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Corporate debt structure and heterogeneous monetary policy transmission[1]

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This paper contains research conducted within the network "Challenges for Monetary Policy Transmission in a Changing World Network" (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

ChaMP is coordinated by a team chaired by Philipp Hartmann (ECB), and consisting of Diana Bonfim (Banco de Portugal), Margherita Bottero (Banca d'Italia), Emmanuel Dhyne (Nationale Bank van België/Banque Nationale de Belgique) and Maria T. Valderrama (Oesterreichische Nationalbank), who are supported by Melina Papoutsi and Gonzalo Paz-Pardo (both ECB), 7 central bank advisers and 8 academic consultants.

ChaMP seeks to revisit our knowledge of monetary transmission channels in the euro area in the context of unprecedented shocks, multiple ongoing structural changes and the extension of the monetary policy toolkit over the last decade and a half as well as the recent steep inflation wave and its reversal. More information is provided on its website.

Corporate debt structure and heterogeneous monetary policy transmission

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Abstract

Using French firm data, we show that corporate debt structure plays a significant role in monetary policy transmission. In addition to interest rate policy, we analyse the impact of a novel ECB-induced sovereign spread shock that is related to bond liquidity and show that both types of policy tightening diminish French firms' investment. The transmission of conventional shocks is stronger for firms with higher shares of bank debt, but contractionary bond spread shocks lower investment more for firms with higher shares of bond debt. Bond liquidity tightening leads to higher bond-bank loan interest rate spreads and lower bond issuance.

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1. Introduction

Since the Global Financial Crisis, the share of debt securities in total non-financial corporation (NFC) debt has increased significantly.[1] This increase was particularly striking in the Euro area, traditionally dependent on bank-based finance, where the bond share of corporate debt almost doubled between 2007 and 2021 (from 9% to 16.6%). In France, the share of bond debt in total firm debt rose from 19% to 30% in the same period, but there were other countries where the increase was even more dramatic. In Spain, for example, market debt as a share of total firm debt went from 3% in 2007 to 14.7% in 2021.

Financial instruments that firms use to finance their activity have different characteristics, making them imperfect substitutes. Previous literature has shown that bank loans and bond securities respond differently to monetary policy shocks (Kashyap, Stein, and Wilcox, 1993, Becker and Ivashina, 2014, Lhuissier and Szczerbowicz, 2022). As such, corporate debt structure can matter for the monetary policy transmission.

In this paper, we not only show the importance of debt composition in the transmission of conventional monetary policy to French firms' investment but, using a novel approach, we also investigate the effect of unconventional monetary policy arising from movements in sovereign Bond SPreads (BSP) and tightly linked to liquidity. We show that the impact on firm investment depends jointly on the type of monetary policy and the firms' debt structure. Firms that are more dependent on bank finance react more to conventional monetary policy (CMP) shocks, while firms more reliant on market finance are more reactive to BSP shocks.

The importance of debt structure of NFC for monetary policy transmission was highlighted by Philip Lane and Isabel Schnabel, yet with apparently different conclusions. On one hand, Lane (2022) argued that a large bank share of NFC debt may dampen conventional monetary transmission due to slower speed of pass-through of policy rate changes into bank lending rates, when compared with corporate bond yields. On the other hand, Schnabel (2021) claimed that CMP shocks should have a stronger impact on the rates charged for bank loans than for corporate bonds, so the real effects of CMP strengthen with the share of bank finance in the economy. These contrasting views highlight that the importance of debt structure for the monetary transmission is not yet fully understood.

[1] Adrian, Colla, and Shin (2013), Darmouni and Papoutsi (2022).

The canonical New Keynesian channel of monetary policy focuses on real rates and their impact on demand, via intertemporal consumption optimization. In such models, the financing structure of firms is irrelevant, as typically the Modigliani-Miller theorem holds. Recent literature has focused on financial frictions, where additional channels are present. For example, monetary policy has been shown to affect NFC investment through a "balance sheet channel" (Bernanke and Gertler, 1995). This channel implies that policy rate increases can make it more expensive for the firms to borrow externally and raise the firm-specific user cost of capital, decreasing their investment. Higher policy rates increase the "external finance premium" because they reduce asset values, and thus decrease the value of firms' balance sheets and their net worth.[2] Most of this literature has focused on loans or is silent about the distinction between market and bank debt.

But in the presence of financial frictions, the pass-through of monetary policy to bank and market debt could be quite different. In that case, central bank's rates would affect firms differently, depending on their access to different types of external financing. The firm-specific debt structure becomes an important factor of this heterogeneity, as long as monetary policy has an uneven impact on the costs of bank lending and debt securities (Holm-Hadulla and Thürwächter, 2021) and there is imperfect substitution between the two types of credit. Both bank loans and corporate bond markets can be subject to different frictions, independently reinforcing or attenuating the monetary transmission mechanism.[3]

According to the bank lending channel, CMP tightening leads to more restrictive bank credit conditions. In these circumstances, bond markets can provide an alternative to bank financing to NFC that have access to that "spare tyre" (Kashyap, Stein, and Wilcox, 1993, Adrian, Colla, and Shin, 2013).[4] If monetary tightening decreases bank loans but stimulates corporate bond issuance, then the effectiveness of monetary policy could be hampered. The investment will fall less after interest rates hikes for the firms

[2]The external finance premium is the difference between the cost of capital raised by firms externally and the cost of capital raised using cash flows generated internally.

[3]Bank loans tend to be more costly and more exposed to cyclical shifts in credit supply (Becker and Ivashina, 2014). Bonds on the other hand are held by a dispersed number of investors, which makes them difficult to renegotiate existing credit contracts in times of financial distress, impeding efficient restructuring (Bolton and Scharfstein, 1996, Crouzet, 2017). Another difference is that in France, corporate bonds have longer maturities than bank loans on aggregate, and they are more likely to have fixed interest rates (Gueuder and Ray, 2022).

[4]The term "spare tyre" was used by Greenspan (1999) in his speech "Do efficient financial markets mitigate financial crises?", where he referred to capital markets as substitutes for the loss of bank financial intermediation.

with better access to bond markets (Crouzet, 2021). Moreover, the burden of adjustment will fall disproportionately on firms that do not have access to the bond market "spare tyre", leading to possibly unwanted competitive effects of monetary policy. However, as argued by Darmouni, Giesecke, and Rodnyansky (2020), when frictions in bond financing are important, a bond lending channel can potentially dominate and firms with more bond financing would be *more* negatively affected by monetary tightening. In this paper, using a panel of micro data of French firms, we show that this is the case for bond spread shocks, but not for conventional ones which have a stronger impact on firms that rely relatively more on bank financing.

The implementation of unconventional monetary policy (UMP) has added an additional dimension to monetary policy and its transmission. In this paper, we acknowledge the development in central bank toolkits and investigate whether there are differences in the transmission of CMP and (a particular type of) UMP with respect to corporate debt structure. UMP have already been shown to have heterogeneous effects on issuance and cost of each debt instrument compared to CMP.[5] Quantitative easing, in particular, reduced risk premia on debt securities, which stimulated corporate bond issuance rather than bank lending to NFC.[6] Therefore, conventional and unconventional monetary policies have potentially different effects on NFC investment.[7] In this paper, we focus on the bond credit channel of unconventional monetary policies and show that firms which rely relatively more on market finance are more sensitive than those that rely more on bank finance, while the converse holds true for conventional monetary policy.

More specifically, we use firm-level panel data for France (FIBEN) to investigate the relevance of corporate debt structure for ECB monetary policy transmission. Our dataset consists of more than 11,000 distinct firms and around 80,000 observations, over the period 1999-2019. We rely on high frequency surprises around ECB announcements to identify monetary policy shocks. For CMP, we use the updated surprises from

[5] Lhuissier and Szczerbowicz (2022) show that an expansionary CMP in the United States leads to a rise in aggregate loans and a decline in debt securities issuance, while an expansionary UMP generates a decline in loans and a rise in debt issuance.

[6] There is evidence that central bank asset purchases lowered the NFC debt securities cost relative to the cost of bank funding, thus encouraging companies to switch from bank to bond financing (see for instance Arce, Mayordomo, and Gimeno, 2020, De Santis and Zaghini, 2021, Grosse-Rueschkamp, Steffen, and Streitz, 2019).

[7] Holm-Hadulla and Thürwächter (2021) study the effects of the ECB shocks to short-term and long-term rate on euro area countries' GDP. They show that a higher bond share goes along with a weaker transmission of short-term policy rate shocks to GDP, but the transmission of longer-term yields policy shocks is stronger.

Jarociński and Karadi (2020), who separate conventional monetary policy shocks from central bank informational shocks. These surprises are based on risk-free yield changes of maturity up to one year around ECB announcements, which allows them to capture both interest rate decisions and (Odyssean) forward guidance. For UMP, we use the high frequency changes of 10-year sovereign spreads between French and German bonds around ECB announcements, in order to study the effect of monetary policy shocks linked to French bond market liquidity.[8]

We begin by identifying a novel UMP shock extracted from movements in French-German 10-year sovereign spreads around ECB announcements (BSP shocks). Since conventional monetary policy could also have an impact on bond spreads, we orthogonalize the 10-year French-German spread surprises[9] with respect to CMP surprises. We then show that ECB-induced BSP tightening shocks reduce French sovereign bond market liquidity, as measured by bid-ask spreads, across *all* available maturities and their first principal component.

We use local projections (LP) proposed by Jordà (2005) to evaluate the average impact of ECB conventional and unconventional monetary policy on French firms' investment. We find that both CMP and BSP shocks have an economically and statistically significant negative effect on French firms' investment. Then we proceed to estimate the heterogeneous effect of both types of monetary policy depending on firms' debt structure. We control for firm fixed effects to capture permanent differences across firms and also for sector-time fixed effects in order to capture differences in how sectors respond to aggregate shocks. We provide evidence that monetary policy transmission to firm investment is a function of each firm's share of market debt and the specific type of monetary policy being used. Conventional monetary policy has a stronger impact on firm investment when the firm is more reliant on bank loans, while unconventional policies that increase liquidity in bond markets (such as quantitative easing) have a stronger effect when firm financing is more market-based.

To shed light on the mechanism of transmission, we also show that contractionary BSP shocks transmit to a lower share of bond debt in new issuance, with negative effects on NFC investment. Moreover, we also show that after a contractionary BSP shock the relative cost of bonds compared to bank loans increases, indicating that the

[8]The French sovereign bond market is comparable to the German market in terms of credit rating, currency and amounts outstanding in the individual bonds (Ejsing and Sihvonen, 2009). Moreover, Schwarz (2018) finds that liquidity is an important driver of Euro area sovereign spreads.

[9]Using data from Altavilla et al. (2019).

transmission of BSP to funding costs is stronger for market debt.

The contribution of this paper is twofold. First, we identify a bond-liquidity channel of MP, associated with BSP shocks, and provide evidence on its impact on the liquidity of the French bond market. Second, we study the role of corporate debt structure in the transmission of both types of monetary policy to investment. By uncovering the relative importance of bond and bank credit supply shocks induced by these two types of monetary policy, we provide novel empirical evidence on the credit and liquidity channels of different forms of monetary policy.

The paper is organised as follows. Section 2 provides an overview of the literature. Section 3 describes the data used, while Section 4 compares the aggregate effects of both types of monetary policy and explores the role of the debt structure in the heterogeneous responses of firms to the two monetary policy shocks. Section 5 uses complementary data sources to shed light on the transmissions channels and Section 6 concludes.

2. Literature

Our paper relates to the literature on the credit channel of monetary policy, both from the firm balance sheet and the bank lending channel perspectives.[10] This literature links the heterogeneous response of firms to monetary policy shocks in the presence of financial frictions, related both to banks and NFC balance sheets. Ottonello and Winberry (2020) find that firms with low default risk are the most responsive to monetary shocks. Other studies argue that the firm-level response also depends on their size (Gertler and Gilchrist, 1994), their holdings of liquid assets (Jeenas, 2023) and the type of financial constraints faced by the firms (Chitu et al., 2023). Cloyne et al. (2023) use the firm's age and dividend payouts as a proxy for financial constraints, finding that financial frictions account for about one third of the aggregate investment response to conventional monetary policy.

The imperfect substitutability of different instruments of corporate debt generates additional frictions that affect monetary policy transmission. In particular, the share of floating-rate debt and the debt maturity were shown to affect the transmission of monetary policy to firms' investment and stock prices (Ippolito, Ozdagli, and Perez-

[10]For the firm balance sheet channel, see Ashcraft and Campello (2007), Bernanke and Gertler (1995), and Gertler and Gilchrist (1994). For the bank lending channel, see Bernanke and Blinder (1988), Bernanke and Gertler (1995), Jiménez et al. (2012), Stein and Kashyap (2000), Kishan and Opiela (2000).

Orive, 2018, Gürkaynak, Karasoy-Can, and Lee, 2022, Jungherr et al., 2022).[11]

Another important aspect of debt heterogeneity is related to the loan-bond composition of corporate debt.[12] The firm-level evidence from the United States shows that a higher share of bonds in corporate financing attenuates the impact of conventional monetary policy on firms' stock prices and investment, in line with the bank lending channel (Crouzet, 2021, Ippolito, Ozdagli, and Perez-Orive, 2018). In this context, the possibility of issuing corporate bonds can hamper the effectiveness of interest rate increases, as the NFC can substitute bank loans with bond financing, even if only partially so. On the other hand, Darmouni, Giesecke, and Rodnyansky (2020), using firm-level data, highlight that stock prices and investment of listed euro area firms with higher bond to asset ratios are more affected by conventional monetary policy shocks than their counterparts, pointing to the importance of bond market frictions in the euro area.

We contribute to this literature by investigating the reaction of French firms investment to conventional monetary policy shocks. French firms have the highest share of bond financing in the EA, and as such we provide evidence that is more in line with the US evidence. This reinforces the idea that bond market depth is important to explain differences between US and EA-wide results. More importantly, we study here not only the role of bond-loan debt structure for CMP transmission but also for UMP transmission, with a focus on the bond liquidity channel.[13] To do this, we use high-quality microeconomic data on French firms. Earlier literature found that unconventional monetary policy reduces corporate bond yields and risk premia, stimulating corporate bond issuance (Wright, 2012, Altavilla and Giannone, 2017, Lo Duca, Nicoletti, and Vidal Martínez, 2016, Lhuissier and Szczerbowicz, 2022). Giambona et al. (2020) used microeconomic data to study the effect of QE on investment. They find that investment by firms with access to the bond market increases. Using aggregate data in a panel of EA countries, Holm-Hadulla and Thürwächter (2021) show that the share of aggregate bond financing plays an opposite role in conventional and unconventional monetary policy transmission. It weakens the transmission of short-term policy rate shocks to GDP but strengthens the effects of monetary policy shocks to longer-term yields, which tend to be more responsive to UMP measures. This suggests that the bank lending

[11] See also Bräuning, Fillat, and Wang (2020), Barclay and Smith Jr (1995), Diamond and He (2014).

[12] The composition of debt instruments and related financing costs play an important role in firms' investment dynamics. See Dees et al. (2022), De Fiore and Uhlig (2015), Adrian, Colla, and Shin (2013).

[13] Our sample also includes firms that are not publicly listed.

channel is not the main transmission channel for UMP. In this paper, we explore a separate channel of UMP related to bond liquidity, exploiting firm-level data.[14] We provide a novel way to identify unconventional monetary policy shocks that affect liquidity, and show that firms which are more reliant on corporate bonds markets for their external finance are more impacted by it than firms that are more reliant on bank lending.

Finally, our paper is related to the literature studying the impact of monetary policy shocks using high-frequency identification (Kuttner, 2001, Gürkaynak, Sack, and Swanson, 2005, Gertler and Karadi, 2015, Gerko and Rey, 2017, Jarociński and Karadi, 2020, Nakamura and Steinsson, 2018, Altavilla et al., 2019 among others). We add to this literature by constructing high frequency surprises for the bond liquidity channel of monetary policy, which was particularly important during ECB asset purchase programs. We identify shocks that impact bond liquidity from movements in 10-year French-German sovereign spreads around ECB policy announcements that are orthogonal to CMP shocks.

