Cross-border banking in Europe: What explains financial disintegration?

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Abstract

Financial integration in Europe through cross-border banking increased significantly prior to the global financial crisis and reversed to some extent in its aftermath to stabilize at markedly lower levels compared to the pre-crisis peak. Zooming in on respective sectors, cross-border claims vis-à-vis other banks were most affected by deleveraging after the global financial crisis, whereas banks' cross-border lending to the non-bank sector even slightly increased. This paper uses a wide range of possible determinants of such development in an integrated framework using data on banks' cross-border exposures and a newly constructed dataset on sectoral taxes, macroprudential policies, institutional quality, as well as indicators of banking sector health. By employing two econometric set-ups we single out high non-performing loans as the most important impediment to cross-border lending after the financial crisis. Improving institutional quality, conversely, is a significant a pull factor for cross-border lending, especially vis-à-vis banks. Furthermore, we find some evidence that taxation deters cross-border lending to the banking sector, while it increases cross-border lending to the non-banking sector. Increasing use of macroprudential policies in host countries had no effect on overall cross-border flows, albeit it negatively impacts on cross-border lending to non-banks.

Keywords: bank levy, cross-border lending, deleveraging, financial integration, macroprudential policies, regulation

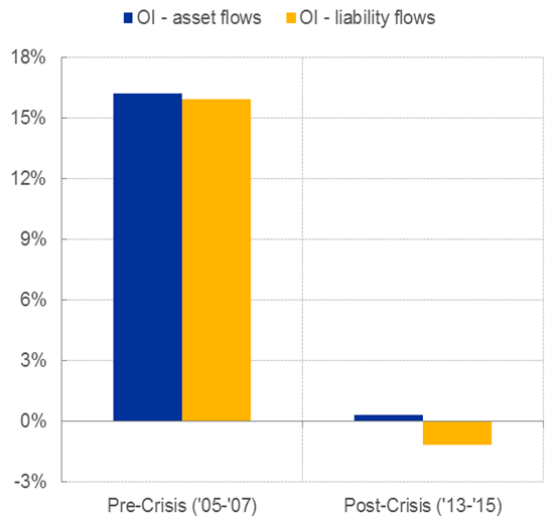
JEL Classification numbers: F21, F30, G11, G15, G28

1. Introduction

Financial integration in Europe via cross-border banking has undergone two distinct episodes over the past two decades. The first – culminating at the time of the global financial crisis – featured dynamically growing financial integration, among the euro area countries and later with countries joining the European Union. The second episode – triggered by the crisis – brought a reversal in financial integration with varying impact across countries. In this paper we examine the drivers of the reversal of cross-border banking integration across EU countries using data on cross-border banking exposures and a newly constructed dataset on sectoral taxes and macroprudential policies, as well as indicators of banking sector health and institutional quality.

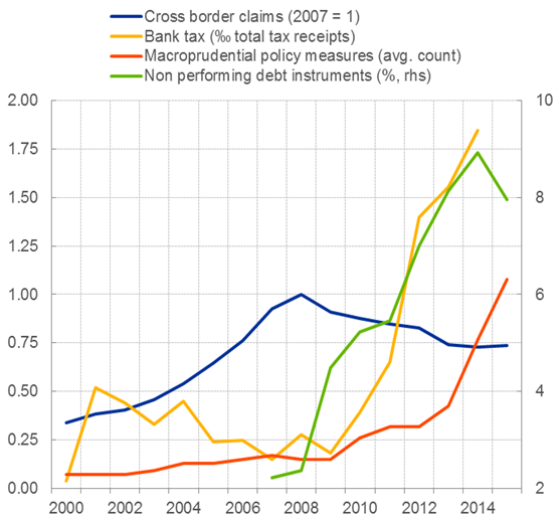
European Union countries are among the most integrated economies in the world, both in terms of trade and finance. We focus on one aspect of financial integration, which is bilateral cross-border bank exposure. In general, we could observe two distinct periods of financial integration in Europe. During the years preceding the global financial crisis, financial integration of EU countries was increasing at a relatively high pace. Other investment flows in the balance of payments statistics, which mostly reflect cross-border banking flows, amounted to, on average, 16% of EU GDP annually during the 2005-2007 period (see Figure 1). Precipitous deleveraging in the aftermath of the global financial crisis and the sovereign debt crisis was followed by some continued reversal of cross-border banking liability flows and stalled cross-border banking asset flows in the post-crisis period (see Figures 1 and 2).

Figure 1: Other Investment flows in the EU
% of GDP



Source: ECB, authors' calculations.

Figure 2: Financial integration, policy measures, and banking sector health



Note: Cross border claims is the sum of bilateral cross border claims of banks in 15 reporting countries on the bank and non-bank sector in 28 receiving countries in the EU. Bank tax measures tax receipts from banks relative to total tax receipts. Macroprudential policy measures index is the average count of macroprudential policy measures implemented. Non-performing debt instruments is measured as average non-performing debt instruments as percentage of total debt instruments.
Sources: BIS LBS, Eurostat, Cerutti et al. (2015), ESRB, authors' calculations.

The post-crisis reversal of financial integration in Europe coincided with deterioration in asset quality and was followed by increasing sectoral taxes and adoption of macroprudential measures in the EU (see Figure 2). Interestingly, the implementation of macroprudential policies and an increasing tax

burden are coupled with stalled cross-border financial integration. Is it indeed the case that adoption of such policies reduced financial integration in the EU? Or are the remnants of the global financial crisis manifested in persistently high shares of non-performing assets on banks' balance sheets behind reduced cross-border banking activity?

The remainder of this paper is organised as follows. Section 2 describes data sources and also provides some stylized facts about the reversal of banking integration in the EU. Section 3 briefly reviews the related literature. Section 4 presents our cross-sectional analysis comparing the pre- and post-crisis period, which is complemented by a panel data approach in Section 5. Section 6 includes several robustness checks and Section 7 concludes.

2. Data sources

2.1 Cross-border banking data

Data on bilateral cross-border banking positions are gathered from the Bank for International Settlements' (BIS) databank on locational banking statistics. The locational banking statistics (LBS) detail the currency and geographical composition of banks' balance sheets at quarterly frequency. They capture outstanding claims and liabilities of banking offices located in the BIS reporting countries, including intragroup positions.[1] Therefore the BIS locational banking statistics could well approximate capital flows intermediated by banks between source and host countries. The choice of locational versus consolidated versus locational data is often not discussed in depth in the literature and there is no consensus on which type of the BIS banking data should be used to address the question of cross-border banking. We would argue in favour of LBS, as these could well approximate actual bilateral cross-border flows between two countries more precisely since they exclude local claims of branches and subsidiaries reported in CBS (immediate counterparty basis).[2] In this paper we focus on 28 EU countries, out of which 15 countries are also BIS reporting countries.[3] We perform several adjustments of the data reported by the BIS in order fill the missing observations and eliminate exchange rate-related valuation effects (for further details see Annex).

