Cross-Border Capital Flows and Bank Risk-Taking

Valeriya Dinger* Daniel Marcel te Kaat†

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Abstract

Though financial crises are usually preceded by external deficits, the channels through which international capital flows affect financial stability have hardly been identified. This paper studies the impact of global capital flows on bank risk-taking. Employing a euro area bank-level dataset between 2001 and 2012 for identification purposes, we show that banks in countries with external deficits increase the share of loans in their portfolios and reduce the average quality of loans. Further, we document that the deterioration of bank asset quality following surges in international capital inflows is related to agency problems.

Keywords: Bank Lending, Bank Risk-Taking, Current Account, Capital Flows, Agency Problems

JEL classification: F32, F41, G01, G21

*University of Osnabrück, School of Economics and Business Administration, Rolandstr. 8, 49069 Osnabrück (Germany), valeriya.dinger@uni-osnabrueck.de

†Corresponding author. University of Osnabrück, School of Economics and Business Administration, Rolandstr. 8, 49069 Osnabrück (Germany), dantekaat@uni-osnabrueck.de

1 Introduction

Substantial macroeconomic research establishes a positive relationship between cross-border capital inflows, lending booms and the incidence of financial crises (e.g., Reinhart and Rogoff, 2008; Gourinchas and Obstfeld, 2012; Caballero, 2014). However, the mechanisms of how international capital flows affect the asset side of banks are underexplored in the existing literature. Whereas numerous theoretical (Dell'Ariccia and Marquez, 2006; Acharya and Naqvi, 2012) and empirical (Maddaloni and Peydró, 2011; Jiménez et al., 2014; Ioannidou et al., 2015) papers explore the monetary policy transmission through the bank lending channel, less attention has been devoted to the role of banks in the transmission of international capital flows. According to national accounting identities, cross-border capital flows close the gap opened by current account deficits, thus providing additional international funding to banks located in countries with external deficits, either through the global interbank market or through the issuance of commercial papers and bonds. Therefore, similar to lax monetary policy, international capital inflows increase the quantity and reduce the price of loanable funds with potential effects on the dynamics of both bank lending and risk-taking (Acharya and Naqvi, 2012). The extant international finance literature focuses on the impact of cross-border capital flows on the dynamics of bank loan volumes (e.g., Reis, 2013; Benigno and Fornaro, 2014; Benigno et al., 2015; Samarina and Bezemer, 2016; Baskaya et al., 2017a; Baskaya et al., 2017b). Yet, the effects of foreign capital on credit risk-taking remain underexplored.

Theoretically, cross-border capital inflows can affect credit risk-taking through several channels. One channel is presented by Martinez-Miera and Repullo (2017), who derive a general equilibrium model of the relationship between real interest rates and the structure and risk-taking incentives of the banking system. Banks lend to a set of heterogeneous entrepreneurs, which they can monitor to reduce the probability of default; however, monitoring entails a cost for the bank. The main frictions of the model are agency problems in the banking sector, so that investors cannot observe the monitoring effort of banks, exacerbating moral hazard problems and increasing banks' risk-taking incentives. In this framework, the authors show that a global savings glut—which increases the international supply of savings—leads to a reduction in interest rates, an expansion of bank lending,

and a decline in the monitoring intensity of banks, which, in turn, reduces the quality of banks' loan portfolios and raises their probability of default. Alternative theoretical channels, which achieve the same empirical predictions with regard to the relationship between capital inflows and bank risk-taking, depart from the assumption that capital inflows generate excess liquidity. Existing theories then relate excess liquidity to lower interest rates, which induce banks to search for yield (Rajan, 2006), as well as to an aggravation of bank agency problems, leading bank managers to soften lending conditions (Acharya and Naqvi, 2012).

This paper examines the above hypotheses regarding the effects of cross-border capital flows on the patterns of bank lending and risk-taking, employing panel data models for 4,000 banks from eleven euro area countries. The micro-level dimension of our data allows us to explore the within-country differences across banks. As a consequence, (i) we are better able to identify the transmission channels from cross-border capital flows to changes in bank lending and risk-taking and (ii) our estimates are less sensitive to the underlying rationale for international capital flows, strengthening the causal interpretation of the coefficients. In particular, even when omitted variables on the country-level correlate with foreign capital flows, inter-bank differences in the sensitivity with respect to capital flows should not be affected.

Our empirical tests particularly benefit from using a sample of euro area banks because the intertemporal variation in foreign capital flows in that region was far-reaching and displayed considerable cross-country heterogeneity through the 2000s, aiding identification of its effects on bank balance sheets using panel data.[1] An additional advantage of euro area banks is that they operate within a monetary union so that we can isolate fluctuations in international capital flows from changes in the monetary policy stance.

Our empirical model encompasses several econometric tests. We start by documenting the relationship between cross-border capital flows and the dynamics of bank lending along three dimensions. First, we examine the dynamics of overall bank lending in order to understand the interaction between capital inflows and lending booms. We then continue with the identification of the changes in banks' loan-to-asset ratios. This exercise allows

[1] For instance, the pronounced cross-country and time variation allows us, by including country and time fixed effects, to control for country-specific and time-invariant factors in our regressions.

us to assess whether international capital inflows induce banks to substitute securitised assets with loans, for which local banks have a comparative advantage over foreign investors. Since lending to firms is typically riskier than investments in other assets, this substitution effect is a first sign of higher bank risks. Third, as lending booms are usually associated with an easing of lending standards (e.g., Acharya and Naqvi, 2012), we also explore the impact of global capital on credit risk-taking incentives.

To establish the causal interpretation of our results, we next provide an extension to our baseline model, which disentangles episodes during which the dynamics of cross-border capital flows are driven by global (supply) push factors, rather than local (demand) pull factors.[2] Based on the evidence of the existing research that the domestic risk-free interest rate decreases during episodes of supply-driven international capital flows (whereas interest rates rise when demand-driven local pull factors affect the dynamics of cross-border capital flows; see Martinez-Miera and Repullo, 2017), we corroborate the consistency of our coefficient estimates by restricting the sample to episodes in which inflows (outflows) of foreign capital are associated with reductions (rises) in the spread of 10-year sovereign bonds.

Following the theoretical literature reviewed above, our next step is to identify bank agency problems as the main mediating channel from cross-border capital flows to increased bank risk-taking. Particularly, we differentiate between gross capital inflows and outflows of debt, equity and foreign direct investments. This test is predicated on the evidence that higher gross capital **in**flows increase the share of funding held by foreign investors—in contrast to lower gross capital **out**flows that imply higher stakes of domestic lenders. The increase in the share of foreign investors holding positions in euro area banks, however, is associated with higher information asymmetries, as monitoring is more costly and/or less complete for distant lenders (Brennan and Cao, 1997; Tille and van Winscoop, 2010). The extant literature further shows that the increase in asymmetric information is most pronounced if capital flows mostly consist of cross-border debt flows. Specifically, Neumann (2003) argues that portfolio debt flows—relative to equity flows and FDI—do not incorporate levels of ownership and thus exacerbate manager controls,

[2] See Baskaya et al. (2017b), who argue that global push factors are exogenous with respect to bank lending behaviour in Europe.

increasing the severity of information asymmetries. Overall, we thus hypothesise that gross capital inflows (particularly gross debt inflows), by increasing bank agency problems, are the main drivers of higher credit risk-taking associated with surges in foreign capital inflows.

Last but not least, we further exploit the bank-level dimension of our dataset, examining the effects of cross-border capital flows on bank lending and risk-taking conditional on different bank characteristics. As argued above, these tests essentially explore the within-country differences between banks. They allow us to better identify the transmission channels from cross-border capital flows to changes in credit risk-taking and make our estimates less sensitive to the underlying rationale for international capital flows, thus buttressing the causal interpretation of our coefficients. These tests further enable us to disentangle loan supply from loan demand side effects, which is important for the policy implications of our paper, particularly regarding financial sector regulation. Based on the assumption that banks' different characteristics only affect the supply of credit and leave loan demand unaffected, we establish the ability of cross-border capital flows to affect bank lending supply in terms of volumes and riskiness.

