply-side hypotheses impact commonality in resiliency differently across the GIIPS and non-GIIPS group of countries. This is of substantial importance given the liquidity dry-ups that occured during the euro area sovereign debt crisis, especially for the periphery GIIPS countries.

4. Data

We employ high-frequency data from the MTS platforms (Mercato dei Titoli di Stato), Europe's premier interdealer fixed-income market for euro-denominated government bonds. Our dataset includes both crisis and calm periods and extends from January 2008 to December 2013. Following Claeys and Vašíček (2014), De Santis (2014), and O'Sullivan and Papavassiliou (2020), we consider November 2009 as the beginning of the euro area sovereign debt crisis.

We use data from the following countries (in alphabetical order): Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain. We use a rich dataset that contains the three best bid and ask quotations throughout each trading day, time-stamped to the nearest second. As per standard practice, we have removed quotes recorded outside regular trading hours, i.e. from 8:15 am to 5:30 pm CET. Similar to O'Sullivan and Papavassiliou (2020, 2021) we work with benchmark, fixed coupon-bearing sovereign bonds from the domestic MTS markets, using four time-to-maturity segments: 2-, 5-, 10-, and 30-year benchmark securities.

We focus on the tightness and depth liquidity dimensions and construct relative spread and quoted depth liquidity measures for all countries defined as:

- Relative spread: the best bid-ask spread divided by the quote midpoint, where best spread is the difference between the best ask quote and the best bid quote, while the midpoint is estimated as: $(A_{it}+\mathrm{B}_{it})/2$, where A_{it} is the posted best ask price for security i at time t, and B_{it} is the best posted bid price for security i at time t.

- Quoted depth: best bid size plus best ask size, where size denotes the quantity of securities bid or offered for sale.

We estimate resiliency following Kempf et al. (2015). The relationship between past liquidity levels L_{t-1} and current liquidity flows $\Delta L_t = L_t - L_{t-1}$ is modelled as a mean reversion process of the form:

$$\Delta L_t = \kappa \left(\phi - L_{t-1}\right) + \varepsilon_t \tag{3}$$

where φ denotes liquidity's long-run value, κ is the speed of adjustment to liquidity's long-run value which measures resiliency, and ε_t is a normally distributed white noise error term. The higher the speed of adjustment κ, the higher the liquidity resiliency in the bond market. To remove serial correlation in the model's residuals (liquidity is persistent as documented in previous studies, e.g. Chordia et al. (2000) and Hasbrouck and Seppi (2001)) and to eliminate possible bias in the estimation of resiliency, we include past liquidity changes as additional explanatory variables in the model as follows:

$$\Delta L_{i,t}^{S/D} = \alpha_{i,T}^{S/D} - \kappa_{i,T}^{S/D} L_{i,t-1}^{S/D} + \sum_{\tau=1}^{3} \psi_{i,t-\tau}^{S/D} \Delta L_{i,t-\tau}^{S/D} + \varepsilon_{i,t}^{S/D} \quad (4)$$

where S/D indicates whether liquidity is proxied via the relative spread (S) or the quoted depth (D), and t denotes the time index of day T. The appropriate number of lags for inclusion in the model is estimated using the Akaike information criterion (AIC). We estimate the model on a daily basis for all countries' benchmark bonds using a 5-minute interval in the liquidity data. We follow the approach of O'Sullivan et al. (2024) and winsorize by 95 percent the spread and depth liquidity measures in order to weed out the morning and afternoon extreme values so as not to affect our resiliency estimates. Along these lines, we impose a non-negativity truncation on the resiliency measures to avoid resiliency taking on negative values.

We also use a wide array of demand-side and supply-side variables to study the fundamental sources that drive commonality in resiliency. Specifically, we employ the following *control* variables:

- Sovereign bond market logarithmic returns.
- Trading volume, computed as the first extracted principal component from all individual bond quoted depth liquidity proxy.
- Market liquidity resiliency (spread- and depth-based), defined as the first principal component extracted from the resiliency of individual bonds.
- Credit Default Swap (CDS) spreads obtained from Markit.

- 10-year sovereign bond yield data obtained from Bloomberg (the first extracted principal component of the respective countries' 10-year bond yields is applied).
- MOVE index, a market-implied measure of bond market volatility obtained from Refinitiv, which is calculated from options prices and reflects the collective expectations of market participants about future volatility.

We also employ the following *supply-side* variables:

- European Overnight Index Average (EONIA) rate, the interest rate for one-day loans between European banks, obtained from the ECB Statistical Data Warehouse. The hypothesized correlation between changes in the EONIA rate and changes in commonality is positive, as it reflects tighter credit conditions and higher costs of debt.
- Treasury Eurodollar (TED) spread, the difference between the interest rate on three-month U.S. Treasury bills and the three-month LIBOR, obtained from the FRED economic database (St. Louis FED).
- FTSEurofirst 300 Banks Index, the domestic bank returns for the 10 Eurozone countries obtained from Refinitiv.
- London Interbank Offered Rate and Overnight Indexed Swap (LOIS) spread, a key measure of credit risk within the banking sector obtained from Bloomberg. A higher LOIS spread implies that banks are less willing to borrow funds from each other in the interbank market, signaling the presence of liquidity dry-ups as well as higher funding costs.
- ECB excess liquidity, which represents liquidity amounts exceeding those consistent with minimum reserve requirements, obtained from

the ECB website. The relationship between excess liquidity and commonality in resiliency is expected to be positive, as a result of ECB's liquidity operations.

- Euro Stoxx bank index, a capitalization-weighted index that includes banks in the monetary union and in Europe, obtained from Refinitiv.

Finally, we use the following *demand-side* variables (described in Section 3):

- ZEW euro area Economic Sentiment Index obtained from Refinitiv.
- Sentix euro area and Sentix U.S. sentiment index obtained from Refinitiv.
- Economic Policy Uncertainty (EPU-Euro, EPU-UK, and EPU-US) index, obtained from the economic policy uncertainty website of Baker et al. (2016).
- Foreign exchange rate fluctuations (EUR/USD) obtained from Refinitiv.

5. Empirical findings and discussion

We divide our empirical findings into two sections. Section 5.1 presents and discusses the results of CCA. Section 5.2 examines the fundamental sources that drive commonality in resiliency in ways related to supply and demand determinants of liquidity.

5.1. Canonical correlation analysis

The studies by Kempf et al. (2015) and O'Sullivan et al. (2024) provide evidence of commonality in resiliency for stocks and sovereign bonds, respectively. Kempf et al. (2015) use the approach of Chordia et al. (2000) and document the presence of commonality in resiliency for FTSE-100 stocks. More recently, O'Sullivan et al. (2024) document strong commonality in resiliency for euro area sovereign bonds using principal components analysis (PCA). We take one step further to investigate the presence of common factors in resiliency using CCA.

Unlike PCA that deals with relationships within sets of variables, CCA deals with relationships between sets of variables, in fact it seeks linear combinations of variables from two datasets that maximize their correlation. Both methods are complementary since the ratios correlated to the extracted factors in PCA are also important in defining the canonical variates in CCA (Garcia-Gallego and Mures-Quintana, 2016). However, as CCA determines the canonical variates that are orthogonal linear combinations of the variables within each set that best explain the variability both within and between sets, it will provide more robust evidence regarding the presence of common factors in resiliency.

Table 1 presents the CCA results for spread-based resiliency. We aim at investigating whether commonality in resiliency exists between GIIPS and non-GIIPS sovereign bond markets, and whether any documented commonality between them is statistically significant. That is, our objective is to evaluate the strength of the association between GIIPS and non-GIIPS sovereign bond resiliency. The independent variable set (predictor) includes the spread-based resiliency for non-GIIPS countries (Austria, Belgium, Finland, France, Germany, and the Netherlands), whilst the dependent variable set includes the corresponding resiliency measures for GIIPS countries (Greece, Ireland, Italy, Portugal, and Spain). We include all four maturity segments in the model for all countries which sums the independent variable set to 24 and the dependent variable set to 20. In CCA, although one variable set is often identified as the predictor set and the other as the criterion set, the nature of the approach being a correlational method makes the selection ultimately arbitrary (Sherry and Henson, 2005).

Panel A of Table 1 reports the first three canonical correlations. The first canonical correlation of 0.778 is more important than the others, while the second and third canonical correlations take on the values of 0.450 and 0.382 respectively, pre-crisis. Although not reported, the first three squared canonical correlations are 0.605, 0.203, and 0.146 respectively, and indicate a strong canonical relationship between GIIPS and non-GIIPS resiliency.

Panel B of the table reports the canonical redundancy analysis, i.e. the proportion and cumulative proportion of total variation in GIIPS and non-GIIPS resiliency that is explained by the canonical variates. The first canonical variate for non-GIIPS resiliency explains 16.7% of the non-GIIPS resiliency variation and 20.7% of the GIIPS resiliency variation. Respectively, the first canonical variate for GIIPS resiliency explains 10.1% of the non-GIIPS resiliency variation and 12.5% of the GIIPS resiliency variation. The first three covariates for non-GIIPS resiliency explain 25.8% of the non-GIIPS resiliency variation and 32.6% of the GIIPS resiliency variation, while the corresponding percentages for the first three covariates for GIIPS resiliency are 11.7% and 14.7%, respectively. In the crisis period, there is a reduction in the explained variation in the dependent variable set, however, the amount explained is still high and significant.

Panel C of the table presents tests of statistical significance. The tests indicate that the two sets of variables are significantly associated by canonical correlation. The Wilks' lambda, F-statistic, and p-value are reported. The results show that non-GIIPS spread-based resiliency is statistically relevant for predicting GIIPS resiliency pre-crisis. The crisis period results are also statistically significant and exhibit higher Wilks' lambda and F-statistic values than those in the pre-crisis, suggesting that common factors have a profound impact on the relationship between GIIPS and non-GIIPS resiliency.

Table 2 presents the CCA results for depth-based resiliency which are qualitative similar to those of spread-based resiliency. Overall, the results indicate that the liquidity resiliency of GIIPS and non-GIIPS countries exhibits stronger commonalities pre-crisis, however, common factors remain at reasonably high levels during the crisis period as well. Since the presence of commonality in resiliency is now established, we study the drivers of such commonality in the section that follows.

