The Interbank Market Puzzle

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Preliminary, comments welcome!

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Abstract

This study documents significant differences in the interbank market lending and borrowing levels across countries. We argue that the existing differences in interbank market usage can be explained by the trust of the market participants in the stability of the country's banking sector and counterparties. We test our assumptions by employing different proxies for trust in the banking system and by controlling for bank-specific risk. We find that banks originating from a country that has experienced longer periods of banking crises or more bank failures are able to attract less interbank deposits. However, we find that the quality of legal regulations and institutions can help mitigate the adverse impact of the low level of trust in the banking system. Hence, institutional factors might partially substitute for the limited trust and enhance interbank activity.

JEL codes: G01, G21, G28

Key words: interbank market, trust, counterparty risk, crises, legal enforcement, regulations

1 Introduction

The interbank market is an informal market in which banks borrow and lend each other funds up to established internal limits based on an institution's risk appetite. The interbank market is now global. It has no centralized location and funds flow simultaneously worldwide. On one hand, the interbank market plays crucial roles in domestic financial systems because first, central banks intervene in this market to guide policy interest rates, and second, efficient liquidity transfer can occur between surplus and needy banks through a well-functioning interbank market (Furfine, 2001; Acharya et al., 2008). Moreover, theoretical studies suggest that interbank markets allow risk sharing (Bhattacharya and Gale, 1987). After the 2007–2009 global financial crisis, studies find that efficient risk sharing through the interbank market might not occur during crises due to moral hazard and market frictions in the lending market. In particular, the financial problems of investment bank Bear Sterns and the failure of Lehman Brothers showed that interbank markets can be an important channel of contagion. Interbank exposure might present a systematic risk to the stability of the financial system. The crisis events of 2007 resulted in a significant increase in market rates and a simultaneous decrease in transaction volume in the interbank market. According to Afonso et al. (2011), the situation in the interbank market can be explained by the increase in counterparty risk and precautionary liquidity hoarding in anticipation of future shortages.

On the other hand, we still know very little how the interbank market works, despite the existence of many recent studies on interbank market risk and interconnections. We know that the interbank market allows banks to adjust the volume of assets and liabilities as well as to manage the interest and exchange rate risks that arise from customer business. Hence, there is a great variation between banks in their use of the interbank market within each country's banking sector. Moreover, the average ratio of interbank activities to total bank positions seems to be quite stable over a long horizon (BIS, 1983). The difference, however, is the position of the interbank market across countries. The average ratio of loans to depository institutions to total assets of insured commercial banks in the United States (US) was 1.81% from 1934 to 2015,

1 while that for Germany was 20.61% from 1950 to 2015.2 Figure 1 shows the average share of interbank lending and borrowing in commercial bank assets for the US, Japan, France, Germany, and the UK. During 2000-2014, the size of interbank lending as measured by the share of interbank lending to total assets was significantly higher in France and Germany than in Japan and US (2%-4%). Similarly, the share of interbank deposits as measured by the share of interbank deposits to total liabilities and equity was also significantly higher in France and Germany than in Japan and the US.

FIGURE 1A &1B

These data raise several important questions that have remained unexplored up to now. Why is there such a difference in the size of the interbank market across countries? What determines the participation of banks in the interbank market? Is risk sharing better in those countries with greater usage of the interbank market? Our study attempts to shed light on these questions by using a cross-country dataset on banking sector characteristics and by controlling for bank-specific risk.

Our sample covers all domestic commercial, cooperative, and savings banks with available information on interbank borrowings from 1995 to 2015. We analyze only interbank borrowing, as it allows us to control for bank-specific risk, which determines the level of activity of banks in the interbank market (Heider et al., 2015; Sarmiento, 2016). Henceforth, we use the terms "interbank borrowing" and "interbank deposits" interchangeably, yet it should be underlined that interbank borrowings include both deposits and loans. In the interbank market, banks have a powerful incentive to monitor each other, as interbank deposits and loans are not insured and often uncollateralized (Furfine, 2001). Rochet and Tirole (1996), however, highlight that peer monitoring can be weakened by government interventions.

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[1] The data are from the US FDIC for insured commercial banks, available at: https://www5.fdic.gov/sdi/main.asp?formname=standard

[2] The data are from Deutsche Bundesbank, available at: http://www.bundesbank.de/Navigation/EN/Statistics/Banks_and_other_financial_institutions/Banks/banks.html

We drop foreign-owned banks from the sample, as their interbank activities through internal capital markets can be very different from those of domestic banks. De Haas and Van Lelyveld (2010) provide evidence for the existence of internal capital markets within multinational banks. The authors show that through the internal capital market, parent banks support subsidiaries in countries where economic conditions are improving, but decrease their activities in countries where economic conditions are deteriorating.

Lastly, we match the domestic bank-level data with data on country-level characteristics, such as structure of financial system, central bank assets, and legal and institutional characteristics. Moreover, we use several proxies for trust in the banking sector, which, in our opinion, can determine the differences of banks' interbank deposits across countries. As mentioned above, the interbank market is an informal market and initially, was mainly a market of short-term placement of deposits (Bernard and Bisignano, 2000). Nowadays, the market is very international and banks located throughout the world participate in domestic market making as well as cross-border transactions. The main criteria for participation are that the bank establishes itself as creditworthy compared to other banks and is not constrained by domestic regulations. The transactions are arranged by the banks' dealers over the phone and the deal is confirmed by subsequent exchanges of confirmation between the banks. However, the dealer performs the transactions within limits, which are set up based on internal assessment of risk of counterparties.

In the case of a failure, the interbank deposits are most likely to be lost, as they are not insured. Meanwhile, the likelihood that the bank will fail depends on its financial situation and the attitude of the supervisor authority and governments to bank failure. Thus, in this study, we define trust as the subjective assessment of the stability of the banking sector and the risk of counterparties. Hence, trust varies strongly across institutions as well as countries.

Indeed, our results indicate that, first, trust is crucial in determining the interbank market size. Higher trust helps banks to obtain liquidity in this unsecured market through mitigating information asymmetries about counterparty credit risk and developing lending relationships. The level of trust in this market can be influenced by the historical stability of the banking sector. Therefore, in order to measure trust, we use the length of banking crisis and the number

of bank failures in history as a proxy. If a bank is located in a country that has experienced longer periods of banking crisis or more bank failures in the past, trust can be weaker and support less interbank activities given the counterparty credit risk and the possible adverse selection in this market. This effect is present when we control for law enforcement, legal origin, and other country-level characteristics.

Second, legal and regulatory institutions play an important role in explaining the difference in interbank market participation at the country level. Numerous studies suggest that legal and institutional differences shape both the price and non-price terms of bank loans around the world (Qian and Strahan, 2007). Consistently, we find that these ex-post mechanisms in institutions can benefit the development of the interbank market. More importantly, these institutional factors can mitigate the adverse effect of crises on interbank activities and further help to build trust in the interbank market.

Third, banks with higher liquidity mismatch and risk tend to have higher demand for interbank borrowing during normal periods, whereas during crises, such banks have less access to the interbank market. We want to ascertain that trust is not a proxy for other determinants for interbank market participation. This finding on the association between bank risk and interbank activities is consistent with the relationships allowing banks to access liquidity in the presence of market frictions, such as transactions and information costs. Based on the market discipline theory, participants of the unsecured interbank market have incentives to monitor their counterparties due to the lack of collateral to hedge counterparty risk. Hence, riskier banks are expected to be credit rationed although they might have higher liquidity needs (Furfine, 2001; Ashcraft and Bleakley, 2006; King, 2008). Moreover, consistent with studies on interbank lending relationship (Cocco et al., 2009), we document that larger banks are more likely to be borrowers in the interbank market.

A major endogeneity concern with our investigation is that some other country features, for example, the structure of the financial system, might affect the functions of the banking system as well as crises in the past (Allen et al., 2012), and hence, could further influence interbank activities. In order to isolate these possibilities, we employ a matching algorithm to define a treated group of banks located in countries with the longest duration of banking crises

and a control group of banks with comparable size, located in the counties with the lowest duration of crises, yet similar financial structure. After the matching, we find the effect is still present while the economic impact of crises is even stronger.

In order to examine the causal effect of laws and institutions further, we identify those countries that have experienced improvement of legal enforcement and explore whether and how the banks located in these countries respond differently through interbank activities to crises compared to those located in other countries without such institutional changes. We find that strengthening of legal enforcement can mitigate the impact of crises on the association between market discipline and interbank borrowings. In other words, our results provide evidence that laws and institutions might substitute for market discipline in the interbank market.

Our study contributes to the literature on the lending relationship in the interbank market in the following three ways. First, to best to our knowledge, this is the first study to present significant differences in banks' usage of interbank market across countries. Afonso, Kovner and Scholar (2013) show that there is substantial heterogeneity in the structure of the trading relationship in the US overnight interbank lending market. Some banks rely on spot transactions, while most form stable, concentrated borrowing relationships to hedge liquidity needs. These borrowers with concentrated interbank relationships can be almost completely insulated from exogenous shocks. Cocco et al. (2009) use a unique dataset on the Portuguese interbank market and show that the relationships are an important determinant of interbank market activities. Larger banks with more imbalance in their reserve deposits are more likely to borrow funds from other banks than are those with less imbalance. Bräuning and Fecht (2016) use German interbank payment data and support the view that established relationships matter for the availability of interbank credit and affect the reallocation of liquidity through the interbank market. However, none of these studies utilizes cross-country interbank market data or documents differences in interbank market usage across countries. An important question is what determines the development of the interbank market. Using the evidence of domestic banks from 96 countries, we document that trust and institutions are both important determinants of interbank activities.

Second, we contribute to the literature on interbank liquidity during crisis periods. Freixas and Jorge (2008) and Bruche and Suarez (2010) argue that during crises, there might be a reduction in interbank lending due to increased borrowers' counterparty risk, while Caballero and Krishnamurthy (2008), Acharya and Skeie (2009), and Allen et al. (2009) attribute it to lenders' liquidity hoarding. Afonso et al. (2011), using the US overnight interbank market around the time of the Lehman bankruptcy, show that counterparty credit risk plays a larger role than precautionary liquidity hoarding does. Acharya and Merrouche (2011), using a sample of large settlement banks in the UK, report that after the crisis of 2007–2008, liquidity demand was precautionary in nature in that it increased on days of high payment activity and for banks with greater credit risk. Moreover, Iyer and Peydro (2011), using the setting of the Indian banking system, find robust evidence that higher interbank exposure to failed banks leads to larger deposit withdrawals and the interbank linkages among surviving banks further propagate the shocks. Iyer et al. (2014), employing a Portuguese loan-level dataset, finds that banks that relied more on interbank borrowing before the crisis decreased their credit supply more than other banks did during the crisis.

Lastly, this study is related to the literature on the role of institutions in the development of the financial system and financial structure. Allen and Gale (1997) show that bank-based financial systems can intertemporally smooth risk, leading to higher welfare than under a market-based system. Correspondingly, risk sharing through the interbank market is clearly an important issue and needs to be incorporated into the analysis of the comparison of financial systems. A substantial body of literature tries to explain the differences of financial structure across countries from different perspectives, including law, politics, and culture (Beck et al., 2001). However, only a few of them include the interbank market and discuss its role in understanding the structural difference of financial systems. Our study provides new evidence on the association between interbank market size and structure of the banking or financial system. More importantly, we show that a country's institutional framework is important for the development of the interbank market and its improvement might help build diminished trust following a crisis.

The reminder of the paper is organized as follows. Section 2 presents the stylized facts on the significant differences in interbank activity across countries. Section 3 describes the data and summary statistics of our sample and provides country-level evidence on the interbank market. Section 4 presents the methodology and main results. In Section 5, we expand our investigation on the impact of trust in the interbank market and present the results of robustness tests. Section 5 concludes.

2 Stylized facts

This section provides a cross-country overview of interbank market activity. Figures 2A and 2B show the structure of bank assets and liabilities for five countries: the US, Japan, France, Germany, and the UK from 2000 to 2009. On average, the ratio of interbank loans to total bank assets is 2.4% for the US during this period, followed by Japan with a ratio of 4.9% and the UK with a ratio of 13.2%. France and Germany have much higher interbank loan ratios of 28.7% and 22.5%, respectively. Regarding liabilities, US banks have the lowest ratio of interbank deposits, 2%, followed by Japan, with a ratio of 4.4%, and the UK, with a ratio of 9%. Again, France and Germany have much higher interbank deposit ratios, at 31.2% and 26.6%, respectively.

In terms of other bank assets and liabilities, France and Germany also tend to have the highest ratios of loans to deposits among the five countries, at 116.9% and 105.6%, respectively. The average ratio of loans to deposits for Japanese banks is 80.6%, the lowest among the five countries. In Japan, the ratio reflects a “balance-sheet recession” over the two decades, characterized by a change in household and company behavior toward paying down debt and increased savings, even as interest rates remain at record low levels. Consequently, the economy slowed down due to reduced household consumption and business investment (Koo, 2014).

FIGURE 2A & 2B

However, Table 1 shows some changes in the level of interbank deposits since the 2007–2009 global financial crisis. In all the countries except Japan, we observe a decline in interbank deposits relative to bank assets. The decline started in the UK and the US in 2007, while in

France and Germany, it started in 2008. By contrast, in Japan, bank deposits slightly increased, but the level remained relatively low compared to deposits held by banks in France or Germany. Interestingly, the decline in interbank loans was much lower, and in most countries, the levels of interbank loans to banks' total assets are comparable to those observed in the years prior to the crisis. An exception is the US, where interbank loans and deposits remain significantly lower than before the crisis. Although the interbank market measured as share of loans and deposits to total assets shrunk by more than 30% since 2007, it is still higher than in the US, the UK, or Japan.

TABLE 1

The observed decline in interbank deposits and lending can be explained by the increased counterparty credit risk during the crisis. Indeed, declining trust during the crisis among banks in the US, UK, and EU might explain why the level of interbank deposits in those countries or region declined following the global financial crisis. Germany and France still have lower levels of deposits, which might be the outcome of new regulations restricting government bailouts in the future.

The simultaneous changes in interbank deposits and lending confirm that banks tend to hold significant interbank exposure on both sides of the balance sheet. The observation is in line with Blume et al. (2016), who find that banks lend to other banks and borrow from other banks simultaneously, and do so persistently. The authors term this property interbank intermediation to distinguish it from the traditionally defined bank intermediation. Moreover, they show that this intermediation is derivative to the banks' client book – household and firms, which determine the build-up of interbank books.

Figure 3 presents the interbank loans and deposits to total assets for domestic banks across the EU member countries in 2016, showing significant differences in interbank market activity by country. Among the EU member countries, Germany has a relatively large interbank market, where the average interbank loans and deposits amount to 11.4% and 13.5% of total assets in 2016, respectively. In contrast, interbank loans in Finland amounted to 0.7% of total assets, while interbank deposits amounted to 0.02% of total assets in Estonia in 2016. The average

interbank loans and deposits for all EU banks remained strongly balanced and reached 5.7% of total assets.

