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Assessing the Effects of the Global Financial Cycle on Eurozone's Financial Stress: Does the Quantitative Easing Matter?

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Assessing the effects of the Global Financial Cycle on Eurozone's financial stress: Does the Quantitative Easing matter?

By
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Abstract

This paper examines whether the expanded Quantitative Easing policies of the European Central Bank during the period 2015-2022 have influenced the impact of the Global Financial Cycle (GFC) on the Eurozone's financial stress. The threshold regression reveals that these policies implementation has reduced the impact of GFC on financial stress in the post-2015 period, and thus contributed to lower systemic risk. The impulse responses of the quantile regression show that a global risk aversion shock does not have persistent effects on the financial stress distribution, and thus the GFC would not "set the tone" of Eurozone's financial conditions.

KEYWORDS Quantitative easing; financial stress, global financial cycle, systemic risk; balance sheet; threshold regression; quantile regression analysis
JEL CLASSIFICATION E52; E58; G15

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1. Introduction

From the early 2000s to 2007, the global economy has exhibited its best performance in the last four decades, and as a result many countries experienced a boom in credit expansion and asset prices. However, these events ended in a severe financial turmoil in the form of credit crises and falling asset prices, leading to the global financial crisis of 2007-2008 which plunged the world economy into a deep recession.

After the collapse of Lehman Brothers, conventional monetary policies, with interest rates at the zero bound, have become impotent, and thus all major central banks have embarked on Asset Purchase Programmes (APP), popularly referred to as Quantitative Easing (QE), to alleviate financial market stress, stimulate growth and achieve price stability (Bullard, 2010). Initially, the European Central Bank (ECB) has responded to the Lehman bankruptcy and the Greek crisis by initiating two unconventional policy programmes – the Covered Bond Purchasing Programme (CBPP) and the Securities Markets Programme (SMP) – which have made only small contributions to the increase of the Eurosystem's balance sheet. In mid-2014 the ECB initiated its large scale APP, and in January 2015, the Governing Council announced an expanded APP of €60 billion a month of net purchases from March 2015. Having hit a peak of €80 billion a month in 2016, asset purchases have slowly fallen with monthly bond buys at €15 billion in the final quarter of 2018. From November 2019 to March 2022, net purchases amounted to €20 billion a month, then the monthly bond buys amounted to €40 billion in April 2022, €30 billion in May 2022, and €20 billion in June 2022. On 9 June 2022 the Governing Council decided to discontinue net asset purchases under the APP as of 1 July 2022, but to continue reinvesting, in full, the principal payments from maturing securities. On 15 December 2022 the Governing Council decided that from the beginning of March 2023, the APP will decline as the Eurosystem will not reinvest all the principal payments from maturing securities (European Central Bank, 2023). Figure 1 plots the total assets of the consolidated balance sheet of the Eurosystem. The area between the two vertical lines indicates the period of the expanded APP. The total assets increased from €2.2 trillion in January 2015 to €8.8 trillion in June 2022, and then within a year gradually declined to €7.6 trillion.

INSERT FIGURE 1 HERE

The empirical literature has argued that QE policies have substantial effects on financial markets and the real economy (Luck and Zimmermann 2020; Mallick, Mohanty, and Zampolli 2017; Wen 2014; Glick and Leduc 2013; Rosa 2012; Chen, Cúrdia, and Ferrero 2011; Neely 2010). This literature, however, has not examined whether QE policies have alleviated financial market stress by affecting market optimism in the presence of global financial turbulence.

The present study fills in this gap in the literature by examining whether the ECB's unconventional monetary policies under the APP have influenced the effects of the Global Financial Cycle (GFC) on Eurozone's financial stress. We capture the market optimism of QE policies by analyzing the asymmetric response of the financial stress to GFC developments before and after the implementation of these policies, and also to changes in the balance sheet of the Eurosystem using a threshold regression analysis. If the analysis indicates that the QE policies under the APP have reduced systemic risk, we will proceed to examine whether shocks to global risk aversion have persistent effects on the distribution of Eurozone's financial stress. Our goal is to evaluate the argument that the presence of the GFC would "set the tone" of domestic financial conditions (Rey, 2015) by examining whether the GFC acts as a propagation mechanism that leads to a persistent impact on the domestic financial markets.