The first of these tests departs from the argument of Holmstrom and Tirole (1997) that poorly capitalised banks do not fully internalise their risk of default. Therefore, bank capital can be used as a measure of bank agency problems.[3] Following this argument, our hypothesis is that the nexus between international capital flows and credit risk-taking is disproportionately strong in banks with low capital-to-asset ratios. The second test is based on the assumption that the extent to which a bank's loan supply is modified by cross-border capital flows is contingent on its funding structure. The test explores whether foreign capital disproportionately raises the lending and risk-taking incentives of domestic banks (that are more reliant on domestic liquidity conditions than globally-active banks) and banks that predominantly use interbank funding (which is presumably more affected by cross-border capital flows), rather than retail deposits.

Our results are as follows. We show that inflows of foreign capital lead banks to expand their lending and risk-taking. In particular, both loan growth and the relative change in

[3]The same argument is additionally supported by Allen et. al (2011) and is also consistent with the empirical results of Berger and Bouwman (2013), who show that banks with less capital have lower probabilities of survival, particularly during banking crises.

the loan-to-asset ratios are positively affected by capital inflows. In economic terms, a 1-percentage point (henceforth pp) increase in capital inflows over GDP leads to 0.89 pp higher loan growth and 0.73 pp higher growth rates of the loan-to-asset ratios. Moreover, in line with the theoretical literature on bank lending standards reviewed above (e.g., Acharya and Naqvi, 2012), capital inflows are also associated with higher ratios of impaired loans in total loans. These results are further amplified during episodes in which supply-driven push factors dominate the dynamics of cross-border capital flows. Overall, these findings identify two channels through which capital flows increase aggregate bank risks. First, the increase in the loan-to-asset ratios uncovers a substitution effect associated with global capital flows. The international capital flowing into a country crowds domestic banks out of the securitised asset markets, such as sovereign bonds, and makes them focus on their risky core business of granting loans. This is not per se a negative sign for financial stability, but simply indicates the deepening of financial intermediation following the influx of capital. Second, the increase in the ratio of impaired loans implies that banks grant more loans to risky borrowers. Therefore, what turns financial deepening into a financial hazard is the result that the average quality of bank loans deteriorates, increasing banks' exposure to economic downswings.

We further show that higher gross capital inflows (and in particular gross debt inflows) that increase the stakes of foreign investors for which monitoring is more costly and less complete—relative to lower gross capital outflows that imply higher stakes of domestic investors—drive the dynamics of bank lending associated with foreign capital, establishing that the risk-increasing effects of capital flows are exacerbated by bank agency problems.

Finally, we strengthen the causal interpretation of our results by exploiting the cross-country, cross-bank variation of our dataset. In detail, we show that cross-border capital flows overproportionally affect (i) banks with low capital-to-asset ratios, which serves as a proxy for agency problems between managers and their investors; (ii) interbank-dependent relative to deposit-taking institutions; and (iii) domestically owned relative to foreign-owned banks. These findings do not only suggest that supply side effects are important drivers of the nexus between capital flows and bank lending (as loan demand is independent of banks' funding and ownership structures), but also that global capital in-

flows disproportionately increase the incidence of financial crises via their effect on credit risk-taking incentives, when (domestic) banks have a more unstable form of funding, due to either low equity ratios or few retail deposits. From a policy perspective, it might thus be desirable to increase bank capital requirements upon observing surges in capital inflows, reducing the impact of agency cost issues.

These findings contribute to the existing literature in several dimensions. As the first empirical study to comprehensively examine the effect of international capital flows on bank-level risk-taking, this paper contributes to the understanding of the risk-taking channel as a function of the macroeconomic environment (e.g., Bernanke and Blinder, 1992; Kashyap and Stein, 2000; Jiménez et al., 2012; Jiménez et al., 2014; Ioannidou et al., 2015) by identifying a strong effect of a to date underexplored macroeconomic variable. Relative to the few studies on the relationship between cross-border capital flows and banks' asset side (Reis, 2013; Benigno and Fornaro, 2014; Benigno et al., 2015; Samarina and Bezemer, 2016; Baskaya et al., 2017a; Baskaya et al., 2017b), which focus on changes in bank loan volumes, we mainly explore the dynamics of credit risk-taking by showing that foreign capital induces banks to substitute securitised assets with imminently riskier loans and that the average quality of these loans deteriorates. Therefore, our paper further contributes to the literature on early financial crisis warnings by examining how external capital inflows affect banks' credit risk-taking and, thereby, increase the likelihood of financial crises. This concept is in line with substantial research that stresses the importance of capital flows for the probability of financial crises (e.g., Reinhart and Rogoff, 2008; Jordà et al., 2011; Mendoza and Terrones, 2012; Jagannathan et al., 2013).

This paper is structured as follows: The data and the empirical identification strategy is the focus of Section 2. In Section 3, we present our initial results. Section 4 exploits the bank-level dimension of our dataset by examining the effects of cross-border capital flows conditional on different bank characteristics. In Section 5, we perform several robustness checks. Section 6 concludes.

2 Sample, Data and Methodology

2.1 Data

Our analysis employs bank-level data from the following eleven euro area countries during 2001-2012: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.[4] Banks in these countries are an ideal laboratory because the intertemporal variation in cross-border capital flows in the euro area was far-reaching and displayed considerable cross-country heterogeneity through the 2000s, aiding identification of its effects on bank balance sheets using panel data.[5] An additional advantage of euro area banks is that they operate within a monetary union so that we disentangle changes in international capital flows from changes in the monetary policy stance.

Our bank-level data are drawn from the Bankscope database, provided by Bureau van Dijk. We correct our dataset for implausible observations, such as negative loan volumes, negative capital-to-asset ratios and negative liquidity ratios. This leaves us with 48,275 bank-year observations described in detail in Section 2.3 and 2.4.[6] We mostly include unconsolidated balance sheet data (i.e., Bankscope codes U1 and U2) because consolidated statements might be affected by foreign subsidiaries, operating in countries with another intensity of international capital flows.[7] We match this bank-level data with a rich set of important macroeconomic variables on the country-level, including different measures of cross-border capital flows.

2.2 Econometric Specification

As previously mentioned, this paper identifies the impact of international capital flows on the dynamics of bank lending along three dimensions. First, we examine the dynamics

[4]Starting in 1995, these countries had to meet several convergence criteria and also coordinated their monetary policy stance. As Greece failed to meet the criteria, it entered the euro at a later stage. We thus exclude Greece from the sample. However, the results are also robust to the inclusion of Greek banks.

[5]For instance, the pronounced cross-country and time variation allows us, by including country and time fixed effects, to control for country-specific and time-invariant factors in our regressions.

[6]In our regressions, we report a smaller number of observations because our regressors enter with lags and because we make use of dependent variables (loans and impaired loans) that are not available for all banks.