3. Data and summary statistics

3.1. Monetary policy shocks

We rely on high frequency surprises to identify monetary policy shocks. For CMP, we use the updated surprises from Jarociński and Karadi (2020) who separate conventional monetary policy shocks from central bank informational shocks. These (updated) surprises around ECB announcements are based on risk-free asset changes of maturity up to one year, capturing both interest decisions and near-term forward guidance.[15]

Unconventional monetary policy is a large set of tools that encompasses anything that goes beyond the use of policy rates. This can include very diverse instruments such as forward guidance, asset purchases or lending operations. Since we want to examine the role of credit channels in bank and bond financing of French firms, we want to capture unconventional monetary policy shocks that are most directly connected to

[14]Recent work by Lee and Engel (2024) highlights a link between QE, liquidity and investments in risky foreign assets. Here, we focus on the impact of unconventional monetary policy on the domestic economy.

[15]The updated MP shocks are currently available on Marek Jarocinski's webpage. The updated series are based on the 1st principal component of the Monetary Event-window changes in OIS with maturities 1, 3, 6 months and 1 year. The Monetary Event-window is defined as in Altavilla et al. (2019).

French bond markets. To do this, we use the high frequency movements in the 10-year French-German sovereign spread (BSP shock). To remove any possible systematic effect of CMP on these spreads, we also orthogonalize these surprises with respect to the CMP shocks. Figure A3 displays the time series of the two types of shocks. As expected, CMP shocks seem more frequent until 2008, while BSP shocks are more prominent during the zero lower bound (ZLB) period.

Table 1: Largest BSP Shocks

Date	BSP shock	Sources	Explanations
12/03/2020	0.117	ECB statement, Financial Times	Christine Lagarde stated it was not the ECB's role to respond to movements in government debt markets.
08/12/2011	0.057	ECB press release, Financial Times	Announcement of 3-year LTRO. Markets were disappointed by the downplaying of the prospect of renewed sovereign bond purchases.
02/08/2012	0.054	ECB statement, Reuters	ECB disappoints markets which expected a more immediate OMT implementation.
04/06/2020	−0.053	ECB statement, Financial Times	Increase of pandemic emergency purchase programme (PEPP) envelope by €600 billion (including undisclosed amount of corporate bonds).
09/02/2012	−0.051	ECB press release, ECB statement, Reuters	ECB eases eligibility criteria for collateral used in Eurosystem credit operations.
06/11/2008	−0.048	ECB statement, Reuters	After a 50 basis points cut, analysts suggest door to further monetary policy easing is likely to remain open.
07/07/2011	0.047	ECB statement (Q&A), Reuters	Jean-Claude Trichet refused to discuss further steps if Euro zone crisis worsens, generating uncertainty about acceptance of Greek collateral
06/05/2010	0.034	ECB statement (Q&A), The New York Times	Jean-Claude Trichet declares that purchases of Greek bonds were not discussed at this meeting.
06/06/2012	−0.030	ECB statement, Reuters	ECB decided to continue conducting its main refinancing operations at fixed-rate tender procedures with full allotment for as long as necessary.
03/11/2011	−0.029	CBPP programme announcement	ECB announces details of its new covered bond purchase programme (CBPP2).
03/03/2011	−0.029	ECB statement, Financial Times	QT postponed: "ECB shelved further steps to unwind the exceptional support for eurozone banks."
10/05/2001	0.028	ECB statement, Monthly Bulletin	Lower M3 growth than previously announced.

To better understand the nature of these unconventional shocks, we also provide a narrative description of the events associated with the windows where we observe the largest intra-day BSP shocks. Table 1 provides information on what was communicated at the dates of the 12 largest BSP shocks (in absolute terms). For example, the largest shock in our sample occurs on March 12, 2020 after the COVID-19 pandemic outburst. At this date, markets were disappointed by the modest strengthening of the APP and the statement by President Lagarde reaffirming that the ECB is "not here to close spreads". In other dates, there was also significant movement in the 10-year French-German spread during conferences that featured announcements regarding asset purchase programs, suggesting these are likely important drivers of the spread. Empirical evidence shows indeed that the announcements of the ECB asset purchases such as OMT and PEPP reduced the 10-year French-German spread (Szczerbowicz, 2015, Hubert et al., 2024).

Both French and German sovereign bond markets are comparable in terms of credit rating, currency and amounts outstanding in the individual bonds (Ejsing and Sihvonen, 2009), but most importantly there is also evidence that movements in French-German sovereign spreads reflect mostly changes in liquidity premia.[16] Later, in Section 4.1., we will show that BSP surprises have a strong and consistent impact on French sovereign bond liquidity across all maturities and their first principal component. This strong link to liquidity is evidence that a bond market liquidity channel is present and constitutes one of the drivers of firm-level impact.

There are also important reasons to believe movements in the sovereign spread can be important to firms, and in particular to corporate bond markets. First, ECB asset purchases were shown to spill over to corporate bonds (Altavilla, Carboni, and Motto, 2021). Second, sovereign bond yields are an important benchmark for corporate bond pricing. They usually represent a floor for corporate bond yields or, in terms of bond prices or credit ratings, a ceiling, known as the "sovereign-ceiling hypothesis" (Borensztein, Cowan, and Valenzuela, 2013, Adelino and Ferreira, 2016, Almeida et al., 2017).

3.2. Firm-level data

We measure the impact of the ECB monetary policy on French firms' investment using firm-level data on French companies from the Banque de France's FIBEN (*Fichier Bancaire des Entreprises*) database. We rely on the consolidated database as investment and financing choices are often decided at the group level. We combine two consolidated databases for each of the accounting standards under which French companies can publish their results (French standards and International Financial Reporting Standards).

Companies are identified by their SIREN number, which is an Insee[17] code identifying uniquely each company, organization or association operating in France. Results are typically reported once a year, so data is annual, but the reporting date and the length of the fiscal year can vary. To avoid double-counting we exclude observations

[16] ECB (2009), box 4: "New evidence on credit and liquidity premia in selected euro area sovereign yields".

[17] French National Institute of Statistics and Economic Studies.

whenever there are multiple entries with the same SIREN-date pair, and for consistency we exclude those for which the duration of the fiscal year is different from 12 months. This ensures that any observation is for a complete year of business.

For the remaining observations, if the reporting month is between January and June, the observation year is considered as occurring the preceding year for the purpose of aligning it with time-sector fixed effects or annual aggregate controls. Otherwise, it is considered as occurring in the year of reporting. This allows us to consider the year in which most of the activities described in the observation take place.

Given that our monetary policy shocks are daily, we follow Durante, Ferrando, and Vermeulen (2022) and align the yearly aggregation of shocks to match the reporting month of each firm. Yearly aggregation follows the formula below, yielding firm-specific monetary policy shocks based on their reporting month.[18]

$$Y_{f,t} = \sum_{j=r_{f,t}+1}^{12} m_{j,t-1} + \sum_{j=1}^{r_{f,t}} m_{j,t} \tag{1}$$

where $Y_{f,t}$ is the firm-f specific shock at year t, $r_{f,t}$ is the reporting month of firm f in year t and $m_{j,t}$ is the MP shock in month j of year t.

Finally, we exclude observations with negative equity, negative assets or with leverage above the 99th percentile to exclude firms close to or in default. We also winsorize the remaining firm-level variables at the 1st and 99th percentiles for the regressions, as is standard in the literature.

3.3. Descriptive statistics

Our working sample contains 81 358 observations from 11 478 distinct groups (henceforth *firms*). Our sample covers the years after the introduction of the Euro in 1999 to 2019.[19] There is substantial heterogeneity among the firms of our sample. We report summary statistics in Table 2 and in Figure 1. The average share of bond debt in total debt (henceforth bond ratio) is on average 0.05, due to the presence of a high number of firms that do not finance themselves through bonds. This is about half of the ratio

[18] In Appendix A, we show that results are robust to using a more straightforward calendar year aggregation.

[19] We remove the observations from 2020, so as not to incorporate the Covid-19 pandemic period.

found by Darmouni, Giesecke, and Rodnyansky (2020) in their dataset of large firms that enter the EURO STOXX 50 index. Around 80% of the observations in our sample are from firms declaring no bond debt during that reporting year.

Table 2: Summary statistics

	Mean	Std.dev.	Min	Max
Monetary policy shocks (pp)*				
CMP shocks	0.04	0.10	-0.09	0.26
BSP shocks	-0.01	0.04	-0.10	0.08
Dependent variable				
Investment rate** (%)	1.57	5.87	-19.58	43.25
Aggregate control variables				
French output gap	-0.006	1.60	-2.6	2.79
French inflation	1.38	0.77	0.07	2.81
VIX	19.9	7.06	11.04	40
10y French sovereign rate	3.01	1.65	0.13	5.39
3m interbank rate	1.75	1.76	-0.36	4.63
Firm-specific control variables				
Leverage	0.25	0.17	0	0.79
Total assets (in bn)	0.39	1.72	0	25.72
Cash flows to total assets	0.10	0.07	-0.19	0.75
Bond ratio	0.05	0.16	0	1
Maturity ratio***	0.56	0.36	0	1

** MP shock moments calculated under a calendar-year aggregation ** Investment rate is defined as the difference in net tangible assets with respect to lagged total assets. *** Maturity ratio is defined as the share of debt with maturity above 1 year.*

Figure 1 displays histograms from the subsample of firms that finance themselves at least partly through bonds.[20] Within the group that has access to the bond market, there are more firms with low bond ratios than there are with large ones. Despite this pattern, the distribution is more even for bond ratios than it is for bond debt over assets. There is a non-negligible number of observations across all possible values of bond ratios, allowing us to explore this dimension of the panel data. For bond debt over assets, we observe a more concentrated distribution. This is expected, since firms at the higher end of the distribution need to combine high leverage ratios with high bond ratios. In Figure A1 of Appendix A, we also provide histograms for the logarithm of assets, the share of firm debt with maturity above 1 year (henceforth *maturity ratio*) and

[20] As mentioned before, there is a large mass point at 0, such that including it masks the heterogeneity within the remaining firms.

leverage for the full sample of firms.

Figure 1: Distribution of bond ratios and bond debt over total assets

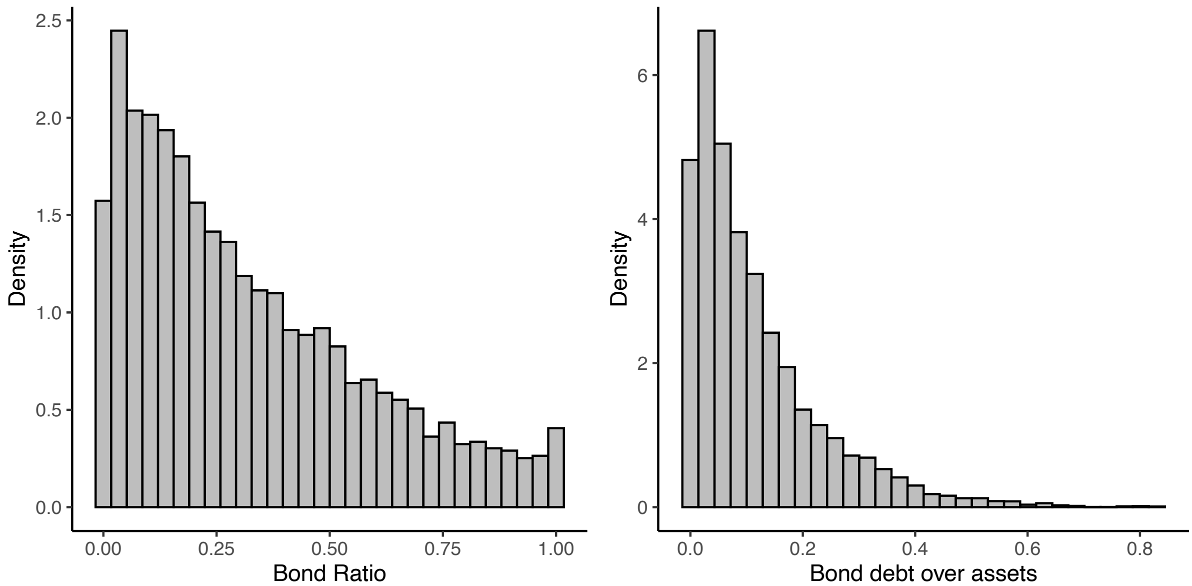
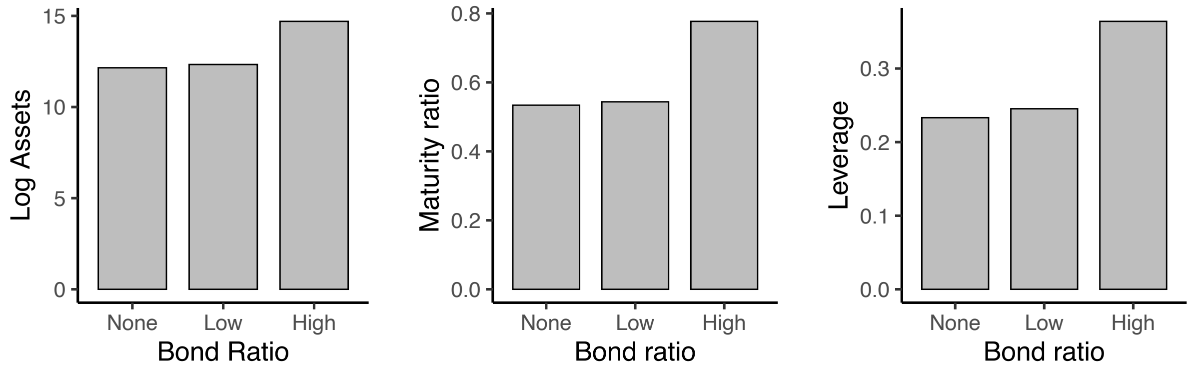


Figure 2 provides information on firms' assets, maturity ratio and leverage, according to their corporate debt structure. For each variable, we indicate the average across 3 categories of firms: those with a bond ratio equal to zero, those with a bond ratio below a cut-off value and those with a bond ratio above it. The cut-off value is the median bond ratio of firms with non-zero bonds. Firms with a bond ratio higher than the (conditional) median are on average significantly larger than those within the other two categories. They are also more highly levered and have higher maturity ratios relative to the other two groups.