The theoretical argument that frames the empirical analysis in the present context is that there exists a global risk factor which affects the returns on risky assets and cross-border capital flows leveraged from global banks and asset managers, and this factor is related to global risk aversion which has been identified as a major driver of the GFC. In addition, this global factor is related to the developments of the US dollar and the stance of the US monetary policy (Miranda-Agrippino and Rey, 2020). As surges in capital flows tend to amplify the domestic credit cycle, something that was observed during the global financial crisis, a tightening of global financial conditions may lead non-financial companies and households to withdraw deposits from local banks, thus increasing the lending spreads and consequently the cost of borrowing funds in financial markets and thus financial volatility and stress (BIS, 2015). In addition, higher volatility in U.S. assets leads to higher risk premia, as higher U.S.-specific uncertainty leads to deleveraging pressure on U.S. intermediaries, triggering higher global risk premia and lower global asset values (Akinci, Kalemli-Ozcan, and Queralto, 2022). In other words, the GFC in capital flows is negatively related to global risk aversion and feeds into domestic financial conditions which are reflected in financial turbulence and stress.

2. Empirical Analysis

2.1 Data and univariate analysis

To quantify the effects of the GFC on the Eurozone's financial stress, we turn to the data and estimate firstly threshold regressions to identify the likely efficacy of QE policies to affect market optimism, and secondly quantile regressions to identify the impulse responses of the distribution of financial stress to a global risk aversion shock. We use monthly data for sixteen Eurozone countries from 2000M1 to 2023M6.[1] The countries are Austria, Belgium, Cyprus, Germany, Spain, Finland, France, Greece, Croatia, Ireland, Italy, Luxemburg, Malta, Netherlands, Portugal, and Slovakia. For each country, we obtain the Country-Level Index of Financial Stress (CLIFS) published by the ECB. This index contains six measures of financial stress from three financial markets: equity, bonds, and foreign exchange. When aggregating the sub-indices the CLIFS accounts for comovements across markets.[2] In addition, we use data for the implied volatility index (VIX) to capture risk in stock markets, the broad effective exchange rate for the United States, the interbank interest rate for euro area, the ECB marginal lending facility rate, and the Eurosystem total assets.

The literature (Miranda-Agrippino and Rey, 2020) has used a number of international financial variables to capture the fluctuations of the GFC, including the VIX index and the dollar exchange rate. In the present analysis, these two variables are used to summarize fluctuations in the GFC. The VIX index, derived from S&P

[1] We have excluded countries with missing data.
[2] For further details, see Duprey, Klaus, and Peltonen (2015).

500 index options, is used by the literature (Passari and Rey 2015; IMF 2017) to indicate the global financial conditions with higher values reflecting lower tolerance for risk-taking and decreases in leverage. In the data, the VIX and the dollar exchange rate exhibit similar comovements. We illustrate this in Figure 2 where both variables increase strongly during the global financial crisis and during the Covid-19 pandemic. The correlation coefficient is equal to 0.12 with a *P-value*=0.045. In theory (Jiang, Krishnamurthy, and Lustig, 2018; Krishnamurthy and Lustig, 2019), the positive association of the two variables is related with the role of the dollar as a safe-haven asset. A rise in global risk aversion increases the demand for dollar assets due to the convenience yield they offer. At the same time, the appreciation of the dollar may dampen (trade channel) or exacerbate (financial channel) the effect of global risk shocks to the rest of the world.

INSERT FIGURE 2 HERE

We log all variables, except for the interest rates. In each month, we construct the mean of the log of the CLIFS across the panel of sixteen countries for that month and term this variable FSI. Figure 3 plots the cross-sectional mean and the log of the VIX. We observe that both variables are remarkably very close and exhibit the same fluctuations. The correlation coefficient 0.74 (*P*-value=0.00) shows a very tight link between the two variables. Figure 4 plots the cross-sectional mean and the log of the dollar exchange rate. Until the end of 2014, the two variables exhibit a negative correlation with a coefficient -0.18 (*P-value*=0.02). Since then, the two variables exhibit a positive and statistically significant correlation with a coefficient 0.58. These stylized facts show that during the expanded APP, the dollar appreciation is related with an increase in domestic financial stress.

INSERT FIGURES 3-4 HERE

2.2 Threshold regression analysis

Let us assume that the FSI is determined by a threshold autoregressive (TAR) process with two regions defined by a threshold ζ:

$$y_t = \boldsymbol{y}_t\boldsymbol{\beta}_1 + \boldsymbol{x}_t\boldsymbol{\gamma}_1 + \boldsymbol{z}_t\boldsymbol{\delta}_1 + \varepsilon_t \qquad \text{if } -\infty < \phi_t < \zeta \qquad (1)$$

$$y_t = \boldsymbol{y}_t\boldsymbol{\beta}_2 + \boldsymbol{x}_t\boldsymbol{\gamma}_2 + \boldsymbol{z}_t\boldsymbol{\delta}_2 + \rho d_t + \varepsilon_t \qquad \text{if } \zeta < \phi_t < \infty \qquad (2)$$