Following Cesa-Bianchi et al. (2016), we construct an index of cross-border banking integration at the country pair level by scaling bilateral claims and liabilities by the sum of host and home countries' GDP.[4]

$$K_{ijt} = (1/2)\left[ln\left(\frac{C_{ijt}}{Y_{it}+Y_{jt}}\right) + ln(\frac{L_{ijt}}{Y_{it}+Y_{jt}})\right]$$

The intensity of financial integration across EU countries varies significantly (see Figure 3). Serving as a financial hub, the United Kingdom clearly stands out as the most financially integrated country followed by Luxembourg, Germany, the Netherlands, Ireland, and France. Central and south-eastern European countries (CESEE) are on average the least financially integrated countries.[5]

[1] The BIS also collects data on banks' country risk exposures and reports them as the consolidated banking statistics (CBS). They include the worldwide consolidated positions of banks headquartered in the BIS reporting countries, including positions of their foreign affiliates net of intragroup positions.

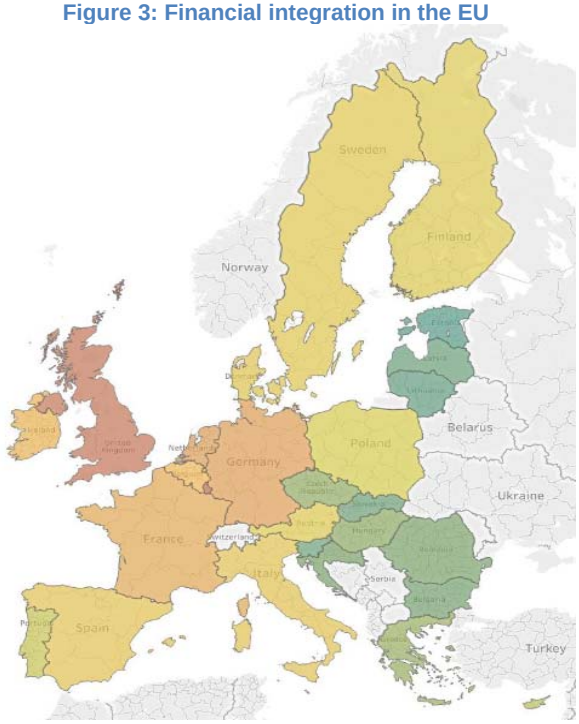
[2] See Annex Figure 1 for an illustration of the BIS locational banking data.

[3] The countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

[4] An alternative specification of the financial integration index could be to use host and home countries' population as a scaling factor.

[5] Note, however, that none of the CESEE countries reports to the BIS. Hence, the degree of financial integration within the CESEE region is not covered in this measure. Furthermore, CESEE countries are relatively small in terms of their economic output, while countries where cross-border banking claims originate are relatively large, which also lowers the degree of financial integration using our measure.

Figure 3: Financial integration in the EU



Note: colour coded average values of the financial integration index by Cesa-Bianchi et al. (2016) for 2016Q1. Dark shades of red and green indicate the highest and lowest average levels of bilateral financial integration, respectively.
Source: BIS (LBS), authors' calculations.

The BIS data allow for a more granular breakdown of banks' cross-border exposures into claims and liabilities vis-à-vis banks and the non-bank sector as well as into different categories of financial instruments. Zooming in on cross-border claims in Europe[6], we could observe that cross-border claims vis-à-vis other banks were most affected by deleveraging after the global financial crisis, whereas cross-border claims vis-à-vis the non-bank sector slightly increased (see Figure 4). Turning to financial instruments, banks mainly reduced cross-border claims in the form of loans and deposits which however still remained the most important financial instrument of cross-border lending (see Figure 5).[7]

[6] Our sample consists of cross-border claims of 15 EU countries, which report to the BIS, vis-à-vis all EU countries against both, banks and the non-bank sector.

[7] Banks' cross-border liabilities evolved in a similar fashion (see Annex).Annex

Figure 4: Cross-border claims (in trillions euro)

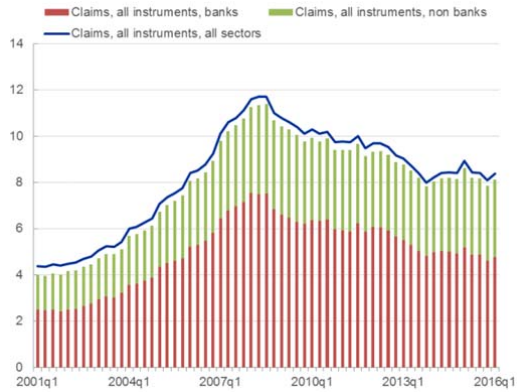
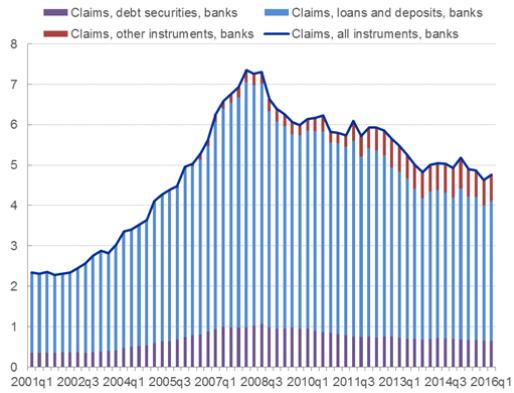


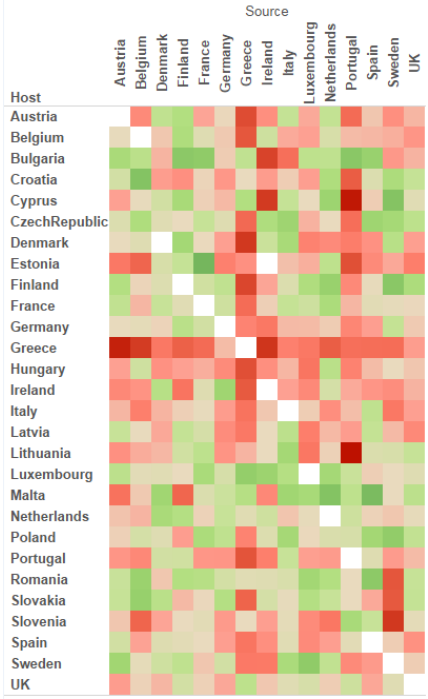
Figure 5: Claims vis-à-vis the banking sector (in trillions euro)



Note: Sum of cross-border claims of 15 EU reporting countries on EU28 countries. Discrepancy between cross-border claims against all sectors and sum of claims against banks and non-bank sector reflect claims against the other sectors. Source: BIS (LBS), authors' calculations.

