Borrowers and Market Discipline: Evidence from European Banks

Abstract

The 2008-2009 global financial crisis has renewed attention that bank regulation cannot ensure unilateral financial stability without the market playing an active disciplinary role. In this paper, we argue that borrowers can act as disciplinary agents because of their vested interest in the loss of their lending relationships. We use individual bank level data and estimate the structural model of loan market by applying disequilibrium econometrics. The identification problem is solved with instrumental variables. Our findings suggest that it is possible to discipline banks from the asset side. From a sample of banks in 14 European Union countries during the period 1997-2007, we document that borrowers decrease their loan demands significantly as banks increase their risk. Borrowers' monitoring of bank health is found to be more evident for small banks, private banks and banks operating in bank-based financial systems. Our findings suggest that more stringent capital requirements, enhanced bank transparency and intensive supervision are necessary to limit excessive risk taking by large and state banks as well as those that operate in market-based financial systems.

JEL Classifications: G21; D50; G29

Keywords: Borrower discipline; Monitoring; Loan Demand; Bank Risk

1 Introduction

The theory of market discipline suggests that bank stakeholders act to mitigate the buildup of bank risk. Several theoretical and empirical evidence have shown that stakeholders on the liability side such as large-denominated deposit contract holders, subordinated-debt holders and stockholders are able to provide timely and effective control over their banks' risk exposure. Stakeholders on the asset side have incentives to prevent their banks from taking excessive risk as well, however, the role of these stakeholders has been largely ignored because it is hard to estimate their influence. In this paper, we contribute to market discipline literature by investigating whether borrowers' demand for bank loans are sensitive to financial health of their banks. We posit that borrowers have incentives to monitor their banks' health because they are aware of the benefits of having a long-term lending relationship (Sette and Gobbi, 2015; Bolton et al., 2016) and it may be costly to switch their banks (Huber, 2018; Darmouni, 2020). Our empirical analysis confirms that borrowers in Europe consider financial soundness of their banks when they demand for loan and actively engage in monitoring.

The importance of bank health for borrowers has been well studied in the literature. The early papers examine the impact of the failure of banks on their borrowers (Slovin et al., 1993; Yamori and Murakami, 1999; Djankov et al., 2005) and document that the stock performance of borrowing firms is adversely affected. Recently, a study by Huber (2018) shows that lenders' health may damage financing and investment activities of borrowers. He finds that after the decline in equity capital because of significant losses on international trading portfolio during the global financial crisis, a German bank reduced its loan supply to its borrowers. He shows that following the lending cut, capital stock of firms that have a relationship lending with that bank decreased by an average of 13 percent relative to the similar firms with no lending relationship. His most striking finding is that the negative effect of temporary lending cut did not recover afterwards.

After the financial crisis of 2007-2009, banks decreased their lending supply considerably but firms that have long-term relationship with their banks have not been affected adversely. The evidence show that firms in longer relationships have easier access to funds during the credit crunch, enabling them to better weather the shocks. Sette and Gobbi (2015) examine Lehman default shock and its consequence on credit market using a sample of more than 30,000 Italian corporate borrowers. They find that banks increase credit

commitments more to the firms that they have a longer relationship. Similarly, Bolton et al. (2016) show how relationship banking plays an important role in dampening the effects of negative shocks following a crisis. Using detailed credit register information for 179 Italian banks before and after the Lehman Brothers' default, they provide evidence that relationship-banks increase their supply of loans in times of crisis.

Credit markets are always vulnerable and a shock may push borrowers to search for a new lender. Thus, it is very important for firms to take these possibilities into consideration while choosing their banks. Examining American firms that depend more on lending relationships for the period 2004-2010, Darmouni (2020) documents that borrowers that change their banks get loans with worse terms than those stayed with their current banks. Schwert (2018) emphasizes that bank-firm matching is endogenous and influenced by the bank capital. He shows that firms that are most susceptible to reductions in loan supply have relationships with the most resilient, i.e., well-capitalized, banks using a sample of syndicated loans to public corporations in US during 1987-2012.[1] Theoretically, Allen et al. (2011) demonstrate that in highly competitive credit markets, borrowers prefer to receive loans from banks that hold capital beyond the minimum requirements. Similarly, Onder and Ozyildirim (2014) show that borrowers are willing to pay high interest rates to the less risky banks in order to minimize possible liquidity problems in the interim stages of their long-term projects. Rather an early empirical evidence, Kim et al. (2005) show that borrowers pay a significantly higher interest rate to well-capitalized banks in Norway which has an implication that banks may invest more in quality.

Borrowers' abilities to evaluate a bank's true condition (monitoring) and to affect bank managers' actions (market influence) can be interpreted as market discipline from a bank's asset side.[2] If firms borrow less from risky banks (lending relationship), that may be an incentive for bank managers to avoid taking excessive risks. In this paper, using individual bank-level data from Europe, we investigate the association between borrowers' loan demand and banks' perceived risks to inquire whether borrowers monitor their banks.

[1]Schwert (2018) shows that borrowers prefer to have a relationship with well-capitalized banks because these banks are more likely to monitor them. In this paper, we look at the other side of this relationship and argue that borrowers prefer to have a long-term relationship with their banks and are likely to monitor their banks to take excessive risk.

[2]Bliss and Flannery (2002) identify two components of market discipline. The first component, market monitoring, entails accurate assessment by stakeholders of changes in a bank's condition. In the second component, market influence, stakeholders can affect a bank manager's actions.

We use a disequilibrium econometrics approach based on the system of separate demand and supply equations together with optimization function which defines the actual loans granted as minimum of demand and supply.

We choose to investigate European banks for the existence of borrower discipline because borrowers in Europe seem to have more incentives to monitor or discipline their banks than those in other regions in the world. First, Europe has the world's largest banking systems.[3] Second, European firms are more reliant on bank loans. Bank financing in the European Union is larger than other sources of external financing, such as bonds and stocks. For example, stock market capitalization to bank credit to the private sector ratio was 56% in European countries in 2010 and increased only to 64% in 2018. Third, bank supervision is excessively lax in Europe. Langfield and Pagano(2016) document that weak bank regulation and supervision in Europe is one of the reasons for having a bigger banking system than capital markets. Moreover, banks in European countries are subject to political influences (Hau and Thum, 2009).

A major challenge that needs to be addressed in analyzing the relationship between bank health and loan demand is the estimation of demand for loans issued by banks at different interest rates. One must have ex ante information on both the demand for and supply of loans at alternative loan rates.[4] We employ proxy measures and apply disequilibrium econometrics (Fair and Jaffee, 1972; Maddala and Nelson, 1974; Goldfelfd and Quandt, 1975; Gourieroux et al., 1980) to directly estimate the structural model of the loan market. In the literature, there are several papers that use disequilibrium

[3]Langfield and Pagano(2016) report that total assets of banks in EU was 334% of its GDP in 2013 whereas Japanese and US banks' assets were amounted to 196% and 115% of their GDP, respectively in 2013. In 2018, total banking assets to GDP ratio were 158%, 113%, and 62% in Japan, EU-15 and US, respectively. Data source: `https://www.theglobaleconomy.com/rankings/bank_assets_GDP/`

[4]It is ideal to have individual loan applications as in credit registry data used by Jimenez et al. (2012) to measure loan demand but unavailability of loan applications data (application/rejection/origination) restricts researchers to employ indirect approaches such as survey techniques and/or proxy measures. Unfortunately, there is no loan-level or firm-level survey data for the countries analyzed in this study. Although according to the "Decision of the European Central Bank of February 24, 2014" (ECB/2014/6 (`https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014D0006%2801%29`), central banks share granular credit data with each other a more comprehensive overview of the indebtedness of borrowers subject to adequate confidentiality safeguards, they are mostly confidential and not available to researchers.

econometrics for credit and bond markets in a single country.[5] In this paper, we use it for bank-level panel data.

Our empirical analysis covers 14 European Union (EU-14) countries for the period between 1997 and 2007. The global financial crisis had a major impact on the global banking landscape and hence we ended the sample before the start of the global financial crisis. Becker and Ivashina (2014) present evidence that borrowers change financing from borrowing to bond issuance while banks reduced their lending during the crisis. Iwanicz-Drozdowska, Smaga and Witkowski (2016) mention that financial support was provided by states in EU countries to financial institutions with deteriorating standing. Furthermore, the new regulations such as Dodd-Frank and Basel 3 have implemented to enhance effective market supervision. In particular, the revised Pillar 3 of Basel 3 aims to help market participants through regulatory disclosure requirement. Disclosures should be presented in a standard form that is understandable to key stakeholders and communicated through an accessible medium. The main criticism of effective market discipline is the claim that stakeholders are not well suited to monitor and act on changes in risk. Although more recent data are available, we end our estimation period in 2007 to avoid possible behavioral change with the global financial crisis and the new rules in Basel 3.

We show that as banks improve their health, their loan demands increase significantly, controlling for other bank characteristics and macroeconomic conditions. The negative relationship between loan demand and bank risk is found to be robust across different subsamples, controlling for year and/or country fixed effects or when equilibrium is assumed in the loan market. We observe that this relation is more apparent for small banks, private banks and banks operating in bank-based financial systems. The results suggest that further incentives and new market disclosure rules are necessary to promote the monitoring of large banks, public banks and banks operating in market-based financial systems. Our findings have particular implications for Europe because, as Langfield and Pagano (2016) explain, there exists a regulatory favoritism towards banks (especially large

[5]The disequilibrium econometric analysis has been used for: credit crunch analysis (Laffont and Garcia, (1977) for Canada; Sealey (1979) for USA; Ito and Ueda (1981) for USA and Japan; Pazarbasioglu (1997) for Finland; Ghosh and Ghosh (1999) for Korea, Indonesia, Thailand), bond market (Stenius (1982) for Finland), monetary transmission mechanism (Hurlin and Kierzenkowski (2007) for Poland), financing of constraint/unconstraint firms (Carbo-Valverde et al. (2009) for Spain; Kremp and Sevestre (2013) and Burdeau (2015) for France), the impact of global financial crisis (Wosko (2016) for Poland).

banks) in the form of bailout guarantees and regulatory forbearance, which may increase systemic risk and have a negative impact on economic growth.