FIGURE 3

The unbalanced structure of the balance sheet of the banks in some EU member countries might be due to foreign banks' activities. Figure 4 shows the interbank loans and assets of domestic and foreign subsidiaries and branches, and the share of foreign ownership in each country. After including the interbank activities of foreign banks, the interbank exposure on both sides of the balance sheet among the member countries is more balanced. However, Luxemburg and Malta are exceptions. Both countries are financial centers and with relatively high foreign ownership. When we account for the interbank activity of domestic and foreign banks, Luxemburg has the largest interbank market among the EU member countries. In 2016, the interbank loans and deposits in Luxemburg amount to 30.6% and 26.6% of total assets, respectively.

FIGURE 4

Lastly, Figure 5 shows the share of the total amount owed to credit institutions over total assets for domestic banks in the EU for 2007 to 2016. The data confirms the observation in Table 1 that interbank loans and deposits are not stable. In almost all countries, the amount owned to credit institutions declined over the period, which we attribute to the financial crisis of 2007-2008 and the Euro crisis of 2009. In the EU, the amount owned to all domestic credit institution over total assets declined from 15.5% in 2007 to 5.3% in 2016. During this period, only Romania, Finland, and Cyprus have higher borrowed amounts in 2016 than in 2007.

FIGURE 5

Overall, the data shows large variations in interbank activity, even among relatively homogenous countries, such as EU member states. However, across member countries, interbank exposure remained simultaneous on both sides of banks' balance sheets. Interbank deposits and loans were almost balanced for all EU banks. Moreover, we find a relatively large variation in interbank activity across time. Existing literature rarely examines these two facts, which provides the motivation for our study.

3 Data and summary statistics

3.1 Sample

We obtain financial data on commercial, cooperative, and savings banks from the Bankscope database. Our sample period is 1995 to 2015, but the panel is unbalanced, as we do not have data for all years for each bank. Our sample comprises only banks that operate as independent companies or with single locations, as multinational banks use internal capital markets to fund and support their activities across countries (De Haas and Van Lelyveld, 2010). We also exclude foreign banks in our study since their activities may be highly affected by home countries' institution. Foreign subsidiaries' interbank deposit decisions are likely to be determined more by the current policy of the multinational bank than by countries' institutional factors (See, Allen et al., 2013). Additionally, Adams-Kane et al. (2017) show that foreign bank activities are strongly influenced by the current home country's economic conditions. Thus, we decide to exclude all the foreign-owned banks, as their activities might be highly affected by the home countries' situation.

However, in countries in which the level of foreign ownership is low, the difference in the usage of the interbank market between domestic banks and all institutions is also low. In Germany, whereas foreign ownership of banks was only 5% in 2013 (Claessens and Van Horen, 2015), the average level of bank deposits to total assets for domestic and foreign banks versus only domestic banking groups and standalone banks was 16.58% and 16.32%, respectively, in 2013[3]. By contrast, in Estonia the share of foreign ownership was 97% in 2013. The differences between Germany and Estonia are significant. The average level of bank deposits to total assets for domestic and foreign banks and branches versus only domestic banking groups and standalone banks in Estonia was 0.0004% and 15.46%, respectively, in 2013.

Based on these results, we select for our sample only domestic-owned banks operating domestically. In order to establish bank ownership, we create a dataset on the evolution of

[3] The data are from the ECB statistic.

ownership for the period 1995–2015. This dataset builds on the data compiled by Claessens and Van Horen (2014), which comprises only about one-third of our sample. The full coverage is for 11,557 domestic commercial banks, savings banks, and cooperative banks from 166 countries. We drop all the countries that have less than five operating banks from our sample, thereby reducing the number of banks in the sample by 1.3%. The final sample contains 11,412 domestic banks from more than 96 countries (Appendix Table A1).

We classify a bank as domestically owned when 50% or more of its shares are held by domestic entities. As Claessens and Van Horen ownership database does not cover all the banks, we update the missing information on bank ownership using hand-collected information from various sources. The information sources used to build the dataset comprise primary Bankscope, supplemented by annual reports and national supervisory publications.

The World Bank's Global Finance Database is used for information on country-level variables on financial system development (private credit to GDP) to measure the development of banking system. Country-level variables on governance and regulation are from the Worldwide Governance Indicator (WGI) database constructed by Kaulfman, Kraay, and Mastruzzi (2010). The database contains measures of legal enforcement, regulation quality, government effectiveness, and political stability for more than 200 countries over the period 1996–2005. The information on countries' legal origin is from Djankov et al. (2007), which we update using mainly CIA Factbook. The information on the years of systematic banking crisis is from Laeven and Valencia's (2013) database. They identify 147 crises in 115 countries over the period 1973–2011, whereas we update the database for the years until 2015.

We merge the abovementioned datasets. The bank's financial data in year *t* are matched with the country-level variables, such as financial structure and regulation, in year *t-1*. We end up with more than 74,500 bank-year observations. Additional information on the definitions and sources of variables are in Appendix Table A2.

3.2 Variables and descriptive statistics

3.2.1 Interbank deposits and bank-level control variables

Table 1 presents large differences across countries in interbank deposits as well as interbank lending. We decide to investigate only interbank deposits as these data enable us to identify banks that took the deposits, but not the source (i.e., domestic or foreign). By contrast, in the case of interbank lending, we know the identities of banks that lend to other banks, but we do not know whether the bank is located in the same country or abroad. We hypothesize that trust in the country's financial system and the bank's counterparties are determinants of the differences in the interbank market across countries. Only the data on interbank deposits allow us to control for the location of the interbank funds and henceforth, we use it as the dependent variable, which is measured as deposits and borrowing from banks scaled by total asset in year *t*.

TABLE 1

Panel A of Table 2 provides detailed summary statistics for the dependent variable and the bank-level control variables used in the study. We winsorize the bank variables at 1% and 99%. The dependent variable *Interbank deposits* ranges from 0 to 1, with a mean value of 0.08 and standard deviation of 0.11. The average ratio of interbank borrowing by country for the sample is slightly higher at 0.11. The results indicate that more banks are located in countries with lower levels of interbank borrowing.

The core set of bank-level controls include the ratio of loans to deposits (*LtD*). The ratio shows a large variation among the banks in the sample, yet the mean value indicates that in the average bank, deposits exceed loans, and consequently, these banks do not need to borrow in the interbank market. Thus, we can assume that the average bank locates its surplus funds either in the interbank market or in securities, mainly government bonds. Securities provide liquidity insurance, as they can be used as collateral in the interbank market, which enables banks to pool liquidity and settle unexpected transaction flows resulting from distributional shocks without holding cash. Hence, a high ratio of total securities to total assets (*Securities*) might indicate financial stability.

Similarly, banks with a solid capital base (*Equity*) and profitability (*ROA*) should signal stability and thus, be positively related to interbank deposits. Furfine (2001) reports that borrowing banks with higher profitability and capital ratios pay lower interest rates in the interbank market. He also finds that bank size is an important determinant of transaction interest rates of interbank market participation. One explanation is that larger banks are more likely to be more creditworthy, because they are subject to too-big-to fail policies. In this study, we control for *Size* of a bank using the ratio of its assets to GDP.

Panel B of Table 2 presents the differences in bank characteristics in the two group countries, which are divided based on their systematic banking crisis experience in the past. We classify a crisis as "long" if its duration was 5 years or more. On the other hand, a crisis is defined as "short" if its duration was less than 5 years. Next, we employ one-to-one propensity score matching based on a country's financial structure to define the "short" group of banks.

TABLE 2

The comparative statistics show that banks in countries that have experienced longer periods of banking crises tend to have significantly lower levels of interbank borrowings, which is in line with our expectations. The difference is statistically significant at the 1% level. The results show that banks in countries with longer crisis have significantly lower liquidity mismatch measured by *LtD*, which could be the result of lower access to the interbank market. Moreover, banks with longer crises have higher equity ratios, which could mean that banks in those countries are forced to have more conservative policies. Surprisingly, these banks are slightly more profitable yet also smaller than banks in countries with shorter past periods of crisis. Consequently, the results indicate that there are significant differences in banks' structure between countries with different histories of bank crisis.

3.2.2 Trust in the interbank market

In the last two decades, the economic literature has recognized that trust has a positive effect on economic development (Knack and Keefer, 1997) and financial development (Guiso et al., 2004; 2008). However, the concept of trust has received interest in the finance literature only recently. Most recent research has concentrated on relationship lending, which is not

surprising, considering that the word "credit" originates from the Latin creditum, which means something entrusted to another; while in Middle French, "credit" means to believe, to trust, and to provide credit.

Harhoff and Korting (1998) analyze the lending relationship between banks and small and medium-sized (SME) firms in Germany. The authors find that there is a negative relationship between a bank manager's trust of an SME and required collateral and interest rates. Hernandez-Canovas and Martınez-Solano (2010) find that the existence of trust between a firm and a bank improves the firm's access to financing and reduces borrowing costs. Similarly, Moro and Fink (2013) find that SMEs that enjoy high levels of trust from loan managers obtain more credit and are less credit constrained. Lastly, Duarte et al. (2012) analyze the role of trust in peer-to-peer lending and found that borrowers that are seemingly more trustworthy are more likely to be funded and can receive lower rates than less trustworthy borrowers are able to.

In addition, trust seems to play an important role in the interbank market. Cocco (2009) shows that relationships are an important determinant of banks' ability to access funds and of the amount of liquidity available in the interbank market. Bräuning and Fecht (2016) shows that established lending relationships matter for both the availability and pricing of interbank liquidity. Meanwhile, Affinito (2012) shows that interbank relationships persist over time, and functioned well during the recent global financial crisis.

Thus, the empirical results have indicated that existing relationships, which are likely to be built on trust, are an important attribute of the interbank market. Harhoff and Korting (1998), however, documents that trust in the bank–firm relationship is complex and cannot be explained by other variables as duration of the relationship or the extent of competition (lenders). A popular proxy for trust in the literature is the World Values Survey, yet Glaeser et al. (2000) documents that standard survey questions do not appear to measure trust. The authors argued that answers to the survey questions are more closely related to the trustworthiness of the respondents than to their propensity to trust others. More importantly, in our study, we are interested not in individuals' perceptions, but rather in the trust of banks in the interbank market participants within a country. Trust in individual people differs significantly from the trust of an organization in the market. We define trust in our study as a bank's belief' in its peers'

honesty and good-faith commitments within the country's interbank market.Our major two proxies for trust are directly related to banking system stability, *Crisis length* and *Bank failures*, as we consider that a long banking crisis as well a significant number of bank failures are traumatic experiences for the banking sector and consequently, for the interbank market. The first proxy, *Crisis length,* is defined as the length (total number of years) of banking crises in the country over the period 1970 to 2011. Following Laeven and Valencia (2013), we define a systematic banking crisis as producing significant signs of financial distress in the banking sector and triggering significant policy interventions to assist or intervene. The starting year of the systematic banking crisis is that when both conditions are met. Meanwhile, the end of the crisis is defined as the year before both real GDP growth and real credit growth are positive for at least 2 consecutive years. In all cases, however, the duration of the crisis is truncated after 5 years, starting from the 1st year of the crisis. As a result of the truncation in some of the countries, the global financial crisis of 2007–2009 was classified as finished, yet the countries did not in fact meet the criteria for ending the crisis by 2015. We keep the methodology of Laeven and Valencia (2013), as in our opinion, the truncation of the duration of the crisis does not affect our results. In our study, we focus on those crises that result in output loss of more than 10% of GDP. We assume that large systemic banking crises might lead to a decline of trust in the banking sector, including the interbank market. After merging the banking crisis database with the bank-level datasets, we are able to identify 314 systemic banking crises across countries.

Figure 6 shows the distribution of the number of countries in our sample with different levels of banking crisis length. In the sample, 22 countries have never experienced a banking crisis, 27 countries had 1 to 3 years of banking crises, 31 countries had 4 to 6 years of crises, and 11 countries experienced more than 7 years of crises. Argentina and Ecuador are the two extreme countries that experienced a systematic banking crisis, which persisted for 10 years. The length (years) of banking crises allows us to consider both the frequency and severity of crises.

In addition, we set crisis windows spanning the 5 years of the banking crisis. The banking crisis window is proxied by the variable *Crisis*, which takes the value 1 in the year when the banking crisis became systematic, following the definition of Laeven and Valencia (2013), and 0 otherwise. The final year of the banking crisis is the year before both real GDP growth and real credit growth are positive for at least 2 consecutive years. In this way, the crisis window begins with the first signs of major problems in the banking system and finish in the moment of the recovery. However, we truncate the duration of a crisis window at 5 years, starting from the 1st year of the crisis.

FIGURE 6

The second proxy, *Bank failure*, is defined as the natural logarithm of the total number of bank failures in the country. We use the status of a bank to identify whether it has severe financial problems. If a bank is marked in the Bankscope database as "bankrupt," "active (receivership)," or "in liquidation," then we treat it as a bank failure. How to deal with insolvent banks, whose numbers vary across countries significantly, is a political decision. We assume that the methods used to resolve bank failures can strongly determine trust in counterparties and the financial system.

The distinctive differences in resolution of banking crises across countries shows the outcome of the savings and loan crisis (S&L) in the US and the banking crisis in Switzerland in 1991–1996. In both cases, the banking crisis affected mainly regional banks and was related to real estate booms in earlier years. As a result of the S&L crisis, US federal agencies liquidated 1,043 institutions and the total direct costs attributable to the closing of insolvent thrift institutions during 1986–1995 amounted to USD 145.7 billion (Curry and Shibut, 2000), which was around 2.5% of US GDP in 1990. In Switzerland, banks incurred estimated losses of around CHF 42 billion, which was more than 16% of Swiss GDP in 1990, yet only a single bank had to be liquidated (Westernhagen et al., (2004). In both cases, however, the number of regional banks (thrift banks) was reduced by more than 50% at the end of the banking crisis.

In the European Union (EU) too, the number of bank failures remained relatively small in comparison to the US during the global financial crisis of 2007–2009. Nevertheless, based on the US experience, the 19 Eurozone countries introduced a new institution, the Single Resolution Board, in 2016, to deal in a unified way with failing institutions in the EU. However, the financial problems of the Italian bank Banca Monte dei Pashi di Sienna shows that governments still try to circumvent the new regulation in order to save their national institutions. In our opinion, how a government deals with insolvent banks strongly determines trust within the banking sector, as bank failures are long-lasting traumatic experiences within the banking sector.

For robustness, we also use a third proxy, Bank Z-score, which measures the bankruptcy risk for individual banks. We calculate the Z-score as the ratio of a bank's leverage (capital on assets) and the mean of its ROA to the volatility of its ROA deduced from the probability that the bank's losses exceed its capital. The measure is often applied in the literature to measure the individual probability of default of banks (Laeven and Levine, 2009) as well to measure the banking system stability (Lee and Hsieh, 2014).

