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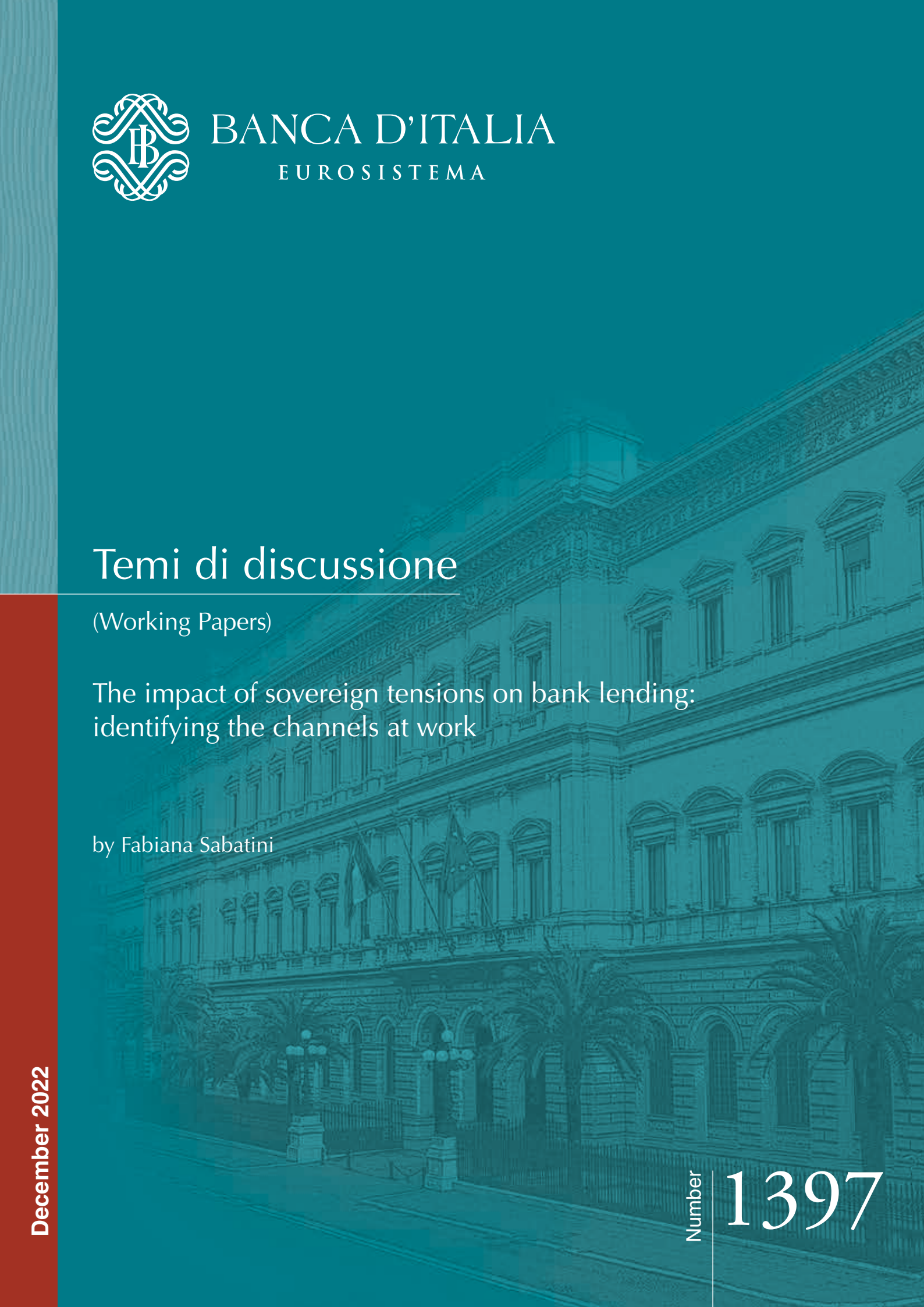
by Fabiana Sabatini



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THE IMPACT OF SOVEREIGN TENSIONS ON BANK LENDING: IDENTIFYING THE CHANNELS AT WORK

by Fabiana Sabatini*

Abstract

Banks' holdings of sovereign bonds are an important component of the multifaceted bank-sovereign nexus. This paper exploits the unexpected increase in sovereign yields in Italy in May 2018 to quantify the impact of a drop in value of banks' government bond portfolios on their supply of loans (direct channels). It disentangles the effect stemming from the worsening in banks' capitalization (balance sheet channel) from that associated with a reduced ability to raise funds using government bond holdings as collateral (liquidity channel). Results show that banks with large government bond portfolios reduced their lending more; evidence indicates that this is a consequence of the balance-sheet channel. The liquidity channel was not activated, partly thanks to the ample availability of Eurosystem funds held by banks. I then control for the channels at work for the banking system as a whole, regardless of government bond holdings (indirect channels), and find that the generalized increase in the cost of funding for banks (cost of funding channel) has a negative impact on bank lending.

JEL Classification: G01, G21, E5, E51.
Keywords: credit supply, banks' sovereign holdings, bank lending channel.
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Contents

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1 Introduction[1]

A deterioration of sovereign creditworthiness may negatively affect the supply of bank lending in several ways.[2] Two important channels are directly related to the amount of sovereign bonds that banks hold on their balance sheets (*direct channels*). The first is activated by the impact on bank capitalization exerted by a reduction in the value of sovereign bonds: indeed, the unrealized losses on sovereign portfolio at market values dent capital position (bank balance-sheet channel; see Albertazzi et al. 2014). The second is triggered by the reduction in the amount of funds that banks can raise in collateralized wholesale markets or through Eurosystem operations, since government bonds are largely used as collateral (liquidity channel; see Angelini et al. 2014).

In addition to these two mechanisms, sovereign risk may deteriorate bank's funding conditions - and in turn impair the supply of loans to the private sector - via a number of *indirect channels*, which are at work for all banks and whose activation and intensity do not depend on the amount of sovereign bonds held by a given institution. Among these: an increase in sovereign yields determines a rise in the cost of bank funding as country risk normally acts as a floor for the cost of issuing bonds (cost of funding channel, see BIS 2011); the reduction in the benefits of implicit and -if present- explicit government guarantees can increase banks risk premia (government guarantee channel; see Mäkinen et al. 2020 and Correa et al. 2014); sovereign downgrades often lead to downgrades of banking institutions as sovereign ratings are normally a ceiling for the private borrowers (rating downgrade channel, see Adelino and Ferreira 2016).

Finally, the reduction in lending supply may be due to other factors rather than the deterioration in credit institutions' conditions; for example, a large strand of the literature documents that public debt portfolios held by banks expanded after the sovereign debt crisis, reflecting either government pressure or risk-shifting motives (see Popov and Van Horen 2014 and Becker and Ivashina 2018). Whatever the reason behind it, the increase in sovereign bonds holdings may be conducted at the expense of loan granting, causing a decline in credit supply (crowding-out effect of loans).

The main objective of this paper is to provide a quantitative estimation of the balance-sheet *versus* the liquidity channel within the direct channels; the focus is on credit supply granted by Italian banks between June 2018 and December 2018 - i.e., in the six months following the increase observed in Italian sovereign yields in May 2018. While the literature has established a significant positive relation between the overall amount of government bonds held by banks and the reduction in credit supply following an increase in sovereign risk (Popov and Van Horen 2014, Bottero et al. 2020), a quantitative assessment of the

[1]I am grateful to Fabiano Schivardi for guidance and support. I would like to thank Andrew Ellul, Filippo De Marco, Andrea Polo, Alessandro Secchi, Giuseppe Ferrero, Federico Maria Signoretti, Margherita Bottero, Massimiliano Affinito, Maria Sole Pagliari, Stefano Schiaffi, Francesco Palazzo and Giovanni Soggia for useful comments and suggestions, as well as seminar participants at the Bank of Italy, Luiss and 2022 EEA Meeting. The views expressed in this paper do not necessarily reflect those of Bank of Italy. All errors are the responsibility of the author.

[2]For a more detailed description of the cannels see BIS (2011)

impact of each of the two aforementioned channels is still lacking - to the best of my knowledge. Given that sovereign tensions can affect, via direct channels, both lending and real variables such as firms' investments and employment (see Altavilla et al. 2015, Bottero et al. 2020 and De Marco 2018), a deep understanding of the mechanisms at work in their transmission provides policymakers with useful information for the regulatory treatment of government bonds in banks' portfolios.

The key factor that allows to disentangle the two mechanisms is that the changes in the value of a government bond are treated differently depending on the portfolio classification of the asset. In particular, according to the International Financial Reporting Standard 9 (IFRS 9), a financial asset can be classified into the following portfolios: (i) *held to collect*, (ii) *fair value through other comprehensive income* and (iii) *fair value through profit and loss*. Financial assets not intended to be sold can be allocated in portfolio (i) and are held at the amortised cost: this means that changes in their value will not affect capital position and the balance-sheet channel won't be activated for these bonds; assets classified under (ii) and (iii) are instead held at market values, implying that changes in their price impact capital position. On the contrary, in case of a price variation, the liquidity channel is triggered for all bonds as their valuation as collateral is independent of the portfolio under which they are allocated.

Summarizing, the amount of securities held at market value will affect the intensity of both channels, while the amount of securities at amortised cost will determine the intensity of the liquidity channel only. A direct consequence is that the growth of loans after the outbreak of sovereign tensions can be associated with the pre-shock share of sovereign debt under each portfolio in order to disentangle the impact of each channel on lending policies. Specifically, when included in a regression having loan growth as the dependent variable, incidence on total assets of (i) sovereign exposures and (ii) sovereign exposures held in the fair value portfolios will provide an estimate of the relevance of, respectively, the liquidity channel and the bank balance-sheet channel.