5.2. Drivers of commonality in liquidity resiliency

Our measure of commonality is a variant of the approach used in Mancini et al. (2013). We run regressions of individual bond liquidity resiliency on regional liquidity resiliency (where the region is either GIIPS, or non-GIIPS) as follows:

$$L_{j,t}^{\tau} = \alpha_j^{\tau} + \beta_j^{\tau} L_{R,t} + \epsilon_{j,t}^{\tau} \tag{5}$$

where $L_{j,t}^{\tau}$ is day t liquidity resiliency (either relative spread or quoted depth) for a bond from country j with maturity τ, $L_{R,t}$ is regional liquidity resiliency taken to be the first principal component from the panel containing the resiliency of all bonds in a given region, β_j^{τ} is the slope coefficient and $\epsilon_{j,t}^{\tau}$ are the idiosyncratic liquidity resiliency shocks for the bond. The average adjusted R-squared from the above regressions across all bonds in a region is taken as a measure of that region's commonality in liquidity resiliency. We extract adjusted R-squared, $R_{COM,m}^2$, on a monthly basis for months $m = 1, \ldots, M$.

We examine the impact supply and demand based factors have on commonality by running regressions of the following form:

$$\Delta R_{Com,m}^2 = \alpha + \beta \Delta \text{Proxy}_m + \gamma \Delta \text{Controls}_m + \varepsilon_m \tag{6}$$

where $R_{Com,m}^2$ is the monthly adjusted R-squared measuring commonality in resiliency, *Proxy* refers to cross-sectional supply-side and demand-side drivers of commonality in resiliency in the euro area, and *Controls* denotes the cross-sectional market or economic controls that potentially impact commonality in resiliency. Differences are used to ensure the dependent and independent variables are stationary. A constant term is included to assess whether commonality in resiliency has increased or decreased over time. Newey-West standard errors are reported in the above regressions.

Table 3 (5) reports results for supply-side drivers of commonality in relative spread (RS) resiliency of non-GIIPS countries in the pre-crisis (crisis) period. Model 1 is the model in Equation (6). In Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the models, while Model 8 includes all supply-side variables that are added to the base model contemporaneously. Focusing first on controls, as described in Section 4, we find that commonality in RS resiliency increases with market returns and trading volume which agrees with results in Panagiotou et al (2023). This finding indicates that when the market performs well with positive returns and increased trading activity, commonality in resiliency strengthens. This relation reverses in the crisis period as depicted in Table 5 where a fall in market returns and trading volume result in an increase in commonality, although the regression coefficients are not significant. In both pre-crisis and crisis samples, an increase in the level of resiliency results in a reduction in commonality as liquidity resiliency amongst individual bonds is more likely to move together when resiliency itself is falling. This effect is highly significant in the pre-crisis sample although is not significant in the crisis. CDS premia increases result in (in)significant increases in commonality in pre-crisis (crisis) periods, whereas bond yields do not significantly impact commonality in both samples, a finding inconsistent with supply-side explanations of liquidity commonality, which confirms the findings in Karolyi et al. (2012) and Panagiotou et al. (2023). This aligns with the expectation that higher credit risk leads to increased uncertainty in the market, causing investors to react more uniformly to market-wide factors, thereby increasing commonality in RS resiliency. Finally, market volatility (in)significantly impacts commonality in the pre-crisis (crisis) sample with higher market volatility resulting in higher commonality as expected. This finding is consistent with the funding liquidity hypothesis and is in line with the results from stock markets in Karolyi et al. (2012), foreign exchange markets in Mancini et al. (2013), and sovereign bond markets in Panagiotou et al. (2023).

Turning to the proxies for supply-side determinants, we find that the EONIA rate and TED spread do not impact RS commonality in both pre- and crisis periods. FTSEurofirst 300 returns positively impact RS commonality in the pre-crisis period with a p-value of 0.042 but are insignificant in the crisis period which contradicts the predictions of the funding liquidity hypothesis (it implies that when market makers' capital constraints tighten, liquidity increases) and is in line with the findings in Karolyi et al. (2012) but contradicts those in Richter (2022). This is similar to the result that market returns have a positive impact on commonality in the pre-crisis period. In the pre-crisis period, market participants are less concerned about the solvency of euro area banks and their impact on RS resiliency commonality is in line with the impact of overall market returns on commonality. We also find commonality decreasing in LOIS spreads with a p-value of 0.013 pre-crisis but with an insignificant relation in the crisis period. In the pre-crisis period, ECB excess liquidity and Euro Stoxx bank index returns do not have a significant impact on commonality in non-GIIPS bond resiliency but they become significant drivers of commonality in the crisis period. The excess ECB liquidity is likely synchronously invested into the bond market by banks, thus increasing bond market RS resiliency commonality. The effect of excess ECB liquidity on commonality in resiliency is consistent with the supply-side explanations of commonality and the findings by Pelizzon et al. (2016) which highlight the importance of funding liquidity as determinant of market liquidity during periods of stress. Similarly, in the crisis period we find that a decrease in dealer stock returns is associated with an increase in resiliency commonality, as the ability of market makers to operate in the crisis period is impacted resulting in liquidity dry-ups and increased synchronization of bond market resiliency measures. As we transition from the pre-crisis to crisis, the R-squared values decrease as a result of the aforementioned breakdowns in liquidity.

Table 4 (6) reports results for supply-side drivers of commonality in quoted depth (QD) resiliency of non-GIIPS countries in the pre-crisis (crisis) period. Similar to RS resiliency, we observe that QD resiliency commonality increases with trading volume and decreases with the level of QD resiliency, although the latter relation is not significant. We also find that QD resiliency commonality increases significantly with the FTSEurofirst 300 returns and decreases significantly with the LOIS spread in the pre-crisis period as we found with RS resiliency commonality, which refutes the predictions of the supply-side hypothesis. Furthermore, in the crisis period, QD resiliency commonality increases with ECB excess liquidity as dealers are likely to simultaneously invest a large portion of this excess liquidity into euro area government bonds. The R-squared values in Table 4 are lower than those in Table 3 which indicates that models based on RS resiliency explain a more substantial proportion of variance in liquidity than the models based on QD resiliency during the pre-crisis period. This is in agreement with O'Sullivan and Papavassiliou (2020) where is reported that spread-based liquidity commonality tends to be stronger than depth-based commonality.

Demand-side drivers are examined in Tables 7 to 10 for the non-GIIPS region. Table 7 (9) reports results for demand-side drivers of commonality in spread-based resiliency of non-GIIPS countries in the pre-crisis (crisis) period. Model 9 includes all demand-side variables that are added to the base model contemporaneously. Pre-crisis, the EUR/USD exchange rate is the only demand-side proxy that marginally impacts RS resiliency commonality for non-GIIPS bonds. Increases in the EUR/USD rate result in increased commonality, possibly as a result of USD appreciation indicating an increase in demand for a reserve currency which also increases demand for safe assets such as non-GIIPS bonds. This result is in agreement with the observations in Karolyi et al. (2012) but contradicts findings in Richter (2022) who examines commonality in the euro area bond market using conventional liquidity proxies. In the crisis period depicted in Table 9, the Sentix-euro area measurement of sentiment is the only demand proxy that significantly impacts non-GIIPS RS resiliency commonality, with a decrease in sentiment resulting in an increase in commonality with market participants rebalancing their portfolios into safer non-GIIPS bonds.

The results for demand-side drivers of QD resiliency commonality are presented in Tables 8(10) for the pre-crisis (crisis) period. Pre-crisis, the EUR/USD exchange rate increases QD resiliency commonality as we found for RS resiliency commonality. We also find EPU-US significantly negatively impacts QD commonality, meaning an increase in U.S. policy uncertainty, whilst controlling for European policy uncertainty, results in commonality dropping. This could possibly be due to higher U.S. policy uncertainty resulting in more demand for U.S. Treasuries and non-GIIPS bonds, increasing the quoted depth in non-GIIPS bonds thus reducing the commonality in QD resiliency. In the crisis period, both U.S. policy uncertainty and European policy uncertainty negatively impact QD resiliency but are just outside the 10% significance level.

Table 11 (13) reports results for supply-side drivers of commonality in RS resiliency for GIIPS bonds in the pre-crisis (crisis) period. Similar to the results reported for non-GIIPS bonds, we find euro area bank returns positively impact RS resiliency commonality pre-crisis but no other supply-side driver impacts RS resiliency commonality in this sample period. In the crisis, we also find that no supply-side driver impacts RS resiliency commonality, however, in Model 8 most of those drivers appear statistically significant when added contemporaneously to the model along with the control variables.

Table 12 (14) reports results for supply-side drivers of commonality in QD resiliency for GIIPS bonds in the pre-crisis (crisis) period. As with RS resiliency commonality, we find that euro area bank returns are the only significant supply-side driver with bank returns positively impacting QD resiliency commonality pre-crisis. In the crisis, we find that the TED spread and ECB excess liquidity positively impact QD resiliency commonality and that euro area bank returns negatively impact commonality in resiliency. The TED spread increasing is indicative of increasing credit and liquidity risk in markets and is associated with an increase in QD resiliency commonality as it is likely investors rebalance their portfolios away from GIIPS bonds. A decrease in euro area bank returns in the crisis is associated with increased QD resiliency commonality as liquidity reduces considerably in these bonds. As with previous findings, we show ECB excess liquidity results in increases in commonality likely due to the synchronized use of these excess liquidity reserves by dealer banks.

Table 15 (17) reports results for demand-side drivers of commonality in RS resiliency for GIIPS bonds in the pre-crisis (crisis) period, and Table 16 (18) reports the same drivers for QD resiliency. In Table 15 we observe that no demand-side driver impacts RS resiliency in the pre-crisis. In the crisis, Table 17 shows that an increase in European policy uncertainty results in a decrease in RS resiliency commonality but this impact is only marginally significant. Similarly, Table 16 shows an increase in U.S. policy uncertainty results in a decrease in QD resiliency commonality in the pre-crisis, with no significant demand-side drivers in GIIPS QD resiliency commonality over the crisis shown in Table 18. We find no evidence that sentiment index helps to explain time-variation in commonality in resiliency.