Figure 2: Corporate debt structure and firm characteristics



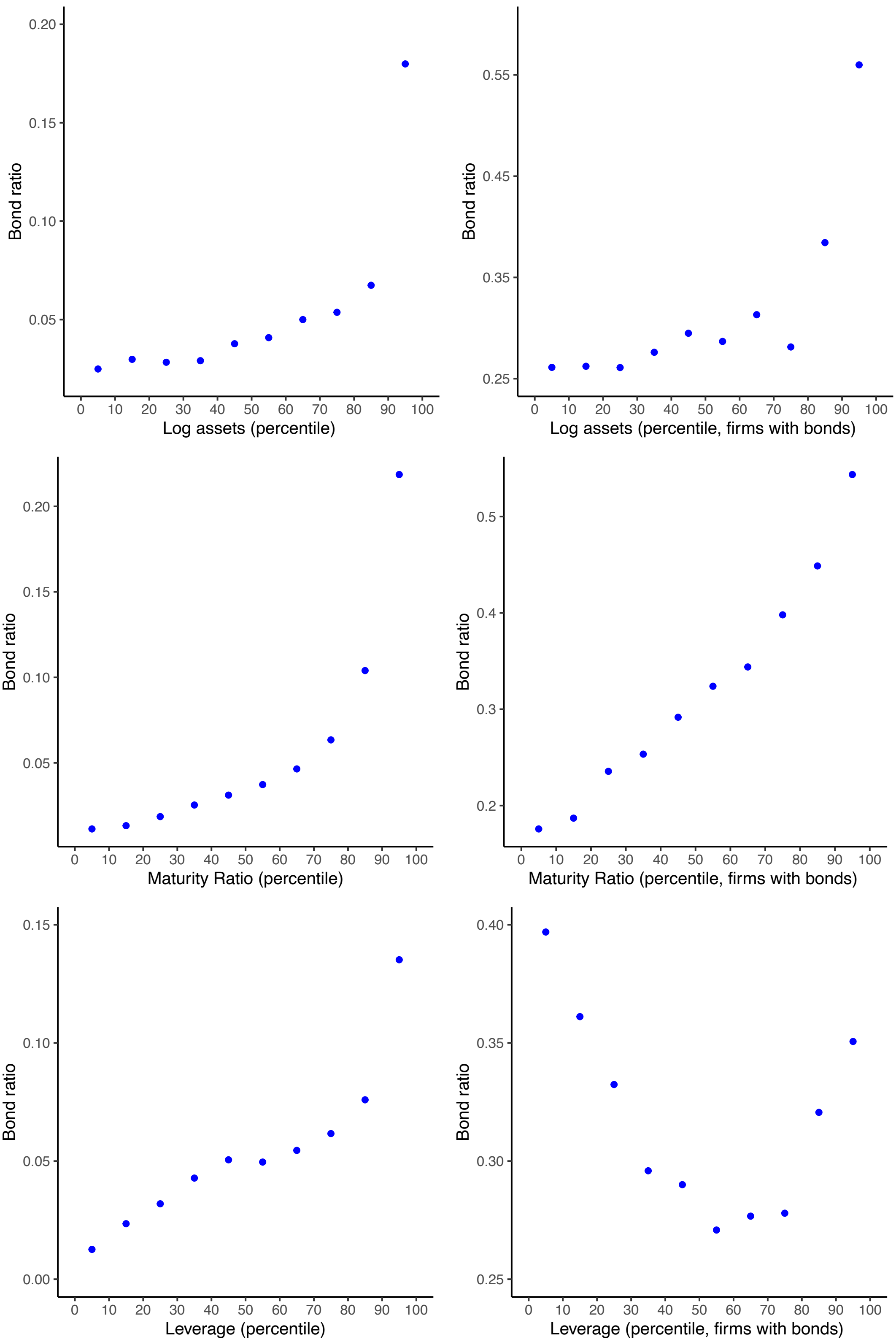
Each panel represents the average of the corresponding variable for three groups of firms: those with no bonds, those with bond ratios below the median (conditional on having bonds), and firms with bond ratios above the median.

Figure 3 shows binned scatter plots of the average bond ratio for different bins of, respectively, assets, maturity ratio and leverage.[21] Panels on the left are constructed using the full sample, while the ones on the right restrict the analysis to only firms with bonds. As can be seen in the top row, there is a positive relationship between bond ratio and asset size. The distribution has therefore significant skewness, with large firms having significantly larger bond ratios. In the top right panel, we see a similarly shaped distribution when we limit the sample to firms with non-zero bond debt, but with much higher values of bond ratios (and a bit more noise). In the middle row, we see that a similar pattern applies to the maturity ratio, defined as debt above 1 year maturity over total debt. Firms with higher maturity ratios tend therefore to have larger bond ratios.

In the bottom row, we highlight that doing a similar analysis by leverage reveals very different patterns in the full sample and the bond firms subsample. While we have a stable and monotonic positive relationship in the full sample, the subsample is U-shaped. The combination of the two panels shows that the low average bond ratios for firms in the lower leverage percentiles of the full sample are driven by firms with no bonds, but conditional on having bonds, low leverage firms actually have the highest share of bonds across the bins represented.

[21] Figure A2 in Appendix A also shows the equivalent charts for cash flow over assets.

Figure 3: Binned scatterplots of bond ratios by asset size, maturity and leverage



4. Monetary policy transmission to firm investment

In this section we first provide evidence of a strong link between BSP shocks and bond liquidity, as measured by bid-ask spreads. We then show that although both shocks are contractionary for firm investment, BSP shocks have a stronger impact on firms which are more reliant on market debt, while CMP shocks have a stronger impact on firms that are more reliant on bank loans.

4.1. Liquidity shocks and bid-ask spreads

In this sub-section, we show that BSP shocks have a strong link with bond market liquidity. We also show that the impact is felt at all levels of maturity, despite the BSP shocks being identified using only 10y French and German bonds.

We use smooth local projections (S-LP) as in Barnichon and Brownlees (2019). This penalization method can help deal with excess variability, without restricting ex-ante the shape of the impulse response function.[22] We use S-LP, as without the cross-sectional dimension of the panel, the number of observations is reduced considerably. Yet standard local projections are heavily parametrized and so estimates can be less precisely estimated and can be erratic in smaller samples (Ramey, 2016). On the other hand, more efficient VAR approaches might be too restrictive and lead to bias. To address these issues, S-LP make use of a shrinkage parameter that pins down the bias/variance trade-off of the estimator. When this parameter is set to 0, the method coincides with standard local projections estimated by least squares, whereas when it is large the impulse response converges to a polynomial distributed lag model (Almon, 1965). We follow Barnichon and Brownlees (2019), and let the data choose the shrinkage parameter using 5-fold cross-validation, picking the value that provides the best pseudo-out-of-sample fit.[23]

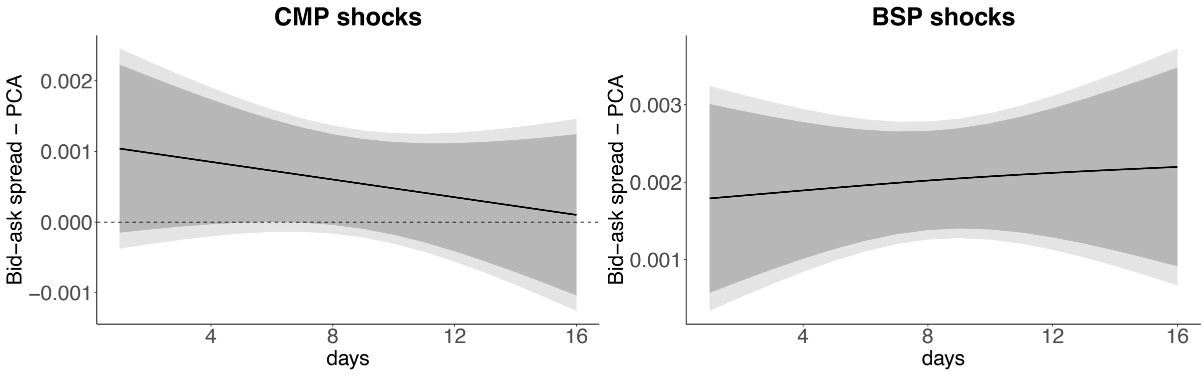
We run smooth local projections on daily bid-ask spread data for French sovereign bonds with maturities running from 1m to 50y.[24] Given that momentum is an important factor for asset prices at higher frequencies, we include 6 lags of the shocks. Our specification is as follows:

[22]See Li, Plagborg-Møller, and Wolf (2024).
[23]For additional details on the method and its properties, see Barnichon and Brownlees (2019).
[24]The following maturities were considered: 1m, 3m, 6m, 1y, 2y, 3y, 5y, 10y, 15y, 20y, 30y and 50y.

$$BidAsk_{i,t+h} = \alpha_h S_t + \sum_{l=1}^{6} \Gamma_l^h S_{t-l} + \epsilon_{i,t+h} \tag{2}$$

where $BidAsk_{i,t+h}$ is the h-day forward bid-ask spread of bonds with maturity i (or their first principal component). S_t is either the CMP or the BSP shock at time t. In Figure 4, we show the impact of each shock on the first principal component of bid-ask spreads across all maturities. In Figure A4 of Appendix A, we also show the results for each individual maturity.

Figure 4: Response of first principal component of bid-ask spreads to CMP (left panel) and BSP (right panel) shocks



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: days after the shock.

Figure 4 shows that the BSP shocks have a consistent positive impact on the first principal component of bid-ask spreads, pointing to the worsening of market liquidity of French sovereign bonds. After a contractionary BSP shock, the common component of bid-ask spreads across all maturities rises by about 0.2bp. The average bid-ask spread of 10y bonds is about 0.4bp, so it is not a trivial value.[25]

The same is not true for CMP shocks, for which there is no consistent liquidity impact, as can be seen on the left panel of Figure 4. Looking at specific maturities, there is some limited impact on intermediate maturities but overall the effect is much less clear. In particular, there is no positive impact of CMP on any of the bid-ask spreads in the set of maturities used to identify CMP shocks (1m, 3m, 9m and 1y). However, there is some impact on spreads at 10y maturity, highlighting the importance

[25] In Appendix A, Figure A5 shows results are robust to excluding data after 2019, while A6 shows this result is robust to including a Great Financial Crisis dummy that takes the value 1 during 2008, albeit it reinforces the result that CMP shocks are much less linked to liquidity than BSP ones.

of orthogonalizing movements in the spread from CMP shocks when identifying BSP shocks.

Although it is hard to claim that *all* high frequency movements in the French-German spread are due to relative liquidity across these markets, the evidence provided in this section clearly indicates that there is a stronger and more consistent link between BSP shocks and liquidity in bond markets, than there is between CMP shocks and liquidity. This is not claiming that CMP has no impact on liquidity, rather simply that BSP shocks can be a useful proxy for (monetary policy driven) bond market liquidity shocks.

4.2. Investment response to monetary policy

We now examine the aggregate effect of monetary policy shocks on French firms' investment rates. To capture the time profile of the response, we use a panel local projection approach proposed by Jordà (2005). We define net investment rate $I_{i,t}$ of firm i as the first difference of net tangible assets in year t, scaled by total assets in year *t-1*.[26]

To measure the effect of conventional and unconventional monetary policy shocks at time t on investment at horizons $h \in (0, 1, ..., 5)$, we estimate the following set of equations:

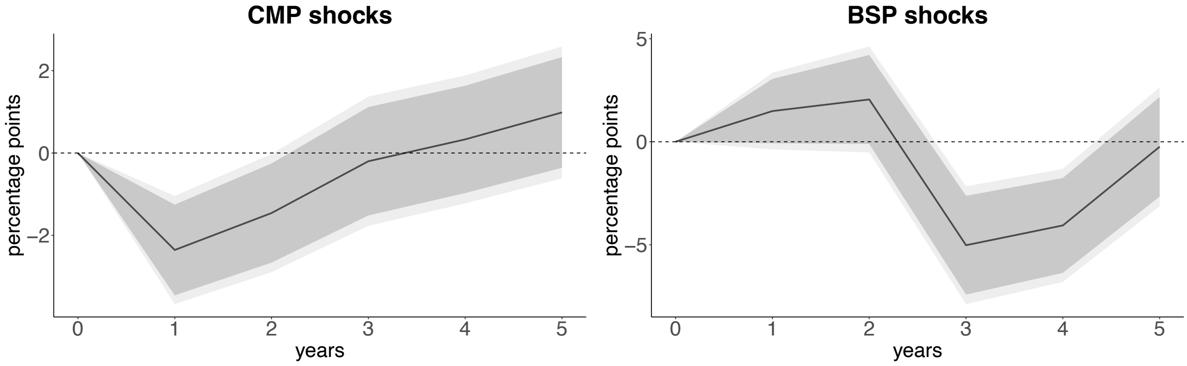
$$\Delta I_{i,t+h} = \alpha^h S_{i,t} + \Psi^h Z_{t-1} + \sum_{l=1}^{3} \Gamma_l^h X_{i,t-l} + \mu_i^h + \epsilon_{i,t+h} \tag{3}$$

where $\Delta I_{i,t+h}$ is the h-year forward difference in the net investment rate: $\Delta I_{i,t+h} = I_{i,t+h} - I_{i,t-1}$. $S_{i,t}$ is a vector of CMP and BSP shocks aligned to the reporting month of firm i. Z_{t-1} is the control vector of lagged aggregate controls: French output gap, French inflation, VIX, 10-year French sovereign rate, 3-month interbank rate. $X_{i,t-1}$ is the vector of lagged firm-specific controls: leverage, total assets, cash flows to total assets, bond ratio, maturity ratio and a bond dummy that is equal to 1 for firms that have non-zero share of bond financing. μ_i are firm fixed effects.

Figure 5 shows the average impulse response function of investment rate to a 100 basis point upward surprise for CMP (left panel) and BSP shock (right panel) at each horizon h (from 1 to 5 years). A CMP tightening of 100bp leads to a 2.4pp decline of investment with respect to firm's total assets, while a contractionary BSP shock of 100bp reduces it by close to 5pp. The CMP shock has an economically and statistically

[26]Our focus is on tangible investment, as research has indicated that fluctuations in debt financing have a more significant impact on physical investment, whereas equity financing fluctuations are more closely linked to R&D investment dynamics (Bianchi, Kung, and Morales, 2019)

Figure 5: Average response of investment to CMP (left panel)
and BSP (right panel) shocks



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

significant negative effect in the first two years after the shock, while the BSP shock decreases French firms' investment with a longer lag, starting only on the third year after the shock.

Our estimates for CMP shocks are consistent with the ones found in the literature.[27] The identified BSP shock has an impact at its peak that is larger per bp of the shock. We normalize the impulse response to 100bp shocks, which we find easier to interpret economically. Nevertheless, Figures A10 and A11 of Appendix A show the impulse responses of specifications (3) and (4) when each shock is rescaled by its standard deviation in the sample.

To better understand whether the investment response to BSP shocks is driven by sovereign French market developments or rather by movements in German yield (possibly reflecting some flight-to-safety reactions), we also add to our specification the surprises in 10-year German bond yields during the same announcement window.[28] Figure A19 in Appendix A displays the average response of investment to CMP and BSP shocks with this additional control, confirming that our results are not driven by surprises in 10-year German yields.

In Appendix A, we additionally show that results are robust to not using any

[27] For example, using US firm-level data, Cloyne et al. (2023) show that a 100bp rise in the interest rate leads to a fall in business investment between 2.4 and 3.2% on average after two years. Papers where investment is defined as the log change in net tangible assets tend to find larger values, such as 10% in Ferreira, Ostry, and Rogers (2023) or 31% in Durante, Ferrando, and Vermeulen (2022).

[28] As in case of the BSP shocks, we orthogonalise the surprises in 10-year German yield on the days of ECB announcements with CMP shock.

aggregate controls[29] (Figure A12) or using only output gap and inflation (Figure A13). Finally, results are also robust to aggregating shocks through a simple calendar year sum (instead of adjusting to each firm's reporting month), which is not surprising given most firms in our sample report their results in December (Figure A14).

4.3. Heterogeneous Transmission of Monetary Policy

In order to investigate possible heterogeneity in the transmission of the two types of monetary policy shocks, we explore the role of corporate debt structure. To do this, we again estimate LP, but we interact the shock with the (lagged) firm-specific *bond ratio* (defined as the share of bond liabilities in total firm debt). A value of 0 indicates that the firm has only bank loans, while a value of 1 implies the firm has no bank loans but only bond debt.

$$\Delta I_{i,t+h} = \alpha_b^h B_{i,t-1} S_{i,t} + \alpha_m^h M_{i,t-1} S_{i,t} + \sum_{l=1}^{3} \Gamma_l^h X_{i,t-l} + \mu_i^h + \theta_{s,t}^h + \epsilon_{i,t+h} \tag{4}$$

where $B_{i,t-1}$ is the lagged bond ratio and $M_{i,t-1}$ the maturity ratio, defined as long-term debt over total debt. We include a maturity interaction term since the literature has previously highlighted the role of maturity[30] and the average maturity of bond debt tends to be longer than for bank loans.[31] Although we do not have data on the full maturity structure of each firm, we can still construct a maturity ratio $M_{i,t}$, defined as the share of firm debt with maturity above 1 year. In our sample, the unconditional correlation of $M_{i,t}$ with the bond ratio $B_{i,t}$ is equal to 0.27.