The processes of deleveraging after the global financial crisis was not only heterogeneous across sectors and financial instruments, but also across country pairs within the EU (see Figure 6). We report the change in average bilateral cross-border claims between the pre-crisis (2005-2007) and the post-crisis (2013-2015) period. We observe that for some country pairs deleveraging between the two periods was significant (dark red), while for other country pairs cross-border exposure actually increased (dark green). Three interesting observations emerge. First, all source countries heavily reduced exposures vis-à-vis Greece, which is striking, but hardly surprising given macroeconomic developments in the country. Second, there is no single source country that reduced its cross-border exposures against all host countries. Third, an increase of cross-border exposure between the two periods was not so rare, as one may have expected.

Figure 6: heterogeneity in deleveraging across country pairs



Note: Change in average bilateral cross-border claims between the pre-crisis (2005-07) and the post-crisis (2013-2015) period. Dark red indicates high negative values (i.e. deleveraging) and dark green indicates high positive values. Ireland heavily reduced exposures vis-à-vis Estonia. To sharpen the picture this observation has been dropped. Source: BIS (LBS), authors' calculations.

2.2 Explanatory variables

To assess the role of macroprudential policies, we construct a database of macroprudential measures taken in EU countries by combining information from the Cerutti et al. (2015) database (henceforth: CCL database) for the 2000-2013 period with the European Systemic Risk Board database (henceforth: ESRB database) for the period 2010-2016.[8] The CCL database is built on a comprehensive survey, the Global Macroprudential Policy Instruments (GMPI), carried out by the IMF's Monetary and Capital Department during 2013–2014. It contains data on macroprudential policy measures for 119 countries for the 2000-2013 period and 12 macroprudential measures (see Table 1).[9]

In the CCL database, a macroprudential measure is expressed as a binary variable being unity for the period it was actually in place (i.e., from the year it was introduced until the year it was withdrawn). The macroprudential measures are aggregated into two categories: (i) measures aimed at borrowers' leverage and financial positions (LTV and DTI ratios) and (ii) measures aimed at financial institutions' assets or liabilities (DP, CTC, LEV, SIFI, INTER, CONC, FC, RR GG, and TAX). The macroprudential policy index (MPI) sums up all macroprudential measures in place for a given year.

Table 1: Macroprudential Policies

Cerutti et al. (2015)	ESRB dataset
General Countercyclical Capital Buffer/Requirement (CTC)	Countercyclical conservation buffer (CCyB)
Capital Surcharges on SIFIs (SIFI)	G-SII and O-SII Buffer
Leverage Ratio (LEV)	Leverage Ratio
Loan-to-Value Ratio (LTV)	Loan-to-value (LTV)
Debt-to-Income Ratio (DTI)	Debt service-to-income (DSTI) Loan-to-income ratio (LTI)
Limits on Interbank Exposures (INTER)	
Time-Varying/Dynamic Loan-Loss Provisioning (DP)	
Concentration Limits (CONC)	
Limits on Foreign Currency Loans (FC)	
Reserve Requirement Ratios (RR)	
Limits on Domestic Currency Loans (CG)	
Levy/Tax on Financial Institutions (TAX)	
	Systemic Risk Buffer (SRB)
	Liquidity Ratio (LR)
	Loan-to-deposit ratio (LTD)
	Loss-given-default (LGD)

Turning to the ESRB database, the EU prudential rules for banks—set out in the Capital Requirements Directive (CRD IV) and the Capital Requirements Regulation (CRR)—envisage requirements for designated authorities, competent authorities and/or Member States to notify the ESRB of measures of macroprudential interest. Hence, this database contains information on macroprudential policy measures taken by the ESRB members (i.e., EU28 countries, Iceland, and Norway). Since the ESRB is a relatively new institution – it was established in 2010 – the bulk of the measures in this database are recorded for the 2010-2016 period. The ESRB database contains information on the date of the decision on the respective macroprudential measure and the implementation date of this measure. The ESRB database, reports, among other macroprudential

[8] For further details see ESRB (2016).

[9] Cerutti et al. (2015) define their LTV measure as the sub-set of LTV measures used as a strict cap on new loans, as opposed to a loose guideline or merely an announcement of risk weights; and RR as the subset of RR measures that impose a specific wedge on foreign currency deposits or are adjusted counter-cyclically.

measures, also recommendations (e.g. on loan amortisation, loan maturity, risk weights), measures that are highly heterogeneous across countries (e.g. Pillar II requirements), or measures that are not immediately binding for banks' business decisions (e.g. stress test). Such measures are excluded from our analysis.

In order to map the ESRB and the CCL databases, we adopted the following strategy. As the ESRB database reports the exact day when a macroprudential measure was implemented, while the CCL database reports only the year, we use 30 June as a cut-off date to decide in which year the measure is implemented (i.e. measures which became active post the cut-off date are coded for the following year). Similarly to the CCL database, we use binary coding. The categories of macroprudential measures reported in the CCL database only partly overlap with the measures reported in the ESRB database. As a result, we could identify the following three groups of macroprudential measures (see Table 1). The first group consists of measures that could be clearly identified in both databases. The second group consists of measures reported in the CCL database only and the third group of measures reported only in the ESRB database.

In our analysis we focus on macroprudential measures included in the first group. The omitted macroprudential policies should not – in our view – lead to large biases in our results, as there are very few instances across EU countries, where such policies were actually implemented.[10] As one of the robustness checks we extend the scope of macroprudential measures in our database by assuming that all measures reported in the second group remained in place for the period 2013-2015. Our main results remain unchanged.

Turning to sectoral taxes, we construct a measure of relative tax burden on the banking sector from the National Tax Lists[11] submitted by EU countries to Eurostat for the period 1995-2014. We select all sector-specific taxes and levies affecting the banking sector including bank levies, mandatory contributions to deposit insurance funds, and taxes on financial and capital transactions. We construct three variants of relative sectoral tax burden, dividing tax revenues from sectoral taxes by total tax revenues in a given year. The first variant includes all three taxes mentioned above and could be considered as a broad measure of the sectoral tax burden on the financial sector. The second variant excludes taxes on financial capital transactions. The third variant focuses only on the bank levy.[12] In our analysis we use the third variant due to identification clarity. It should be noted, that the relative tax burden imposed by the bank levy is relatively limited ranging from 0.08% in Germany to 1.15% in Slovakia in 2014, the latest year available, by which 12 EU countries had introduced bank levies.

We proxy health of the banking sector by the ratio of non-performing loans over total gross loans from the IMF's Financial Soundness Indicators (FSIs) database in annual frequency.[13] To measure the impact of changes in the institutional and regulatory environment which have been identified as important determinants of international capital flows (see, for example, Schmitz (2011), and Papaioannou (2009)) we include a broad indicator of institutional quality, taking the average score of the World Bank's Worldwide Governance Indicators (WGI) per country and year. This composite index includes the following indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Finally,

[10] DP is used in Bulgaria and Spain, in the latter case there is no change over time. INTER is used by Bulgaria, Croatia, France, Germany, Portugal, and Romania. For Croatia and France, there is no variation over time. CONC is used by 10 countries (Belgium, Bulgaria, Croatia, Czech Republic, France, Iceland, Norway, Poland, Romania, and Spain), however, only 2 exhibit variation over time (Romania and Croatia). FC is used by Austria, Hungary, and Romania. RR was used by Bulgaria between 2005 and 2007. CG is not used by any country.