3.2.3 Legal origins, enforcement, and governance

The literature has shown that legal institutions and enforcement might influence the development of the financial system. Levine (1998) finds that banks are better developed in countries that protect creditors and enforce contracts effectively. He documents that countries with German-based legal systems tend to have better-developed banks and thus, he argued that the legal system materially influences banking development.

We control for legal origins using the dummy variable *Common law*, which takes the value 1 if the country has a common law legal origin, and 0 otherwise. LaPorta et al. (1998) show that common law countries emphasize the rights of creditors to a greater degree than civil law countries, including Germany. Panel B of Table 2 shows that the sample mean for the variable is 0.35, indicating that more banks are located in civil law countries in our sample.

Levine (1998) argues that enforcement of legal codes is as important as legal regulations themselves. We control for contract enforcement using the variable *Rule of law*. The variable is an estimated index on the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, and the courts. The index was developed first by Kaulfman, Kraay, and Mastruzzi (1999) and then updated every year (Kaulfman, Krayy, and Mastruzzi, 2010). The original index ranges from -2.5 (weak governance) to 2.5 (strong governance). In our sample, the index ranges from -1.89 to 2.12, with a sample mean of 1.27.

Rajan and Zingales (2003) document that there are significant changes in financial development across countries and time that cannot be explained by legal origin. The authors argue that political forces as well the current structure of the financial system are mainly responsible for these changes, whereas historical factors might also determine the developments. Similarly, Pagano and Volpin (2001) stress that political factors shape the regulations of the banking industry and its enforcements. According to these authors, political intervention is often rooted in the conflict between large and small banks as well as between the protection of creditor rights and debtor interest. Furthermore, the study shows that political forces influence the resolution of bank failures, which strongly vary across countries. Consequently, political factors shaping and enforcing regulations seems to determine the functioning of the banking industry strongly.

We use four proxies to control for the quality of the government, country regulations, and their enforcement. The first proxy is the variable *Reg. quality*, which reflects the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. The original index ranged from -2.5 (weak governance) to 2.5 (strong governance), whereas in our sample, it ranges from -2.15 to 2.25 with a sample mean of 1.16. The second proxy is the variable *Gov. effect,* which represents the quality of public services, the degree of its independence from political pressure, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The original index was also standardized from -2.5 (weak governance) to 2.5 (strong

governance). For the countries in our sample, the minimum value is -1.71 and the maximum value is 2.36, with a sample mean of 1.31. The third proxy is the variable *Accountability,* which measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The original index ranges from -2.5 (weak governance) and 2.5 (strong governance) and for the countries in our sample, it ranges from -2.1 to 1.83. The last proxy is the variable *Pol. stability*, which measures the likelihood of political instability and/or politically motivated violence. The measure is standardized from -2.5 (weak governance) to 2.5 (strong governance), while for the countries in our sample, it ranges from -2.41 to 1.66. On one hand, the mean values of the four governance indicators indicate that more banks are located in countries with stronger legal enforcement and better governance. On the other hand, the data show fairly large variations in the institutional development of countries in the sample.

3.2.4 Other country characteristics

The structure and development of a country's financial system might determine the functioning of the financial intermediaries and consequently, the interbank market. We use three variables to proxy for the characteristics of a country's financial system. First, we use *Private credit*, defined as the ratio of private credit by deposit money of banks to the country's GDP, to measure the development of the banking system. Private credit excludes credit to the public sector and cross claims of one group of intermediaries on another. Consequently, private credit is a good measure of the amount of savings channeled through intermediaries to private borrowers. Second, we control for the size of central bank assets (*Central Bank*), following Huzinga and Demirgüç-Kunt (2000), who illustrate that in developing countries, the central bank plays a relatively large role in credit provision. Third, we control for stock market development using the variable *Market cap*, which is the ratio of stock market capitalization to the country's GDP. Lastly, we control for the power of banks in a country by means of the combined market share using the assets of the three largest banks (*Concentration*). Beck et al. (2006) presented strong evidence that concentrated banking systems are more stable. Consistent with these findings, Schaeck et al. (2009) find that concentration decreases the crisis

probability and increases time to crisis. Hence, we expect that banking sector concentration will be positively related to the size of the country's' interbank market.

4 Methodology and main results

4.1 Identification strategy

Interbank markets are informal markets that enable banks to manage, pool, and redistribute their funds, and thereby provide lending and deposit facilities more efficiently. The amount borrowed and interest rate charged on interbank transactions reflects, in part, the credit risk of the borrowing institution (Broecker, 1990). This, however, does not explain the significant difference of the use of the interbank market across countries. We consider that an important factor explaining the existing differences in the interbank market is the level of trust of banks in a country's market and its peers. To test this hypothesis, we estimate the following baseline model, controlling for bank- and country-specific characteristics:

$$Interbank\ borrowing_{i,j,t} = \beta_0 + \beta_1 Bank_{i,j,t} + \beta_2 Country_{\ j,t} + \beta_3 Trust_{j,t} + \beta_4 Y_{i,j,t} + \varepsilon_{i,j,t} \quad (1)$$

where the indexes *i*, *j*, and *t* represent bank, country, and time, respectively. The vector of bank-specific variables, $Bank_{i,j,t}$, characterizes bank performance and risk. In particular, we include proxies for funding structure, securities, equity performance, and bank size. The vector of country-specific variables, $Country_{j,t}$, characterizes the countries' legal system, institutional development, and structure of financial system. The relationship between interbank borrowing and our proxies for trust, $Trust_{i,j,t,}$ is allowed to vary across countries and time. Furthermore, we include year fixed effects, $Y_{i,j,t,}$. We do not control for country fixed effects, as some country-specific variables are time invariant, such as legal origins.

4.2 Determinants of interbank deposits

The results in Table 3 document that bank and country characteristics as well trust are important in explaining the level of interbank borrowing across countries. In column (1) to (5), we use *Crisis length* as a proxy for the trust in the banking system, whereas in column (6) to

(10), we use *Bank failures*, defined by the natural logarithm of the number of bank failures in the country instead. In all the specifications, the coefficients for the variables *Crisis length* and *Bank failures* are negative and statistically significant at the 1% level. Both variables confirm that higher trust in the interbank market can improve the usage of the interbank market. The coefficients of Crisis length suggest that one more year of crisis experienced in the history may reduce the interbank deposit size by 8.7% (0.00677/0.0775). The coefficients of Bank failures also indicate that more bank failures in the past would reduce the interbank market size. In terms of economic magnitude, 1% increase in the number of bank failures is associated with 13.0% (0.0101/0.0775) decrease in interbank deposit size.

The bank-specific variables are in line with our predictions; only the coefficient for bank profitability (ROA) is not significant in all the regressions. Meanwhile, the coefficients for the remaining bank-specific variables are all statistically significant at the 1% level. The coefficient for Size is positive in all the regressions. This is in line with the findings of Cocco et al. (2009), who argue that large banks are more likely to be net borrowers whereas smaller banks tend to net lenders in the interbank market. As expected, banks with funding needs, or positive loans-to-deposit ratios, are more likely to borrow in the interbank market. Surprisingly, however, the equity ratio and the coefficient for profitability is negative in all the regressions, meaning that banks that obtain funding in the interbank market are more likely to have lower capitalization, which does not imply higher risk, taking into account that the coefficient for Securities is positively related to interbank borrowing. The funding strategy of the banks might explain the lower profitability, as interbank funding is relatively costlier than non-financial deposits are, while securities provide lower interest income than loans do.

The country-specific variables indicate that both the institutional factors and financial structure are important determinants of interbank market size. The coefficient for Common law is significant and positively related to interbank market borrowing. One explanation for this result is that common law countries provide better institutional protection for interbank market participants. Indeed, in all the specifications, the coefficients for *Rule of law*, *Reg. quality*, *Gov. effect*, *Accountability,* and *Pol. stability* are positive and statistically significantly at the 1%

level. Thus, the results indicate that institutional development is an important determinant of interbank market development.

Another explanation for this result could be that common law countries tend to have better developed financial systems (La Porta et al., 1998). The results, however, indicate that interbank market usage is larger only in countries with strong bank-based financial systems. The coefficient for *Private credit* is positive and significant in all the specifications. In terms of economic impact, 1% increase in private credit to GDP ratio brings 22.8% (0.0177/0.0775) more usage in the interbank market. By contrast, we find that central bank assets and market capitalization are negatively related to interbank borrowing and the coefficients are statistically significant. The results indicate that in countries where banks have a larger role in financial intermediation than central banks or capital markets do can be considered as having higher levels of interbank market usage. Moreover, Beck et al. (2013) find that an increase in competition has a larger impact on banks' risk-taking incentives in countries with better developed stock exchanges. Considering that the coefficient for concentration is positively and significantly related to the interbank market at the 1% level in all the specifications, the analysis again confirms the importance of banking sector stability in explaining the levels of interbank market usage.

TABLE 3

We repeat the regressions using Bank Z-score as another proxy for the trust in the banking system. In column (1) to (5) we run the regressions using the full sample while in column (6) to (10) we exclude U.S. banks. Consistently, we find that the coefficient of Bank z-score is negative in all the regressions and is statistically significant in all the specifications at the 1% level, confirming that trust in the stability of the banking sector is an important factor explaining the levels of interbank market usage across countries. The coefficient for the bank-specific variables and country-specific variables do not change much after employing a different proxy for trust and mostly remain significant at the 1% level.

5 Impact of trust on the interbank deposit market

The trade-off between counterparty risk and liquidity hoarding suggests that trust plays a key role in the unsecured interbank market. A systemic banking crisis with a number of bank failures could be a negative exogenous shock to future trust in the interbank market. The results in Tables 3 and 4 show that if a bank is located in a country with higher risk of bank failure and a large number of bank failures or longer periods of banking crises in the past, then it will borrow less on average in the interbank market. In addition, the usage of the interbank market might be strongly determined by the structure of the financial system. Claessens et al. (2010) document that recessions and financial disruptions in emerging markets are often more costly than in developed countries, and it takes more time for emerging economies to recover. The authors attribute this difference to the fact that emerging countries have less developed financial systems. Meanwhile, Demirgüç-Kunt and Levine (1999) observe the tendency for countries' financial systems to become more market-oriented as they become richer. Therefore, we can assume that in countries with bank-based financial systems, which are often emerging economies, the banking crisis has on average a stronger negative effect on the usage of the interbank market. Consequently, the structure of the financial system, especially the role of banks in intermediation, can determine our results.

TABLE 4

We use the difference-in-difference estimation technique to isolate this possibility and further explore the causality of the number of bank failures and banking crises on the development pattern of the interbank market, controlling for the structure of the financial system. As traumatic experience has a strong impact on trust (Alesina and La Ferrara, 2005), we define a treatment group and a control group of banks based on the total duration of all banking crises in the past. In the regression, the variable Treated equals 1 if the bank is located in a country with a history of past banking crisis longer than 5 years in total, and 0 otherwise. Next, we employ the propensity score-matching algorithm without replacement based on the structure and development of the financial system, Private credit and Mkt. cap., to define the control group of banks. Using the matching algorithm, we employ in the regression 6,456

treated banks (with 33,966 bank-year observations) and 4,491 control banks (with 33,966 bank-year observations). We exclude from the sample all US banks, which does not change our main results, as we show in the sensitivity analysis. US banks, however, dominate our dataset and therefore, we decide to exclude them in our further analysis, as they could bias our results.

Table 5 presents the regression results on the effect of banking crises on interbank market size using the matched sample. In all the specifications, the coefficient of Treated is negative and significant at the 1% level. Furthermore, the results are economically important, as they show that, Ceteris Paribus, banks can reduce interbank borrowing by up to 35% (0.0272/0.0775) if they are located in a country that experienced a severe banking crisis in the past.

The bank-level and country-level control variables are in line with the main results. In all but one specification, the coefficients for bank-level and country-level variables have the same signs as those in Table 4 and remain statistically significant at the 1% level. The exception is the coefficient for the variable Pol. stability, which is now insignificant.

TABLE 5

5.1 The mitigating role of legal and regulatory institutions

Numerous studies suggest that legal and institutional difference shape both the price term and the non-price terms of bank loans across the world (See, e.g. Qian and Strahan, 2007). Not surprisingly, we also find that institutions are an important factor in explaining borrowing in interbank markets. Indeed, the coefficients for legal origin and institutions were statistically significant at least at the 1% level in all the regressions. Qian and Strahan (2007) argue that improving countries' institutions might improve financial outcomes by reducing the risks associated with lending. Based on their argument, we can expect better institutions to mitigate the lack of trust in a country's interbank market following shocks from banking crises. We test this assumption by introducing an interaction term between banking crisis window and governance indicators in the regressions.

Table 6 reports the results for the crisis window and the interaction term. First, we find that a systematic banking crisis negatively effects interbank borrowing. The coefficient for the crisis window variable, *Crisis*, has statistically significant negative signs in all the regressions at the 1% level. We find that a current systematic banking crisis has a much larger negative effect on interbank market transactions than past experience does, as the coefficient for the crisis windows is significantly larger than that for the length of past banking crisis. For example the coefficient in column (1) suggest that during a banking crisis, the interbank borrowing can drop by 76.8% (0.0595/0.0775) on average. Consequently, we find strong evidence that the interbank market is likely to malfunction during a financial crisis. Acharya and Skeike (2011) explain the reduced volumes or extreme levels of rates for interbank loans during a crisis by banks' precautionary demand for liquidity. The authors argue that banks hoard liquidity and decrease term lending, which is determined by its own risk that it will be unable to roll over debt that matures before the term of the interbank loan. Similarly, Acharya and Merrouche (2012) show that banks, especially weaker ones, hoarded liquidity in response to the funding risk during the global financial crisis of 2007. The authors show that the increase of bank liquidity was precautionary in nature, whereas banks that made greater losses hoarded more liquidity during a crisis. Bräuning and Fecht (2016), on the other hand, argue that increased counterparty credit risk negatively affected interbank liquidity during the crisis of 2007. Meanwhile, Heider et al. (2015) develop a theoretical model and show that liquidity hoarding and counterparty risk were intrinsically linked during the crisis of 2007. The authors argue that as banks are forward looking and their holdings of liquidity are endogenous, they might decide to hoard liquidity anticipating an interbank market malfunctioning caused by counterparty credit risk.

However, our results show that the negative effect of the global financial crisis on interbank market malfunctioning might depend on countries' institutional frameworks. In all the regressions, the interaction terms between governance indicators and *Crisis* have significant and positive coefficients. Thus, the results indicate that in countries with better legal enforcement, regulation quality, or stronger government effectiveness and political stability, the marginal negative impact of a banking crisis on interbank borrowing would be mitigated

significantly. These results are consistent with those of Qian and Strahan (2007), who find that institutional factors enhance loan availability. Our results show that institutional factors are important for the functioning of the interbank market, including crisis periods. Indeed, the coefficients for the interaction term are larger when the crisis widow variable is interacted with proxies for legal enforcement, regulation quality, or stronger government effectiveness. Meanwhile, the coefficient for the interaction term between crisis and political stability is relatively small. There are at least two possible explanations for why those institutional factors are important during a crisis period. First, it might be easier for banks to overcome the increased counterparty credit risk in the interbank market during a crisis with high regulation quality and strong enforcement. Second, stronger government effectiveness is likely to be related to a well-functioning central bank, which might be willing to intervene in the interbank market during a crisis period. Allen et al. (2009) present a model showing that a central bank can successfully intervene to fix malfunctioning interbank markets.

