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Interest rate elasticity of bank loans: The case for sector-specific capital requirements

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Abstract

Empirical credit demand analysis undertaken at the aggregate level obscures potential behavioral heterogeneity between various borrowing sectors. Looking at disaggregated data and analyzing bank loans to non-financial companies, to financial companies, to households for consumption and for house purchases separately with respect to a common set of macroeconomic determinants may facilitate more accurate empirical relationships and more reliable insights for economic policy. Using quarterly Euro area panel data between 2003 and 2013, empirical evidence for heterogeneity in borrowing behavior across sectors and the credit cycle with respect to interest rates, output and house prices is found. The results motivate sector-specific, counter-cyclical capital requirements.

Keywords: Bank loans, disaggregation, interest rate elasticity, macro-prudential tools

JEL: E44, E51, E52

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1 Introduction

Understanding the factors underlying the credit cycle is a central element of the analysis of macroeconomic and financial developments. It constitutes an important part of the framework used to extract signals about both economic growth and financial stability over the medium to longer term.

In the recent past, research has started to explore these dynamics using disaggregate credit data. The intuition is that credit demand analysis undertaken at the aggregate level obscures differences in objectives and constraints between the various borrowing sectors. The idea is that there is not one credit cycle that affects all sectors alike, but that every sector has its own cycle. Different sectors may be subject to different financing opportunities and opportunity costs of taking out a loan. As a matter of fact, an analysis of the dynamics between loans and other macroeconomic variables which is based on disaggregate data is expected to result in more accurate empirical findings and more reliable insights for economic policy.

Most of the models using disaggregated data distinguish between bank lending to companies and households and analyze the nexus between credit and GDP. Büyükkarabacak and Valev (2010) using a data set on corporate and household lending in 37 developed and developing countries between 1990 and 2007 find that household credit growth raises debt levels without much effect on long-term growth, while the effect of corporate credit expansions on leverage is much more tempered by the concurrent increase in GDP. In a study of 45 countries and the period from 1994 to 2005 Beck et al. (2012) conclude that loans to companies are positively associated with GDP, but that there is no correlation between economic growth and household lending. Using data on the US and 50 other countries Grydaki and Bezemer (2013) and Bezemer et al. (2013), respectively, separate 'non-financial business and consumption' from 'financial and real estate' lending and find that distinguishing between these yields robust positive growth effects, at least for credit flows. For stock data, they find negative effects on output growth and explain this by arguing that many of the countries analyzed suffer from 'too much finance'.[1] Hense (2014), using German data develops a loan variable which comprises only real sector lending,[2] He finds a long-term co-integrating link between real sector bank loans and GDP and, unlike in a model with real sector and financial sector bank loans combined, causality running from real sector loans to GDP, with the real sector model performing better in forecasting economic growth than the model based on aggregate loans.

Less research, using disaggregate data, has addressed the role of bank loans for financial stability. This is surprising since the disaggregation of loans by borrowing sector can potentially give even more valuable insights in this sphere compared to the field of macroeconomic policy.[3]

To understand why the analysis of credit developments disaggregated by borrowing sector might be even more relevant to financial stability issues than for economic growth, it is important to distinguish between different types of loans according to

[1] See Arcand et al. (2012) for an overview.

[2] Real sector lending as defined by Hense (2014) comprises total corporate loans excluding loans to financial institutions (non-MFIs), insurance companies, housing enterprises, holding companies and construction companies.

[3] See the exemplary study by Eichengreen and Mitchener (2003).

the different economic functions they serve, as Werner (1997), Turner et al. (2010), Turner (2013) and Hudson and Bezemer (2012) suggest. In other words, it is about distinguishing between the different objectives of the borrowers for taking out loans. Following the approach of distinguishing between different objectives is different to the usual corporate vs. household sector based distinction. With respect to the reason of taking out a loan two different kinds of objectives have to be considered: (i) On one hand, the objective to facilitate consumption needs, (ii) while on the other hand, to provide the funds for an investment. These two objectives determine each borrower's behavior which - depending on the relative importance of the two objectives - will vary across sectors and throughout the credit cycle. (i) If the objective is to increase the consumption level and fund purchases beyond one's means, the borrowing objective has elements of fulfilling needs that can not be postponed to times when these purchases are within one's means. The loan may well be a necessity good in this case. One of the characteristics of a necessity good is that its price elasticity is low. The interest rate elasticity of a loan taken out to consume should be low accordingly. (ii) If the objective is to invest, the objective is to take advantage of investment opportunities. A machine is an investment for which a business might take out a loan. The interest rate elasticity of loans taken out for investment may be very different to loans taken out for consumption needs.

In general, an inverse relationship between interest rates and loans is assumed, both for consumption and investment loans, since demand for credit will decrease with rising rates. Occasionally, however, we can observe loans and rates moving in the same direction. This is due to counteracting supply or demand effects, as Bernanke and Blinder (1988), Bernanke (1993), Bernanke and Gertler (1995), Hubbard (1998) have shown. Rates and loans moving in the same direction tends to happen during times of either strong economic growth or recessions such as during the global economic boom between 2005 and 2008 or likewise the subsequent bust starting in 2008 after the Lehman collapse. In these periods of high macroeconomic and financial volatility, balance sheet and bank lending channel effects often weaken the general strong negative relationship when in the process of co-stimulating credit growth and asset price increases, self-reinforcing borrower and lender beliefs and incentives play out. Local thinking can lead investors to ignore those parts of the distribution of possible returns which involve default risks and as Gennaioli et al. (2010) put it, 'owe their very existence to neglected risk'. As a matter of fact, in the light of confidence and the prospect of attractive financial return which overshadows the restraining effect of the higher cost of obtaining those returns, higher interest rates can actually even increase borrowing demand. As long as borrowers earn more on their assets than they pay for the refinancing of their liabilities, their balance sheets grow profitably and their lenders, in this case the banks, are insensitive to the level of interest rates. So, with respect to the time horizon, we have to be careful with respect to the relationship between interest rates and loans.