[11] The National Tax List contains a detailed list of budget revenues from taxes and social contributions using national classification.

[12] See table A.1 in the Annex for more details.

[13] The data is gathered at annual frequency for the EU 28 countries. If annual data was not available for a given country it was replaced by the fourth quarter figure of the quarterly series. This was the case for Croatia, Cyprus, the Czech Republic, Estonia, Finland, Greece, Lithuania, and Malta.

macroeconomic variables are from the IMF's International Financial Statistics (IFS) and the World Economic Outlook databases and the gravity controls are from the CEPII database, Mayer and Zignago (2011), and Toubal and Melitz (2014).

3. Brief review of related literature

Our paper is related to several strands of the existing literature and contributes to it by investigating a relatively wide range of possible determinants of cross-border deleveraging in an integrated framework.

The first strand of literature analyses developments of capital flows in the recent period. McQuade and Schmitz (2016) conclude that global capital flows have settled at a far more moderate level in the post-crisis period compared to what was observed prior to the financial crisis. The onset of the global financial crisis led to a precipitous decline in international financial flows, representing an abrupt interruption of the financial globalisation process (Milesi-Ferretti and Tille, 2011; Lane, 2013). Broner et al. (2013, 2014) document the pro-cyclicality of gross capital flows and their collapse during financial crises. The importance of global factors for gross international capital flows, specifically common risk factors, is highlighted by Forbes and Warnock (2012). Furthermore, Rey (2015) shows that capital flows are strongly correlated across different types and regions due to a global financial cycle. There are several studies, which focus on cross-border banking flows. Forbes et al. (2016) note that the decline in global capital flows was particularly pronounced in cross-border banking. Cerutti and Claessens (2016) document the retrenchment of cross-border bank lending in the aftermath of global financial crisis, describing it as "the great cross-border bank deleveraging". Potential determinants of "financial deglobalisation" (Forbes, 2014), include an increase in home bias (Gianetti and Laeven, 2012), government intervention in the banking system (Rose and Wieladek, 2014), banks' vulnerabilities (Cerutti and Claessens, 2016), and regulatory tightening (Bremus and Fratzscher, 2015; Ichiue and Lambert, 2016).

The second strand of literature analyses regulatory arbitrage following the implementation of macroprudential policies. Houston et al. (2012) are among the first to provide some evidence of regulatory arbitrage, specifically for the period before the global financial crisis (i.e. 1996-2007). More recently, Bremus and Fratzscher (2015) show that increasing independence and power for supervisory authorities leads to credit flowing abroad. However, for the euro area, they find that more stringent capital requirements at home actually reduce cross-border banking activity.[14] Reinhardt and Sowerbutts (2015) document the differential impact of various macroprudential policies on cross-border borrowing. They find that more stringent capital requirements lead to a higher demand from the non-bank sector for funds from banks operating across the border. This effect is absent if macroprudential actions target lending standards (i.e. loan-to-value ratio). Buch and Goldberg (2016) also stress that international spillovers vary across prudential instruments finding that spillovers on loan growth rates were not large on average between 2000 and 2014. Forbes et al. (2016) find that interaction between prudential regulations and unconventional monetary policy explain roughly 30% of the contraction in aggregate UK cross-border bank lending which corresponds to around 10% of the global contraction. Finally, Ichiue and Lambert (2016) suggest that tighter regulatory standards could explain around half of the decline in non-resident lending-to-GDP ratio in the aftermath of the global financial crisis. Overall, there seems to be no consensus in the literature on the impact of regulatory tightening via macroprudential policy on cross-border bank flows. Some studies highlight the role of regulatory arbitrage, which could increase cross-border banking exposures and thus

[14] Bremus and Fratzscher (2015) present evidence for 15 source and 46 host countries out of which 9 and 19 are EU Member States, respectively. We aim to provide a more detailed picture of EU cross border banking by including all available EU source and receiving countries in the analysis (15 sending, 27 receiving. (LU is excluded in the regressions)).

increase financial integration, while others stress that adhering to more stringent rules is costly for banks, which in turn reduce cross-border exposures.[15]

In contrast, literature analysing the impact of sectoral taxes on banks is scarce. It should be noted, however, that Cerutti et al. (2015) include 'levy/tax on financial institutions' in their macroprudential policy index (MPI). We treat sectoral taxes separately from macroprudential measures.

Regarding banking sector indicators, Cerutti and Claessens (2016) explore the effect of, inter alia, a range of performance and vulnerability indicators on cross-border banking. They conclude that non-performing loans, return on assets, and risk weighted assets to total assets cannot explain cross-border deleveraging during the global financial crisis (i.e. the 2008Q2-2009Q2 period). We extend their analysis by looking at longer time periods.

4. Determinants of cross-border banking - Cross-sectional analysis

4.1 Empirical strategy

We build on the frameworks presented by Galstyan and Lane (2013) and Bremus and Fratzscher (2015) and estimate a cross-sectional specification using variables expressed as differences between two distinct periods. We define a pre-crisis period (2005-2007) and a post-crisis period (2013-2015) for which we average all variables. Subsequently we take the difference between the two periods, which we use in our estimation.

$$\Delta C_{ij} = \beta_0 + \beta_1 \ln(C_{ij}^{pre}) + \beta_2 \Delta WGI_i + \beta_3 \Delta WGI_j + \beta_4 \Delta NPL_i + \beta_5 \Delta NPL_j + \beta_6 \Delta MPI_i + \beta_7 \Delta MPI_j + \beta_8 \Delta BANKTAX_i + \beta_9 \Delta BANKTAX_j + \alpha' X_{ij} + \epsilon_{ij}$$

Hence, in the above equation $\Delta C_{ij} = \ln(C_{ij}^{post}) - \ln(C_{ij}^{pre})$ denotes the change in the source country's *i* claims on the host country *j* between the pre- and post-crisis periods. Such specification helps to identify determinants of the significantly different development of cross-border lending prior and after the global financial crisis. We use the following regressors, which the literature recognizes as potential determinants of cross-border banking flows for the source and host countries:

WGI_i and WGI_j are composite indices of institutional quality; NPL_i and NPL_j are non-performing loan ratios, indicating banking sector health conditions, MPI_i and MPI_j are macroprudential policy indices and $BANKTAX_i$ and $BANKTAX_j$ are measures of the sectoral tax burden on banks. The matrix X_{ij} includes other control variables - push and pull factors of cross-border banking flows specified in the literature such as differences short-term interest rates, and GDP growth (Herrmann and Mihaljek, 2010; Bremus and Fratzscher, 2015), as well as variables used in the gravity literature such as bilateral distance, a language similarity index, and a common legal origin dummy (Galstyan and Lane, 2013). Furthermore, we also control for the pre-crisis level of bilateral cross border claims following Galstyan and Lane (2013) who find a "reversion to the mean" effect showing that cross-border positions were cut most in the countries where pre-crisis holdings (initial stocks) were the largest. All explanatory variables are expressed in differences, except for the time invariant gravity variables.[16]

[15] There are studies monitoring the implementation of these policies and also estimate their impact on local economy. The former includes Cerutti et al. (2015), which constructs an index of macroprudential policies for a wide sample of countries. They found that once implemented, these policies reduce real credit growth. However, their impact is lower for financially mature countries and open economies, which could hint to possible circumvention of macroprudential policies. In a more recent paper Cerutti et al. (2016) provide a more granular view on macroprudential policies by constructing an index tracking their stringency.