The key findings from these results are the following. First, supply-side explanations are more important than demand-side explanations for the GIIPS countries in both pre-crisis and crisis periods, even after controlling for market volatility, market liquidity and trading activity, although evidence is stronger for the crisis period. This result contradicts the findings by Karolyi et al. (2012) and Koch et al. (2016) who find the demand-side factors more important than the supply-side ones for U.S. stocks, and shows that during large market declines such as those of the euro area debt crisis, supply-side factors contribute more to commonality variation. However, this result is in line with the predictions of Brunnermeier and Pedersen (2009) who argue that commonality arises in times of tight funding constraints, and with findings in Coughenour and Saad (2004) and Comerton-Forde et al. (2010) from U.S. stock markets, and with those in Richter (2022) and Panagiotou et al. (2023) from euro area sovereign bond markets. Richter (2022) argues that this finding in sovereign bond markets may be due to the fact that bond markets use only a relatively small number of dealers to supply liquidity compared to the stock market which uses a larger number of market participants who trade with each other in a limit order book market setting. The impact of demand- and supply-side explanations on non-GIIPS countries commonality is very similar with no dramatic differences, however, the results are not as strong as those for GIIPS countries. This makes perfect sense as GIIPS countries documented larger market declines than non-GIIPS countries during the crisis, and exhibited tighter funding constraints reflecting the unwillingness of banks to intermediate.

Second, within the supply-side models, spread-based resiliency is highly significant during the crisis for GIIPS as expected, but is insignificant pre-crisis. In the crisis period, spread-based resiliency is a highly significant driver of commonality with increases in resiliency driving declines in commonality (see Table 13), whereas it is only a significant driver of commonality during the pre-crisis period for GIIPS in the case of the full multivariate model. In this case, an increase in resiliency is associated with a decline in commonality in resiliency (see Table 11). On the other hand, depth-based resiliency for GIIPS is not significant during the crisis, but becomes statistically significant pre-crisis. As depth-based resiliency increases, we find that commonality falls (see Table 12). Although the results are not always significant the overall association is that an increase in liquidity resiliency results in declines in liquidity commonality. When market liquidity is more resilient (either spread- or depth-based market liquidity) the market recovers quicker from price shocks both in terms of spreads reducing and depths increasing. This in turn reduces commonality in resiliency where the latter mainly increases during turbulent times, times of liquidity crunches or during liquidity injections (Hameed et al., 2010; Karolyi et al., 2012) [2].

Overall, the results for spread-based resiliency are stronger than those of depth-based resiliency confirming previous findings by Panagiotou et al. (2023) and O'Sullivan et al. (2024). Supply-side variables are more significant during the crisis for GIIPS countries than pre-crisis, especially when they are added to the full regression model that includes combinations of the supply-side factors with the control variables. We get conflicting results for market returns, but consistent results for volatility between spread- and depth-based resiliency for GIIPS. With regard to non-GIIPS countries, we find that trading volume, volatility, spread-based resiliency, and CDS spreads are statistically significant pre-crisis across all models but become insignificant to a large extent during the crisis. FTSEurofirst 300 returns and the LOIS spread are significant only pre-crisis, whilst ECB excess liquidity and Euro Stoxx bank index returns are significant only during the crisis. LOIS spread being insignificant during the crisis indicates that banks are less willing to lend to each other and signifies the presence of liquidity shortages and an increase in funding costs. The fact that ECB excess liquidity is significant during the crisis makes sense as excess liquidity is likely synchronously invested into the bond market which strengthens commonality in resiliency, consistent with the supply-side explanations of commonality.

Third, within the demand-side models, spread-based resiliency is significant during the crisis only for GIIPS countries, whereas depth-based resiliency is significant only during the pre-crisis, a finding in agreement with

[2] Generally speaking, it is difficult to make inferences about liquidity on the basis of either spreads or depths alone. Lee et al. (1993) show that the combination of wider spreads and smaller depths is sufficient to infer a decrease in quoted liquidity. Market makers actively manage information asymmetry risk by adjusting both spreads and depths, which also affects their commonality, especially during periods of market turbulence.

the supply-side explanations. Resiliency is not a significant driver for non-GIIPS countries, nevertheless, spread-based resiliency is more important than depth-based resiliency. Control variables are highly significant pre-crisis, but become insignificant in the crisis for both GIIPS and non-GIIPS countries.

The aforementioned results show that resiliency, although a stand-alone dimension of liquidity which is weakly correlated with conventional spread and depth liquidity proxies, indicating the uniqueness of information contained in resiliency (O'Sullivan et al., 2024), tends to behave similarly to conventional spread and depth liquidity proxies, and it's commonality is being driven, on average, by the same supply- and demand-side variables as those documented in previous studies. Given that this study is the first to investigate the determinants of liquidity resiliency, we hope that our findings will motivate new research in this area.

6. Conclusions

Using a rich high-frequency dataset from the MTS markets, this paper provides the first systematic study of commonality in liquidity resiliency and its determinants for euro area sovereign bonds. As the order book replenishment mechanism has increased in recent years, resiliency is of paramount importance to market participants today than ever before.

We provide robust evidence regarding commonality in resiliency of core and periphery bond markets focusing on the euro area sovereign debt crisis period. Our analysis uncovers a number of important determinants of time-variation in commonality in resiliency. Our findings are consistent with the predictions of supply-side explanations related to funding liquidity constraints. Our main finding is that supply-side explanations are more important than demand-side explanations during the crisis period, especially for GIIPS countries whose liquidity was significantly impaired. This finding shows that central banks could potentially mitigate liquidity risk during periods of market stress by increasing the funding of financial intermediaries.

On the contrary, the impact that demand- and supply-side explanations exert on the commonality of non-GIIPS countries is very similar with no notable differences. Overall, our findings indicate that commonality in resiliency is being driven by the same supply- and demand-side variables, on average, as those that drive commonality in conventional spread and depth liquidity proxies.

There are several policy implications from this research. Our findings could help regulators and policymakers to enhance their understanding of liquidity resiliency in order to monitor market quality and financial stability more effectively and to implement new regulations. As commonality in resiliency has an impact on market quality and intensifies in stress periods with the potential for contagious, market-wide effects, central banks would be interested in taking measures to lower commonality and thus reduce the susceptibility of the financial system to extreme liquidity dry-ups that occur across many securities. Likewise, investors and portfolio managers who face execution risk need to consider liquidity risk and the implications of commonality in resiliency in order to make informed decisions.

References

1. Acharya, V.V., Pedersen, L.H., 2005. Asset pricing with liquidity risk. Journal of Financial Economics. 77, 375-410.
2. Amihud, Y., Mendelson, H., 1986. Asset pricing and the bid–ask spread. Journal of Financial Economics. 17, 223-249.
3. Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets. 5, 31-56.
4. Baker, M., Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. Journal of Finance. 61, 1645-1680.
5. Baker, S.R., Bloom, N., Davis, S.J., 2016. Measuring economic policy uncertainty. Quarterly Journal of Economics. 131, 1593-1636.
6. Bali, T.G., S.J. Brown, Y. Tang., 2017. Is economic uncertainty priced in the cross-section of stock returns?. Journal of Financial Economics. 126, 471-489.
7. Beetsma, R., Giuliodori, M., de Jong, F., Widijanto, D., 2013. Spread the news: The impact of news on the European sovereign bond markets during the crisis. Journal of International Money and Finance. 34, 83-101.
8. Bernardo, A.E., Welch,I., 2004. Liquidity and financial market runs. Quarterly Journal of Economics. 119, 135-158.
9. Borga, M., 2001. Canonical correlation – a tutorial. Linkopings University, Sweden
10. Borio, C., 2000. Market liquidity and stress: selected issues and policy implications. BIS Quarterly Review November, 38-48.
11. Brockman, P., Chung, D.Y., Perignon, C., 2009. Commonality in liquidity: A global perspective. Journal of Financial and Quantitative Analysis. 44, 851-882.
12. Brunnermeier, M.K., Pedersen, L.H., 2009. Market liquidity and funding liquidity. Review of Financial Studies. 22, 2201-2238.

13. Chordia, T., Roll, R., Subrahmanyam, A., 2000. Commonality in liquidity. Journal of Financial Economics. 56, 3-28.

14. Chordia, T., Sarkar, A., Subrahmanyam, A., 2005. An empirical analysis of stock and bond market liquidity. Review of Financial Studies. 18, 85-129.

15. Chung, K.H., Chuwonganant, C., 2014. Uncertainty, market structure, and liquidity. Journal of Financial Economics. 113, 476-499.

16. Claeys, P., Vašíček, B., 2014. Measuring bilateral spillover and testing contagion on sovereign bond markets in Europe. Journal of Banking and Finance. 46, 151-165.

17. Coluzzi, C., Ginebri, S., Turco, M., 2008. Measuring and analyzing the liquidity of the Italian treasury security wholesale secondary market. University of Molise. Economics and Statistics Discussion Paper No. 44

18. Comerton-Forde, C., T. Hendershott, C. Jones, P. Moulton, M. Seasholes., 2010. Time variation in liquidity: The role of market maker inventories and revenues. Journal of Finance. 65, 295-331.

19. Cotelioglu, E., 2024. Do mutual funds and ETFs affect the commonality in liquidity of corporate bonds? Journal of Empirical Finance. 101520

20. Coughenour, J.F., Saad, M.M., 2004. Common market makers and commonality in liquidity. Journal of Financial Economics. 73, 37-69.

21. De Santis, R.A., 2014. The euro area sovereign debt crisis: identifying flight-to-liquidity and the spillover mechanisms. Journal of Empirical Finance. 26, 150-170.

22. Fleming, M.J., 2003. Measuring treasury market liquidity. Economic Policy Review. 9, 83-108.

23. Froot, K.A., Dabora, E.M., 1999. How are stock prices affected by the location of trade? Journal of Financial Economics. 53, 189-216.

24. Garcia-Gallego, A., Mures-Quintana, M.J., 2016. Principal Components And Canonical Correlation Analyses As Complementary Tools. Application To The Processing Of Financial Information. Economic Computation

and Economic Cybernetics Studies and Research, Faculty of Economic Cybernetics, Statistics and Informatics, vol. 50(4), pages 249-266.

25. Gargano, A., Pettenuzzo, D., Timmermann, A., 2019. Bond return predictability: economic value and links to the macroeconomy. Management Science. 65, 508-540.

26. Garleanu, N., Pedersen, L.H., 2007. Liquidity and risk management. American Economic Review. 97, 193-197.

27. Gefang, D., Koop, G., Potter, S.M., 2011. Understanding liquidity and credit risks in the financial crisis. Journal of Empirical Finance. 18, 903-914.

28. Gromb, D., Vayanos, D., 2002. Equilibrium and welfare in markets with financially constrained arbitrageurs. Journal of Financial Economics. 66, 361-407.