[7]When banks only report consolidated statements, we include these in our regressions.

of bank loan volumes. Second, we explore the changes in the loan-to-asset ratio as a further dependent variable to determine whether international capital flows induce banks to change the relative importance of loans in their balance sheets. Third, we explore the effect of foreign capital flows on banks' credit risk-taking. These dimensions of bank lending are summarised in the following two regression equations:

$$\begin{aligned} LOANS_{ijt} &= \alpha_t + \alpha_j + \beta * CAPITALINFLOWS_{j,t-1} + \delta * MACRO_{j,t-1} \\ &\quad + \theta * BANK_{i,j,t-1} + \varepsilon_{ijt} \end{aligned} \tag{1}$$

$$\begin{aligned} RISK_{ijt} &= \alpha_t + \alpha_j + \beta * CAPITALINFLOWS_{j,t-2} + \delta * MACRO_{j,t-2} \\ &\quad + \theta * BANK_{i,j,t-2} + \varepsilon_{ijt} \end{aligned} \tag{2}$$

where i indexes banks, j countries and t years. The main regressors are various lagged gross and net measures of international capital flows over GDP (*CAPITALINFLOWS*).[8] We add a large set of macroeconomic variables, denoted by *MACRO*, to our models. *BANK* comprises several bank-level covariates. All of the variables are explained in detail in Section 2.3. For the first two dimensions of bank lending, summarised in equation (1), all of the regressors are lagged by one year to minimise endogeneity concerns. For the analysis of credit risk-taking, as shown in equation (2), the regressors enter with a two-year lag to account for the fact that an easing of credit standards is reflected in the risks of a bank's balance sheet only with some delay.[9]

As some of our regressors do not vary extensively over time, fixed effects regressions yield imprecise estimates.[10] Therefore, we use a random effects model that—as time-invariant bank effects are unlikely to be correlated with aggregate capital flow measures—produces

[8] For several reasons, the fact that cross-border capital flows are serially correlated is not problematic. First, the time dimension of our dataset is short. Second, most of our dependent variables do not exhibit pronounced forms of serial correlation. As a result, we obtain precise standard errors, although our key regressor is not serially uncorrelated (see Bertrand et al., 2004). Beyond this, we cluster standard errors at the country-level and hence, obtain conservative t-statistics.

[9] In the robustness section, we present specifications with alternative lag structures.

[10] See Wooldridge (2010), Chapter 10.

unbiased and consistent estimates. The random effects estimator has also been shown to be more efficient than a fixed effects model or pooled OLS regressions in this context.[11] We include time dummies, α_t, in our regressions to control for time-varying variables that are relevant for all banks in our sample independent of the country of operation. Additionally, the use of country dummies, α_j, absorbs any heterogeneity across countries that is constant over time, such as long-run demographic characteristics or the institutional framework and quality. Moreover, the standard errors are clustered at the country-level to account for the within-country correlation across banks.[12]

To establish the causal interpretation of our results, we extend the aforementioned equations in two dimensions. The first extension is based on the implications of the extensive literature on the importance of global push factors, such as the VIX or macroeconomic conditions in the US, for the dynamics of cross-border capital flows (e.g., Calvo et al., 1996; Fratzscher, 2012; Bluedorn et al., 2013; Rey, 2013; Bruno and Shin, 2015), combined with the results of Baskaya et al. (2017b), who argue that global push factors are exogenous with respect to bank lending behaviour in Europe. Existing research argues that the domestic risk-free interest rate decreases during episodes of supply-driven international capital flows; instead, interest rates rise, when demand-driven local pull factors affect the dynamics of cross-border capital flows (e.g., Martinez-Miera and Repullo, 2017). Therefore, to establish the consistency of our coefficient estimates, we present specifications that restrict the sample to episodes in which inflows (outflows) of foreign capital were associated with reductions (rises) in the spread of 10-year sovereign bonds. For these periods, based on the argument scheduled above, we can convincingly claim that the dynamics of cross-border capital flows are supply-driven and thus exogenous with respect to bank lending in the euro area.

The second set of tests to corroborate the unbiasedness of our estimates exploits the bank-level dimension of our dataset, examining the effects of cross-border capital flows on bank lending and risk-taking conditional on banks' different characteristics. As these tests es-

[11] See also Wooldridge (2010), Chapter 10.

[12] Some econometricians, such as Angrist and Pischke (2009), only recommend clustering in cases in which the number of clusters is larger than eleven. To account for this possible criticism, in an alternative (unreported) regression, we made use of the fact that random effects models (estimated using GLS) already correct for autocorrelation in the error term. Additionally, we only corrected these errors for heteroskedasticity. The results remain qualitatively unchanged and, because the standard errors obtained from clustering appear more conservative, we stick to this method.

sentially explore the within-country differences between banks based on an interaction between a country and a bank characteristic, we are able to identify the transmission channels from cross-border capital flows to changes in bank lending and risk-taking. In addition, our estimates are less sensitive to the underlying rationale for international capital flows, thus buttressing the causal interpretation of our coefficients. In particular, even when omitted variables correlate with foreign capital flows, inter-bank differences in the sensitivity with respect to capital flows should not be affected.

Departing from the argument of Holmstrom and Tirole (1997) that poorly capitalised banks do not fully internalise their risk of default, and that thus bank capital can be used as a measure of bank agency problems, our hypothesis in the first of these tests is that the nexus between international capital flows and credit risk-taking is disproportionately strong in banks with low capital-to-asset ratios. We then strengthen the role of banks' different funding structures for their sensitivity to the effects of cross-border capital flows by testing whether foreign capital mostly affects the lending and risk-taking behaviour of domestic banks (that are more reliant on domestic liquidity conditions than globally-active banks) and banks that predominantly use interbank funding, rather than retail deposits.

2.3 Variable Description

2.3.1 Dependent Variables

As mentioned above, we focus on three dimensions of bank lending in this paper. The dimension of overall loan supply is proxied by the relative change in outstanding loan volumes of a particular bank at a particular point in time (*LOANS*). We further use the growth rate of the loan-to-asset ratio as a further dependent variable ($LOANS/ASSETS$) to assess whether international capital inflows induce banks to substitute securitised assets with loans, for which local banks have a comparative advantage over foreign investors. Finally, we use the share of impaired loans relative to total loans (*IMPAIREDLOANS*) to examine the impact of cross-border capital flows on credit risk-taking.[13] The inclusion of

[13] As the latter only takes on values between 0 and 1, typical linear regression models might deliver predictions that are outside the unit interval. Hence, we implement the following logit transformation: $\ln(\frac{x}{1-x})$. This transformation has very important key features: First, it removes the scaling boundaries, such that our dependent variable might take values that cover the entire real line. Thus, this transformation allows for the implementation of the usual linear regression models. Moreover, this transformation provides

the impaired loans ratio allows us to study the average quality of bank loans, as it only increases if banks grant riskier loans. Consequently, higher ratios imply that banks soften lending conditions, a result consistent with the theoretical mechanisms presented above. In Section 5, we stress the robustness of our risk-taking results by including the z-score, as a proxy for the distance to default, and the share of loans loss provisions over net interest income as additional risk variables.

2.3.2 Explanatory Variables

To explore the aforementioned dimensions of bank lending, our analysis employs a broad measure of cross-border capital flows that includes (i) the liquidity flowing directly into the banking systems and (ii) the liquidity flowing into the capital markets in general, thereby potentially inducing banks to substitute securitised assets with loans. Specifically, we use the negative of the current account balance ($CAPITALINFLOWS$) as our main explanatory variable. According to national accounting identities, cross-border capital flows close the gap opened by current account deficits, thus providing additional international funding to banks located in countries with external deficits, either through the global interbank market or through the issuance of commercial papers and bonds. In this context, Shin (2012) documents for advanced Europe that the current account balance co-moves with gross cross-border banking sector inflows, thereby affecting the financial conditions in that region. Therefore, following this argument, we also use the current account as our main variable approximating the amounts of global capital flows that enter the financial systems and induce changes in the quantity and quality of credit allocation.[14]

In Section 3.2, we will further disentangle the current account balance and differentiate between gross inflows and outflows of debt, equity and foreign direct investments (FDI).

a symmetric distribution around zero (e.g., Baum, 2008).

[14] We do not use BIS bank flows as our main proxy for international capital flows because it only includes the liquidity flowing directly into the banking systems. Consequently, it would not allow us to examine substitution effects associated with foreign capital flows. In addition, BIS flows did not accurately approximate cross-border bank flows during the global financial and European sovereign debt crisis. This is the case because private interbank credit flowing into external deficit countries (BIS bank flows) declined, which induced the ECB to step in as an intermediary, to channel public funds to banks in these countries (measured by TARGET2 balances), to restore banks' access to international funding and, thus, to sustain the current account deficits in these countries (Sinn and Wollmershäuser, 2012). This is a further reason to use the current account as our main regressor, since it captures both the private and public funds flowing into these countries and affecting the liquidity conditions of the banking sectors.