Understanding the difference between consumption and investment loans with respect to their borrowing objective is one step. Distinguishing between different forms of investment objectives is a second step. The choice for investing is determined by multiple factors such as the borrower's business model, refinancing requirements, opportunity costs etc. Basically, we can, however, distinguish between two ultimate objectives of taking out a loan: To use the loan (ii) a) either for creating something new, like building a company, or (ii) b) to purchase something

already in existence, like a financial asset. The reason for the necessity of distinguishing between these two objectives is due to the difference between a business model where cash flows repay the investment in a continuous manner and one where price increases, realized at the time of an eventual sale, pay off the initial investment. The difference in the refinancing method brings along a different response of the two investment objective forms to macroeconomic changes, especially interest rate dynamics. A company investing in a new project (manufacturing product development, energy investment, etc.) and intending to repay the loan out of cash flows of the project on the one hand may be very sensitive to minor variations in interest rates. On the other hand, a second company pushing for projects where expectations of asset or property price inflation are strongly embedded in the investment decision (home ownership, commercial real estate, etc.), will potentially be less affected and respond far less sensitive by even quite large increases in interest rate. Investors expecting medium-term annual capital appreciation of 10-15% will not see their propensity to borrow affected by small increases in lending rates - whether rationally grounded (moral hazard) or due to behavioral biases such as the 'this time is different'-rationale (see Reinhart and Rogoff (2009)). In other words, the effective net return, the difference between expected return and refinancing rate, i.e. the relative interest rate spread is crucial here and whether the business model of a company rests on one or the other business model can cause very different elasticities of credit demand.

As a consequence of this, some studies have documented that a recurrent phenomenon in the run up of the credit cycle may suggest a systematical shift in the distribution of borrowers. The central bank's interest rate policy seems to play an important role in this respect. Especially, long-term investments, sensitive to interest rates, are exposed to price distortions and, therefore, long-term, capital-intensive investments, also pension obligations are at high risk of uncertainty. Consequently, projects are increasingly funded short-term. Rajan (2013) stresses the role of the risk-taking channel which explains lax monetary policy causing over-investment in areas where credit and financial assets are sensitive to low interest rates and not constrained by forces such as international competition. He states, 'the economy may get too many buildings and too few machines'. Miao and Wang (2013) consider a two sector model, and find that bubbles may misallocate resources across sectors and reduce welfare.

One reason for systematic shifts during boom and bust periods is the balance sheet channel. Higher net worth agents may have more collateral to put up against the funds they need to borrow, and thus are closer to being fully collateralized than low net worth agents. As a result, lenders assume less risk when lending to high net worth agents, and agency costs are lower. The cost of raising external funds should therefore be lower for high net worth agents. With the economy growing and asset prices increasing all borrowers look better collateralized since they have higher net worth.

Two factors cause the balance sheet channel to affect, however, some borrowers to be better collateralized than others. Firstly, it makes a difference whether the assets are collateralizable or not. Financial assets can be used as collateral for all sorts of things, including additional loans, providing them with a value-add for their alternative use as collateral. In their seminal paper Bernanke and Gertler (1989) stress the importance of collateralizable net worth, as opposed to human capital.

Chaney et al. (2012) find that increased real estate values for companies are related to increases in firm borrowing and investment.

The second factor relates to characteristics of the collateral. In general, this relates to assets plegdable which are of good quality depending their level of risk, marketability and liquidity (see BIS (2012). The regulatory framework of Basel III defines the minimum standards for funding risk, such as the liquidity coverage ratio (LCR) in which assets are considered to be high-quality liquid assets if they can be immediately and easily converted into cash at little or no less of value.[4]

So, the fact that frameworks favor characteristics of assets such as marketability and liquidity, has an effect on the distribution of bank lending, i.e. the assets ultimately invested. And, following Kindleberger (1978), herding and constant asset price increases play a role in pushing assets which are marketable and liquid to rise in value relatively more than machinery or capital goods in booming economies as financial markets become exuberant when asset price increases have persisted for a considerable period - and conversely, to fall sharper during crises. Investors may expect price increases to continue and start looking increasingly for short-term capital gains instead of long-term periodic income from assets. This will draw more funds to asset markets and increase their prices. In fact, as the classic theory of rational bubbles (Tirole (1985)) suggests in a situation of increasing interest rates, bubbles crowd out resources from other sectors and activities, such as borrowing and investment by non-financial firms.[5] Banks may substitute away from lending to non-financial firms and focus on investing in bubbly assets (e.g. mortgages and real-estate). Ivicic and Cerovac (2009) find out, this crowding out effect has an effect on the balance sheets of companies. The probability of default of those companies providing the requested investment objects and related services, such as a construction or real estate company, is lower than the one of those in the agriculture and manufacturing or non-financial service sector. Similarly, Bleck and Liu (2014) consider the relationship between liquidity injections, asset prices, and economic growth in a model with two sectors. They find that if too much liquidity is injected into the economy, the sector receiving the liquidity can overheat and crowd out the other sector. This has implications for macroeconomic policy as Chakraborty et al. (2013) suggest in their analysis on the practice of policymakers relying upon a mechanism which implies that through improving asset prices consumers will increase demand during periods of deficient aggregate demand. They note that the focus on increasing asset prices, and in particular real-estate prices, may be wrong as the potential harm to non-financial firms' borrowing and investment will be even bigger and will hurt the economy as a whole.

So given the literature and the theoretical intuition that financial companies are exposed to different dynamics from non-financial companies, and a household's objective to take out a loan for consumption follows other objectives and constraints than the same household's interest to use the money to purchase a house, we choose for our analysis an objective-based approach where we distinguish between different

[4]See BIS (2013). For instance, the ECB and the Bank of Japan, unlike the Fed and the Bank of England, treat bank loans equivalent to marketable assets and accept them as collateral. This may be due to the different underlying market structure, i.e. a bank-based financial structure, and a central bank policy objective such as the belief that the acceptance of credit claims fosters bank lending, especially to small and medium-sized enterprises (SMEs) and private households.

[5]In a recent paper by Farhi and Tirole (2012), this effect is stronger for financially constrained firms.

borrowers within the corporate and household sector.

We formulate two hypotheses:

1. Interest rates have an ambiguous link to loans. There a times when the general negative relationship is undermined by counteracting supply and demand factors, depending among other factors on the stage of the credit cycle and the time horizon. We expect a negative relationship in the long run, but observe a positive link in certain periods, i.e. the short run.

2. Different sectors have different investment objectives which causes the interest rate elasticity of bank lending to vary across sectors. Figure 1 shows annualized bank lending growth rates of the various sectors and indicates a difference in the volatility of lending to FC (black, solid line) and HHhp (grey, dotted line) compared to lending to NFC (black, dashed line) and HHcon (grey, dashed-dotted line).

