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The sovereign-bank nexus: The role of debt and monetary policy

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The Sovereign-Bank Nexus: the Role of Debt and Monetary Policy

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The sovereign-bank nexus: the role of debt and monetary policy

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December 2020

Abstract

This policy report analyzes one aspect of the sovereign-bank nexus: the feedback effects between banks and sovereigns derived from the holdings of sovereign debt in domestic banks. We study how this relationship evolved during the European debt crisis and how it responded to the implementation of ECB monetary policy based on Open Market Operations and Marginal Lending Facilities. We find evidence of carry trade behavior by banks and we have some mild evidence that this channel may have been boosted by the liquidity provision policies.

JEL Codes: E42, E44, E51, E52, E58.

Keywords: Sovereign-bank nexus; European debt crisis; Monetary policy; ECB; Liquidity.

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1 Introduction

In this policy report we study the sovereign-bank nexus in the recent years in the context of Europe from an empirical point of view. Particularly, we analyze the interlink between sovereign debt overhang and the exposure of banks to sovereign risks and its evolution before and after the European sovereign debt crisis with a focus on the economies most affected by the recent debt crisis, i.e. Greece, Italy, Portugal and Spain. Even though the macroeconomic behavior of the region during the second half of the decade has been roughly stable, the current COVID-19 crisis shares a few ingredients with the environment in 2010-2012 and it is important to read current developments in the light of what the debt crisis has taught to us.

The banking and sovereign debt crisis in Europe started after the US Great Financial Crisis of 2007. The initial stage of the crisis affected the banking sector in Iceland, which was latter followed by many other countries, particularly Portugal, Spain, Italy and Greece. Then, the crisis evolved to a sovereign debt crisis due to the perceived unsustainable path of sovereign debt in Southern European economies. These two stages of the crisis increased the risk of, not only weak banks, but also solvent banks in the whole Euro Area mainly because solvent banks held government debt, considered risk free, from various European countries.

The term sovereign-bank nexus is used to denote the relationship between the government and the banking sector. The concerns behind this relationship is not new and it is not exclusive of European economies, i.e. the sovereign bank nexus was central to the 2001 Argentinean default and banking crisis during the abandonment of the Convertibility program. At its core is the study of the financial health of bank balance sheets that hold governments' debt. The sovereign-bank nexus exists in all countries but in the Euro Area the relationship can be understood as a slightly different one where banks from various European countries exhibit similar nexus with several sovereigns within the Union. This is a feature that became clear during the debt crisis as many analysts acknowledged the exposure of banks to several sovereigns' debt.

In this paper we review the empirical and theoretical literature that has recently analyzed this nexus. In light of the theory, we contribute to the empirical literature. We study the

structural relationship between sovereign debt exposure of domestic banks. Our objective is threefold: (1) to focus on the impact of portfolio re-balancing of banks in the spreads and debt sustainability risks, (2) the impact of risk of debt crisis in the banking sector, and (3) the role of monetary policy in the development of the crisis and the nexus.

To address these issues we estimate a VAR for each country, including country relevant variables such as GDP, sovereign yields and sovereign debt growth and share of debt in the hands of domestic banks. Importantly, we include in our estimation two variables that determined the monetary policy stance during the crisis: the management of standing facilities and the open market operations. We also include an exogenous dummy variable that is zero until 2012Q2 and one after the second quarter of 2012 to capture the impact of the “whatever it takes” Draghi’s speech.

We find that liquidity injections can increase debt exposures, this is true as a consequence of open market operations as well as after the provision of standing facilities. Yet, none of the liquidity providing monetary policy measures seem to induce a deterioration of fiscal balances for these economies. That is, with our dataset we do not seem to find an impact on fiscal policy at the country level.

We also find some evidence that portfolio re-balancing, i.e. more exposed position to government debt, has a fiscal impact on the sovereign yields, suggesting that the market priced negatively the sovereign-bank nexus. This is something we find specially for the case of Portugal but not in other cases. Variance decomposition analysis suggests a share of yields is explained by banks’ debt holdings in all the cases but to a greater extent for Portugal. This is also reflected historically for the period between 2010-2012 in the historical variance decomposition in some cases too.

The remainder of the paper goes as follows. In Section 2, we discuss theoretical and empirical approaches to the sovereign-bank nexus. In Section 3, we discuss the links between government and banks and dynamics of banks exposures to government debt in southern economies during the Euro Sovereign Debt Crisis. Section 4 presents our econometric analysis. Section 5 concludes.

2 The sovereign-bank nexus in the literature

Since the beginning of the debt crisis in Europe, the sovereign-bank nexus became a topic of interest for academic, particularly macro-finance, and policy makers worried about financial stability and the role of macro-prudential policies. In this section I discuss the findings of some of the relevant papers and the contribution of this report, however, an extensive review of the literature is out of the scope of this policy report.

[Acharya and Steffen \(2015\)](#) provides a detailed analysis of the strategy of banks regarding the purchase of sovereign debt. Their main objective is to understand banks behavior towards the demand of sovereign debt and the motives for such a behavior. To accomplish their objective, they build a dataset that mainly comprises several waves of bank data from the European Banking Authority (EBA) until 2012. At a micro-level, they find evidence of carry-trade behavior by banks during the European Debt crisis. That is banks were able to collect funds at low interest rates (i.e. they go short in German bonds) and invest those funds in the purchase of southern European debt (Greece, Ireland, Italy, Portugal and Spain) that have a higher return.