TABLE 6

An important feature of the interbank market that distinguishes it from markets for longer-term loans is that lending is unsecured. Banks provide credit and deposits to other banks based on standard agreements up to a limit based on the creditworthiness of the counterparties. This means that not only the relationship but also the quality of regulation and legal enforcement might be important. The latter can substitute for weak protection of interbank market agreements. We further analyze the impact of those two factors on the interbank market by splitting the sample based on improvements of a country's legal enforcements. As a result, we obtain two subsamples of 1) banks in countries with improvements in legal enforcements and 2) banks in countries where legal enforcement remained unchanged or even weakened in the period of study.

Table 7 shows the results, where column (1) and (3) presents countries with improvements in rule of law and regulatory quality, respectively. In opposition, column (2) and (4) presents the results for countries with no improvements. In those countries, we find that banks with higher liquidity mismatch, lower equity ratio and lower profitability are more likely come to

resort to interbank market for temporary liquidity. Interestingly, in those countries bank's size seems to be important and is statistically significant at 1% level. Next, we interacted the bank level variables with the crisis window variable and find that in countries with decreasing institutional framework banks with liquidity mismatch are less likely to receive deposit through the interbank market. It appears that in those countries the interbank counterparty risk is evaluated higher than in countries with improved institutional framework, which in turn may exacerbate the malfunctioning of the interbank market during a crisis period.

Indeed, we find also that in countries with improved institutional framework the coefficients for the variable showing the length of past crisis are insignificant. In contrast, in countries with no improvements in rule of law or regulatory quality, respectively, the coefficient for past crisis length is negative and statistical significant at 1% level. In our opinion, the results indicate that an improvement in the countries institutional framework can reverse the mistrust to the banking sector following a banking crisis and improve the functioning of the interbank market.

5.2 Robustness analysis

Lastly, we performed several sensitivity analyses to gauge the robustness of our results. First, we exclude the US banks from our sample as they account for 40.5% (4,621 banks out of 11,412) observations. Hence, the results of the study may be biased by the overrepresentation of the US banks in the sample. After excluding US banks, we have in total 6,792 banks over 95 countries. Table 8 and columns (6)-(10) in Table 4 presents the results, which are highly consistent with those suggested with the main results in Table 3 and columns (1)-(5) in Table 4. Indeed, we find that the economic impact of legal and regulatory institutions on interbank market is even stronger with larger, significant, and positive coefficients.

TABLE 8

Besides their need for working balances, banks' demand for interbank funds is driven by the required reserves that they have to hold at the central bank. Links between the overnight interbank market and the market for bank reserves are determined strongly by reserve

requirement arrangements. Gray (2011) shows that the reserve requirements as well the basis of it calculations varies strongly across the countries, which in turn could influence our results. We decided, henceforth, to rerun the regression using only banks from the euro area, which are subject to the same central bank policy. As the euro zone expanded during the period of study we use two subsamples, which consists of the 11 original euro zone countries and the 19 countries that are eurozone members nowadays. Column 1 and 2 Table 9 shows the results for the two subsamples, respectively. We find that the coefficients of the proxy for trust are negatively correlated and statistical significant in the specifications, what means that our results are not determined by the central bank policy.

TABLE 9

Cocco et al. (2009) documents that bank size is an important determinant of interbank market interest rates, and of lending relationships. They find that, on average, large (small) banks tend to be net borrowers (lenders) in the market. Moreover, they find that small banks find it optimal, when borrowing funds, to concentrate their borrowing activity, however, the same is not true when lending funds. Iori et al. (2008) analyzed the trading strategies on the overnight interbank market and find that not all banks actively manage their minimum reserves. Their results indicate that smaller banks tend to keep their reserve account at the required level constantly through the maintenance period. Moreover, a network analysis provided information on the presence of two main communities of the interbank market, one mainly composed by large and foreign banks, the other composed by small banks. The existing results thus indicate that banks size may be an important determinant of interbank lending and borrowing. Indeed, in all our regression the coefficient for banks size was statistically significant at 1% level. Therefore, we have created two subsamples with banks from the upper and lower quartile based on their asset size. Columns 1 and 2 in Table 9 present the results, which are similar to those we have presented previously. The coefficients of the proxy for trust are negatively correlated and statistical significant in the specifications with the subsample of large and small banks, respectively.

Finally, the results may be influenced by major banks located in global financial centers. There has been some evidence showing that the interbank market is dominated by the offices of major banks located in the principal financial centers around the world (BIS, 1983). For the international interbank market, the main criteria for participation are that the borrowing bank establishes itself as creditworthy in the eyes of other banks and further it is not constrained by regulatory obstacles, such as exchanges controls or supervisory limits. We decided, therefore, to exclude banks from US, United Kingdom, Singapore, and Hong Kong from the sample. We find that excluding the banks from those countries does not change our main results, whereas we present the results in the Appendix Table 3A for brevity.

Concluding, the sensitivity analysis confirms the robustness of our results on the importance of trust on the activity of interbank market. However, as in other studies, our empirical analysis has its limitations. One of the problems are the proxies for trust, which in practice is difficult to measure, especially between financial institutions.

6 Conclusion

The interbank market is an informal market that enables banks to manage and redistribute their funds, and so provide financial intermediation more efficiently. The bilateral nature of the interbank market does not differ across countries. We document however that banks engagement in the interbank market differs strongly across the countries. In this study, we try to explain those differences and analyze the effect of three sets of factors related to banks borrowing in the interbank market: a) bank level variables, b) trust to the market and c) countries institutional framework.

In line with the literature we find that bank-level variables, especially bank's funding ratio and size, are important factors in explaining the level of banks activity in the interbank market. The results confirm that in an unsecured credit markets such as interbank markets, peer monitoring plays an important role. More importantly, however, we find that trust in the banking sector and peers is an important factor explaining the differences in the interbank market activity across countries. We believe that higher trust to the market and its participants helps to obtain liquidity in the interbank market through mitigating information asymmetries

about counterparty credit risk. More specifically, we show that if a bank is located in a country that has experienced longer banking crisis or more bank failures in the past, finance its activity to lesser extend using the interbank market.

Lastly, we show that countries institutional factor such as legal enforcement and regulation quality play an important role in explaining the cross-country difference in interbank participation, and may mitigate the adverse impact of banking crises or bank's failures in the past. The results are consistent with the law and finance literature showing that strong institutional framework enhance loan availability in unsecured markets as it provides better protection against bankruptcy.

We think that the last aspect is important from policy point of view taking into account the significant role of interbank market in the banking sector. It shows that the activity of the interbank market can by enhanced by improving countries institutional framework. An interesting question remains however whether the improved framework affect also the terms of interbank loans and deposits, namely the maturity and interest costs. We leave this questions for further research when more data on interbank market transactions is available.

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Figure 1A. Breakdown of 10-year-average bank assets: 2000-2009

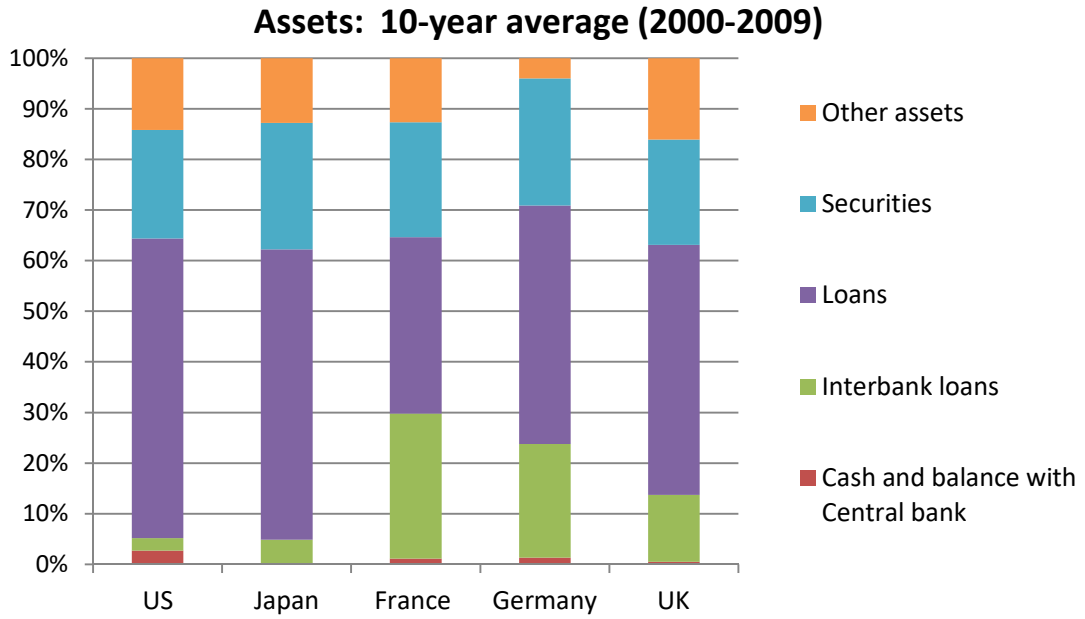
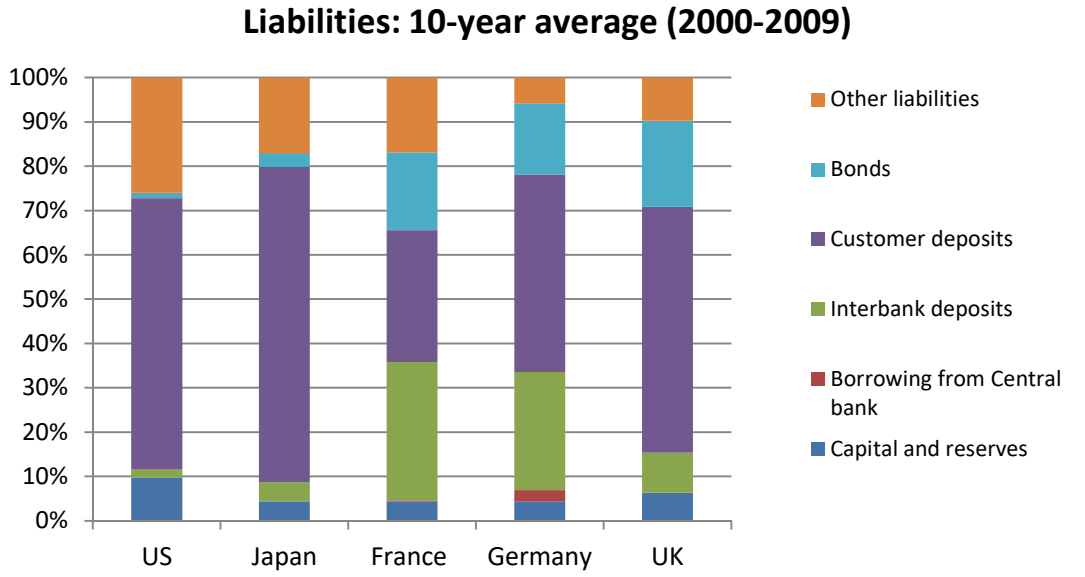


Figure 1B. Breakdown of 10-year-average bank liabilities: 2000-2009



Source: OECD Statistics; Japanese Banker Association

Figure 2A. Structure of Bank Assets

This figure plots the structure of bank assets for five countries – the US, Japan, France, Germany and the UK from 2000-2009. The US and Japan have much lower interbank loan ratio (interbank loan/total bank assets), averaging 2.44% and 4.28%, respectively. The UK, Germany, and France have higher interbank loan ratios, averaging 13.20%, 22.48% and 28.68%, respectively.