The paper is organized as follows: The next section explains the hypotheses tested in the study. Section 3 presents the empirical model used in the estimations. The results are reported in Section 4. Section 5 concludes the paper.

2 Hypotheses

Theoretical and empirical studies indicate that borrowers prefer to have a long-term relationship with their banks (see Elyasiani and Goldberg (2004) and Bolton et al. (2016) for a detailed survey of the literature). Such a relationship may lead to lower loan rates, lower collateral requirements and better access to external finance. However, several factors may cause this relationship to be disrupted[6] and necessitate that borrowers look for other financiers. If borrowers are unable to replace their relationships, either with other lenders or in other ways on equal terms, they may face problems created by information asymmetries and transaction cost frictions. To avoid possible frictions, disruptions or lending rationing, we argue that borrowers rely on a lending relationship with financially healthy banks (Hubbard et al., 2002; Schwert, 2018). This argument is consistent with the market-discipline paradigm (Bliss and Flannery, 2002) that benefits of monitoring banks' health may outweigh costs for borrowers who have a valuable stake in lending relationships. This line of argument leads to our first testable hypothesis:

Hypothesis 1: Borrowers' loan demand is negatively associated with a bank's health, controlling for other bank characteristics and macroeconomic conditions.

We argue that borrowers' incentive to monitor large banks is less than the incentive to monitor small banks because borrowers from small banks are more likely to be affected from the failure of their banks than borrowers from large banks. Empirical research

[6]In the literature, there is much evidence that real, financial or regulatory shocks can make banks unwilling to lend, even when there is no change in borrowers' overall creditworthiness. For example, Kashyap and Stein (2000) and Khwaja and Mian (2008) show that the impact of monetary policy shocks on lending is stronger for banks with fewer liquid assets; Bernanke and Lown (1991), Hancock and Wilcox (1994) and Peek and Rosengren (1995) find that bank lending may be limited for low-capital banks in periods of tight money; Ashcraft (2005) presents evidence that bank failures due to exogenous shocks cease a borrower's long-term relationship with her bank.

postulates that having a relationship with a healthy bank is more important for small borrowers than large borrowers because the former depend more on bank loans and are less likely to have access to alternative financing. Holmstrom and Tirole (1997) show that firms with less collateral (e.g., small firms) are more likely to borrow from banks, whereas wealthier firms are more likely to use market financing. Using data from the Survey of Small Business Finances for the US, Petersen and Rajan (1994) find that small firms concentrate their business with a single lender and incur high costs if they switch banks. Khwaja and Mian (2008) present evidence for Pakistan that small firms have difficulty in overall borrowing if lenders are faced with liquidity problems, whereas large firms are more protected from lenders' liquidity shocks. Berger et al. (2017) show that small banks are better able to provide financial support to small businesses than large banks especially during local economic downturns. All of these studies suggest that shocks to the banking system and/or their bank's failure can have a significant impact on the supply of credit to small businesses, and it is very costly for bank-dependent small firms to switch to another bank.[7] Laeven et al. (2015) document that large banks are more likely to create systemic risk than smaller banks. Yet, large banks are more likely to receive public sector support in case of distress (Langfield and Pagano, 2016) whereas community and medium-sized banks and thrifts were allowed to fail during the 2008-2009 global financial crisis (Bennett et al., 2015). Considering all of these studies, a negative relationship between bank risk and loan demand is expected to be more evident for small banks. On the contrary, unlike large firms, small firms may not have a power to influence their banks.

Hypothesis 2: There is a negative and significant relationship between bank risk and loan demand for small banks, whereas no significant relationship is expected for large banks, controlling for other bank characteristics and macroeconomic conditions.

In bank-based financial systems, banks play a leading role in mobilizing savings, allocating capital, overseeing corporate managers' investment decisions and providing risk-management vehicles. In market-based systems, equity markets are more important in intermediation activities, exerting corporate control and easing risk management (Demirgüç-Kunt and Levine, 2001; Chakraborty and Ray, 2006). Because of firms' heavy

[7]Degryse et al. (2011) examine the staying, switching and dropping costs for small firms in Belgium following a bank merger and show that firms that cannot find a new bank relationship (droppers) perform worse than switchers or stayers.

dependence on banks in the former system, borrowers will be affected more if their lenders fail (Kang and Stulz, 2000; Bae et al., 2002).[8] Therefore, it is expected that borrowers in bank-based financial systems are more likely to monitor their lenders compared to those in market-based financial systems.

Hypothesis 3: The financial system, whether bank-based or market-based, affects the relationship between bank risk and borrower loan demand. The relationship between bank risk and loan demand is negative for banks operating in countries with a bank-based financial system, whereas no significant relationship is expected between risk and loan demand for banks operating in countries with a market-based financial system, controlling for other bank characteristics and macroeconomic conditions.

Existing studies provide evidence on the stability and risk-taking behavior of banks with different ownership patterns. For example, La Porta et al. (2002), Sapienza (2004) and Khwaja and Mian (2005) present evidence that public banks fund politically desirable but inefficient projects and transfer resources to politically connected borrowers. Iannotta et al. (2007) show that among large European banks, public banks are the least stable, followed by private banks. Illueca et al. (2014) find that savings banks in Spain that are subject to political influence by regional governments exhibit higher ex ante risk-taking and higher ex post loan defaults. These findings have raised concerns on the quality of loans issued by public banks and their risk. Although differences exist between the risk-taking and lending behavior of private and public banks, it is expected that all governments provide some guarantee to their banks. Based on these findings, we hypothesize that borrowers have less incentive to monitor public banks than private banks.

Hypothesis 4: Bank ownership type matters in the relationship between loan demand and bank risk. There is a negative relationship between the riskiness of privately owned banks and their loan demand, whereas no significant relationship is expected between the loan demand of public banks and their risk, controlling for other bank characteristics and macroeconomic conditions.

[8]There are some exceptions. For example, although Norway is classified as a bank-based economy (Demirgüç-Kunt and Levine, 2001), Ongena et al. (2003) find only a small and temporary impact of bank failure on client firms because of the availability of other financing sources in Norway.

3 Empirical Framework

3.1 Identification

In order to empirically test the above hypotheses and examine the association between bank riskiness and borrower demand for bank loans, we have the challenge of separating the effect of bank risk on loan demand from that of loan supply. We try to solve this problem with instrumental variable (IV) estimation.

We use two instrumental variables to identify loan demand: bank reputation measure and GDP. In the literature, there is evidence that firms prefer to borrow from reputable banks since firms benefit from the strict bank's screening and monitoring activities that mitigate the information asymmetry between insiders and outsiders (Ross, 2010; Ioannidou and Ongena, 2010). Hence, we posit that bank reputation only affects loan demand and does not directly affect bank's willingness to supply credit. Although reputation is an important bank asset, it is not measurable and can not be easily recognized in financial statements. We use several proxies for bank reputation in the empirical analysis, including the asset share of a bank in the banking industry of a country. In addition to the reputation measure, we adapt a model á la Bernanke and Blinder (1988) and use real GDP as our second IV that is related to loan demand.

On the supply side, we also have two instrumental variables: the availability of loanable funds at the bank level and a bank's return on alternative investments. We use deposits of a bank and the return on government bonds as proxies for loanable funds and the return on alternative investments, respectively.

The most important problem with instrumental variables is that an instrument may be correlated with the omitted variables. We check the correlation between the instrumental variables used in loan demand and loan supply models and error terms from demand and supply equations. None of these instrumental variables is found to be correlated with the error terms of the corresponding model. Another concern in the estimations with instrumental variables is the weak correlation between instruments and endogenous variables. According to Angrist and Krueger (2001), this bias is approximately zero if the number of instruments is equal to the number of endogenous variables, which is the case in our model. Nevertheless, we use the Limited Information Maximum Likelihood estimator, as suggested by Anderson et al. (1982) in order to eliminate any overidentification problem.

3.2 The Empirical Model

We employ a disequilibrium model to assess the relationship between loan demand and banks' perceived financial health. The model consists of demand and supply equations for bank loans and a disequilibrium condition. In the analysis, we use individual bank-level data and describe loan demand equation for bank i operating in country j at time t as follows:

$$L^D_{ijt} = \alpha_0 + \alpha_1\ Bank\ Risk_{ijt} + \alpha_2\ r_{ijt} + \Theta X^D_{ijt} + \Psi Z_{ijt} + \epsilon^D_{ijt}. \quad (1)$$

where L^D_{ijt}, $Bank\ Risk_{ijt}$, r_{ijt}, X^D_{ijt} and Z_{ijt} represent the amount of loan demanded, proxy for measuring bank risk, an implied interest rate on loans, instrumental variables unrelated to loan supply and affecting only loan demand, and other exogenous variables affecting both loan demand and loan supply of bank i operating in country j in year t, respectively. ϵ^D_{ijt} denotes the error term of the loan demand model. Similarly, loan supply equation is specified as follows:

$$L^S_{ijt} = \beta_0 + \beta_1\ Bank\ Risk_{ijt} + \beta_2\ r_{ijt} + \Phi X^S_{ijt} + \Omega Z_{ijt} + \epsilon^S_{ijt}. \quad (2)$$

where L^S_{ijt} and X^S_{ijt} represent the amount of loan supplied and instrumental variables that are unrelated to loan demand and affecting only loan supply. ϵ^S_{ijt} denotes disturbance terms in the loan supply model. Following disequilibrium models employed in the credit-market literature, we assume that the observed loan amount, L_{ijt}, is the minimum of the loan amount demanded or supplied and the direction of the change in price is related to excess demand in the market:

$$L_{ijt} = \min(L^D_{ijt}, L^S_{ijt}) \quad (3)$$

$$\Delta\ r_{ijt} = \gamma\ (L^D_{ijt} - L^S_{ijt}) + u_{ijt}, \quad (4)$$

where γ represents how quickly interest rates adjust to the equilibrium. Two extreme values of γ, zero and infinity, represent no adjustment and instantaneous adjustment, respectively.