where y is the cross-sectional mean of the log of the CLIFS (FSI), $\boldsymbol{y}$ is a 1×2 vector of lagged values of y, $\boldsymbol{\beta}$ is a 2×1 vector of region-specific parameters, $\boldsymbol{x}$ is a 1×2 vector of covariates containing the variables that summarize the GFC, such as the log of VIX and the log of the dollar exchange rate, $\boldsymbol{\gamma}$ is a 2×1 vector of region-specific coefficients, $\boldsymbol{z}$ is a 1×2 vector of control variables capturing monetary policy actions, $\boldsymbol{\delta}$ is a 2×1 vector of region-specific coefficients, d is a dummy variable capturing the Covid-19 pandemic, ϕ is a threshold variable and ε is an IID error with mean zero and variance σ^2. The first policy covariate is the difference between the ECB marginal lending facility rate and the interbank interest rate, and this policy margin captures conventional monetary policy stance. An increase in the policy margin will indicate that the ECB actions contain the liquidity of financial markets, thus creating more uncertainty and consequently increasing financial stress. The second policy covariate is the first-difference of the log of the Eurosystem's total assets and captures unconventional monetary policy stance. An increase in the QE operations will imply that the Eurosystem expands its balance sheet whenever the economic conditions deteriorate, thus reducing financial uncertainty and stress.

We are interested in estimating the parameters $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ for the two regions, where the first region refers to the subset of observations in which the threshold variable ϕ is less than ζ, and the second region to the subset of observations in which the threshold variable ϕ is greater than ζ. If the estimated coefficients $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ are statistically different between the two regions, it will imply an asymmetric response of the FSI to GFC developments before and after the implementation of the expanded QE policies, and also to changes in the balance sheet of the Eurosystem.

Initially, we test for unit roots and the results are reported in Table 1. The conventional test proposed by Kwiatkowski et al. (KPSS, 1992) indicates that all variables concerned, such as the FSI, the log of the VIX, the log of the dollar exchange rate and the growth rate of total assets are stationary, with the exception of the difference between the ECB marginal lending facility rate and the interbank interest rate, which is stationary with breaks, as indicated by the structural breaks test proposed by Kapetanios (KAP, 2005). In addition, we have tested the hypothesis of a unit root against a stationary TAR for the FSI, using Enders and Granger (1998) approach of a linear attractor model. The estimated value of the *F*-statistic 211.7 is greater than the 5% critical value of 4.56, implying that the FSI is a stationary TAR.

INSERT TABLE 1 HERE

Then, an AR model for the FSI has been estimated for various lags and the BIC selected two lags which are included in the TAR model. We have used the total assets of the Eurosystem as the threshold variable and assumed two regions, justified by the fact that the mean of the total assets was about €1.5 trillion until 2014 and increased to €5.3 trillion thereafter. The TAR model also contains the log of the VIX (x_1), the log of the dollar exchange rate (x_2), the first lag of the policy margin (z_1), the first lag of changes in the log of the total assets (z_2) and a dummy variable which takes one at March 2020, capturing the eruption of the covid-19 pandemic, and zero elsewhere. Given that the values of the two lags were similar across regimes, we tested the hypothesis of a region-invariant first and second lags. For both lags, the *p*-values of the $\chi^2(1)$ statistics 0.99 and 0.18, respectively, could not reject the null hypothesis. In turn, we have estimated the TAR model with a region-invariant autoregressive lags, and the results are reported in Table 2. The estimated value of the threshold variable is €2.7 trillion and splits the sample into two regions. The first one corresponds to the subset of observations in which the total assets are less than or equal to €2.7 trillion (low total assets region) and the other one corresponds to the subset of observations in which the total assets are greater than €2.7 trillion (high total assets region). The coefficient of x_1 which captures the GFC is 0.59 in the low total assets region and 0.21 in the high total assets region. We have examined for a cross-section asymmetry of the impact of GFC on Eurozone's financial stress by testing the hypothesis that the two coefficients of x_1 are equal across the two regions. The value of the $\chi^2(1)$ statistic 0.19 (*P-value*=0.00) implies that we cannot accept the null hypothesis that x_1 is region-invariant, suggesting that the implementation of the expanded APP has contributed significantly to lower systemic risk, by affecting market optimism, and thus has reduced the impact of GFC on Eurozone's financial stress. This observation is also supported from the statistical significance of the lagged growth rate of the total assets that carries a negative sign, implying that an increase in the growth rate of the total assets reduces financial stress. The dollar exchange rate that captures an aspect of the GFC has different effects across regions. In the low total assets region, an appreciation of the dollar reduces systemic risk through the trade channel which positively influences the Eurozone's economy. On the other hand, in the high total assets region, which reflects the implementation of the expanded APP, an appreciation of the dollar increases systemic risk, since QE policies and the strong dollar convey conflicting signals about the developments of the Eurozone's economy. Finally, the variable that captures the conventional monetary policy is significant in the high total assets region and carries a positive sign, suggesting that whenever the interest rate policies of the ECB contain the liquidity of financial markets that will increase systemic risk by negatively affecting market optimism.