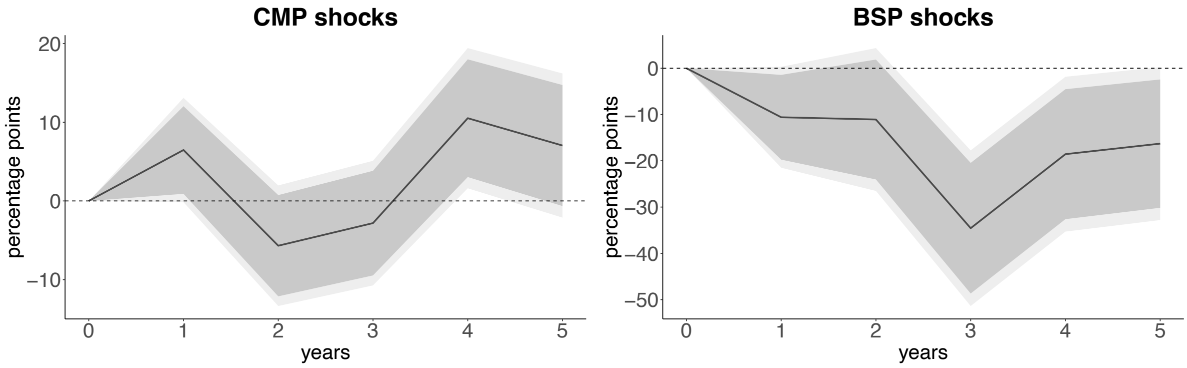
Since we are now interested only in the heterogeneity of responses, we can include sector-time fixed effects $\theta_{s,t}$ which will (among other things) absorb aggregate demand effects of monetary policy and any sector-specific responses to the shocks. All other variables, such as shocks, firm-specific controls and firm fixed effects, are as in Equation (3).

[29]Since monetary policy shocks are exogenous, in principle lagged aggregate controls are not strictly necessary.

[30]Deng and Fang (2022) show that firms who hold more long-term debt are less responsive to conventional monetary shocks. Using detailed bond-level date, Jungherr et al. (2022) show that firms with more maturing debt are more exposed to fluctuations in the real interest rate.

[31]It is also important to mention that 83% of debt of French companies is fixed-rate debt (Gueuder and Ray, 2022). See Gürkaynak, Karasoy-Can, and Lee (2022) for the impact of cash flow exposure on monetary policy transmission.

Figure 6: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) shock depending on firms' bond share



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

Figure 6 shows the estimated coefficients for the interaction variable between monetary policy shocks and the lagged bond share in NFC debt. As the left panel of the graph indicates, after a contractionary 100bp CMP shock, firm investment falls less, the higher its share of market financing is. In particular, the contemporaneous decline in investment with respect to total assets of firms with no bonds is 6.4pp bigger on impact compared to fully bond reliant ones (i.e. comparing a firm with a bond ratio of 0 to one with a bond ratio equal to 1) and peaks at 10.5pp three years after the shock (year 4). On the other hand, after a contractionary 100bp BSP shock, firm investment falls more, the higher is its market financing share. On impact, the decline in investment of fully bond reliant firms is 10.6pp bigger compared to fully bank reliant ones, and this effect increases to 34.6pp at its peak, two years after the shock (year 3). In other words, a one standard deviation higher bond ratio (i.e by 0.16) would be associated with an extra 5.5 percentage point reduction in investment following a 100bp BSP shock.

In Figure A16 of Appendix A, we also provide the impulse response functions for the interaction terms between monetary policy shocks and maturity. We show in Figure A18 that the bond ratio results are also robust to excluding this maturity interaction from the specification. Figure A20 in Appendix A shows that results are also robust to adding the interaction of lagged bond share with the surprises in the German 10-year bond yields, using the same window on ECB announcement days. Finally, as in the previous section, we also provide figures that show that results are robust to aggregating shocks through a simple calendar year sum without accounting for the month the firms report their results (Figure A15).

The transmission of monetary policy to firm investment is therefore contingent upon a firm's market debt structure and the specific monetary policy instrument employed. Conventional monetary policy has a stronger impact on firm investment when the firm is more reliant on bank loans, while unconventional policies that increase liquidity in bond markets (such as QE) have a stronger effect when firm financing is more market-based. To shed light on why this is the case, we explore in the next section the links between each type of credit supply and the two types of monetary policy shocks.

5. Inspecting the transmission channel

5.1. Impact on aggregate debt flows and prices

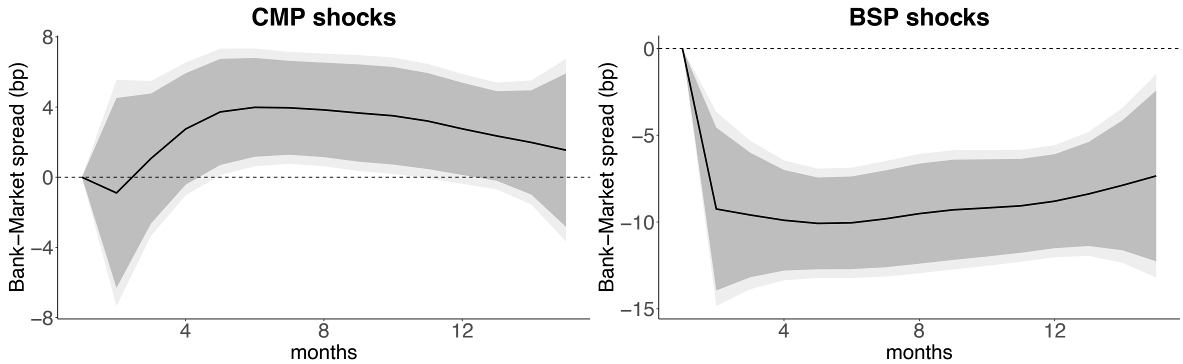
In Section 4.2., we established that the different types of monetary policy affect firms differently depending on their financing structure. In this section, we investigate the channels by looking at funding cost data. Unfortunately, we do not have data on firm-specific funding costs so we need to look at aggregate variables. On the other hand, this allows us to use monthly frequency which might be important when looking at financial variables.

Looking at aggregate variables reduces the sample size, which is why we use smooth local projections, as in Section 4.1. We explore the transmission channel in more detail by looking at the impact of monetary policy shocks on the cost of debt, as well as on the quantity dimension (flows and stocks).[32] In Figure 7, we show the response of the bank-market spread, defined as the rate of bank loans compared with the average yield of corporate bonds.

In the left panel, we see the response of the aggregate bank-market spread to a CMP shock. As monetary policy contracts, the spread seems to marginally and non-significantly fall in the short run, but quickly becomes persistently and significantly positive. As highlighted by Schnabel (2021), conventional shocks have indeed a *stronger* pass-through to bank loan rates relative to bond ones. After a BSP shock, market rates rise more than bank rates and therefore spreads are reduced. The impact of such unconventional shocks is then also *stronger* for bond markets. Firms facing these

[32]Monthly data on French NFC financing is published on Banque de France website: https://www.banque-france.fr/en/statistics/loans/financing-entreprises-2024-06.

Figure 7: Response of bank-market spreads to CMP (left panel)
and BSP (right panel) shocks



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: months after the shock.

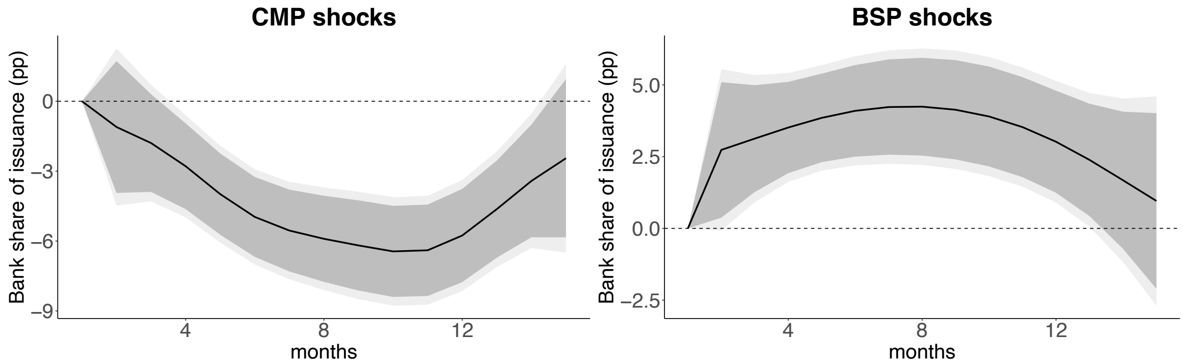
dynamics could then try to substitute bank debt with market debt after a CMP shock and conversely, they could substitute market debt with bank debt after a BSP shock.

The difference in speed of adjustment in spreads to each of the shocks is also consistent with Lane (2022) who argues that the pass-through is *faster* to bond market prices than to bank rates. After a contractionary CMP shock, a faster but smaller rise in bond yields could explain the delayed reaction in the left graph, while a slower and smaller rise in bank rates could also explain why the impact after the BSP shock peaks so soon. The impulse response can then shed light on how the two statements are not necessarily contradictory.

In Figure 8 we can see the impact on debt flows in response to the two shocks. In the left panel, we observe that the share of bank debt in new issuance falls after a CMP shock and in the right panel we see that it rises after a BSP shock. This is again consistent with the interpretation that there is segmented transmission and different pass-through of different shocks to different debt markets. The banking sector is more sensitive to CMP shocks and so interest rates hikes have a higher pass-through to bank loans. On the contrary, bond markets are more sensitive to BSP shocks, which have therefore a stronger pass-through to bond debt volumes than to bank loans. In Appendix A, we also show that the same effects can be observed in the relative stocks of debt (Figure A7) but also the absolute flows and not just the relative ones (Figures A8 and A9).

These results shed light on the channels explaining the results of our baseline

Figure 8: Response of bank share of issuance to CMP (left panel)
and BSP (right panel) shocks



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: months after the shock.

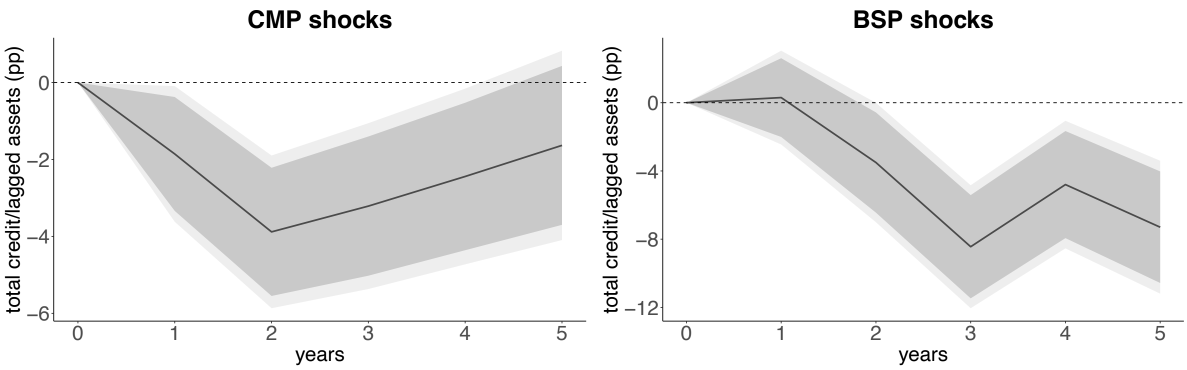
regressions. After a CMP tightening, firms that are more dependent on bank lending tend to contract investment significantly more than firms that have more access to bond markets, while BSP tightening affects bond-dependent firms relatively more. Given the reaction of quantities and prices, the two shocks act as relative supply shocks on each of the two markets: CMP for bank debt and BSP for bond debt. We also show that firms with high reliance on bond financing can use it as a "spare tyre" when faced with CMP shock. Yet, bond financing makes them more exposed to unconventional monetary policy tightening, in particular to shocks that impact the liquidity of bond markets, like our BSP shock.

The two markets are not perfectly integrated and firms have difficulty substituting one for the other, irrespective of the direction required. As the left panel of Figure A8 and the right panel of Figure A9 in Appendix A show, there is some degree of substitutability since bond flows rise after a contractionary CMP shock and bank loan issuance grows after a contractionary BSP shock. However, this is not sufficient to stop the contractionary effects on aggregate investment, as highlighted in our baseline panel results.

5.2. Firm-level data: Total Credit

Although we do not have data on firm-level funding costs for each debt instrument, in this section we explore the panel data to shed additional light on the credit channel of monetary policy transmission. Consistent with our interpretation of this channel, along with imperfect substitution across credit instruments, we expect total credit to fall across firms for all shocks, but CMP to have a stronger impact on firms that are more bank-based, while BSP to have a stronger impact on more market-based firms.

Figure 9: Average response of total credit to CMP (left panel) and BSP (right panel) shocks



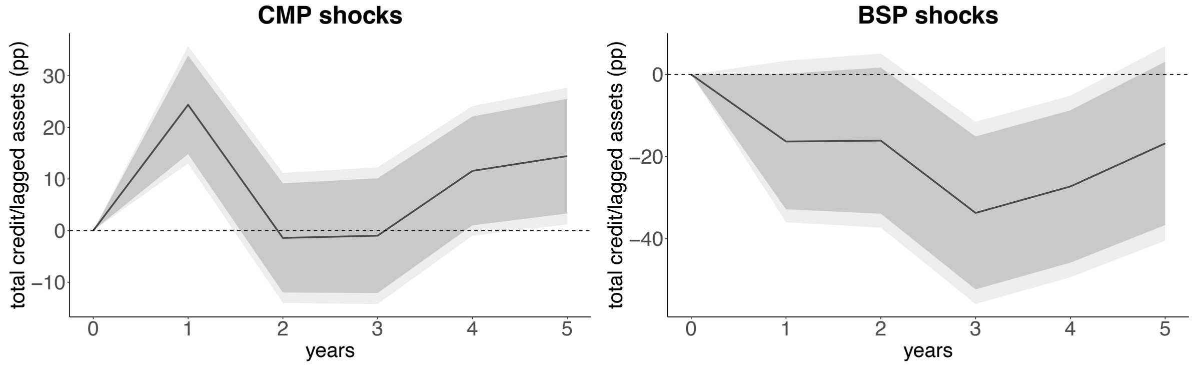
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

We first look at total firm credit, scaled by lagged assets, using the same controls and fixed effects as in Equation (3). Using LP to compute the impulse responses, we show in Figure 9 the estimated effect in percentage points of a 100 basis point upward surprise for CMP (left panel) and BSP (right panel) shocks. The left panel highlights that CMP shocks have an economically and statistically significant negative effect, with the total credit falling up to 3.9pp of lagged total assets 2 years after the shock. The BSP on the other hand leads to a fall in credit that reaches around 8.4pp of lagged assets 3 years after the shock. Unsurprisingly, both shocks are contractionary and lead to reductions in firm credit.

We then explore the cross-sectional heterogeneity, and let the panel results reveal the role of debt structure in the monetary policy transmission. To do so, we interact monetary policy shocks with the lagged bond ratio in NFC debt, including the same controls and fixed effects as in Equation (4). Figure 10 shows the estimated coefficients for the interaction variable between monetary policy shocks and the lagged bond ratio in NFC debt.

After a contractionary CMP shock (left panel), firms' total credit falls less, the higher the bond share is. On the other hand, after a contractionary BSP shock, firms' total credit falls more, the higher the bond share is. The transmission of conventional monetary policy to total credit is stronger for firms that are more dependent on bank financing,

Figure 10: Heterogeneous response of total credit to CMP (left panel) and BSP (right panel) shock depending on firms' bond ratio



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

while it is weaker for those that have more market financing. On the other hand, those that are more market-based are more exposed to unconventional monetary policy shocks that affect liquidity in bond markets.[33]

6. Conclusion

In this paper, we identify significant heterogeneity in the transmission of monetary policy across firms. Using a novel approach to identify unconventional monetary policy shocks that are tightly linked to liquidity and a large panel of French firms, we show that while both conventional monetary policy and bond spread shocks reduce average firm investment, the strength of this effect depends on their debt structure.

Firms which are more reliant on bank credit contract investment relatively more after contractionary CMP shocks, but are affected less by contractionary bond spread shocks. This points to imperfect integration across the two debt markets. Using aggregate data, we show that there is substantial substitution between types of debt after each type of monetary policy shock. While there is some degree of substitutability, it is insufficient to stop the contractionary effect of monetary policy on NFC investment.