A number of conditions are required for these estimates to measure the impact of sovereign tensions on lending supply. First, the shock under study should be exogenous to the banking system - i.e., it should not be caused by a deterioration in banks' health. To this end, I exploit the episode of sharp rise in the Italian sovereign yields observed in the Spring of 2018 and connected with the sudden increase in the political uncertainty. In the second half of May, after the failure of several attempts to form a new government, yields on sovereign bonds increased by around 200, 175 and 110 basis points on the two-, five- and ten-year horizons respectively. Given that this rise was unexpected and mainly reflected the high uncertainty over the formation of the new government, the shock can be regarded as exogenous, making this event an ideal setting to study the impact of sovereign tensions on the supply of credit. Its exogenous nature is confirmed by the fact that, in the period preceding the rise in sovereign yields, indicators for the Italian banking system were pointing to sound and improving conditions: during 2017 and in the first months of 2018 banks' profitability and capitalization strengthened markedly, while non-performing loans

ratio declined to the pre-sovereign crisis levels.

The shock exploited in this paper presents two advantages with respect to the one observed during the sovereign debt crisis and largely used in the literature to estimate the impact of sovereign tensions on credit supply. A first advantage is that the rise in government yields in 2018 was unanticipated, as it was connected to the sudden rise in the uncertainty of the political background. A second one is that the shock observed in 2018 did not involve other countries apart from Italy, so I am able to properly estimate the effects of sovereign tensions originated in a specific country on its bank credit supply.

A second condition required to the aim of this study is that loan supply must be isolated from loan demand: in order to do this, I follow the methodology pioneered by Khwaja and Mian (2008) by means of a granular dataset comprising 1,047,378 observations at bank-firm level: the proper identification of credit supply is possible by adding in the regressions firm-time fixed effects that control for observed and unobserved firm heterogeneity - and thus for the demand of credit. Third, banks' investment and lending policies may be commonly influenced by non-observables characteristics, i.e. the bank business model, potentially raising an issue of identification. This identification issue is dealt with by including bank fixed effects: controlling for time-invariant unobserved characteristics of banks on such a short horizon, bank business model is reasonably controlled for because this feature does not change frequently over time.

The results show that, as a consequence of the outburst of sovereign tensions in the Spring of 2018, government bonds portfolios are negatively associated with the growth of credit supply. In addition the drop in credit supply was triggered by the *balance-sheet channel*, while I find no evidence of an activation of the *liquidity channel*. The effect of this channel is remarkably smaller than that found by similar studies on 2021-2011, suggesting that the sovereign debt crisis hit the banking system more severely than the shock under study here. Specifically, a one-standard deviation increase in the share of government bonds at fair value is associated with a reduction in the growth rate of credit to a given firm slightly lower than one percentage points; for comparison, De Marco (2018) finds that a one standard deviation increase in the market-to-market sovereign exposure is associated with a drop in the growth of credit of almost 6 percentage points, while, after recasting their effects in percentage points, a one standard deviation increase in the sovereign to assets variable implies a reduction of around 4 percentage points in Bottero et al. (2020).

After estimating the baseline model, I extend the analysis along two dimensions. First, I add variables measuring the impact of the indirect channels, which might have also affected lending supply during the horizon considered. In particular, I include proxies for (i) the cost of funding channel, (ii) the (implicit or explicit) public guarantees channel and (iii) the crowding-out effect of loans.[3] Results on the direct channels hold. At the same time, regressions indicate that also the cost of funding channel was also an important driver of

[3]I deliberately disregard the rating channel, which is unlikely to have had any role in the period considered: in 2018 only Moody's - among the most important credit rating agencies - downgraded the Italian sovereign rating, only by one notch and within the investment-grade class (to Baa3).

the reduction in lending supply. This result is consistent with Bofondi et al. (2017), according to whom during the most acute phase of sovereign debt crisis the generalized rise in the cost of funding was the main driver for the much stronger reduction in lending by Italian domestic banks with respect to that carried-out by foreign branches. As about the economic magnitude, an increase of a one standard deviation in the proxy for the funding channel is associated with a 1.1 percentage points reduction in the growth rate of loan supply, comparable to that associated with the balance-sheet channel - and smaller than the one found by Bofondi et al. (2017) (3 percentage points).

Second, I check whether the abundant liquidity provided by the ECB to the euro area banking system may explain the finding that the liquidity channel did not activate following the 2018 sovereign shock. This hypothesis would reconcile the result of the baseline with those found by studies on the sovereign debt crisis, according to which the strains on liquidity wholesale markets for banks was arguably the main factor behind the tightening of loan supply conditions since the end of 2011. In order to do so, for each bank I compute the share of total funds raised on private collateralized markets (with either euro area private banks or central counterparties) over the total collateralized funding (which comprises also the liquidity raised via Eurosystem operations). Then, I add the interaction between this variable and the government bonds holdings in the baseline equation: the coefficient on the interaction term is negative and significant, suggesting that larger recourse to the market (as compared with the Eurosystem operations) is associated with an activation of the liquidity channel. As for the magnitude, the results indicate that for the same borrower, the growth of credit from a hypothetical bank raising funds on the market only was 0.3 percentage points lower than that of a hypothetical bank recurring only to the Eurosystem operations.

Summing up, the analysis suggests that the size of banks' sovereign portfolios matters in the transmission of sovereign shocks and affects credit supply via an adverse impact on both capitalization and funding conditions on wholesale markets. At the same time, when controlling for the other indirect channels of the multifaceted bank-sovereign nexus, the contribution of banks' direct exposure is not the most important mechanism, as the economic significance associated with the cost of funding channel is slightly larger.

The paper contributes to the empirical literature is several ways. First, it provides a novel quantification of the effects of a rise in sovereign yields on bank supply of credit by distinguishing, within the direct channels, the bank-balance sheet and liquidity channels. Second, this is the first work, to the best of my knowledge, to compare the direct and indirect channels through which a shock to government financing costs can propagate to the availability of funds to the economy. Finally, the paper investigates how the stance of monetary policy can affect the propagation of sovereign tensions to bank supply of credit, and provides evidence that the non-activation of the liquidity channel is due to the large recourse of credit intermediaries to Eurosystem funds instead of private markets ones.

As an important *caveat*, this analysis does not take into account that the direct holdings of government bonds by credit institutions has also important beneficial effects for financial

and, in turn, macroeconomic stability. This is for example related to banks' tendency to act as contrarian investors in sovereign bond markets during episodes of financial tensions (Lanotte et al. 2016).

The rest of the paper is structured as follows: Section 2 reviews the related literature; Section 3 describes the data, Section 4 addresses the identification issues and describes the empirical strategy. Section 5 presents the results of the baseline and some robustness checks, while Section 6 presents the extensions. Section 7 briefly discusses the evidence presented and concludes.

2 Related literature

This paper relates to two strands of literature. First, it is connected to the studies analysing the relationship between banks' balance-sheet strength and credit availability (the so called *bank lending channel*; see Bernanke and Gertler 1995). A number of studies have documented how lending supply is crucially affected by the degree of bank capitalization. In their seminal work, Bernanke and Lown (1991) document that the credit crunch observed in the United States in the early nineties may be partly attributed to the shortage of capital suffered by credit institutions. Other studies have also highlighted the role of funding conditions and liquidity of bank balance-sheets in determining the effects of monetary policy and other shocks on credit supply (Kashyap and Stein, 1995; Stein and Kashyap, 2000). In recent years, after the pioneering work by Khwaja and Mian (2008), the use of large bank-firm matched datasets to study adverse shocks to credit supply has become more and more frequent. Among these, Jimenèz et al. (2012) find that the tightening in credit supply following a worsening in macroeconomic conditions, as higher interest rates or lower GDP, is stronger for banks with weaker capital and liquidity conditions; Jiménez et al. (2014), Schivardi et al. (2017), Acharya et al. (2019) find that low capitalized banks supply more credit to riskier firms than better capitalized banks. Other works show that adverse shocks on bank funding are transmitted to credit supply to non-financial sector, either as a reduction in credit granted (Puri et al. 2011) or as a reallocation of credit portfolio toward low-risk firms (Olivier et al. 2020). This work contributes to this strand of literature by investigating the effects on credit supply of a sudden deterioration in banks' conditions; importantly, and differently from previous works, the methodology proposed aims at disentangling the effects of the shock on the liquidity position from those of the shock on the capital position.

The second strand of literature to which this paper contributes concerns the impact of sovereign tensions on bank credit supply. In a precursor work, Arteta and Hale (2008) study the effect of sovereign debt crises in emerging markets and find that these are associated with a reduction of foreign credit to domestic firms. Since then, a large number of works have focused on the impact of the European sovereign debt crisis of 2011-2012. Bofondi et al. (2017) find that during the sovereign debt crisis domestic banks in Italy reduced credit supply by more than foreign banks, as a consequence of a rise in their

cost of funding. Some studies focused on the impact of the direct holdings of government securities on credit supply: Becker and Ivashina (2018), using a dataset covering the period 1995-2015 identify the set of firms with a positive demand for funds; for these firms, they document that whenever the potential lender was a bank with a high exposure to sovereign domestic debt, then the firm was more likely to increase the debt issuance rather than bank credit: this result is interpreted as a consequence of the reduced credit supply by the banks most exposed to sovereign debt; Popov and Van Horen (2014), using a dataset on European syndicated loans, document that banks exposed to stressed euro-area public debt reduced lending to firms by more than less exposed banks; Bottero et al. (2020) use firm-bank matched data from the Italian Credit Register and find that during periods of distress on sovereign debt markets higher direct exposures are associated with a stronger reduction in credit supply. De Marco (2018) is the closest work to this paper, as he analyses the mechanism whereby sovereign stress propagates to credit supply via public debt holdings: he finds that the negative effect on credit supply is stronger for banks with a higher share of short-term funding while the level of capitalization does not matter. This result is interpreted as evidence that in the period considered a cost of funding channel was at work while a bank balance-sheet channel was not. Differently from the previous studies, this paper proposes a method to disentangle the two main mechanisms connected with the direct public bonds holdings (the bank balance-sheet and the liquidity channels), based on the accounting classification of bonds.