We will analyze bank lending to four different, non-bank sectors: Loans to NFC (non-financial companies), loans to FC (financial companies), loans to households for consumption (HHcon) and loans to households for house purchases (HHhp). For each of the sectors we perform panel models (pooled OLS, FE, for stocks and flows) with the credit variable as the dependent variable for each borrowing sector and a common set of macroeconomic determinants (GDP, house prices and interest rates).[6] We will use Euro area quarterly data from 2003-2013.

The empirical evidence is broadly consistent with the two hypotheses. Firstly, interest rates show duality in their impact on loans. In the long run, the demand channel is dominating and they have an inverse relationship. In the short run, during the boom and bust period period from 2005-2012, there is, however, a positive impact from supply effects. With respect to the second hypothesis of different interest rate elasticities, we find that during the time span from 2003 up to 2005 and again from 2012 until 2014, which we regard as 'normal times', in contrast to abnormal, boom and bust times, FC and HHhp borrowing are more sensitive than NFC and HHcon, respectively. During abnormal times the interest rate's counter-cyclical effect is, however, undermined by dynamics going in the other direction which is especially the case for FC lending and HHhp loans, and less so for NFC lending and HHcon loans. The results imply that preemptive interest rate policy is a necessary but not sufficient condition for financial stability. In addition, there is a case for macro-prudential tools, and these tools have to be counter-cyclical and sector-specific.

The paper is structured as follows: Section 2 covers the methodology and modeling framework. Section 3 presents the data. In Section 4 the empirical findings of the regressions of each sectoral credit variable on GDP, house prices and interest rates will be presented. In Section 5 a discussion of the implications of the results follows with references to net present value calculations and evidence of sector-specific macro-prudential tools already in place. Section 6 concludes.

[6] A similar approach has been used for an analysis on money demand by von Landesberger (2007).

2 Methodology

Two possible approaches can be taken to model sectoral borrowing and investigate interest rate elasticity. Bank lending to various sectors can be explained either by a common set of determinant variables or by specific determinants, which may differ across sectors. We follow the first approach in order to be able to compare the different elasticities of bank lending with a focus on interest rate elasticity.

We perform a Euro area panel analysis with bank lending to non-financial companies (NFC), to financial companies (FC),[7] to households for consumption (HHcon) and to households for house purchases (HHhp) as varying dependent variables. Each of those sectoral borrowing variables is regressed on the same three independent variables: GDP, house prices and interest rates. We will focus on the difference between bank lending to NFC vs. FC and bank lending to HHcon vs. HHhp.

Such an identical modeling framework will fall short of taking into account important sector-specific characteristics with respect to, for instance, the set of alternative refinancing opportunities, scale variables or loan maturity patterns. Against this background, the models constructed for each sector are not to be interpreted as a comprehensive explanation of the borrowing behavior. In order to preserve the valid statistical representation of the data, we adjust the modeling framework of each borrowing sector by including country and time fixed effects, and using errors which are robust to auto-correlation, heteroskedasticity and contemporaneous cross-sectional dependence, if required. This property is necessary in order to be able to compare the results of the model. It is, however, conceivable that the parameter estimates could still suffer from a bias, which in the context of a more refined sectoral specification could be reduced. This alternative modeling strategy would, however, cloud a comparative analysis across sectors and not provide any insights into the potential effects of an aggregation bias.

Each sector regression is estimated in semi-log-linear form. For robustness, we will perform estimations not only with stocks, but also with flows.[8] We find that panel-specific auto-correlation, heteroskedasticity and cross-sectional dependence are present in the error structure of the data.[9] In order to adjust the standard errors appropriately, we apply Prais-Winsten estimators with panel-corrected standard errors (PCSE) suggested by Beck and Katz (1995).[10]

[7] Although 'other financial intermediaries' (OFI) including financial auxiliaries and 'insurance corporations and pension funds' (ICPF) comprise a large variety of entities, they are subsumed as financial companies (technically, the 'non-monetary financial intermediaries') for the purpose of simplicity.

[8] Since unit root tests are ambiguous about some variables being I(0) or I(1), we cannot completely ignore the possibility of non-stationarity. Estimations methods geared at investigating long-term relations and tackling potential non-stationarity (error-correction including a co-integrating vector), could be more appropriate. As we are, however, also interested in dynamics over a shorter period (2005-2008 and 2008-2012), we stick to standard fixed effects panel analysis since the assumptions of long-term error-correction methods may not be fulfilled.

[9] Specifically, we use the Wooldridge (2002) test for auto-correlation in panel data, the Greene (2000) test for group-wise heteroskedasticity, and the Pesaran (2004) test for cross-sectional dependence in panel data. For the models of HHcon, we did not find cross-sectional dependence.

[10] STATA's 'xtpcse' command has been used for the estimations which relies on errors robust to auto-correlation, heteroskedasticity and/or cross-sectional dependence. FGLS estimates might be more efficient depending on the covariance structure, but tend to be unacceptably optimistic when used with data of 10 to 20 panels and 10 to 40 periods per panel. So we use OLS/Prais-Winsten estimates with PCSE which may be more appropriate since their coverage probability is closer to

We perform 4 different panel regressions. First, we start with a simple (pooled) OLS:

$$credit_{it} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 gdp_{it} + \boldsymbol{\beta}_2 hp_{it} + \boldsymbol{\beta}_3 ir_{it} + \boldsymbol{u}_{it} \quad (1)$$

where *credit*, *gdp* and *hp* denote the logs of bank loans to each sector, output and house prices. *ir* represents the interest rate, i the Euro area country and t the quarter of observation.