Heterogeneous monetary policy impact on firms' investment has important policy

[33] In Figure A17 of Appendix A, we also provide the impulse response functions of total credit for the interaction term between monetary policy shocks and maturity.

implications. Investment of large NFC with better access to capital markets could be more affected by quantitative tightening, while investment of smaller firms more reliant on bank loans would decrease more following a conventional tightening. In the absence of a coordinated approach, monetary policy can generate winners/losers depending on the tool used. On the other hand, policy can be more targeted when there are specific issues with one type of funding.

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Appendix A

Figure A1: Additional histograms

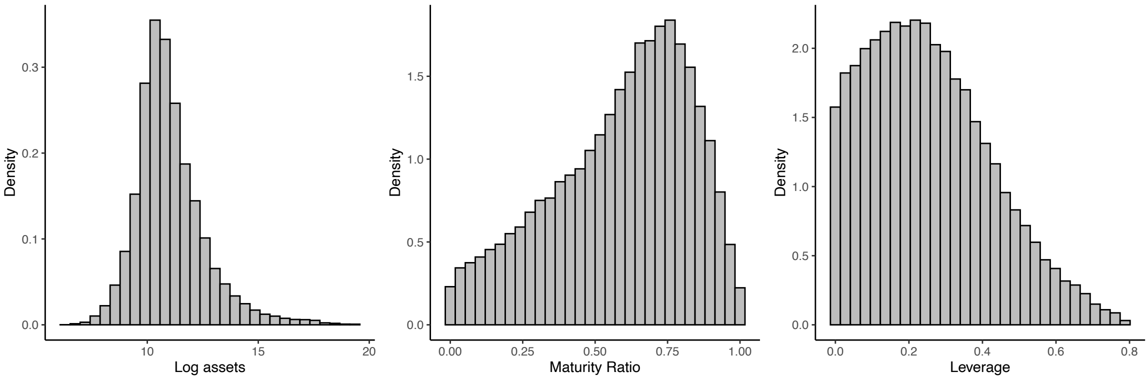


Figure A2: Binned scatterplots of bond ratios by cash flow over assets

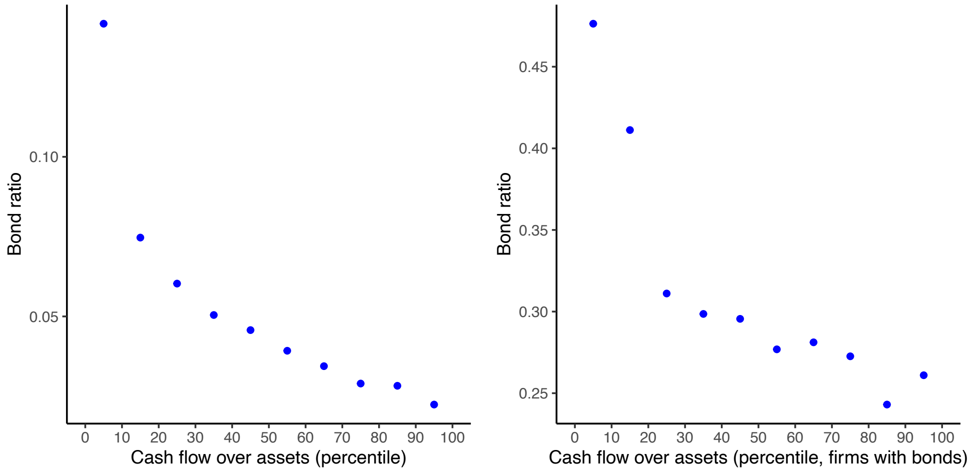


Figure A3: CMP shocks (left) and BSP shocks (right) on the days of ECB Governing Council meetings

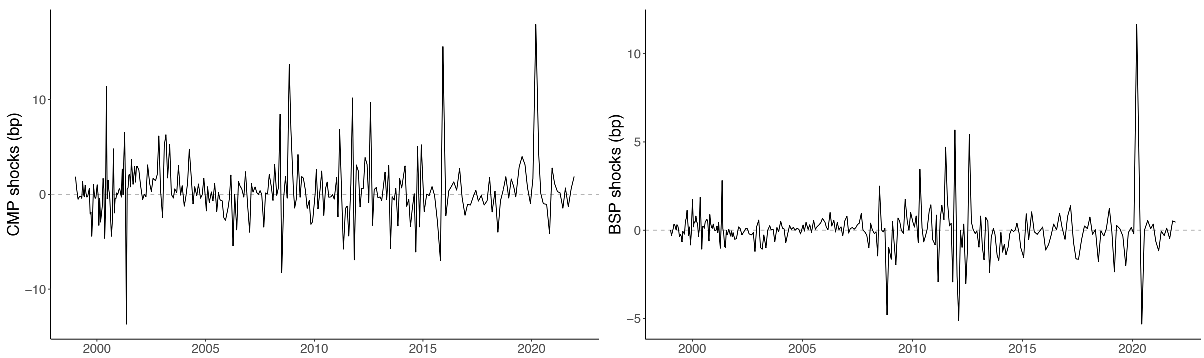
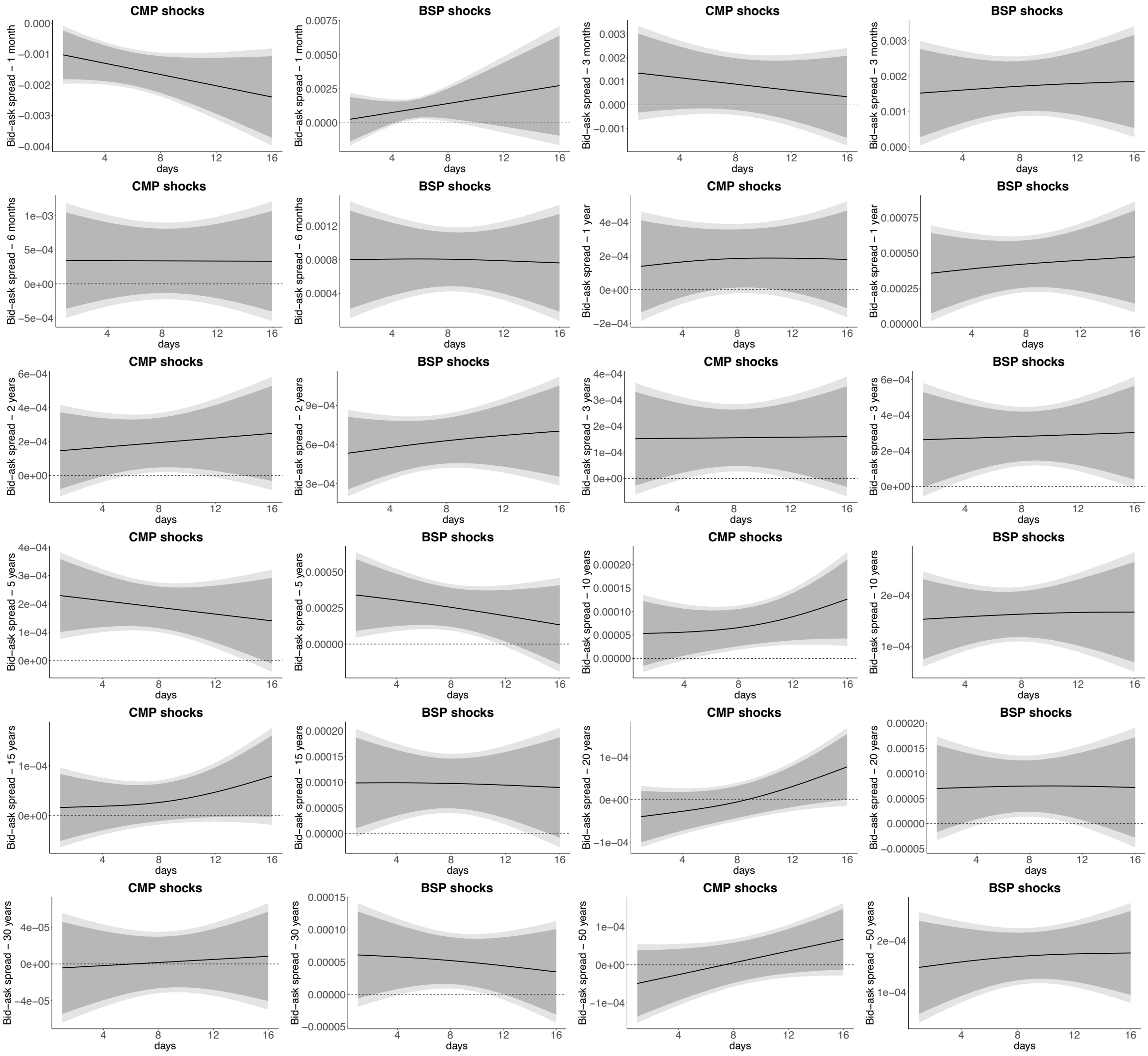
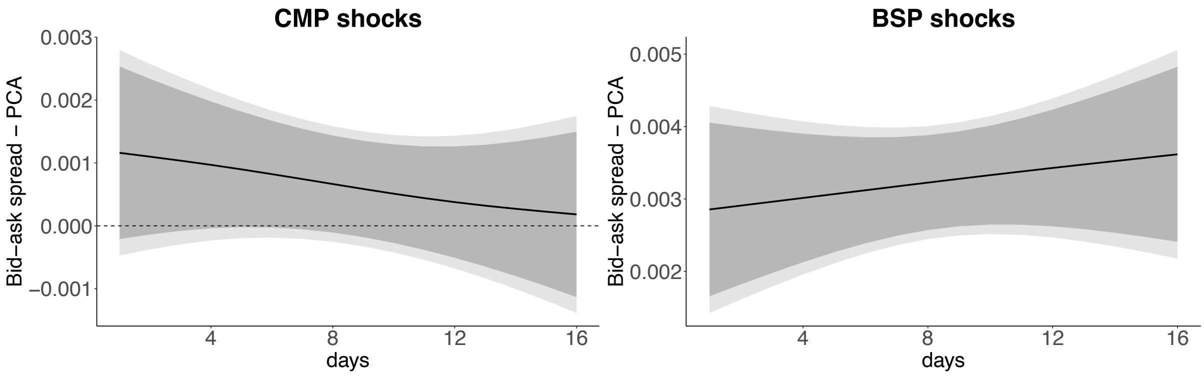


Figure A4: Response of bid-ask spreads at different maturities to to CMP and BSP shocks



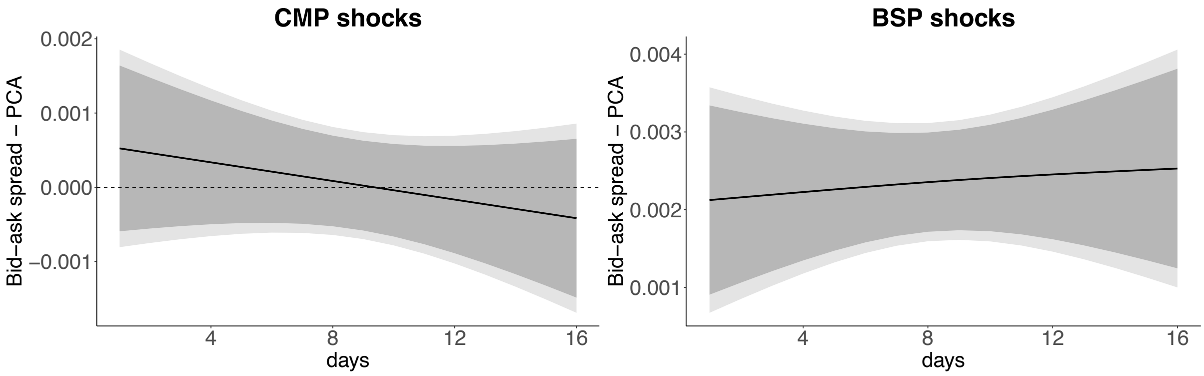
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: days after the shock.

Figure A5: Response of first principal component of bid-ask spreads to CMP (left panel) and BSP (right panel) shocks (excluding 2020 onwards)



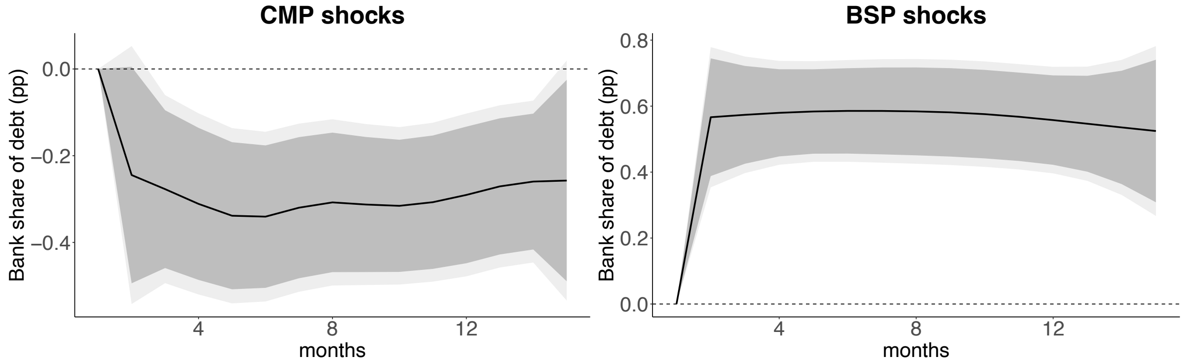
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: days after the shock.

Figure A6: Response of first principal component of bid-ask spreads to CMP (left panel) and BSP (right panel) shocks (with 2008 dummy)



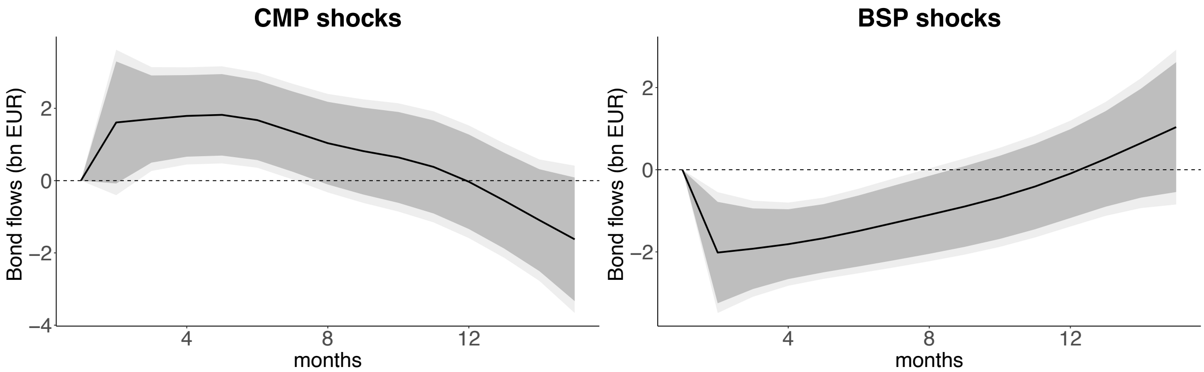
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: days after the shock.

Figure A7: Response of bank share of debt to CMP (left panel) and BSP (right panel) shocks



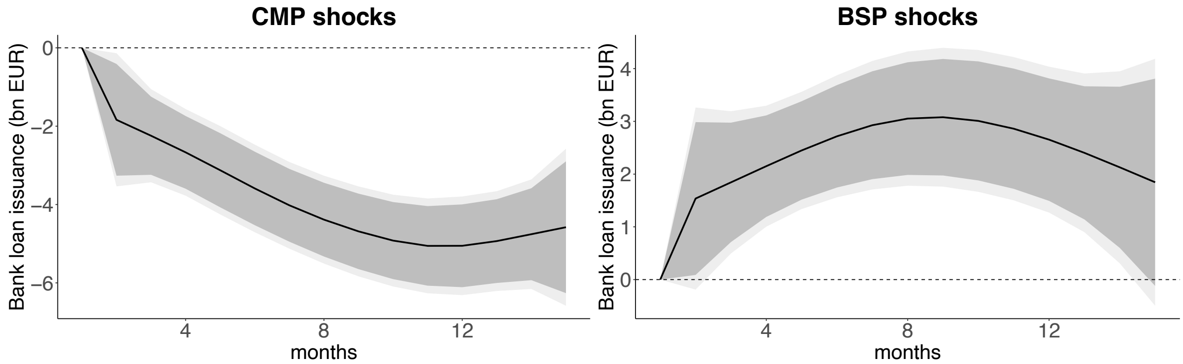
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: months after the shock.