3 Data

I use a unique dataset at bank-firm level obtained by merging the information from the Italian Credit Register (CR) and the Supervisory Reports statistics. The CR contains information at loan level on credit granted in Italy by credit institutions to non-financial borrowers of outstanding amount above 30,000 euros (250 euros for bad loans). The dataset distinguishes between three types of loans: revolving credit lines, term loans, loans backed by accounting receivables. Observations are collected at a quarterly frequency and I focus on credit granted, which is less affected by firms' decisions - as compared to drawn credit - and thus is better suited to capture the dynamics of loan supply (for more details on the dependent variable, see Section 3.2). Information on bank balance sheets are obtained by the Supervisor Reports statistics. Banks are required by law to report information on balance sheet quantities on a monthly basis (or quarterly for certain items). As it will be explained in detail below, I collect information on banks' capitalization, sovereign exposure, liquidity and funding structure, profitability and total assets. I collect data at four different dates in 2018: March, June, September and December. Banking information before January 2018 cannot be used because the implementation of the International Financial Reporting Standard 9 (IFRS 9) caused statistical discontinuity in several bank characteristics, notably in the accounting classification of sovereign bond portfolios (see Section 3.1 for more details). The dataset includes all firms borrowing from at least 2

banks in each of the 4 periods; overall, the sample comprises 141,749 firms borrowing from 181 banks, for a total of 469,046 bank-firm relationships.

3.1 The classification of bonds under the IFRS 9

The International Financial Reporting Standard 9 (IFRS 9) came into force in January 2018 and replaced the earlier International Accounting Standard 39 (IAS 39). According to the new standard, a financial asset can be allocated in one of the following portfolios: (i) *Held to collect*, (ii) *Fair value through other comprehensive income*, or (iii) *Fair value through profit and loss*. Assets under portfolio (i) are valued at the amortized cost, while assets under portfolios (ii) and (iii) are valued at fair value.

IFRS 9 aims at reducing banks' discretion in the allocation of financial assets in different portfolios. For this purpose, it requires to carry-out two tests: (i) the *solely payments of principal and interests test* (SPPI test), which requires that the asset gives rise to cash flows that are solely payments of principal and interests on the principal amount outstanding; (ii) the *business models test*, which evaluates the purpose for which the asset is held. Government bonds always satisfy the SPPI test, so their allocation reflects only the result of the business model test. Specifically, if the bank holds the government bond with the only purpose of collecting cash flows over the life on the instrument, then the government bond will be assigned to the *Held to collect* portfolio. Instead, if the bank pursues both the collection of contractual cash flows and the sale of financial assets, the asset will be recorded under the *Fair value through other comprehensive income* portfolio. Finally, in case of other businesses models (i.e., trading models), the security will be recorded under the *Fair value through profit and loss* portfolio.

It is important to stress the following points. First, the result of the business model test, that identifies the first allocation of the asset, is conducted by taking into account objective elements of the investment and not a simple assertion by the bank: the entity must consider all relevant evidence that is available at the date of the assessment (as for instance, it is necessary to consider the frequency, value and timing of sales in prior periods, the reasons for those sales and expectations about future sales activity[4]). This prevents that banks use discretion in the allocation of bonds to portfolios. Second, subsequent movements of assets across portfolios are very difficult, as reclassification into other categories is possible only by changing the business model behind the assets.[5]

Under the assumption that the direct channels comprise only the balance sheet and the liquidity channel, the classification of government bonds held by banks provides a crucial information for disentangling the relative role of each direct channel, which is the main contribution of this paper. The intuition behind this approach is that for bonds classified at amortized cost only the liquidity channel is activated: therefore, the impact on credit supply associated with the direct sovereign exposure for a hypothetical bank holding bonds

[4]See Regulation (EU) 2016/2067 of 22 November 2016.

[5]Reclassification of assets up to a 10 per cent of the value without a change in the business model is also possible, but only under strict conditions and limitations, ibidem.

only under portfolio (i) estimates the liquidity channel. Similarly, for a bank that allocates government bonds under portfolios (ii) and (iii), the development of credit granted associated with its sovereign exposure will be the sum of both the bank-balance sheet and the liquidity channel. Comparing the growth of credit to the same borrower by two banks, differing only in the allocation of government bonds in each portfolio, allows estimating the magnitude of each channel at work.
Information on portfolios is reported on a monthly basis and I can compute the relative share of government bonds held at amortised cost or at market values by each bank at every point of time. Figure 1 graphically reports the incidence of government bonds over total assets and government bonds held at fair value over total assets by significant and less significant institutions.

3.2 Variables used in the regression

Table 1 reports names and descriptions for the variables used in the regressions and Table 2 reports the summary statistics before the shock, in March 2018 (panel A) and after the shock, for the second half of 2018 (panel B).
The dependent variable is the growth of credit at the bank-firm level on a 3-month horizon; in line with the literature, the variable is built using credit granted, as opposed to drawn credit, as the variations in the latter depend also on firms' decisions and liquidity needs - and therefore might reflect demand side factors. Credit supply fell in the second half of 2018: average and median lending dynamics are -0.9 and -0.1 per cent respectively, from -0.6 and 0.0 observed in the pre-shock period.
The key regressors are the ratio of Italian government bonds over total assets (*GovBonds*) and Italian government bonds held at fair value over total assets (*FVGovBonds*): as showed in the next section, they estimate respectively the liquidity and the balance sheet channel. Domestic public bonds portfolio is an important fraction of banks' assets, representing around 10.3 per cent of total assets for the average credit institution in the pre-shock period; the share of public bonds held at fair value is lower and equal to 6 per cent in the pre-shock period. In the post-shock period the share over total assets of total public bonds increased to 11.2 per cent while that of public bonds held at fair value slightly diminished to 5.6 per cent. The difference in the dynamics of *FVGovBonds* and *GovBonds* in the post-shock period may partly reflect the different impact that a soaring in government bonds yields has on these variables: indeed, a rise in sovereign yields reduces the value of government bonds held at fair value but leaves unchanged the value of those held at amortised cost. To take into account the mechanical reduction of *FVGovBonds* with respect to *GovBonds* in the post-shock period, these variables are measured at the pre-shock period only (March 2018) and are time-invariant: therefore, only the interaction with the dummy *Post* is estimated because *FVGovBonds* and *GovBonds* are absorbed by bank fixed effects. Figure 1 shows that both *GovBonds* and *FVGovBonds* are differently distributed across bank type; the share of government bonds over total assets held by smaller banks (less

significant institutions) is higher than 18 percentage points while for significant institutions this indicator is around 6 per cent. Less significant institutions also display a higher incidence of domestic bonds held at fair value (around 9 per cent), while for significant banks this incidence is around 4 per cent. The differences of the distributions across banks might reflect that both the choices on the dimension of public portfolio and on the allocation of bonds under different portfolios may be associated with different bank characteristics, i.e. business models; in order to address this issue, it is important to include bank fixed effects that control for the time-constant features of credit institutions.

Other time variant bank characteristics may be associated with lending policies and the allocation of bonds over different portfolios. To tackle this issue and in line with the literature, I add in each regression the following standard bank variables: *capital ratio* (the ratio of regulatory capital to risk weighted assets), *size* (log of total assets), *ROA* (bank profit to total assets), *liquidity ratio* (the ratio of cash plus non-domestic government securities to total assets), *interbank funding ratio* (wholesale deposits to total assets). To take into account that in the post-shock period the capitalization of banks with a higher incidence of government bonds held at fair value reduces mechanically more than that of banks with a lower incidence, I measure *capital ratio* at the pre-shock period only and, as for *GovBonds* and *FVGovBonds*, only the interaction with *Post* is estimated.

Finally, to control for the features of a single lending relation, the following variables at bank-firm time level are also included: *share of credit*$_{ijt} = \frac{credit_{ijt}}{\sum_i credit_{ijt}}$ is the ratio between the size of the credit granted at bank-firm level over the total bank credit that the firm obtains; it measures how much the firm is dependent from the bank and, when equal to 1, the bank is the only source of bank credit for the firm. $bind_{ijt} = \frac{granted_{ijt}\text{-}drawn_{ijt}}{granted_{ijt}}$ is computed as the difference between granted and drawn credit over credit granted: when zero, it signals that if the firm needs a new loan then it must apply for it.

4 Empirical strategy

4.1 Identification issues

Identifying the direct channels through which sovereign tensions impact on credit supply to firms poses relevant identification issues. In this section I will argue that the empirical strategy chosen is well-suited to address them.

A first identification issue is that the increase in Italian yields must be exogenous with respect to the health of Italian banking system and in particular it must not be caused by a deterioration in banks' conditions. The paper focuses on the sudden increase in the Italian sovereign yields recorded in the second half of May 2018 and observed against a political background that became increasingly unstable. In particular, when several attempts to form a new government failed in the second half of May, the uncertainty over the formation of the government suddenly rose. The increase in the uncertainty impacted on the Italian sovereign market: in less than two weeks, between the 18$^{\text{th}}$ and the 30$^{\text{rd}}$ of

May, yields on government bonds increased by around 200, 175 and 110 basis points on the two-, five- and ten-year horizons respectively (Fig.2). For the identification strategy it is important to stress that when the rise in sovereign yields occurred, the Italian banking system was sound and indicators were pointing to improving conditions: during 2017 and in the first months of 2018 banks' profitability grew markedly (for significant groups, annualized return on equity rose to 8.4 per cent in the first quarter of 2018 from 5.1 per cent in the first three months of 2017[6]); non-performing loans ratio declined to the pre-sovereign crisis levels; banks' capital ratio strengthened and the gap with other European banks narrowed.[7] Summarizing, the shock arose from the sharp rise in political instability and did not originate from a deterioration in the banking conditions system, and can therefore be regarded as exogenous to the banking system.