Then, we perform fixed effect estimation controlling for heterogeneity across panels where the heterogeneity is indicated by $\boldsymbol{v}_i$:

$$credit_{it} = (\boldsymbol{\beta}_0 + \boldsymbol{v}_i) + \boldsymbol{\beta}_1 gdp_{it} + \boldsymbol{\beta}_2 hp_{it} + \boldsymbol{\beta}_3 ir_{it} + \boldsymbol{\epsilon}_{it} \quad (2)$$

In the third setting, we extend the list of independent variables. Since we want to check our first hypothesis whether the relation between loans and interest rates is affected by demand and supply factors during boom and bust periods differently compared to normal times, we add a boom and bust interest rate dummy *irdum*. Demand and supply channels are difficult to disentangle since in reality the channels are mutually reinforcing. By including a dummy variable we try to approximate the additional effect of boom and bust specific demand and supply factors on the relationship between interest rates and loans. In practice, we interact the observations of the interest rate with a dummy which is equal to one for the boom and bust period between 2005q4 and 2012q2. We use 2005q4 as the starting point since from then on the ECB raised interest rates consecutively, followed, of course, by a period where interest rates were cut considerably after the Lehman collapse in 2008q3. We choose 2012q2 as the ending point of the boom and bust period in the regressions, since at that time the ECB announced that 'within our mandate, the ECB is ready to do whatever it takes' (see Draghi (2012)) which for many brought an end to the period of extreme volatility. The regression looks as follow:

$$credit_{it} = (\boldsymbol{\beta}_0 + \boldsymbol{v}_i) + \boldsymbol{\beta}_1 gdp_{it} + \boldsymbol{\beta}_2 hp_{it} + \boldsymbol{\beta}_3 ir_{it} + \boldsymbol{\beta}_4 irdum_{it} + \boldsymbol{\eta}_{it} \quad (3)$$

with *irdum* representing the boom and bust dummy interacted with interest rates for the period from 2005q4 until 2012q2.

In the fourth estimation, we finally add time fixed effects $\boldsymbol{z}_t$:

$$credit_{it} = (\boldsymbol{\beta}_0 + \boldsymbol{v}_i) + \boldsymbol{\beta}_1 gdp_{it} + \boldsymbol{\beta}_2 hp_{it} + \boldsymbol{\beta}_3 ir_{it} + \boldsymbol{\beta}_4 irdum_{it} + \boldsymbol{z}_t + \boldsymbol{\zeta}_{it}. \quad (4)$$

(5)

(6)

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the nominal level.

3 Data

Quarterly data for Germany between 2003q1 and 2013q4 is used. Loans, GDP and house price data are in log terms. The interest rate is in percentages. We examine 10 individual Euro area countries for the panel analysis: Austria (AT), Belgium (BE), Finland (FI), France (FR), Germany (DE), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT) and Spain (ES). Data for Cyprus (CY), Estonia (EE), Greece (GR), Luxembourg (LU), Malta (MT), Slovenia (SI) and Slovakia (SK) has not been used in the analysis because either the data was not available from 2003q1 onward (GR (loans), LU (house prices)) or the countries were not part of the Euro area in 2003 (CY, EE, MT, SI, SK).

The sectoral bank lending data is taken from the ECB's Monetary Statistics on MFI balance sheets and is based on outstanding amounts of MFIs to counterparties resident in the Euro area at the end of the period.[11] GDP data is from the ECB and is seasonally adjusted. House prices are taken from the ECB's Residential Property Price Index Statistics. For AT, ES, IE, IT and PT, they cover new and existing dwellings, for DE new and existing flats. For BE, FI, FR, NL they include only existing dwellings.[12]

With respect to the interest rate, we use the 3-month quarterly average Euribor based on monthly averages. The average interest rate offered at the inter-bank market between the major Euro area banks for unsecured funds is used as a reference for two reasons. (i) Loan interest rates might be more appropriate for bank lending demand and, conversely, money market rates for loan supply, but neither the ECB nor national central banks offer loan interest rate data for FC, and we explicitly want to compare bank lending to NFC with bank lending to FC. Insofar, we use the Euribor as a proxy of short term interest rates and implicitly assume that the actual loan interest rates of NFC and FC borrowing change proportionally with respect to changes in the Euribor. (ii) We use the Euribor because we assume it to be a fair representation of the main refinancing rate set by the ECB and to serve as a more appropriate interest rate than the official policy rate, since it follows more closely market rates, so it reflects much more the actual interest rates at which funds are offered by banks. Using a proxy instead of the actual loan interest rates may, in fact, be better for purposes of investigating the link between policy rate changes (short term money market rates higher correlation to policy rates than loan interest rates have) and loan demand. In other words, we use *money* market rates instead of loan rates to avoid endogeneity problems, since we assume interest rates to be exogenous given that they follow closely the policy rates of the ECB, and we use money *market* rates to have a more realistic representation of the market conditions than the actual policy rate.[13]

[11] For data of Dutch banks, additional data from the De Nederlandsche Bank has been used to correct for statistical breaks especially in June 2005.

[12] Iossifov et al. (2008) point out that country-specific indices whose bases differ (dwellings vs. flats, new vs. existing) are not be the best option for comparing level elasticities across countries. This data is, however, the most precise data available for house price developments, and will be controlled for by including country-specific effects.

[13] The problem here is certainly that we cannot be certain that the money market rates is exogenous. But this issues applies even for the policy rate, since it is determined according to a reaction function.

4 Empirical results

The empirical findings for the four sectors based on stocks are shown in Tables 1, 2, 3 and 4. The four columns of each table correspond to the four regressions of each sector explained earlier and are indicated at the top of each column correspondingly. Model (1) represents the pooled OLS estimation, model (2) the country fixed effects estimation, model (3) adds the boom-bust interest rate dummy and model (4) includes on top time fixed effects.

With regards to both GDP and house prices, we find a strong positive pattern of similar size for all regressions. Bank loans rise as GDP and house prices rise which suggest the impact of transaction demand and wealth effect dynamics. In model (4) with time fixed effects, the effect of both GDP and house prices is weaker, with house prices rather than GDP retaining its strong significance for loans in most sectors.

The relation between loans and interest rates is more complex but similar across sectors: In models (1) and (2) the coefficient of the interest rate is (mostly) negative as the theory of opportunity costs would suggest, yet, the effect is very small. Once the boom-bust interest rate dummy is, however, included, as in models (3) and (4), the coefficients of the interest rate become meaningful, with respect to both size and significance. The coefficient of the boom-bust interest rate dummy is negative, but smaller in absolute terms than the coefficient of interest rates. In model (3), however, the additional coefficient makes the overall interest rate effect during booms and busts much smaller than in normal times. Taking model (3) of loans to FC (Table 2) as an example, we see that as interest rates rise by 1 percent, loans will go down by 8.3% in normal times, whereas in abnormal times they will go down only by 3% (0.083 - 0.053 = 0.03). The results of the estimations including time fixed effects (model (4)) show a different picture: The coefficients are either not significant, or if significant, not very meaningful.

