ISSN: 3049-7159

Research Article

Journal of Business and Econometrics Studies

Liquidity-Driven Crisis Episodes: A CGARCH Model of the Greek Sovereign Spread

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Received: September 22, 2025; **Accepted:** September 26, 2025; **Published:** October 05, 2025

ABSTRACT
This paper provides evidence of the liquidity-driven nature of sovereign debt crisis episodes, with an application to the case of Greece. The results of a Component GARCH model (CGARCH) of the Greek sovereign spread for data between Jan. 1999 and Dec. 2020 are provided. A long-term component of Greek sovereign spread volatility is distinguished from a short-term component. The short-term component is liquidity-driven and peaks during crisis incidents, consistent with the prescriptions of the literature on self-fulfilling crises.

Keywords: Sovereign Spreads; Greek Debt Crisis, GARCH Models, Self-Fulfilling Crisis

JEL Classification
- G01 Financial Crises
- G1 Asset Markets and Pricing
- H63 Sovereign Debt

Introduction

Since the onset of the Greek and Eurozone debt crisis, empirical papers on the determinants of sovereign spreads have pondered over evidence of market-sentiment effects, over and beyond fundamentals. In parallel, a long-standing strand of papers has been devoted to so-called "self-fulfilling liquidity crises." Typically, such episodes are preceded by massive selloffs and rising liquidity premia, which in turn raise the cost of debt rollover. From a theoretical perspective, determining fiscal solvency according to a No-Ponzi condition in the Intertemporal Government Budget Constraint may seem relatively straight-forward. A sovereign is deemed to be solvent when the present value of its future surpluses suffices to cover its outstanding debt obligations. In reality, however, "solvent but illiquid" is more often the source of sovereign debt crises.

In line with the theoretical distinction of the long-term fiscal fundamentals of solvency against short-term market sentiment and uncertainty effects, this paper seeks to provide relevant empirical evidence for the Greek sovereign spread by using a technique which is more often applied in the financial literature, a Component GARCH model. The main question raised is whether the impact of a short-term component may be distinguished for the second moment of the spread and whether such a component is driven by market liquidity. In addition, the results of this paper examine whether incidents in the Greek crisis timeline may be associated with short-term market sentiment, as opposed to changes in a long-term component of volatility.

This paper contributes to the literature by distinguishing between a long-term and short-term component of the volatility of Greek spreads. On a time series basis, and for the sample covering the entire crisis period, this is the first relevant application.

Related Literature

The Component GARCH model was first developed by Engle & Lee to distinguish between a permanent and a transitory component in the volatility of stock returns. Primary explanations for the existence of components in volatility relate to the heterogeneity of traders in financial markets and heterogeneity of information, through the arrival of news [1][1].

Citation: Ersi-Iliana Savvopoulou. Liquidity-Driven Crisis Episodes: A CGARCH Model of the Greek Sovereign Spread. J Bus Econo Stud. 2025. 2(5): 1-4. DOI: doi.org/10.61440/JBES.2025.v2.88

This paper follows the approach of Li et al., as applied to the Greek sovereign spread, for the purpose of distinguishing between a fundamentals (long-term) and a market-sentiment (short-term) component in the volatility of the Greek sovereign spread[2]. Since the sovereign spread is a financial-markets-based metric, this section suggests the application of the CGARCH-M model and its interpretation to the Greek sovereign spread. To date, Sosvilla-Rivero & Morales-Zumaquero have applied a CGARCH model to the sovereign bond yields of a panel of EMU countries to distinguish between a permanent and transitory component in volatility [2][3]. On a time series basis for Greece over the course of the crisis and for the Greek sovereign spread, the suggested application is novel.

Data and Model

Data

For the dependent variable, monthly data between January 1999 and December 2020 for the Greek 10-Year Government bond yield spread have been used [2][4]. Figure 1 depicts the behaviour of the Greek sovereign spread over the course of the period since the onset of the EMU [3][5].