The event exploited in this paper is an ideal setting and presents two advantages with respect to previous studies analysing the impact of sovereign tensions on credit supply by exploiting the sovereign debt crisis. One is that the rise in government yields in 2018 was unanticipated, as it was connected to the sudden rise in the uncertainty of the political background; on the contrary, international sovereign debt markets were under stress since the Greek bailout in 2010, well before yields on Italian sovereign securities markedly rose in July 2011; when the Italian government securities yields abruptly rose, this increase partly incorporated fears over the conditions of the Italian banking system: this poses serious problems in estimating the causal effect of sovereign tensions on the banking credit supply. Another advantage is that the development in government debt markets observed in 2018 did not involve other countries apart from Italy: therefore, I can study the effects of sovereign tensions originated in a country on the credit supply of banks operating in that specific country, ruling out the possibility that the estimates are affected by macro-financial shocks originated outside the national borders and transmitted to domestic financial institutions.[8]

A second identification issue is that the supply of credit needs to be properly isolated from the demand of credit. The whole dynamic of credit reflects firms' demand for funds and is, in turn, affected by macroeconomic conditions; in particular, in a context of high political uncertainty, non-financial corporations might temporally reduce the demand of funds for investment purposes. I deal with these aspects by following the methodology pioneered by Khwaja and Mian (2008). Firm-time fixed effects are included in the regressions and all time-varying unobserved heterogeneity at firm level is controlled for: thus, I control for any shock originated from firms. This approach allows for unbiased estimates as long as the demand shocks are not bank-specific: in other words, in the post-shock period firms' demand should not differ according to the amount of government securities held by banks

[6] See Economic Bulletin, 2018, 3.

[7] See Economic Bulletin, 2018, 3 and Financial Stability Report, 2019, 1.

[8] A large literature investigates the international transmission of financial shocks: Peek and Rosengren (1997) focus on cross-borders lending; Schnabl (2012), Baskaya et al. (2017) focus on the propagation via international funding of domestic banks; finally, Cetorelli and Goldberg (2011), Peek and Rosengren (2000) investigate the role played by global banks.

or to the relative share of each accounting portfolio, which is a plausible assumption.
A third issue for identification is that banks' lending policies and the allocation of bonds under different portfolios might be correlated and explained by bank characteristics. This aspect is addressed in two ways. First, in order to control for time-varying observable heterogeneity among credit institutions, the regression includes bank variables that, according to the literature, influence the amount of government bonds held by banks[9](Section 3.2 provide details on the variables used in the regressions). However, the correlation between lending policies and allocations of public bonds over different portfolios might still be explained by unobservable factors, namely the bank business model; in order to deal with this aspect, the inclusion of bank fixed effects would control for the non-observable constant heterogeneity at bank level and, on a short span of time, also for bank business model (since this is very persistent over time).

The final dataset covers the whole 2018 and comprises 1 pre-shock observation and 2 post-shock observations, and bank fixed effects can be included. Ideally, I would have included another pre-shock observation but going backward is not possible as the entry into force of the International Financial Reporting Standard 9 (IFRS 9) in January 2018 caused statistical discontinuities in the classification of government bonds among different accounting portfolios.[10] Another issue to deal with is the differences in the measurement for share of government bonds under the different portfolios in the post-shock period: indeed, the increase in yields on sovereign securities implies a mechanical reduction of the exposure of sovereign bonds held at fair value with respect to the exposures of sovereign bonds at amortised cost. This problem is solved by taking the sovereign exposures in the pre-shock period only.[11]

4.2 Model

In order to identify the direct channels through which sovereign tensions affect the total amount of bank credit supply, the paper estimates a model at bank-firm level; the sample period comprises 4 quarterly data over 2018 and the shock is at Q2. Bank variables are included in every regression in order to control for bank heterogeneity; all independent variables are lagged because decision, approval and grant of credit require sometimes to be taken by the bank. Specifically, I am assuming that the rise in government yields that occurred at the end of May will take some time to affect credit supply, and its effect is not exerted already in June. Bank fixed effects control for time-invariant observed and unobserved characteristics, among which also the business model. The variables exploited to

[9]See, for instance, Bottero et al. (2020) or Gennaioli et al. (2018).

[10]In January 2018 the IFRS 9 replaced the earlier International Accounting Standard 39 (IAS 39); the coming into force of the new principle was followed by a strong increase at the aggregate level of the share of Government bonds held in the portfolios measured at amortised cost; this likely reflected that it was no longer possible for less significant institutions (LSI) to neutralize the capital gain or capital losses of the financial assets classified as 'Available for sale' as under IAS 39 (i.e. to opt for the so called *prudential filter*. More details can be found at: 5th update of Circular No. 263, Bank of Italy (Italian only).

[11]See the next subsection for more details.

identify the channels are the ratio over total assets of total government bonds, $GovBonds_{i,t}$, and the ratio over total assets of total government bonds held at fair value, $FVGovBonds_{i,t}$. The model to be estimated is:

$$\begin{aligned}\Delta b_{ij,t+1} = \alpha \text{GovBonds}_{i,pre} \times \text{Post} + \\ \beta \text{FVGovBonds}_{i,pre} \times \text{Post} + \gamma_1 \text{X}_{i,t} + \gamma_2 \text{X}_{i,t} \times \text{Post} + \\ \delta_1 \text{R}_{ij,t} + \delta_2 \text{R}_{ij,t} \times \text{Post} + \mu_{j,t} + \eta_i + \epsilon_{ij,t} \quad (1)\end{aligned}$$

where $\Delta b_{ij,t+1}$ is the difference in log credit granted by bank i to firm j between period t+1 and period t; $X_{i,t}$ are bank controls, $R_{ij,t}$ contains variables built using Credit Register (CR) information measuring the strength of firm-bank relation, such as *share of credit* and *bind* (see Section 3.2 for further details, or Table 1 for descriptions). Finally, $\mu_{j,t}$ and η_i are firm-time fixed effects and bank fixed effects. The variables $FVGovBonds_{i,pre}$ and $GovBonds_{i,pre}$ are absorbed by bank fixed effects because, as explained in the previous section, they are time-invariant in order to avoid the mechanical reduction of the ratio of government bonds held at fair value with respect to the ratio of government bonds in the post-shock period. The two variables of interest are $GovBonds_{i,pre} \times Post$ and $FVGovBonds_{i,pre} \times Post$: in particular, the coefficients α and β estimate respectively the contribution of the liquidity channel and the bank balance-sheet channel to the log-change in loans granted. To see why this is the case, consider first the ratio of government bonds held at amortised cost over total assets, $AmGovBonds_{i,pre}$; since changes in sovereign yields do not impact on the value of the bonds included in this portfolio, no decrease in the capital item is recorded and thus the bank balance sheet channel is not activated; on the contrary, the liquidity channel is triggered because when raising funds against collateral, the latter reflects market values despite the accounting method at which it is recorded in the bank's balance sheet. Therefore, $AmGovBonds_{i,pre}$ approximates the liquidity channel to which a bank is exposed to. Now consider eq.(1) and rearrange it as:

$$\begin{aligned}\Delta b_{ij,t+1} = \alpha \text{GovBonds}_{i,pre} \times Post + \beta \text{FVGovBonds}_{i,pre} \times Post + ... = \\ = \alpha(\text{FVGovBonds}_{i,pre} + \text{AmGovBonds}_{i,pre}) \times Post + \beta \text{FVGovBonds}_{i,pre} \times \text{Post} + ... = \\ = \alpha \text{AmGovBonds}_{i,pre} \times \text{Post} + (\alpha + \beta) \text{FVGovBonds}_{i,pre} \times \text{Post} + ...\end{aligned}$$

The coefficient on $GovBonds_{i,pre}$, α, is equal to the one that would be estimated if $AmGovBonds_{i,pre}$ were included in the regression and, as explained, $AmGovBonds_{i,pre}$ measures the liquidity channel. In the last equation, instead, the coefficient on $FVGovBonds_{i,pre}$ would estimate both the direct channels and it is equal to $(\alpha + \beta)$: given that α measures the effect of the liquidity channel, then it easily follows that β estimates the impact of the bank balance

sheet channel.[12]

5 Results

Table 3 reports the estimates of the parameters of equation (1). As reference, Column 1 shows the results obtained with a specification without including the sovereign exposure held at fair value. Variables are lagged and the effect of sovereign tensions on the quarterly credit growth begins in Q3. The coefficient on $GovBonds_{i,pre} \times Post$ is found negative and significant, indicating that higher shares of public bond portfolios held before sovereign tensions are associated with larger reduction in bank credit supplied to firms in the post-shock period. Starting from Column 2 also sovereign exposure held at fair value is included. Column 2 reports the results without including bank fixed effects, so that the incidence of government bonds held in the pre-shock period can also be estimated: both ($GovBonds_{i,pre}$ and $FVGovBonds_{i,pre}$) are associated with higher growth of credit to firms; however, during the post-shock period, $GovBonds_{i,pre} \times Post$ is no longer significant and $FVGovBonds_{i,pre} \times Post$ becomes negative and significant; this suggests that the balance-sheet channel played a role for Italian banks during the second half of 2018, while the liquidity channel did not affect credit supply. Identification concerns might arise for estimates reported in Column 2, as the relative allocation of government bonds across different portfolios and banks' lending policies might be influenced by unobservable banking features, i.e. bank business model. To tackle this issue, Column 3 reports the results for the complete specification of equation (1), i.e. including bank fixed effects. In this specification $GovBonds_{i,pre} \times Post$ is no longer significant while $FVGovBonds_{i,pre} \times Post$ is negative and highly significant. This confirms that, even controlling for time-unvarying banks' characteristics, during the second half of 2018 (i.e. the post-shock period) the balance-sheet channel played a role and determined a reduction in credit supplied by Italian banks. The economic magnitude of the balance-sheet channel can be appraised by comparing credit supply for two banks differing in the share of government bonds held at fair value (before the shock) by a one-standard deviation (which corresponds to 4.56 pp). I find that a higher exposure to sovereign bonds at fair value determined a reduction in the growth rate of credit supply of 0.8 percentage points. This value is smaller if compared to findings of previous works: for example, De Marco (2018) finds that a one standard deviation increase in the market-to-market sovereign exposure is associated with a drop in the growth of credit of almost 6 percentage points; when recasting the estimates of Bottero et al. (2020) in percentage points, a one standard deviation increase in the sovereign to assets implies a reduction of around 4 percentage points.

