

Interest rates, corporate lending and growth in the Euro Area*

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Abstract

The sluggish development of corporate lending has remained the central concern of EU monetary policy makers as it is considered to hinder seriously the resurgence of growth. This paper looks at the development of loans to large corporations vs SMEs in the pre-crisis and post-crisis period and wishes to answer: (i) to which extent do allocated loan volumes actually contribute to output growth? (ii) which factors determine the development of loans, considering above all loan interest rates? and (iii) what causes differences in loan interest levels across the EA? The results indicate that different loan developments in the EA explain very well differences in output development, loans to SMEs contribute even more to output growth than those for large corporations. Loan development itself is negatively influenced by the interest level which differs significantly across EA members, with small loans in addition always being charged an interest premium over large loans. The capitalization of banks, the size of banks and their internationalization play a role as well. A part of the sluggish growth of loans can be explained by the increasing use of alternative financial instruments by large firms. Interest rates in turn are following the ECB interest rate, - but this link has become looser in the post-crisis period, and long term government bond rates. Different risks faced by banks and different bank structures have become important explanatory factors of interest rates in the post-crisis period.

Keywords: Corporate lending; Credit market fragmentation; Interest pass-through; bank lending rates; Finance and growth; Euro Area;

JEL codes: E40; E43; E44

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1 Introduction

Since the great economic crisis, corporate lending has remained stagnant and has rather unequally developed in the EA. This is generally considered as a major reason for the slow re-establishment of economic growth in the EA.

Since the use of other instruments of financing from the capital market is limited in the EA, borrowing from banks is the central financing instrument of firms. To promote credit growth, the ECB has reduced its key interest rate since the great economic crisis in 2008 in drastic cuts. However, despite a common monetary policy in the EA, significant differences in loan interest rates persist among EA members and have even grown, notably in the EA periphery interest rates are significantly higher (see Figure 2 and Al-Eyd and Berkmen (2013)).

In addition, the interest rate reduction by the ECB has not reduced interest rates for all type of corporate loans to the same extent. Distinguishing between large scale and small scale loans (loans above and below 1 million Euros), one can note a steady and even increasing interest level premium for small scale loans. This loan category serves primarily financing of the small and medium enterprise (SME) sector which is highly important in the EA, not only in the periphery where it accounts e.g. for 80% of employment and 70% of GVA in Italy, Spain and Portugal (Al-Eyd and Berkmen, 2013), and even 85% of employment in Greece. Also in smaller core EA members like Austria, Belgium and the Netherlands the SME sector accounted for 60% of value added in 2012 (Klein, 2014). In summary, therefore, financing costs have remained particularly high in the periphery, and for the SME sector. Credit markets are fragmented in the EA.

This paper will consider loan development for large scale and small loans in the EA, - 2 loan categories which can be seen as a proxy for financing of large corporations versus SMEs.¹ It looks at the development in these loan segments at different stages of the business cycle in the 2000s, firstly, the boom in the pre-crisis period before 2008 and, secondly, the recession and slow recovery in the post-crisis period. Its aim is to investigate the relation between ECB policy rates, loan interest rates, loan development and economic growth. Specifically the paper wishes to assess empirically:

- Whether loan growth in the large enterprise and in the SME sector is an important factor for economic growth in the EA;
- Which factors determine loan development for large and SME enterprises in the EA, in particular which role do interest developments play;
- Which factors condition the development of interest rates for corporate lending and to which extent do these interest rates reflect the ECB policy.

The stagnation of lending to the enterprise sector has been repeatedly pointed out by European economic policy institutions in recent years (EIB, 2014; European Commission, 2014). That loan growth in general is important for output growth has been shown, e.g. by Cappiello et al. (2010). This paper goes further and addresses specifically the contribution of corporate loans to output growth since the debate on the sluggish corporate loan growth requires to verify if and to which extent it actually affects growth. Moreover, since a considerable debate exists on the unfavourable access of SMEs to finance, the paper distinguishes between the growth effect of small versus large loans, which is practically left out in the literature.²

¹This approach to treat loans below 1 million Euro as SME lending and those above 1 million Euro as lending of large corporations is common in the literature, see OECD (2016).

²An exception is Ciccarelli et al. (2013) and Klein (2014).

The factors determining loans are discussed and empirically investigated in the monetary policy transmission literature and in the finance literature, often based on survey data or data from credit registers and remain therefore confined to certain countries, or lead to an incomplete view on financing through large banks only. This paper uses the complete registered credit volume to non-financial corporations reported by EA banks through their central banks to the ECB and distinguishes between large and small scale loans.