[16] Data on non-performing loans are not available for most countries prior to 2008. Hence, the 2008 values are taken for 2007 in order to compute the difference. This most likely underestimates the rise in NPL ratios since NPLs where already on the rise in 2008 in the wake of the financial crisis.

We estimate this model by OLS, sequentially using the BIS (LBS) data on cross-border claims vis-à-vis all sectors, banks, and the non-bank sector as the dependent variable. By doing so, we want to identify determinants of the systematically different development of cross-border claims on banks and the non-bank sector in the post-crisis period. As our model includes controls for macroeconomic conditions in both, the source and host countries we can rule out that shifts towards lending across the border reflects lower demand for loans in the source country. By using FX-adjusted data on cross-border banking exposures, we also rule out the impact of valuation effects due to exchange rate changes.

4.2 Results

Table 2 shows the results for different specifications. The columns show the results for the full specification (columns 1, 4, and 7) and variations of the model where we include source or host country fixed effects and exclude the corresponding regressors, respectively. This approach serves as a first robustness check by successively controlling for unobserved source and host country characteristics.

A first striking result is the fact that the explanatory variables indeed show distinct impacts across the categories of cross-border lending we are considering. It can therefore be the case that while certain policies show no effect on total cross-border claims they might very well influence its respective components.

The reversal in cross-border banking integration in the EU has been significantly affected by unresolved banking sector problems in both recipient and source countries. We find that the surge in NPLs in source countries – which can be interpreted as an indicator of unresolved financial sector problems, legacy issues and legal framework problems – was associated with larger deleveraging. Surprisingly, higher NPLs in host countries are shown to have had a positive effect on cross-border lending (columns 1 and 3). Taking a closer look at the results for claims vis-à-vis banks and non-bank sector, it becomes obvious that the positive effect on all claims is observed because cross-border lending to the non-bank sector increases with higher NPL ratios in host countries (columns 7 and 9). This indicates that in countries where banking sector problems were particularly pressing, the role of domestic banks in terms of credit provision to the non-bank sector is significantly reduced and substituted by credit intermediated across the border.

Institutional quality is a significant pull factor for cross-border bank claims (e.g. Papaioannou, 2009). Better institutions, scoring higher in the WGI index, are associated with increasing cross-border flows for host countries. In our model, banks reduce cross-border lending when institutional quality improves in their home country. This seems particularly the case for exposures towards the non-bank sector as the coefficient on the WGI index are highly significant and negative (columns 7 and 8).

Turning towards the estimates of the effect of macroprudential policies on cross-border claims we find no significant impact of the increasing use of macroprudential tools on cross-border lending after the global financial crisis. The coefficients on the MPI index are small and insignificant throughout. Hence we conclude that, overall, it was not through to regulatory tightening that banks reduced their cross-border positions during the period considered. As noted by Buch and Goldberg (2016), international spillover effects could vary across different types of prudential instruments.

Taxation of the banking sector in source countries is associated with increasing cross-border claims although the coefficient is only significant when host country fixed effects are included (column 2). Making use of the more granular data, we find that cross-border positions are increasing with higher taxes in source countries especially vis-à-vis the non-bank sector. This points towards possible regulatory arbitrage with banks shifting activity abroad when they are taxed at home. We also observe higher taxation in the host country being a pull factor for cross-border lending to the non-bank sector. Thus, it seems that increasing tax burdens on banks in a host country might lead to a substitution

effect towards the use of cross-border bank credit, while taxation does not have a significant impact on cross-border positions vis-à-vis banks.

Finally, the gravity and macro controls mostly show the expected signs across the columns. Host country's GDP is positively associated with cross-border lending, while source country's GDP is insignificant. Bilateral geographic distance is not a decisive factor: while the coefficient has the expected negative sign in all specifications, it is only significant at the 10% level for claims on non-banks. Other gravity controls such as a common language and common legal origin are found not to drive cross-border bank holdings in the EU. We also find that the monetary policy stance in the source country, approximated by short-term interest rate and often reported as important push factor for cross-border lending in the literature, has no impact in our model. Similarly, the impact of the monetary policy stance in the host country turns insignificant. In fact, we find a negative coefficient for cross-border claims vis-à-vis banks, indicating that a positive interest rate differential even led to withdrawal of cross-border lending to the non-banking sector. These effects might however differ for a sample including countries outside the EU.[17] The extent of real linkages between EU countries matters and softens the deleveraging process after the financial crisis. Countries which had higher levels of bilateral trade before the crisis reduced their bilateral cross-border banking activity less. Akin to Galstyan and Lane (2013), we also find a "reversion to the mean" effect since countries reduced their claims more vis-à-vis partners with whom they had a larger initial stock of claims.