[Black et al. \(2016\)](#) analyzes the evolution of systemic risk of European banks since 2007 to the end of the Debt crisis in Europe. To analyze this issue, the authors develop a measure of systemic risk using a portfolio of heterogeneous banks by constructing an insurance premium against losses derived from crisis in the banking system. The main finding of this paper is that bank risks have different drivers in the first wave, the first part of the crisis that followed the Global Financial Crisis, and the second wave, the one associated to southern Europe default risk. The highest risk was in 2011 due to the risk of sovereign defaults. As highlighted by the authors, even though banks from several countries were identified as systemically large, the ones that grew the most in term of systemic importance during the period were the Spanish and Italian.

[Popov and Van Horen \(2013\)](#) studies how sovereign debt stress affects bank lending when banks are exposed to government debt. They find strong evidence that banks that were exposed to the GIIPS (Greece, Ireland, Italy, Portugal and Spain) debt decreased lending more than other banks. In a related paper, [Acharya et al. \(2018\)](#) studies a similar point

finding that both bank's exposure and changes in the risk taking behavior of banks during the debt crisis reduces up to 53% the probability of firms to obtain a syndicated loan.

Dell'Ariccia et al. (2018) provide a detailed discussion of the many links that usually connect banks and governments with particular attention to the case of banks in the Euro zone. In the paper, the authors are concerned about the policy design and the weighting of pros and cons of each channel.

In a recent paper, Hristov et al. (2020) studies the impact of unconventional monetary policy on the sovereign-bank nexus to see how this relationship evolves for certain monetary policy shocks. The authors measure the unconventional policy shock by means of the Eurosystem total assets and find that monetary policy shocks tend to increase the exposure of MFIs.

Most of the contributions to the topic has been empirical, mainly based on econometric analysis of time series or cross-section data. Instead, a dynamic stochastic general equilibrium (DSGE) approach to the impact of liquidity shocks and the unconventional monetary policy of ECB is in Quint and Tristani (2018) but the authors consider the whole Euro Area instead of specific countries. Hence, open market operations are endogenous variables in their VAR.

To the best of my knowledge, my approach differs from that of the literature in the following directions: (1) I study four VAR models, one for each country for the period that includes the first quarter of 2004 to the fourth quarter of 2019, including the pre-crisis and post-crisis periods, (2) I consider monetary policies to be exogenous and include a variable to capture the impact of the Draghi's speech, (3) I consider two instruments for liquidity provision policies separately, namely the marginal lending facility and the open market operations, besides in this way I will be able to assess the relative importance of each of them and the fact that the different policies were implemented at different times in different stages of the crisis, (4) I study whether banks' exposure increased due to monetary policy and (5) I study whether fiscal surplus was affected by monetary policy and the behavior of banks.

3 Aspects of the sovereign-bank nexus

The European debt crisis made explicit the doom loop of the sovereign-bank nexus in the Euro Zone. The relationship among banks and sovereigns includes many links, often bi-directional, and can be classified as follows:

- A set of weak banks in the financial system have negative fiscal effects in the context of monetary union because it raises the expected fiscal costs of bailing out the banking sector. Absent a monetary union the negative impact of expectations of bailout can have both monetary and fiscal effects depending on whether the public expects the bailout from taxpayers or from a lender of last resort role of the central bank.
- When banks hold sovereign debt, debt increases affect the balance sheet of the banks. Particularly, in the context of a crisis with increasing sovereign spreads we should observe a deterioration of the balance sheets of the banks with a negative impact on the lending to the private sector.
- As highlighted in [Dell’Ariccia et al. \(2018\)](#) an additional channel for the link between banks and governments is the “safety net channel”, i.e. governments guarantees (explicit or implicit).
- If banks represent a large share of sovereign bond demand, banking instability can affect the pricing of sovereign debt if it reduces their demand of sovereign bonds and have a detrimental effect on their liquidity.
- Both sectors are also affected by the economic dynamics of countries and regions, what [Dell’Ariccia et al. \(2018\)](#) refers to as the macroeconomic channel.

These links have been present in Europe well before the crisis. Banks, indeed, held large shares of debt from European governments, particularly domestic, a home bias that exacerbated during bad times. [Figure 1](#) present the holdings of government debt from domestic banks for Greece, Italy, Portugal and Spain since 2004 as a ratio to GDP. As seen in the figure, banks position in domestic sovereign bonds has been traditionally large and increased substantially during the crisis. The literature highlights many reasons for

this. As described before, one reason for this was the regulatory framework, as [Popov and Van Horen \(2013\)](#) describes, the Capital Requirement Directive allows to assign 0 risk weight to sovereign bonds issued in Euros, without the 25% limit on exposure. Hence, sovereign debt is considered a risk free (high quality) collateral for the liquidity provision at ECB. Additionally, these assets are liquid assets and especially important in countries with less developed asset markets. Another reason is related, potentially, to a search for yield in the context of low return of risk free assets. Sovereign debt of troubled countries was attractive to banks in this period because they paid high yields. i.e. southern economies debt allows banks to get cheap liquidity while paying high return. As already discussed by the literature there was a strong carry trade component in the development of the crisis and the excessive exposure of banks to sovereign risks.