29. Hair, J., Anderson, R., Babin, B., Black, W., 2018. Multivariate Data Analysis. Cengage Learning EMEA, 8th edition.

30. Hameed, A., Kang, W., Viswanathan, S., 2010. Stock market declines and liquidity. Journal of Finance. 65, 257-293.

31. Hasbrouck, J., Seppi, D.J., 2001. Common factors in prices, order flows, and liquidity. Journal of Financial Economics. 59, 383-411.

32. Huberman, G., Halka, D., 2001. Systematic liquidity. Journal of Financial Research. 24, 161-178.

33. Kamara, A., Lou, X., Sadka, R., 2008. The divergence of liquidity commonality in the cross-section of stocks. Journal of Financial Economics. 89, 444-466.

34. Karolyi, A.G., Lee, K-H., van Dijk, M.A., 2012. Understanding commonality in liquidity around the world. Journal of Financial Economics. 105, 82-112.

35. Kempf, A., Mayston, D., Gehde-Trapp, M., Yadav, P.K., 2015. Resiliency: A dynamic view of liquidity. Working Paper, University of Cologne.

36. Koch, A., Ruenzi, S., Starks, L., 2016. Commonality in liquidity: A demand-side explanation. Review of Financial Studies. 29, 1943-1974.

37. Korajczyk, R.A., Sadka, R., 2008. Pricing the commonality across alternative measures of liquidity. Journal of Financial Economics. 87, 45-72.

38. Kyle, A.S., Xiong, W., 2001. Contagion as a wealth effect. Journal of Finance. 56, 1401-1440.

39. Lee, C.M.C., Mucklow, B., Ready, M.J., 1993. Spreads, depths, and the impact of earnings information: An intraday analysis. Review of Financial Studies. 6, 345–374.

40. Lybek, T., Sarr, A., 2002. Measuring liquidity in financial markets. IMF Working Papers, 02/232.

41. Mancini, L., Ranaldo, A., Wrampelmeyer, J., 2013. Liquidity in the foreign exchange market: measurement, commonality, and risk premiums. Journal of Finance. 68, 1805-1841.

42. Morris, S., Shin, H.S., 2004. Liquidity black holes. Review of Finance. 8, 1-18.

43. O'Sullivan, C., Papavassiliou, V.G., 2020. On the term structure of liquidity in the European sovereign bond market. Journal of Banking and Finance. 114, 105777.

44. O'Sullivan, C., Papavassiliou, V.G., 2021. A high-frequency analysis of return and volatility spillovers in the European sovereign bond market. European Journal of Finance. Published online: 06 Apr 2021.

45. O'Sullivan, C., Papavassiliou, V.G., Wafula, R.W., Boubaker, S., 2024. New insights into liquidity resiliency. Journal of International Financial Markets, Institutions and Money. 90, 101892.

46. Panagiotou, P., Jiang, X., Gavilan, A., 2023. The determinants of liquidity commonality in the Euro-area sovereign bond market. European Journal of Finance. 29, 1144-1186.

47. Papavassiliou, V.G., Kinateder, H., 2021. Information shares and market quality before and during the European sovereign debt crisis. Journal of International Financial Markets, Institutions and Money. 72, 101334.

48. Pástor, L., Stambaugh, R.F., 2003. Liquidity risk and expected stock returns. Journal of Political Economy. 111, 642-685.

49. Pelizzon, L., M.G., Subrahmanyam, D., Tomio, J. Uno., 2016. Sovereign credit risk, liquidity, and European Central Bank intervention: Deus ex machina?. Journal of Financial Economics. 122, 86-115.

50. Rehse, D., Riordan, R., Rottke, N., Zietz, J., 2019. The effects of uncertainty on market liquidity: Evidence from Hurricane Sandy. Journal of Financial Economics. 134, 318-332.

51. Richter, T.J., 2022. Liquidity commonality in sovereign bond markets. International Review of Economics and Finance. 78, 501-518.

52. Sadka, R., 2006. Momentum and post-earnings-announcement drift anomalies: the role of liquidity risk. Journal of Financial Economics. 80, 309-349.

53. Schneider, M., Lillo, F., Pelizzon, L., 2016. How has sovereign bond market liquidity changed? An illiquidity spillover analysis. Goethe University, SAFE Working Paper No. 151.

54. Sherry, A., Henson, R.K., 2005. Conducting and interpreting canonical correlation analysis in personality research: A user-friendly primer. Journal of Personality Assessment. 84, 37-48.

55. Vayanos, D., 2004. Flight to quality, flight to liquidity, and the pricing of risk. Unpublished working paper. National Bureau of Economic Research, Cambridge, MA.

56. Wu, Y., 2019. Asset pricing with extreme liquidity risk. Journal of Empirical Finance. 54, 143-165.

Table 1: CCA and redundancy analysis: Relative spread-based resiliency

Pre-crisis					Crisis				
Panel A: Canonical Correlations					**Panel A: Canonical Correlations**				
1st	0.778				1st	0.652			
2nd	0.450				2nd	0.361			
3rd	0.382				3rd	0.279			
Panel B: Canonical Redundancy Analysis					**Panel B: Canonical Redundancy Analysis**				
Variation in NGIIPS resiliency explained by:					Variation in NGIIPS resiliency explained by:				
	NGIIPS Resiliency		GIIPS Resiliency			NGIIPS Resiliency		GIIPS Resiliency	
	Prop	Cum	Prop	Cum		Prop	Cum	Prop	Cum
1st	0.167	0.167	0.101	0.101	1st	0.160	0.160	0.068	0.068
2nd	0.047	0.214	0.010	0.111	2nd	0.050	0.210	0.007	0.075
3rd	0.043	0.258	0.006	0.117	3rd	0.046	0.256	0.004	0.078
Varation in GIIPS resiliency explained by:					Varation in GIIPS resiliency explained by:				
	NGIIPS Resiliency		GIIPS Resiliency			NGIIPS Resiliency		GIIPS Resiliency	
	Prop	Cum	Prop	Cum		Prop	Cum	Prop	Cum
1st	0.207	0.207	0.125	0.125	1st	0.149	0.149	0.063	0.063
2nd	0.065	0.272	0.013	0.139	2nd	0.093	0.242	0.012	0.076
3rd	0.054	0.326	0.008	0.147	3rd	0.059	0.302	0.005	0.080
Panel C: Statistical Significance tests					**Panel C: Statistical Significance tests**				
	Wilks	F	P-value			Wilks	F	P-value	
1st	0.143	2.414	0.000		1st	0.351	2.976	0.000	
2nd	0.362	1.358	0.000		2nd	0.612	1.527	0.000	
3rd	0.454	1.176	0.000		3rd	0.703	1.219	0.000	

Panel A reports the first three canonical correlations for relative spread-based resiliency during pre-crisis (January 2008 until October 2009) and crisis (November 2009 until December 2013) periods. Relative spread is defined as best bid-ask spread divided by the midpoint of the bid and ask quotes. Resiliency is estimated on a daily basis using a 5-minute interval in the liquidity data as per Equations (3)-(4). The relative spread measures are winsorized by 95 percent in order to weed out the morning and afternoon extreme values. A non-negativity truncation is imposed on the resiliency measures to avoid resiliency taking on negative values. Panel B presents a canonical redundancy analysis for GIIPS (Greece, Ireland, Italy, Portugal, Spain) and non-GIIPS (Austria, Belgium, Finland, France, Germany, Netherlands) countries. The upper part of Panel B reports the total variation in non-GIIPS resiliency explained by the non-GIIPS and GIIPS resiliency canonical variates, while the lower part of Panel B reports the varation in GIIPS resiliency explained by the non-GIIPS and GIIPS resiliency canonical variates. Panel C reports tests of statistical significance. The Wilks' lambda, F-statistic, and P-values are reported. Wilks's lambda distribution is approximated with a x^2 distribution. Calculations are based on benchmark, fixed coupon-bearing sovereign bonds from the domestic MTS markets using four time-to-maturity segments: 2-, 5-, 10-, and 30-year benchmark securities.

Table 2: CCA and redundancy analysis: Quoted depth-based resiliency

Pre-crisis					**Crisis**				
Panel A: Canonical Correlations					**Panel A: Canonical Correlations**				
1st	0.774				1st	0.681			
2nd	0.524				2nd	0.448			
3rd	0.444				3rd	0.280			
Panel B: Canonical Redundancy Analysis					**Panel B: Canonical Redundancy Analysis**				
Variation in NGIIPS resiliency explained by:					Variation in NGIIPS resiliency explained by:				
	NGIIPS Resiliency		GIIPS Resiliency			NGIIPS Resiliency		GIIPS Resiliency	
	Prop	Cum	Prop	Cum		Prop	Cum	Prop	Cum
1st	0.156	0.156	0.094	0.094	1st	0.147	0.147	0.068	0.068
2nd	0.063	0.220	0.017	0.111	2nd	0.055	0.202	0.011	0.079
3rd	0.035	0.255	0.007	0.118	3rd	0.038	0.240	0.003	0.082
Varation in GIIPS resiliency explained by:					Varation in GIIPS resiliency explained by:				
	NGIIPS Resiliency		GIIPS Resiliency			NGIIPS Resiliency		GIIPS Resiliency	
	Prop	Cum	Prop	Cum		Prop	Cum	Prop	Cum
1st	0.201	0.201	0.120	0.120	1st	0.170	0.170	0.079	0.079
2nd	0.081	0.282	0.022	0.143	2nd	0.110	0.280	0.022	0.101
3rd	0.052	0.334	0.010	0.153	3rd	0.078	0.358	0.006	0.107
Panel C: Statistical Significance tests					**Panel C: Statistical Significance tests**				
	Wilks	F	P-value			Wilks	F	P-value	
1st	0.108	2.784	0.000		1st	0.291	3.534	0.000	
2nd	0.270	1.772	0.000		2nd	0.543	1.904	0.000	
3rd	0.372	1.485	0.000		3rd	0.680	1.340	0.000	

Panel A reports the first three canonical correlations for quoted depth-based resiliency during pre-crisis (January 2008 until October 2009) and crisis (November 2009 until December 2013) periods. Quoted depth is defined as best bid size plus best ask size. Resiliency is estimated on a daily basis using a 5-minute interval in the liquidity data as per Equations (3)-(4). The quoted depth measures are winsorized by 95 percent in order to weed out the morning and afternoon extreme values. A non-negativity truncation is imposed on the resiliency measures to avoid resiliency taking on negative values. Panel B presents a canonical redundancy analysis for GIIPS (Greece, Ireland, Italy, Portugal, Spain) and non-GIIPS (Austria, Belgium, Finland, France, Germany, Netherlands) countries. The upper part of Panel B reports the total variation in non-GIIPS resiliency explained by the non-GIIPS and GIIPS resiliency canonical variates, while the lower part of Panel B reports the varation in GIIPS resiliency explained by the non-GIIPS and GIIPS resiliency canonical variates. Panel C reports tests of statistical significance. The Wilks' lambda, F-statistic, and P-values are reported. Wilks's lambda distribution is approximated with a x^2 distribution. Calculations are based on benchmark, fixed coupon-bearing sovereign bonds from the domestic MTS markets using four time-to-maturity segments: 2-, 5-, 10-, and 30-year benchmark securities.