We hypothesize that the loan demand of bank i operating in country j at time t, L^D_{ijt}, significantly decreases as bank risk ($Bank\ Risk_{ijt}$) increases.We employ five components of the CAMEL rating to assess a bank's health or risk: capitalization is measured by the ratio of total capital to total assets (CAR); asset quality is defined by the ratio of loan loss provisions to net interest revenue (LLP); a bank's managerial quality or efficiency is

measured by net interest expense to gross revenue ($COST$); bank profitability is calculated by return on average assets (ROA) and bank liquidity is assessed by the ratio of liquid assets to customer and short-term funds ($LIQR$).[9]

In addition to these measures, *Z-SCORE*, defined as the return on average assets plus the capital-asset ratio divided by the standard deviation of the return on assets, is used to proxy bank risk.[10] Combining accounting measures of profitability, leverage and volatility, *Z-SCORE* indicates the number of standard deviations that a bank's return on assets must drop before equity is depleted and the bank becomes insolvent. Thus, a higher *Z-SCORE* indicates a lower risk. In our estimations, we use the natural logarithm of *Z-SCORE* to smooth out its extreme values, as in Demirgüç-Kunt and Detragiache (2011) and Gaganis et al. (2020). These bank health variables are also included in the loan supply model.

The interest rate, r_{ijt}, is proxied with net interest income over average earning assets because of the unavailability of data on the actual interest rate charged on an average loan. This endogenous variable is included in both the loan demand and loan supply models.

The exogenous variables (Z_{ijt}) are assumed to affect both loan demand and loan supply of banks, including stock market return ($Stock\ Return_{jt}$), the volatility of returns on bank shares relative to the volatility of market returns ($\sigma_{Bjt}/\sigma_{Mjt}$), bank types and the dummy variable for Euro zone countries. The return in the stock market is included in the loan demand model to control for the cost of alternative financing for firms. It is expected that as the cost of issuing equity increases, the demand for bank loans increases. On the other hand, if firms are able to raise external funds from the stock market at a low cost, the cost of borrowing increases and loan demand declines. Stock market return may also reflect market sentiment or represent future productivity growth in the economy. Banks may take into consideration the return on the stock market in making their loan supply decisions. Hence, this variable is expected to increase banks' loan supply.

[9]This ratio is similar to the measure offered in the new regulations on liquidity risk, disclosed by the Basel Committee in December 2010 as part of the post-crisis regulatory package known as Basel III (Tirole, 2011).

[10]The denominator of *Z-SCORE* (the standard deviation of each bank's ROA) is calculated over the sample period (1997-2007), assuming that the standard deviation of the ROA of each bank remains constant during that time.

The volatility of returns on bank shares relative to the volatility of returns[11] in the domestic stock market, $(\sigma_{Bjt}/\sigma_{Mjt})$, is included in both models to control for the expected risk in the banking sector relative to the total risk in each country. The impact of this relative measure on loan provision is uncertain. For example, if risk in the banking sector relative to variability in the stock market $(\sigma_{Bjt}/\sigma_{Mjt})$, increases, credit supply is expected to decline to reduce risky lending activities. However, if general riskiness in the market compared to bank risk increases, that is, $\sigma_{Bjt}/\sigma_{Mjt}$, decreases, banks may lower their credit supply. Then, the relationship between relative risk measure and loan supply will be positive. On the loan demand side, if relative risk in the banking sector increases, firms are less likely to demand loans, whereas an increase in the relative risk in the stock market may make firms less likely to invest and demand bank loans because of the increase in market risk. This increase in relative risk might also increase loan demand if firms hesitate to issue seasoned equity.

The strong acceleration of cross-border financial flows in the Euro area after the introduction of the single currency (Lane, 2006) suggests that borrowers' loan demand was affected by this change. To control for the effect of a common currency on loan demand and supply, we include a dummy variable $(EuroZone_{jt})$ that equals one if a member country j is in the Euro area in year t. If the number of alternative lenders available for borrowers increases in the Euro area, the coefficient of *EuroZone* in the loan demand model is expected to be negative. Moreover, the use of a common currency has increased wholesale banking activities (Centeno and Mello, 1999) and significantly intensified competition in the financial services industry. Financial institutions have mainly responded to these pressures by cutting costs and consolidating their activities, either through mergers and acquisitions or through cross-shareholdings. We have no a priori expectation about this impact on loan supply because an increase in competition is expected to reduce a bank's loan supply but a decline in the cost of external funding may increase the funds available in the lending market.

Cooperative and *Commercial* are dummy variables indicating bank types. Saving banks are taken as a base group. Westman (2011) states that commercial banks maximize share-

[11]The standard deviation of annual returns is used to measure volatility in the banking sector and stock market in each country. The end-of-month values of the FTSE stock index and the FTSE bank index for each country are used to calculate the returns on the stock market and banking sector in each country, respectively.

holder value; cooperative banks provide value to their client-owners and savings banks have social or regional objectives. Hesse and Cihak (2007) emphasize that the disclosure practices and the requirements of cooperatives are substantially below those of commercial banks, especially listed ones. They claim that there is no incentive for shareholders and depositors to exert effective market discipline on these institutions. Empirically, cooperative banks are also found to have more difficulties in adjusting to adverse circumstances and changing risks (see, for example, Brunner et al., 2004; Fonteyne, 2007; Hesse and Cihak, 2007). Moreover, Dermine (2002) shows that there are differences in banks' funding resources by their type. For example, cooperative banks do not rely much on interbank markets or debt issuances. Hence, we control for bank type (commercial, savings and cooperative) with different business models in the loan demand and supply equations. In addition to these control variables, we include the lagged dependent variable, L_{ijt-1}, in both loan demand and supply models as a proxy for omitted variables. All monetary values are expressed as of the end of 2007.

As seen in equations (1) and (2), there are also demand-specific (X^D_{ijt}) and supply-specific (X^S_{ijt}) variables in the model in order to isolate the effect of bank risk on loan demand from loan supply. As demand-specific variables, we include in the model the natural logarithm of real GDP in country j at time t *(Output$_{jt}$)* and a proxy for bank reputation *(Bank Reputation$_{ijt}$)*. We assume that these variables influence only loan demand and are uncorrelated with loan supply. The growth in real GDP can be considered as a proxy for borrowers' funding needs, which drive the demand for loans from banks. A weakening in the economic stance reduces loan demands by firms and consumers.

Based on the evidence in the literature, we assume that borrowers prefer to demand loans from reputable banks. It is well recognized in the literature that getting a loan from a reputable bank provides a positive signal to the market that the borrower is good (Diamond, 1991). Following Ross (2010), we estimate the reputation of lenders with their asset shares. A dummy variable, *Bank Reputation*$_{ijt}$, is created that takes a value of 1 for those banks that are above the 90th percentile in terms of total assets in their country in a specific year. We employ other proxies, such as an indicator variable for the largest three banks in terms of their assets in the banking sector, the asset share of each bank, and a dummy variable indicating whether the bank is listed in the stock exchange. We also use the lagged values of the first two variables, since the current asset share may not be observable by borrowers in that year.

We include two supply-specific variables: The availability of loanable funds, $Deposit_{ijt}$, measured by the natural logarithm of bank deposits, and the opportunity cost of banks to provide credit to firms and other borrowers, $Bond\ Return_{jt}$, measured by their return on three- to five-year government bonds. Both variables are assumed to influence only loan supply and unrelated to loan demand. Deposits are considered as a major source of loanable funds and expected to be positively associated with loan supply. For example, Ivashina and Scharfstein (2010) show that banks that had better access to deposit financing did reduce their lending less during the financial crisis of 2008. Government bonds are considered as a risk-free investment alternative to banks, and an increase in returns on government bonds is expected to reduce loan supply. Burgstaller and Scharler (2010) show that the aggregate loan supply to corporates is flat and fluctuations in loan demand do not affect the lending rates, Hence, the opportunity cost of lending is not expected to affect loan demand but it affects loan supply.

The parameters of the simultaneous equations system (Equations 1-4) are estimated using the limited information maximum likelihood (LIML) method. We also estimated our model with full information maximum likelihood (FIML), since Maddala and Nelson (1974) show that in the absence of information about the price adjustment process and assuming that errors are normally distributed random variables, the model itself will determine whether the observation belongs to the demand or supply equation.[12]

3.3 Data

We test our hypotheses using a sample of commercial, cooperative and savings banks operating in EU-14 countries for the period 1997 to 2007. It is an unbalanced panel. The bank data are obtained from Bankscope, a commercial database maintained by the Brussels-based Bureau van Dijk. In addition to providing a comprehensive database for cross-country studies, Bankscope provides accounting information at the bank level in a standardized format, adjusting for differences in accounting and reporting standards. Nevertheless, it does not provide information on lending by loan type. Thus, we use total loans in our analysis.

We obtain the data on stock market returns and the yield on government bonds from

[12]We did not report the results of FIML estimations in order to save space. The results are similar to those reported in Tables 2-9.

Datastream. The macroeconomic variables are taken from Eurostat. The beginning of the sample period is determined by the availability of the data. The sample period ends before the start of the recent global crisis.

We use consolidated financial statements.[13] To minimize the effects of measurement errors, following Lepetit et al. (2008), we exclude the extreme bank/year observations (the 2.5% lowest and highest values) for each variable in the model. We have around 900 observations for each year and 10,001 observations in the sample. They are not uniformly distributed among countries (see Appendix Table A1 for the distribution of banks). The definition of all variables and their data sources are reported in the Appendix (Table A2). The descriptive statistics variables used in the analysis are reported in Tables A3.