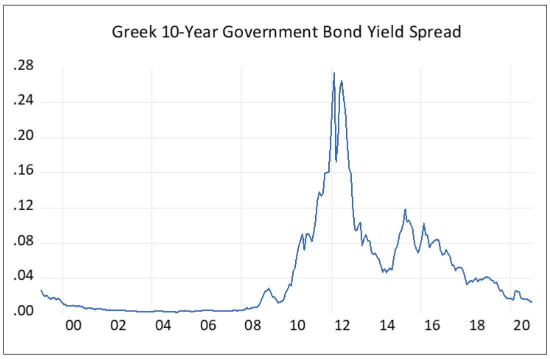

Figure 1: Plot of the Greek 10-Year Government Bond Yield Spread

In line with the relevant literature on the liquidity determinant of sovereign spreads, the Bid-Ask spread (bas) on 10-year Greek Government Bonds is included as a measure of liquidity risk. An increase in the bid-ask spread level indicates deteriorating liquidity conditions and has, thus, been associated with an increase in sovereign spreads. The bid-ask spread increased sharply in the beginning of the financial crisis and continued on this upward trend during the Eurozone debt crisis. However, in the aftermath of the ECB's extraordinary reaction to the crisis in 2012, the bid-ask spread declined significantly (Figure 2). A brief deterioration in liquidity conditions is further observed in 2015. Thereafter, the bid-ask spread on the Greek 10-year government bond gradually declined, albeit lingering at levels higher than before the crisis [4][6].

The Model

Equations 5α-5c describe the CGARCH-M model estimated in this paper, augmented for short-term liquidity effects (bas_t) in the temporary variance equation. Equation (5a) is the mean equation, Equation (5b) corresponds to the permanent volatility component and Equation (5c) relates to transitory volatility. Following Li, et al. the transitory component in the variance may be related to market sentiment and short-run speculative pressures.

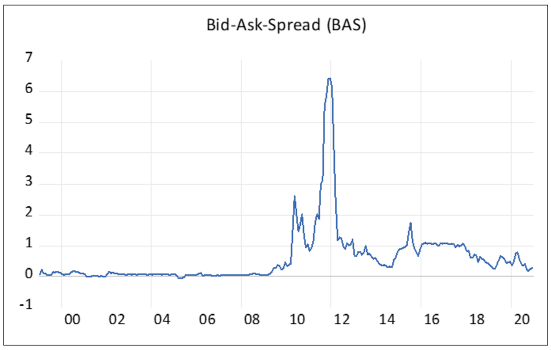

Figure 2: Plot of the Bid-Ask Spread on 10-Year Greek Government Bonds

$$spread_t = C + \beta spread_{t-1} + \gamma\sigma_t + \varepsilon_{t-1} \quad (5a)$$

$$q_t = C_4 + C_5(q_{t-1} - C_4) + C_6(\varepsilon^2_{t-1} - \sigma^2_{t-1}) \quad (5b)$$

$$\sigma^2_{t-1} = q_t + C_7(\varepsilon^2_{t-1} - q_{t-1}) + C_8 D_{t-1}(\varepsilon^2_{t-1} - q_{t-1}) + C_9(\sigma^2_{t-1} - q_{t-1}) + C_{10} bas_t \quad (5c)$$

Where:

- D_{t-1} is a dummy variable corresponding to the asymmetric effect of shocks, $D_{t-1}=1$ for $\varepsilon_{t-1}<0$, and $D_{t-1}=0$ for $\varepsilon_{t-1}\geq 0$;
- q_t corresponds to the long-run component of the conditional variance indicative of the effect of shocks to economic fundamentals and which converges to the long-run time-invariable volatility level C_4 with a speed of C_5;
- C_7 is the coefficient that reflects the initial impact of a shock to the transitory component of volatility;
- C_9 is the "degree of memory in the transitory component";
- C_8 is the coefficient of the asymmetric effect once multiplied with the dummy variable.

[1]According to the literature, the findings of CGARCH models may be interpreted as a challenge of the Efficient Market Hypothesis, at least in its strong form (Haque et al., 2004; Abu Zarour, 2007; Zarour & Siriopoulos, 2008). The CGARCH model is used as an alternative to the FIGARCH model for long memory in the conditional variance. Based on an application to oil prices, Kang et al. (2009) have suggested that the out-of-sample fit for FIGARCH and CGARCH models may be superior to that of GARCH and IGARCH models.

[2] Following the literature on C-GARCH-M models, which to date is mostly applied to the Uncovered Interest Parity (Li et al., 2012) and to currency crises (Guimaraes & Karacadag, 2004), the distinction between a permanent (long-term) and a transient (short-term) component relates to the fundamentals-versus-market-sentiment discussion in financial and currency-crisis literature. Pramos & Tamirisa (2006) also relate the transient component in CGARCH models to short-term trader position-taking.

[3] Sosvilla-Rivero & Morales Zumaquero (2012) develop a CGARCH model for daily data of 10-year government bond yields for 11 EMU countries, including Greece, for data between 26 March 2001 and 31 December 2010. In contrast, The Model in this paper is a CGARCH-M with leverage effects (threshold) based on the time-series of the Greek sovereign spread only, for monthly data between January 1999-December 2020.