INSERT TABLE 2 HERE

2.3 Quantile regression analysis

Having established that the implementation of the expanded APP has reduced the impact of the GFC on domestic financial stress, we next proceed to examine whether shocks to global financial conditions, proxied here by the VIX, affect the distribution of FSI, especially in the lower and upper tails reflecting, respectively, low and high financial stress. To this end, we estimate impulse responses to a global risk aversion shock over the period 2015M1-2023M6. We follow Jorda (2005) and construct impulse response functions using local projections for k=0,1,…,6 (in months) from the estimation of the following quantile specification

$$Q_\tau\left(y_{t+k}\middle|\boldsymbol{\psi}_t\right)=a(\tau)+\boldsymbol{y}_t\boldsymbol{\beta}(\tau)+\gamma_{k1}x_{1t}(\tau)+\gamma_2 x_{2t}(\tau)+\boldsymbol{z}_t(\tau)\boldsymbol{\delta}+\rho d_t(\tau)+\varepsilon_t(\tau) \qquad (3)$$

where $Q_\tau\left(y_{t+k}\middle|\boldsymbol{\psi}_t\right)$ is the FSI at quantile τ, given the vector of covariates $\boldsymbol{\psi}_t$. The covariates are defined as before. The coefficient γ_{k1} measures the response of the FSI in month $t+k$ and quantile τ to a global risk aversion shock in month t. Figures 5-7 plot the dynamics of responses at three quantiles with the 90% confidence band. Panel A shows the response at 0.05 quantile, panel B at the median (0.50 quantile), and panel C at 0.95 quantile. In the lower tail of the distribution, the shock leads to a significant decline in the FSI in the last two months of the simulation, indicating that a US-specific uncertainty shock is not destabilizing when the financial stress is low. In the median and the upper tail of the distribution, the shock leads to a significant increase in the FSI which is however short-lived. It is worth noting that the US-specific uncertainty shock will be more destabilizing when the financial stress is high (95th percentile) than it is moderate (50th percentile). This dynamic analysis demonstrates that a shock to global risk aversion does not have persistent effects on the distribution of Eurozone's financial stress implying that the financial conditions in the euro area are not persistently influenced by the GFC in the era of the expanded APP. Table 3 reports the quantile estimates at the 95th percentile. The one lagged growth rate of total assets has information content that is useful to predict movements in the financial stress, with the negative sign highlighting the effectiveness of the expanded APP.

INSERT FIGURES 5-7 HERE

3. Conclusions and implication

First, the implementation of the expanded APP during the period 2015-2022 has significantly reduced the impact of GFC on financial stress in the post-2015 period compared with the pre-2015 period, and thus contributed to lower systemic risk.

Second, a global risk aversion shock does not have persistent effects on the distribution of financial stress in the post-2015 period.

The implication of the above results is that under adequate QE policies, as those implemented in the Eurozone in the post-2015 period, the presence of the GFC would not systematically affect the domestic financial conditions.

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Table 1: Calculated statistics of unit root tests

Tests/variables	y	x_1	x_2	z_1	z_2
KPSS-LM test	0.23	0.33	0.34		0.10
Critical value at 1% = 0.741					
KAP-*t* test				-9.72	
Critical value at 1% = -7.40					
TAR-*F* test	211.67				
Critical value at 5% = 4.56					

Notes: y is the log of the mean of FSI, x_1 is the log of VIX, x_2 is the log of the dollar exchange rate, z_1 is the difference between the ECB marginal lending facility rate and the interbank interest rate, and z_2 is the growth rate of total assets of the Eurosystem. The KPSS test is one-sided LM statistics. If the LM statistic is greater than the critical value, then the null hypothesis is rejected and the series is non-stationary. The KAP test is a sequential one-sided Augmented Dickey-Fuller (ADF) *t*-statistic. If the *t*-statistic is smaller than the critical value, then the null hypothesis is not rejected and the series is non-stationary. The TAR test is an extension of the one-sided standard ADF *F*-statistic. If the *F*-statistic is smaller than the critical value, then the null hypothesis is not rejected and the series is non-stationary.