All banks in each country are ranked based on their total assets in each year. Those in the lowest 90th percentile are classified as small banks and the rest are grouped as large banks. Banks are also classified as public and private, using the general bank specifications reported in Bankscope. Countries are grouped as market-based and bank-based using the financial structure index, developed by Demirgüç-Kunt and Levine (2001). Four countries in our sample are market-based: Denmark, the United Kingdom, the Netherlands and Sweden.[14]

Table 1 shows the mean values of bank risk measures for each group of banks. The average capital-asset ratio is 7.1%, slightly lower than the Basel I requirement of 8%. Small banks have a higher capital-asset ratio but hold fewer liquid assets compared to large banks. Although small banks have higher profitability and soundness measures, they operate less efficiently and have higher interest expense-to-gross revenue ratio than large banks. Interestingly, banks operating in market-based financial systems have lower average z-scores than those in bank-based systems. Those in the former group have the highest capital-asset (12.96%) and return-on-assets (1.12%) ratios and the highest asset quality. The capital-asset ratio in market-based countries is more than two times higher than the average ratio in bank-based countries. Although private banks have higher

[13]If consolidated financial statements were available, they were used in the following order of Bankscope Consolidation codes: C1, C2 and C*. If no consolidated statements were available for a bank, we used unconsolidated statements in the order of U1, U2 or U*.

[14]Demirgüç-Kunt and Levine (2001) create a financial structure index by calculating the conglomerate ratio of banking sector development relative to stock market development with respect to size, activity and efficiency. Countries with a ratio greater than the mean value are classified as bank-based and those with less than the mean value as market-based.

capital adequacy, asset quality, profitability, and liquidity measures, their efficiency and soundness measures are worse than public banks. On average, the banks that adopt International Financial Reporting Standards (IFRS) have lower risk than the banks that do not adopt IFRS. Banks listed on stock exchanges have a lower risk with respect to CAMEL measures than non-listed ones. However, the average z-score of the latter types of banks is higher than that of the former.

INSERT TABLE 1 HERE

4 Empirical Results

4.1 All Banks

The LIML estimations of the loan demand and loan supply equations for the disequilibrium model are shown in Tables 2 and 3, respectively. Each column indicates the bank risk measure included in the model. The findings support our main hypothesis for the EU-14 countries: Bank loan demand increases as bank risk decreases, controlling for other bank characteristics and macroeconomic conditions. More specifically, we find that as banks in the EU-14 countries improve their capitalization *(CAR)*, profitability *(ROA)*, liquidity *(LIQR)* or soundness *(Z-SCORE)* measures, their loan demand increases. Moreover, if banks reduce their interest expenses relative to their revenues *(COST)* or their loan loss provisions to total interest income ratio *(LLR)*, their loan demand also increases. All the coefficients of bank risk measures are found to be significant. We measure the demand with realized loan amount provided by a bank. The true loan demand from less risky banks may be higher than this realized level because these banks may discourage or reject some borrowers. However, the observed loan amount may be a better proxy for loan demand from risky banks if borrowers demand less from risky banks. As a results, our proxy may cause the underestimation of the true coefficients on bank risk measures.

INSERT TABLES 2 AND 3 HERE

At the bottom of each table, we report the results of the hypotheses testing the significance of instruments in the first-stage regressions individually and jointly. The results of the tests indicate that our instruments are significant. We use the Hausman (1978) procedure to test the null hypothesis that instruments are exogenous by regressing the

residuals on all the exogenous variables. The χ^2 test statistic is calculated by multiplying the number of observations included in the model and R^2 from the residual regression. The overidentification test for instrument validity indicates that the instruments are exogenous because almost all of the R^2s from the residual regressions are found to be zero, confirming the validity of the instruments.

Although bank reputation *(Bank Reputation$_{ijt}$)* is found to be significant in the first-stage regression, as reported at the bottom of Table 2, it is not found to be a significant factor in explaining loan demand from banks with the LIML estimation.[15] One possible reason for the insignificant coefficient is that our dummies are not perfectly measuring bank reputation. Another reason is the possibility of multicollinearity. In the literature, there is evidence that borrowers are willing to pay higher interest rates in order to receive a loan from more reputable banks (Chemmanur and Fulghieri, 1994; Kim et al., 2005). However, Ross (2010) shows that dominant (reputable) banks may offer borrowers loans with more attractive terms. The inclusion of an implied interest rate may be reducing the significance of the reputation measure in the estimations.

We find that a decline in intermediation costs (r) and an increase in real GDP *(Output)* significantly increase loan demand regardless of the risk measure included in the model. An increase in the cost of alternative financing for firms *(Stock Return)* has a positive effect on loan demand. If the cost of issuing equity increases, the demand for loans is found to increase significantly. This positive association can be also explained by the enhancement of firm values with the increase in asset prices. The improvement in firms' balance sheets because of the increase in collateral values may increase their loan demands. However, an increase in the risk in the banking sector relative to the whole market is found to reduce loan demand from banks, as expected.

Loan demand is found to decline significantly after the Euro's adoption. It can be explained by the availability of other funding alternatives. Previous evidence show that with the single currency, European companies have been able to raise funds in the securities markets. For example, Hartmann et al. (2003) report the expansion of the market for corporate bonds after the introduction of the Euro. Similarly, Galati and Tsatsaronis

[15]The coefficient on reputation measure is found to be insignificant when we use the FIML estimation or when we measure bank reputation with different proxies, that is, the asset share of each bank, a dummy variable that takes a value of 1 for the largest three banks in its country in that year, or a dummy variable indicating banks listed in the stock exchange.

(2003) mention that the Economic and Monetary Union (EMU) has increased the attractiveness of market-based financing methods and Rajan and Zingales (2003) show that the European financial system has actually become more market-based with the Euro.

Over the period 1997 to 2007, we find that borrowers requested significantly more loans from cooperative banks but fewer from commercial banks than from savings banks. This finding might be explained by savings banks' traditional objectives: They mainly enable savings opportunities for the public, carry out social or beneficiary work and support regional development projects (Westman, 2009). Considering the narrow focus of savings banks, many borrowers may seek loans from cooperative banks. However, the significance of the coefficients of bank types changes depending on the bank risk measure used in the model.

Four out of six coefficients have zero in the 5% confidence interval for the market adjustment parameter, γ, indicating that there is almost no price adjustment if there is excess demand in the market. In the models with capital adequacy and liquidity ratios, there is more than zero price adjustment. Only three coefficients on the excess demand adjustment parameter are found to be significant. The significant coefficients of this variable suggest that there may be some credit rationing in the case of excess demand in the loan market.

Similar to the demand side, all the bank risk indicators are found to be significant and have the expected impact on loan supply (Table 3). In particular, we observe that as bank capitalization, profitability and liquidity ratios increase, banks increase their loan supply, whereas banks with larger provisions for loan loss reserves and those with lower operating efficiency reduce their loan supply. Moreover, banks with higher z-scores are able to significantly increase their loan supply during the sample period.

The control variables in the supply model in general have the expected signs and are significant. For example, banks are found to increase their loan supply when the net interest margin on loans or the amount of real deposits increases. The yield on government bonds has a negative and significant effect on the loan supply of European banks during the sample period. This finding shows that as banks' opportunity cost increases, they reduce their credit supply. We find that banks decrease their supply of credit as total risk in the banking sector relative to risk in the market increases. Moreover, if the stock market is doing well, banks are found to increase their loan supply. The impact of joining a monetary union on an individual bank's loan supply function *(EuroZone)* is found to

be insignificant. With respect to the types of banks, we find that the loan supply of cooperative and commercial banks is significantly more than the supply of savings banks over the sample period. This finding can be explained by savings banks' limited or lack of access to outside funding (Westman, 2009).

4.2 Large Banks versus Small Banks

We present the loan demand regression results for small and large banks in Tables 4 and 5, respectively.[16] The findings support our hypothesis that borrowers monitor small banks using risk indicators. All bank risk measures are found to be significant in explaining the loan demand of small banks. We find that as small banks improve their capital-to-asset ratio, return on assets, liquid assets relative to their short-term funds or financial soundness *(Z-SCORE)*, loan demand increases significantly. Moreover, loan loss reserves relative to interest income and net interest expense-to-gross revenue ratios are significantly and negatively associated with loan demand. For large banks, our findings suggest that borrowers seem to consider only capital adequacy and profitability ratios when requesting loans. The insignificant coefficient on bank risk variables can be explained by borrower expectation that European governments will bail out large and distressed banks (Langfield and Pagano, 2016).

INSERT TABLES 4 AND 5 HERE

Bank reputation has different impacts on loan demand in small and large banks. It has a negative association with loan demand from small banks,[17] whereas it is found to be

[16]The LIML loan supply estimation results indicate that small banks significantly reduce their loan supply when their risk increases. Their supply is found to increase significantly with the implied interest rate, their real deposits and the return in the stock market and decrease significantly with the return on government bonds. If the risk of the banking sector relative to the risk of the total market increases, we find that small banks' loan supplies decline significantly. Furthermore, small cooperative and commercial banks supply significantly more loans than small savings banks. Similar to small banks, large banks' loan supply is found to be significantly affected from the return on government bond and return on stock market. The former has a negative effect and the latter has a positive effect on loan supply of large banks. Unlike small banks, bank risk, real deposits and implied interest rate are not found to be significant factors in explaining loan supply of large banks. Large cooperative and large commercial banks provide significantly more loans than large saving banks.

[17]In estimations for small and large banks, we used the bank's deposit share in the banking sector as a proxy for bank reputation.

positive but significant only when CAR is used as a measure of risk for the sample of large banks. The negative coefficients on small banks can be explained by the findings from the literature that small firms reduce their loan demand from banks that have higher reputations because these banks have tighter lending standards (see e.g. Berger and Udell, 2002). However, borrowers from top 10 percent, i.e., large firms do not have these concerns.