In this test, we show that the economic effects of gross debt inflows are not different from those of the current account. This result is consistent with Shin (2012) and points to the high correlation between an overall measure of net capital flows and gross banking sector (debt) inflows in the euro area.

In line with the existing empirical literature on bank lending and risk-taking (e.g., Dinger and von Hagen, 2009; Jiménez et al., 2014; Ioannidou et al., 2015), we add the following macroeconomic covariates to our model. First, we control for the growth rate of real GDP (*GROWTH*). Second, banks may also be non-trivially affected by changes in long-term interest rates. Consequently, our analysis includes the change in the 10-year sovereign bond yields (*YIELD*). Third, we include per capita GDP (*PERCAPITAGDP*) as a general index of economic development (e.g., Dinger and von Hagen, 2009). Our expectation regarding the sign of these variables is that bank lending is positively associated with economic growth, lower interest rates and a higher index of economic development. In preliminary regressions, we also included additional macroeconomic variables, such as inflation, government expenditures (as a proxy for fiscal policy), and the output gap (as a measure for the current business cycle). The estimated coefficients were mostly insignificant and, therefore, we exclude them from our regressions.

Moreover, we control for several variables on the bank-level that are likely to affect the dynamics of lending and credit risk-taking. The first control is the logarithm of total assets (*SIZE*). The second one is the ratio of liquid assets in total assets (*LIQUIDITY*) and the third variable is used to account for the presence of bank agency problems by controlling for the unweighted capital-to-asset ratio of banks (*CAPITAL*).[15] Finally, we also control for a bank's return on assets (*PROFITABILITY*). Related to this set of bank controls, we expect smaller banks with higher liquidity ratios to lend more. Moreover, banks subject to higher agency problems (due to lower capital ratios and/or returns on assets) are likely to be more prone to credit risk-taking. Table A.1 (Appendix) provides further specifics of the variables.

[15] We use banks' actual capital ratio, rather than their regulatory capital ratio, since it is a better proxy for the prevalence of agency problems. In addition, regulatory capital ratios are only reported by a small fraction of the banks in our sample.

2.4 Summary Statistics

Having described the choice of variables for the subsequent analysis, this section focuses on key summary statistics regarding these variables.

The median change of the loan-to-asset ratio is negative. This means that on average banks substitute securitised assets for loans. The positive value of *LOANS* suggests that banks increase their loan supply during 2001-2012.

Table 1: Summary Statistics

	Obs.	Mean	S.D.	25th	Median	75th
Dependent Variables						
LOANS/ASSETS	39906	-0.22	35.53	-4.01	-0.05	3.85
LOANS	39906	5.03	42.86	-0.89	3.45	9.86
IMPAIRED LOANS	13003	-3.00	1.13	-3.52	-2.90	-2.30
Macroeconomic Regressors						
CAPITAL INFLOWS	48275	-2.04	4.11	-6.18	-1.89	0.88
GROWTH	48275	1.33	2.38	0.45	1.64	3.30
PER CAPITA GDP	48275	32.42	7.93	27.49	30.46	35.45
YIELD	48275	-3.34	15.51	-14.89	-4.92	11.29
DEBT INFLOWS	36964	10.88	12.18	2.51	6.85	20.80
EQUITY INFLOWS	36964	1.22	5.36	-2.03	1.64	5.29
FDI INFLOWS	36964	3.34	5.23	-0.06	2.27	6.52
DEBT OUTFLOWS	36964	10.57	12.56	0.19	6.78	22.39
EQUITY OUTFLOWS	36964	1.05	4.67	-2.55	2.63	3.87
FDI OUTFLOWS	36964	4.21	5.18	0.90	3.76	6.37
Bank-Level Regressors						
CAPITAL	48241	11.17	15.02	5.09	6.92	10.47
PROFITABILITY	48085	0.66	4.39	0.15	0.33	0.72
SIZE	48275	6.61	1.93	5.34	6.40	7.72
LIQUIDITY	46785	43.76	22.65	28.71	39.54	54.63

Table 2: The Distribution of Sample Banks over Time

Country	**2001**	**2006**	**2012**
Austria	208	308	268
Belgium	97	84	71
Finland	14	20	24
France	408	418	376
Germany	1803	1873	1805
Ireland	60	57	32
Italy	782	733	622
Luxembourg	110	101	91
Netherlands	79	74	71
Portugal	39	48	34
Spain	158	238	154
$\sum$	3758	3954	3548

The negative mean of $CAPITALINFLOWS$ indicates that most banks in our sample are located in countries with capital outflows/external surpluses (see Table 2 for the distribution of banks over time and across countries). On average, the economic growth rate in our sample is equal to 1.33%, per capita GDP has a value of 32,420 € and long-term interest rates decrease by 3.34% per annum, reflecting the fact that the early 2000s were a period of expansionary monetary policy and decreasing interest rates.

Turning to the covariates on the bank-level, the median bank has a capital-to-asset ratio of 6.92%, a return on asset of 0.33% and a liquidity ratio of 39.54%.

Table 3 displays the simple pairwise correlation between our main measure of cross-border capital flows and the dependent variables employed in the following analysis. In line with the theoretical arguments presented in the introduction, the positive correlation coefficients suggest that higher inflows of foreign capital are associated with higher loan volumes, a substitution of securitised assets for loans and higher credit risk-taking. Section 3 will evaluate the evidence between cross-border capital flows and the dynamics of bank lending consistent with Table 3, using the panel data model outlined in Section 2.2.

Table 3: The Correlations between Capital Flows, Bank Lending and Risk-Taking

	CAPITAL INFLOWS	LOANS	LOANS/ASSETS	IMPAIRED LOANS
CAPITAL INFLOWS				
LOANS	0.495			
LOANS/ASSETS	0.195	0.625		
IMPAIRED LOANS	0.209	0.042	0.081	

3 Results

3.1 Initial Results

In this section, we present our initial results that establish the general relationship between inflows of international capital, bank lending and risk-taking. Table 4 underlines that higher inflows of foreign capital lead to significantly higher bank loan volumes and increased loan-to-asset ratios. In particular, a 1-pp increase in international capital flows leads to 0.89 pp higher loan growth rates and 0.73 pp higher growth rates of the loan-to-asset ratio. Moreover, foreign capital also raises the shares of impaired loans in total loans, indicating that banks that operate in countries with high capital inflows increase the risks in their loan portfolios.

These results uncover two channels through which international capital inflows affect financial stability. The increase in the loan-to-asset ratios implies that banks substitute new investments in securitised assets, such as (sovereign) bonds, with loans. As loans are on average riskier than bonds, this substitution increases the degree of overall bank risks. However, the mere fact that banks change the composition of their balance sheets does not fully capture the rise in bank risks. In fact, the increase in the share of impaired loans to total loans implies that, additionally, the average quality of bank loans deteriorates.

The substitution effect, indicated by the rise in loan-to-asset ratios, is not per se a negative sign for financial stability, as it simply underlines the deepening of financial intermediation following inflows of global capital. What turns financial deepening into a financial hazard is the result that banks disproportionately increase lending to risky borrowers, which raises the shares of impaired loans in the long-run.