Table 3: Supply-side drivers of commonality in Relative Spread (RS) resiliency of non-GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8
Market return	0.193	0.193	0.175	0.238	0.170	0.230	0.175	0.255
	(**0.034**)	(**0.042**)	(**0.059**)	(**0.010**)	(**0.068**)	(**0.032**)	(**0.085**)	(0.104)
Trading volume	0.057	0.056	0.056	0.027	0.060	0.054	0.053	-0.001
	(**0.004**)	(**0.024**)	(**0.004**)	(**0.061**)	(**0.006**)	(**0.011**)	(**0.009**)	(0.987)
RS resiliency	-0.194	-0.194	-0.183	-0.166	-0.220	-0.204	-0.191	-0.175
	(**0.002**)	(**0.002**)	(**0.010**)	(**0.004**)	(**0.000**)	(**0.000**)	(**0.003**)	(**0.001**)
CDS	0.060	0.061	0.053	0.063	0.065	0.063	0.048	0.029
	(**0.002**)	(**0.012**)	(**0.029**)	(**0.003**)	(**0.003**)	(**0.003**)	(**0.063**)	(0.363)
10-year bond yields	0.096	0.095	0.134	-0.040	0.135	0.082	0.099	-0.070
	(0.709)	(0.699)	(0.574)	(0.837)	(0.614)	(0.775)	(0.679)	(0.808)
Market volatility	0.003	0.003	0.002	0.002	0.003	0.003	0.002	0.003
	(**0.023**)	(**0.028**)	(0.224)	(0.146)	(**0.002**)	(**0.026**)	(**0.087**)	(0.339)
EONIA rate		0.006						-0.018
		(0.979)						(0.953)
TED spread			0.056					0.034
			(0.539)					(0.859)
FTSEurofirst 300				0.001				0.001
				(**0.042**)				(0.168)
LOIS spread					-0.001			-0.001
					(**0.013**)			(0.484)
ECB excess liquidity						-0.011		-0.021
						(0.254)		(0.319)
Euro Stoxx bank index							-0.002	-0.004
							(0.586)	(0.369)
Constant (time trend)	-1.969	-1.968	-2.027	-2.292	-1.970	-1.974	-1.974	-2.520
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.653	0.653	0.660	0.692	0.677	0.663	0.658	0.766

The table reports results of OLS time series regressions of changes in monthly average commonality in relative spread-based resiliency on changes in various cross-sectional supply-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the model. Model 8 includes all controls and supply-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Supply-side drivers include the EONIA rate, TED spread, FTSEurofirst 300 bank returns, LOIS spread, ECB excess liquidity, and Euro Stoxx bank index returns. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. Non-GIIPS countries include Austria, Belgium, Finland, France, Germany, and the Netherlands. The pre-crisis period spans the dates from January 2008 to October 2009.

Table 4: Supply-side drivers of commonality in Quoted Depth (QD) resiliency of non-GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8
Market return	0.037	0.039	0.027	0.085	0.021	0.078	0.047	0.093
	(0.650)	(0.633)	(0.767)	(0.392)	(0.736)	(0.410)	(0.579)	(0.416)
Trading volume	0.026	0.026	0.026	-0.012	0.030	0.024	0.028	-0.027
	(**0.049**)	(0.222)	(**0.053**)	(0.323)	(**0.058**)	(0.119)	(**0.073**)	(0.321)
QD resiliency	-0.080	-0.081	-0.077	-0.089	-0.077	-0.087	-0.083	-0.080
	(0.311)	(0.365)	(0.329)	(0.126)	(0.363)	(0.310)	(0.337)	(0.260)
CDS	-0.001	0.000	-0.004	0.000	0.006	0.001	0.005	-0.016
	(0.961)	(0.996)	(0.842)	(0.987)	(0.696)	(0.944)	(0.814)	(0.402)
10-year bond yields	0.278	0.275	0.299	0.150	0.284	0.258	0.276	0.088
	(0.185)	(0.166)	(0.200)	(0.387)	(0.166)	(0.263)	(0.222)	(0.650)
Market volatility	-0.001	-0.001	-0.001	-0.002	0.000	0.000	-0.001	0.000
	(0.597)	(0.634)	(0.571)	(0.262)	(0.972)	(0.892)	(0.643)	(0.819)
EONIA rate		0.018						-0.221
		(0.954)						(0.211)
TED spread			0.025					-0.013
			(0.778)					(0.884)
FTSEurofirst 300				0.001				0.001
				(**0.015**)				(**0.008**)
LOIS spread					-0.002			-0.002
					(**0.017**)			(**0.047**)
ECB excess liquidity						-0.010		-0.010
						(0.190)		(0.515)
Euro Stoxx bank index							0.001	-0.002
							(0.692)	(0.429)
Constant (time trend)	-1.922	-1.919	-1.947	-2.348	-1.923	-1.927	-1.920	-2.627
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.264	0.264	0.267	0.436	0.355	0.284	0.267	0.635

The table reports results of OLS time series regressions of changes in monthly average commonality in quoted depth-based resiliency on changes in various cross-sectional supply-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the model. Model 8 includes all controls and supply-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Supply-side drivers include the EONIA rate, TED spread, FTSEurofirst 300 bank returns, LOIS spread, ECB excess liquidity, and Euro Stoxx bank index returns. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. Non-GIIPS countries include Austria, Belgium, Finland, France, Germany, and the Netherlands. The pre-crisis period spans the dates from January 2008 to October 2009.

Table 5: Supply-side drivers of commonality in Relative Spread (RS) resiliency of non-GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8
Market return	-0.130	-0.131	-0.131	-0.124	-0.122	-0.139	-0.106	-0.118
	(**0.068**)	(**0.067**)	(**0.081**)	(**0.096**)	(**0.089**)	(**0.057**)	(**0.078**)	(**0.084**)
Trading volume	-0.019	-0.028	-0.003	-0.010	-0.006	-0.002	-0.021	0.005
	(0.714)	(0.574)	(0.965)	(0.846)	(0.906)	(0.967)	(0.621)	(0.932)
RS resiliency	-0.064	-0.072	-0.061	-0.066	-0.067	-0.032	-0.034	-0.001
	(0.283)	(0.280)	(0.326)	(0.276)	(0.275)	(0.584)	(0.563)	(0.989)
CDS	0.003	0.002	0.006	0.004	-0.005	0.018	-0.036	-0.022
	(0.893)	(0.938)	(0.796)	(0.848)	(0.836)	(0.312)	(0.212)	(0.432)
10-year bond yields	-0.021	-0.024	0.005	0.002	-0.025	-0.032	0.040	0.044
	(0.807)	(0.783)	(0.960)	(0.984)	(0.770)	(0.710)	(0.665)	(0.670)
Market volatility	-0.001	-0.001	0.000	-0.001	-0.001	0.000	-0.002	0.000
	(0.732)	(0.708)	(0.883)	(0.773)	(0.768)	(0.925)	(0.525)	(0.922)
EONIA rate		0.171						0.175
		(0.681)						(0.697)
TED spread			0.237					0.305
			(0.420)					(0.521)
FTSEurofirst 300				-0.030				0.000
				(0.458)				(0.714)
LOIS spread					0.008			0.003
					(0.127)			(0.667)
ECB excess liquidity						0.001		0.001
						(**0.000**)		(**0.000**)
Euro Stoxx bank index							-0.009	-0.010
							(**0.013**)	(**0.012**)
Constant (time trend)	-2.023	-2.026	-2.076	-1.872	-2.018	-2.021	-2.038	-2.212
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.167	0.171	0.175	0.176	0.186	0.255	0.259	0.368

The table reports results of OLS time series regressions of changes in monthly average commonality in relative spread-based resiliency on changes in various cross-sectional supply-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the model. Model 8 includes all controls and supply-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Supply-side drivers include the EONIA rate, TED spread, FTSEurofirst 300 bank returns, LOIS spread, ECB excess liquidity, and Euro Stoxx bank index returns. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. Non-GIIPS countries include Austria, Belgium, Finland, France, Germany, and the Netherlands. The crisis period spans the dates from November 2009 to December 2013.

Table 6: Supply-side drivers of commonality in Quoted Depth (QD) resiliency of non-GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8
Market return	-0.169	-0.171	-0.169	-0.172	-0.164	-0.172	-0.179	-0.200
	(**0.083**)	(**0.073**)	(0.103)	(**0.064**)	(**0.099**)	(**0.088**)	(**0.073**)	(**0.066**)
Trading volume	0.038	0.023	0.057	0.033	0.045	0.043	0.040	0.062
	(0.478)	(0.669)	(0.327)	(0.568)	(0.402)	(0.424)	(0.460)	(0.259)
QD resiliency	0.059	0.054	0.064	0.058	0.062	0.062	0.058	0.065
	(0.427)	(0.479)	(0.401)	(0.441)	(0.415)	(0.422)	(0.404)	(0.397)
CDS	0.016	0.016	0.019	0.015	0.011	0.020	0.033	0.042
	(0.309)	(0.314)	(0.235)	(0.328)	(0.540)	(0.236)	(0.209)	(0.129)
10-year bond yields	0.012	0.004	0.045	0.002	0.009	0.011	-0.016	0.010
	(0.934)	(0.977)	(0.792)	(0.991)	(0.954)	(0.939)	(0.912)	(0.955)
Market volatility	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003
	(0.744)	(0.775)	(0.578)	(0.768)	(0.704)	(0.706)	(0.665)	(0.369)
EONIA rate		0.294						0.364
		(0.626)						(0.573)
TED spread			0.296					0.829
			(0.445)					(0.258)
FTSEurofirst 300				0.014				0.001
				(0.765)				(0.352)
LOIS spread					0.005			0.001
					(0.416)			(0.943)
ECB excess liquidity						0.001		0.001
						(**0.003**)		(**0.002**)
Euro Stoxx bank index							0.004	0.004
							(0.457)	(0.462)
Constant (time trend)	-2.126	-2.131	-2.193	-2.197	-2.123	-2.125	-2.120	-2.699
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.180	0.190	0.190	0.181	0.185	0.197	0.194	0.267

The table reports results of OLS time series regressions of changes in monthly average commonality in quoted depth-based resiliency on changes in various cross-sectional supply-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the model. Model 8 includes all controls and supply-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Supply-side drivers include the EONIA rate, TED spread, FTSEurofirst 300 bank returns, LOIS spread, ECB excess liquidity, and Euro Stoxx bank index returns. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. Non-GIIPS countries include Austria, Belgium, Finland, France, Germany, and the Netherlands. The crisis period spans the dates from November 2009 to December 2013.

