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Interbank rate uncertainty and bank lending

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Abstract

This paper investigates the effects of interbank rate uncertainty on lending rates to euro area firms. We introduce a novel measure of interbank rate uncertainty, computed as the cross-sectional dispersion in interbank market rates on overnight unsecured loans. Using proprietary bank-level data, we find that interbank rate uncertainty significantly raises lending rates on loans to firms, with a peak effect of around 100 basis points during the 2007-2009 global financial crisis and the 2010-2012 European sovereign crisis. This effect is attenuated for banks with lower credit risk, sounder capital positions and greater access to central bank funding.

JEL classification: E44, D80, G21.

Keywords: Interbank market, uncertainty, bank lending.

Non-technical summary

Over the last decade, a vast literature has documented the adverse effects of disruptions in the interbank market on the rest of the economy, drawing motivation from the developments during the global financial crisis of 2007-2009 and the European sovereign debt crisis of 2010-2012. This paper provides contribution to this literature by investigating empirically how interbank rate uncertainty affects bank lending rates on loans to euro area non-financial corporations, and how this is influenced by bank-specific characteristics. Understanding this connection on the disaggregated level presented here is key both for thinking about monetary policy transmission as well as bank regulation.

To that end, we introduce a novel measure of interbank rate uncertainty, computed as the cross-sectional dispersion in interest rates on overnight unsecured loans between euro area banks. Pertaining to overnight unsecured loans, our measure of interbank rate uncertainty should be relatively immune to uncertainty about the future course of (monetary policy) interest rates; instead it could be interpreted as reflecting counterparty risk and precautionary motive for hoarding liquidity in the interbank market. Using proprietary data on a large set of individual banks, we run panel regressions of bank lending rates to non-financial corporations on interbank rate uncertainty and its interactions with bank-level funding and capital positions.

We find that interbank rate uncertainty raises lending rates on loans to firms, with upward pressures peaking at around 100 basis points during the interbank market disruptions of the 2007-2009 global financial crisis and 2010-2012 European sovereign crisis. Consistent with theoretical insights, this effect of interbank rate uncertainty entails considerable time variation and bank heterogeneity. It is significantly more adverse for banks facing higher credit risk, as seen in their CDS spreads, and attenuated for banks with sounder capital positions and greater access to central bank funding. These findings lend empirical support to the bank-lending channel and suggest a possible role for monetary and macro-prudential policy to stabilise interbank rate uncertainty.

1 Introduction

During the global financial crisis of 2007-2009 and the European sovereign debt crisis of 2010-2012, central banks and researchers have argued that disruptions in the interbank market and damages to the interbank network have contributed considerably to the severity of the recessions. A substantial theoretical literature has investigated the fragility of banking networks and the possibility for ensuing systemic banking crises (for example see Acemoglu et al. 2015; Allen and Gale, 2000; Freixas et al. 2000; Brusco and Castiglionesi, 2007; Caballero and Simsek, 2013). However, it has remained a considerable challenge to shed empirical light on these issues. Some of the literature has sought to reconstruct empirical banking networks from interbank loans (Gai et al. 2011), but drawing aggregate conclusions from such measures has largely remained elusive.

In this paper, rather than assessing the details of the banking networks per se, we focus on a single characteristic of that network: the dispersion of interbank rates. Suppose a bank in need of borrowing from the bank network will know to find itself exposed to a rate drawn at random from this dispersion, now more properly interpreted as interbank rate uncertainty. In anticipation, such a bank might then decide to be more cautious in its own lending to firms, either lending less and/or charging a higher rate. Do we see this in the data? This appears to be an empirically feasible question, and it is the question that we tackle in this paper.

To that end, we introduce a novel measure of interbank rate uncertainty, computed as the cross-sectional dispersion in interbank market rates on overnight unsecured loans.[1] For the sake of a comprehensive characterisation of the overnight interbank market, we derive this measure of dispersion on the basis of a Furfine-type algorithm applied to individual transaction data extracted from the leading European payment system (TARGET2).[2] Pertaining to overnight unsecured loans, our measure of interbank rate uncertainty should be relatively immune to uncertainty about the future course of (monetary policy) interest rates; instead it could be interpreted as reflecting counterparty risk and precautionary motive for hoarding

[1] Here we follow the practice of the uncertainty literature that often uses measures of cross-sectional dispersions to proxy for uncertainty.