The difference in the magnitude partly reflects the distinct nature of the event under study as De Marco (2018) and Bottero et al. (2020) focus on a period that radically changed the perception of government debt riskiness; however, such big gap suggests that during 2018

[12]The identification of the two channels may be weakened during prolonged and very acute phases of sovereign crises, when the market tends to value banks' public portfolios at fair value.

the effects of the *direct channels* was smaller than during 2011.
The coefficient on overall exposure to sovereign bonds - which measures the liquidity channel - is instead not statistically significant, suggesting that this channel did not activate at the aggregate level in the episode considered. It is still possible that the channel is activated for banks that have a structurally higher recourse to this source of funding. To take this into account, I add to equation (1) interactions with the dummy *high interbk*$_i$, which takes value 1 if, in the pre-shock period, the bank is above the median of the bank-level distribution of the variable *Interbank funding ratio* (corresponding to 15.4 per cent). Results, reported in Column 4, show that the liquidity channel did not activate also for this subset of banks, as $GovBonds_{i,pre} \times high\ interbk_t \times Post$ is not statistically significant (as $FVGovBonds_{i,pre} \times high\ interbk_i \times Post$). The remaining coefficients are unaffected and, in particular, the one on (the non-interacted) $FVGovBonds_{i,pre} \times Post$ remains negative and significant.
Results are robust to different way of clustering the standard errors: instead of double cluster at the bank and firm level, I cluster at the bank level (unreported regressions).

6 Extensions

In this section I extend the baseline model in two directions. First, I include controls for the other channels through which sovereign tensions transmit to the banking system. As mentioned, these are indirect channels and tend to activate - during periods of turbulence on the sovereign debt market - irrespective of a given bank's direct exposure to public debt. This analysis has the twofold objective of being a robustness check for the baseline results and of providing an assessment of the relative importance of the direct channels as compared to the other transmission channels of sovereign tensions.
Second, I dig deeper into the result on the (non-activation of the) liquidity channel and, in particular, check whether this result may be explained by the very broad availability of funds raised via the Eurosystem's refinancing operations. This hypothesis would reconcile the result of the irrelevance of the liquidity channel in 2018 with those of the studies on the sovereign debt crisis, according to which the dry-up of funding liquidity for banks was arguably the main factor behind the tightening of loan supply conditions since the end of 2011.

6.1 Taking into account the indirect channels of sovereign tensions

The baseline model presented in Section 4 focuses on the transmission channels - from sovereign tensions to bank balance sheets and thus bank lending - activated by the direct holdings of government debt by credit institutions (*direct channels* of sovereign tensions). As mentioned, however, a rise in sovereign yields might impact banks and thus lending policies through several other indirect channels (for a detailed review of the transmission channels of sovereign tensions, see BIS 2011). First, a prominent indirect channel is the

generalized increase in the cost of funding for banks that is typically associated with a rise in sovereign yields (which are the basis for the pricing of bank bonds[13]) and which is transmitted to the private sector via a worsening of lending conditions (*cost of funding channel*; Angelini et al. 2014, Bofondi et al. 2017). One way to assess the impact of sovereign tensions via this channel is to use a proxy of banks' refinancing needs in the post-shock period, as credit institutions will face an increased cost to roll-over debt expiring during the post-shock period. To this end, I include in the regression the amount of bonds issued that are due to expire in the second half of 2018 over total assets, that is *Maturing issued bonds ratio*.

Second, sovereign tensions may be transmitted to banks also via a deterioration of the implicit or explicit guarantees that governments provide to credit institutions, should they end up in financial distress (*government guarantee channel*). Banks with larger amounts of deposits held by households and firms tend to be more affected by this channel, as these institutions are *ex ante* regarded as more likely to be bailed-out by authorities in order to protect deposit holders. Following Mäkinen et al. (2020), I account for this transmission channel by including in the regressions the variable *Deposit retail ratio*, that is the share of deposits held by households over the GDP, which measures a given bank's market share of deposits and is positively correlated with the expected support of government in case of bank distress.

Third, following a rise in government yields the amount of credit granted might reduce as a consequence of banks' decision to modify the composition of their assets and increase the amount of public bonds (crowding-out effect of lending). This phenomenon is documented by several studies (see Battistini et al. 2014) and, differently from the other channels described so far, is not associated with a deterioration of banks' balance sheet conditions. Some studies explain it as the result of pressure by the governments on credit institutions to buy domestic debt during periods of sovereign stress (*moral suasion* hypothesis, see Becker and Ivashina 2018 and Ongena et al. 2019). For others this phenomenon is driven by profitability and risk-shifting motives (see Acharya and Steffen 2015). In order to control for this effect, I augment equation (1) with the variable *Government bonds purchases*, which measures the growth of sovereign bonds net purchases at the bank level. Notice that - in order to capture potential crowding out effects - this variable is included with the same timing of the dependent variable (and not with a 1-period lag).

Two additional indirect channels, which are often mentioned as important in the sovereign-bank nexus, are not included in this analysis because they most likely did not play a relevant role in the episode considered. First, I do not consider the *sovereign downgrade channel*, which arises as sovereign ratings typically represent a ceiling for those assigned to private borrowers: a sovereign downgrade is often followed by downgrades of credit institutions, which increases the cost and reduces availability of funding on financial markets. In the period object of this study this channel is unlikely to have played any role, as only Moody's

[13]For more details, see the ECB website The compass of monetary policy: favourable financing conditions, Chart 4.

- among the main credit rating agencies - downgraded the Italian sovereign rating in the course of 2018 by one single notch, to Baa3, without affecting its investment-grade class. Moreover, the downgrading occurred at the end of October 2018, which is almost at the very end of the post-shock period included in the regression. Second, sovereign tensions can be transmitted via international spillovers, for example through cross-border interbank exposure or through direct claims vis-à-vis the non-financial sector of countries in distress. As the episode of sovereign tensions in 2018 was entirely driven by the uncertainty related to the Italian political situation and other countries were not affected, international spillovers hardly played any role.

Results for the extended regressions are presented in Table 4. The first 3 columns include the three variables capturing the indirect channels one at the time: *Maturing issued bonds ratio*, *Deposit retail ratio* and *Government bond purchases*; the last column includes all of them. For the direct channels, results are always consistent with those of the baseline regression: in each specification the coefficient on the balance-sheet channel is negative and significant and implies a lower growth rate for highly-exposed banks by about 0.8 percentage points (1.0 for the specification in column 2). Similarly, the coefficient on the liquidity channel is not statistically different from zero.

The table shows that sovereign tensions affected credit supply also through all the indirect channels, as the coefficients on all the three proxies of these indirect channels are negative and significant when they are included one at the time; in Column 4, instead, *Deposit retail* $\times$ *Post* is no longer significant, signalling that in 2018 the government guarantee channel did not play a role. In terms of magnitude, the impact of the cost of funding is sizeable and comparable to that of the balance-sheet channel: the difference in credit supply growth for two banks differing by a one-standard deviation of the *Maturing issues bonds ratio* $\times$ *Post*, is 1.1 percentage points. This result is overall consistent with previous research conducted on the sovereign debt crisis: as for instance, Bofondi et al. (2017) also find that, in the semester following the abrupt rise in Italian government yields at the beginning of July 2011, domestic banks cut lending by more than foreign branches and this behaviour was the consequence of the rise in the cost of funding; they find however a larger magnitude for the channel, with domestic banks displaying a growth of credit smaller than 3 percentage points with respect to that of foreign branches. Finally, the variable *Government bond purchases* is also found negative and significant, but the economic magnitude is negligible.