To compare the regressions for the various sectors more easily, especially the potential difference between bank loans to non-financial companies as dependent variable compared with those to financial companies and between results of loans to households for consumption loans compared with those to households for house purchases, we put each sector's model (3) results side by side in Table 5.

In the model with loans to NFC as dependent variable the GDP coefficient is higher than in the model of FC loans (0.765 vs. 0.527). GDP has a stronger effect on NFC borrowing than on FC borrowing. Looking at household loans, one can see that loans for consumption means respond more to GDP dynamics than loans for house purchases (0.658 vs. 0.599). The opposite seems to be the case for house prices. Both loans to FC and HHhp (0.800 and 0.782) react more strongly to house price movements than loans to NFC and HHcon (0.536 and 0.393), respectively.

With regards to the interest rate elasticity, FC and HHhp borrowing seem more sensitive (-0.083 and -0.050) than lending to NFC and HHcon (-0.023 and -0.016), respectively. Conversely, the boom-bust interest rate dummy coefficient is (positively) higher in the case of lending to FC and HHhp with 0.053 and 0.037 as the coefficients for FC and HHhp vs. 0.013 and 0.009 for NFC and HHcon, respectively.

In sum this means that during booms and busts the counter-cyclical effect of interest rates is weaker for FC and HHhp borrowing.[14] As a consequence, we can conclude that our results support our second hypothesis since we find borrowing sectors being characterized by different interest rate elasticities.

For robustness, especially in case non-stationarity is an issue, we check the results for the flows in Tables 6, 7, 8 and 9. Again, we find (except for one case) positive patterns between lending and GDP and house prices. The significance levels are, however, lower. In some cases there is no significance at all. The relation between loans and interest rates is statistically insignificant and economically negligible. However, during the boom-bust period we see a positive and significant effect of interest rates on borrowing. For illustration, the estimation results of each sector's model (3) (in cases where time fixed effects are also required by tests such as HHhp, we use model (4) as the reference) are shown together in Table 5. There is no consistent difference between the sectoral lending response to GDP and house prices. The same is true for the interest rate, but the boom-bust interest rate coefficient shows again the different behavior of FC and HHhp borrowing compared to NFC and HHcon, respectively.

Apart from the implications that NFC borrowing reacts differently to interest rate changes than FC borrowing, and that HHcon borrowing follows other interest rate dynamics than HHhp borrowing, the empirical findings allow another conclusion. While NFC vs. FC and HHcon vs. HHhp demonstrate a different borrowing behavior, we find similarities comparing NFC with HHcon borrowing and FC with HHhp borrowing with respect to interest rate, GDP and house price changes.

5 Implications

To summarize, the empirical results suggest the following with respect to our two hypotheses:

1. While increases in the interest rate do not immediately reduce the borrowing demand, either due to the limited time available for borrowers to adjust or because they resist to adjust, eventually, in the long run, the interest rate increases lead to a fall in the demand for credit - and this applies for all borrowing sectors. So, the counter-cyclical, credit growth dampening effect of interest rates exists, but it is weaker in abnormal times. This is an indication for the ambiguous relation between loans and interest rates during booms and busts.

2. The empirical findings of different borrowing behavior support the intuition of different interest rate elasticites. Similarities between some sectors are, however, also borne out in the data which suggest the idea that some sectors share similar dynamics. Indeed, it may be the case that the 4 different sectors make up two different groups: On one side of the spectrum there are bank loans to households for consumption issues (HHcon) and to non-financial companies

[14] Yet, netting the two effects, the effect of the standard interest rate and the boom-bust interest rate dummy together, loans to FC and HHhp are still more sensitive to interest rates.

for investment in new, physical assets (NFC) which share a similar borrowing behavior with respect to interest rates, GDP and house prices, while on the other side of the spectrum, demonstrating a similarly different behavior to the set of macroeconomic determinants, loans to households for house purchases (HHhp) and investment in existing, financial assets (FC).[15] So, while the interest rate policy of a central bank is set with the objective to affect all sectors equally, the sectors seem, in fact, to be affected very differently. At least, they respond very differently.

5.1 NPV illustration

To understand why sectors are characterized by partly similar, partly different interest rate elasticity patterns in their borrowing behavior, it is helpful to explain the dynamics by using net present value (NPV) methodology. This will also shed some light on why there is a case for counter-cyclical sector-specific macro-prudential tools. We start with the following baseline NPV calculation:

$$NPV = -CF_0 + \sum_{t=0}^{T} \frac{CF_t}{(1+i)^t}$$

with CF_t the expected cash flow in period t and i the estimated discount rate (the rate of return that could be earned on an investment with similar risk; for simplicity, we assume here constant discount rates.). The problem of NPV calculation is, of course, the fact that actual values for future cash flows and the discount rate are unknown. Estimating the values, therefore, becomes a daunting challenge, for some sectors and projects more than others.

But uncertainty in the approximation of the correct values is not the only problem. The empirical findings of the sectoral panel analysis suggest that estimations of cash flows and discount rates may be biased, or some of these estimations more biased than others.

The bias, either upwards or downwards, originates from the effect of self-reinforcing borrower and lender beliefs stimulating credit growth and financial markets, or at least affecting the prices of some assets more than others. On the one hand, assets which are marketable and liquid rise in value during booms relatively more than machinery or capital goods as investors expect price increases to continue further and look for short-term capital gains of marketable and liquid assets. This will draw more funds to these assets and increase their prices. On the other hand, these sectors channel the funds into assets which can be used as collateral. Rising collateral values cause lending to increase in sectors which push collateral values to rise even further. Our empirical findings support this process. Rising house prices have a stronger effect on those borrowing sectors such as FC and HHhp which invest in

[15] This is not to say that the categorization into two groups of borrowing objectives and assets finally invested in perfectly reflects reality such that e.g. loans to NFC exclusively end up in investing new, physical assets where cash flows repay the investment in a continuous manner while loans to FC are exclusively used for purchasing existing, financial assets where price increases, realized at the time of an eventual sale, pay off the initial investment. However, the categorization serves as a proxy to analyze the different underlying dynamics that affect each borrowing sector.

assets which tend to be more marketable and liquid and therefore attract higher funds. In addition, since lending for household consumption will partly fulfill needs to live and will, therefore, be less elastic, these loans will react less sensitive to house price dynamics.