Table 2: Threshold regression estimates

Dependent variable: y_t

	***Region* 1**		***Region* 2**	
Regressors	Coefficients	Robust S.E/*P-value*	Coefficients	Robust S.E/*p-value*
x_{1t}	**0.593**	0.052/0.00***	**0.215**	0.075/0.00***
x_{2t}	-0.842	0.147/0.00***	0.958	0.403/0.02**
$z_{1t\text{-}1}$	-0.013	0.070/0.85	0.616	0.137/0.00***
$z_{2t\text{-}1}$	-0.0001	0.006/0.98	**-0.017**	0.008/0.04***
cons	1.066	0.653/0.10*	-6.407	1.867/0.00***
Region-invariant independent variables				
$y_{t\text{-}1}$	0.424	0.047/0.00***		
$y_{t\text{-}2}$	0.172	0.048/0.00***		
*dum*20	0.873	0.086/0.00***		

Tested hypothesis of asymmetry across regions:
Region 1 coefficient of x_1= Region 2 coefficient of x_1
$\chi^2(1) = 19.40$
$P > \chi^2 = 0.000$***

Notes: Full sample: 2000M3-2023M6. ***, **, * indicate significance at 1%, 5%, 10% levels.

Table 3: High financial stress (95th percentile) regression estimates

Dependent variable: y_t

Regressors	Coefficient	Robust std. Error	*t*-test	*P*-value
y_{t-1}	0.336	0.057	5.84	0.000***
y_{t-2}	0.245	0.034	7.20	0.000***
x_{1t}	**0.842**	0.071	11.83	**0.000*** **
x_{2t}	-0.496	0.759	-0.65	0.515
z_{1t-1}	-0.309	0.346	-0.89	0.374
z_{2t-1}	**-4.570**	1.023	-4.46	0.000***
cons	-0.511	3.522	-0.15	0.885
Pseudo R^2	0.5887			

Tested hypothesis: Coefficient of x_1=1
$F(1, 95) = 4.91$
$P > F = 0.029$**

Notes: Sample 2015M1-2023M6. Number of observations = 102. ***, ** indicate significance at 1%, 5% levels.