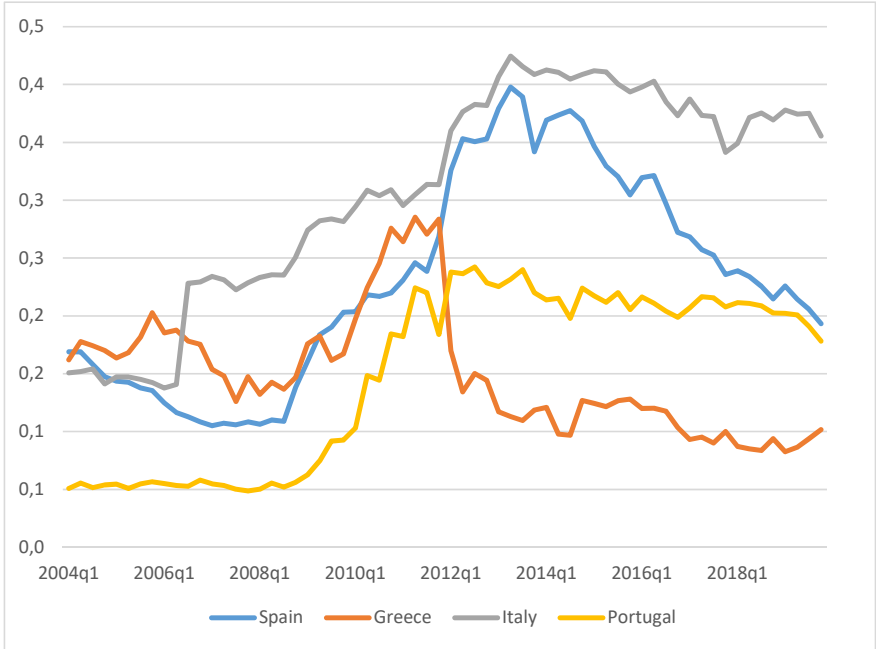


Figure 1: Domestic bank exposure to government debt divided by annualized GDP

Note: own calculations based on data from [Arslanalp and Tsuda \(2014\)](#) and the OECD.

4 Econometric analysis

We turn now to our main application. Our objective is to elicit a VAR for the sovereign-bank nexus that is suitable to study the interdependence between governments and banks in a context of macroeconomic distress and is also able to address the impact of monetary policy. In this regard, we want to study if sovereign debt exposure affects the stress in banking sector and if the stress in the banking sector affects spreads through the demand role of banks. We focus on the countries of Southern Europe that were most affected by the Debt crisis: Greece, Italy, Portugal and Spain and collect data from 2004Q1 to 2019Q4. As the countries operate in the context of a Monetary Union we need to consider that there are exogenous monetary variables that affect domestic debt and banking industry. These variables are considered exogenously determined, in the sense that their realizations do not depend on the evolution of domestic variables, the institutional setting of the EU motivates this identification. Consequently, we design a VAR with an important block of exogenous monetary variables to account for the role of the common monetary and liquidity policies.

4.1 Data

Our choice of variables acknowledges that the sovereign debt and yield are affected by (and also affects) the decisions of the banking industry, particularly the amount of sovereign bonds they hold; additionally, both agents affect (and are also affected) the macroeconomic performance of each country. We include then a measure of economic activity (output growth), we include sovereign yields (the yields on long term government bonds), primary fiscal surplus to output ratio and the log of holdings of domestic banks of sovereign bonds in real terms. Our key variable for each country are the sovereign bonds holdings from domestic banks data that we take from [Arslanalp and Tsuda \(2014\)](#). The rest of the data is from OECD and the ECB.

In the block of exogenous variables, we include two variables that capture the international environment: the VIX and the interbank borrowing rate that is common to the whole Euro Area. To capture the role of monetary policy in the Euro Area, we consider variables that measure the ECB policy stance and liquidity provision. We include: main refinancing

operations (MRO), long term refinancing operations (LTRO) and other liquidity provisions (Fine-tuning reverse operations plus Structural reverse operations) that are part of the Open Market Operations and marginal lending facility (MLF) that is part of the Standing Facility (all in logs and real terms). We include different liquidity measures because the ECB seems to have used them as alternative ways of providing liquidity to the economy at different times. Nominal variables that are written in real terms are deflated by its country domestic GDP deflator with a base year of 2015. Also included are a linear, a quadratic and a cubic trend. An important variable that we introduce is a dummy variable to indicate the periods after 2012Q2 to capture the impact of Draghi's speech which should not be reflected in the actual realization of monetary policy but nevertheless had a strong impact on market expectations about future monetary policy.