Table 2: Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Claims, all instruments, all sectors			Claims, all instruments, banks			Claims, all instruments, non banks		
log GDP (source)	1.043	1.618		-1.854	-4.047*		1.724	3.042	
	(1.602)	(1.645)		(2.199)	(2.257)		(1.918)	(1.986)	
log GDP (host)	2.179***		2.135***	3.762***		3.939***	1.968***		1.713**
	(0.648)		(0.678)	(1.084)		(1.123)	(0.732)		(0.754)
Distance (ln)	-0.099	-0.125	-0.127	0.020	-0.247	-0.098	-0.199*	-0.150	-0.151
	(0.094)	(0.132)	(0.099)	(0.153)	(0.225)	(0.158)	(0.104)	(0.144)	(0.108)
Common legal origin	0.262	0.059	0.164	0.033	-0.288	-0.143	0.325	0.036	0.350
	(0.196)	(0.206)	(0.206)	(0.365)	(0.390)	(0.366)	(0.218)	(0.238)	(0.227)
Common language index	-0.091	-0.091	0.102	0.168	1.240	0.043	-0.365	-0.652	-0.039
	(0.456)	(0.488)	(0.455)	(0.757)	(0.871)	(0.779)	(0.481)	(0.575)	(0.466)
Short term interest rate (source)	-0.056	-0.061		0.026	0.052		-0.069	-0.081*	
	(0.040)	(0.038)		(0.058)	(0.054)		(0.048)	(0.047)	
Short term interest rate (host)	-0.045		-0.036	-0.131**		-0.129**	-0.003		-0.001
	(0.040)		(0.040)	(0.058)		(0.056)	(0.048)		(0.047)
Initial stock	-0.204***	-0.272***	-0.184***	-0.181***	-0.152*	-0.192***	-0.369***	-0.462***	-0.384***
	(0.048)	(0.055)	(0.052)	(0.068)	(0.083)	(0.072)	(0.061)	(0.065)	(0.071)
Initial bilateral trade	0.386***	0.509***	0.349***	0.672***	0.448***	0.745***	0.536***	0.781***	0.508***
	(0.083)	(0.111)	(0.092)	(0.114)	(0.159)	(0.125)	(0.086)	(0.130)	(0.089)
WGI composite index (source)	-0.333	-0.402*		-0.135	0.102		-0.653***	-0.794***	
	(0.207)	(0.211)		(0.330)	(0.318)		(0.221)	(0.222)	
WGI composite index (host)	0.145*		0.137*	-0.094		-0.091	0.133		0.137
	(0.080)		(0.081)	(0.128)		(0.125)	(0.094)		(0.094)
MPI (source)	0.045	0.024		-0.283	-0.206		-0.009	-0.061	
	(0.122)	(0.117)		(0.180)	(0.176)		(0.138)	(0.135)	
MPI (host)	0.024		0.032	-0.064		-0.095	-0.013		0.006
	(0.081)		(0.080)	(0.123)		(0.122)	(0.090)		(0.090)
NPLs (source)	-0.044**	-0.037**		-0.059***	-0.073***		-0.045**	-0.032	
	(0.017)	(0.016)		(0.022)	(0.023)		(0.021)	(0.020)	
NPLs (host)	0.022**		0.020*	-0.019		-0.012	0.036***		0.032***
	(0.010)		(0.011)	(0.016)		(0.016)	(0.010)		(0.010)
Bank tax (source)	0.309	0.482**		0.572	0.242		0.899***	1.232***	
	(0.229)	(0.243)		(0.383)	(0.371)		(0.283)	(0.313)	
Bank tax (host)	0.175		0.126	-0.098		-0.145	0.552**		0.560**
	(0.235)		(0.237)	(0.360)		(0.359)	(0.269)		(0.268)
Observations	353	353	353	343	343	343	346	346	346
R-squared	0.28	0.40	0.30	0.35	0.45	0.38	0.29	0.40	0.31
Source country FE	no	no	yes	no	no	yes	no	no	yes
Host country FE	no	yes	no	no	yes	no	no	yes	no

Robust standard errors in parentheses. All variables except for the time-invariant gravity variables are expressed in post- and pre-crisis differences.
*** p<0.01, ** p<0.05, * p<0.1

[17] Note, however, that Bremus and Fraztscher (2015) also find a negative coefficient for the difference in destination country short term interest rates for their sample of 46 receiving countries including EMEs.

5. Determinants of cross-border banking – Panel data analysis

5.1 Empirical strategy

In this section we employ a gravity model approach using the full panel dimension of the dataset, which could provide complementary insights on determinants of cross-border lending over the 2007-2014 period.[18]

$$C_{ijt} = \beta_0 + \beta_1 WGI_{it} + \beta_2 WGI_{jt} + \beta_3 NPL_{it} + \beta_4 NPL_{jt} + \beta_5 MPI_{it} + \beta_6 MPI_{jt} + \beta_7 BANKTAX_{it} + \beta_8 BANKTAX_{jt} + \boldsymbol{\alpha}'\boldsymbol{G} + \boldsymbol{\delta}'\boldsymbol{M} + \mu_i + \theta_j + \gamma_t + \epsilon_{ijt}$$

We include various gravity variables in the matrix ***G,*** as for instance geographical distance, language similarity, and legal origin, most of which are constant over time. In addition, we also use macroeconomic variables grouped in matrix ***M*** to approximate push and pull factors for cross-border banking flows following, e.g., Herrmann and Mihaljek (2010). These include bilateral differences in long-term interest rates as well as GDP in both source and host countries. Furthermore, we add source and host country fixed effects, as well as year fixed effects. While the former control for unobserved country heterogeneity, the latter tackle common shocks. Thus, we are able to control for common global factors, the importance of which are stressed by Forbes and Warnock (2012) and Rey (2015).

5.2 Results

Table 3 depicts model specifications (see columns 1 to 3) referring to the different (sub)categories of cross-border claims under consideration. The gravity controls have the expected sign across specifications (except for the common language index). Bilateral trade has a positive and significant effect on financial integration and in particular on the extent of cross-border lending to banks. Geographical distance, which tends to proxy information asymmetries, has a dampening effect, as common in the gravity literature on international finance. This effect is, however, absent for the banking sector indicating that information asymmetries are less pronounced vis-à-vis banks abroad compared to the non-bank sector. This could, however, also reflect the fact that intragroup lending is included in the BIS (LBS) data used in our analysis. A common legal origin increases cross-border lending, especially to the non-bank sector.

For our main variables of interest we see that macroprudential policies in host countries are negatively correlated with claims on the non-bank sector while there is no effect on claims on banks. The increasing use of macroprudential policies in host countries is thus linked to a decrease in cross-border lending, especially vis-à-vis the non-bank sector. There is no effect of macroprudential tightening on cross-border lending vis-à-vis banks. Macroprudential policy measures in the source countries on the other hand are not a push factor for cross-border banking lending. Hence, we cannot confirm the presence of regulatory arbitrage within the EU.

Institutional quality can be a pull factor for cross-border lending, especially vis-à-vis banks. The positive and significant coefficients on the WGI in host countries is particularly pronounced for claims vis-à-vis the banking sector (column 2) while it is insignificant for the specification using cross-border lending to the non-bank sector as the dependent variable (column 3).

Taxation on the other hand deters cross-border flows to banks as shown by the negative and significant coefficient on the bank tax indicator for host countries (in column 2). Taxation in host countries has, however, no significant effect on total cross-border lending. This suggests that banks

[18] Ideally, we would want to perform this exercise for a longer timeframe. However, data on NPLs is not available for most countries before 2007.

reduce cross-border activity by cutting funding to their affiliates in countries with higher relative tax burden on the banking sector.

The most important driver of cross-border bank lending after the global financial crisis, however, is poor banking sector health as captured by the NPL ratios in our model. Cross-border claims are significantly negatively impacted by deteriorating portfolio quality in source and host countries alike. This is particularly the case for lending to banks (column 2) for which coefficients for source as well as host countries' levels of NPLs are larger[19]. According to our estimates, cross-border lending would be 17.8% higher if banks were not constrained by the unresolved financial sector problems, legacy issues and legal framework bottlenecks associated with the high post-crisis NPL levels in their countries of residence.

Turning to macroeconomic control variables, the long term interest rate differential between source and host country is not a significant driver for cross-border lending in the period considered. To understand this result one has to keep in mind the particular period under consideration which covers the global financial crisis and the euro area sovereign debt crisis. High long-term interest rates, especially in the wake of the sovereign debt crisis, can be seen as a sign of stress in the respective countries. Many investors, including banks, rushed towards safe havens during this period. Economic activity, however, was an important pull factor for the source country. If GDP was higher in the source country more cross-border lending was retrenched from the banking sector as indicated by the negative coefficient on log GDP (see column 2). Higher host country GDP levels on the other hand lead to higher flows to the non-bank sector (column 3).