Table 4: The Initial Results

	entire sample coverage			episodes in which exogenous push factors dominate		
	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
CAPITAL INFLOWS	0.885**	0.728**	0.055***	1.144***	0.606**	0.033**
	(2.19)	(2.43)	(4.84)	(2.76)	(2.30)	(2.03)
CAPITAL	0.156	-0.198**	-0.005	-0.145	-0.219**	0.001
	(1.30)	(-2.22)	(-0.82)	(-1.52)	(-2.08)	(0.37)
PROFITABILITY	-0.599**	-0.500***	-0.001	-0.490	-0.534**	-0.013
	(-2.34)	(-4.51)	(-0.11)	(-1.14)	(-2.40)	(-0.65)
SIZE	-2.627***	-0.418**	-0.089***	-1.450***	-0.484	-0.109***
	(-7.90)	(-2.12)	(-3.98)	(-2.63)	(-1.47)	(-7.63)
LIQUIDITY	0.440***	0.432***	-0.004***	0.247***	0.250***	-0.005***
	(6.13)	(6.54)	(-3.47)	(3.01)	(3.36)	(-5.46)
GROWTH	2.524**	0.877	-0.052	3.616**	1.172	-0.063*
	(2.35)	(1.33)	(-1.64)	(2.02)	(1.00)	(-1.76)
YIELD	-0.217***	-0.212***	0.020***	-0.173	0.068	0.006
	(-3.19)	(-2.91)	(3.95)	(-0.96)	(0.48)	(1.50)
PER CAPITA GDP	-0.037	-0.027	-0.084	1.741***	1.085***	0.023
	(-0.19)	(-0.15)	(-1.55)	(3.93)	(3.81)	(0.27)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	39765	39765	7543	18046	18046	4244
R-squared	0.015	0.011	0.190	0.022	0.016	0.210

Table 4 presents the results for our baseline model that explores the effects of net capital inflows, defined as the negative of the current account over GDP, on bank loan growth, growth of the loan-to-asset ratio and the share of impaired loans in total loans. The regressions include a vector of macroeconomic and bank-level covariates. Further, we incorporate year and country fixed effects. The t- statistics are reported in parentheses, using standard errors that are clustered at the country - level. In the columns (4)-(6), we restrict the sample to episodes,in which inflows (outflows) of foreign capital are accompanied by reductions (increases) in interest rates, as during these episodes, exogenous push factors dominate local pull factors in driving the dynamics of international capital flows.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To establish the causal interpretation of our results along these dimensions, we next present an extension to our baseline model, which is based on the implications of the extensive literature on the importance of global push factors for the dynamics of cross-border capital flows (e.g., Calvo et al., 1996; Fratzscher, 2012; Bluedorn et al., 2013; Rey, 2013; Bruno and Shin, 2015), combined with the results of Baskaya et al. (2017b), who argue that global push factors are exogenous with respect to bank lending behaviour in Europe. Existing research argues that the domestic risk-free interest rate decreases during episodes of push-driven (supply-driven) international capital flows; instead, interest rates rise, when demand-driven local pull factors affect the dynamics of cross-border capital flows (e.g., Martinez-Miera and Repullo, 2017). Following this argument, we continue restricting the sample to episodes in which inflows (outflows) of foreign capital are associated with reductions (rises) in the spread of 10-year sovereign bonds, since for such periods, we can convincingly claim that the dynamics of cross-border capital flows are supply-driven and thus exogenous with respect to bank lending in the euro area. Columns (4)-(6) show that the effects of international capital flows—in terms of both economic size and statistical significance—in these sub-periods are similar to those in the entire sample. In unreported estimations, we also document that capital flows do not have a significant effect on the dynamics of bank lending during episodes in which demand factors dominate (that is, when inflows (outflows) of foreign capital are associated with rises (reductions) in the spread of 10-year sovereign bonds). This result implies that only supply-driven cross-border capital flows that reduce the interest rates on borrowing from abroad are associated with more lending and risk-taking.

Throughout all of our model specifications, especially two macroeconomic covariates have a significant effect on banks, namely the change in 10-year sovereign bond yields and economic growth. Consistent with the literature on the effects of monetary policy on bank lending (e.g., Jiménez et al., 2014; Ioannidou et al., 2015), we find decreasing interest rates and higher GDP growth to increase bank lending. Both macroeconomic variables, however, are not associated with higher credit risk-taking, as the share of impaired loans does not increase following interest rate reductions or episodes of higher economic growth. The effects of the bank-level controls on lending and risk-taking are in line with previous research by Gambacorta (2005), Altunbas et al. (2012) and Bou-

vatier and Lepetit (2012), among others. Larger banks have lower loan growth rates and a higher average loan quality. In addition, high performing banks have decreasing loan volumes and banks with higher liquidity buffers lend more to seemingly safe borrowers, as the ratios of impaired loans are lower for these banks.

3.2 The Differential Impact of Gross Capital Inflows and Outflows

Based on the evidence that, in advanced Europe, gross cross-border banking sector inflows co-move with the current account (e.g., Shin, 2012), we use the negative of the current account balance to measure the amounts of capital flowing into the banking systems as our main explanatory variable in Section 3.1. However, there is a substantial debate on the differences between the various types of international capital flows with differential predictions about the impact of cross-border capital flows on bank lending. For instance, gross debt flows are deemed particularly volatile, thus affecting the probability of financial crises disproportionately (e.g., Obstfeld, 2012). In this section, we address this argument by providing a test that allows us to examine the differential impact of gross inflows and outflows of debt, equity and foreign direct investments.

From a theoretical perspective, differentiating between gross capital in- and outflows is important because both types differ in their sensitivity with respect to information asymmetries: Brennan and Cao (1997) and Tille and van Winscoop (2010) argue that foreign agents are less informed about the quality of domestic assets than domestic agents. As a consequence of lower information asymmetries, banks are better disciplined by domestic than by international investors. Following this line of arguments, we evaluate the role of asymmetric information by testing the hypothesis that especially gross flows **into** the banking system that increase the shares of foreign investors holding bank liabilities—rather than reductions in capital **out**flows that raise the stakes of domestic lenders—drive the risk-increasing effects associated with external deficits. The extant literature further shows that it is important to differentiate between the various types of foreign capital flows: Neumann (2003) argues that portfolio equity flows and FDI—relative to debt flows—incorporate levels of ownership and thus facilitate manager controls, reducing the severity of information asymmetries.

Overall, we therefore separately explore the role of gross inflows and outflows of debt, equity and foreign direct investments in shaping the dynamics of bank lending and risk-taking. Gross inflows are calculated as the change in the domestic stock of debt, equity and FDI liabilities over GDP. Equivalently, we define gross outflows as the relative change in the stock of the respective foreign assets.[16] In columns (1)-(3), we present the results for a horserace of the three types of capital inflows and in columns (4)-(6), we display the outcomes of the capital outflow horserace.

Columns (1) and (2) of Table 5 provide evidence that only inflows of debt increase bank loan volumes and loan-to-asset ratios significantly. In contrast, neither inflows of FDI nor inflows of equity affect banks in their lending decisions. Turning to the risk-increasing effects of the various types of capital inflows, both debt and equity inflows affect the shares of impaired loans. This result implies that not only the foreign capital flowing directly into the banking system induces banks to increase credit risks, but also the capital flowing into the capital markets in general (equity and debt), underlining our argument of a substitution effect driving rising bank risks after financial integration.

Table 5 further documents that the effects of gross debt inflows do not differ significantly from our initial estimates of Section 3.1: whereas a 1-standard deviation increase in gross debt inflows (approximately 12.2%) increases the growth rates in loan-to-asset ratios by 1.76 pp, net capital inflows (measured by the current account) that increase by one standard deviation (3.9%) raise the loan-to-asset growth rates by 2.36 pp. Similarly, the 1-standard deviation estimate for the ratios of impaired loans with respect to net capital inflows is equal to 0.129—compared to 0.117 with respect to gross debt inflows. These results are in line with the literature that highlights the pronounced correlation between gross debt flows and the current account in the euro area (e.g., Shin, 2012).

[16] In these regressions, we exclude the top and bottom 3% of observations because of extreme outliers in Ireland and Luxembourg that serve as international financial centers.