Concerning the interest level, first, the literature on monetary policy transmission discusses the interest pass-through of central bank rates to loan rates. Existing studies, for example Kok and Werner (2006), point out that it is heterogeneous across EA countries. Differences in the lending rates to corporations across countries are attributed to risk factors (Holton and Rodriguez d’Acri, 2015). Second, the banking literature discusses factors on the demand and supply side that determine interest rates. This paper attempts to combine these two approaches examining the impact of monetary policy rates, risk factors and bank structures on interest rates. Moreover, it shows the differences in explanatory factors for small and large scale corporate loan interest rates, which is so far missing in the literature.

The paper accounts for the differences in factors determining lending on the one side, and the interest level on the other side, across the pre- and post crisis period. The two periods represent different stages in the business cycle. Between these 2 periods, the regulatory framework of the banking sector has significantly changed. Moreover, the sovereign debt crisis created an unexperienced stress factor for national banking systems in the post-crisis period.

Methodologically, the paper proceeds in two steps. First, a simultaneous equations model with quarterly panel data is used to test the effect of loan growth on output growth on the one side, and the effect of output and other risk factors and structural banking characteristics on loan growth on the other side. Second, the factors explaining interest rates for corporate lending are investigated in another set of regressions.

The main findings of the paper are that loan growth is a key explanatory factor of output growth, the impact of small loans being even higher than that of large loans. Loan growth in turn is seriously negatively affected by the real interest level of loans. EA countries with mounting or diverging interests suffer from insufficient corporate loan growth. Large loans benefit from a larger and more internationalized banking structure. Small loans also benefitted from a larger banking structure in the pre-crisis period, but this turned out to be prohibitive for small loans in the post-crisis period. Also can a more internationalized banking sector and a higher banking concentration not serve the development of small scale loans. A high capitalization of banks became crucial in both loan segments in the post-crisis area.

When estimating then the factors determining large and small scale loan interest rates, we see that the impact of the ECB rate on the real interest rate declines in the post-crisis period. The level of long-term bond rates, an indicator for the general financial situation and trustworthiness of the financial sector of the country, is equally important for the loan interest rate level. Real interest rates reflect the general economic climate in the EA, they declined in periods of prosperity and grow in periods of economic decline. Further they reflect the risk level for banks and increase with the share of non-performing loans and lending margins. Interest rates for small loans are specifically mounting with the rate of company closures in the SME sector. Also are bank structures important for the interest level. While a larger average size of banking branches in a country leads to lower interest rates, a higher concentration in the banking sector increases interest rates.

2 Literature

The paper is related to several branches in the literature: (i) The literature on monetary policy transmission emphasizing the credit channel, (ii) the literature on bank lending which ascribes the credit volume to demand and supply factors, (iii) the literature on the interest pass-through that tests the correspondance of bank interest rates to monetary policy rates, and (iv) other banking literature explaining the loan interest level by risk and cost factors, and (v) the literature linking loan development to output development.

In the 1990s, the influential papers of Bernanke and Blinder (1992), Bernanke and Gertler (1995) and Mishkin (1996) proposed theoretical arguments how the central bank's monetary policy would be transmitted to the real economy via the credit process. They considered that monetary policy would first work through the interest rate channel. The interest rate decided by the central bank would directly determine the refinancing conditions of the banking sector and be passed over to interest costs to be paid by companies. Consequently, monetary policy would influence investment and output via this interest channel. However, since often the interest rate channel does not work properly, Bernanke and Blinder (1992) and Bernanke and Gertler (1995) considered that financial intermediation plays a key role in monetary policy transmission and elaborated our understanding of the credit channel. They argued that in the credit channel two sides need to be considered, the bank lending channel which considers how the supply of loans by banks is determined, and the balance sheet channel which stresses how the credit-worthiness of the borrower is influenced. Bernanke and Blinder (1992) stressed that lending conditions of banks would change with different monetary policies. Expansionary policies would improve the lending conditions of banks while restrictive monetary policies would deteriorate them. As a consequence credit supply should increase/contract when the central bank sets an expansionary/restrictive monetary policy. Mishkin (1996) argued that monetary policy works through the so-called balance sheet channel. It influences the wealth and credit-worthiness of companies. A contractive monetary policy will reduce growth prospects of the company and thus reduce its credit-worthiness. A decline in asset prices reduces the basis for collateral and thus available loans to companies. The balance sheet effect would therefore amplify productivity shocks.