[2] See Arciero et al. (2016) and Frutos et al. (2016), for earlier applications of this algorithm to the euro area.

liquidity in the interbank market.[3]

Armed with our interbank rate uncertainty measure, we investigate the impact on bank-to-firm lending rates. Specifically, we employ a panel regression of bank-level lending rates to (non-financial) firms on interbank rate uncertainty as well as its interactions with three variables proxying for bank-level funding (i.e. bank CDS spreads, and banks' borrowing through ECB's refinancing operations divided by main assets) and capital positions (bank capital divided by main assets). We control for additional bank-level characteristics and macroeconomic variables. In terms of data, we match datasets on bank-level lending rates and balance-sheet characteristics with confidential data on banks' recourse to ECB's refinancing operations, and bank CDS spreads data taken from Thomson Reuters Datastream. The analysis covers monthly data starting from June 2007 for 323 individual banks, comprising 80% of the assets held by euro area Monetary Financial Institutions.

We find that interbank rate uncertainty raises lending rates on loans to firms, with upward pressures peaking at around 100 basis points during the interbank market disruptions of the 2007-2009 global financial crisis and 2010-2012 European sovereign debt crisis. The effect of interbank rate uncertainty is considerably heterogeneous across banks and periods. First, it is significantly more adverse for banks facing higher credit risk, as seen in their CDS spreads. Second, it is attenuated for banks with a sounder capital base than their peers, suggesting that macro-prudential and micro-prudential policy, via strengthening capital standards, can contribute shielding the economy from the adverse impact of interbank rate uncertainty. Third, this impact is more contained for banks with a greater access to central bank funding, pointing to some alleviating effects of monetary policy via liquidity provision.

To assess the extent to which our measure reflects a component of uncertainty that is specific to the interbank market, in our empirical application we control for two relevant measures of general economic uncertainty. The first measure is the option-implied volatility on the Standard & Poor's 500 stock market index (VIX index), which is widely used in the literature as a broad measure of uncertainty, as documented for instance in Bloom (2014). The second measure, which we define as Euribor uncertainty, is constructed as the

[3] Heider et al. (2015) for instance develop a model of interbank lending and borrowing in which liquidity hoarding and counterparty risk are intrinsically linked.

interquartile range of the option-implied probability density function of the three-month Euribor interest rate one year ahead.[4] Rather than pertaining to overnight interbank loans (and hence contrary to our measure), Euribor uncertainty refers to future interbank market rates, and so it is presumably affected by uncertainty about policy rates going forward. Our estimates hold up the inclusion of these two measures of general economic uncertainty.

Viewed from this perspective, our paper provides contribution to the literature on the economic effects of uncertainty, as extensively reviewed for instance in Bloom (2014). That literature has argued how heightened uncertainty leads to a contraction in investment and consumption, either via increasing the option value of a sit-and-wait strategy in the presence of irreversible actions ("real options" effects; see for instance Bernanke, 1983), or via raising the external finance premium in the presence of financial frictions in credit markets ("financial frictions" effects; see for instance Christiano et al., 2014). Empirically, a number of studies have provided support to these predictions using a variety of proxies and indicators for uncertainty (see for instance Bloom et al., 2007). For instance, some studies have focused on uncertainty about economic policy and the regulatory sphere. Baker et al. (2013) for example develop an index of economic policy uncertainty and investigate its effect on investment and hiring. Fernandez-Villaverde et al. (2011b) focus on the uncertainty about future fiscal policy, and its impact on aggregate economic activity. Other studies have been more agnostic on the exact source of uncertainty, focusing on a variety of uncertainty proxies and relating them to macroeconomic activity (see for instance Jurado et el., 2013). Closely connected to our paper, Buch et al. (2015), Bordo et al. (2016) and Valencia (2017) assess how alternative measures of uncertainty similarly affect the credit channel. Differently to these contributions, we are explicit on the source of uncertainty, that we identify as rooted in bank-to-bank borrowing and find statistically and economically significant for bank-to-firm lending, beyond and above proxies of general economic uncertainty. As a result, our paper fits also within the strand of literature documenting how vulnerabilities in the banking system might originate and/or amplify adverse real-financial interactions (see for instance Acharya and Skeie, 2011; Brunnermeier and Sannikov, 2014; He and Krishnamurthy, 2012;

[4] The three-month Euribor is the rate at which a selection of European banks lend one another unsecured funds denominated in euros with a maturity of three months.