In other words, net present value calculations of borrowers and lenders might be biased considerably depending on the (characteristics of the) asset invested. The bias of investments into marketable, liquid and collateralizable assets and, therefore, lending to borrowers which invest in these assets, leads to a crowding out of those sectors which do not provide these assets, i.e. lending to NFC and HHcon declines in booms. In NPV language, this may translate to (i) the estimated discount rate of FC and HHhp borrowers being lower/higher than the actual one (or at least lower/higher than similar NFC and HHcon borrowers from a risk-return perspective) and/or (ii) the expected value of the future cash flows of FC and HHhp borrowers being higher/lower than the actual ones (or at least higher/lower than similar NFC and HHcon borrowers from a risk-return perspective).

As long as the rise in prices is justified by their fundamental values, there is no problem. But eventually, when agents realize that prices and fundamental values have fallen apart by an unsustainable amount and act on this, the bubble bursts. When the bubble bursts followed by a macroeconomic shock, the bias becomes apparent - and the estimations of cash flows and discount rates have to be adjusted. The consequence is a debt overhang problem.

In fact, the rising risk of a macroeconomic shock caused by borrowers and lenders not taking into account that the sum of their decisions can result in a bubble bursting, is an externality of purely private return and risk assessments. In fact, the bigger the boom has been financed by credit, the bigger the externality because debt overhang problems arise and a balance sheet recession is likely.[16] Of course, there are also many borrowers and lenders that do take into account, but do not act or hesitate to act on this understanding. But it does not matter whether the macroeconomic shock is not reflected in private risk assessments because of cognitive dissonance, emotional biases, measurement error, or deliberate speculation of rising asset prices.

Given that lending to FC and HHhp is biased and can more likely than lending to NFC and HHcon cause an externality of a macroeconomic shock, we have to find ways to correct NPV calculations by internalizing the externality and, thereby, correcting the bias. A modification of the baseline NPV calculation is required, a risk-adjusted NPV which corresponds to the actual NPV value.[17] There are two ways of modification, both having the same effect:

One way of modification is by multiplying each cash flow by an additional risk factor. The risk factor adjusts the cash flows by the increased risk of a macroeconomic shock that arise from an additional credit-financed asset purchase:

$$NPV_{RF} = -CF_0 + \sum_{t=0}^{T} \frac{CF_t \cdot RF_t}{(1+i)^t}$$

with NPV_{RF} indicating the risk-factor adjusted NPV and RF_t the risk factor (factoring in the increased risk of a macroeconomic shock resulting from a purely private

[16] See Turner (2014) and Koo (2009).

[17] Analogous to Stewart et al. (2001). We could also use a probability tree to model rNPV analogous to CDS probability calculations.

return and risk assessment), with $RF_t < 1$. From this follows: $NPV_{RF} < NPV$.

Alternatively, and analogous to the concept of a social discount rate, we explicitly internalize the externality of a purely private return and risk assessment ignoring the social cost of a macroeconomic shock by adding a premium, e_t with $e_t > 0$, to the discount rate:[18]

$$NPV_e = -CF_0 + \sum_{t=0}^{T} \frac{CF_t}{[1 + (i + e_t)]^t}.$$

with NPV_e indicating the externality-internalized risk-adjusted NPV and where as indicated earlier, $NPV_{RF} = NPV_e$. Analogously to the case of the risk-factor adjusted NPV, we see that: $NPV_e < NPV$. Determining what exact values to choose for either the risk factor R_t or the externality premium e_t is, however, challenging, yet, so is the baseline estimation of the cash flows and discount rates.

5.2 Financial regulation

Given the theoretical intuition of fundamentally different borrowing objectives across sectors and across the credit cycle and the empirical evidence of varying interest rate (GDP and house price) elasticities, macro-prudential tools should be designed in a sector-specific, counter-cyclical way. As Tucker (2009) points out, the key is to influence the marginal cost of lending to exuberant parts of the economy, while preserving the flexibility to raise aggregate capital requirements if necessary. Capital required to back lending to FCs and HHhp could be increased, while leaving requirements for lending to NFCs and HHcon unaffected. Turner (2014) argues that this implies setting risk weights for lending to FC and HHhp higher than those underpinning the Basel II and Basel III internal rating systems since they reflect purely private assessments of potential losses.

A couple of central banks, such as Australia, Brazil, India, Ireland, Switzerland, UK and some others, have started to experiment with so-called 'sectoral capital requirements' (SCR). SCR can be operationalized in different ways: (i) raising the sector risk weights directly through a multiplicative scalar, (ii) raising the floor under risk weights for certain exposures (iii) or imposing capital buffer add-ons depending on its exposure to the sector in question.[19] So, they do not only increase the relative cost for banks of lending to the specified sector, but banks may find it hard to raise external equity to fund lending that has been singled out by the macro-prudential authority as particularly risky, increasing the pressure on banks to build up capital through retained earnings or by reducing the loan supply, most likely to the targeted sector. In addition to the borrowing sector dimension, SCRs can be applied for specific types of intra-financial system activity, or by instrument.

[18]The social discount rate dates back at least to Marglin (1963) who discusses the rejection of private ('market-exhibited') time preference in favor of social time preference, so the optimal level of investment is the level at which the marginal productivity of investment equals the marginal social rate of discount rather than the level at which the marginal productivity equals the market rate of discount that would emerge from the interplay of private decisions.

[19]See Annex 5 of BIS (2012).

SCR work, however, only in conjunction with a mix of other macro-prudential measures. One is higher capital requirements in general. Admati and Hellwig (2013) force banks to maintain much more of their financing in the form of equity rather than debt, so that bank shareholders rather than taxpayers will bear most or all of the downside risk of bank losses. To convince those that say that Admati and Hellwig (2013) overstate the benefits and understate the costs associated with this proposed reform, this could be structured more in a counter-cyclical way.

Noss and Toffano (2014) show that changes in aggregate bank capital requirements during an upswing affect lending to households far weaker than that to NFCs. Bridges et al. (2014) find that in the year following an increase in capital requirements lending (in descending order based on point estimates) for commercial real estate is reduced, but also loans to other companies and household secured lending. The sector-specific aspect is, therefore, crucial given the heterogeneous response of different sectors to a change of aggregate capital requirements just like with interest rates.