Table 7: Demand-side drivers of commonality in Relative Spread (RS) resiliency of non-GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	0.193	0.197	0.193	0.212	0.233	0.266	0.228	0.237	0.332
	(**0.034**)	(**0.049**)	(**0.042**)	(**0.018**)	(**0.044**)	(**0.012**)	(**0.043**)	(**0.018**)	(**0.022**)
Trading volume	0.057	0.059	0.059	0.061	0.052	0.051	0.039	0.043	0.010
	(**0.004**)	(**0.006**)	(**0.011**)	(**0.004**)	(**0.005**)	(**0.003**)	(0.166)	(**0.008**)	(0.868)
RS resiliency	-0.194	-0.192	-0.195	-0.205	-0.221	-0.289	-0.190	-0.189	-0.306
	(**0.002**)	(**0.004**)	(**0.003**)	(**0.004**)	(**0.004**)	(**0.023**)	(**0.001**)	(**0.001**)	(0.288)
CDS	0.060	0.062	0.063	0.062	0.072	0.075	0.074	0.063	0.077
	(**0.002**)	(**0.004**)	(**0.004**)	(**0.001**)	(**0.017**)	(**0.003**)	(**0.017**)	(**0.003**)	(0.138)
10-year bond yields	0.096	0.082	0.066	0.086	0.052	0.080	0.007	-0.019	-0.053
	(0.709)	(0.787)	(0.846)	(0.756)	(0.847)	(0.811)	(0.971)	(0.935)	(0.913)
Market volatility	0.003	0.003	0.003	0.003	0.004	0.005	0.004	0.003	0.008
	(**0.023**)	(**0.021**)	(**0.037**)	(**0.061**)	(**0.042**)	(**0.057**)	(**0.017**)	(**0.034**)	(0.225)
ZEW		0.002							0.001
		(0.768)							(0.915)
Sentix-euro area			0.003						-0.002
			(0.810)						(0.922)
Sentix-US				0.281					-0.041
				(0.509)					(0.959)
EPU-Euro					-0.002				0.008
					(0.413)				(0.446)
EPU-UK						-0.003			-0.008
						(0.193)			(0.522)
EPU-US							-0.003		-0.006
							(0.338)		(0.322)
EUR/USD								0.726	0.730
								(**0.098**)	(0.695)
Constant (time trend)	-1.969	-1.981	-1.969	-1.963	-1.722	-1.497	-1.564	-3.010	-2.021
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.001**)	(**0.004**)	(**0.000**)	(0.582)
R-squared	0.653	0.655	0.655	0.664	0.668	0.681	0.681	0.675	0.741

The table reports results of OLS time series regressions of changes in monthly average commonality in relative spread-based resiliency on changes in various cross-sectional demand-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 8 we add (one at a time) additional explanatory demand-side variables to the model. Model 9 includes all controls and demand-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Demand-side drivers include the ZEW euro area Economic Sentiment Index, Sentix euro area and Sentix U.S. sentiment index, Economic Policy Uncertainty (EPU-Euro, EPU-UK, and EPU-US) index, and EUR/USD foreign exchange rate fluctuations. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. Non-GIIPS countries include Austria, Belgium, Finland, France, Germany, and the Netherlands. The pre-crisis period spans the dates from January 2008 to October 2009.

Table 8: Demand-side drivers of commonality in Quoted Depth (QD) resiliency of non-GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	0.037	0.040	0.039	0.042	0.093	-0.008	0.088	0.121	-0.150
	(0.650)	(0.638)	(0.646)	(0.669)	(0.423)	(0.957)	(0.441)	(0.275)	(0.610)
Trading volume	0.026	0.031	0.031	0.027	0.021	0.030	-0.002	0.001	0.045
	(**0.049**)	(**0.051**)	(0.100)	(0.149)	(**0.064**)	(**0.044**)	(0.856)	(0.911)	(0.450)
QD resiliency	-0.080	-0.070	-0.082	-0.085	-0.098	-0.052	-0.062	-0.120	0.181
	(0.311)	(0.396)	(0.327)	(0.410)	(0.279)	(0.519)	(0.331)	(**0.063**)	(0.474)
CDS	-0.001	0.002	0.004	-0.001	0.012	-0.006	0.021	0.001	0.038
	(0.961)	(0.910)	(0.808)	(0.969)	(0.483)	(0.763)	(0.128)	(0.891)	(0.454)
10-year bond yields	0.278	0.254	0.224	0.277	0.212	0.305	0.132	0.107	0.019
	(0.185)	(0.296)	(0.390)	(0.208)	(0.410)	(0.178)	(0.489)	(0.596)	(0.923)
Market volatility	-0.001	-0.001	-0.001	-0.001	0.000	-0.002	0.002	0.000	-0.001
	(0.597)	(0.625)	(0.727)	(0.756)	(0.931)	(0.545)	(0.130)	(0.669)	(0.599)
ZEW		0.003							0.010
		(0.590)							(**0.099**)
Sentix-euro area			0.006						0.013
			(0.482)						(0.360)
Sentix-US				0.045					-0.060
				(0.946)					(0.921)
EPU-Euro					-0.002				-0.007
					(0.225)				(0.546)
EPU-UK						0.001			0.011
						(0.685)			(0.391)
EPU-US							-0.005		-0.005
							(**0.031**)		(0.253)
EUR/USD								1.326	-0.666
								(**0.046**)	(0.821)
Constant (time trend)	-1.922	-1.939	-1.922	-1.921	-1.666	-2.096	-1.277	-3.823	-1.032
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.001**)	(**0.001**)	(0.813)
R-squared	0.264	0.274	0.278	0.264	0.305	0.277	0.430	0.419	0.672

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Table 9: Demand-side drivers of commonality in Relative Spread (RS) resiliency of non-GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	-0.130	-0.116	-0.091	-0.134	-0.143	-0.134	-0.140	-0.127	-0.112
	(**0.068**)	(0.104)	(0.179)	(**0.075**)	(**0.048**)	(**0.048**)	(**0.086**)	(**0.070**)	(0.170)
Trading volume	-0.019	-0.019	-0.018	-0.030	-0.029	-0.030	-0.039	-0.023	-0.062
	(0.714)	(0.704)	(0.684)	(0.539)	(0.598)	(0.565)	(0.545)	(0.620)	(0.219)
RS resiliency	-0.064	-0.061	-0.053	-0.065	-0.057	-0.055	-0.064	-0.062	-0.049
	(0.283)	(0.313)	(0.386)	(0.271)	(0.367)	(0.393)	(0.287)	(0.319)	(0.452)
CDS	0.003	-0.003	-0.012	0.002	0.006	0.001	0.005	0.000	-0.011
	(0.893)	(0.909)	(0.664)	(0.925)	(0.813)	(0.953)	(0.855)	(0.991)	(0.682)
10-year bond yields	-0.021	0.004	0.050	-0.033	-0.044	-0.037	-0.054	-0.031	-0.021
	(0.807)	(0.968)	(0.586)	(0.686)	(0.645)	(0.679)	(0.573)	(0.718)	(0.840)
Market volatility	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001	-0.003
	(0.732)	(0.765)	(0.707)	(0.704)	(0.679)	(0.781)	(0.481)	(0.710)	(0.290)
ZEW		-0.003							0.003
		(0.369)							(0.445)
Sentix-euro area			-0.013						-0.018
			(**0.064**)						(**0.022**)
Sentix-US				0.289					0.334
				(0.334)					(0.275)
EPU-Euro					-0.001				-0.001
					(0.430)				(0.546)
EPU-UK						-0.039			0.049
						(0.328)			(0.577)
EPU-US							-0.001		-0.001
							(0.473)		(0.505)
EUR/USD								0.270	0.427
								(0.657)	(0.552)
Constant (time trend)	-2.023	-2.020	-2.013	-2.032	-1.909	-1.934	-1.888	-2.386	-2.384
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.005**)	(**0.025**)
R-squared	0.167	0.182	0.236	0.186	0.177	0.178	0.177	0.171	0.290

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Table 10: Demand-side drivers of commonality in Quoted Depth (QD) resiliency of non-GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	-0.169	-0.197	-0.190	-0.170	-0.197	-0.174	-0.184	-0.163	-0.226
	(**0.083**)	(**0.035**)	(**0.045**)	(**0.090**)	(**0.018**)	(**0.044**)	(**0.069**)	(**0.089**)	(**0.005**)
Trading volume	0.038	0.038	0.038	0.033	0.010	0.015	0.006	0.029	-0.006
	(0.478)	(0.488)	(0.493)	(0.527)	(0.849)	(0.774)	(0.925)	(0.576)	(0.913)
QD resiliency	0.059	0.055	0.052	0.055	0.057	0.067	0.064	0.063	0.060
	(0.427)	(0.354)	(0.437)	(0.453)	(0.479)	(0.392)	(0.374)	(0.414)	(0.331)
CDS	0.016	0.029	0.025	0.016	0.019	0.010	0.018	0.010	0.030
	(0.309)	(**0.088**)	(0.147)	(0.322)	(0.203)	(0.540)	(0.239)	(0.621)	(0.188)
10-year bond yields	0.012	-0.037	-0.025	0.009	-0.037	-0.014	-0.040	-0.005	-0.108
	(0.934)	(0.788)	(0.865)	(0.954)	(0.796)	(0.920)	(0.785)	(0.970)	(0.355)
Market volatility	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001	-0.001
	(0.744)	(0.764)	(0.743)	(0.768)	(0.948)	(0.682)	(0.937)	(0.824)	(0.807)
ZEW		0.006							0.008
		(0.103)							(0.114)
Sentix-euro area			0.007						-0.006
			(0.354)						(0.531)
Sentix-US				0.122					-0.011
				(0.664)					(0.972)
EPU-Euro					-0.002				-0.002
					(0.102)				(0.281)
EPU-UK						-0.001			0.012
						(0.150)			(0.871)
EPU-US							-0.001		-0.001
							(0.103)		(0.643)
EUR/USD								0.524	0.225
								(0.484)	(0.811)
Constant (time trend)	-2.126	-2.131	-2.131	-2.130	-1.844	-1.960	-1.915	-2.831	-2.046
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.006**)	(0.111)
R-squared	0.180	0.231	0.196	0.183	0.233	0.216	0.200	0.192	0.307