Adrian and Boyarchenko, 2012). For instance, a number of studies have documented how the severe liquidity dry-ups experienced during the global financial crisis of 2007-2009 and the European sovereign debt crisis of 2010-2012 stem from distresses in interbank markets (see for instance, Allen and Carletti, 2008; Brunnermeier, 2009; Frutos et al., 2016). Afonso et al. (2011) test the importance of both liquidity hoarding and counterparty risk in the U.S. interbank market, following Lehman's bankruptcy, finding that heightened concerns about counterparty risk reduced liquidity and increased the cost of finance for weaker banks.[5] Other studies have formalised the adverse macroeconomic impact of money market freezes within dynamic general equilibrium models (see for instance Bruche and Suarez, 2010; Gertler et al., 2016; De Fiore et al., 2019). Our work provides granular evidence on a possible mechanism via which interbank market conditions interact with bank funding and capital vulnerabilities in ways that affect price conditions of bank credit to non-financial firms.

The paper is organised as follows. Section 2 describes the measure of interbank rate uncertainty and its relation with alternative measures of uncertainty, as well as the bank-level data used in the estimation. Section 3 presents the modelling framework and derives the main findings. Section 4 concludes.

2 Data and measurement of uncertainty

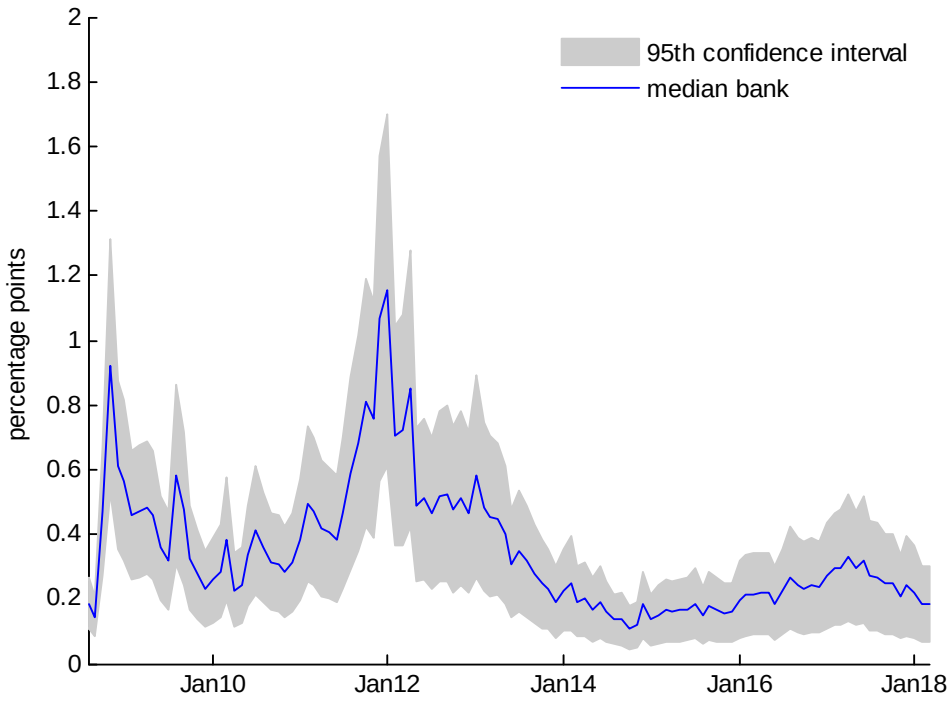
2.1 Bank-level data

For the empirical analysis, we combine information on bank-level variables from alternative sources. The source for the bank-level balance-sheet variables, including main assets, bank capital and interbank liquidity, is the Individual Balance Sheet Items database (IBSI) while bank lending rates (on new loans to non-financial corporations) and deposit rates are extracted from the Individual MFI Interest Rate database (IMIR).[6] These two proprietary datasets are maintained at the ECB and, for the purpose of this paper, they are matched with confidential information on banks' recourse to ECB's (standard and non-standard)

[5] A number of studies have focused on modelling frictions that limit an efficient distribution of liquidity by interbank markets (Flannery, 1996; Freixas and Holthausen, 2005; Repullo, 2005).