A detailed description of different instruments for monetary policy can be found at the ECB resources, however it is important to highlight that the instruments included in our exercise have different features that may allow them to have different impact on the economy. Among the Open Market Operations, the MRO have frequency and maturity of a week, are decentralized executed by national central banks while the LTRO have a longer maturity, 3 months, conducted monthly by the Eurosystem. Instead, Standing facilities absorb/provide overnight liquidity and are administered in a decentralized way by the national central banks and are based on collateralized overnight loans.¹

4.2 Empirical strategy

We design a Vector Autoregressions for each country and estimate them using a Bayesian approach.² Using the standard notation, in this section we briefly present the model to estimate together with the specification of the model and priors: this section closely follows

¹Information about the liquidity provision instruments is available at: <https://www.ecb.europa.eu/mopo/implement/html/index.en.html>, and <https://www.ecb.europa.eu/mopo/implement/omo/html/index.en.html>

²We use the BEAR package. See <https://www.ecb.europa.eu/pub/research/working-papers/html/bear-toolbox.en.html>.

some standard derivations described in the companion resources of the toolbox. Define:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + C x_t + \epsilon_t,$$

as the reduced for version of the VAR that we estimate for a general order of p . Here the y_t is the vector of endogenous variables, x_t are the exogenous regressors and ϵ_t are the reduced form shocks which are assumed to be normal with mean zero and variance-covariance matrix of Σ . This model can be written in a more compact way as:

$$Y = \begin{bmatrix} y'_1 \\ y'_2 \\ \vdots \\ y'_T \end{bmatrix}; X = \begin{bmatrix} y'_0 & y'_{-1} & \cdots & y_{1-4} & x'_1 \\ y'_1 & y'_0 & \cdots & y_{2-4} & x'_2 \\ \vdots & \vdots & & \vdots & \vdots \\ y'_{T-1} & y'_{T-2} & \cdots & y_{T-4} & x'_T \end{bmatrix}; B = \begin{bmatrix} A'_1 \\ A'_2 \\ A'_3 \\ A'_4 \\ C' \end{bmatrix}; \tilde{\epsilon} = \begin{bmatrix} \epsilon'_1 \\ \epsilon'_2 \\ \vdots \\ \epsilon'_T \end{bmatrix}.$$

Denote: $y = \text{vec}(Y)$, $\bar{X} = I_n \otimes X$, $\beta = \text{vec}(B)$ and $\varepsilon = \text{vec}(\tilde{\epsilon})$. Hence, we write the VAR as

$$y = \bar{X}\beta + \varepsilon$$

Following standard notation, define the vector of unknown parameters by θ , use y for the data $f(y|\theta)$ for the likelihood and $\pi(\theta)$ for the prior distribution. The Bayesian approach is design to learn about the unknown parameters by exploring the shape of the posterior distribution of the parameters conditional on the data:

$$\pi(\theta|y) \propto f(y|\theta)\pi(\theta).$$

We estimate each model with independent Normal-Wishart prior as presented in Table 1. The table contains the hyper-parameters of the prior distributions. The values in the table are standard for this model in the literature.

We use a Gibbs Sampler to estimate the model, running 10,000 draws but we discard the first half. The structural decomposition is recursive and we order the variables as (from first to last): output growth, Surplus to output ratio, the log of the bank position in government debt and the sovereign interest rate (interest rate yields). We include a constant and the exogenous variables already described. Our model has only one lag according to the DI criterion.

Hyper-Parameters		
Parameter	Description	Value
Autoregressive coefficient		0.8
λ_1	Overall prior tightness	0.1
λ_2	Cross-variable weightings	0.5
λ_3	Lag decay	2
λ_4	Exogenous variables tightness	100

Table 1: Prior’s hyper-parameters

With this model, we want to inquire about the sovereign bank nexus with an exclusive focus on the sovereign debt holdings of banks, we narrow the nexus in this way because other channels are not easy to quantify as many of the links between banks and the government are contingent liabilities, i.e. deposit insurance and other already described in previous sections. There are many interesting angles to cover but our main objective is to study which role the nexus played in the evolution of fiscal variables (surplus and yields) and how did policies affected the nexus, that is, how did the liquidity provision policy and the sovereign yields affected the exposure of banks to sovereign debt.

We do this by analyzing the Impulse response functions (IRF) and the evidence about the variance decomposition to assess the actual importance of various shocks in the long run and at given points in time, with an interest on the crisis period. In all the results that follow we consider credible sets of 68%.

4.3 Banks’ holdings of sovereign bonds

Our first exercise is to analyze the impact of monetary policies in sovereign debt holdings of domestic banks in countries that were affected by the debt crisis. As described before, we consider the impact of different policy instruments classified as Standing Facilities and Open Market Operations. For our economies, part of the monetary union, these variables measured at the union level are exogenous and are assumed to have a contemporaneous effect on the domestic variables. Figure 2 presents the response of the log of government

debt holdings in hand of domestic banks to a shock to the log of real Marginal Lending Facilities (an expansion of liquidity at the Euro level measured in real terms).