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Table 11: Supply-side drivers of commonality in Relative Spread (RS) resiliency of GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8
Market return	0.478 (0.141)	0.632 (0.186)	0.496 (0.151)	-0.585 (0.252)	0.536 (**0.090**)	0.438 (0.205)	0.433 (0.216)	-1.183 (**0.028**)
Trading volume	0.102 (**0.006**)	0.113 (**0.023**)	0.103 (**0.011**)	-0.009 (0.764)	0.104 (**0.009**)	0.106 (**0.004**)	0.096 (**0.029**)	-0.111 (**0.058**)
RS resiliency	0.024 (0.744)	0.035 (0.652)	0.021 (0.794)	-0.044 (0.651)	0.028 (0.707)	0.018 (0.807)	0.016 (0.837)	-0.139 (**0.096**)
CDS	0.028 (0.835)	-0.010 (0.945)	0.062 (0.698)	0.066 (0.473)	0.044 (0.767)	0.006 (0.967)	-0.038 (0.892)	-0.339 (**0.018**)
10-year bond yields	-0.321 (0.221)	-0.311 (0.221)	-0.335 (0.238)	-0.448 (**0.091**)	-0.322 (0.239)	-0.318 (0.243)	-0.329 (0.210)	-0.706 (**0.000**)
Market volatility	-0.003 (0.202)	-0.003 (0.224)	-0.003 (0.333)	-0.004 (**0.096**)	-0.003 (0.289)	-0.004 (0.135)	-0.004 (0.226)	-0.002 (**0.082**)
EONIA rate		-0.150 (0.588)						-0.880 (**0.012**)
TED spread			-0.039 (0.703)					-0.259 (**0.013**)
FTSEurofirst 300				0.001 (**0.002**)				0.003 (**0.000**)
LOIS spread					-0.001 (0.492)			0.024 (0.754)
ECB excess liquidity						0.013 (0.195)		-0.001 (0.883)
Euro Stoxx bank index							-0.002 (0.746)	-0.011 (**0.001**)
Constant (time trend)	-1.820 (**0.000**)	-1.868 (**0.000**)	-1.781 (**0.000**)	-2.357 (**0.000**)	-1.827 (**0.000**)	-1.826 (**0.000**)	-1.818 (**0.000**)	-3.013 (**0.000**)
R-squared	0.463	0.470	0.467	0.613	0.470	0.485	0.468	0.904

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Table 12: Supply-side drivers of commonality in Quoted Depth (QD) resiliency of GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8
Market return	0.523	0.522	0.526	0.222	0.566	0.642	0.377	0.655
	(**0.032**)	(**0.068**)	(**0.027**)	(0.432)	(**0.020**)	(**0.085**)	(0.196)	(0.239)
Trading volume	0.017	0.016	0.017	-0.023	0.017	0.019	0.021	-0.016
	(0.198)	(0.331)	(0.182)	(0.383)	(0.191)	(0.191)	(0.131)	(0.600)
QD resiliency	-0.190	-0.190	-0.191	-0.192	-0.184	-0.161	-0.228	-0.114
	(**0.006**)	(**0.008**)	(**0.012**)	(**0.004**)	(**0.009**)	(0.102)	(**0.006**)	(0.363)
CDS	-0.055	-0.054	-0.050	-0.037	-0.043	-0.038	-0.018	0.006
	(0.391)	(0.601)	(0.567)	(0.571)	(0.554)	(0.657)	(0.855)	(0.968)
10-year bond yields	-0.046	-0.046	-0.048	-0.107	-0.049	-0.062	-0.013	-0.162
	(0.579)	(0.622)	(0.624)	(0.136)	(0.570)	(0.457)	(0.913)	(0.181)
Market volatility	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.004
	(**0.001**)	(**0.001**)	(**0.018**)	(**0.000**)	(**0.001**)	(**0.012**)	(**0.001**)	(**0.054**)
EONIA rate		0.003						-0.183
		(0.987)						(0.595)
TED spread			-0.006					-0.031
			(0.925)					(0.711)
FTSEurofirst 300				0.046				0.001
				(**0.059**)				(**0.012**)
LOIS spread					-0.026			-0.001
					(0.413)			(0.456)
ECB excess liquidity						0.006		0.012
						(0.585)		(0.436)
Euro Stoxx bank index							0.002	-0.031
							(0.458)	(0.867)
Constant (time trend)	-1.883	-1.882	-1.877	-2.093	-1.887	-1.893	-1.875	-2.209
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.723	0.723	0.724	0.776	0.726	0.730	0.734	0.812

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Table 13: Supply-side drivers of commonality in Relative Spread (RS) resiliency of GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8
Market return	-0.148	-0.165	-0.121	-0.151	-0.185	-0.150	-0.150	-0.137
	(**0.025**)	(**0.009**)	(**0.061**)	(**0.018**)	(**0.019**)	(**0.026**)	(**0.022**)	(**0.051**)
Trading volume	0.013	0.002	0.026	0.004	0.007	0.013	0.014	-0.058
	(0.640)	(0.952)	(0.389)	(0.927)	(0.794)	(0.666)	(0.625)	(0.299)
RS resiliency	-0.087	-0.098	-0.085	-0.086	-0.087	-0.087	-0.086	-0.093
	(**0.082**)	(**0.050**)	(**0.076**)	(**0.087**)	(**0.067**)	(**0.084**)	(**0.091**)	(**0.008**)
CDS	0.027	0.023	0.030	0.027	0.034	0.023	-0.009	-0.034
	(0.378)	(0.511)	(0.319)	(0.382)	(0.266)	(0.483)	(0.826)	(0.498)
10-year bond yields	-0.106	-0.096	-0.110	-0.107	-0.088	-0.104	-0.096	-0.058
	(0.289)	(0.361)	(0.267)	(0.292)	(0.321)	(0.304)	(0.365)	(0.496)
Market volatility	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.002
	(0.681)	(0.612)	(0.643)	(0.692)	(0.620)	(0.684)	(0.769)	(0.562)
EONIA rate		0.554						0.719
		(0.170)						(**0.020**)
TED spread			0.339					1.805
			(0.310)					(**0.001**)
FTSEurofirst 300				0.017				0.002
				(0.789)				(**0.019**)
LOIS spread					-0.011			-0.022
					(0.179)			(**0.008**)
ECB excess liquidity						-0.002		-0.004
						(0.521)		(0.859)
Euro Stoxx bank index							-0.004	-0.009
							(0.272)	(**0.009**)
Constant (time trend)	-1.723	-1.731	-1.799	-1.813	-1.729	-1.723	-1.727	-3.323
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)
R-squared	0.142	0.184	0.159	0.143	0.177	0.143	0.153	0.404

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Table 14: Supply-side drivers of commonality in Quoted Depth (QD) resiliency of GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8
Market return	-0.001	0.015	0.055	0.012	0.030	0.009	-0.001	0.081
	(0.988)	(0.833)	(0.435)	(0.864)	(0.728)	(0.890)	(0.987)	(0.347)
Trading volume	0.036	0.043	0.063	0.085	0.041	0.040	0.036	0.057
	(0.310)	(0.249)	(0.115)	(**0.059**)	(0.237)	(0.231)	(0.316)	(0.291)
QD resiliency	-0.003	0.016	-0.005	-0.008	-0.009	-0.003	-0.004	-0.016
	(0.938)	(0.741)	(0.895)	(0.839)	(0.801)	(0.942)	(0.914)	(0.785)
CDS	0.003	0.004	0.010	0.001	-0.004	0.027	0.008	0.056
	(0.955)	(0.935)	(0.844)	(0.991)	(0.950)	(0.608)	(0.923)	(0.501)
10-year bond yields	0.022	0.022	0.013	0.023	0.003	0.005	0.020	-0.028
	(0.809)	(0.805)	(0.862)	(0.777)	(0.971)	(0.958)	(0.842)	(0.763)
Market volatility	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002
	(0.320)	(0.267)	(0.192)	(0.293)	(0.387)	(0.318)	(0.307)	(0.288)
EONIA rate		-0.386						0.383
		(0.016)						(0.976)
TED spread			0.728					0.689
			(**0.006**)					(0.296)
FTSEurofirst 300				-0.001				0.023
				(**0.090**)				(0.841)
LOIS spread					0.010			0.008
					(0.215)			(0.446)
ECB excess liquidity						0.001		0.001
						(**0.000**)		(**0.000**)
Euro Stoxx bank index							0.001	0.003
							(0.911)	(0.545)
Constant (time trend)	-1.824	-1.817	-1.988	-1.326	-1.819	-1.823	-1.824	-2.094
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.005**)
R-squared	0.047	0.067	0.136	0.095	0.080	0.127	0.047	0.221

The table reports results of OLS time series regressions of changes in monthly average commonality in quoted depth-based resiliency on changes in various cross-sectional supply-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 7 we add (one at a time) additional explanatory supply-side variables to the model. Model 8 includes all controls and supply-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Supply-side drivers include the EONIA rate, TED spread, FTSEurofirst 300 bank returns, LOIS spread, ECB excess liquidity, and Euro Stoxx bank index returns. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. GIIPS countries include Greece, Ireland, Italy, Portugal, and Spain. The crisis period spans the dates from November 2009 to December 2013.