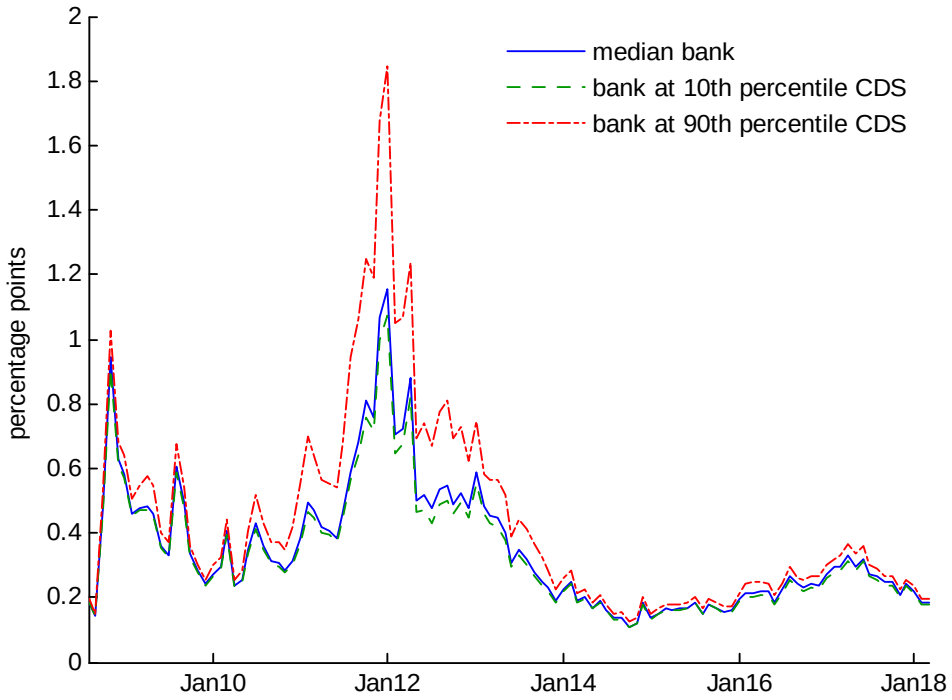
[6] For details on the representativeness of the dataset see Altavilla et al. (2019).

Figure 4: Estimated historical contribution of interbank rate uncertainty on bank lending rate spreads.



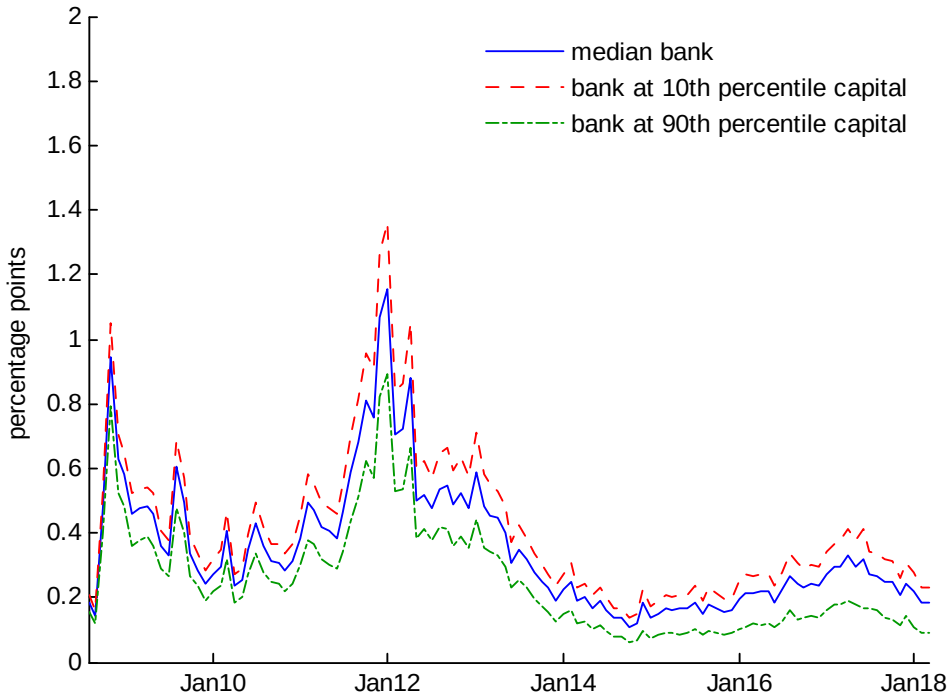
Note: The figure shows the historical contribution of interbank rate uncertainty on lending rates, based on the uninteracted and interaction terms of uncertainty and coefficient estimates of the baseline specification. The contribution "median bank" (blue line) refers to the hypothetical bank that, at each point in time, stands at the 50th percentile of the cross-sectional distribution of each bank-level variable entering the interaction terms. The shaded area denotes the 95 percent confidence bands.