Figure 1: Eurosystem's total assets

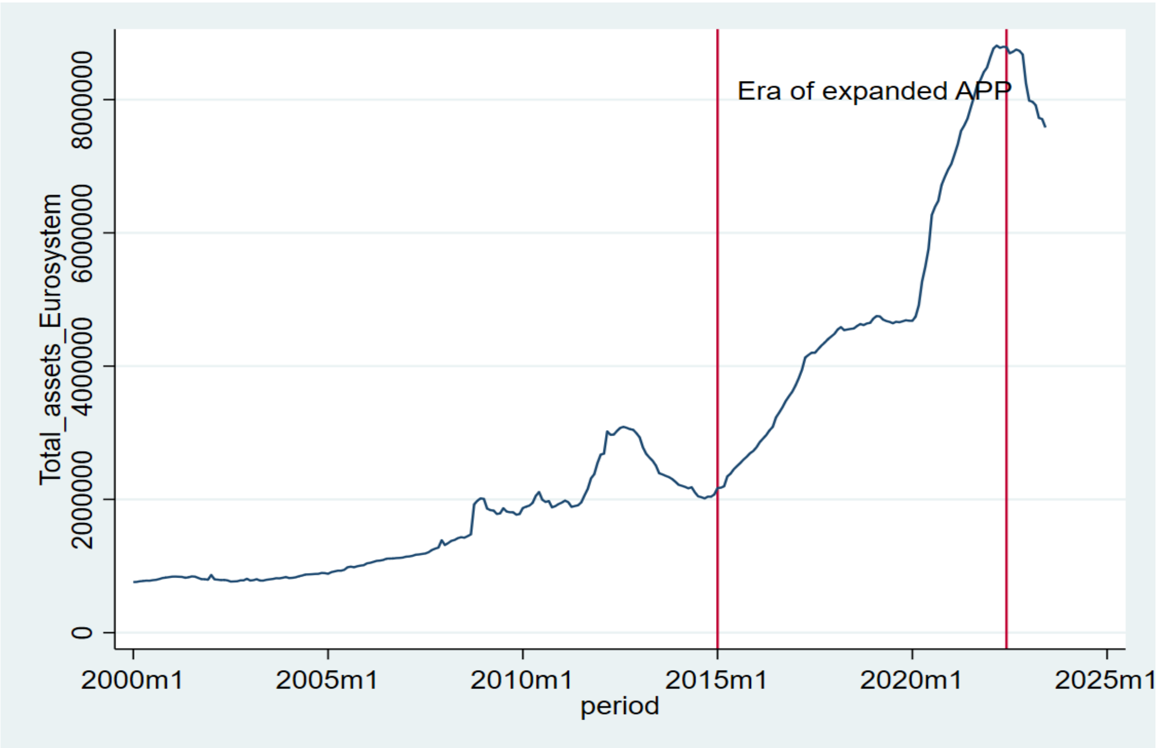

Figure 2: Global risk aversion and the dollar

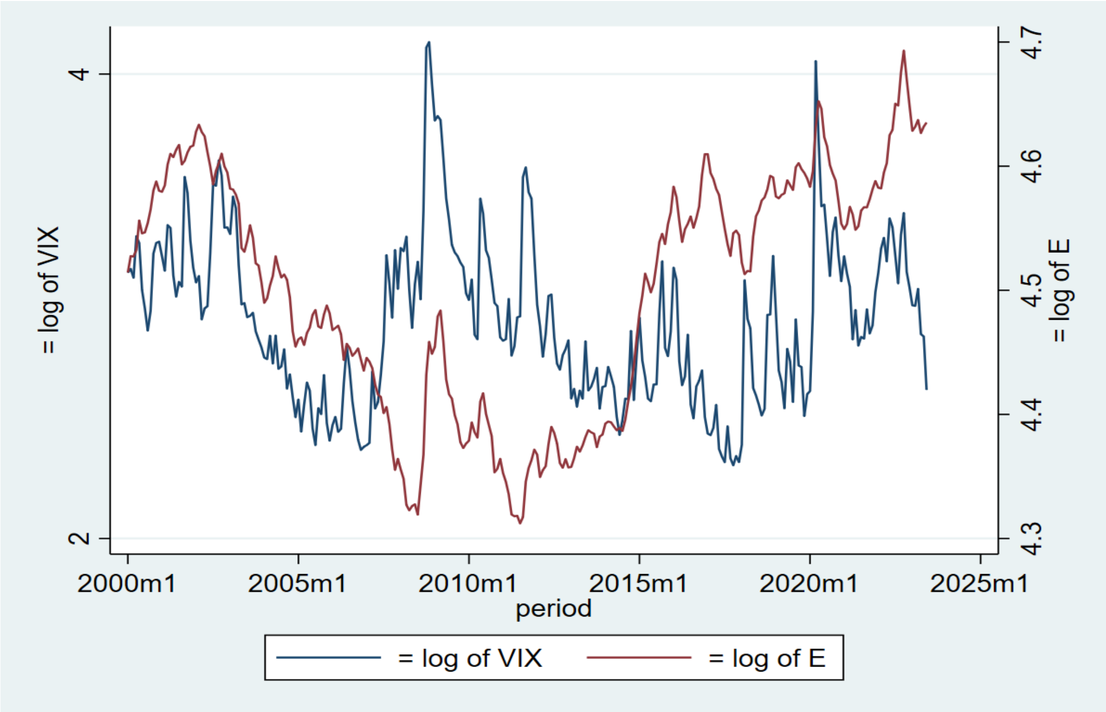

Figure 3: Cross-sectional average of finance stress index and global risk aversion