[4]Monthly data for the Greek 10-Year Government Bond Yield ($Yield_{GR,t}$) and the German 10-Year Bund ($Yield_{GER,t}$)) have been obtained from the FRED Database (2021g, 2021f). The spread has been calculated based on the following equation:

$$spread_t = Yield_{GR,t} - Yield_{GER,t} \quad (4)$$

The inclusion of the asymmetric effect term (dummy variable) in the CGARCH-M model follows Li et al. , Guimaraes & Karacadag and Glosten et al [5-8].

Results

Table 1: CGARCH-M Model Results for the Greek Sovereign Spread

Dependent Variable: SPREAD
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Sample (adjusted): 1999M02 2020M12
Included observations: 263 after adjustments
Failure to improve likelihood (non-zero gradients) after 46 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
σ_t	0.981143	0.084113	11.66464	0.0000
C	-9.57E-05	2.16E-05	-4.431439	0.0000
$spread_{t-1}$	0.882226	0.001024	861.8090	0.0000
Variance Equation				
C(4)	-3.34E-07	9.43E-08	-3.543159	0.0004
C(5)	0.554785	0.614446	0.902903	0.3666
C(6)	-0.019568	0.060535	-0.323249	0.7465
C(7)	0.392150	0.080464	4.873585	0.0000
C(8)	-0.302697	0.053158	-5.694271	0.0000
C(9)	0.673732	0.063202	10.66001	0.0000
C(10)	1.58E-06	2.39E-07	6.602047	0.0000

R-squared	0.961166	Mean dependent var	0.042728
Adjusted R-squared	0.960867	S.D. dependent var	0.053528
S.E. of regression	0.010589	Akaike info criterion	-9.062190
Sum squared resid	0.029152	Schwarz criterion	-8.926367
Log likelihood	1201.678	Hannan-Quinn criter.	-9.007606
Durbin-Watson stat	1.713623		

Figure 3 plots the estimated model conditional time-varying volatility and its permanent component. The distance between total conditional time-varying volatility and the permanent component corresponds to the transitory component of volatility. Based on Figure 3, market-sentiment effects were particularly strong during the Greek PSI in 2012, yet thereafter their impact subsided. Additional brief increases in the size of the transient component of volatility are present at the end of 2014 and in 2016. The model works well in showing that crises are associated with short-term market sentiment effects and liquidity. The instance of partial default in the first half of 2012 is captured by a global peak in the transitory component.

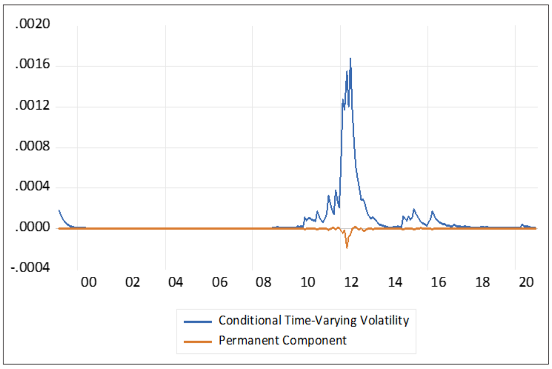

Figure 3: Model-Based Conditional Time-Varying Volatility and Permanent Component [2][7].

According to Table 1, the time-invariant volatility (C_4) is very close to zero. Short-term market sentiment effects dominate the pricing of Greek sovereign spreads (C_5 is not significant)[8]. The transitory effect of news (C_8) is significant and negative shocks to the sovereign spread are associated with lower volatility than positive shocks. Short-run market sentiment effects relate to liquidity conditions in the Greek government debt (C_{10})[9]. Some degree of memory is present in the transient component of the volatility (C_7 is statistically significant). Shock persistence in the transitory component exceeds 1 (C_7+C_9) and is indicative of explosive short-run market sentiment behavior.

Conclusion

Results distinguish between a short-term and long-term component in the volatility of Greek sovereign spreads and suggest that the short-run market-sentiment component of volatility dominates market pricing. The evolution of the conditional time-varying volatility and its components over time supports the hypothesis that short-term market-sentiment effects are associated with crisis outcomes and periods. In addition, short-term volatility is shown to be liquidity-driven. In line with the literature, the impact of news on the transitory component of the Greek sovereign spread is significant.

The study provides a quantitative method to depict that short-term liquidity-driven market sentiment predominantly drives Greek sovereign risk pricing during crises episodes [9-15].