Figure 5: Estimated historical contribution of interbank rate uncertainty on lending rate spreads conditional on bank CDS spreads.



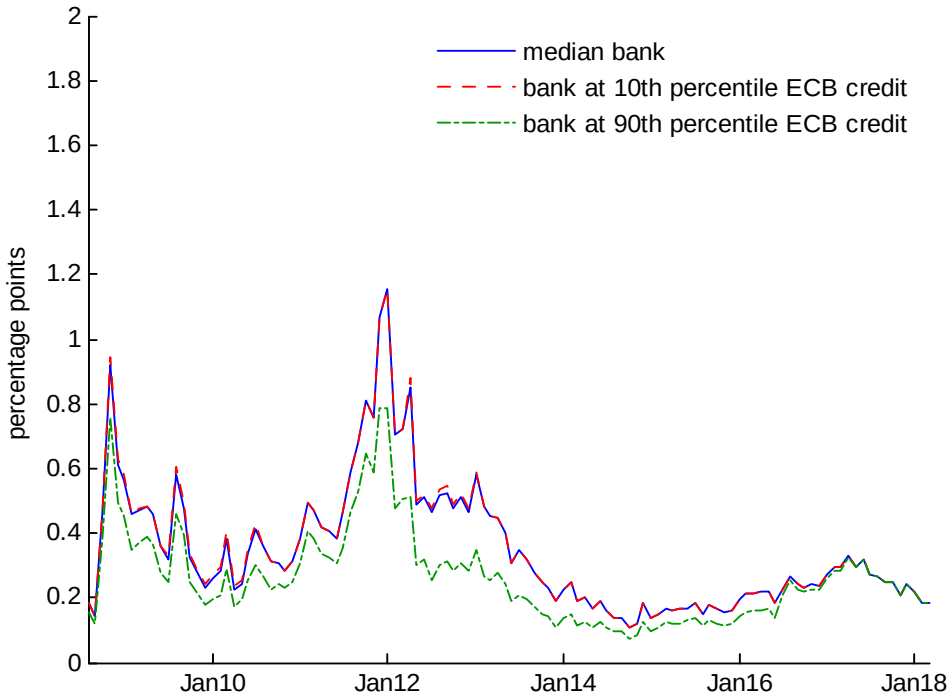
Note: The figure shows the historical contribution of interbank rate uncertainty on lending rates, based on the uninteracted and interaction terms of uncertainty and coefficient estimates of the baseline specification. The contribution "median bank" (blue line) refers to the hypothetical bank that, at each point in time, stands at the 50th percentile of the cross-sectional distribution of each bank-level variable entering the interaction terms. The green and red dashed lines refer to hypothetical banks that stand respectively at the 10th and 90th percentile of the CDS spreads cross-sectional distribution, while the other bank-level variables are evaluetd at the 50th percentile of the respective distributions.

Figure 6: Estimated historical contribution of interbank rate uncertainty on lending rate spreads conditional on bank capital ratio.