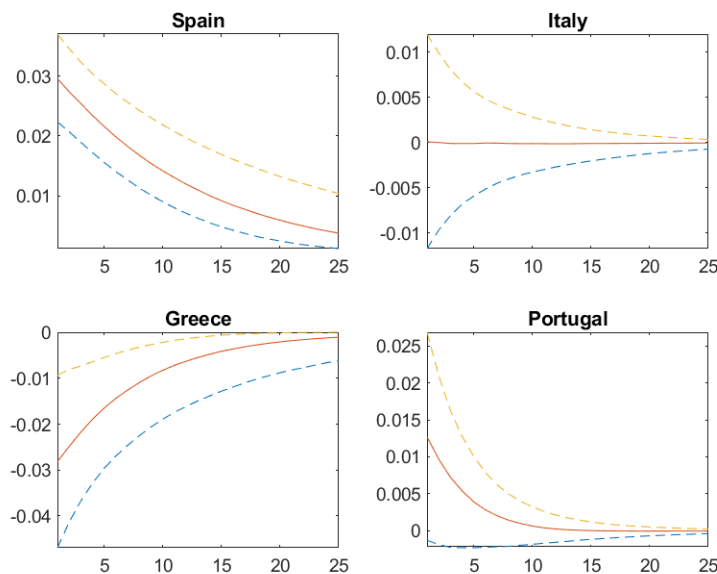


Figure 2: IRF of the stock of government debt in banks to Marginal Lending Facility shock

Note: Response of log real government bonds in hands of domestic banks to a unitary innovation to the log of real marginal lending facility. The impulse responses are computed to an horizon of 25 quarters.

As seen in the figure, the provision of liquidity through standing facilities seems to be used to expand the share of sovereign debt in domestic banks portfolio in the cases of Portugal, Spain and to a lesser extent, Italy, with ample uncertainty. Hence, additional liquidity from standing facilities seems to have a positive effect on banks' exposure to sovereign debt. Figure 3 presents the impulse response functions of the same variable to a unitary shock of liquidity provision through open market operations.

As seen in the figure, there is also evidence that the Open Market Operations induce an increase in the exposure of banks to domestic sovereign debt. Particularly for the cases of Italy and Portugal. In the same line we observe the response in the case of Spain, but with higher uncertainty than in the other countries. For the case of Greece, instead, we can see that open market operations shocks induce a fall in banks' exposure.

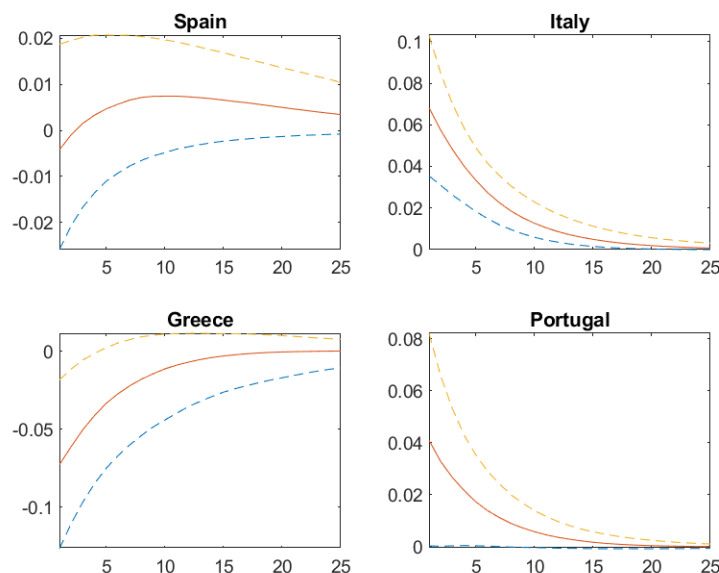


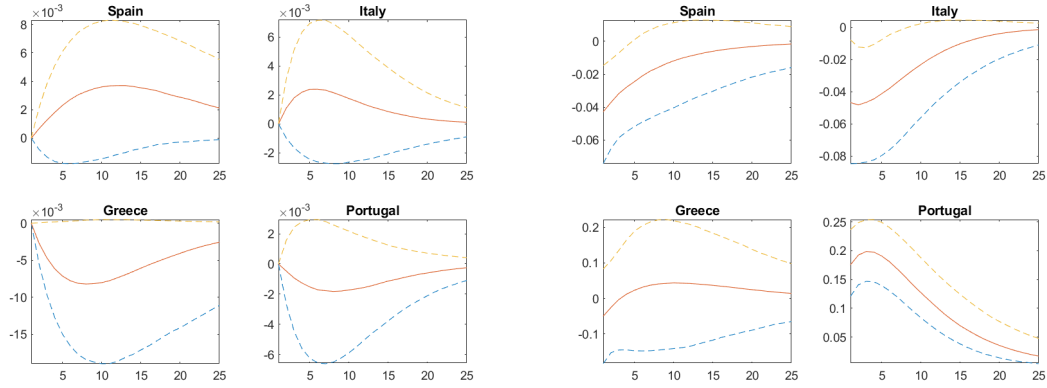
Figure 3: IRF of the stock of government debt in banks to Open Market Operations

Note: Response of log real government bonds in hands of domestic banks to a unitary innovation to the log of real open market operations. The impulse responses are computed to an horizon of 25 quarters.

This is particularly the case in the period 2011q3 to 2012q4, period that coincides with the strong increase in bank exposure to sovereign debt as can be seen from Figure 1. After 2014 there is, in contrast, the monetary authority tends to exploit open market operations relatively more than standing facilities, coincident with a reduction on spreads and lower bank exposure.

Figure 4 studies the existence of a carry trade incentive in our sample. Namely, whether increases in the sovereign debt yields increase the exposure of banks to sovereign debt.

As seen in the figure, for this sample our model is consistent with the carry trade strategy, particularly for Spain and Italy, and with higher uncertainty also for the case of Portugal. Increases in the returns of sovereign debt seem to induce domestic banks to increase their exposure to sovereign debt.