Figure A8: Response of bond issuance CMP (left panel) and BSP (right panel) shocks



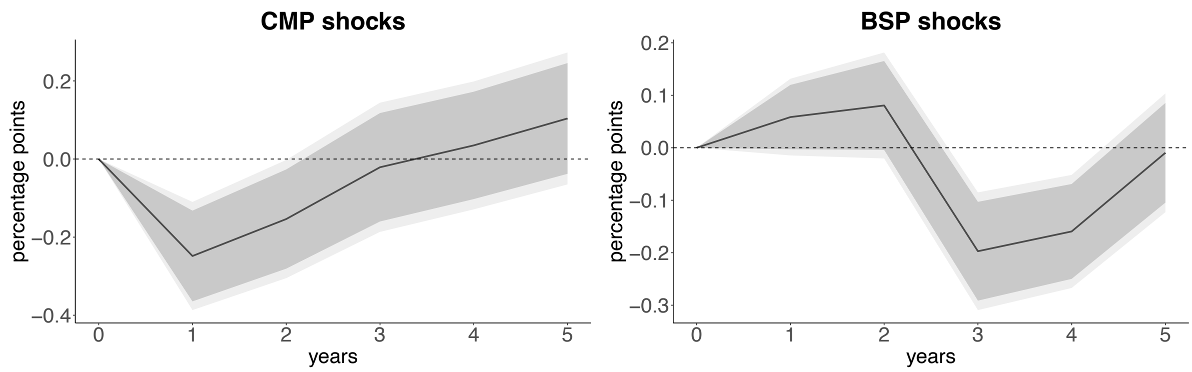
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: months after the shock.

Figure A9: Response of bank loan flows to CMP (left panel) and BSP (right panel) shocks



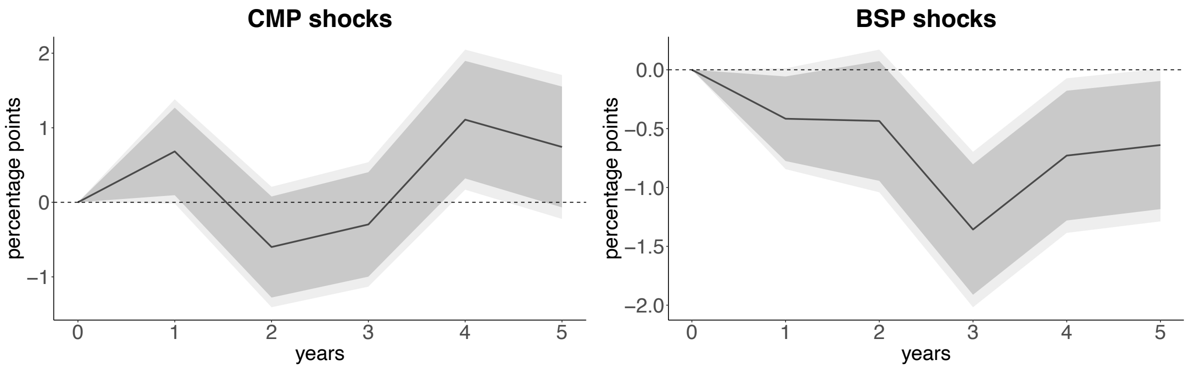
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: months after the shock.

Figure A10: Average response of investment to CMP (left panel) and BSP (right panel) shocks (shocks normalized by their standard deviation)



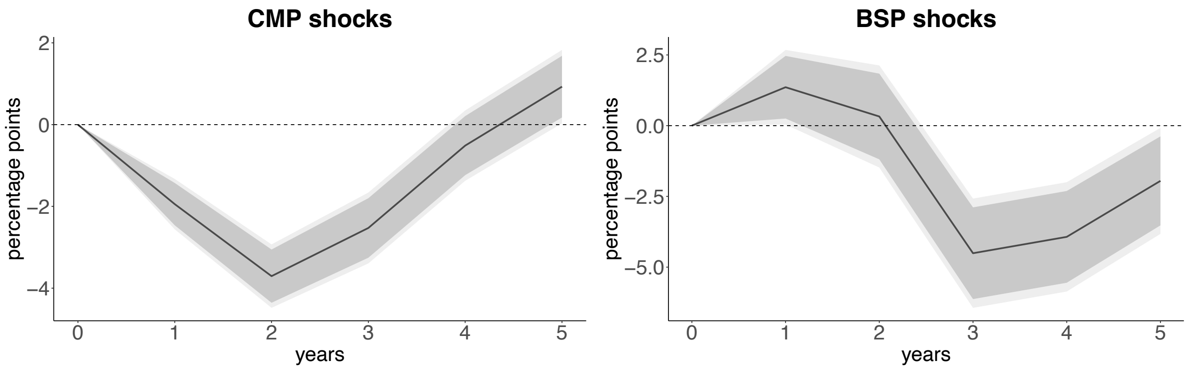
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A11: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) shock depending on firms' bond share
(shocks normalized by their standard deviation)



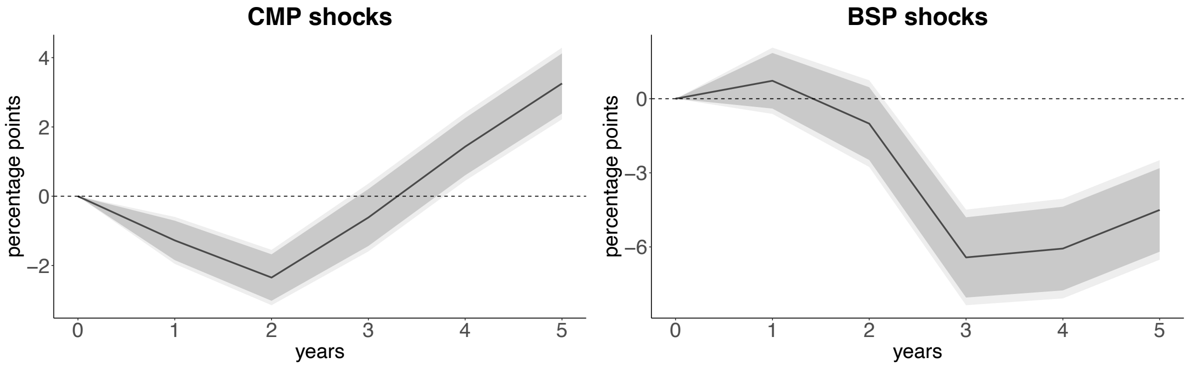
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A12: Average response of investment to CMP (left panel) and BSP (right panel) shocks
(no aggregate controls)



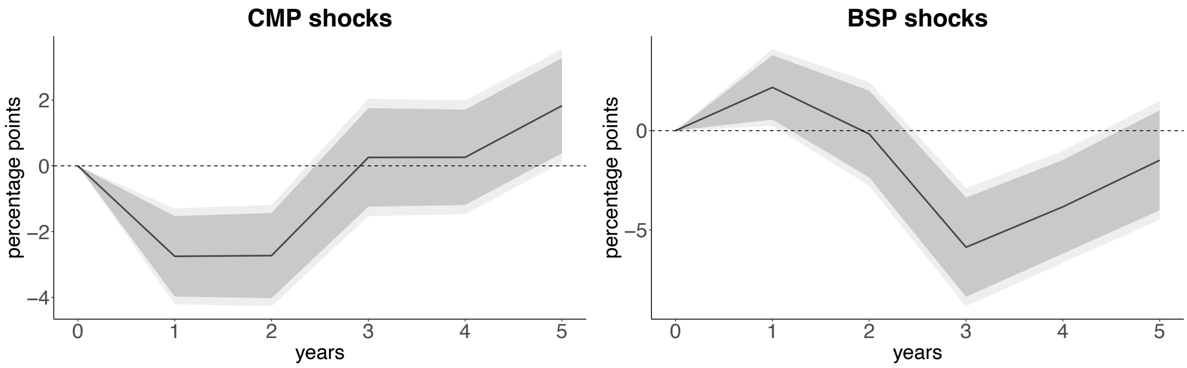
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A13: Average response of investment to CMP (left panel) and BSP (right panel) shocks
(only output gap and inflation as controls)



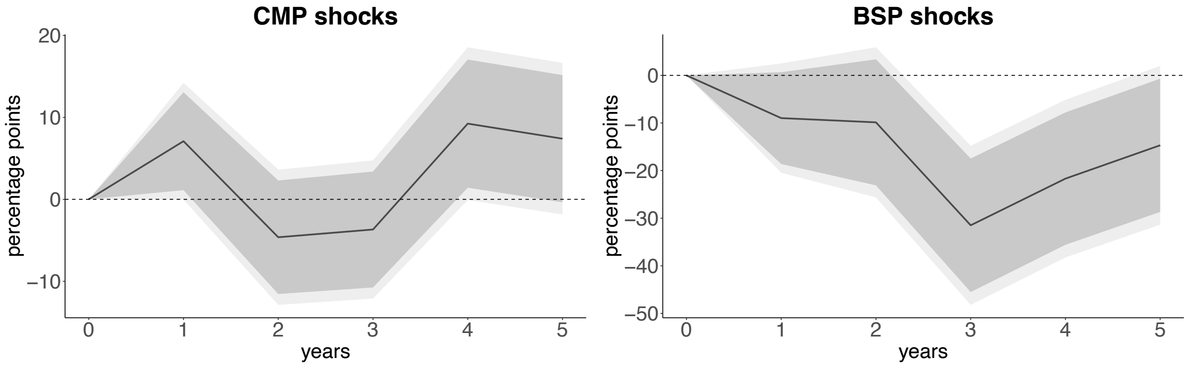
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A14: Average response of investment to CMP (left panel) and BSP (right panel) shocks
(yearly non-firm-specific shocks)



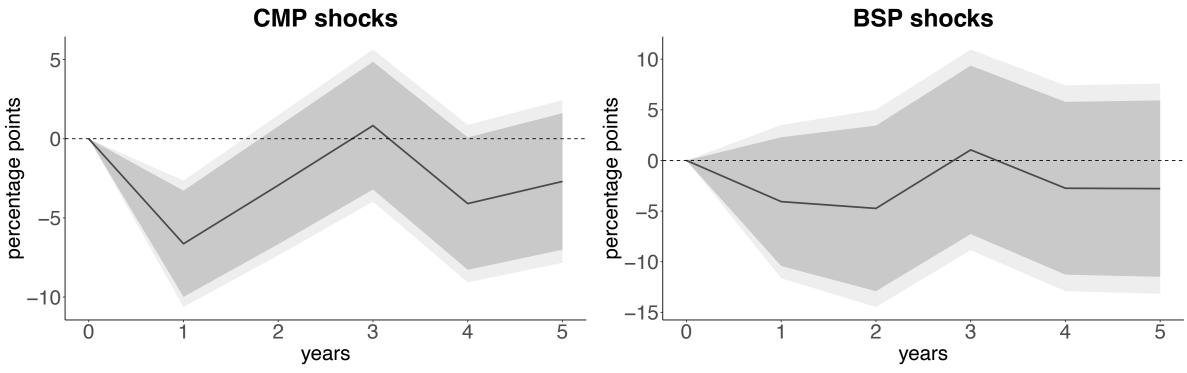
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A15: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) shock depending on firms' bond share (yearly non-firm-specific shocks)



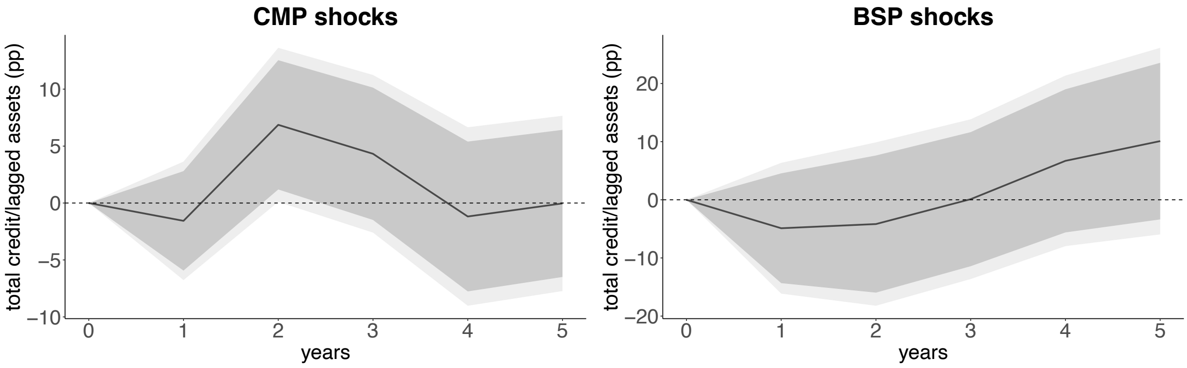
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

Figure A16: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) depending on firms' share of long-term debt $M_{i,t}$



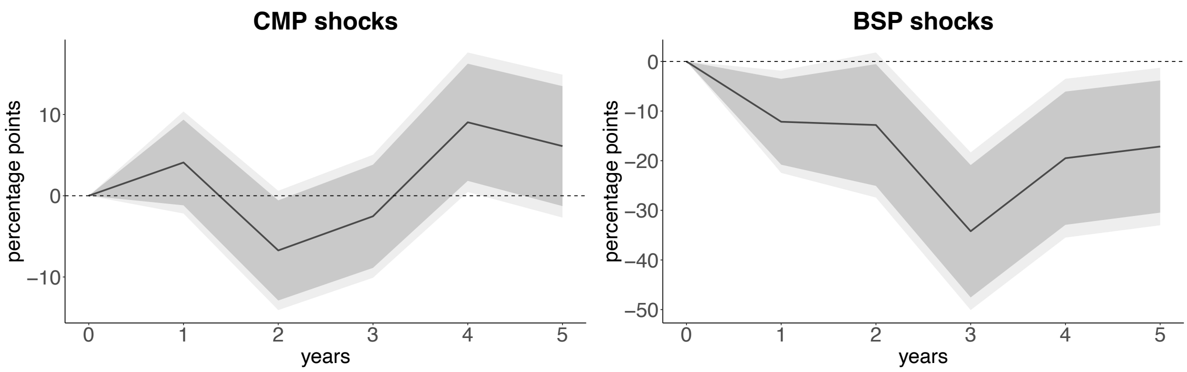
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

Figure A17: Heterogeneous response of total credit to CMP (left panel) and BSP (right panel) depending on firms' share of long-term debt $M_{i,t}$



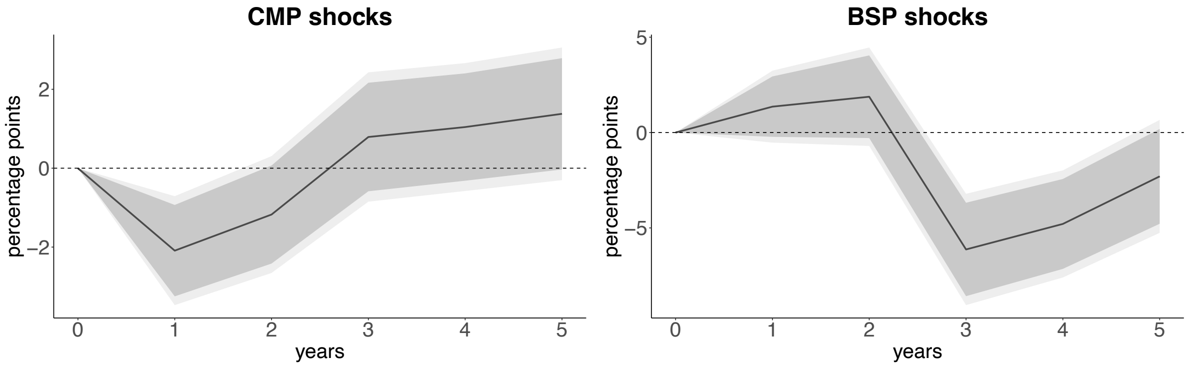
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

Figure A18: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) shock depending on firms' bond share (no maturity interaction)



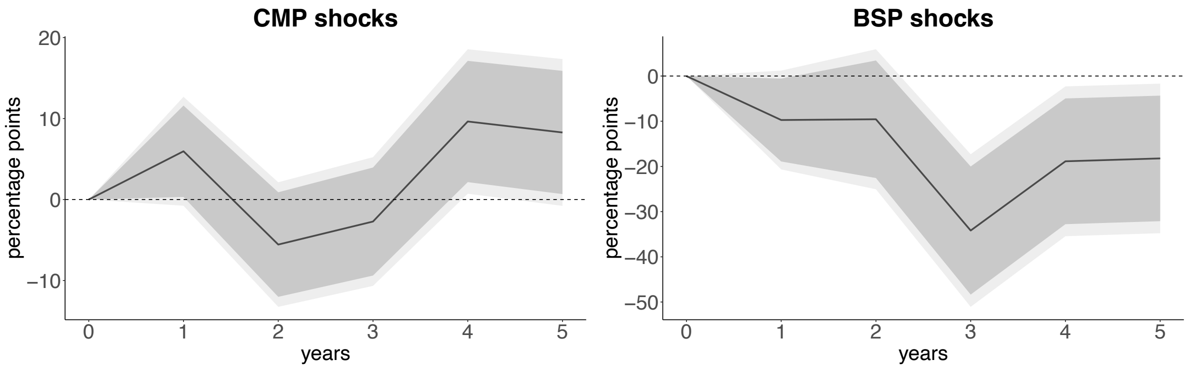
Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals. X-axis: years after the shock.