Table 5: The Differential Impact of Gross Capital Inflows and Outflows

	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
DEBT INFLOWS	0.152*	0.144**	0.010**			
	(1.93)	(2.42)	(2.48)			
EQUITY INFLOWS	0.184	-0.016	0.020**			
	(0.93)	(-0.13)	(2.23)			
FDI INFLOWS	0.153	0.037	-0.016***			
	(1.55)	(0.50)	(-2.62)			
DEBT OUTFLOWS				-0.011	-0.013	-0.006
				(-0.12)	(-0.19)	(-0.50)
EQUITY OUTFLOWS				0.317	0.014	0.012
				(0.82)	(0.05)	(0.71)
FDI OUTFLOWS				0.108	0.075	-0.007
				(1.51)	(1.11)	(-1.30)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	28834	28834	5994	28834	28834	5994
R-squared	0.013	0.009	0.186	0.013	0.009	0.188

In these regressions, we examine whether gross inflows differ from gross outflows in their effects on bank loan growth, growth of the loan-to-asset ratios and the share of impaired loans in total loans.Inflows are calculated as the change in outstanding liabilities of the respetive asset type over GDP. Outflows are the change in the stock of the respetive foreign asset over GDP. The regressions include a vector of macroeconomic and bank-level covariates. We also incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Turning to the horserace among the capital outflow variables, columns (4)-(6) indicate that none of the coefficients is significant. Therefore, there is an obvious difference in the impact of higher inflows and lower outflows, although both lead to higher net inflows of capital, i.e., a deterioration of the current account. Mainly increases in gross (debt) inflows lead to both higher bank loan volumes and higher bank risks, providing empirical evidence for the theoretical hypothesis that especially inflows of capital—which increase the stakes of foreign investors that have worse monitoring abilities due to the presence of information asymmetries—drive the risk-increasing effects following international financial integration. Consequently, the results of this section are consistent with the theoretical arguments presented above: bank agency problems are the main mediating channel from foreign capital to bank lending and risk-taking.

4 The Effect of Cross-Border Capital Flows Conditional on Banks' Funding and Ownership Structures

In Section 3, we have shown that cross-border capital inflows raise credit risk-taking incentives. By relating these capital flows in the euro area to supply-driven, exogenous push factors, we have also established the causal relationship between capital flows and bank risk. We next identify the transmission channels from cross-border capital flows to changes in bank lending behaviour and, additionally, corroborate the unbiasedness of our estimates by exploiting the bank-level dimension of our dataset. Specifically, we examine the effects of cross-border capital flows on bank lending and risk-taking conditional on banks' different characteristics (i.e., both their different ownership and funding structures). As these tests essentially explore the within-country differences between banks based on an interaction between a country and a bank characteristic, our estimates are less sensitive to the underlying rationale for international capital flows. For instance, even if unobservable variables correlate with both foreign capital flows and bank lending behaviour, inter-bank differences in the sensitivity with respect to capital flows should not be affected.

This exercise is also important because observable loan volumes reflect the equilibrium of loan demand and loan supply side effects. This paper, however, aims to identify the impli-

cations of cross-border capital flows for the supply side of credit, which is also relevant for the policy implications of our analysis, in particular regarding the regulation of the banking system. Based on the assumption that banks' ownership and funding structures only affect the supply of credit and leave loan demand unaffected, we establish the role of loan supply effects for the dynamics of banks' loan volumes by identifying a heterogeneous effect of cross-border capital flows depending on these bank characteristics.

4.1 Bank Capitalisation as a Measure of Agency Problems

In Section 4.1, we examine whether credit risk-taking is attenuated in banks with high capitalisation. This test builds on Holmstrom and Tirole (1997), who view bank capital as a measure of the agency problems in banks: poorly capitalised banks do not fully internalise their risk of default and, therefore, have higher incentives for increased credit risk-taking.

For the empirical identification of this hypothesis, we split our sample into well capitalised banks, defined as banks with a capital-to-asset ratio in the top 25% of the annual distribution, and into normally capitalised banks (the rest of the distribution).[17] Again, as agency problems decrease in the capitalisation of banks, we expect the effects of cross-border capital flows to be weaker in the sub-set of well capitalised banks.

Columns (1)-(3) of Table 6 indicate that the effects of international capital flows on lending and risk-taking of normally capitalised institutions are similar to those of our baseline model. Higher inflows increase loan volumes, loan-to-asset ratios and the shares of impaired loans significantly. In contrast, columns (4)-(6) suggest that foreign capital does not significantly affect well capitalised banks in their lending decisions. For this subsample, inflows of global capital only have a weak effect on the shares of impaired loans: with a t-ratio of 1.79, the coefficient on capital flows in column (6) is significant at the 10% level.

[17] As explained in Section 2, we use banks' actual capital ratio, rather than their regulatory capital ratio, since it is a better proxy for the prevalence of agency problems. In addition, regulatory capital ratios are only reported by a small fraction of the banks in our sample.

Table 6: Bank Capital as a Measure of Bank Agency Problems

	normal capital-to-asset ratios			**high capital-to-asset ratios**		
	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
CAPITAL INFLOWS	0.998*	0.731**	0.043***	0.402	0.634	0.097*
	(1.84)	(2.28)	(2.98)	(0.83)	(1.62)	(1.79)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	30638	30638	3969	9127	9127	3574
R-squared	0.012	0.009	0.221	0.019	0.018	0.112

Table 6 presents the results for the regressions that explore the effects of net capital inflows, defined as the negative of the current account over GDP, on bank loan growth, growth of the loan-to-asset ratio and the share of impaired loans in total loans. We estimate the regressions separately for banks with low and high capital-to-asset ratios to account for the role of capital in shaping bank agency problems. The regressions include a large set of macroeconomic and bank-level covariates We also incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

These results are in line with the literature that views the capital-to-asset ratio as the main bank-level variable capturing the degree of agency problems: the dynamics of bank lending in terms of increased risks are driven by banks with a lower capitalisation. From a policy perspective, higher bank capital ratios are thus likely to reduce bank agency problems, help to internalise banks' default risks and induce them to fund safer projects.

4.2 Banks with Different Funding Structures

In the next set of tests, we provide evidence that our baseline results are mainly supply driven by exploring whether capital flows especially affect interbank-dependent, in contrast to deposit-taking, financial institutions. Cross-border capital flows should most strongly affect the supply of loans by banks which depend on wholesale funding, since these banks benefit disproportionately more from external deficits that increase the quantity of interbank loans.

We define a bank as mainly deposit-taking if its share of interbank liabilities in total assets is in the lowest 25% of the annual distribution; otherwise, a bank is defined as reliant on interbank funding. Therefore, as a result of this threshold, financial institutions defined as deposit-taking have ratios of interbank liabilities in total assets between 0%-6%. Interbank-dependent institutions, in contrast, have interbank ratios between 6% and 90%. The fact that we define most banks as interbank-dependent mirrors the distribution of interbank funding—the majority of banks in our sample have significant interbank exposures on their balance sheets.

Table 7 presents the results for this analysis. Columns (1)-(3) display the effects of global capital flows on bank loans and risks for the sub-set of deposit-taking institutions. For these banks, capital flows only affect the loan-to-asset ratios significantly with the expected signs. Neither the loan growth rates nor the fractions of impaired loans are affected significantly at conventional levels. In contrast, for the sub-set of banks that are reliant on interbank funding, external deficits do not only increase the loan-to-asset ratios, but also loan growth and credit risk-taking (columns (4)-(6)). In economic terms, a 1-pp increase in cross-border capital inflows is associated with an increase in the relative change of the loan-to-asset ratio by 0.7 pp, and an increase in credit growth by more than 1 pp—which is even higher than the effect identified in the baseline model.