(a) IRF of GDDB to R^g

(b) IRF of R^g to GDDB

Figure 4: Impulse response to address feedback effects

Note: GDDB stands for government debt in hand of domestic banks (in logs) and R^g stands to the government debt yield. The impulse responses are computed to an horizon of 25 quarters. All IRF are responses to a unitary innovation to the relevant structural shock.

4.4 Fiscal impact of liquidity provision

Given that some liquidity expansion increase banks' holdings of sovereign debt, a relevant question is about the fiscal impact of liquidity. Does liquidity provision strategy by the ECB induce a relaxation of fiscal rules?

The following figures present the response of surplus to output ratio in Spain, Italy, Greece and Portugal after a shock to the Standing facilities and Open Market Operations, respectively.

As seen in Figures 5 and 6 there seems to be a small (and uncertain) deterioration in the position of the government only for Portugal and Italy after a shock to the marginal lending facility. For the remainder of the cases, evidence suggests that expansive liquidity policies in any instrument has zero or positive effect on the surpluses, especially in the cases of open market operations' shock.

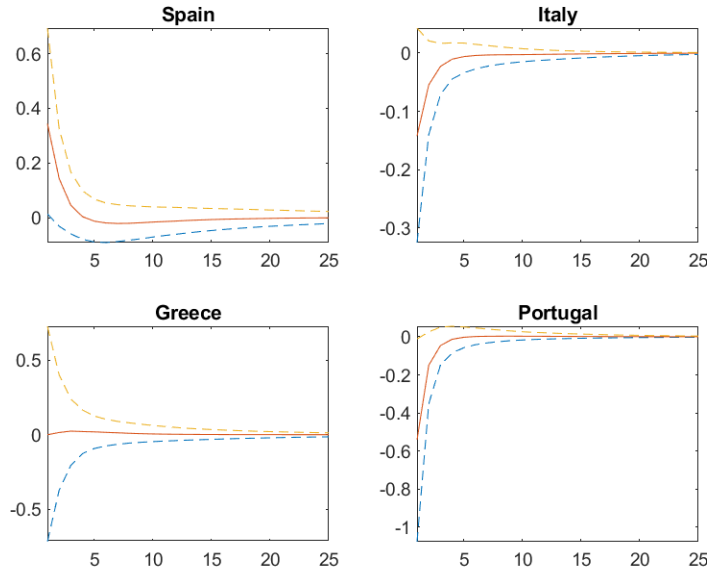


Figure 5: IRF of the sovereign surplus to Marginal Lending Facilities

Note: Response of surplus to output ratio for each country to a unitary innovation to the log of real Marginal Lending Facility. The impulse responses are computed to an horizon of 25 quarters.

4.5 The impact of credible announcement

Mario Draghi's speech in 2012 is usually considered as the key variable in the monetary policy design to stop the European debt crisis. We consider it as a shock of a credible announcement in this paper and we measure it by a dummy that takes a value of 1 for each period after 2012q2.

Figure 7 presents the response of endogenous variables to a shock to our dummy variable. Our model captures the expected response of most variables in all countries. In general, as observed in the figure, the announcement was expansionary in terms of output growth, contributed to fiscal consolidation, tended to reduce bank exposure (except for Greece that notably, the announcement dissipated default expectations pushing banks to increase banks demand of Greek bonds) and reduces sovereign spreads.

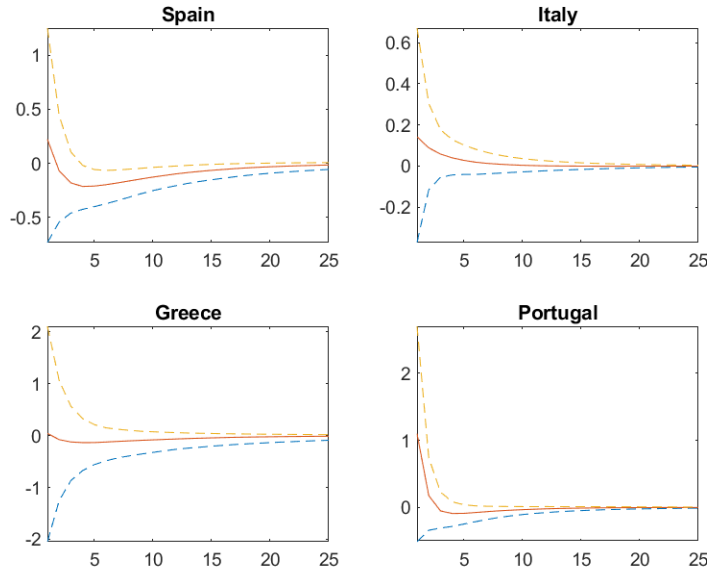


Figure 6: IRF of the sovereign surplus to Open Market Operations

Note: Response of surplus to output ratio for each country to a unitary innovation to the log of real open market operations. The impulse responses are computed to an horizon of 25 quarters.

4.6 Feedback effects in the sovereign-bank nexus

Our findings so far suggest that the sovereign-bank nexus has been boosted by the sovereign yields and, to some extent, liquidity provision by the ECB, at least for some of the countries.