Figure A19: Average response of investment to CMP (left panel) and BSP (right panel) shocks
(controlling for surprises in 10y German yield)



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Figure A20: Heterogeneous response of investment to CMP (left panel) and BSP (right panel) shock depending on firms' bond share
(controlling for surprises in 10y German yield)



Note: Light (dark) grey bands correspond to 95% (to 90%) confidence intervals.
X-axis: years after the shock.

Corporate debt structure and heterogeneous monetary policy transmission

Marie Alder*, Nuno Coimbra**, Urszula Szczerbowicz***

* European University Institute
** Banque de France
*** SKEMA Business School

Workshop "New insights from financial statements"

The views expressed in this paper are solely those of the authors and do not represent the views of the Eurosystem or the Banque de France

Corporate bonds since the Global Financial Crisis

- Share of bond debt in non-financial corporations (NFCs) has increased since GFC
- Rise in bond share of corporate debt particularly high in the Euro Area (EA)
  - Almost doubled between 2007 and 2021 (9% to 17%)
  - France: from 19% to 30%
  - Spain: from 3% to 15% in 2021

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⇒ How much does debt structure matter for MP transmission?

  - Does it depend on the type of monetary policy?

▸ Literature ▸ Contribution

Corporate debt structure and monetary policy transmission

Debt structure is important in the view of policy-makers:

- **P. Lane (2022)**: "As a more bank-based system, the euro area might entail a more delayed reaction through the interest rate channel, as compared to countries where firms finance themselves predominantly with market-based debt."

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$\Rightarrow$ Affects speed and responsiveness of MP transmission

▸ Literature ▸ Contribution

Findings

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$\Rightarrow$ *Akin to funding supply shocks in each market (CMP $\leftrightarrow$ bank loans, BSP $\leftrightarrow$ bonds)*

High-frequency Identification of Monetary Policy Shocks

Conventional Monetary Policy shocks

CMP shocks: updated Jarociński and Karadi (2020) shocks

- Unexpected changes in assets around the ECB announcements
  - First principal component of Overnight Index Swaps (OIS) with maturities up to 1 year
- Monetary Event-window as in Altavilla et al. (2019)
  - Median quote from 13:25-13:35 compared to median quote 15:40-15:50
- Cleaned from CB information effects

▸ Decomposition

Bond Spread shocks (BSP)

Overview

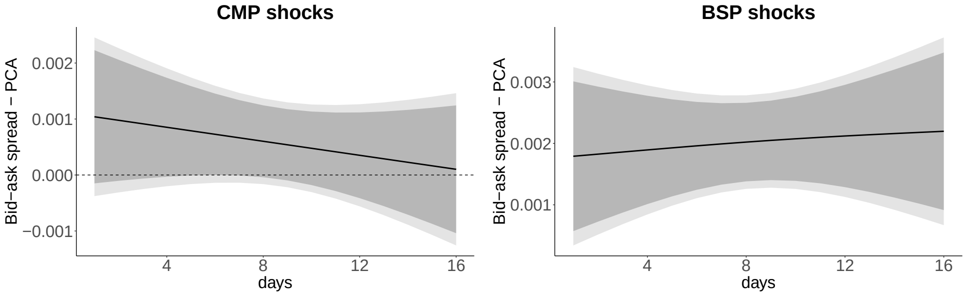
- Capture unconventional monetary policy shocks connected to FR bond markets
- High-frequency changes in 10-Year France-Germany sovereign spread
  - Around ECB announcements
  - Monetary Event-window from Altavilla et al. (2019)
- Further orthogonalized with respect to CMP surprises
  - Remove structural impact of CMP on spreads and liquidity

▸ Motivation ▸ Time Series ▸ Narrative description

Bond Spread shocks and bid-ask spreads

Strong link between BSP shocks and bid-ask spreads of FR sovereign bonds

- First Principal Component across all maturities (FR bonds): ▸ Individual maturities



▸ Details

Baseline results

FIBEN dataset

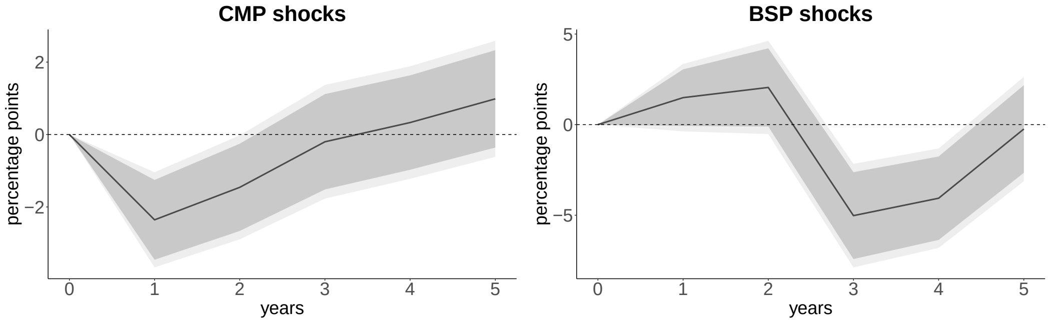
- Yearly firm-level data on French companies from the FIBEN consolidated database
  - Data collected from corporate tax declarations (*liasse fiscale*)
- $>$80k observations for $>$11k different firms
  - Unbalanced panel, firm entry and exit from dataset
- Yearly aggregation of shocks aligned to reporting month of each firm
- **Net investment rate**: first difference of net tangible assets (NTA) in year t, divided by total assets (A) in year $t-1$

$$I_{i,t} = \frac{NTA_{i,t} - NTA_{i,t-1}}{A_{i,t-1}}$$

▸ Hypotheses

MP impact on French NFC investment

Average response of investment to CMP and Bond Spread shocks ▸ Specification

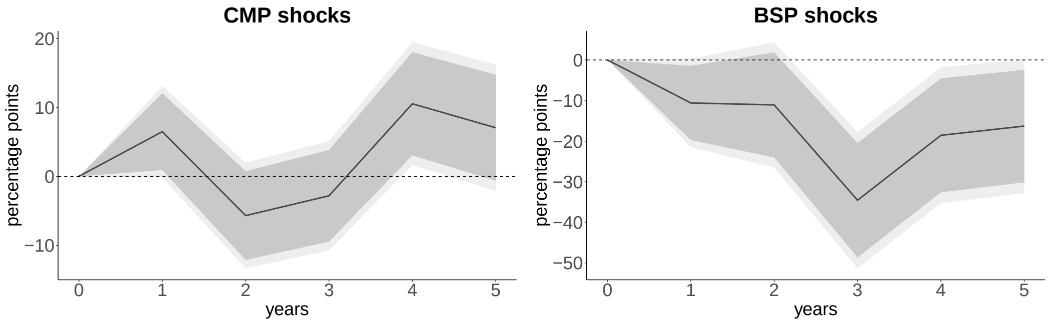


Note: estimated effect of a 100 bp upward surprise for CMP (left panel) and BSP (right panel) shocks on the net investment rate at the firm level, at each horizon h (up to 5 years).

- $\nearrow$ 100bp CMP $\Rightarrow$ 2.4pp $\searrow$ of investment wrt firm's total assets
- $\nearrow$ 100bp BSP $\Rightarrow$ 5.0pp $\searrow$ of investment wrt firm's total assets

MP and Investment: the role of debt structure

Interacting shocks with firms' bond ratios ▸ Specification



Note: IRFs for the interaction term of the MP shock with the lagged bond share. 100 bp upward surprise for CMP (left panel) and BSP (right panel) shocks, at each horizon *h* (up to 5 years).

MP and Investment: the role of bond share

- Contractionary CMP: investment rate falls less, the higher its share of bond financing
  - Contemporaneous decline of a fully bond reliant firm ($B_{i,t-1} = 1$) is 6.4pp less per 100bp than a fully bank reliant one ($B_{i,t-1} = 0$)
  - Effect peaks at 10.5pp during the 3rd year after the shock (1.11pp per stdev)

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  $\Rightarrow$ **Schnabel**: *bank-based economy more responsive to CMP*

- Contractionary BSP: investment falls more, the higher its share of bond financing
  - Contemporaneous decline in investment rates of fully bond reliant firms is 10.5pp larger per 100bp than a fully bank reliant one
  - Effect peaks at 34.6pp during the 3rd year after the shock (1.36pp per stdev)

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Robustness: ▸ Calendar aggregation ▸ Other aggregate Controls ▸ No aggregate Controls ▸ Excluding Maturity

Inspecting the Transmission Channels

Inspecting the mechanism

Look at the impact of the two types on shocks on:

- **Total credit** of French firms (panel) ▸ Average impact ▸ Role of bond share
  - Similar results: funding $\leftrightarrow$ investment

Inspecting the mechanism

Look at the impact of the two types on shocks on:

- **Total credit** of French firms (panel) ▸ Average impact ▸ Role of bond share
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- **Relative cost** of bonds and bank loans (aggregate) ▸ Results
  - CMP tightening $\Rightarrow$ relative cost of bank loans rises
  - BSP tightening $\Rightarrow$ relative cost of bank loans falls

Inspecting the mechanism

Look at the impact of the two types on shocks on:

- **Total credit** of French firms (panel) ▸ Average impact ▸ Role of bond share
  - Similar results: funding $\leftrightarrow$ investment
- **Relative cost** of bonds and bank loans (aggregate) ▸ Results
  - CMP tightening $\Rightarrow$ relative cost of bank loans rises
  - BSP tightening $\Rightarrow$ relative cost of bank loans falls
- **Debt issuance** in bonds and bank loans (aggregate) ▸ Relative flows ▸ Absolute flows
  - CMP tightening $\Rightarrow$ bank loan issuance *falls*, bond issuance *rises*
  - BSP tightening $\Rightarrow$ bank loan issuance *rises*, bond issuance *falls*
  - Aggregate flows contract but some degree of **substitutability**

Conclusions

- Contractionary CMP and BSP shocks decrease investment of French firms
- MP impact on firm investment depends on firm debt structure:
  - Firms which are more reliant on bank credit contract investment relatively more after contractionary CMP shocks,
  - but contract investment less after contractionary BSP shocks
- Imperfect integration across the two markets
  - Some degree of substitutability,
  - but not enough to undo impact on NFC investment and credit

Conclusions

Key messages for statistical producers

- Data granularity and firm-level analysis
  - Importance of firm-level data to capture heterogeneous impact of MP
  - Lack of data on firm-specific funding costs for each debt instrument
- Data frequency
  - Monthly frequency can be important when looking at financial variables (firm credit...)
- Need for more loan-level data

Appendix

Related Literature

Go Back

Financial frictions and investment

- Cloyne et al. (2023) find that financial frictions account for about one third of the aggregate investment response to monetary policy.
- Firm-level response to MP shock depends on default risk (Ottonello and Winberry, 2020), the firms' age (Cloyne et al., 2023), firms' size (Gertler and Gilchrist, 1994) and their holdings of liquid assets (Jeenas, 2019).

Related Literature

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Debt composition and monetary transmission

- Share of floating-rate debt and the debt maturity were shown to affect the transmission of MP to firms' investment and stock prices (Ippolito et al., 2017, Gürkaynak et al. 2022, Jungherr et al., 2022).
- Bond/loan composition: higher bond share weakens CMP transmission (Crouzet 2021, Holm-Hadulla and Thurwachter 2021), but the opposite is true when bond market frictions dominate (Darmouni et al. 2020) or when LT rates are affected by the CB (Holm-Hadulla and Thurwachter 2021).

Related Literature ▸ Go Back

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MP identification

- MP shocks using high-frequency identification: Kuttner (2001), Gerko and Rey (2017), Jarocinski and Karadi (2020), Altavilla et al (2019), ...

Contribution ▸ Go Back

1. We identify a **bond-liquidity channel of MP** and provide evidence on its impact on French firms' investment. In particular, we provide evidence on the impact of the ECB policies on the liquidity of the French bond market and its effect on corporate bond prices.

2. We study the **role of corporate debt structure** in the transmission of both types of monetary policy to investment.

3. We uncover the **relative importance of bond and bank credit supply shocks** induced by CMP and Bond Spread (BSP) shocks

   ⇒ novel evidence on the bank lending and liquidity channels of both MP types.

Conventional Monetary Policy shocks

Go back

Variable	Shock	
	Monetary policy (negative co-movement)	CB information (positive co-movement)
m_t, high frequency		
Interest rate	+	+
Stock index	−	+

Source: Jarociński and Karadi (2020)

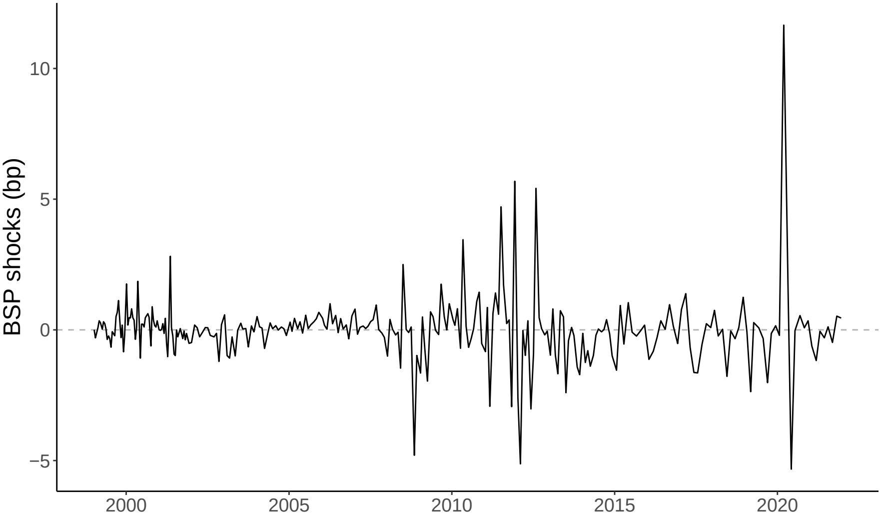
BSP shocks ◂ Go back

Motivation

- French and German sovereign bond markets have many similarities
  - Ejsing and Sihvonen, 2009
  - Same currency, similar credit rating, comparable amounts outstanding
- Evidence that movements in spread reflect mostly changes in **liquidity premia**
  - ECB Monthly Bulletin 09/2009
- They also affect French sovereign bond market liquidity

Bond Spread shocks: daily

Go back



Bond Spread shocks: narrative description

Go back

- **Largest BSP shocks and the events that triggered them:**

Date	Shock (bp)	Description
2012/02/09	-5.13	Eligibility rules eased for sovereigns
2012/12/08	5.69	Downplayed possible renewal of bond purchases.
2020/03/12	11.66	CL: "We are not here to close spreads"
2020/06/04	-5.33	PEPP increased, includes corporates