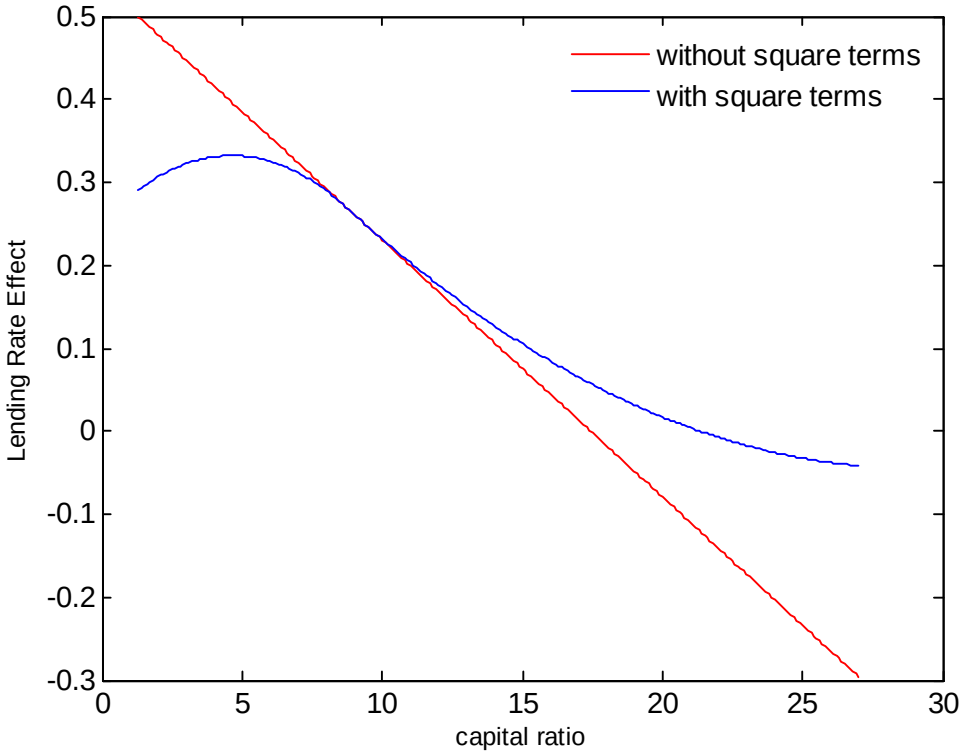
Note: The figure shows the historical contribution of interbank rate uncertainty on lending rates, based on the uninteracted and interaction terms of uncertainty and coefficient estimates of the baseline specification. The contribution "median bank" (blue line) refers to the hypothetical bank that, at each point in time, stands at the 50th percentile of the cross-sectional distribution of each bank-level variable entering the interaction terms. The red and green dashed lines refer to hypothetical banks that stand respectively at the 10th and 90th percentile of the capital (over main assets) cross-sectional distribution, while the other bank-level variables are evaluetd at the 50th percentile of the respective distributions.

Figure 7: Estimated historical contribution of interbank rate uncertainty on lending rate spreads conditional on ECB credit.



Note: The figure shows the historical contribution of interbank rate uncertainty on lending rates, based on the uninteracted and interaction terms of uncertainty and coefficient estimates of the baseline specification. The contribution "median bank" (blue line) refers to the hypothetical bank that, at each point in time, stands at the 50th percentile of the cross-sectional distribution of each bank-level variable entering the interaction terms. The red and green dashed lines refer to hypothetical banks that stand respectively at the 10th and 90th percentile of the ECB credit (over main assets) cross-sectional distribution, while the other bank-level variables are evaluetd at the 50th percentile of the respective distributions.

Figure 8: Marginal effect of interbank uncertainty on lending rates conditional on bank capital ratio - with and without square terms.



Note: The figure shows the effect of one standard deviation increase in interbank rate uncertainty on lending rates, conditional on bank capital ratio. The effect is derived considering the un-interacted of uncertainty as well as its interaction terms with banks' balance-sheets characteristics, with and without the square interaction terms. The range of values for the capital ratio spans the historical distribution; the other bank-level variables entering the interaction terms are evaluated at the 50^{th} percentile of their historical distribution.

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