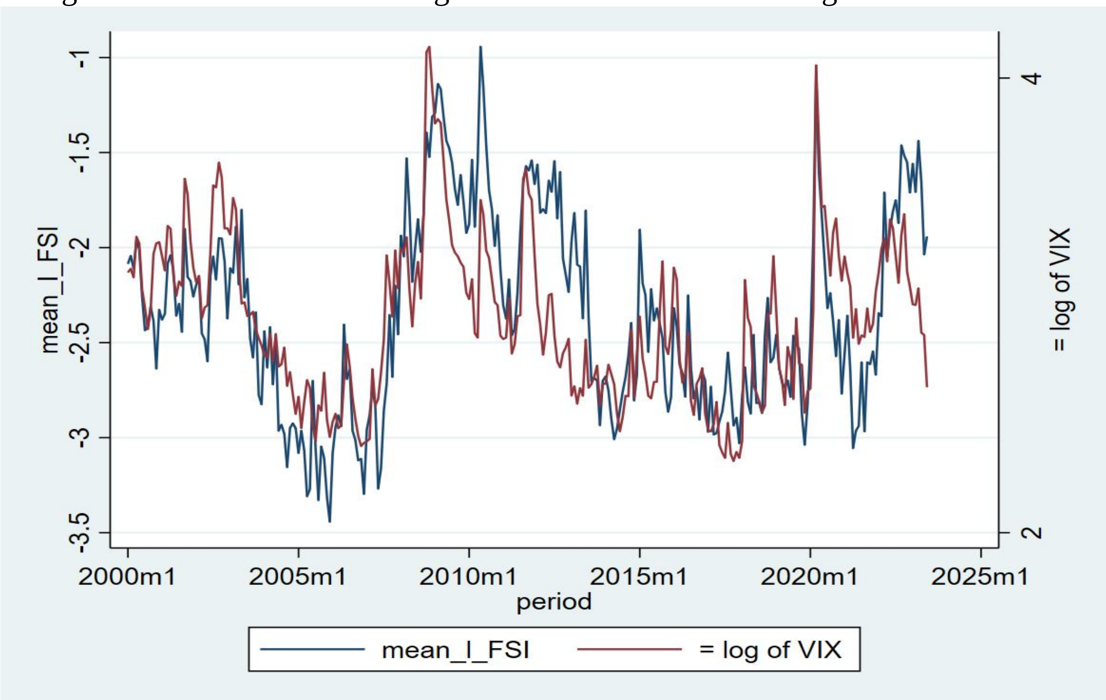

Figure 4: Cross-sectional average of finance stress index and the dollar

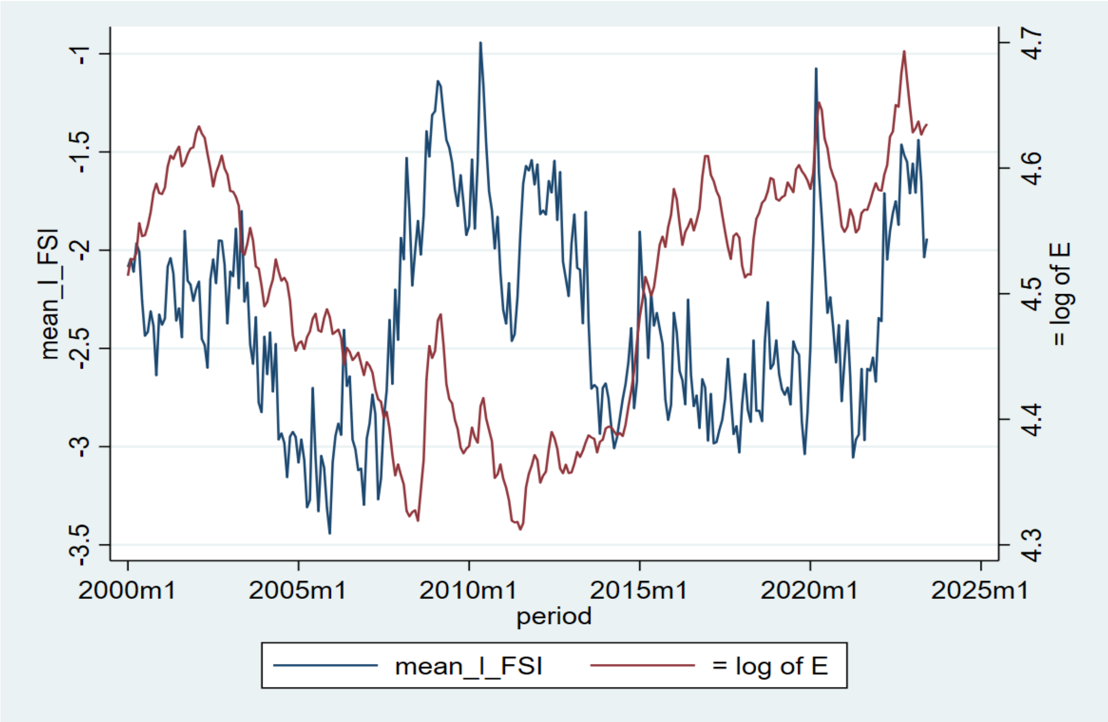

Figure 5: Dynamics of response to a global risk aversion shock (0.05 quantile)