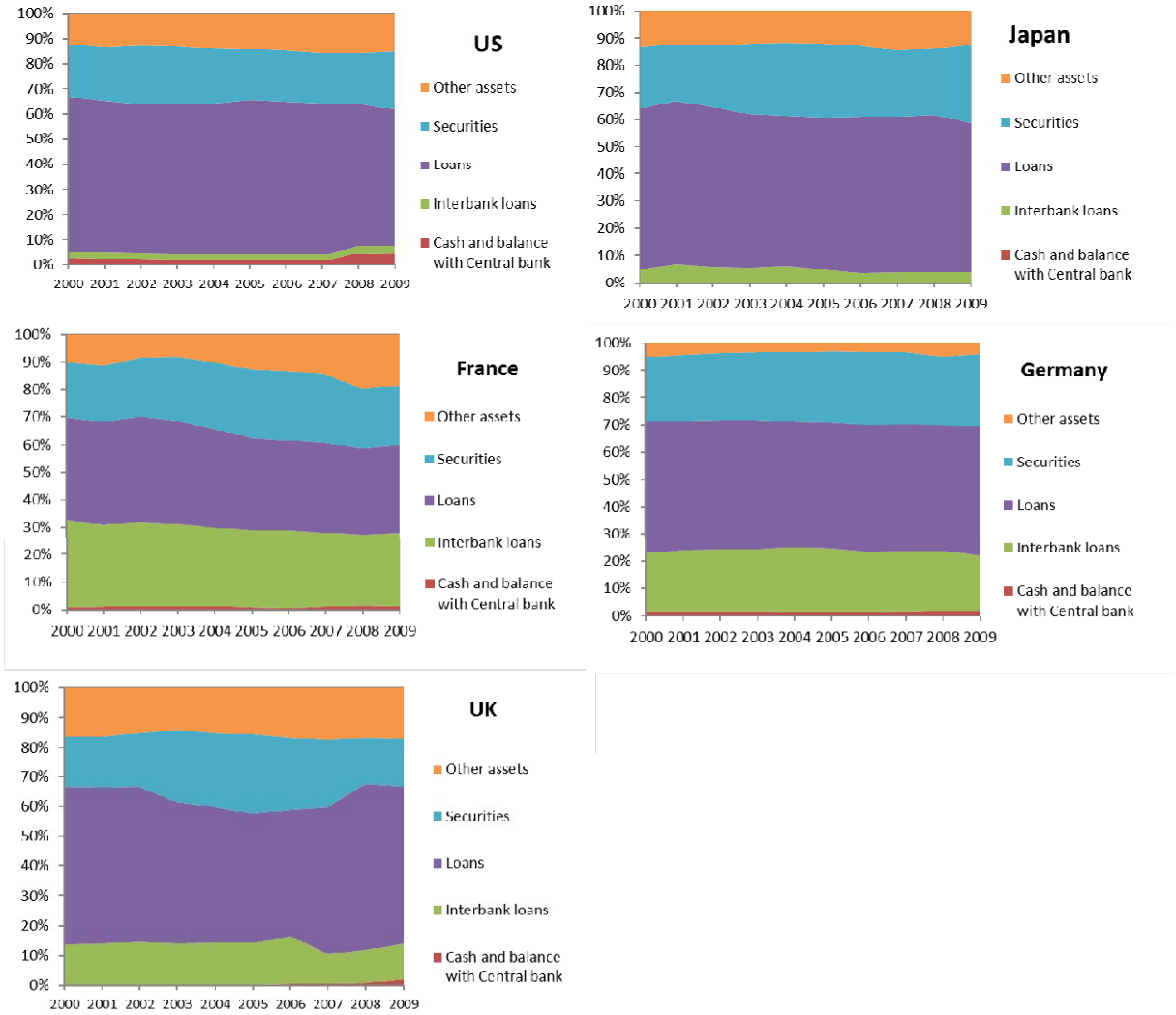
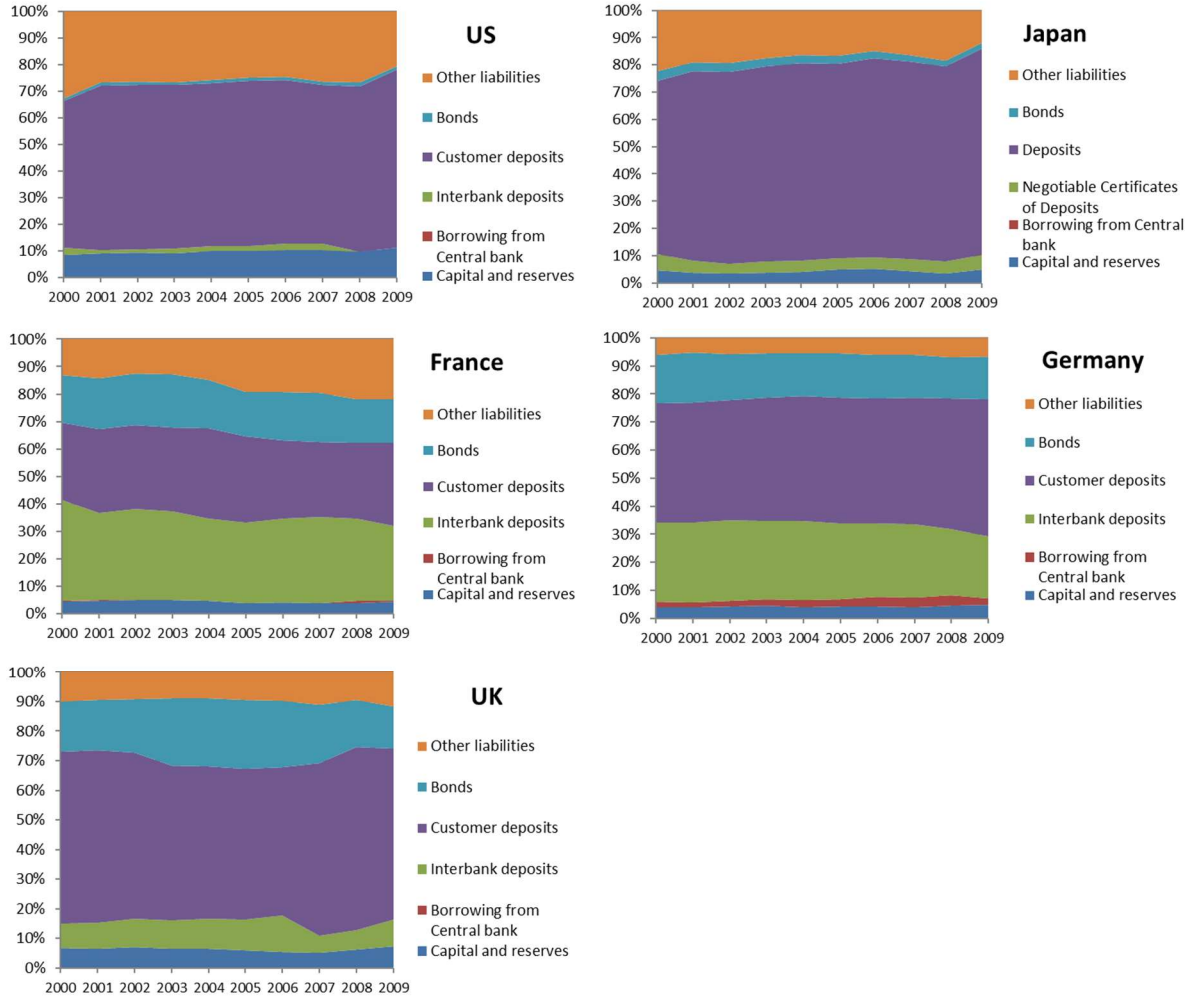


Figure 2B. Structure of Bank Liabilities

This figure plots the structure of bank liabilities for five countries – the US, Japan, France, Germany and the UK. The US and Japan have lower interbank deposit ratio (interbank deposit/total liabilities), averaging 1.95% and 4.41%, respectively. The UK, Germany and France have higher interbank deposit ratios, averaging at 9.02%, 26.61% and 31.19%, respectively.



Source: OECD Statistics; Japanese Banker Association

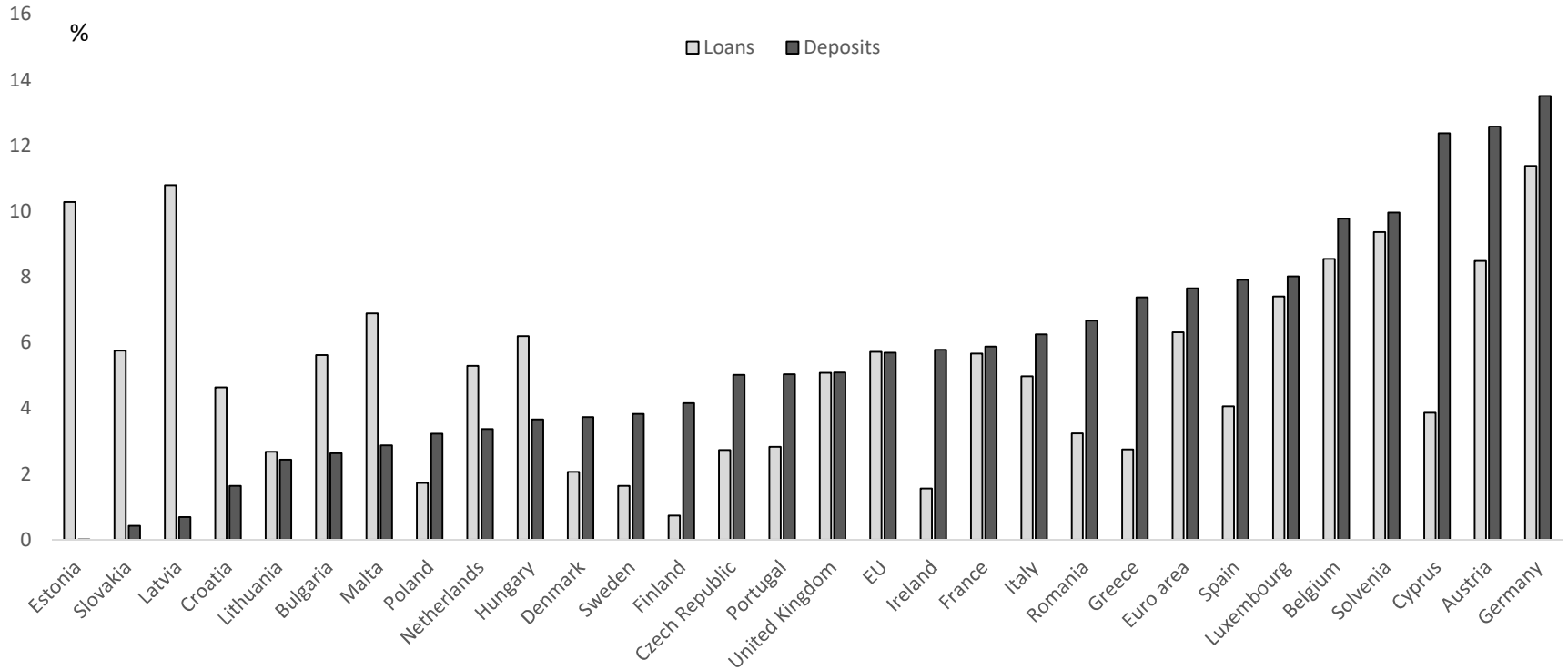
Table 1. Comparative statistics: ratios of interbank deposits and loans

The table presents the comparative statistics of the ratios of interbank deposits and interbank loans for the five countries - the US, the UK, Japan, Germany and France from 2000 to 2014. We calculate interbank deposits as borrowing or deposits from banks and interbank loans as funds due to banks.

	Germany		France		UK		Japan		US	
	Interbank deposits	*Interbank loans*	*Interbank deposits*	*Interbank loans*	*Interbank deposits*	*Interbank loans*	*Interbank deposits*	*Interbank loans*	*Interbank deposits*	*Interbank loans*
2000	29.17%	25.52%	36.09%	32.00%	8.02%	13.22%	3.00%	3.94%	6.88%	4.43%
2001	28.94%	26.42%	34.84%	32.27%	8.52%	13.74%	2.56%	3.75%	7.05%	4.87%
2002	28.87%	27.80%	35.49%	32.62%	9.73%	14.38%	2.38%	5.21%	6.71%	5.01%
2003	28.29%	27.89%	34.08%	30.55%	9.54%	13.74%	1.97%	4.48%	5.91%	4.21%
2004	28.31%	28.48%	34.75%	30.70%	10.30%	13.94%	1.91%	4.25%	5.48%	4.13%
2005	28.45%	29.29%	34.85%	30.50%	10.44%	13.95%	1.81%	4.62%	4.66%	3.46%
2006	28.48%	29.94%	34.83%	29.37%	12.44%	16.06%	1.76%	3.86%	4.60%	3.81%
2007	29.21%	31.57%	36.01%	30.38%	5.68%	10.12%	2.78%	2.68%	4.84%	4.25%
2008	28.96%	32.14%	35.49%	29.53%	6.50%	10.97%	2.57%	3.04%	3.37%	2.63%
2009	26.56%	29.65%	33.32%	28.72%	9.05%	11.92%	3.97%	2.98%	2.46%	1.86%
2010	23.44%	26.12%	31.28%	28.18%	7.93%	8.04%	3.31%	2.96%	2.15%	1.57%
2011	21.83%	26.59%	32.07%	30.97%	8.87%	8.93%	4.90%	4.34%	1.17%	0.93%
2012	21.84%	26.46%	31.70%	30.45%	9.67%	9.76%	4.43%	3.76%	1.29%	0.98%
2013	21.64%	26.84%	30.84%	30.31%	11.27%	11.03%	3.38%	4.81%	1.06%	0.78%
2014	21.76%	26.21%	30.62%	30.03%	8.08%	7.86%	3.76%	10.45%	0.83%	0.55%
Average	26.38%	28.06%	33.75%	30.44%	9.07%	11.84%	2.97%	4.34%	3.90%	2.90%

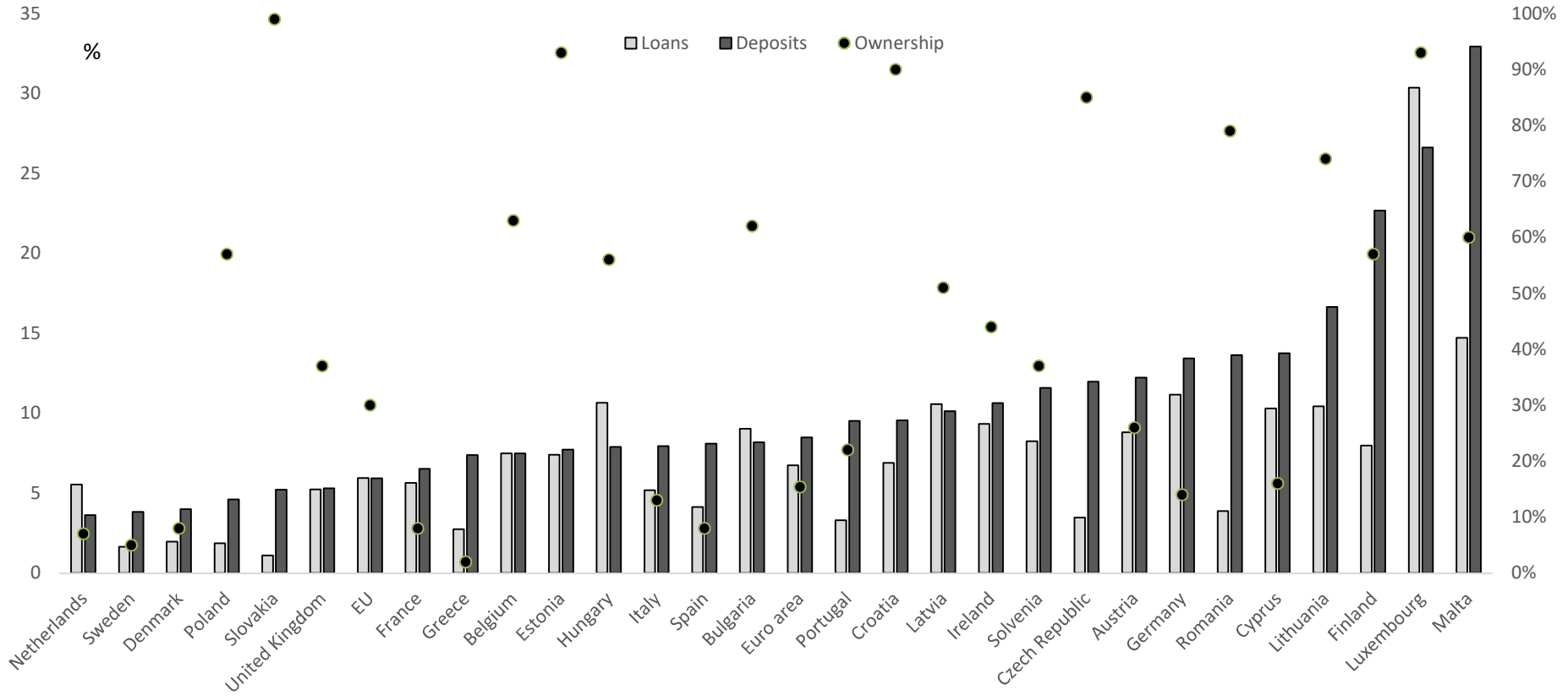
Source: ECB; Bank of England; Japanese Bank Association; FRB.