Borrowing should also be regulated by the imposition of maximum loan-to-value or loan-to-income ratios, whether on a continuous across-the-credit-cycle basis, and/or on a counter-cyclical basis. As Turner (2014) suggests also underwriting rules should be imposed which require that mortgage borrowers must assess borrower credit worthiness by focusing on their capacity to repay out of cash flow, with no permissible assumption that house price increases will make the debt affordable. And there are many other measures: Constraining the supply or at least the aggressive marketing of very high interest rate consumer lending, the public sponsorship or licensing of categories of bank which are required to focus solely on the function which most financial literature describes and the provision of credit to businesses to fund either working capital or new capital investment, see Turner (2014).

The evidence of the examples shows that, indeed, SCR have been used in conjunction with tools affecting terms and conditions of lending. Different tools seem to be required for different goals. However, it is a challenge to specify how to use them in each case precisely. For instance, a study of the BoE (2014) shows that banks' resilience is more directly enhanced when broad sectors or the stock of exposures are targeted, whereas if credit growth is supposed to be controlled, the effects are different, suggesting that calibration is important. Also timing is critical. The fact that SCR have been implemented with other macro-prudential tools complicates the impact analysis.

Whereas in general the arguments are in strong favor for globally harmonized rules and tools to avoid regulation arbitrage, there may be a case not only for counter-cyclical sector-specific macro-prudential tools, but for tools which are also country-specific. This subsidiarity principle might be, however, undermined by international competition, particular within a European single market.[20]

There is, however, also a strong case for using the counter-cyclical effect of interest rates even more preemptively than used today. Despite the overriding attraction of macro-prudential tools, they are not the panacea to all stability problems of the financial system. They are a necessary, but not a sufficient condition. History shows

[20]Apart from the panel models which are at the core of this paper we analyzed regressions of the 10 Euro area individual countries separately and found considerable variation between the countries. A heterogeneous borrowing behavior across countries motivates a case for national regulation along Euro area and/or international regulation.

that financial innovation is attracted to regulatory barriers. Interest rates are, however, the regulatory tool that cannot be circumvented, they apply universally (see Borio and Drehmann (2009)), or as Stein (2013) puts it: The interest rate 'gets in all of the cracks'.

6 Conclusion

The empirical findings motivate counter-cyclical sector-specific capital requirements since the borrowing behavior of various sectors with respect to interest rates (and GDP and house prices) depend on the stage of the credit cycle and the borrower's objectives for taking out the loan.

Higher general capital requirements, stronger counter-cyclical capital buffers, and the use of interest rates in a preemptive way will all play a role in leaning against unsustainable credit growth. But since borrowers respond very differently, this does not adequately address the phenomenon of booms and busts. Optimal policy cannot avoid differentiation between the different borrowing sectors (and the different instruments and activities).

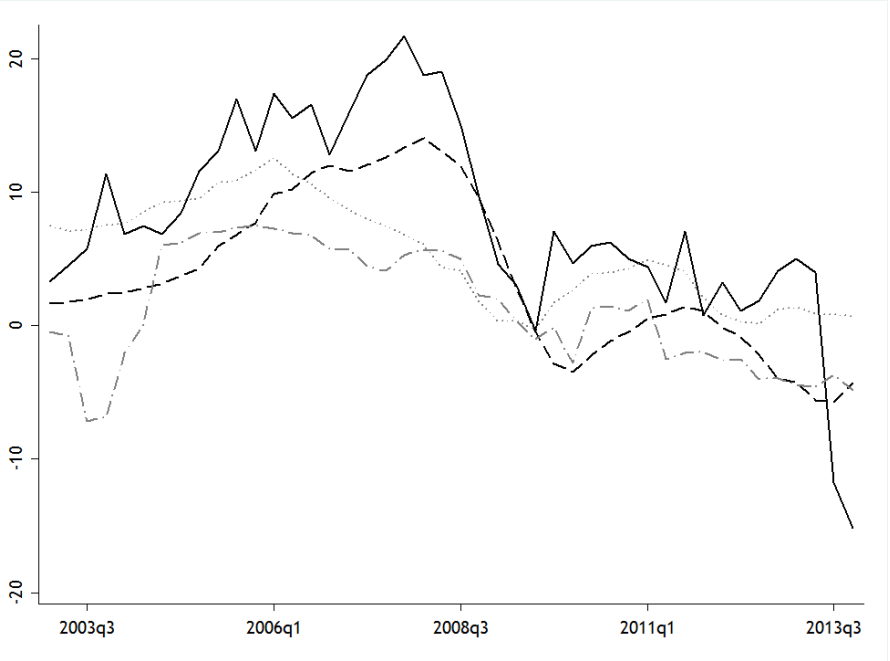
It is highly debated whether public policy should seek to influence credit allocation at all. Perfect discrimination will never be achieved, so it is difficult to precisely choose which sectors, instruments, and activities should be restricted, and which ones should receive an accommodating push. Given the fact that the credit process can be biased with respect to growth and allocation, however, the need for policy interventions to correct the bias should not be precluded from the start.

Further research should examine the experience of countries with different uses of sectoral capital requirements.

It has to be pointed out that the results do not follow from models which represent a 'best economic explanation' of the borrowing behavior, but from statistical representations under the restriction of a common set of determinants. In other words, differences in the parameter estimates could reflect the impact of omitted sector-specific variables. Yet, the theoretical intuition very convincingly supports the fact that the ultimate borrowing objective of the various sectors is essential in determining the reaction to interest rates and to other macroeconomic variables.

Appendix

Figure 1: Bank credit growth (annualized), breakdown by sector (in %)



Note: The black lines show the growth rates of loans to the corporate sector, where the dashed indicates the growth rate of loans to non-financial companies and the solid line the growth rate of loans to financial companies. Correspondingly, the grey lines show the growth rates of loans to the household sector, where the dashed-dotted indicates the growth rate of consumption loans and the dotted line the growth rate of house purchase loans.