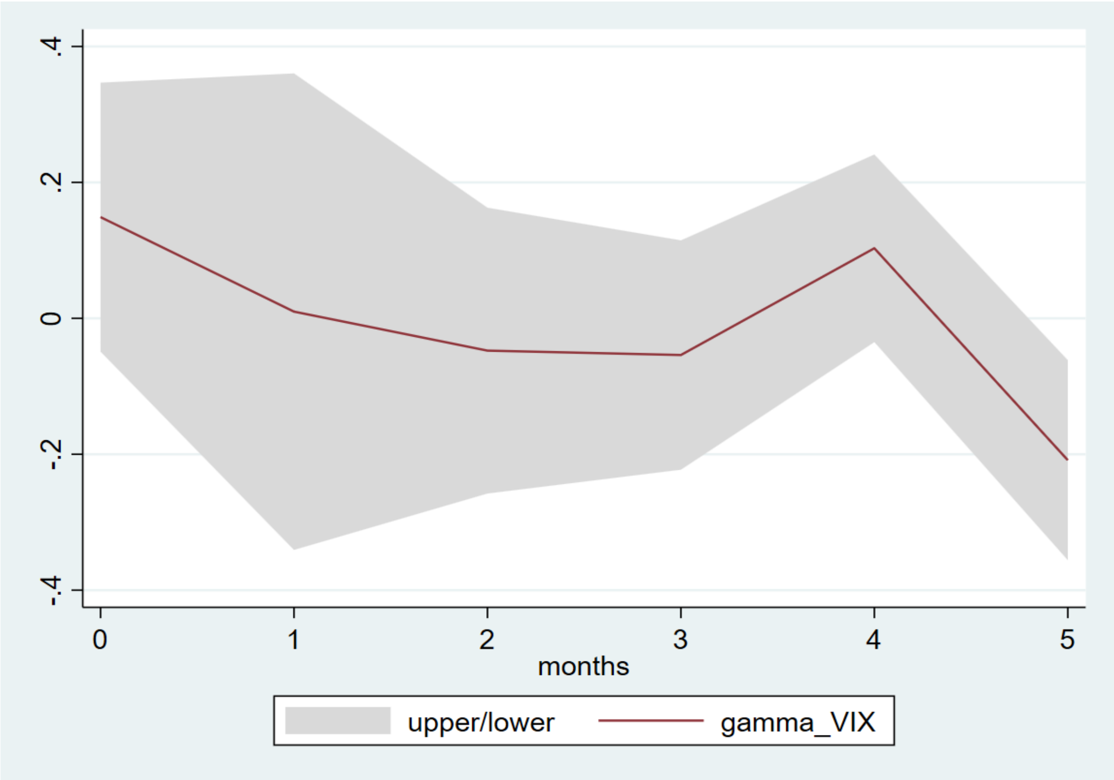

Figure 6: Dynamics of response to a global risk aversion shock (median)

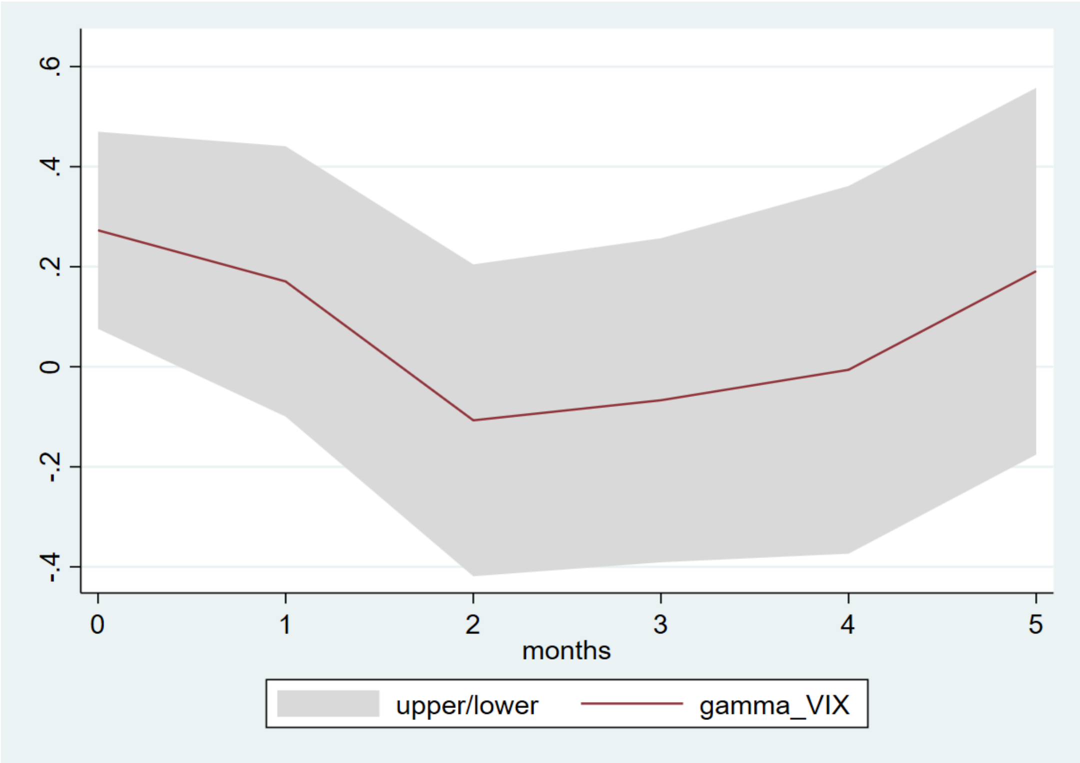

Figure 7: Dynamics of response to a global risk aversion shock (0.95 quantile)