Table 7: Banks with Different Funding Structures

	low dependence on interbank funding			high dependence on interbank funding		
	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
CAPITAL INFLOWS	0.536	0.775**	0.008	1.017*	0.711**	0.061***
	(1.55)	(2.33)	(0.52)	(1.92)	(2.20)	(3.18)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	9375	9375	4073	30390	30390	3470
R-squared	0.022	0.024	0.170	0.013	0.009	0.196

Table 7 presents the results for the regressions that explore the effects of net capital inflows, defined as the negative of the current account over GDP, on bank loan growth, growth of the loan-to-asset ratio and the share of impaired loans in total loans. We run the regressions separately for banks with a low and a high interbank dependence, as both types of banks are affected differently by global capital flows. The regressions include a large set of macroeconomic and bank-level covariates We also incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3 Domestic vs. Foreign Bank Ownership

Finally, we strengthen the evidence that the results documented in our baseline exercise are mostly supply driven by examining the different ownership structures of banks. Specifically, in the following test, we split our sample into one sub-sample of domestically owned banks and one sub-sample of foreign-owned banks, defined as banks whose equity is to at least 50% owned by an institution based in a foreign country.[18]

This exercise is important against the background that foreign-owned/global banks manage liquidity on a **global** scale, actively using cross-border internal funding in response to **local** liquidity shocks (e.g., Cetorelli and Goldberg, 2012a; Cetorelli and Goldberg, 2012b). Therefore, we hypothesise that foreign-owned banks are less affected by country-specific in- and outflows of liquidity, as they can—independently of such **local** capital flows—activate capital markets internal to the organisation (which are only affected by **global** liquidity conditions).

Table 8 provides evidence consistent with this hypothesis: international capital inflows raise the loan growth rates, the growth rates of the loan-to-asset ratios and the shares of impaired loans of domestically owned banks, as can be gauged from the significant capital flow coefficients in columns (1)-(3). In contrast, cross-border capital flows only affect one of the three outcome variables for the sub-sample of foreign-owned banks significantly—the loan growth rates in column (4). This result is in line with the literature on the financial stability aspects associated with foreign bank entries (e.g., Detragiache et al., 2008; Beck and Martinez Peria, 2010; Gormley, 2010): foreign-owned banks typically "cherry pick" good borrowers, so that credit booms do not raise their ratios of impaired loans. Domestically owned banks, however, are left with a worse remaining credit pool. As a consequence, higher credit growth of local banks is followed by an increase in loans that are close to default.

[18] The ownership data, provided by Claessens and van Horen (2014), is only available for a small fraction of banks in our sample.

Table 8: Domestic vs. Foreign Bank Ownership

	domestically owned banks			**foreign-owned banks**		
	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
CAPITAL INFLOWS	1.773*	1.043**	0.031*	1.078**	0.117	0.026
	(1.95)	(2.08)	(1.67)	(2.24)	(0.35)	(1.16)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4322	4322	950	1613	1613	188
R-squared	0.057	0.045	0.402	0.059	0.038	0.293

Table 8 presents the results for the regressions that explore the effects of net capital inflows, defined as the negative of the current account over GDP, on banks' loan growth, growth of the loan-to-asset ratio and the share of impaired loans in total loans. We run the regressions separately for domestically and foreign-owned banks, as both types of banks are affected differently by global capital flows. The regressions include a set of macroeconomic and bank-level covariates, in addition to year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Overall, as loan demand is independent of banks' funding and ownership structures, the results of Section 4 establish the role of credit supply side effects for the dynamics of bank loan volumes. In addition, they stress that the risk-increasing effects associated with episodes of cross-border capital inflows are exacerbated in domestically owned banks with low capital ratios (strong agency problems) and a high dependence on interbank funding. Therefore, global capital inflows disproportionately increase the incidence of financial crises via their effect on credit risk-taking incentives when domestic banks have a more unstable form of funding and operate subject to stronger agency problems between bank managers and their investors.

5 Robustness Checks

This section presents the results of several robustness checks. First, we estimate equations (1) and (2) using fixed effects regressions. Second, we restrict the analysis to various sub-periods, excluding the financial and sovereign debt crisis that might disproportionately affect our estimates. Third, we confirm the robustness of our risk-taking results by exploring the effects of international capital flows on several other bank risk variables. Finally, we also adjust the lag structure of our model.

The results presented in Table A.2 are generated by adding bank fixed effects to our model. Although we argue in Section 2.2 that bank dummies lead to imprecise estimates because several of our regressors exhibit low time variation, this robustness check stresses that unobserved time-invariant heterogeneity across banks does not bias our estimates. Attendant results for all three dependent variables show that the sign and significance of the estimated coefficients of net capital inflows is robust to including bank fixed effects.

We continue by estimating our model over two sub-periods. In columns (1)-(3) of Table A.3, we exclude the sovereign debt crisis from our sample. Moreover, in columns (4)-(6), we restrict the sample period to 2001-2007 to underline that our results are not driven alone by the financial crisis and related changes in credit risk-taking incentives. The results indicate that our coefficients are consistently estimated for both sub-periods. Therefore, neither the sovereign debt crisis nor the financial crisis are substantial drivers of our results.

In our previous analyses, credit risk-taking was measured by the share of impaired loans over total loans. In the following sensitivity analysis, we explore the effects of global capital flows on several other bank risk measures. Specifically, we use the z-score as an additional outcome variable, which we calculate as follows:

$$ZSCORE_{ijt} = \frac{ROA_{ijt} + SOLVENCY_{ijt}}{sd(ROA)_{ij}}. \tag{3}$$

ROA is the return on assets, $SOLVENCY$ is the capital-to-asset ratio and $sd(ROA)$ is the standard deviation of *ROA*, calculated over the entire sample period.[19] Lepetit and Strobel (2013, 2015) show that the z-score is negatively proportional to banks' probability of insolvency. It is therefore widely used in the empirical banking literature (e.g., Beck et al., 2009; Laeven and Levine, 2009; Köhler, 2012). In line with these papers, due to the skewness of this variable, we take the natural logarithm of the z-score. We further dis-aggregate the z-score in columns (2) and (3) of Table A.4 by exploring the effect of capital flows on the returns on assets and the capital-to-asset ratios, scaled by $sd(ROA)$. This specification allows us to identify the main component driving the dynamics of the z-score. As a last dependent variable that proxies bank risk-taking, we use the ratio of loan loss provisions over net interest income, which was not included in our baseline specifications because it is more vulnerable to accounting manipulations.[20]

The first column of Table A.4 demonstrates that capital inflows lead to highly significantly lower bank z-scores. Specifically, a 1-pp increase in capital inflows reduces the z-score by 1.5%. This result implies that banks in countries with surges in foreign capital inflows are closer to insolvency. Columns (2)-(3) underline that this effect is mainly driven by reductions in the capital-to-asset ratios. Again, the coefficient on net capital flows is significant at the 1% level. For the ratio of loan loss provisions (column (4)), we also obtain an estimate that is consistent with increased credit risk-taking. That is, capital inflows increase the shares of loan loss provisions over net interest revenue in a highly significant manner. Thus, this sensitivity analysis corroborates the effect of foreign capital flows on bank risk-taking.

[19] Calculating it over a three- or four-year rolling window does not change the results.

[20] See Ahmed et al. (1999) and Hanweck and Ryu (2005), who discuss the appropriateness of loan loss provisions and net interest income as proxies for bank risks.

As the last robustness check, we adjust the lag structure for the set of bank risk variables. In the previous specifications, these were regressed on variables that entered with a two-year lag, since credit risks usually only manifest with a delay. In the following specification, we implement our regressions related to bank risks with a one-year and three-year lag, respectively. Columns (1)-(5) of Table A.5 show the results for the bank risk variables when the regressors only enter with a one-year lag. The results indicate that the z-scores are affected significantly; however, the time lag of one year is not sufficient to influence credit risks in a significant manner. For the time lag of three years, almost all bank risk proxies are affected significantly by international capital flows. Thus, whereas capital inflows directly affect bank lending and banks' z-scores, the risk-increasing effects on the credit portfolios require a time lag of at least two years.