A still unanswered question is how important is the sovereign-bank nexus in the long run. We study the Forecast Error Variance Decomposition of banks' holdings and sovereign spreads. In Figure 8 we can see that there seems to be a small contribution in a 25 quarters horizon of yield shocks to explain banks' holdings of government debt (particularly large in Spain and Greece with a 68% credibility). Instead, sovereign yields are largely explained by banks' debt holdings in Portugal and, to a lesser extent, in the other cases.

Are they particularly important at a given point in time? and, how? Figure 9 presents historical decomposition of banks' holdings and sovereign yields. As seen in the figures, they line up with the evidence of the impulse responses and forecast error variance decomposition.

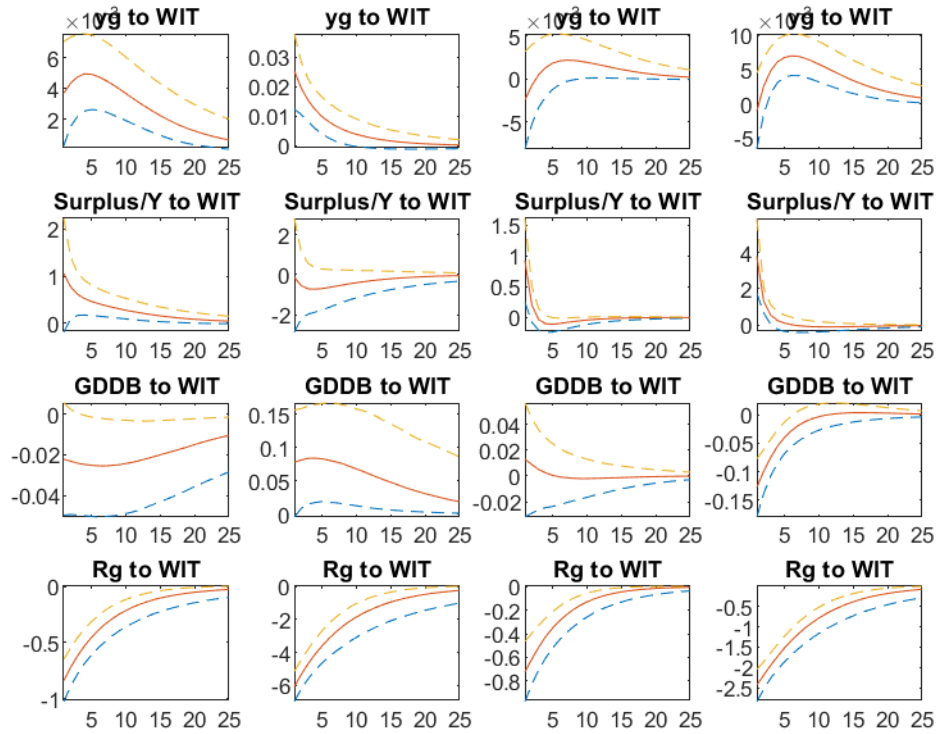


Figure 7: IRF of endogenous variables to the “whatever it takes” shock

Note: Each column represents, by country, the responses of all endogenous variables to the dummy that indexes periods after 2012q2 that we introduce to capture the impact of Draghi’s speech (WIT, “whatever it takes”). The first column is for Spain, the second for Greece, third for Italy and the last column is for Portugal. The impulse responses are computed to an horizon of 25 quarters.

To some extent, sovereign yields explain just a little of the increase in banks’ exposure particularly during 2010-2014, depending on the country. However, banks’ holdings explain a large share of spreads behavior in the same period, particularly for Portugal (panel “d”) and Spain (panel “a”).