We find that regardless of being a small or a large bank, increasing loan rates (r) and declining stock market returns reduce loan demands from banks. Other variables, however, have different impacts on loan demand from small and large banks. For example, growth in real GDP increases loan demand from small banks but does not significantly change loan demand from large banks. Bank loans to businesses and/or consumers typically grow more slowly during economic contractions. Our findings show that this association is significant for small banks in Europe during the sample period. Similarly, the volatility of stock returns of listed banks to the volatility of stock returns of the whole market is found to have a negative and significant association with loan demand from small banks. It is also found that the Euro's launch had a negative and significant effect on the loan demand of small banks, but did not affect large banks. After the introduction of the single currency, small banks have especially faced more intense competition from multi-nationals. It seems that the changing market structure affected borrowers' behavior towards small banks. Finally, we find that small cooperative banks had larger loan demands than small savings banks, whereas small commercial banks had significantly limited loan demand relative to small saving banks in Europe. The speed-of-adjustment factor is found to be positive and significant for small banks for most of the models but insignificant for large ones. These coefficients suggest that small banks adjust their prices faster than large banks in times of excess demand, and they seem to face credit rationing.

4.3 Bank-Based versus Market-Based Financial Systems

Tables 6 and 7 summarize the LIML estimates that examine borrowers' monitoring behavior in bank-based and market-based financial systems, respectively. The findings with all the bank risk measures support our hypothesis. We find a significant and negative relationship between bank risk measures and loan demand in countries with bank-based

financial systems.[18] On the other hand, the results suggest that borrowers in market-based financial systems consider only capitalization, profitability and cost-efficiency measures as significant bank health indicators.

INSERT TABLES 6 and 7 HERE

Similar to our previous findings, the proxy for interest rate is found to be negatively associated but output growth rate and return in the stock markets are found to be positively associated with loan demand for all banks regardless of the financial system they operate in. Interestingly, the increase in total risk of stocks of listed banks relative to the total risk of all stocks is found to increase loan demand in bank-based countries but decrease it in market-based countries. Our findings for market-based countries seem to be as expected and are similar to our overall findings. The positive association between relative banking sector volatility and loan demand in bank-based countries can be explained by the role of banks in the equity markets of these countries. Langfield and Pagano (2016) report that European banks, especially large ones, are protected by governments, and these banks also control the stock markets of these countries. Since banks can control equity markets in bank-based financial systems, the increase in relative volatility does not have a negative effect on them.

The coefficients of the *EuroZone* dummy variable in bank-based and market-based countries are alike and indicate a significant decline in borrowing from banks upon the introduction of a single currency. In bank-based countries, the loan demand from cooperative banks is significantly higher than the loan demand of savings banks, whereas no significant difference between these types of banks is observed in market-based countries. However, we could not explain the mixed coefficients for commercial banks in bank-based

[18]With respect to loan supply, in both financial systems, banks increase their loan supply with an increase in their real deposits, implied interest rates and return on stock market, and decrease their loan supply with the increase in interest rate on government bonds. Loan supply is found to decline significantly with the introduction of a common currency in market-based countries. With respect to bank risk measures, z-score and profitability significantly increase the loan supply of banks in market-based systems, whereas z-score, profitability and loan loss reserves significantly affect the loan supply of banks in bank-based financial systems. If risk in the banking sector relative to the overall market increases, we find that only banks operating in market-based economies significantly decrease their loan supply. Interestingly, banks in bank-based systems do not change their supply with an increase in relative risk in the banking sector. In bank-based economies, cooperative and commercial banks are found to supply significantly more loans than savings banks.

countries. The speed-of-adjustment parameter suggests that banks change their prices in case of credit rationing in bank-based markets but not in market-based economies.

4.4 Public Banks versus Private Banks

Tables 8 and 9 report the LIML estimates for the loan demand of private and public banks over the sample period, respectively. The results indicate that the loan demand of private banks significantly increases as their risk indicators decline. Specifically, if their capital-asset ratio, profitability, liquidity or financial soundness increases, loan demand from private banks in the EU-14 countries is found to increase significantly. Moreover, *LLP* and *COST* measures are significantly and negatively associated with loan demand from these banks. In contrast to private banks, borrowers seem to pay no attention to the level of capital-asset ratio, cost efficiency or financial soundness of public banks. The findings suggest that if these banks can increase profitability, liquidity or asset quality *(LLP)*, they can receive significantly more loan demand. Overall, these findings support our last hypothesis that bank ownership affects monitoring behavior of borrowers.

INSERT TABLE 8 AND TABLE 9 HERE

As expected, demand for bank loans from private banks significantly increases as output grows and significantly decreases as uncertainty in the banking sector increases. In line with our previous results, an increase in the cost of alternative financing for firms *(Stock Return)* increases loan demand from private banks significantly. However, these banks are found to lose significant demand when competition increases with a currency union. During the sample period, it is found that in general, loan demand from cooperative private banks is significantly higher than demand from savings banks, whereas commercial banks have significantly lower loan demand than savings banks do.[19] For public banks, none of the control variables is found to be significant, except lagged values of loan demand and speed of adjustment. For example, loan demand from public banks is not found to be

[19]Interest rate, bank risk, real deposits, interest rate on government bonds, return on stock market, relative bank volatility and being a cooperative or commercial bank are found to be significant factors in explaining loan supply of only private banks. All the coefficients have the expected signs. Being in the Euro area is not found to be significant in explaining the loan supply of private banks. Except for bank risk measures and lagged level of loan supply, none of the factors is found to be significant in explaining the loan supply of public banks.

affected in expansionary or contractionary periods. Interestingly, the speed of adjustment to excess loan demand is fast and significant for public banks. They seem to be doing some credit rationing when loan demand increases and adjust their interest rates faster than private banks do.

4.5 Robustness Checks

We perform several robustness checks and present the estimated coefficients on bank risk measures in Table 10.[20] In the first check, the loan market is assumed to be in equilibrium and the loan demand and loan supply functions are estimated under the market equilibrium. The results of the equilibrium model are same as those of the disequilibrium model. In particular, we find that when banks improve their capitalization, profitability, asset quality, cost efficiency, liquidity and soundness measures, their loan demand increases, controlling for loan supply and other bank and country characteristics that might affect loan demand. Since similar results are obtained under the assumption of equilibrium and disequilibrium, we conduct all other robustness checks assuming that the loan market is in disequilibrium.

INSERT TABLE 10 HERE

As a second check, we include year fixed effects and country fixed effects separately and together in both loan demand and loan supply models, in order to control for the omitted factors that change during our sample period and/or any omitted country-specific variables, such as banking structures, legal systems or accounting standards. The results are consistent with our findings that as banks improve their health, their demand increases when we control for only year fixed effects. However, when we include country fixed effects with and without year effects, the results change slightly. The results with capitalization ratio, profitability, management efficiency and asset quality measures are consistent but the soundness measure loses its significance and the coefficient on the liquidity measure changes its sign. Similar results are obtained when we include both country and year fixed effects.

To further examine whether the negative coefficient on $LIQR$ can be explained by differences in accounting standards, we identify banks that adopt the IFRS and re-estimate

[20] We do not report the results of the full models to save space. They are available from the authors upon request.

the model for these banks with country fixed effects. The coefficient of *LIQR* is found to be positive but not significant for this sample of banks. Moreover, *LLP* loses its significance. We explain these changes in coefficients with accounting treatments in measuring liquidity and loan loss provisions. Generally, the dispersion of creditors and the diversification of activities undertaken by banks make measuring liquidity risk more complex (Tirole, 2011). Although *LIQR* is the most commonly used measure for understanding whether the buffer of liquid assets held by a bank will be enough to meet its short-term liabilities, its role in signaling a bank's future difficulties is not supported by the empirical findings after controlling for country-specific factors.

We also estimate our model separately for banks that have stocks listed in the stock exchange and banks that do not. Although we expect to observe that listed banks are more likely to be monitored, our results suggest that borrowers are more likely to monitor unlisted banks than listed banks. The coefficients on bank risk measures for a sample of unlisted banks are similar to our main findings; all have the same signs and are significant. For the listed banks, the signs are as expected but the findings suggest that borrowers only consider profitability, managerial efficiency, liquidity and soundness of listed banks when they demand their loans; the other bank risk measures, that is, capital adequacy and asset quality measures, are found to be insignificant. Borrowers might think that stockholders monitor these measures of banks.

German banks constitute almost half of the sample we analyze, hence, they might dominate our findings, as indicated by Duran and Lozano-Vivas (2013). Therefore, we also estimate our models excluding German banks from the sample. Except for *LLP* and *COST*, the coefficients of all bank risk measures support our hypothesis that borrowers decrease their loan demand significantly as banks increase their risk. The coefficient of *LLP* is found to be positive but insignificant.

The level of bank risk may depend on its business model. For example, Lepetit et al. (2008) and De Jonghe (2010) show that banks that mainly supply loans seem to be less risky than banks with a larger share of non-interest income activities. As a last robustness check, we test whether our results are sensitive to banks' interest income. We divide banks into two groups, based on their net-interest-revenue-to-net-income ratio. We rank banks using their ratio by country and year; banks with a ratio greater than the median ratio are considered to mainly supply loans. The results suggest that, in general, borrowers monitor both types of banks; increases in banks' capitalization, profitability

and liquidity ratios significantly increase these banks' loan demands. The coefficient of loan loss provisions (LLP) is found to be significant only for banks that mainly supply loans.

5 Conclusion

One of the prerequisites for market discipline is that bank stakeholders have incentives to monitor their banks. Borrowers have such an incentive because banks' financial distress can jeopardize the viability of the valuable relationship between banks and borrowers, and it costs borrowers to establish new lending relationships (Huber, 2018). In this paper, we argue that borrowers can discipline their banks to ensure against the loss of their lending relationship, and we hypothesize that borrowers prefer to request loans from sound and less-risky banks.

The results of our analysis of banks in the EU-14 countries between 1997 and 2007 suggest that borrowers discipline their banks by reducing their loan demands from risky banks. Our findings indicate that capitalization, profitability, efficiency, asset quality and liquidity ratios are the risk measures that significantly affect banks' loan demand. Moreover, these risk measures also influence loan demand from small banks, private banks and those operating in bank-based financial systems, whereas not all of these ratios have a significant impact on the loan demand of large banks, public banks and those operating in market-based financial systems. The results for the latter samples should be interpreted with caution because in almost all the models, the instruments are not found to be significant for these samples.