[19] On average, NPL ratios were 5.4 percentage points higher in the post-crisis period (i.e. 2013-2015) when compared to the pre-crisis period (2005-2007).

Table 3: Gravity Model Results

VARIABLES	(1) All claims, all instruments, all sectors	(2) All claims, all instruments, banks	(3) All claims, all instruments, non-banks
ln(GDP) (source)	-0.678	-1.887*	-0.637
	(0.439)	(0.959)	(0.593)
ln(GDP)	0.466	-0.082	1.675***
	(0.526)	(0.933)	(0.575)
Bilateral trade (ln)	0.846***	1.114***	0.746***
	(0.211)	(0.283)	(0.175)
Distance (ln)	-0.565**	-0.413	-0.690***
	(0.221)	(0.289)	(0.209)
Common language index	-1.512**	-0.682	-1.794***
	(0.728)	(0.938)	(0.575)
Common legal origin	0.607**	0.495	0.550**
	(0.287)	(0.377)	(0.229)
Long term interest rate difference	0.003	-0.014	0.001
	(0.007)	(0.018)	(0.008)
WGI (source)	0.015	0.010	-0.071
	(0.065)	(0.100)	(0.079)
WGI (host)	0.212***	0.256**	0.137*
	(0.057)	(0.104)	(0.073)
MPI (source)	0.021	-0.190	0.010
	(0.064)	(0.116)	(0.070)
MPI (host)	0.011	0.115	-0.110*
	(0.042)	(0.078)	(0.064)
BANKTAX (source)	-0.210	-0.223	-0.102
	(0.128)	(0.215)	(0.153)
BANKTAX (host)	-0.082	-0.404*	0.121
	(0.130)	(0.208)	(0.171)
NPLs (source)	-0.033***	-0.065***	-0.033***
	(0.007)	(0.017)	(0.009)
NPL (host)	-0.015***	-0.073***	-0.002
	(0.006)	(0.015)	(0.007)
Observations	2,319	2,223	2,270
R-squared	0.83	0.76	0.82
Source country FE	yes	yes	yes
Host country FE	yes	yes	yes
Year FE	yes	yes	yes

Note: Robust standard errors (clustered at the country-pair level) in parentheses.
Difference in long-term interest rates is difference between host and source.
*** p<0.01, ** p<0.05, * p<0.1

6. Robustness tests

[to be finalized]

7. Conclusions

In this paper we examine the drivers of the reversal of cross-border banking integration across EU countries using data on cross-border banking exposures and a newly constructed dataset on sectoral taxes and macroprudential policies, as well as indicators of banking sector health and institutional quality. Our paper contributes to the existing literature by investigating a relatively wide range of possible determinants of cross-border deleveraging in an integrated framework.

We investigate whether tightening of regulatory policies and an increasing relative tax burden on banks, or the remnants of the global financial crisis manifested in persistently high shares of non-performing assets on banks' balance sheets reduced financial integration in the EU. Taking a more

granular view on cross-border claims in Europe than most of the existing literature, we could observe that banks' cross-border claims vis-à-vis other banks were most affected by deleveraging after the global financial crisis, whereas banks' cross-border claims vis-à-vis the non-bank sector even slightly increased. Indeed, our analysis shows that explanatory variables show distinct impacts across the two subcategories of cross-border lending we are considering. It can therefore be the case that while certain policies show no effect on total cross-border claims they might very well influence their composition.

We employ both a cross-sectional approach comparing the pre- and post-crisis periods as well as a panel data approach for the period of 2007-2014. We show that the most important driver of cross-border bank lending after the global financial crisis the poor banking sector health as captured by the NPL ratios. Cross-border lending would be significantly higher if banks were not constrained by the unresolved financial sector problems, legacy issues and legal framework bottlenecks associated with the high post-crisis NPL levels in their countries of residence. Improving institutional quality on the other hand is a significant pull factor for cross-border lending, especially vis-à-vis banks.

Furthermore, we cannot confirm the presence of regulatory arbitrage within the EU discussed in the literature (Houston et al., 2012; Bremus and Fratzscher, 2015; Reinhardt and Sowerbutts, 2015), since implementation of macroprudential measures does not lead to higher cross-border lending. Increasing use of macroprudential policies in host countries is, however, negatively correlated with cross-border claims on the non-bank sector, while we find no effect on cross-border lending to banks. Hence, tighter macroprudential standards might only be partially responsible for the subdued growth of financial integration in the EU after the financial crisis.

Finally, we find some evidence that higher tax burden on banks deters cross-border lending to the banking sector, while increases cross-border lending to the non-bank sector. One possible explanation for this might be that banks cut cross-border lending to affiliated offices serving non-bank sector in a given country and substitute it by direct cross-border lending to the non-bank sector.

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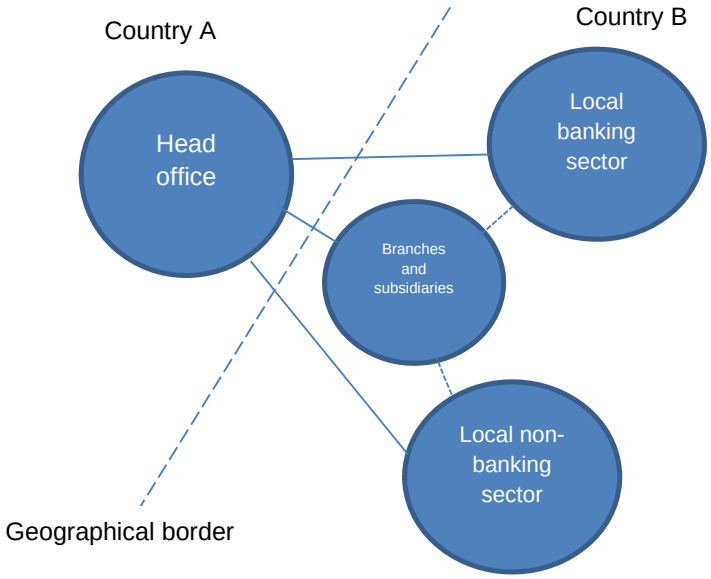
Annex

Adjustment of BIS data

In a first step, we fill gaps in the time series by using a more granular data also provided by the BIS. If, for example, there is a missing observation in time series for the claims on banks for a country pair, while the claims on non-banks and total claims are available, we fill the gap by subtracting the non-bank claims from the total claims series. Subsequently, we adjust respective stock variables for the exchange rate valuation effects using backward adjustment (i.e. starting from the latest data point of a stock variable we subtract the corresponding FX-adjusted flow reported by the BIS and iterate this procedure for the whole time series). In order to get a complete time series the stock and flow series are corrected for the remaining gaps/breaks[20] as follows: missing FX-adjusted flows are replaced with the change in non-adjusted stocks and thus could include valuation effects. If a stock data point were missing too, the stock would be calculated by multiplying the latest existing value with the growth rate of stocks vis-à-vis the world.[21] Finally, we construct annual claims by using the fourth quarter value.