While the interest rate channel is considered to be the most important in countries with well functioning financial markets, it has been pointed out that the bank lending and the balance sheet channel may be important in countries with a less solid financial and enterprise sector or in situations of an economic crisis (Cevik and Teksoz, 2013), the situation in which the EA and particularly its periphery is found since the financial crisis.

This literature on monetary policy transmission has often formed the starting point for DSGE models. A number of empirical studies have also built on these arguments to investigate how loan supply has reacted to monetary policy. Ehrmann et al. (2001) analyse how monetary policy alters bank loan supply in the pre-EMU years.

In the course of the financial crisis and the observed credit crunch the focus on the credit channel has been revived in the empirical literature. Some papers, like Ciccarelli et al. (2013) do this as an element of explaining the monetary policy transmission mechanism, others have more and more focused on the credit channel by itself to explain loan development in the crisis.

Ciccarelli et al. (2013) analyse monetary policy transmission in a SVAR and conclude that financial vulnerability in both the banking and the enterprise sector resulted in substantial effects in the bank lending channel and in the balance sheet channel with consequent heterogenous effects of monetary policy transmission across EA members since the economic crisis 2007/8. They attribute heterogeneity in the credit channel within the EA to bank size and firm size. Hristov et al. (2012) use a panel VAR to study the effect of monetary policy and supply and demand shocks on loan supply and output. They point out that loan supply

shocks arising from the bank side lead to increasing interest rates and output decline while loan demand shocks would result in declining rates.

The empirical literature studying the credit channel geared by the financial crisis partly pursues a macroeconomic view as in Ciccarelli et al. (2013), Hristov et al. (2012), De Santis and Surico (2013), partly is rooted in the microeconomic banking literature.

Macroeconomic studies focusing on the bank lending channel and loan supply face the difficulty to disentangle loan movements into changes in loan supply and loan demand, as pointed out in Bernanke and Gertler (1995) and addressed in Hristov et al. (2012). Ehrmann et al. (2001) and De Santis and Surico (2013) assess the monetary transmission via the bank lending channel and estimate the effect of policy shocks on loan supply by using output growth to control for demand effects.

Ehrmann et al. (2001) derive a reduced model of bank lending from the demand and supply side and estimate the impact of monetary policy on bank lending in the EA using micro data from Bankscope and alternatively the more rich data of EA central banks. In their specification, the effect of monetary policy interest rates on realized loan volumes is estimated, considering also bank characteristics as banksize, liquidity and capitalization. The authors find a negative effect of monetary policy tightening on loan development. Bank size and capitalization were not important in explaining loan growth during the regarded pre-EMU period.

More recent studies have emphasized the importance of bank characteristics in the lending process. De Santis and Surico (2013) use microdata from the Bankscope database and assess the effects of monetary policy shocks on loan growth in 4 large EA countries in 2003-2012 distinguishing between different types of banks (commercial, savings and cooperative banks) and bank characteristics such as size, liquidity and capital to capture supply conditions. They find significant heterogeneity of the effect of monetary policy on loan supply across bank types and countries. Unlike Ehrmann et al. (2001) they find that bank characteristics play an important role in the EA in the 2000s.

Several authors have emphasized the importance of the size of banks for credit growth. Traditionally, large banks are considered to raise external funds more easily and should thus be associated with a more dynamic credit growth in boom and crisis periods. However, most literature argues that small banks are more likely to lend to SMEs. (Beck et al., 2008)

The impact of capitalization and liquidity constraints in the banking sector on loan supply has been studied recently in the context of the financial crisis. Kapan and Minoiu (2013) use individual bank balance sheet data from Bankscope and find that banks that relied heavily on external funding, watched reduced liquidity and sharply reduced credit supply during the financial crisis.

Louri and Migiakis (2016) point to the ongoing process of concentration in the EA banking sector after bank failures during the crisis. As Beck et al. (2008), Demirguc-Kunt et al. (2004), Ratti et al. (2008), Louri and Migiakis (2016) argue that competition in banking is an ambiguous issue. Concentration in the banking sector would coincide with better financing due to more systematic information collection on borrowers, but less competition would drive up lending costs.

Ehrmann et al. (2001) take a closer look on the pre-EMU bank structure and show that relationship lending is very important in some countries in the EA, such as Germany, Austria and Italy. Elsas and Krahen (1998) regard relationship lending in Germany and argue that long term relationships between a company and its house bank better assure credit availability to firms in periods of restrictive monetary policy or deteriorating business climate.

Recently, the financing constraints of SMEs have started to attract particularly attention in the literature.