Several policy implications may emerge from the results of this study. First, because our findings suggest that borrowers are less likely to influence large banks, public banks and banks operating in market-based financial systems, more-stringent capital requirements, enhanced bank transparency and intensive supervision may be necessary to limit excessive risk taking by these banks. Otherwise, market participants' belief that banks are too-big-to-fail may continue to encourage banks to grow and increase their moral hazard risk in Europe. The expectation of government assistance in the event of failure also increases public banks' incentives to take more risks at the taxpayers' expense. Our findings support the recent innovations in EU financial policy, mainly the capital requirement directive and having a single supervisory mechanism (Pagano, et al., 2014).

Second, considering the lack of binding force on national authorities regarding disciplining mechanisms, we suggest that new market disclosure rules should be developed to make investors and others (especially borrowers) more willing to use and act on available information. For example, increased information about off-balance-sheet commitments, firms' liquidity profiles, risk exposures and concentrations within and between financial institutions are necessary. The Basel Committee has already revised and introduced new liquidity rule that is fully effective by 2019. This rule requires banks to hold a minimum liquidity buffer to be able to take corrective action and it complements the minimum capital adequacy rules. We also suggest that adopting IFRS may reduce bank managers' ability to engage in income smoothing and improve the use of loan-loss provisions in signaling future credit risks.

Third, several countries try to assist distressed financial institutions by providing funding. Such resources may not be allocated efficiently if proper requirements are not imposed on their distribution.

To better understand the role of borrowers in market discipline, more research is needed on the dynamics of the bank-borrower relationship and its consequences on loan covenants. One such direction could analyze this relationship during crisis periods. Our empirical evidence confirms that in "normal" periods, borrowers can identify idiosyncratic bank risk and may influence bank behavior. However, under systemic risk, different measures may be needed to test the existence of market discipline.

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Table 1. Mean Values of Bank Risk Measures for Groups of Banks

Table 1 presents the mean values of bank risk measures of groups of banks operating in EU-14 countries for the period 1997-2007. Bank risk measures are capital-asset ratio *(CAR)*, return on average assets *(ROA)*, loan loss provisions-to-net interest revenue ratio *(LLP)*, net interest expense-to-gross revenue ratio *(COST)*, liquid assets-to-customer and short-term funds ratio *(LIQR)*, and the ratio of return on assets plus capital-asset ratio to standard deviation of return on assets *(Z-SCORE)*. *Small Banks* are those that have total assets in the lowest 90th percentile in each year in each country, whereas *Large Banks* are in the highest 10th percentile. Using the financial structure index by Demirgüç-Kunt and Levine (2001), four countries in our sample are market-based: Denmark, the United Kingdom, the Netherlands and Sweden. The other 10 countries are bank-based. Banks that adopt the IFRS are grouped as *Banks adopting IFRS*. If the stocks of a bank are listed in the stock exchanges, there are classified as *Listed Banks*. *N* indicates the number of observations included in each sub-sample.

	CAR	*ROA*	*LLP*	*COST*	*LIQR*		
	(in percentages)					*Z-SCORE*	*N*
All Banks	7.10	0.49	0.16	66.51	21.89	47.86	10,001
Small Banks	7.26	0.50	0.16	66.88	21.53	48.65	9,351
Large Banks	4.87	0.46	0.17	61.14	27.16	36.59	650
Banks in Market-Based	12.99	1.12	0.09	62.41	32.81	32.60	1,193
Banks in Bank-Based	6.31	0.41	0.17	67.07	20.42	49.94	8,808
Private Banks	7.11	0.50	0.16	66.69	21.92	47.74	9,902
Public Banks	6.45	0.35	0.23	48.68	19.20	61.31	99
Banks adopting IFRS	9.20	0.67	0.14	64.94	49.00	47.60	1,605
Banks not adopting IFRS	6.70	0.46	0.17	66.81	16.71	47.92	8,396
Listed Banks	9.24	0.94	0.14	62.53	31.72	35.09	573
Unlisted Banks	6.97	0.47	0.16	66.75	21.30	48.65	9,428

Table 2. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model

Table 2 displays the results of the limited information maximum likelihood estimates for bank loan demand under disequilibrium, for a sample of banks operating in EU-14 countries for the period 1997-2007. The dependent variable is the logarithm of the loan amount from bank i in country j in year t. It is assumed that there is excess demand in the loan market. The bottom of the table reports the results of the tests of significance of the instrument variables, *Bank Reputation* and *Output*. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. The number of observations included in the model is 10,001.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.043	0.047 *	0.027	0.042	-0.029	-0.020
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)
Bank Risk	0.551 ***	5.269 ***	-5.719 ***	-0.051 ***	0.042 ***	0.007 ***
	(0.046)	(0.356)	(1.020)	(0.011)	(0.005)	(0.002)
r	-4.239 ***	-3.845 ***	-2.781 ***	-3.035 ***	-2.903 ***	-3.067 ***
	(0.350)	(0.323)	(0.296)	(0.295)	(0.290)	(0.295)
Output	0.019 ***	0.015 ***	0.018 ***	0.020 ***	0.022 ***	0.021 ***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bank Reputation	-0.008	-0.006	-0.001	-0.005	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Stock Return	0.030 ***	0.026 ***	0.029 ***	0.030 ***	0.035 ***	0.031 ***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
σ_B/σ_M	-0.005	-0.003	-0.011 ***	-0.011 ***	-0.011 ***	-0.012 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EuroZone	-0.025 ***	-0.022 ***	-0.025 ***	-0.026 ***	-0.021 ***	-0.027 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Cooperative	0.008	0.012 **	0.020 ***	0.018 ***	0.012 **	0.020 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Commercial	-0.013 ***	-0.015 ***	-0.001	-0.001	-0.010 ***	0.003
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
L_{-1}	0.996 ***	0.993 ***	0.993 ***	0.992 ***	0.993 ***	0.993 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
γ	0.007 **	0.005	0.006 *	0.005	0.007 **	0.006
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	2.97***	2.08**	2.24***	3.38***	4.01***	3.46***
Bank Reputation	3.81***	3.62***	4.11***	3.72***	3.79***	4.04***
(b) Joint (F-test)	12.10***	8.99***	11.38***	13.21***	15.90***	14.57***

Table 3. Limited Information Maximum Likelihood Results of Bank Loan Supply for Disequilibrium Model

Table 3 displays the results of the limited information maximum likelihood estimates for bank loan supply under disequilibrium, for a sample of banks operating in EU-14 countries for the period 1997-2007. The dependent variable is the logarithm of the loan amount from bank i in country j in year t. It is assumed that there is excess demand in the loan market. At the bottom of the table, the results of the tests of significance of the instrument variables for loan supply, *Deposits* and *Bond Return*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. The number of observations included in the model is 10,001.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.152 ***	-0.094 **	-0.097 **	-0.117 ***	-0.147 ***	-0.161 ***
	(0.037)	(0.044)	(0.040)	(0.042)	(0.037)	(0.041)
Bank Risk	0.229 ***	2.742 ***	-6.565 ***	-0.025 **	0.011 **	0.005 ***
	(0.050)	(0.466)	(0.956)	(0.010)	(0.005)	(0.002)
r	2.005 ***	1.436 **	2.144 ***	2.574 ***	2.704 ***	2.656 ***
	(0.602)	(0.663)	(0.532)	(0.528)	(0.497)	(0.535)
Deposit	0.055 ***	0.049 ***	0.050 ***	0.056 ***	0.057 ***	0.058 ***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Bond Return	-0.139 ***	-0.115 ***	-0.156 ***	-0.171 ***	-0.184 ***	-0.175 ***
	(0.039)	(0.040)	(0.038)	(0.038)	(0.038)	(0.038)
Stock Return	0.037 ***	0.035 ***	0.032 ***	0.035 ***	0.035 ***	0.035 ***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
σ_B/σ_M	-0.008 ***	-0.006 **	-0.009 ***	-0.009 ***	-0.010 ***	-0.010 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EuroZone	-0.006	-0.006	-0.008 *	-0.007	-0.006	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Cooperative	0.020 ***	0.020 ***	0.025 ***	0.024 ***	0.023 ***	0.026 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Commercial	0.005	0.001	0.008 ***	0.010 ***	0.008 ***	0.014 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
L_{-1}	0.952 ***	0.956 ***	0.956 ***	0.950 ***	0.950 ***	0.949 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Deposit	17.98 ***	17.28 ***	16.62 ***	17.33 ***	17.08 ***	17.54 ***
Bond Return	-4.05 ***	-3.67 ***	-4.5 ***	-4.78 ***	-5.07 ***	-4.87 ***
(b) Joint (F-test):	165.19 ***	151.24 ***	142.22 ***	154.98 ***	152.35 ***	158.94 ***

Table 4. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Small Banks

Table 4 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for small banks operating in EU-14 countries for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated for a sample of small banks. Small banks are defined as those that have total assets in the lowest 90th percentile in each year in each country. The number of observations used in the estimations is 9,352. At the bottom of the table, the results of the tests of significance of the instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.070 **	0.020	0.003	0.018	-0.059 **	-0.045
	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)	(0.031)
Bank Risk	0.531 ***	5.013 ***	-6.234 ***	-0.051 ***	0.045 ***	0.006 ***
	(0.045)	(0.357)	(1.051)	(0.011)	(0.005)	(0.002)
r	-4.035 ***	-3.666 ***	-2.630 ***	-2.908 ***	-2.787 ***	-2.917 ***
	(0.351)	(0.327)	(0.302)	(0.300)	(0.295)	(0.300)
Output	0.020 ***	0.016 ***	0.018 ***	0.021 ***	0.023 ***	0.021 ***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bank Reputation	-0.024 **	-0.021 *	-0.020 *	-0.022 *	-0.021 *	-0.022 *
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Stock Return	0.027 ***	0.022 ***	0.025 ***	0.026 ***	0.031 ***	0.026 ***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
σ_B/σ_M	-0.006 *	-0.003	-0.012 ***	-0.011 ***	-0.011 ***	-0.013 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EuroZone	-0.027 ***	-0.024 ***	-0.027 ***	-0.028 ***	-0.023 ***	-0.030 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Cooperative	0.009 *	0.013 **	0.020 ***	0.018 ***	0.012 **	0.020 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Commercial	-0.014 ***	-0.015 ***	-0.002	-0.001	-0.011 ***	0.003
	(0.004)	(0.004	(0.003)	(0.003)	(0.004)	(0.003)
L_{-1}	0.998 ***	0.995 ***	0.995 ***	0.994 ***	0.994 ***	0.994 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
γ	0.007 **	0.005	0.007 *	0.005	0.008 **	0.006 *
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	2.55 **	1.73 *	1.74 *	2.93 ***	3.73 ***	3.02 ***
Bank Reputation	0.54	0.59	0.77	0.53	0.47	0.53
(b) Joint (F-test)	3.61 **	1.81	2.00	4.68 ***	7.36 ***	4.93 ***