6.2 Private markets and Eurosystem operations

The baseline results indicate that the deterioration in banks' liquidity position following the sovereign shock did not contribute to reduce lending supply. This finding is somewhat at odds with those obtained in the literature on the sovereign debt crisis, which identified in the dry-up of liquidity one of the main channels of transmission of sovereign tensions to banks (see, for instance, Angelini et al. 2014).The exercise carried out in the previous section partly reconciles this apparently divergent result as it documents that the indirect

cost of funding channel plays a role in explaining the reduction in credit supply - moreover, its economic magnitude is comparable to that associated with the *balance-sheet channel*.
In this section I focus instead on the direct channels and investigate whether a potential explanation behind the difference in the results compared to the studies analysing the sovereign debt crisis could be related to the overall stronger liquidity position of the banking system in 2018 following several years of expansionary monetary policy by the ECB. In particular, since the 3-year long term refinancing operations (LTRO) launched in December 2011, the recourse to Eurosystem refinancing markedly increased - and, consequently, there was a decline in the relative share of collateralized funds raised on the private markets. In April 2018, just before the abrupt increase in the Italian government yields, the share of Eurosystem funds over total collateralized funds was 23.4 per cent, compared to less than 6 per cent in June 2011, just before the sovereign debt crisis hit the Italian banking system (Fig.3). I conjecture that the increase in the share of funds raised via Eurosystem operations played a role in neutralizing the liquidity channel in 2018.
Banks that normally raise funds more extensively on the wholesale markets rather than via Eurosystem operations might have experienced a stronger deterioration in the ability of raising funds: indeed, private counterparts can trigger margin calls or apply larger haircuts following an increase in sovereign risk; on the contrary, haircuts applied on refinancing operations by Eurosystem national central banks depend only on the residual maturity and the rating of the government bond posted as collateral.[14] Therefore, during sovereign tensions, the larger the recourse to the private markets (with respect to the Eurosystem operations) the stronger the liquidity shock hitting credit institutions.
To test this hypothesis, I proceed in the following way: first, for each bank I compute the share of total funds raised on private collateralized markets (with either euro area private banks or central counterparties) over the total collateralized funding (which comprises also the liquidity raised via Eurosystem operations):

$$share\_mkt = \left(\frac{Privatewholesalefunding_{i,pre}}{Totalwholesalefunding_{i,pre}} \right)$$

I then interact *share_ mkt* with $GovBonds$ in eq. (1) and estimate the following regression:

$$\Delta \mathrm{b}_{ij,t+1} = \theta(\mathrm{GovBonds}_{i,pre} \times share\_mkt \times \mathrm{Post}) + \alpha \mathrm{GovBonds}_{i,pre} \times \mathrm{Post} + \beta \mathrm{FVGovBonds}_{i,pre} \times \mathrm{Post} + \quad (2)$$

The hypothesis being tested here is that larger recourse to private collateralized markets with respect to Eurosystem operations are associated with an activation of the *liquidity channel*, *ceteris paribus*; a larger *share_ mkt* is supposed to have a negative impact on credit supply and as a consequence, the coefficient on the triple interaction term in the brackets is expected to be negative ($\theta < 0$).

[14] For details, see on the ECB website Financial Risk Management of Eurosystem Monetary Policy Operations, July 2015.

Results for equation (3) are shown in Table 5. The specification of Column 1 does not include *FVGovBonds*, similarly to Table 3. The coefficient on the triple interaction term is negative and significant, suggesting that the liquidity channel is activated as the recourse to the private collateralized markets increases. The coefficient on *GovBonds* is negative, even though is not significant. Column 2 includes the share of government bonds held at fair value among the independent variables: consistently with the findings of Section 5, *FVGovBonds* is found negative and significant. Remarkably, also the coefficient on the triple interaction remains negative and significant, suggesting that the *liquidity channel* plays a role for the more exposed banks on the private markets even when controlling for the *bank balance-sheet channel*. Turning to the economic magnitude, for the same borrower the growth of credit granted by a hypothetical bank that raises funds on the private markets only ($share = 1$) is lower by 0.3 percentage points than the growth of credit granted by a bank that raises funds only via Eurosystem operations ($share\_mkt = 0$). This result partly reconciles the findings of Table 3 with previous studies on the sovereign debt crisis, documenting that the *liquidity channel* plays a role even outside periods of severe financial strains as in 2018.[15] Finally, for completeness Column 3 reports the estimates of the regression when adding also the proxies for the indirect channels described in the previous subsection (*Maturing issued bonds ratio* $\times$ *Post*, *Deposit retail ratio* $\times$ *Post* and *Government bonds purchases* $\times$ *Post*): the evidence is in line with Table 3, and indicates an activation of both the balance-sheet and the cost of funding channels.

7 Concluding Remarks

In this paper I provide a quantitative estimation of the relative importance of the *balance-sheet channel* and the *liquidity channel* focusing on the development of credit supply for Italian banks in the second half of 2018. The period under study follows the exogenous increase in the Italian sovereign yields observed in May and connected to the high uncertainty over the formation of the new government. I find that banks' direct holdings of sovereign bonds had a role in transmitting the sovereign shock to credit supply: in particular, the reduction in lending supply was the consequence of the adverse shock to banks' capital position, while the liquidity channel did not contribute. A further extension suggests that the non-activation of the liquidity channel may be related to the very large availability of funds granted via Eurosystem operations in the horizon considered. Finally, the paper confirms that the generalized increase in banks' funding cost associated with the rise in sovereign yields also played a role in the reduction in credit supply.

[15] As the regression always includes *interbank_ratio* and *size* among controls, *share_mkt* captures different compositions of the wholesale funding. However, in order to take into account the absolute exposition of the bank to the private markets, as a robustness check I run again eq. (3) by substituting *share_mkt* first with (i) *mkt_ratio* (the funds raised on the private markets over total assets) and, then, with (ii) *ECB_ratio* (the funds raised via Eurosystem operations over total assets). Table A1 in the Appendix reports the results. As it shows, only the triple interaction with *mkt_ratio* is negative and significant, while that with *ECB_ratio* is not: this is in line with Table 5, and confirms that larger exposures to the private markets are associated with the activation of the liquidity channel.

All in all, results are in line with previous research that finds a negative association between total direct holdings of sovereign bonds and credit supply during episodes of a rise in government yields (Bottero et al. 2020). At the same time the evidence presented in this paper suggests that also the *cost of funding channel* played a comparable role to that of the holdings of sovereign bonds; this in line with the literature documenting that the association between the total direct holdings of public bonds and credit supply may vanish during very acute phases of a crisis, as in this case the impact on banks is mainly driven by a country-specific effect and is largely independent of the composition of their portfolios (Bofondi et al. 2017).

As an important *caveat*, this analysis does not take into account that the direct holdings of government bonds by credit institutions also have important beneficial effects for financial and, in turn, macroeconomic stability. This is for example related to banks' tendency to act as contrarian investors in the sovereign bond markets during episodes of financial tensions (Lanotte et al. 2016).

Assessing whether sovereign tensions are transmitted prominently via direct or indirect channels is a crucial information for policymakers: future research could therefore aim at comparing the overall effects of direct channels with those of indirect channels of sovereign tensions, possibly focusing not only on different episodes of rises of government yields, but also on the effects of different accountability rules in place when the sovereign tensions occur.

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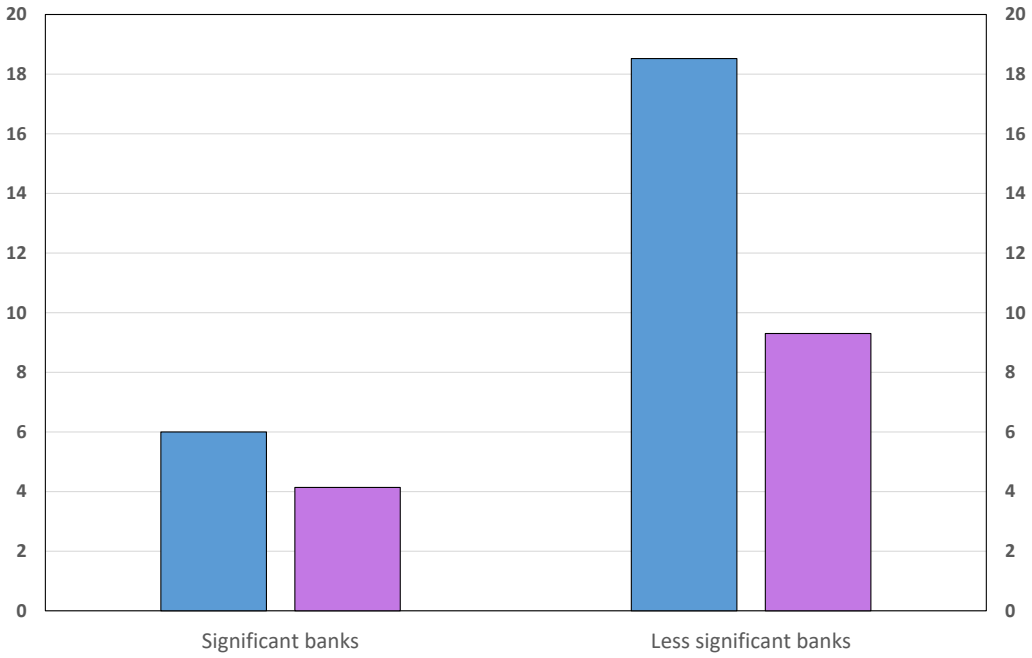
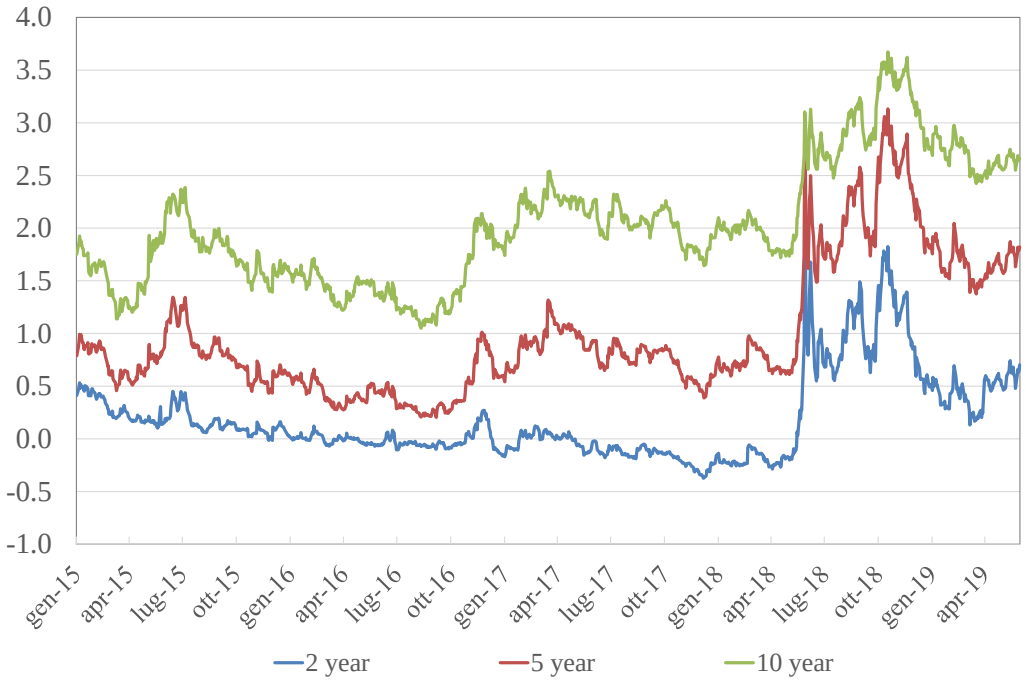
Tables and figures