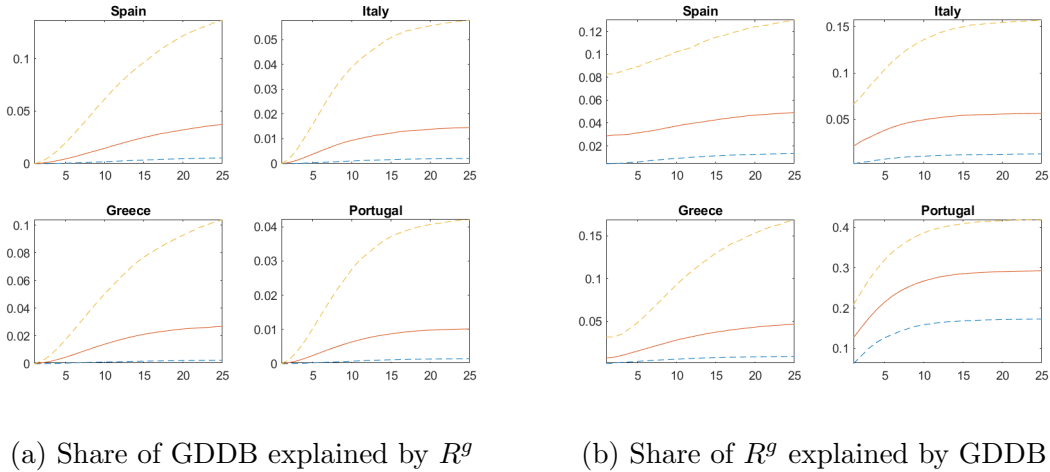


Figure 8: Forecast error variance decomposition

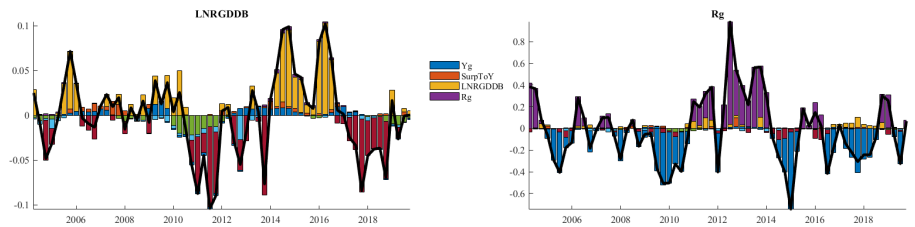
Note: This picture provides the FEVD of Banks' holdings explained (denoted by GDDB) by sovereign yields (denoted by R^g) on the left and R^g explained by GDDB on the right, together with the 68% interval.

5 Concluding remarks

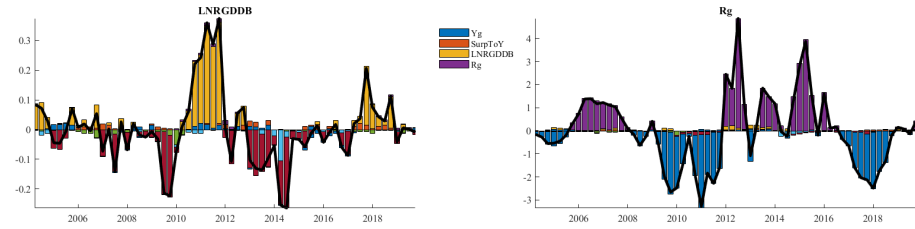
The previous section provides an interpretation of the data. To some extent, particularly during 2011-2012, the sovereign-bank nexus contained in the banks position of sovereign debt was exacerbated with a carry trade investment strategy (even though for the aggregate dataset there is high uncertainty in the IRF to yield shocks) and boosted by the liquidity provision strategy. These, however, do not seem to have had an impact on the design of fiscal policy, measured by the primary surplus to output ratio.

The findings in this report are currently relevant in the context of the new crisis we approach. The COVID-19 crisis is affecting the public finances worldwide. In the presence of recurrent lock-downs of uncertain duration, governments with access to financial markets are issuing large levels of debt to smooth the transitory drop in tax collection and be able to do counter-cyclical fiscal policy. A consequence of this is a rise in sovereign debt. Moreover, on the monetary policy side, the developed countries facing the crisis do not have conventional monetary space.

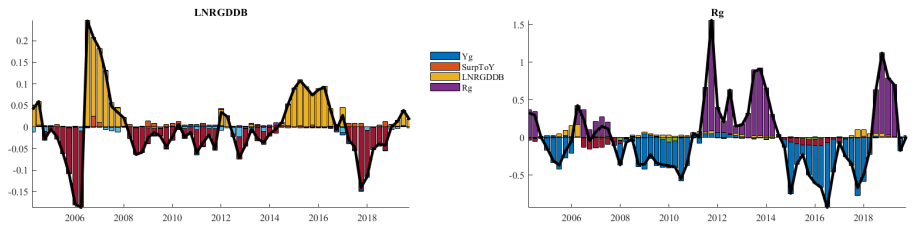
Banks are, according to [Mai \(2020\)](#), financing more than half of the increases in govern-



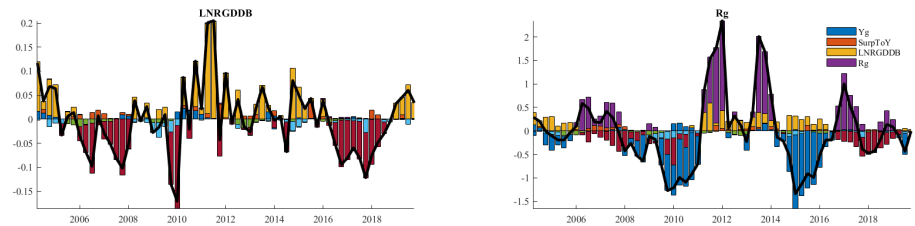
(a) Spain



(b) Greece



(c) Italy



(d) Portugal

Figure 9: Historical Variance decomposition

Note: In purple we have the variability of each variables (Banks' holdings and the sovereign yield) explained by sovereign yields and in yellow the variability explained by banks' holdings. The first column of figures indicated with the label LNRGDDB provide the historical decomposition of the log of real government debt in hand of domestic banks while the second column with label Rg is for sovereign yields.

ment spending. This has an impact on their balance sheets and on the prospects of bank returns. According to this reference, in March, April and May 2020 the exposure of banks to domestic sovereign debt increased in 61, 82 and 52 billion euros, respectively; and even more to other euro area governments.

Our findings, in line with [Mai \(2020\)](#) analysis and in the light of the recent dynamics of sovereign debt, suggest that increases in spreads and liquidity are likely to induce banks to expand their positions in high yield sovereign debt, and relatively more risky bonds. An exacerbation of the sovereign bank nexus can have negative macroeconomic impact as it may increase the vulnerability of banks to sovereign default risk in a context of likely rise in private non-performing loans.

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