[5]A period of relative tranquillity since the onset of the EMU and up to the eruption of the US financial crisis in 2007; a turbulent period covering the ripples of the US financial crisis and the Eurozone debt crisis up to Mario Draghi's famous 'Whatever It Takes' speech in 2012. Additional instances of increased sovereign risk may be located in 2015, when the political narrative and discussions of Grexit were associated with increased levels of Greek sovereign risk; and in early 2020, when despite the effects of the COVID pandemic, the ECB's decision to include Greek government bonds in its asset purchases and in the Pandemic Emergency Purchase Programme (PEPP) induced an easing of liquidity conditions and contributed to lower sovereign spread levels.

[6]Relevant data has been obtained from Bloomberg Terminal (2021).

[7]The Model's in-sample forecasting fit is strong and there are no remaining ARCH effects based on the ARCH-LM test of the residuals. Despite the potentially explosive properties of short-run market sentiment, as the estimated model is a threshold volatility model, it is strictly stationary and ergodic. As in December 2020 (end-of sample), the CGARCH-M model predicted value is 134.3 bps whereas its actual value was 124.9 bps.

[8]In contrast, for daily data in the Greek government bond yield between 2000 and 2010, Sosvilla-Rivero & Morales Zumaquero (2012) estimate this coefficient to be 0.995, indicative of a degree of high persistence in the permanent component of volatility. This paper focuses on a portion of the Greek government bond yield only, the spread, and covers the period of the Greek debt crisis. Therefore, the finding of relatively lower persistence appears to be reasonable.

[9]Using Equation (6) for the long-run half-life measure of Sosvilla-Rivero and Morales Zumaquero (2012), the long-run component half-life of the Greek spread is approximately 1.18 months.

$$LRHL(\hat{p}) = \ln(\tfrac{1}{2}) / \ln(\hat{p}) \quad (6)$$

where $\hat{p}$ corresponds to the estimated coefficient C_5.

The respective figure for the pre-crisis Greek 10-year bond yield estimated by Sosvilla-Rivero & Morales Zumaquero (2012) was 130 days.

References

1. Andersen TG, Bollerslev T. Intra-day Periodicity and Volatility Persistence in Financial Markets. Journal of Empirical Finance. 1997a. 4: 115-158.
2. Andersen TG, Bollerslev T. Heterogeneous information arrivals and return volatility dynamics: Uncovering the long-run in high frequency returns, Journal of Finance. 1997b. 52: 975-1005.
3. Byrne JP, Davis EP. The impact of short- and long-run exchange rate uncertainty on investment: A panel study of industrial countries. Oxford Bulletin of Economics and Statistics. 2005. 67: 307-329.
4. Engle RG, Lee G. A Permanent and Transitory Component Model of Stock Return Volatility. (October 1993). 1993. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5848.
5. Engle RF, Lee G. A Permanent and Transitory Component Model of Stock Return Volatility. Cointegration, Causality and Forecasting: A Festschrift in Honor of Clive W.J. Granger. Oxford University Press, New York. 1999.
6. Glosten L, Jagannathan R, Runkle D. On the relation between expected value and the volatility of the nominal excess return on stocks, Journal of Finance. 1993. 48: 1779-1801.
7. Guimaraes R, Karacadag C. The Empirics of Foreign Exchange Intervention in Emerging Market Countries. The Cases of Mexico and Turkey. IMF Working Paper. 2004. 04: 123.
8. Haque M, Hassan M, Maroney N, Sackley W. An empirical examination of stability, predictability and volatility of Middle Eastern and African emerging stock markets, Review of Middle East Economics and Finance. 2004. 2: 19-42.
9. Kang SH, Kang SM, Yoon SM. Forecasting Volatility of Crude Oil Markets. Energy Economics. 2009. 31: 119-125.
10. Li D, Ghoshray A, Morley B. Measuring the Risk Premium in Uncovered Interest Parity Using the Component GARCH-M model. International Review of Economics & Finance. 2012. 24: 167-176.
11. Muller UA, Dacorogna MM, Dave RD, Olsen RB, Pictet OV. Volatilities of Different Time Resolutions-Analyzing the Dynamics of Market Components. Journal of Empirical Finance. 1997. 4: 213-239.
12. Pramor M, Tamirisa NT. Common volatility trends in the Central and Eastern European currencies and the euro. IMF working paper. 2006. 206.
13. Sosvilla-Rivero S, Morales-Zumaquero A. Volatility in EMU Sovereign Bond Yields: Permanent and Transitory Components. Applied Financial Economics, Taylor & Francis Journals. 2012. 22: 1453-1464.
14. Tong H. Threshold Models in Time Series Analysis-30 Years On. Statistics and its Interface. 2010. 2.
15. Zarour AB, Siriopoulos CP. Transitory and Permanent Volatility Components: The Case of the Middle East Stock Markets. Review of Middle East Economics and Finance. 2008. 4: 3.