Figure 3. Interbank loans and deposits of domestic banks in the European Union countries in 2016
The figure shows the interbank loans and deposits as % of total assets of all domestic banking groups and stand-alone banks in 2016. The data for United Kingdom is for the year 2015



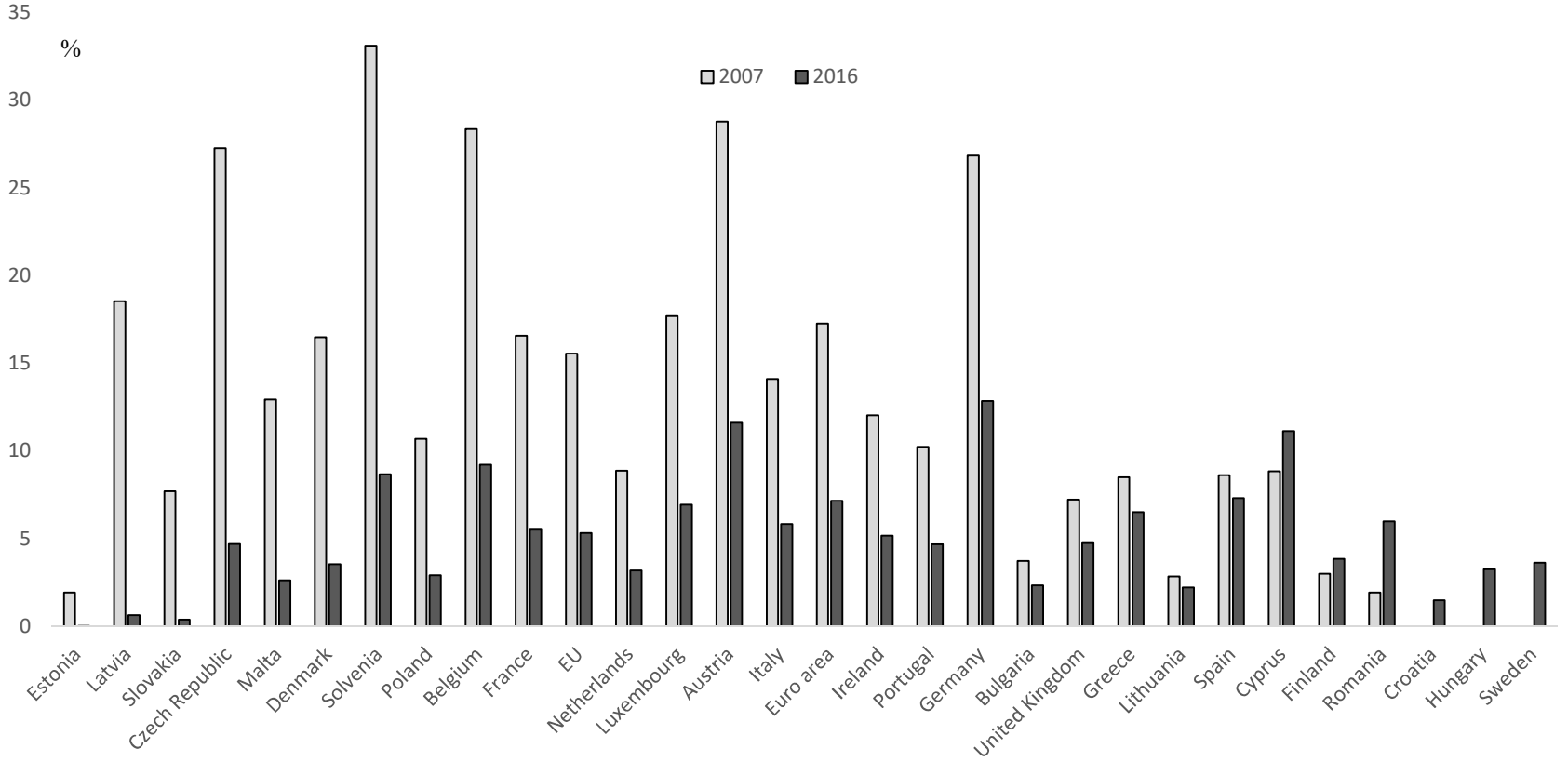
Source: ECB

Figure 4. Interbank loans and deposits of domestic and foreign banks in the European Union countries in 2016.
The figure shows the interbank loans and deposits as % of total assets of domestic banking groups and stand-alone banks, foreign (EU and non-EU) controlled subsidiaries and foreign (EU and non-EU) controlled branches, in 2016 left-hand scale). The points present the share of foreign bank ownership as % of total assets (right-hand scale). The data for United Kingdom is for the year 2015.



Source: ECB

Figure 5. Interbank dependence ratio for domestic banks in the European Union countries in the years 2007 and 2016
The figure presents the interbank market dependence ratio, defined as total amount owed to credit institutions over total assets, for all domestic banking groups and stand-alone banks in the years 2007 and 2016. The data for Cyprus, Denmark, Estonia, Ireland, Germany, Luxembourg, Latvia, Netherlands, and United Kingdom is for the year 2008.



Source: ECB

Table 2. Summary statistics

This table presents the summary statistics of the cross-country bank sample, as well as the difference in characteristics for banks located in countries with long or short periods of bank crises.

Panel A Summary statistics: Bank-level full sample

	Obs	Mean	Std. Dev.	Min	Max
Interbank deposits	74,578	0.0775	0.1107	0.0000	1.0000
LtD	74,578	0.9271	0.5621	0.0657	5.4421
Securities	74,578	0.2135	0.1494	0.0000	0.9903
Equity	74,578	0.0947	0.0534	0.0147	0.3309
ROA	74,578	0.0054	0.0103	-0.0606	0.0727
Size	74,578	0.0026	0.0176	0.0000	0.8561
Crisis length	74,572	4.8989	1.4827	0.0000	10.0000
Bank Z-score	74,195	2.9905	2.7138	-0.3123	11.4330
Common law	73,866	0.3517	0.4775	0.0000	1.0000
Rule of law	72,245	1.2728	0.7560	-1.8900	2.1200
Reg. quality	72,212	1.1628	0.5810	-2.1500	2.2500
Gov. effect	72,212	1.3133	0.6904	-1.7100	2.3600
Accountability	72,247	1.0269	0.6211	-2.1000	1.8300
Pol. stability	72,247	0.6239	0.5906	-2.4100	1.6600
Private credit	73,535	0.7884	0.3481	0.0115	2.6246
Market Cap.	72,803	0.7471	0.4832	0.0001	8.5733
Central Bank	73,556	0.0643	0.0737	0.0000	1.1358
Concentration	69,682	0.5515	0.2084	0.2228	1.0000

Panel B Comparison of bank characteristics: longer vs shorter periods of banking crisis country

	Long	Obs.	Short	Obs.	Diff
Interbank deposits	0.020	33,966	0.123	33,966	0.103***
	(0.000)		(0.001)		(0.001)
LtD	0.862	33,966	0.993	33,966	0.131***
	(0.003)		(0.003)		(0.004)
Securities	0.216	33,966	0.214	33,966	-0.002
	(0.000)		(0.001)		(0.001)
Equity	0.114	33,966	0.083	33,966	-0.031***
	(0.000)		(0.000)		(0.000)
ROA	0.006	33,966	0.004	33,966	-0.002*
	(0.000)		(0.000)		(0.000)
Size	0.001	33,966	0.004	33,966	0.003***
	(0.000)		(0.000)		(0.000)

Figure 6. Distribution of the length of banking crises

This figure plots the distribution of the number of countries that have different lengths of banking crises from 1970-2015 in our sample. Over 20 countries in our sample have no banking crises during this period; 52% have banking crisis of fewer than four years in total; whereas 48% have banking crisis of four or more years in total this period.

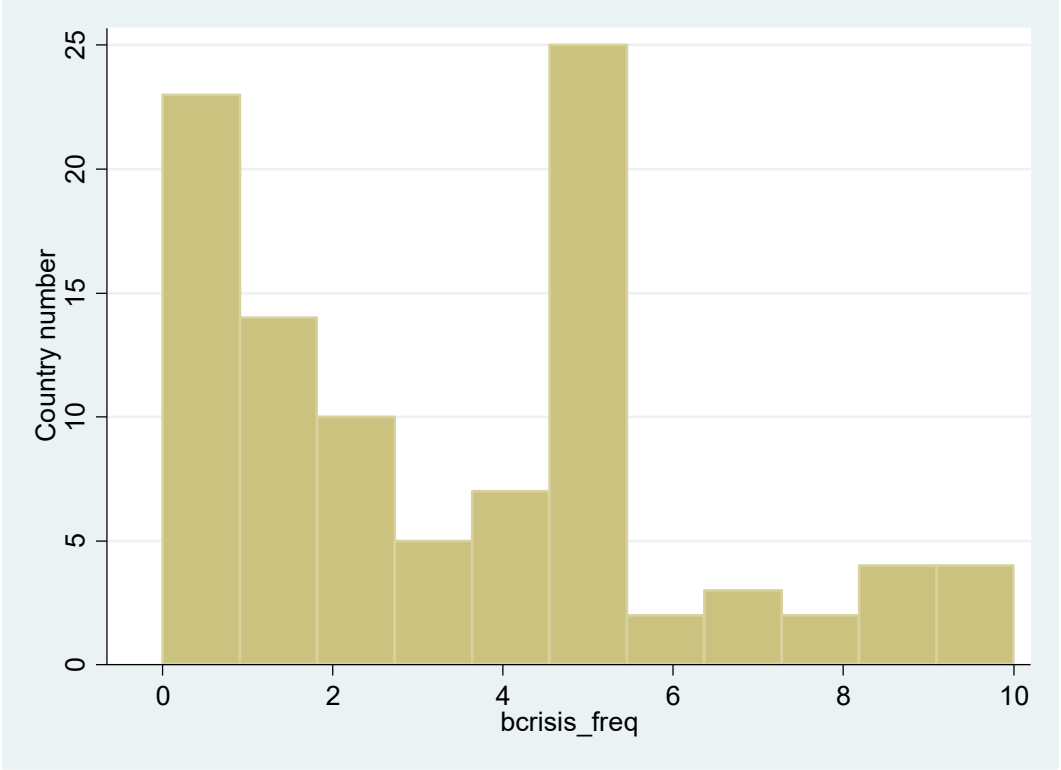


Table 3. Determinants of Interbank Borrowing

This table reports the results of the regressions examining the determinants of interbank borrowing using the full bank-level sample of 11,412 banks in 96 countries. The dependent variable is the size of interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank characteristics										
LtD	0.0715***	0.0695***	0.0716***	0.0690***	0.0683***	0.0760***	0.0728***	0.0755***	0.0733***	0.0710***
	(0.00179)	(0.00178)	(0.00180)	(0.00176)	(0.00178)	(0.00196)	(0.00195)	(0.00195)	(0.00195)	(0.00193)
Securities	0.0919***	0.0917***	0.0922***	0.0938***	0.0965***	0.0872***	0.0872***	0.0865***	0.0884***	0.0896***
	(0.00339)	(0.00341)	(0.00339)	(0.00340)	(0.00341)	(0.00362)	(0.00363)	(0.00363)	(0.00361)	(0.00364)
Equity	-0.257***	-0.274***	-0.249***	-0.282***	-0.292***	-0.249***	-0.276***	-0.236***	-0.282***	-0.288***
	(0.0100)	(0.0100)	(0.0101)	(0.0100)	(0.0100)	(0.0104)	(0.0104)	(0.0105)	(0.0103)	(0.0104)
ROA	0.0240	0.00443	0.0114	-0.00719	-0.0617	0.0157	-0.00317	0.00904	-0.0107	-0.0356
	(0.0401)	(0.0401)	(0.0401)	(0.0396)	(0.0395)	(0.0397)	(0.0396)	(0.0399)	(0.0393)	(0.0394)
Size	0.447***	0.396***	0.467***	0.373***	0.335***	0.585***	0.457***	0.613***	0.453***	0.433***
	(0.0575)	(0.0549)	(0.0586)	(0.0532)	(0.0505)	(0.110)	(0.0953)	(0.113)	(0.0950)	(0.0939)
Country characteristics										
Crisis length	-0.00677***	-0.00656***	-0.00683***	-0.00677***	-0.00520***					
	(0.000351)	(0.000351)	(0.000352)	(0.000356)	(0.000338)					
Bank failure						-0.0101***	-0.0101***	-0.00921***	-0.00959***	-0.00959***
						(0.000639)	(0.000662)	(0.000627)	(0.000657)	(0.000674)
Common law	0.0224***	0.0329***	0.0246***	0.0394***	0.0476***	0.0507***	0.0673***	0.0525***	0.0723***	0.0872***
	(0.00254)	(0.00247)	(0.00249)	(0.00241)	(0.00239)	(0.00348)	(0.00348)	(0.00342)	(0.00339)	(0.00344)
Rule of law	0.0240***					0.0330***				
	(0.000954)					(0.00131)				
Reg. quality		0.0227***					0.0293***			
		(0.00118)					(0.00174)			
Gov. effect			0.0292***					0.0389***		
			(0.00108)					(0.00137)		
Accountability				0.0168***					0.0286***	

				(0.000998)					(0.00184)	
Pol. stability					0.0107***					0.0166***
					(0.00100)					(0.00142)
Private credit	0.0177***	0.0263***	0.0145***	0.0310***	0.0332***	0.000982	0.0171***	-0.00117	0.0184***	0.0261***
	(0.00252)	(0.00246)	(0.00252)	(0.00246)	(0.00246)	(0.00298)	(0.00292)	(0.00289)	(0.00296)	(0.00288)
Mkt. cap.	-0.0548***	-0.0545***	-0.0578***	-0.0532***	-0.0533***	-0.0566***	-0.0572***	-0.0606***	-0.0559***	-0.0587***
	(0.00200)	(0.00197)	(0.00210)	(0.00191)	(0.00194)	(0.00222)	(0.00221)	(0.00235)	(0.00217)	(0.00221)
Central bank	-0.240***	-0.227***	-0.237***	-0.245***	-0.247***	-0.295***	-0.280***	-0.284***	-0.312***	-0.307***
	(0.0110)	(0.0109)	(0.0111)	(0.0109)	(0.0109)	(0.0128)	(0.0126)	(0.0129)	(0.0130)	(0.0132)
Concentration	0.114***	0.123***	0.114***	0.127***	0.139***	0.149***	0.160***	0.152***	0.155***	0.184***
	(0.00497)	(0.00494)	(0.00495)	(0.00491)	(0.00488)	(0.00607)	(0.00619)	(0.00597)	(0.00637)	(0.00595)
Cons.	0.00921*	0.00229	0.00106	0.00378	-0.00357	-0.00848	-0.0164***	-0.0256***	-0.0158***	-0.0201***
	(0.00553)	(0.00551)	(0.00558)	(0.00550)	(0.00550)	(0.00580)	(0.00580)	(0.00587)	(0.00583)	(0.00582)
Year Fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	67119	67119	67119	67119	67119	63867	63867	63867	63867	63867
Adj. R^2	0.431	0.426	0.433	0.424	0.421	0.463	0.455	0.466	0.454	0.451