Table 5. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Large Banks

Table 5 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for large banks operating in EU-14 countries for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated for a sample of large banks. Large banks are defined as those that have total assets in the highest 10th percentile in each year in each country. The number of observations used in the estimations is 650. At the bottom of the table, the results of the tests of the significance of instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	0.361 **	0.483 ***	0.375 **	0.367 **	0.374 **	0.315 *
	(0.170)	(0.161)	(0.165)	(0.168)	(0.166)	(0.170)
Bank Risk	1.219 **	8.384 ***	-1.767	0.008	0.000	0.012
	(0.596)	(2.126)	(4.539)	(0.052)	(0.028)	(0.009)
r	-6.387 **	-5.043 ***	-4.854 **	-4.888 **	-4.637 **	-5.328 ***
	(2.690)	(1.934)	(1.911)	(2.229)	(1.916)	(2.032)
Output	0.011	0.006	0.012	0.012	0.012	0.013
	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)
Bank Reputation	0.055 *	0.040	0.034	0.033	0.033	0.038
	(0.030)	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)
Stock Return	0.097 ***	0.088 ***	0.101 ***	0.102 ***	0.103 ***	0.100 ***
	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
σ_B/σ_M	0.013	0.013	0.007	0.006	0.006	0.007
	(0.016)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)
EuroZone	0.005	0.009	0.013	0.013	0.013	0.011
	(0.019)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Cooperative	0.006	0.012	0.033	0.033	0.033	0.033
	(0.026)	(0.021)	(0.020)	(0.020)	(0.022)	(0.020)
Commercial	0.010	0.003	0.018	0.018	0.018	0.025
	(0.016)	(0.015)	(0.014)	(0.014)	(0.015)	(0.016)
L_{-1}	0.970 ***	0.967 ***	0.972 ***	0.972 ***	0.971 ***	0.972 ***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)
γ	-0.006	-0.006	-0.006	-0.008	-0.006	-0.006
	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	1.45	1.04	1.49	1.73 *	1.37	1.48
Bank Reputation	0.79	1.07	0.85	1.02	0.83	1.03
(b) Joint (F-test)	1.31	1.06	1.41	1.89	1.21	1.53

Table 6. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Bank-Based Systems

Table 6 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for banks operating in European countries with bank-based financial systems for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated. The countries with bank-based financial systems are Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Portugal and Spain. The number of observations used in the estimations is 8,797. At the bottom of the table, the results of the tests of significance of instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.092 **	0.012	-0.037	-0.040	-0.132 ***	-0.123 ***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.039)
Bank Risk	0.714 ***	5.974 ***	-6.435 ***	-0.055 ***	0.053 ***	0.009 ***
	(0.056)	(0.408)	(1.022)	(0.011)	(0.006)	(0.002)
r	-4.783 ***	-3.905 ***	-3.141 ***	-3.414 ***	-3.338 ***	-3.544 ***
	(0.405)	(0.358)	(0.345)	(0.344)	(0.340)	(0.347v
Output	0.020 ***	0.014 ***	0.018 ***	0.022 ***	0.025 ***	0.023 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Bank Reputation	-0.013 **	-0.010	-0.008	-0.012 *	-0.008	-0.009
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Stock Return	0.013	0.013 *	0.021 ***	0.022 ***	0.028 ***	0.022 ***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
σ_B/σ_M	0.011 ***	0.010 ***	0.007 **	0.008 **	0.009 ***	0.007 **
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EuroZone	-0.033 ***	-0.028 ***	-0.022 ***	-0.022 ***	-0.016 ***	-0.023 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Cooperative	0.007	0.014 ***	0.025 ***	0.023 ***	0.015 ***	0.026 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Commercial	-0.008 **	-0.008 **	0.009 ***	0.010 ***	-0.002	0.016 ***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
L_{-1}	0.999 ***	0.996 ***	0.997 ***	0.996 ***	0.996 ***	0.996 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
γ	0.008 **	0.004	0.007 *	0.005	0.008 **	0.006 *
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	6.88 ***	5.65 ***	5.72 ***	7.30 ***	7.73 ***	7.45 ***
Bank Reputation	4.18 ***	4.00 ***	4.38 ***	3.91 ***	4.05 ***	4.34 ***
(b) Joint (F-test)	31.66 ***	23.30 ***	25.34 ***	33.71 ***	37.35 ***	35.91 ***

Table 7. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Market-Based Systems

Table 7 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for banks operating in European countries with market-based financial systems for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated. The countries with market-based financial systems are Denmark, the Netherlands, Sweden, and the United Kingdom. The number of observations used in the estimations is 1,193. At the bottom of the table, the results of the tests of significance of the instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	0.016	0.043	0.090	0.120	0.106	0.080
	(0.086)	(0.079)	(0.078)	(0.080)	(0.079)	(0.084)
Bank Risk	0.227 **	4.249 ***	4.422	-0.071 *	-0.030	0.001
	(0.115)	(0.952)	(4.966)	(0.037)	(0.023)	(0.009)
r	-5.068 ***	-5.693 ***	-4.930 ***	-5.001 ***	-4.953 ***	-4.790 ***
	(0.885)	(0.946)	(0.904)	(0.869)	(0.885)	(0.842)
Output	0.036 ***	0.038 ***	0.035 ***	0.037 ***	0.035 ***	0.035 ***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Bank Reputation	-0.050 *	-0.046	-0.056 **	-0.055 *	-0.052 *	-0.054 *
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Stock Return	0.067 **	0.044	0.070 **	0.062 **	0.063 **	0.067 **
	(0.029)	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)
σ_B/σ_M	-0.074 ***	-0.065 ***	-0.074 ***	-0.074 ***	-0.073 ***	-0.074 ***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
EuroZone	-0.160 ***	-0.162 ***	-0.160 ***	-0.170 ***	-0.163 ***	-0.160 ***
	(0.030)	(0.030)	(0.030)	(0.031)	(0.031)	(0.030)
Cooperative	0.013	0.030	0.008	0.015	0.005	0.007
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Commercial	-0.029 **	-0.033 **	-0.033 **	-0.033 **	-0.029 **	-0.032 **
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
L_{-1}	0.986 ***	0.982 ***	0.983 ***	0.983 ***	0.983 ***	0.984 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
γ	0.012	0.015	0.012	0.013	0.012	0.011
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	1.71*	1.84*	1.74*	1.78*	1.72*	1.59
Bank Reputation	-0.14	-0.04	-0.15	-0.16	-0.21	-0.10
(b) Joint (F-test)	1.48	1.75	1.53	1.60	1.49	1.29

Table 8. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Private Banks

Table 8 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for privately owned banks operating in EU-14 countries for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated. The number of observations used in the estimations is 9,903. At the bottom of the table, the results of the tests of significance of the instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.042	0.047	0.027	0.048	-0.028	-0.023
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)
Bank Risk	0.548 ***	5.204 ***	-5.455 ***	-0.060 ***	0.041 ***	0.007 ***
	(0.045)	(0.352)	(1.032)	(0.011)	(0.005)	(0.002)
r	-4.077 ***	-3.759 ***	-2.726 ***	-2.943 ***	-2.843 ***	-2.987 ***
	(0.333)	(0.310)	(0.286)	(0.284)	(0.280)	(0.285)
Output	0.019 ***	0.015 ***	0.018 ***	0.020 ***	0.022 ***	0.020 ***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bank Reputation	-0.002	-0.002	0.003	-0.000	0.002	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Stock Return	0.032 ***	0.027 ***	0.030 ***	0.031 ***	0.036 ***	0.032 ***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
σ_B/σ_M	-0.005 *	-0.003	-0.012 ***	-0.011 ***	-0.011 ***	-0.013 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EuroZone	-0.024 ***	-0.022 ***	-0.024 ***	-0.025 ***	-0.021 ***	-0.027 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Cooperative	0.007	0.011 **	0.019 ***	0.017 ***	0.012 **	0.020 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Commercial	-0.013 ***	-0.015 ***	-0.002	-0.002	-0.010 ***	0.004
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
L_{-1}	0.997 ***	0.993 ***	0.993 ***	0.993 ***	0.993 ***	0.993 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
γ	0.006 *	0.004	0.005	0.004	0.006 *	0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	2.87 ***	2.01 **	2.20 **	3.32 ***	3.89 ***	3.40 ***
Bank Reputation	3.96 ***	3.82 ***	4.21 ***	3.88 ***	3.93 ***	4.18 ***
(b) Joint (F-test)	12.34 ***	9.55 ***	11.66 ***	13.55 ***	15.91 ***	14.91 ***

Table 9. Limited Information Maximum Likelihood Results of Bank Loan Demand for Disequilibrium Model - Public Banks