Table 15: Demand-side drivers of commonality in Relative Spread (RS) resiliency of GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	0.478	0.240	1.221	0.471	0.435	0.555	0.130	-0.337	0.934
	(0.141)	(0.463)	(**0.090**)	(0.153)	(0.273)	(0.361)	(0.816)	(0.588)	(0.657)
Trading volume	0.102	0.070	0.142	0.102	0.085	0.098	0.054	0.046	0.192
	(**0.006**)	(**0.055**)	(**0.015**)	(**0.009**)	(**0.015**)	(**0.009**)	(0.355)	(0.176)	(0.328)
RS resiliency	0.024	-0.058	0.151	0.021	-0.009	0.017	-0.014	-0.064	0.246
	(0.744)	(0.447)	(0.293)	(0.805)	(0.924)	(0.828)	(0.884)	(0.534)	(0.473)
CDS	0.028	-0.049	0.184	0.028	0.133	0.050	0.125	0.065	0.297
	(0.835)	(0.751)	(0.260)	(0.832)	(0.418)	(0.789)	(0.468)	(0.574)	(0.315)
10-year bond yields	-0.321	-0.257	-0.567	-0.318	-0.333	-0.320	-0.384	-0.432	-0.705
	(0.221)	(0.313)	(**0.054**)	(0.219)	(0.252)	(0.241)	(0.170)	(0.132)	(0.256)
Market volatility	-0.003	-0.003	-0.004	-0.003	-0.002	-0.003	-0.001	-0.002	-0.007
	(0.202)	(0.305)	(0.204)	(0.334)	(0.488)	(0.455)	(0.788)	(0.350)	(0.585)
ZEW		-0.010							-0.006
		(0.151)							(0.830)
Sentix-euro area			0.024						0.042
			(0.130)						(0.145)
Sentix-US				0.042					-0.072
				(0.950)					(0.919)
EPU-Euro					-0.003				-0.012
					(0.347)				(0.396)
EPU-UK						-0.001			0.009
						(0.855)			(0.602)
EPU-US							-0.004		0.002
							(0.219)		(0.783)
EUR/USD								1.554	-0.882
								(0.136)	(0.764)
Constant (time trend)	-1.820	-1.708	-1.896	-1.819	-1.451	-1.729	-1.132	-3.921	-0.871
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.013**)	(0.886)
R-squared	0.463	0.509	0.545	0.463	0.502	0.465	0.525	0.538	0.703

The table reports results of OLS time series regressions of changes in monthly average commonality in relative spread-based resiliency on changes in various cross-sectional demand-side drivers of commonality in resiliency and a number of cross-sectional market or economic controls, as described in Equation (6). Commonality in resiliency is estimated as per Equation (5). Differences are used to ensure the dependent and independent variables are stationary. All regression models are estimated using Newey-West standard errors. Model 1 is the basic model in Equation (6), while in Models 2 through 8 we add (one at a time) additional explanatory demand-side variables to the model. Model 9 includes all controls and demand-side variables that are added to the base model contemporaneously. Control variables include sovereign bond market logarithmic returns, trading volume, market liquidity resiliency, Credit Default Swap (CDS) spreads, 10-year sovereign bond yields, and bond market volatility as captured in the MOVE index. Demand-side drivers include the ZEW euro area Economic Sentiment Index, Sentix euro area and Sentix U.S. sentiment index, Economic Policy Uncertainty (EPU-Euro, EPU-UK, and EPU-US) index, and EUR/USD foreign exchange rate fluctuations. A constant term is included in the regression models to assess whether commonality in resiliency has increased or decreased over time. Regression coefficients are reported along with p-values shown in parentheses. Bold p-values denote statistical significance at either the 1%, 5%, or 10% significance levels. Coefficients of determination (R-squared statistics) are also reported for all regression models. GIIPS countries include Greece, Ireland, Italy, Portugal, and Spain. The pre-crisis period spans the dates from January 2008 to October 2009.

Table 16: Demand-side drivers of commonality in Quoted Depth (QD) resiliency of GIIPS countries (pre-crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	0.523	0.626	0.538	0.517	0.528	0.554	0.481	0.357	0.414
	(**0.032**)	(**0.073**)	(**0.030**)	(**0.055**)	(**0.044**)	(**0.015**)	(**0.069**)	(0.263)	(0.776)
Trading volume	0.017	0.011	0.013	0.018	0.013	0.015	-0.008	0.002	-0.033
	(0.198)	(0.405)	(0.376)	(0.187)	(0.357)	(0.350)	(0.583)	(0.904)	(0.150)
QD resiliency	-0.190	-0.173	-0.181	-0.197	-0.196	-0.200	-0.176	-0.198	-0.166
	(**0.006**)	(**0.035**)	(**0.013**)	(**0.017**)	(**0.013**)	(**0.039**)	(**0.017**)	(**0.007**)	(0.252)
CDS	-0.055	-0.054	-0.063	-0.057	-0.027	-0.048	0.015	-0.044	-0.033
	(0.391)	(0.422)	(0.395)	(0.358)	(0.720)	(0.484)	(0.780)	(0.480)	(0.760)
10-year bond yields	-0.046	-0.050	-0.028	-0.041	-0.052	-0.043	-0.098	-0.091	-0.116
	(0.579)	(0.532)	(0.735)	(0.630)	(0.520)	(0.592)	(0.165)	(0.274)	(0.443)
Market volatility	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.005
	(**0.001**)	(**0.001**)	(**0.002**)	(**0.012**)	(**0.005**)	(**0.034**)	(**0.001**)	(**0.001**)	(0.255)
ZEW		-0.003							0.002
		(0.563)							(0.983)
Sentix-euro area			-0.003						-0.004
			(0.695)						(0.705)
Sentix-US				0.117					-0.044
				(0.693)					(0.912)
EPU-Euro					-0.001				0.003
					(0.497)				(0.378)
EPU-UK						-0.042			-0.001
						(0.766)			(0.728)
EPU-US							-0.002		-0.004
							(**0.017**)		(0.317)
EUR/USD								0.485	0.455
								(0.310)	(0.854)
Constant (time trend)	-1.883	-1.864	-1.880	-1.881	-1.776	-1.820	-1.516	-2.545	-2.135
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.001**)	(0.634)
R-squared	0.723	0.732	0.728	0.729	0.732	0.725	0.767	0.745	0.793

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Table 17: Demand-side drivers of commonality in Relative Spread (RS) resiliency of GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	-0.148	-0.144	-0.145	-0.147	-0.143	-0.156	-0.149	-0.202	-0.161
	(**0.025**)	(**0.063**)	(**0.022**)	(**0.047**)	(**0.031**)	(**0.017**)	(**0.028**)	(**0.001**)	(**0.077**)
Trading volume	0.013	0.013	0.012	0.013	-0.012	0.004	0.014	0.007	-0.025
	(0.640)	(0.657)	(0.696)	(0.640)	(0.732)	(0.889)	(0.637)	(0.809)	(0.506)
RS resiliency	-0.087	-0.089	-0.086	-0.086	-0.074	-0.083	-0.087	-0.087	-0.085
	(**0.082**)	(**0.085**)	(**0.083**)	(**0.091**)	(0.149)	(0.104)	(**0.094**)	(**0.070**)	(0.135)
CDS	0.027	0.022	0.031	0.027	0.046	0.025	0.026	0.003	0.029
	(0.378)	(0.550)	(0.387)	(0.362)	(0.156)	(0.409)	(0.460)	(0.913)	(0.586)
10-year bond yields	-0.106	-0.106	-0.108	-0.106	-0.116	-0.108	-0.105	-0.097	-0.110
	(0.289)	(0.307)	(0.303)	(0.295)	(0.214)	(0.269)	(0.315)	(0.349)	(0.297)
Market volatility	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
	(0.681)	(0.709)	(0.684)	(0.683)	(0.752)	(0.620)	(0.676)	(0.629)	(0.797)
ZEW		-0.001							-0.003
		(0.852)							(0.709)
Sentix-euro area			0.002						0.005
			(0.824)						(0.618)
Sentix-US				0.014					-0.129
				(0.963)					(0.672)
EPU-Euro					-0.001				-0.002
					(**0.092**)				(0.398)
EPU-UK						-0.044			0.029
						(0.328)			(0.779)
EPU-US							0.007		0.001
							(0.928)		(0.556)
EUR/USD								0.910	0.527
								(0.122)	(0.396)
Constant (time trend)	-1.723	-1.723	-1.725	-1.723	-1.498	-1.623	-1.733	-2.944	-2.280
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.010**)
R-squared	0.142	0.143	0.143	0.142	0.176	0.156	0.142	0.179	0.209

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Table 18: Demand-side drivers of commonality in Quoted Depth (QD) resiliency of GIIPS countries (crisis period)

Model	1	2	3	4	5	6	7	8	9
Market return	-0.001	-0.015	-0.002	0.002	-0.001	0.003	-0.004	0.010	-0.065
	(0.988)	(0.836)	(0.977)	(0.981)	(0.985)	(0.963)	(0.958)	(0.889)	(0.482)
Trading volume	0.036	0.037	0.037	0.036	0.042	0.040	0.038	0.037	0.060
	(0.310)	(0.300)	(0.300)	(0.316)	(0.310)	(0.300)	(0.308)	(0.304)	(0.159)
QD resiliency	-0.003	0.000	-0.003	-0.002	-0.004	-0.005	-0.005	-0.002	-0.013
	(0.938)	(0.990)	(0.945)	(0.953)	(0.918)	(0.907)	(0.903)	(0.954)	(0.742)
CDS	0.003	0.014	0.001	0.004	0.000	0.004	-0.001	0.008	0.001
	(0.955)	(0.820)	(0.985)	(0.949)	(0.996)	(0.938)	(0.983)	(0.894)	(0.986)
10-year bond yields	0.022	0.023	0.023	0.022	0.023	0.022	0.026	0.020	0.054
	(0.809)	(0.789)	(0.813)	(0.807)	(0.795)	(0.805)	(0.782)	(0.825)	(0.596)
Market volatility	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
	(0.320)	(0.255)	(0.324)	(0.324)	(0.314)	(0.392)	(0.319)	(0.313)	(0.290)
ZEW		0.002							0.009
		(0.437)							(**0.049**)
Sentix-euro area			-0.001						-0.015
			(0.895)						(**0.062**)
Sentix-US				0.032					0.083
				(0.898)					(0.732)
EPU-Euro					0.031				-0.032
					(0.735)				(0.871)
EPU-UK						0.022			0.030
						(0.697)			(0.790)
EPU-US							0.038		0.001
							(0.740)		(0.717)
EUR/USD								-0.182	0.028
								(0.778)	(0.976)
Constant (time trend)	-1.824	-1.824	-1.823	-1.824	-1.876	-1.875	-1.881	-1.579	-1.945
	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.000**)	(**0.070**)	(0.141)
R-squared	0.047	0.060	0.047	0.047	0.049	0.051	0.049	0.048	0.107

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