Table 4. Interbank Borrowing and the Bankruptcy Risk

This table reports the results of the regressions examining the determinants of interbank borrowing using number of bank failures as a proxy for trust. The dependent variable is the size of interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*									
							Sample excl. US banks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank Characteristics										
LtD	0.0710***	0.0691***	0.0712***	0.0685***	0.0681***	0.0714***	0.0694***	0.0715***	0.0691***	0.0688***
	(0.00183)	(0.00181)	(0.00183)	(0.00180)	(0.00181)	(0.00189)	(0.00188)	(0.00190)	(0.00188)	(0.00188)
Securities	0.0970***	0.0971***	0.0971***	0.0992***	0.100***	0.0962***	0.0977***	0.0966***	0.104***	0.106***
	(0.00352)	(0.00354)	(0.00352)	(0.00353)	(0.00353)	(0.00594)	(0.00601)	(0.00594)	(0.00594)	(0.00591)
Equity	-0.296***	-0.311***	-0.288***	-0.319***	-0.320***	-0.361***	-0.384***	-0.348***	-0.398***	-0.398***
	(0.00992)	(0.00993)	(0.00996)	(0.00993)	(0.00993)	(0.0140)	(0.0140)	(0.0141)	(0.0140)	(0.0140)
ROA	0.114***	0.0865**	0.103**	0.0623	0.0328	0.0930	0.0503	0.0588	0.0160	-0.0386
	(0.0417)	(0.0417)	(0.0416)	(0.0412)	(0.0412)	(0.0827)	(0.0828)	(0.0824)	(0.0825)	(0.0819)
Size	0.465***	0.410***	0.484***	0.381***	0.362***	0.441***	0.392***	0.461***	0.367***	0.349***
	(0.0562)	(0.0531)	(0.0573)	(0.0508)	(0.0502)	(0.0553)	(0.0524)	(0.0566)	(0.0500)	(0.0494)
Bank Z-score	-0.00117***	-0.00114***	-0.00115***	-0.00111***	-0.00109***	-0.00181***	-0.00182***	-0.00175***	-0.00183***	-0.00182***
	(0.000147)	(0.000147)	(0.000147)	(0.000147)	(0.000147)	(0.000199)	(0.000199)	(0.000200)	(0.000199)	(0.000199)
Country characteristics										
Common law	0.0306***	0.0406***	0.0323***	0.0469***	0.0514***	0.0606***	0.0618***	0.0658***	0.0553***	0.0603***
	(0.00251)	(0.00246)	(0.00247)	(0.00242)	(0.00241)	(0.00411)	(0.00423)	(0.00414)	(0.00413)	(0.00439)
Rule of law	0.0208***					0.0251***				
	(0.000921)					(0.00110)				
Reg. quality		0.0183***					0.0216***			
		(0.00113)					(0.00143)			
Gov. effect			0.0257***					0.0311***		
			(0.00105)					(0.00123)		
Accountability				0.0116***					0.0116***	
				(0.000950)					(0.00105)	

Pol. stability					0.00976***					0.00989***
					(0.000996)					(0.00116)
Private credit	0.0246***	0.0328***	0.0216***	0.0376***	0.0371***	0.0153***	0.0255***	0.0116***	0.0328***	0.0319***
	(0.00253)	(0.00248)	(0.00252)	(0.00248)	(0.00248)	(0.00261)	(0.00259)	(0.00260)	(0.00260)	(0.00258)
Mkt. cap.	-0.0531***	-0.0527***	-0.0559***	-0.0516***	-0.0519***	-0.0498***	-0.0502***	-0.0529***	-0.0499***	-0.0498***
	(0.00215)	(0.00211)	(0.00226)	(0.00206)	(0.00207)	(0.00231)	(0.00228)	(0.00242)	(0.00225)	(0.00224)
Concentration	-0.257***	-0.246***	-0.255***	-0.258***	-0.262***	-0.284***	-0.275***	-0.281***	-0.291***	-0.295***
	(0.0113)	(0.0112)	(0.0114)	(0.0111)	(0.0112)	(0.0122)	(0.0122)	(0.0123)	(0.0121)	(0.0122)
Central Bank	0.120***	0.130***	0.120***	0.135***	0.142***	0.104***	0.117***	0.103***	0.130***	0.137***
	(0.00499)	(0.00496)	(0.00498)	(0.00493)	(0.00492)	(0.00530)	(0.00533)	(0.00528)	(0.00518)	(0.00519)
Cons.	-0.0247***	-0.0298***	-0.0320***	-0.0298***	-0.0289***	-0.00627	-0.0126**	-0.0149***	-0.0151***	-0.0141**
	(0.00534)	(0.00534)	(0.00541)	(0.00532)	(0.00531)	(0.00567)	(0.00570)	(0.00574)	(0.00570)	(0.00569)
Year Fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	66854	66854	66854	66854	66854	42543	42543	42543	42543	42543
Adj. R^2	0.426	0.422	0.428	0.420	0.419	0.280	0.274	0.284	0.271	0.269

Table 5. Trust in the interbank market: the role of banking crises

This table reports the results of the regressions examining the role of banking crises in determining interbank borrowing, using the bank-level sample of 6,792 banks over 95 countries (excl. US banks). The dependent variable is interbank borrowing to banks total assets. Treated equals 1 if a bank is located country has no less than five banking crises in the years 1970-2011 (47 countries in total), and 0 otherwise. The control sample is defined by one-to-one propensity-score-matching algorithm based on a country's financial structure (Private credit and Mkt. cap.). We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. var	*Interbank borrowing*				
	(1)	(2)	(3)	(4)	(5)
LtD	0.0649***	0.0634***	0.0645***	0.0633***	0.0630***
	(0.00179)	(0.00178)	(0.00178)	(0.00178)	(0.00179)
Securities	0.128***	0.129***	0.129***	0.130***	0.132***
	(0.00524)	(0.00528)	(0.00523)	(0.00526)	(0.00525)
Equity	-0.309***	-0.346***	-0.301***	-0.359***	-0.368***
	(0.0125)	(0.0123)	(0.0128)	(0.0120)	(0.0121)
ROA	-0.124	-0.229***	-0.147*	-0.252***	-0.320***
	(0.0764)	(0.0762)	(0.0759)	(0.0759)	(0.0754)
Size	0.474***	0.398***	0.485***	0.378***	0.341***
	(0.0529)	(0.0484)	(0.0538)	(0.0469)	(0.0450)
Treated	-0.0272***	-0.0265***	-0.0292***	-0.0268***	-0.0275***
	(0.00148)	(0.00147)	(0.00151)	(0.00147)	(0.00148)
Common law	0.0312***	0.0280***	0.0326***	0.0246***	0.0226***
	(0.00390)	(0.00406)	(0.00391)	(0.00394)	(0.00428)
Rule of law	0.0161***				
	(0.000953)				
Reg. quality		0.0104***			
		(0.00127)			
Gov. effect			0.0175***		
			(0.00105)		
Accountability				0.00666***	
				(0.000970)	
Pol. stability					0.00171
					(0.00107)
Central Bank	-0.284***	-0.284***	-0.280***	-0.291***	-0.289***
	(0.0102)	(0.0101)	(0.0102)	(0.0101)	(0.0102)
Concentration	0.0429***	0.0630***	0.0427***	0.0696***	0.0787***
	(0.00460)	(0.00454)	(0.00468)	(0.00435)	(0.00429)
Cons.	0.0346***	0.0352***	0.0299***	0.0364***	0.0377***
	(0.00487)	(0.00489)	(0.00491)	(0.00488)	(0.00489)
Year Fe	YES	YES	YES	YES	YES
N	44296	44296	44296	44296	44296
Adj. R^2	0.247	0.242	0.248	0.241	0.240

Table 6. The mitigating role of legal and regulatory institutions

This table reports the results of the regressions examining the role of institutions including legal enforcement and regulation quality, etc. in mitigating the effect of crises on interbank borrowing, using the bank-level sample of 6,792 banks over 95 countries (excl. US banks). The dependent variable is the size of interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*				
	(1)	(2)	(3)	(4)	(5)
LtD	0.0792***	0.0771***	0.0769***	0.0769***	0.0749***
	(0.00217)	(0.00217)	(0.00216)	(0.00217)	(0.00217)
Securities	0.129***	0.128***	0.135***	0.134***	0.140***
	(0.00626)	(0.00634)	(0.00625)	(0.00633)	(0.00632)
Equity	-0.317***	-0.364***	-0.322***	-0.376***	-0.392***
	(0.0148)	(0.0146)	(0.0150)	(0.0143)	(0.0144)
ROA	-0.113	-0.244***	-0.152*	-0.258***	-0.320***
	(0.0894)	(0.0893)	(0.0886)	(0.0875)	(0.0870)
Size	0.679***	0.607***	0.667***	0.582***	0.540***
	(0.0754)	(0.0695)	(0.0742)	(0.0669)	(0.0634)
Crisis length	-0.00315***	-0.00283***	-0.00337***	-0.00312***	-0.00198***
	(0.000380)	(0.000380)	(0.000385)	(0.000384)	(0.000398)
Crisis	-0.0595***	-0.0781***	-0.0531***	-0.0670***	-0.0458***
	(0.00364)	(0.00432)	(0.00371)	(0.00379)	(0.00312)
Common law	0.0303***	0.0259***	0.0319***	0.0229***	0.0218***
	(0.00427)	(0.00444)	(0.00431)	(0.00432)	(0.00480)
Rule of law	0.0196***				
	(0.00129)				
Rule of law*Crisis	0.0384***				
	(0.00212)				
Reg. quality		0.0119***			
		(0.00173)			
Reg. quality*Crisis		0.0541***			
		(0.00310)			
Gov. effect			0.0199***		
			(0.00140)		
Gov. effect*Crisis			0.0367***		
			(0.00226)		
Accountability				0.00599***	
				(0.00130)	
Accountability*Crisis				0.0467***	
				(0.00271)	
Pol. stability					0.000151
					(0.00139)
Pol. stability*Crisis					0.0397***
					(0.00267)
Central Bank	-0.562***	-0.576***	-0.540***	-0.618***	-0.621***
	(0.0244)	(0.0237)	(0.0237)	(0.0249)	(0.0247)
Cons.	0.00872	0.0308***	0.0180***	0.0439***	0.0699***
	(0.00607)	(0.00607)	(0.00601)	(0.00577)	(0.00572)
Year Fe	YES	YES	YES	YES	YES
N	35250	35250	35250	35250	35250
Adj. R^2	0.281	0.272	0.275	0.269	0.262

Table 7. The role of institution improvement

This table reports the results of the regressions examining the role of improvements in legal enforcement/regulation quality in mitigating the effect of crises on interbank borrowing, using the bank-level sample of 6,792 banks over 95 countries excl. US banks. The dependent variable is the interbank borrowing to banks total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*			
	ΔRule law		ΔReg quality	
	>0	≤0	>0	≤0
LtD	0.0976***	0.0978***	0.109***	0.0981***
	(0.0240)	(0.00260)	(0.0240)	(0.00260)
LtD*Crisis	0.0705*	-0.0547***	-0.0289	-0.0550***
	(0.0406)	(0.00287)	(0.0446)	(0.00287)
Equity	0.162**	0.0933***	0.212***	0.0929***
	(0.0638)	(0.00699)	(0.0616)	(0.00698)
Equity*Crisis	-0.660***	-0.366***	-0.268**	-0.372***
	(0.134)	(0.0190)	(0.111)	(0.0191)
ROA	-0.174	0.0593**	0.296	0.0581**
	(0.225)	(0.0289)	(0.324)	(0.0289)
ROA*Crisis	-0.787*	-0.168	-0.145	-0.191*
	(0.431)	(0.105)	(0.638)	(0.103)
Securities	1.205	0.191	0.655	0.196
	(1.386)	(0.210)	(1.637)	(0.209)
Size	0.165	0.481***	0.0813	0.516***
	(0.180)	(0.0635)	(0.109)	(0.0672)
Crisis length	0.000537	-0.00341***	0.000506	-0.00346***
	(0.00262)	(0.000386)	(0.00301)	(0.000384)
Common law	0.0294	0.0512***	0.00462	0.0523***
	(0.0184)	(0.00486)	(0.0217)	(0.00480)
Private credit	-0.0119	0.0528***	0.0167	0.0516***
	(0.0241)	(0.00259)	(0.0225)	(0.00259)
Mkt. cap.	-0.0576**	-0.0587***	-0.0192	-0.0587***
	(0.0261)	(0.00183)	(0.0207)	(0.00183)
Central Bank	-0.311***	-0.608***	-0.301***	-0.615***
	(0.0917)	(0.0238)	(0.102)	(0.0239)
Concentration	0.115*	0.113***	-0.0430	0.114***
	(0.0590)	(0.00610)	(0.0404)	(0.00614)
Cons.	-0.0213	-0.00943	0.0374	-0.00809
	(0.0411)	(0.00668)	(0.0536)	(0.00666)
Year Fe	YES	YES	YES	YES
N	283	34278	289	34272
Adj. R^2	0.292	0.318	0.293	0.318

Table 8. Sensitivity analysis of determinants of interbank borrowing: Sample excluding the U.S. Banks

This table reports the results of the regressions examining the determinants of interbank borrowing using the bank-level sample of 6,792 banks over 95 countries. The dependent variable is the size of interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank characteristics										
LtD	0.0719***	0.0699***	0.0719***	0.0697***	0.0691***	0.0760***	0.0736***	0.0754***	0.0743***	0.0726***
	(0.00186)	(0.00185)	(0.00187)	(0.00184)	(0.00186)	(0.00207)	(0.00206)	(0.00206)	(0.00206)	(0.00207)
Securities	0.0908***	0.0917***	0.0914***	0.0971***	0.102***	0.0763***	0.0820***	0.0758***	0.0835***	0.0892***
	(0.00587)	(0.00594)	(0.00587)	(0.00588)	(0.00584)	(0.00654)	(0.00658)	(0.00659)	(0.00651)	(0.00652)
Equity	-0.314***	-0.338***	-0.301***	-0.350***	-0.362***	-0.312***	-0.352***	-0.293***	-0.360***	-0.369***
	(0.0142)	(0.0142)	(0.0143)	(0.0141)	(0.0141)	(0.0152)	(0.0152)	(0.0154)	(0.0150)	(0.0151)
ROA	0.00258	-0.0329	-0.0330	-0.0428	-0.143*	-0.0419	-0.0610	-0.0625	-0.0708	-0.0984
	(0.0818)	(0.0819)	(0.0815)	(0.0817)	(0.0808)	(0.0879)	(0.0882)	(0.0882)	(0.0876)	(0.0881)
Size	0.429***	0.382***	0.450***	0.366***	0.329***	0.630***	0.442***	0.659***	0.439***	0.389***
	(0.0566)	(0.0541)	(0.0578)	(0.0524)	(0.0498)	(0.116)	(0.0940)	(0.119)	(0.0938)	(0.0890)
Country characteristics										
Crisis length	-0.00596***	-0.00589***	-0.00599***	-0.00626***	-0.00477***					
	(0.000358)	(0.000358)	(0.000359)	(0.000367)	(0.000353)					
Bank failure						-0.00842***	-0.0106***	-0.00743***	-0.0101***	-0.0111***
						(0.000727)	(0.000737)	(0.000726)	(0.000725)	(0.000749)
Common law	0.0481***	0.0503***	0.0534***	0.0430***	0.0496***	0.0818***	0.0712***	0.0842***	0.0754***	0.0744***
	(0.00428)	(0.00435)	(0.00430)	(0.00429)	(0.00458)	(0.00688)	(0.00704)	(0.00690)	(0.00702)	(0.00723)
Rule of law	0.0271***					0.0359***				
	(0.00110)					(0.00149)				
Reg. quality		0.0248***					0.0280***			
		(0.00144)					(0.00196)			
Gov. effect			0.0333***					0.0419***		
			(0.00124)					(0.00152)		
Accountability				0.0160***					0.0276***	