Figure A.1 Illustration of BIS Locational Banking Statistics



Cross border claims of country A banks on country B are indicated by solid lines. They can occur vis-à-vis the local banking sector, including branches and subsidiaries of country A banks, or vis-à-vis the local non-banking sector.

Local claims of branches and subsidiaries on the banking and non-banking sector as indicated by the dashed lines are not included in the locational banking statistics.

[20] For a summary of breaks in the BIS dataset see: http://www.bis.org/statistics/breakstables17.pdf

[21] Between 2 and 8 percent of the observations are based on these corrections. The results remain robust when the raw data series are used.

Table A.1 Sectoral taxes on banks

	2014 value	Tax(es) considered
BE	0.11%	Contribution for Financial Stability to the Resolution Funds
DE	0.08%	Bank levy (Bankenabgabe)
IE	0.33%	Bank Levy on DIRT accounts
HU	0.11%	Financial institutions special tax
NL	0.97%	Bank Levies
AT	0.63%	Financial Institutions Stability Fee
PT	0.45%	Contribution on banking industry, contributions for the Resolution Fund
RO	0.26%	Tax on profits from commercial banks
SI	0.32%	Tax on balance wealth paid by banks
SK	1.15%	Special levy on selected financial institutions
FI	0.22%	Bank tax
UK	0.55%	Bank Payroll Tax, Bank Levy

Figure A.2: Cross-border liabilities (in trillions euro)

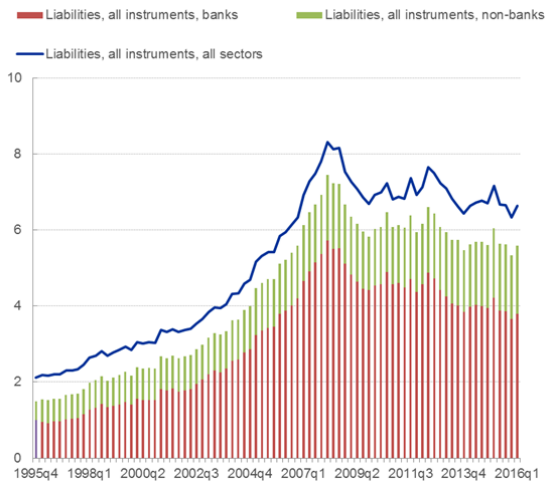
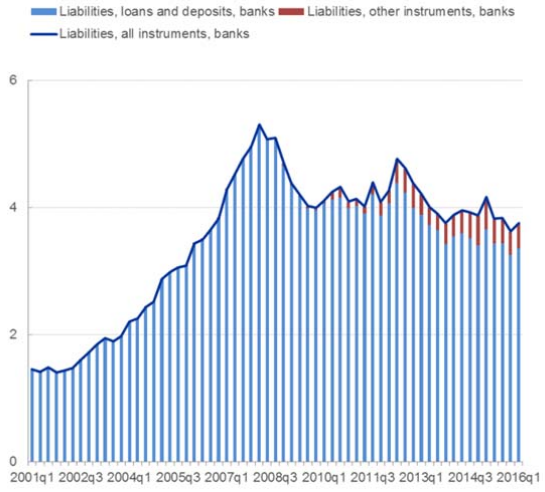


Figure A.3: Liabilities vis-à-vis the banking sector (in trillions euro)



Note: Sum of cross-border liabilities of EU15 reporting countries towards EU28 countries. Total liabilities are higher than the sum of liabilities towards banks and non-banks because the other sectors category is omitted in figure A.2.
Source: BIS (LBS), authors' calculations.

Table A.2 Summary statistics for cross-section analysis

Variable	Observations	Mean	Std. Dev.	Min	Max
Claims, all instruments, all sectors	391	-0.22	1.32	-9.67	2.94
Claims, all instruments, banks	381	-0.94	2.10	-12.07	5.85
Claims, all instruments, non banks	382	0.08	1.48	-9.34	5.89
log GDP (source)	405	0.03	0.14	-0.34	0.30
log GDP (host)	405	0.10	0.15	-0.34	0.33
Distance (ln)	405	7.11	0.64	4.09	8.23
Common legal origin	405	0.19	0.39	0.00	1.00
Common language index	364	0.20	0.15	0.03	0.88
Short term interest rate (source)	405	-1.61	1.60	-4.65	0.00
Short term interest rate (host)	405	-2.20	1.88	-7.03	1.17
Initial bilateral trade	405	21.52	2.14	15.29	25.97
WGI composite index (source)	405	-0.43	0.78	-2.75	0.49
WGI composite index (host)	405	-0.14	0.98	-2.75	2.20
MPI (source)	378	0.79	0.77	0.00	2.50
MPI (host)	391	0.76	0.74	0.00	2.50
NPLs (source)	405	5.42	8.43	-1.03	30.54
NPLs (host)	405	6.99	9.89	-1.03	42.77
Bank tax (source)	405	0.22	0.29	0.00	0.97
Bank tax (host)	405	0.16	0.32	-0.32	1.15

Note: This table shows summary statistics for the variables used in the regressions in Section 4. All variables, except for the time-invariant ones, are expressed in pre- and post-crisis differences.

Table A.3 Summary statistics for panel analysis

Variable	Observations	Mean	Std. Dev.	Min	Max
Claims, all instruments, all sectors	3180	7.52	2.95	-5.70	13.42
Claims, all instruments, banks	3060	6.61	3.47	-9.76	13.20
Claims, all instruments, non banks	3113	6.66	2.85	-22.87	12.11
log GDP (source)	3240	13.32	1.14	10.85	15.16
log GDP (host)	3240	12.23	1.57	9.07	15.16
Bilateral trade	3240	21.61	2.14	14.88	26.32
log distance	3240	7.11	0.64	4.09	8.23
Common language index	2912	0.20	0.15	0.03	0.88
Common legal origin	3240	0.19	0.39	0.00	1.00
Difference in long-term interest rates (host - source)	2640	0.40	3.64	-21.10	22.60
WGI composite index (source)	3240	8.00	2.69	1.39	11.43
WGI composite index (host)	3240	6.24	2.98	0.36	11.43
MPI (source)	3024	0.21	0.48	0.00	2.00
MPI (host)	3128	0.43	0.65	0.00	2.00
Bank tax (source)	3240	0.08	0.19	0.00	0.97
Bank tax (host)	3240	0.08	0.23	0.00	1.64
NPLs (source)	3240	5.23	6.22	0.08	33.78
NPLs (host)	3240	7.00	6.92	0.08	44.97

Note: This table shows summary statistics for the variables used in the regressions in Section 5.