Figure 1: Government bonds, by bank type



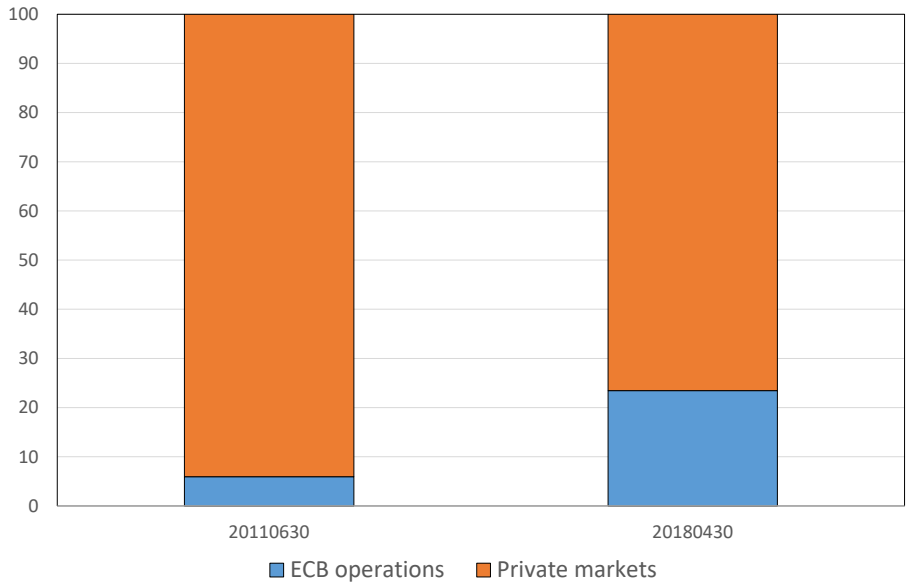
Source: Based on Supervisory Reports statistics.
The figure shows the incidence, over total assets, of Italian public bonds (blue histogram) of which held at fair value (purple histogram) as reported in Supervisory Reports statistics for March 2018.

Figure 2: Yields on Italian government bonds



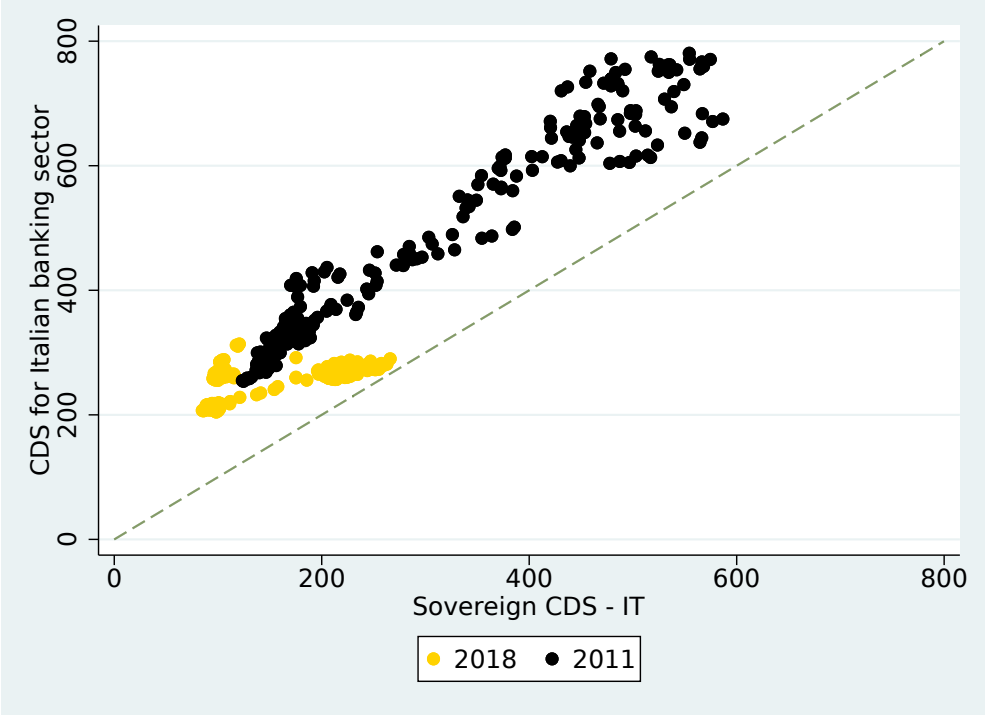
Source: Refinitiv.

Figure 3: Funding on collateralized markets by Italian banks



The figure splits the total of collateralized funds into (i) funds raised toward ECB operations (blu area) and (ii) funds raised on private markets (orange area), as observed in two points in time just preceding the sharp increase in Italian government yields related to the sovereign debt crisis occurred (June 2011) and the one occurred in 2018 related to the political uncertainty in Italy at the time (April 2018). Both histograms sum to 100 per cent. Data are from Supervisory Reports statistics.

Figure 4: Italian banks and sovereign CDS



Each point corresponds to the daily observation of the sovereign 5-year CDS for Italy (x-axis) and 5-year CDS for the Italian banking sector (y-axis). The 5-year CDS for the banking sector is computed as the unweighted mean of the CDS for the Italian credit institutions with a CDS. Daily data from Refinitiv.

Table 1 - Description of variables

Variable	Descriprion
Growth of credit	Log diff. of credit granted from bank to firm on a horizon of 3 months
Capital ratio	Tier 1 ratio (for the post-shock period, amended for the changes due to sovereign tensions)
Liquidity ratio	Cash and foreign sovereign bonds over total assets
Interbank funding ratio	Funds raised on wholesale markets, with either private counterparties or with European Central Bank, over total assets
ROA	Profit and losses over total assets
Size	Log of total assets
Maturing bonds ratio	Issued bonds with residual maturity up to December 2018 over total assets
Government Bonds ratio	Italian sovereign bonds over total assets
Government Bonds at fair value ratio	Italian sovereign bonds held in the fair value portfolios over total assets
Retail deposits to GDP	Deposits held by households over to nominal annual GDP
Government bonds purchases	Growth of purchases of government bonds over the period
Share of credit	Credit obtained by firm j from bank i over total bank loans obtained by firm i
Bind	The difference between credit granted and credit drawn over total credit granted

Table 2 - Descriptive statistics

Variable	Mean	Median	25pct	75pct	Std.Dev.
Panel A : Pre-shock					
Growth of credit	-0.6	0	-3.89	0	21.91
Capital ratio	16.14	15.12	14.08	17.8	2.66
Liquidity ratio	1.62	1.84	0.51	2.42	1.17
Interbank funding ratio	13.65	12.13	10.35	15.97	6.73
ROA	0.28	0.17	0.12	0.49	0.44
Size (log. assets)	10.97	11.32	9.673	12.29	2.212
Maturing issued bonds ratio	1.6	1.5	0.65	2.65	1.19
Government bonds ratio	10.34	7.78	5.47	14.33	7.52
Government bonds at fair value ratio	5.97	4.21	2.4	7.28	4.56
Retail deposits to GDP ratio	2.66	1.44	0.21	2.92	3.14
Government bonds purchases	6.98	8.11	-9.7	21.91	68.09
Share of credit	32	26	14	46	22
Bind	41	36	8	72	44

Variable	Mean	Median	25pct	75pct	Std.Dev.
Panel B: Post-shock					
Growth of credit	-0.91	-0.07	-4.31	0	22.23
Capital ratio	16.54	15.36	13.41	18.4	3.92
Liquidity ratio	1.89	1.46	0.64	2.9	1.27
Interbank funding ratio	15.3	15.74	10.31	18.31	7.43
ROA	0.27	0.36	0.21	0.48	0.43
Size (log. assets)	11.22	11.83	9.871	13.11	2.173
Maturing issued bonds ratio	1.19	1.04	0.44	1.65	0.91
Government bonds ratio	11.28	9.03	5.67	14.33	8.06
Government bonds at fair value ratio	5.61	3.99	2.16	8.26	4.08
Retail deposits to GDP ratio	3.26	1.86	0.32	7.14	3.31
Government bonds purchases	0.03	-0.5	-6.9	2	21.35
Share of credit	32	27	14	46	22
Bind	42	37	9	74	54

The table shows descriptive statistics of the variables used in the regressions, relative to the estimating sample and thus taken over the distribution of firm-bank-quarter observations. Data for Growth of credit, Share of credit and Bind are from the Italian Credit Register. Data on bank characteristics are from the Supervisory Reports. The sample period includes bank-firm relationships observed in March, June, September and December 2018. Growth of credit is the difference in the quarterly log credit granted. Capital ratio is the ratio of regulatory capital to risk

weighted assets; liquidity ratio is the ratio of cash plus non-domestic government securities to total assets; interbank funding ratio is the ratio of wholesale deposits to total assets; ROA is the ratio of bank profit t to total assets; bank size is the log of total assets; maturing issued bonds is the ratio of bonds issued and with residual maturity up to December 2018 to total assets; government bonds ratio is the ratio between the amount of Italian public bonds over total assets; government bonds held at fair value ratio is the ratio between the amount of Italian public bonds allocated under either the fair value through profit and loss portfolio or the fair value through other comprehensive income portfolio over total assets; retail deposits to GDP ratio is the ratio between deposits held by households over the annual nominal GDP; government bonds purchases is the quarterly growth of purchases in Italian public bonds; share of credit is the credit obtained by a firm from the bank over total bank loans held by the firm; Bind is the ratio between the difference of credit granted and credit drawn over the total credit granted.