				(0.00108)					(0.00200)	
Pol. stability					0.00958***					0.0137***
					(0.00116)					(0.00146)
Private credit	0.0112***	0.0214***	0.00734***	0.0283***	0.0302***	-0.00621**	0.0138***	-0.00781***	0.0147***	0.0236***
	(0.00259)	(0.00255)	(0.00258)	(0.00257)	(0.00256)	(0.00304)	(0.00303)	(0.00292)	(0.00309)	(0.00299)
Mkt. cap.	-0.0532***	-0.0536***	-0.0564***	-0.0533***	-0.0530***	-0.0561***	-0.0585***	-0.0604***	-0.0572***	-0.0604***
	(0.00217)	(0.00216)	(0.00228)	(0.00212)	(0.00213)	(0.00248)	(0.00248)	(0.00261)	(0.00245)	(0.00248)
Central bank	-0.261***	-0.252***	-0.259***	-0.272***	-0.273***	-0.306***	-0.310***	-0.294***	-0.341***	-0.337***
	(0.0119)	(0.0118)	(0.0119)	(0.0118)	(0.0119)	(0.0140)	(0.0139)	(0.0141)	(0.0143)	(0.0145)
Concentration	0.0996***	0.112***	0.0989***	0.123***	0.135***	0.134***	0.157***	0.138***	0.152***	0.185***
	(0.00526)	(0.00530)	(0.00525)	(0.00515)	(0.00515)	(0.00683)	(0.00695)	(0.00664)	(0.00712)	(0.00643)
Cons.	0.0194***	0.0124**	0.0103*	0.0120**	0.00483	0.00378	-0.000142	-0.0155**	0.000683	-0.00334
	(0.00583)	(0.00583)	(0.00588)	(0.00585)	(0.00584)	(0.00620)	(0.00621)	(0.00632)	(0.00624)	(0.00623)
Year Fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	42807	42807	42807	42807	42807	39555	39555	39555	39555	39555
Adj. R^2	0.284	0.277	0.288	0.275	0.271	0.311	0.300	0.315	0.300	0.296

Table 9. Robustness check of determinants of interbank borrowing: Eurozone banks and Large and Small banks

Columns (1) and (2) report the results of the regressions examining the determinants of interbank borrowing using the bank-level sample of 6,792 banks only in the 11 (original) and 19 Eurozone countries, respectively. Columns (3) and (4) report the results of estimates using the largest (upper quartile) and smallest (lower quartile) banks in the sample. The dependent variable is the size of interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*			
	Eurozone		Bank size	
	11 countries	19 countries	Q1	Q3
LtD	0.156***	0.155***	0.0896***	0.0531***
	(0.00264)	(0.00267)	(0.00228)	(0.00197)
Securities	0.174***	0.166***	0.120***	0.0673***
	(0.00634)	(0.00642)	(0.00449)	(0.00371)
Equity	-0.398***	-0.394***	-0.328***	-0.184***
	(0.0228)	(0.0229)	(0.0159)	(0.0102)
ROA	-0.473***	-0.527***	0.167***	-0.0300
	(0.145)	(0.146)	(0.0549)	(0.0410)
Size	0.174	0.301**	0.428***	2.495***
	(0.129)	(0.147)	(0.0578)	(0.273)
Crisis length	-0.0183***	-0.0173***	-0.00648***	-0.00481***
	(0.000958)	(0.000999)	(0.000391)	(0.000472)
Common law	-0.0115	-0.0205	0.0208***	0.0266***
	(0.0470)	(0.0491)	(0.00271)	(0.00325)
Rule of law	0.107***	0.105***	0.0289***	0.0164***
	(0.00278)	(0.00317)	(0.00106)	(0.00128)
Private credit	0.120***	0.110***	0.0122***	0.0411***
	(0.00490)	(0.00547)	(0.00272)	(0.00326)
Mkt. cap.	0.0788***	0.0704***	-0.0594***	-0.0505***
	(0.00580)	(0.00609)	(0.00188)	(0.00224)
Central bank	0.371***	0.350***	-0.258***	-0.254***
	(0.0681)	(0.0784)	(0.0130)	(0.0144)
Concentration	0.0287***	0.0413***	0.108***	0.0848***
	(0.00802)	(0.00808)	(0.00592)	(0.00611)
Cons.	-0.228***	-0.222***	-0.00127	0.00637
	(0.0113)	(0.0123)	(0.00630)	(0.00657)
Year Fe	YES	YES	YES	YES
N	27855	27949	49838	50898
Adj. R^2	0.490	0.482	0.441	0.413

Appendix

Table A1. The Interbank Borrowing Size by Country
This table shows the number of banks and the interbank deposit ratio (interbank deposits/total assets) for the countries in our sample. When constructing the sample, we drop those countries with less than five banks in the original dataset.

Country name	Bank number	Interbank borrowing
Argentina	63	4.54%
Australia	8	10.40%
Austria	184	28.07%
Azerbaijan	12	18.20%
Bahamas, The	15	13.97%
Bangladesh	7	5.35%
Belarus	9	10.63%
Belgium	44	17.98%
Bolivia	8	16.98%
Bosnia and Herzegovina	7	2.51%
Brazil	60	3.12%
Bulgaria	8	5.50%
Canada	27	2.09%
Cayman Islands	7	1.35%
China	150	10.74%
Colombia	32	6.26%
Costa Rica	42	12.26%
Cote d'Ivoire	5	23.93%
Croatia	31	1.91%
Curacao	7	6.91%
Cyprus	8	3.36%
Czech Republic	10	34.20%
Denmark	80	17.03%
Dominican Republic	38	1.53%
Ecuador	33	0.48%
Egypt, Arab Rep.	5	4.20%
El Salvador	5	0.00%
Ethiopia	6	2.31%
Finland	35	5.15%
France	174	23.37%
Germany	1879	18.14%
Ghana	5	3.98%
Greece	26	9.66%
Guatemala	27	9.61%
Honduras	10	4.40%
Hong Kong SAR, China	6	8.74%
Hungary	6	16.99%
Iceland	29	11.88%

India	32	6.00%
Indonesia	58	3.62%
Ireland	7	41.81%
Israel	5	14.16%
Italy	1007	13.02%
Japan	464	1.55%
Kazakhstan	9	10.76%
Kenya	24	5.00%
Korea, Rep.	6	0.41%
Lao PDR	5	10.18%
Latvia	5	24.74%
Lebanon	38	4.31%
Libya	6	1.61%
Luxembourg	41	26.94%
Macedonia, FYR	5	3.49%
Malaysia	18	7.47%
Mali	5	15.27%
Mauritania	6	2.65%
Mexico	19	29.32%
Moldova	11	5.24%
Mongolia	10	11.03%
Morocco	7	8.82%
Nepal	5	0.17%
Netherlands	23	22.01%
New Zealand	6	4.61%
Nicaragua	9	21.99%
Nigeria	39	5.05%
Norway	65	10.23%
Oman	5	9.23%
Pakistan	10	12.63%
Panama	28	5.14%
Paraguay	19	9.22%
Peru	10	10.62%
Philippines	23	1.58%
Poland	26	9.20%
Portugal	98	42.20%
Russian Federation	447	9.84%
San Marino	6	2.18%
Senegal	6	13.32%
Serbia	17	4.32%
Singapore	8	12.49%
Slovak Republic	6	12.46%
South Africa	16	22.84%
Spain	203	15.69%
Sweden	90	8.22%
Switzerland	380	10.40%

Tajikistan	6	12.37%
Tanzania	7	6.83%
Thailand	11	2.23%
Turkey	33	4.13%
Ukraine	152	21.52%
United Kingdom	30	14.16%
United States	4621	0.55%
Uruguay	12	11.33%
Uzbekistan	17	7.37%
Venezuela, RB	49	6.38%
Vietnam	26	22.20%
Yemen, Rep.	7	2.76%

Table A2. Variable definitions

Variable	Definitions	Source
Measures of trust in the banking system		
Bank z-score	Ratio of return on assets plus capital-asset-ratio to the standard deviation of return on assets	BankScope
Crisis length.	The number of banking crises occurred in the country from 1970-2015.	Laeven and Valencia (2012) and own computation
Crisis	A dummy variable that takes the value 1 for the years of systematic banking crisis periods and 0 otherwise	
Bank failure	Logarithm of the sum of bank failures in the country in which the bank is licensed	BankScope
Bank level variables		
Interbank borrowing	Borrowing and deposits from banks divided by total assets	BankScope
LtD	Bank's gross nonfinancial loans divided by nonfinancial deposits	
Securities	Securities to total assets	
Equity	Equity to total assets	
ROA	Return on assets	
Size	Bank's total assets divided to gross domestic product of the country in which the bank is licensed	
Country level variables		
Common law	Equals to 1 if the legal origin of the country is common law.	Djankov et al. (2007)
Rule of law	The index of rule of law	Worldwide Governance Indicator Database (2016)
Reg. quality	The index of regulation quality	
Gov. effect	The index of government effectiveness	
Accountability	The index of accountability	
Pol. stability	The index of political stability	
Private credit	Private credit by deposit money banks divided by GDP	World Bank, Global Finance Database (2016)
Market cap.	Stock market capitalization divided by GDP	
Concentration	Assets of three largest commercial banks as a share of total commercial banking assets.	
Central Bank	Central bank total assets divided by GDP	

Table A3. Determinants of Interbank Borrowing Size: Sample excl. Financial Centers (US, UK, Singapore and HK)

This table reports the results of the regressions examining the determinants of interbank borrowing using the bank-level sample excl. the banks located in financial centers US, UK, Singapore and HK). The dependent variable is banks interbank borrowing to total assets. We control for both bank and country characteristics in the regressions. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Dep. Var	*Interbank borrowing*									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank characteristics										
LtD	0.0706***	0.0687***	0.0707***	0.0684***	0.0681***	0.0750***	0.0726***	0.0744***	0.0732***	0.0717***
	(0.00189)	(0.00188)	(0.00190)	(0.00187)	(0.00189)	(0.00208)	(0.00208)	(0.00207)	(0.00208)	(0.00208)
Securities	0.0895***	0.0919***	0.0898***	0.0961***	0.101***	0.0750***	0.0809***	0.0744***	0.0820***	0.0872***
	(0.00592)	(0.00599)	(0.00591)	(0.00593)	(0.00588)	(0.00656)	(0.00659)	(0.00660)	(0.00652)	(0.00653)
Equity	-0.344***	-0.370***	-0.331***	-0.381***	-0.389***	-0.323***	-0.364***	-0.304***	-0.371***	-0.381***
	(0.0143)	(0.0143)	(0.0144)	(0.0143)	(0.0143)	(0.0153)	(0.0152)	(0.0154)	(0.0150)	(0.0151)
ROA	-0.000993	-0.0497	-0.0303	-0.0615	-0.142*	-0.0335	-0.0553	-0.0523	-0.0627	-0.0873
	(0.0820)	(0.0821)	(0.0817)	(0.0819)	(0.0811)	(0.0882)	(0.0884)	(0.0885)	(0.0879)	(0.0884)
Size	0.439***	0.388***	0.461***	0.374***	0.342***	0.610***	0.421***	0.641***	0.419***	0.370***
	(0.0559)	(0.0528)	(0.0573)	(0.0514)	(0.0493)	(0.114)	(0.0913)	(0.117)	(0.0913)	(0.0864)
Country characteristics										
Crisis length	-0.00368***	-0.00337***	-0.00381***	-0.00386***	-0.00263***					
	(0.000371)	(0.000368)	(0.000375)	(0.000372)	(0.000368)					
Bank failure						-0.00840***	-0.0105***	-0.00743***	-0.0101***	-0.0109***
						(0.000728)	(0.000739)	(0.000727)	(0.000727)	(0.000751)
Common law	0.0454***	0.0469***	0.0507***	0.0391***	0.0442***	0.0675***	0.0552***	0.0700***	0.0581***	0.0541***
	(0.00412)	(0.00421)	(0.00416)	(0.00408)	(0.00437)	(0.00704)	(0.00721)	(0.00705)	(0.00713)	(0.00727)
Rule of law	0.0246***					0.0343***				
	(0.00108)					(0.00150)				
Reg. quality		0.0204***					0.0253***			
		(0.00141)					(0.00195)			
Gov. effect			0.0308***					0.0404***		
			(0.00122)					(0.00152)		

Accountability				0.0127***					0.0251***	
				(0.00105)					(0.00200)	
Pol. stability					0.00808***					0.0121***
					(0.00114)					(0.00144)
Private credit	0.0102***	0.0210***	0.00635**	0.0263***	0.0277***	-0.00700**	0.0129***	-0.00887***	0.0134***	0.0214***
	(0.00258)	(0.00255)	(0.00257)	(0.00255)	(0.00254)	(0.00304)	(0.00303)	(0.00292)	(0.00309)	(0.00298)
Mkt. cap.	-0.0512***	-0.0517***	-0.0541***	-0.0513***	-0.0516***	-0.0563***	-0.0588***	-0.0604***	-0.0576***	-0.0606***
	(0.00221)	(0.00219)	(0.00231)	(0.00216)	(0.00218)	(0.00249)	(0.00249)	(0.00261)	(0.00246)	(0.00249)
Concentration	-0.252***	-0.245***	-0.250***	-0.259***	-0.264***	-0.302***	-0.306***	-0.291***	-0.334***	-0.328***
	(0.0118)	(0.0117)	(0.0118)	(0.0117)	(0.0118)	(0.0140)	(0.0138)	(0.0140)	(0.0143)	(0.0144)
Central Bank	0.104***	0.118***	0.102***	0.128***	0.138***	0.139***	0.164***	0.143***	0.159***	0.191***
	(0.00521)	(0.00524)	(0.00521)	(0.00511)	(0.00508)	(0.00679)	(0.00689)	(0.00660)	(0.00707)	(0.00637)
Cons.	0.0104*	0.00247	0.00255	0.00295	-0.00241	0.00562	0.00143	-0.0128**	0.00230	-0.00149
	(0.00595)	(0.00597)	(0.00602)	(0.00596)	(0.00596)	(0.00621)	(0.00622)	(0.00633)	(0.00625)	(0.00623)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	42727	42727	42727	42727	42727	39476	39476	39476	39476	39476
Adj. R^2	0.279	0.272	0.282	0.270	0.267	0.309	0.299	0.313	0.299	0.295