BSP shocks and bid-ask spreads ◂ Go back

Smooth Local Projections (Barnichon and Brownlees, 2019)

We check the link between BSP shocks and liquidity

- Daily data on bid-ask spreads of FR sovereign bonds

BSP shocks and bid-ask spreads ◂ Go back

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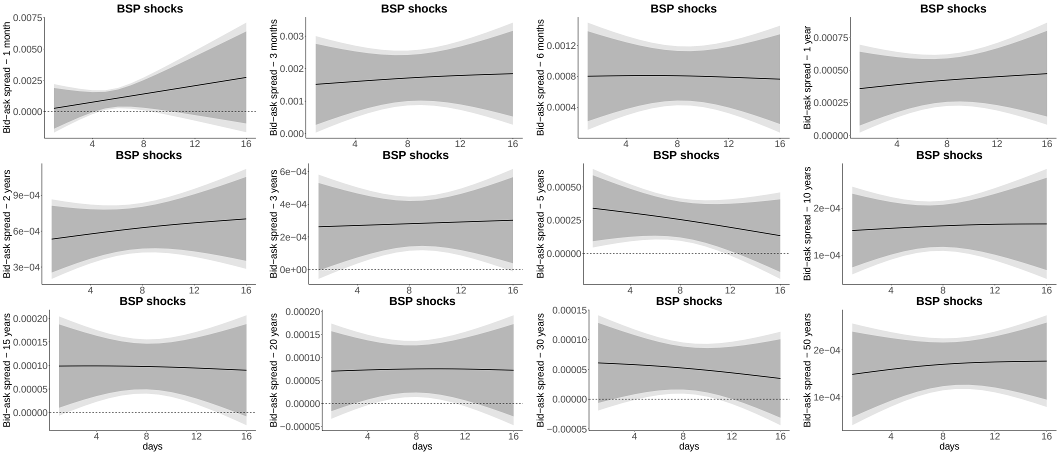
$\Rightarrow$ S-LP penalize variability w/o ex-ante restricting shape of IRFs ▸ Detail

Bond Spread shocks and bid-ask spreads

Go Back



Smooth Local Projections (Barnichon and Brownlees, 2019) ▸ Back

S-LP: IR estimation methodology based on B-spline smoothing

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Shrinkage hyper-parameter λ:

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Following Barnichon and Brownlees (2019):

- 5-fold cross-validation to select λ
- Pick λ with best mean pseudo-out-of-sample fit

Main hypotheses (1/2) Go back

1. **CMP and the bank lending channel**

   - CMP tightening ⇒ firms switch from bank loans to bonds
   - In line with the bank lending channel
   - Kashyap et al. (1992), Becker and Ivashina (2014)

   ▶ Rate hike ⇒ investment should fall **more** for NFCs with higher shares of **bank** debt

Main hypotheses (2/2) Go back

2. Quantitative Easing and the bond liquidity channel

- QE reduces risk premia on debt securities ⇒ stimulates corporate bond issuance
- Altavilla & Giannone (2017), Lhuissier & Szczerbowicz (2021), Grosse-Rueschkamp et al. (2019)

▶ BSP rise ⇒ investment should fall **more** for NFCs with higher shares of **bond** debt

MP and Investment: average effects ◂ Go back

The average effects of the ECB MP on French firms' investment are evaluated using panel local projections (Jordá, 2005).

$$\Delta I_{i,t+h} = \beta^h S_{i,t} + \Psi^h Z_{t-1} + \sum_{l=1}^{L} \Gamma_l^h X_{i,t-\ell} + \mu_i^h + \epsilon_{i,t+h} \quad (1)$$

$\mathbf{\Delta I_{i,t+h}} = I_{i,t+h} - I_{i,t-1}$: h-year forward difference in the net investment rate

$\mathbf{S_{i,t}}$: vector of CMP and BSP shocks

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$\mu_\mathbf{i}$: firm fixed effects

$\mathbf{L = 3}$ for all results shown today

MP and Investment: the role of debt structure

Go back

- Investigate cross-sectional differences wrt corporate debt structure
  - Interact MP shocks with the firm's share of bond debt (bond ratio)

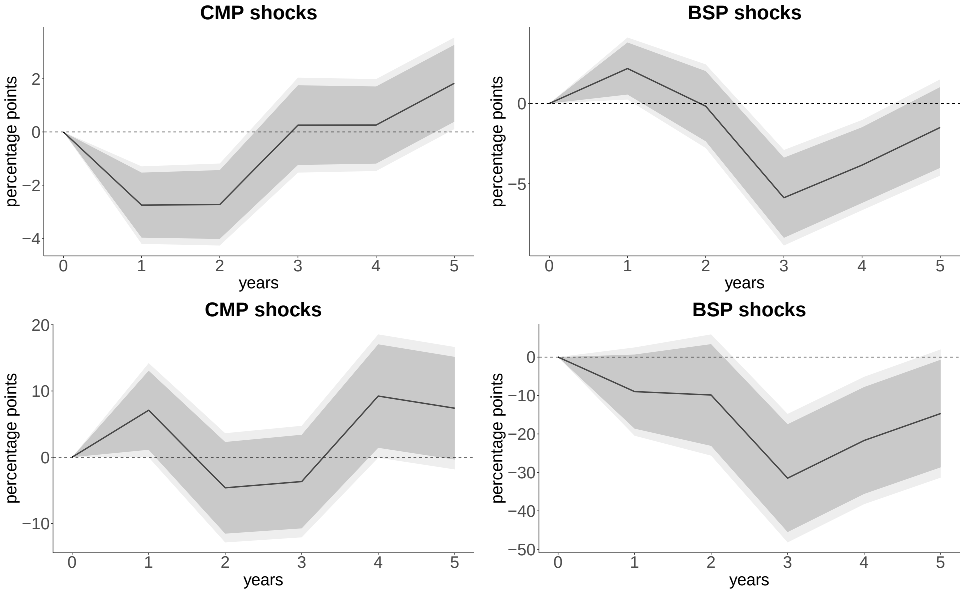
$$\Delta I_{i,t+h} = \alpha^h B_{i,t-1} \times S_{i,t} + \beta^h Mat_{i,t-1} \times S_{i,t} + \sum_{\ell=1}^{3} \Gamma_\ell^h X_{i,t-\ell} + \mu_i^h + \theta_{s,t}^h + \epsilon_{i,t+h} \quad (2)$$

- $B_{i,t-1}$: lagged bond ratio
- $Mat_{i,t-1}$: lagged maturity ratio
- $\theta^h_{s,t}$: sector-time fixed effects

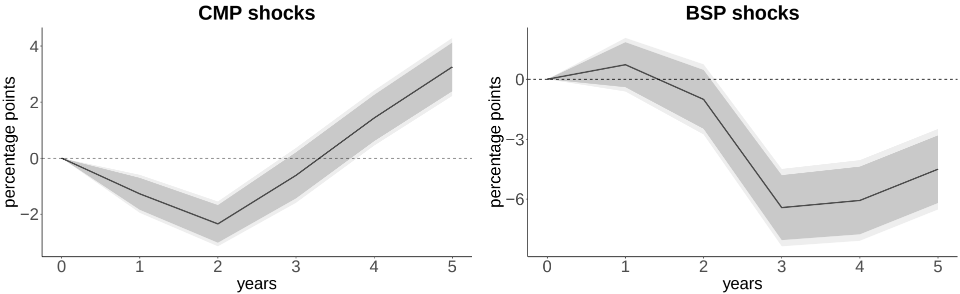
$\Rightarrow$ Positive (negative) α^h means firms with higher bond ratios are less (more) responsive

Simple calendar year aggregation

▸ Go Back

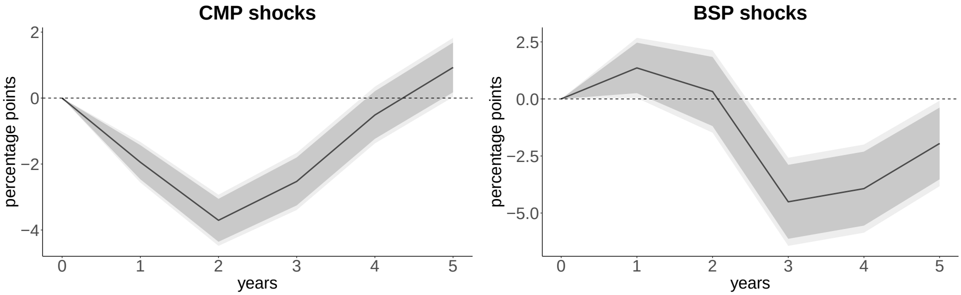


Only output gap and inflation as controls ▸ Go Back



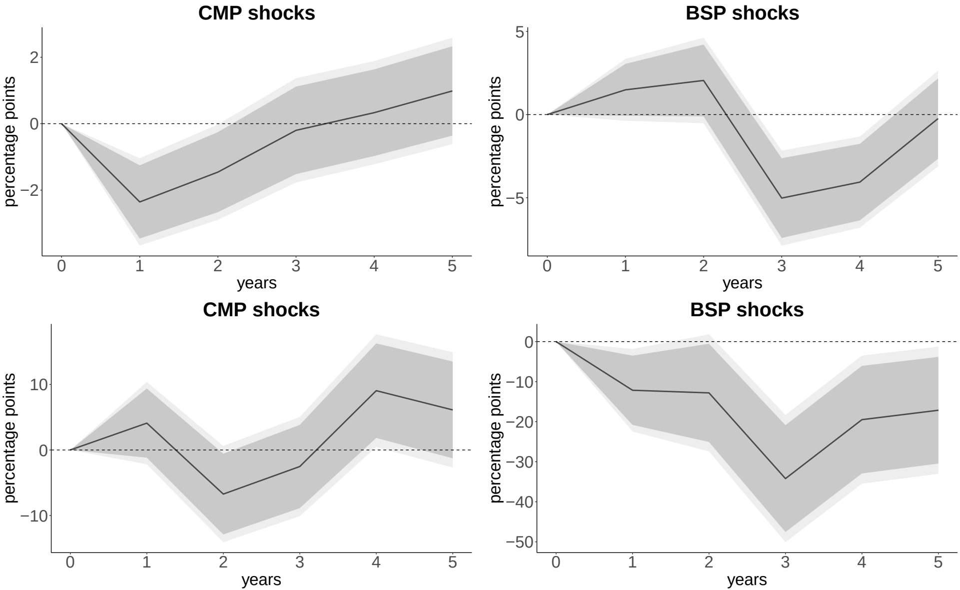
No aggregate controls

Go Back



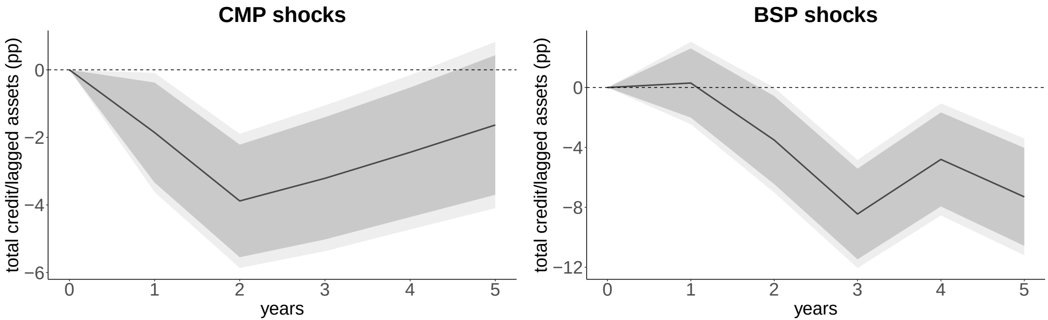
Excluding maturity interaction

Go Back



Total Credit ▸ Go Back

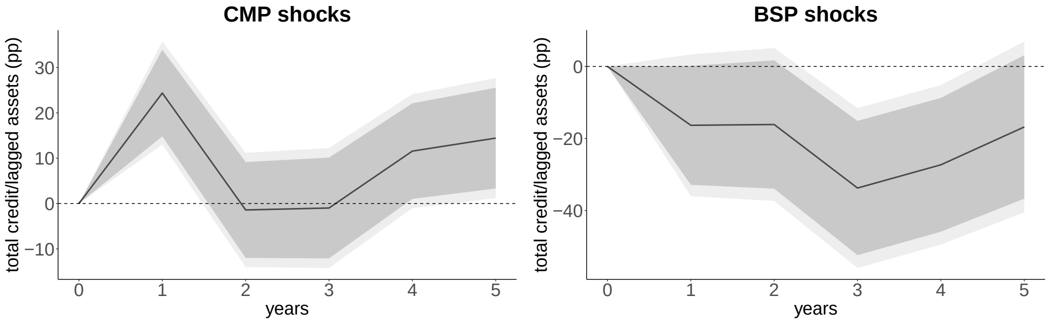
Average response



- Total credit falls across firms for all shocks

Total Credit ▸ Go Back

Heterogeneous response

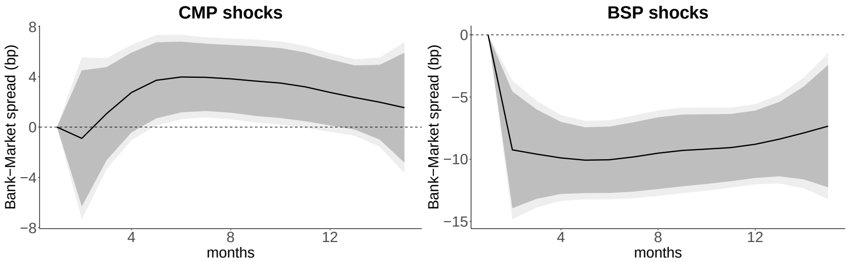


- CMP has a stronger impact on firms that are more bank-based
- BSP shocks have a stronger impact on more market-based firms

Relative Cost

Go Back

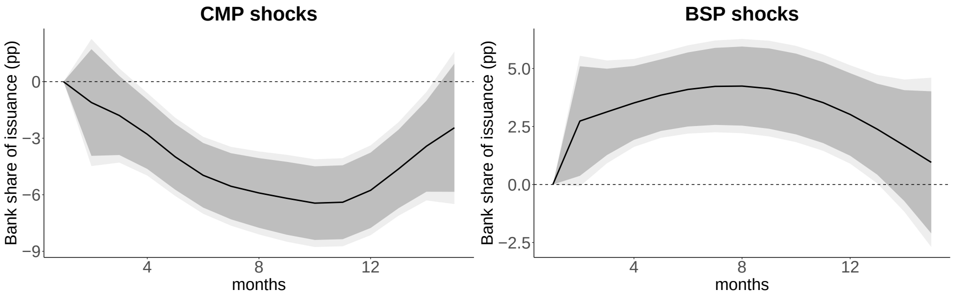
Bank-market spreads i.e. rate of bank loans compared with average yield on corporate bonds



- CMP has stronger pass-through to bank loan rates (Schnabel, 2021),
- but slower transmission after shock (Lane, 2022)
- BSP shock $\Rightarrow$ market rates rise more than bank rates

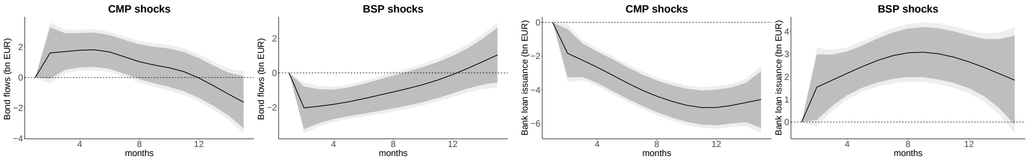
Debt Issuance

Bank share of debt issuance ‣ Go Back



- CMP shock ⇒ share of bank debt in new issuance falls
- BSP shock ⇒ share of bank debt in new issuance rises

Bond and loan issuance ‣ Go Back



- CMP shock ⇒ bond flows increase
- BSP shock ⇒ bank loans increase
- Some degree of **substitutability**,
- ...but not sufficient to stop the contractionary effects on aggregate investment