Table 1: Bank loans to non-financial companies (NFC) (stocks)

	(1) ols	(2) fe	(3) fe	(4) t/fe
lgdp	0.833***	0.767***	0.755***	0.361*
	(32.86)	(23.83)	(25.79)	(1.70)
lhouseprice	0.300***	0.502***	0.536***	0.360***
	(3.97)	(5.92)	(6.92)	(4.52)
ireuribor	-0.006	-0.008	-0.023**	-0.001
	(-1.02)	(-1.34)	(-2.35)	(-0.09)
ird05q4_12q2			0.013*	0.008
			(1.68)	(1.14)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	440	440	440	440

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log outstanding bank loans to non-financial companies on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 2: Bank loans to financial companies (FC) (stocks)

	(1) ols	(2) fe	(3) fe	(4) t/fe
lgdp	0.709***	0.533***	0.527***	0.151
	(10.39)	(6.23)	(9.69)	(0.27)
lhouseprice	0.285	0.825***	0.800***	0.363**
	(1.30)	(4.20)	(5.55)	(1.97)
ireuribor	-0.010	-0.016	-0.083***	0.009
	(-0.64)	(-1.09)	(-3.06)	(0.38)
ird05q4_12q2			0.053**	0.004
			(2.41)	(0.27)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	440	440	440	440

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log outstanding bank loans to financial companies on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 3: Bank loans to households for consumption (HHcon) (stocks)

	(1) ols	(2) fe	(3) fe	(4) t/fe
lgdp	0.688***	0.325	0.658***	0.242
	(27.88)	(1.48)	(19.41)	(0.95)
lhouseprice	0.257***	0.480***	0.393***	0.351***
	(3.70)	(5.78)	(5.10)	(4.07)
ireuribor	-0.007*	-0.004	-0.016**	-0.000
	(-1.74)	(-1.01)	(-2.55)	(-0.04)
ird05q4_12q2			0.009*	0.006
			(1.75)	(1.24)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	440	440	440	440

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log outstanding bank loans to households for consumption on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 4: Bank loans to households for house purchases (HHhp) (stocks)

	(1) ols	(2) fe	(3) fe	(4) t/fe
lgdp	0.748***	0.603***	0.599***	0.607***
	(32.04)	(20.47)	(22.30)	(3.18)
lhouseprice	0.456***	0.758***	0.782***	0.550***
	(6.90)	(9.67)	(10.98)	(8.69)
ireuribor	-0.002	-0.005	-0.050***	-0.001
	(-0.32)	(-0.80)	(-4.11)	(-0.14)
ird05q4_12q2			0.037***	0.009**
			(3.93)	(1.98)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	440	440	440	440

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log outstanding bank loans to households for house purchases on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 5: Overview of bank loans by borrowing sector (stocks)

	NFC	FC	HHcon	HHhp
lgdp	0.755	0.527	0.658	0.599
lhouseprice	0.536	0.800	0.393	0.782
ireuribor	-0.023	-0.083	-0.016	-0.050
ird05q4_12q2	0.013	0.053	0.009	0.037

Note: This table shows results for regressions of quarterly log outstanding bank loans to non-financial companies, financial companies, households for consumption and households for house purchases. Each sector is regressed log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2') using fixed effects.

Table 6: Bank loans to non-financial companies (NFC) (flows)

	(1) ols	(2) fe	(3) fe	(4) t/fe
D.lgdp	0.558***	0.364*	0.460**	0.532**
	(2.77)	(1.77)	(2.40)	(2.53)
D.lhouseprice	0.459***	0.438***	0.446***	0.388***
	(5.64)	(5.14)	(5.63)	(4.92)
D.ireuribor	-0.004	0.001	-0.004	0.004
	(-0.94)	(0.20)	(-1.24)	(0.18)
ird05q4_12q2			0.006***	-0.002
			(9.42)	(-0.17)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	430	430	430	430

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log bank loan flows to non-financial companies on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 7: Bank loans to financial companies (FC) (flows)

	(1) ols	(2) fe	(3) fe	(4) t/fe
D.lgdp	0.712	0.027	0.246	-0.047
	(1.31)	(0.05)	(0.47)	(-0.08)
D.lhouseprice	0.554**	0.308	0.379*	0.273
	(2.42)	(1.33)	(1.69)	(1.19)
D.ireuribor	-0.006	0.009	-0.001	0.003
	(-0.52)	(0.77)	(-0.09)	(0.04)
ird05q4_12q2			0.011***	0.008
			(4.48)	(0.70)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	430	430	430	430

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log bank loan flows to financial companies on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 8: Bank loans to households for consumption (FC) (flows)

	(1) ols	(2) fe	(3) fe	(4) t/fe
D.lgdp	0.254	0.220	0.251	0.279
	(1.05)	(0.88)	(1.01)	(1.03)
D.lhouseprice	0.458***	0.464***	0.466***	0.277***
	(4.90)	(4.63)	(4.67)	(2.83)
D.ireuribor	-0.003	-0.002	-0.003	-0.013
	(-0.58)	(-0.32)	(-0.67)	(-0.48)
ird05q4_12q2			0.002**	-0.025
			(2.34)	(-1.61)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	430	430	430	430

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log bank loan flows to households for consumption on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 9: Bank loans to households for house purchases (FC) (flows)

	(1) ols	(2) fe	(3) fe	(4) t/fe
D.lgdp	0.866***	0.637***	0.633***	0.405**
	(4.64)	(3.54)	(3.52)	(2.11)
D.lhouseprice	0.639***	0.568***	0.567***	0.334***
	(8.37)	(7.75)	(7.74)	(4.84)
D.ireuribor	-0.003	0.003	0.003	-0.053**
	(-0.80)	(0.86)	(0.90)	(-2.43)
ird05q4_12q2			-0.000	0.006
			(-0.30)	(0.48)
country f.e	no	yes	yes	yes
time f.e.	no	no	no	yes
N	430	430	430	430

Note: t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table shows results for regressions of quarterly log bank loan flows to households for house purchases on log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2').

Table 10: Overview of bank loans by borrowing sector (flows)

	NFC	FC	HHcon	HHhp
D.lgdp	0.460	0.246	0.251	0.405
D.lhouseprice	0.446	0.379	0.466	0.334
D.ireuribor	-0.004	-0.001	-0.003	-0.053
ird05q4_12q2	0.006	0.011	0.002	0.006

Note: This table shows results for regressions of quarterly log bank loan flows to non-financial companies, financial companies, households for consumption and households for house purchases. Each sector is regressed log output ('lgdp'), log house prices ('lhouseprice'), interest rate (ireuribor') and interest rate dummy variable for the period from 2005q4 until 2012q2 ('ird05q4_12q2') using fixed effects.

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