6 Conclusion

Although financial crises are regularly preceded by substantial inflows of foreign capital, scarce attention has been devoted to the identification of channels from cross-border capital flows to the incidence of crises. Particularly, the impact of cross-border capital flows on the composition of bank balance sheets has remained underexplored. In this paper, we fill some of this gap by examining the effects of international capital flows on euro area bank lending and risk-taking during 2001-2012. Euro area banks are an ideal laboratory because intertemporal changes in cross-border capital flows in the euro area were far-reaching and displayed considerable cross-country heterogeneity through the 2000s, aiding identification of their effects on bank balance sheets using panel data. In addition, studying countries within a monetary union allows us to isolate fluctuations in international capital flows from changes in monetary policy.

We find that episodes of foreign capital inflows induce banks to increase their loan volumes, their loan-to-asset ratios and their shares of impaired loans. These results imply that cross-border capital flows increase financial instability for two reasons: First, the increase in the loan-to-asset ratios suggests a substitution effect associated with cross-border capital flow episodes. The international capital mainly enters the securitised asset markets and, thus, makes local banks focus on their risky core business of granting loans.

Second, the increase in the ratios of impaired loans implies that banks reduce the average quality of their loan portfolios. The theoretical mechanisms through which international capital flows affect bank risks are built on bank agency problems. We explore the role of agency problems by showing that—although both higher gross capital inflows and lower gross capital outflows increase the liquidity in the banking sector—only higher gross capital inflows that raise the shares of bank liabilities held by foreign investors drive the risk-increasing effects associated with net capital inflows. This result is consistent with Brennan and Cao (1997) and Tille and van Winscoop (2010), who argue that foreign investors have worse monitoring abilities, aggravating bank agency problems. We further show that the effect of capital flows is conditional on banks' ownership and funding structures. In particular, the impact of foreign capital on credit risk-taking decreases in the capitalisation of banks. This result closely corresponds to similar findings on how a low capitalisation increases the intensity of bank agency problems and, thereby, modifies the effect of monetary policy on bank risk-taking. Therefore, the policy implication of this paper is not to restrict capital flows, but rather to increase bank capital buffers, as proposed by Admati et al. (2012). This regulatory approach should decrease bank agency problems, helps to internalise banks' default risks and, therefore, minimises the hazards associated with inflows of cross-border capital.

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Table A.1: Description of the Main Variables

Variable	Description	Unit	Source
LOANS/ASSETS	Growth rate of the loan- to- asset ratios	%	Bankscope, own calculations
LOANS	Growth rate of the loan volumes	%	Bankscope, own calculations
IMPAIRED LOANS	Impaired loans divided by total loans	%	Bankscope
CAPITAL INFLOWS	(-1) * Current account balance over GDP	%	WEO 10/2013,[a] own calculations
GROWTH	Growth rate of real GDP	%	WEO 10/2013
PER CAPITA GDP	PPP adjusted per capita GDP in current international dollars	thousand	WEO 10/2013, own calculations
YIELD	Growth rate of the 10-year sovereign bond yield	%	ECB, own calculations
DEBT INFLOWS	The change in portfolio debt liabilities over GDP	%	Lane and Milesi-Ferretti (2007), own calculations
EQUITY INFLOWS	The change in portfolio equity liabilities over GDP	%	Lane and Milesi-Ferretti (2007),own calculations
FDI INFLOWS	The change in FDI liabilities over GDP	%	Lane and Milesi-Ferretti (2007), own calculations
DEBT OUTFLOWS	The change in portfolio debt assets over GDP	%	Lane and Milesi-Ferretti (2007), own calculations
EQUITY OUTFLOWS	The change in portfolio equity assets over GDP	%	Lane and Milesi-Ferretti (2007), own calculations
FDI OUTFLOWS	The change in FDI assets over GDP	%	Lane and Milesi-Ferretti (2007), own calculations
CAPITAL	Capital / total assets	%	Bankscope, own calculations
PROFITABILITY	Return on assets	%	Bankscope, own calculations
SIZE	Logarithm of total assets	ln (x)	Bankscope, own calculations
LIQUIDITY	Bank liquidity, defined as the difference of total assets and loans divided by total assets	%	Bankscope, own calculations

[a] World Economic Outlook Database, IMF.

Table A.2: Robustness Check: Fixed Effects Regressions

	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS
CAPITAL INFLOWS	1.790**	1.283**	0.042***
	(3.02)	(2.77)	(5.45)
Bank-Level Controls	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Obs	39765	39765	7543
R-squared	0.007	0.006	0.027

This table presents the results for our models estimated through fixed effects regressions. The dependent variables are loan growth, growth of the loan-to-asset ratio and the share of impaired loans in total loans. The main regressors are net capital inflows, defined as the negative of the current account over GDP. We also include macroeconomic and bank- level controls. The t- statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Robustness Check: The Pre-Crisis Period

	2001-2010			2001-2007		
	(1) LOANS	(2) LOANS/ASSETS	(3) IMPAIRED LOANS	(4) LOANS	(5) LOANS/ASSETS	(6) IMPAIRED LOANS
CAPITAL INFLOWS	1.088**	0.819**	0.055***	0.680***	0.506**	0.080
	(2.33)	(2.38)	(4.84)	(4.65)	(1.99)	(1.09)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	36396	36396	7543	26049	26049	4998
R-squared	0.017	0.012	0.190	0.017	0.011	0.203

This table presents the results for the regressions of the loan growth rates, the relative changes in the loan - to - asset ratios and the fractions of impaired loans on net capital inflows, defined as the negative of the current account. The regressions include a vector of macroeconomic and bank-level covariates. Further, we incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Robustness Check: Other Bank Risk Proxies

	(1) Z-SCORE	(2) PROFITABILITY	(3) CAPITAL RATIO	(4) LOAN LOSS PROVISIONS
CAPITAL INFLOWS	-0.015***	-0.009	-0.016***	1.307***
	(-5.07)	(-1.25)	(-5.65)	(4.49)
Bank-Level Controls	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Obs	33752	31228	33911	31869
R-squared	0.122	0.050	0.130	0.053

In these regressions, we examine the effect of capital inflows, defined as the negative of the current account over GDP, on other bank risk proxies, i.e., the z-score, bank profitability, the capital-to-asset ratio and the share of loan loss provisions in net interest revenue. We add a vector of macroeconomic and bank-level covariates. Further, we incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Robustness Check: Other Lag Structures

	one-year lag					three-year lag				
	(1) Z-SCORE	(2) PROFITABILITY	(3) CAPITAL RATIO	(4) LOAN LOSS PROVISIONS	(5) IMPAIRED LOANS	(6) Z-SCORE	(7) PROFITABILITY	(8) CAPITAL RATIO	(9) LOAN LOSS PROVISIONS	(10) IMPAIRED LOANS
CAPITAL INFLOWS	-0.013***	-0.009	-0.014***	0.372	0.004	-0.019***	-0.018**	-0.019***	0.996**	0.026
	(-4.14)	(-0.85)	(-4.23)	(1.20)	(0.40)	(-5.25)	(-2.54)	(-5.43)	(2.50)	(0.69)
Bank-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	39513	36485	39693	37194	9528	28846	26720	28982	27309	6188
R-squared	0.082	0.045	0.087	0.060	0.200	0.142	0.059	0.151	0.060	0.186

In this table, we present the results for regressions of the z-score, bank profitability, the capital-to-asset ratio, the share of loan loss provisions in net interest revenue and the fraction of impaired loans over total loans on net capital inflows, defined as the negative of the current account. We also add a vector of bank-level and macroeconomic covariates. Further, we incorporate year and country fixed effects. The t-statistics are reported in parentheses, using standard errors that are clustered at the country-level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$