Table 9 displays the results of the LIML estimates for only the demand for bank loans, assuming disequilibrium, for public banks operating in EU-14 countries for the period 1997-2007 using six different bank risk measures. The model specified in equations (1)-(4) is estimated. The number of observations used in the estimations is 98. At the bottom of the table, the results of the tests of significance of the instrument variables, *Bank Reputation* and *Output*, are reported. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Bank Risk Measures					
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*
Intercept	-0.385	-0.115	0.077	-0.364	-0.171	-0.044
	(0.648)	(0.532)	(0.522)	(0.525)	(0.512)	(0.550)
Bank Risk	-0.201	8.589 *	-21.074***	0.171 **	0.164 ***	-0.030 *
	(0.372)	(5.013)	(6.405)	(0.074)	(0.048)	(0.018)
r	1.197	-1.230	-3.099	-2.912	0.340	-0.513
	(3.090)	(2.760)	(2.742)	(3.223)	(2.514)	(2.782)
Output	0.031	0.013	0.018	0.029	0.013	0.005
	(0.047)	(0.038)	(0.037)	(0.038)	(0.037)	(0.039)
Bank Reputation	-0.019	-0.042	0.021	0.014	-0.027	-0.016
	(0.044)	(0.039)	(0.041)	(0.044)	(0.038)	(0.040)
Stock Return	0.031	0.011	-0.029	0.023	0.004	0.026
	(0.055)	(0.055)	(0.055)	(0.053)	(0.052v	(0.054)
σ_B/σ_M	0.024	0.018	0.021	0.031	0.024	0.030
	(0.026)	(0.025)	(0.024)	(0.025)	(0.024)	(0.026)
EuroZone	0.009	-0.008	-0.029	-0.009	-0.002	0.001
	(0.030)	(0.030)	(0.030)	(0.029)	(0.027)	(0.029)
Commercial	-0.002	-0.030	0.057	0.053	-0.037	0.021
	(0.042)	(0.034)	(0.042)	(0.049)	(0.035)	(0.045)
L_{-1}	1.000 ***	0.999 ***	0.986 ***	0.996 ***	0.999 ***	1.006 ***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)
γ	0.105 ***	0.125 ***	0.096 ***	0.087 ***	0.080 **	0.088 **
	(0.033)	(0.033)	(0.031)	(0.033)	(0.032)	(0.033)
Specification Tests: Test of significance of instruments in the first-stage regression						
(a) Individual (t-test):						
Output	0.49	0.33	0.51	0.75	0.33	0.06
Bank Reputation	-0.55	-1.09	0.38	0.18	-0.67	-0.32
(b) Joint (F-test)	0.62	1.04	0.14	0.30	0.48	0.08

Table 10. Robustness Tests: The Coefficients of *Bank Risk* under Different Models and Samples.

Table 10 represents the estimated coefficients of *Bank Risk* variables for the loan demand equation. Each row represents a different specification. The *"Equilibrium Model"* row presents the coefficients for the model specified in equations (1) and (2), assuming that the bank loan market is in equilibrium. The *"Country Fixed-Effect Model"* row presents the results for the disequilibrium model, with country fixed effects included in the model for both loan demand and loan supply. The *"Banks Adopting IFRS"* row indicates the estimations controlling for country-fixed effects for the sample of banks that adopted IFRS. The *"Listed Banks"* and *"Unlisted Banks"* rows present the results of the estimations for a sample of banks that are listed and not listed in the stock exchange, respectively. The *"Excluding Banks in Germany"* row presents the coefficients of for a sample of banks that operate in all the sample countries except Germany. The *"Interest Income Below Median"* and *"Interest Income Above Median"* rows present the coefficients for the sample of banks that operate in country i and have interest income in year t that is less than or equal to, and greater than the median interest income in country i in year t, respectively. Standard errors are presented below the parameter estimates in parentheses. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. N represents the number of observations used in each estimation.

	Bank Risk Measures						
	CAR	*ROA*	*LLP*	*COST*	*LIQR*	*Z-SCORE*	*N*
Equilibrium Model	0.546 ***	5.174 ***	-5.574 ***	-0.052 ***	0.041 ***	0.007 ***	10,001
	(0.046)	(0.358)	(1.023)	(0.011)	(0.005)	(0.002)	
Year Fixed Effect	0.590 ***	5.432 ***	-4.105 ***	-0.051 ***	0.037 ***	0.007 ***	10,001
	(0.048)	(0.367)	(1.036)	(0.011)	(0.005)	(0.002)	
Country Fixed-Effect Model	0.375 ***	6.484 ***	-1.943 *	-0.131 ***	-0.052 ***	0.003	10,001
	(0.051)	(0.423)	(1.144)	(0.013)	(0.007)	(0.002)	
Banks Adopting IFRS	0.355 ***	5.052 ***	0.961	-0.045 *	0.010	0.000	1,605
	(0.110)	(0.839)	(3.158)	(0.026)	(0.010)	(0.005)	
Year and Country Fixed Effect	0.373 ***	6.352 ***	-0.729	-0.132 ***	-0.048 ***	0.003	10,001
	(0.051)	(0.427)	(1.143)	(0.013)	(0.007)	(0.002)	
Listed Banks	0.248	3.297 ***	-6.381	-0.202 ***	0.038 *	0.041 ***	572
	(0.218)	(1.102)	(4.720)	(0.048)	(0.021)	(0.009)	
Unlisted Banks	0.578 ***	5.422 ***	-5.789 ***	-0.042 ***	0.044 ***	0.005 **	9,428
	(0.048)	(0.376)	(1.047)	(0.011)	(0.006)	(0.002)	
Excluding Banks in Germany	0.520 ***	4.510 ***	0.628	-0.012	0.028 ***	0.016 ***	5,401
	(0.062)	(0.465)	(1.765)	(0.016)	(0.007)	(0.003)	
Interest Income Below Median	0.602 ***	5.615 ***	-2.487	-0.055 ***	0.036 ***	0.009 ***	5,014
	(0.067)	(0.544)	(1.686)	(0.017)	(0.008)	(0.003)	
Interest Income Above Median	0.417 ***	9.057 ***	-8.317 ***	-0.037 **	0.044 ***	0.005 **	4,986
	(0.065)	(0.788)	(1.181)	(0.015)	(0.006)	(0.002)	

Table A1. Distribution of Banks in the Sample by Country and Year.

Countries	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Austria	48	100	98	107	108	112	118	138	135	137	139	1240
Belgium	27	20	28	25	15	13	11	14	12	14	8	187
Denmark	51	44	54	46	49	57	56	51	32	23	38	501
Finland	4	3	2	4	3	3	4	4	2	3	3	35
France	64	79	77	66	81	65	64	54	53	40	39	682
Germany	406	475	474	475	448	399	414	379	380	377	373	4600
Greece	0	0	0	0	0	0	0	7	7	6	3	23
Italy	161	150	155	143	127	120	132	144	130	109	108	1479
Luxembourg	49	34	36	40	28	26	18	24	18	13	16	302
Netherlands	9	2	6	2	6	8	9	6	9	5	8	70
Portugal	1	1	2	1	4	4	4	8	3	10	10	48
Spain	23	17	14	10	11	9	2	26	20	37	43	212
Sweden	5	5	2	5	9	54	59	59	53	50	61	362
U.K.	31	22	10	18	27	26	29	26	22	24	25	260
Total	879	952	958	942	916	896	920	940	876	848	874	10,001

Source: Authors' calculations using Bankscope dataset.

Table A2. Definition of the variables included in the model.

Variables	*Definitions*	*Source*
CAR	Total Equity/Total Assets	Bankscope
ROA	After-tax Net Income/Total Assets	Bankscope
LLP	Loan Loss Provisions/Net Interest Revenue	Bankscope
COST	Non-interest Expense/Gross Revenues	Bankscope
LIQR	Liquid Assets/(Customer and Short-term Funding)	Bankscope
Z-SCORE	Natural logarithm of $(1+[(ROA+CAR)/\sigma_{ROA}])$	Bankscope
L	Natural Logarithm of Real Loans	Bankscope
r	Net Interest Revenue/Average Earning Assets	Bankscope
Output	Natural Logarithm of GDP in constant prices	WDI
Stock Return	Mean Annual Return on Stocks, calculated using FTSE Stock index	Datastream
Bank Reputation	Dummy variable taking a value of 1 for banks at the highest 10-percentile of all banks ranked based on their total assets in a country in a year, and 0 otherwise	Bankscope
Deposits	Natural Logarithm of Real Deposits	Bankscope
Bond Return	Mean Annual Return on 3-5 Year Government Bonds	Datastream
EuroZone	Dummy variable taking a value of 1 for the countries that are in the Euro zone in the corresponding year, and 0 otherwise	
Cooperative	Dummy variable taking a value of 1 for cooperative banks, and 0 otherwise	Bankscope
Commercial	Dummy variable taking a value of 1 for commercial banks, and 0 otherwise	Bankscope
σ_B/σ_M	Ratio of standard deviation of returns of bank stocks to that of market return	Datastream

Notes: WDI stands for World Development Indicators Database maintained by the World Bank Group.

Table A3. Descriptive Statistics.

Variable	Mean	Standard Deviation	Minimum	Maximum
CAR(%)	7.1023	4.2550	1.9200	37.3700
ROA	0.0049	0.0050	-0.0105	0.0302
LLP	0.1611	0.0013	-0.0019	0.0070
COST	0.6651	0.1226	0.2101	1.1935
LIQR	0.2189	0.2826	0.0006	1.1346
Z-SCORE	47.8700	35.6800	2.0800	200.3100
r	0.0273	0.0100	0.0027	0.0639
L	13.3417	1.4630	9.0474	17.4444
Deposits	13.7823	1.4025	10.3112	17.8618
Bank Reputation	0.0699	0.2550	0.0000	1.0000
Cooperative	0.0833	0.2763	0.0000	1.0000
Commercial	0.3213	0.4670	0.0000	1.0000
Output	12.2084	0.7399	9.7741	14.6305
Stock Return	0.0757	0.1990	-0.5921	0.6717
Bond Return	-0.0214	0.0380	-0.1492	0.1618
σ_B/σ_M	1.4818	0.4558	0.1976	2.5754
EuroZone	0.7205	0.4488	0.0000	1.0000