Table 3 - The channels of sovereign tensions on credit supply: disentangling the direct channels

VARIABLES	(1)	(2)	(3)	(4)
GovBonds		0.14***		
		(4.56)		
FVGovBonds		0.13***		
		(2.89)		
GovBonds x Post	-0.12**	-0.03	-0.06	0.02
	(-2.01)	(-0.54)	(-1.06)	(0.34)
FVGovBonds x Post		-0.26***	-0.19**	-0.15*
		(-4.06)	(-2.49)	(-1.90)
GovBonds x HighInterbk x Post				-0.10
				(-0.97)
FVGovBonds x HighInterbk x Post				-0.16
				(-1.33)
Observations	1,051,388	1,051,389	1,051,388	1,051,388
R-squared	0.389	0.387	0.389	0.389
Bank controls	yes	yes	yes	yes
Bank fixed effects	yes	no	yes	yes
Firm*quarter fixed effects	yes	yes	yes	yes

The table shows regressions of the change in the log of credit granted over a 3-month horizon on the interaction between (i) the share of Italian government bonds over total assets (GovBonds) and the dummy Post, (ii) the share of Italian government bonds held at fair value (FVGovBonds) and the dummy Post. Bank controls and variables at firm-bank level and all their interactions with the dummy Post are added in every regression. To avoid measurement errors arising by the different impact of a rise in sovereign yields on GovBonds and FVGovBonds, these two variables are measured at March 2018 and are therefore time-invariant. The dependent variable is computed as the change in the log of credit granted by the bank to the firm in period t and period t+1. Firm and bank level controls are measured at the end of period t. All independent variables are lagged with respect to the dependent variable. The dummy Post is equal to one if the period t is Jun-2018 or later. The regression includes one pre-shock period and two post-shock periods. The last column also includes the interaction of a dummy equal to one if the bank is above the median in terms of total interbank funding over total assets. Standard errors are double clustered at the bank and firm level. Robust t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 - The channels of sovereign tensions on credit supply: controlling for other indirect channels

VARIABLES	(1)	(2)	(3)	(4)
GovBonds x Post	-0.07	-0.06	-0.05	-0.09
	(-1.44)	(-1.30)	(-0.90)	(-1.58)
FVGovBonds x Post	-0.16*	-0.21***	-0.19**	-0.15*
	(-1.87)	(-3.44)	(-2.44)	(-1.90)
Maturing issued bonds ratio x Post	-0.57**			-0.83**
	(-1.99)			(-2.52)
Deposit retail x Post		-0.46*		-0.24
		(-1.84)		(-1.05)
Government bonds purchases x Post			-0.02**	-0.02**
			(-2.27)	(-2.26)
Observations	1,051,388	1,051,388	1,046,642	1,046,642
R-squared	0.389	0.389	0.389	0.389
Bank controls	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes
Firm*quarter fixed effects	yes	yes	yes	yes

The table shows regressions of the change in the log of credit granted over a 3-month horizon on the interactions between (i) the share of Italian government bonds over total assets (GovBonds) and the dummy Post, (ii) the share of Italian government bonds held at fair value (FVGovBonds) and the dummy Post. Bank controls and variables at firm-bank level and all their interactions with the dummy Post are added in every regression. To avoid measurement errors arising by the different impact of a rise in sovereign yields on GovBonds and FVGovBonds, these two variables are measured at March 2018 and are therefore time-invariant. The dependent variable is computed as the change in the log of credit granted by the bank to the firm in period t and period t+1. Firm and bank level controls are measured at the end of period t. The dummy Post is equal to one if the period t is Jun-2018 or later. The regression includes one pre-shock period and two post-shock periods. Maturing issued bonds ratio is the ratio, over total assets, of bonds issued with maturity up to December 2018 and proxies the cost of funding channel. Deposit retail ratio is computed as bank deposits held by households over GDP and controls for the government guarantee channel. Government bonds purchases is the growth in the domestic public bonds purchases, controlling for the crowding-out effect of lending, is the only variable not lagged with respect to the dependent variable. Standard errors are double clustered at the bank and firm level. Robust t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 - The role of recourse to Eurosystem funds on the activation of the liquidity channel

VARIABLES	(1)	(2)	(3)
GovBonds x Share_mkt x Post	-0.26*	-0.28**	-0.36***
	(-1.88)	(-2.13)	(-2.75)
Share_mkt x Post	0.03	0.03	0.06**
	(1.11)	(1.21)	(2.08)
GovBonds x Post	-0.03	0.05	0.03
	(-0.36)	(0.75)	(0.40)
FVGovBonds x Post		-0.21***	-0.17**
		(-3.11)	(-2.36)
Deposit retail x Post			-0.30
			(-1.14)
Maturing issued bonds ratio x Post			-0.84***
			(-2.75)
Government bonds purchases x Post			-0.01**
			(-2.23)
Observations	1,050,950	1,050,950	1,046,348
R-squared	0.389	0.389	0.390
Bank controls	yes	yes	yes
Bank fixed effects	yes	yes	yes
Firm*quarter fixed effects	yes	yes	yes

The table shows regressions of the change in the log of credit granted over a 3-month horizon on the interactions between (i) the share of Italian government bonds over total assets and the dummy Post, (ii) the share of Italian government bonds over total assets scaled on the relative recourse to funds raised on private collateralized markets over total wholesale funding (share_mkt) and the dummy Post and (iii) the share of Italian government bonds held at fair value (FVGovBonds) and the dummy Post. Bank controls and variables at firm-bank level and all their interactions with the dummy Post are added in every regression. Share_mkt is computed as the share of funds raised on the private collateralized markets over the total funds raised on the collateralized markets. To avoid measurement errors arising by the different impact of a rise in sovereign yields on GovBonds and FVGovBonds, these two variables are measured at March 2018 and are therefore time-invariant. The dependent variable is computed as the change in the log of credit granted by the bank to the firm in period t and period t+1. Firm and bank level controls are measured at the end of period t. The dummy Post is equal to one if the period t is Jun-2018 or later. The regression includes one pre-shock period and two post-shock periods. Maturing issued bonds ratio is the ratio, over total assets, of bonds issued with maturity up to December 2018 and proxies the cost of funding channel. Deposit retail ratio is computed as bank deposit held by households over GDP and controls for the government guarantee channel. Government bonds purchases is the growth in the domestic public bonds purchases, controlling for the crowding-out effect of lending, is the only variable not lagged with respect to the dependent variable. Standard errors are double clustered at the bank and firm level. Robust t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix

Table A1 - The role of recourse to Eurosystem funds on the activation of the liquidity channel: different definitions for share_mkt

VARIABLES	(1)	(2)	(3)	(4)
GovBonds x Post	-0.05	0.05	-0.05	-0.01
	(-0.85)	(0.85)	(-0.78)	(-0.10)
GovBonds x mkt_ratio x Post	-1.35*	-1.71**		
	(-1.88)	(-2.22)		
mkt_ratio x Post	0.10	0.16		
	(1.08)	(1.51)		
FVGovBonds x Post		-0.25***		-0.21***
		(-4.92)		(-4.37)
GovBonds x ECB_ratio xPost			-1.35	-0.95
			(-1.50)	(-1.16)
ECB_ratio x Post			0.30*	0.24
			(1.68)	(1.42)
Observations	1,050,993	1,050,993	1,050,993	1,050,993
R-squared	0.389	0.389	0.389	0.389
Bank controls	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes
Firm*quarter fixed effects	yes	yes	yes	yes

The table is a robustness check for Table 5. In Columns 1 and 2 the change in the log of credit granted over a 3-month horizon is regressed on the interactions between (i) the share of Italian government bonds over total assets and the dummy Post, (ii) the share of Italian government bonds over total assets, the relative recourse to funds raised on private collateralized markets over total assets (mkt_ratio) and the dummy Post and (iii) the share of Italian government bonds held at fair value (FVGovBonds) and the dummy Post. In Columns 3 and 4 the change in the log of credit granted over a 3-month horizon is regressed on the interactions between (i) the share of Italian government bonds over total assets and the dummy Post, (i) the share of Italian government bonds over total assets, the relative recourse to funds raised via Eurosystem operations over total assets (ECB_ratio) and the dummy Post and (iii) the share of Italian government bonds held at fair value (FVGovBonds) and the dummy Post. Bank controls and variables at firm-bank level and all their interactions with the dummy Post are added in every regression. To avoid measurement errors arising by the different impact of a rise in sovereign yields on GovBonds and FVGovBonds, these two variables are measured at March 2018 and are time-invariant. The dependent variable is computed as the change in the log of credit granted by the bank to the firm in period t and period t+1. Firm and bank level controls are measured at the end of period t. The dummy Post is equal to one if the period t is Jun-2018 or later. The regression includes one pre-shock period and two post-shock periods. Standard errors are double clustered at the bank and firm level. Robust t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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