Beck and Demirguc-Kunt (2006) argue that the SME sector is found to host technology driven innovative companies. SMEs would, however, face more constraints to finance. They find from a cross-country firm level data base, the Business Environment Survey, that SMEs depend more on bank finance than large firms which can use for example equity, and also have a more difficult access to bank credit than large firms. While the traditional view is that smaller banks permit relationship lending and are an advantage for access of small firms to credit, Beck et al. (2008), however, find that large banks promote SME finance and argue that they offer a greater variety of financing instruments such as factoring and leasing that permits them to reduce risk. Foreign banks would be beneficial for SME lending since they would bring more advanced lending techniques. More competition in the banking sector would reduce interest rates and demanded collateral for lenders (Beck et al., 2008). Similarly, Berger and Udell (2005), argue that the technological advantage of large banks to collect hard facts information on SMEs can be an advantage for SMEs to obtain financing. They put this in contrast to the financing of SMEs by small banks based on relationship lending and hence propose that a dominance of large banks would not be a disadvantage for SME financing.

A few studies have analysed the access of finance of SMEs in the Euro Area based on the Bank Lending Survey (Ferrando et al., 2015; Klein, 2014; Ciccarelli et al., 2013). Ciccarelli et al. (2013) include the issue of lending of different loan sizes by introducing survey data on this issue in a VAR analysis. The only study to my knowledge that uses complete data on agreed loan volumes by size is Hubert and Viennot (2013) who analyse the monetary policy transmission in France. No study has yet been proposed that looks at the interest pass-through in different categories of loan size and the bank lending channel in these loan categories for all EA members on the basis of actual agreed loan volumes. This paper wishes to fill this gap.

In the above cited literature the specification of the loan equation differs to some degree. Papers that stress the monetary policy transmission include the policy interest rate in the loan equation (for example Ehrmann et al., 2001; Ciccarelli et al., 2013; Hubert and Viennot, 2013). A few papers include the interest rate of credit directly in the loan equation (Klein, 2014; Hubert et al., 2015). Mostly it is not separated between the demand and supply side of the loan decision.

This paper follows this approach and estimates a reduced form. It considers the agreed loan volumes to be determined by output growth which captures the demand side and bank lending rates. Thus it introduces the lending costs and not the monetary policy rate directly in the loan equation. It accounts for a number of bank characteristics that describe the managerial approach in banking as well as the capacity to provide credit. Moreover, this paper performs an estimation for both large scale and small scale loans in order to stress the differences in factors explaining the loan development in the two types of loans.

The paper addresses the factors behind the interest level in a separate estimation, considering the ECB policy rate as a principal explanatory besides risk factors and bank structures.

This part starts from the numerous literature that has assessed the interest pass-through, i.e. the question to which extent bank lending rates reflect changes in monetary policy rates. For example, Angeloni and Ehrmann (2003) estimate the reaction of bank loan and deposit rates to money market rates in the early EA and find that the effect has become higher and more homogenous across EA countries since the creation of EMU. Hubert and Viennot (2013) estimate the response of different bank lending rates in France to the ECB policy rate. Creel et al. (2013) estimate the effect of ECB policy changes on different money market, bond and credit rates and conclude that all rates follow the ECB policy. Kwapil and Scharler (2013) extend this approach and include expectations in their estimates. Kok and Werner (2006) and van Leuvensteijn et al. (2013) show that the interest rate pass-through is heterogenous in the EA and that competition in banking explains these differences. ECB (2010) and

Darracq Paries et al. (2014) show that credit risk explains interest spreads. Hristov et al. (2012) finds that the interest rate pass-through has become more heterogenous since the financial crisis due to different economic structures in EA members. Belke (2013) in contrast finds that heterogeneity existed already before the crisis.

The banking literature considers more systematically factors on the demand and supply side which can explain interest rates. Rughoo and Sarantis (2014) show that competition in the banking sector leads to lower interest rates. Similarly, van Leuvensteijn et al. (2013) find that the monetary transmission mechanism is more effective when the banking sector exhibits more competition. Louri and Migiakis (2016) consider bank concentration, liquidity and sovereign bond rate spreads, to capture tensions in the banking system arising from the sovereign debt crisis, and EBC's systemic risk indicator to explain lending interest rates. Al-Eyd and Berkmen (2013) wish to assess the interest rate pass-through and regress the development of corporate lending rates on Euribor rates, financial credit default swap spreads and sovereign bond rates (to capture credit risk), bank bond spreads at issuance and term deposit rates to capture bank funding costs, asset to capital ratio and loan to deposit ratio (to capture leverage), and an indicator of economic outlook. They find that apart from monetary policy rates, bank funding costs, credit risk and weak balance sheet positions are the reasons for diverging corporate lending rates in EA.

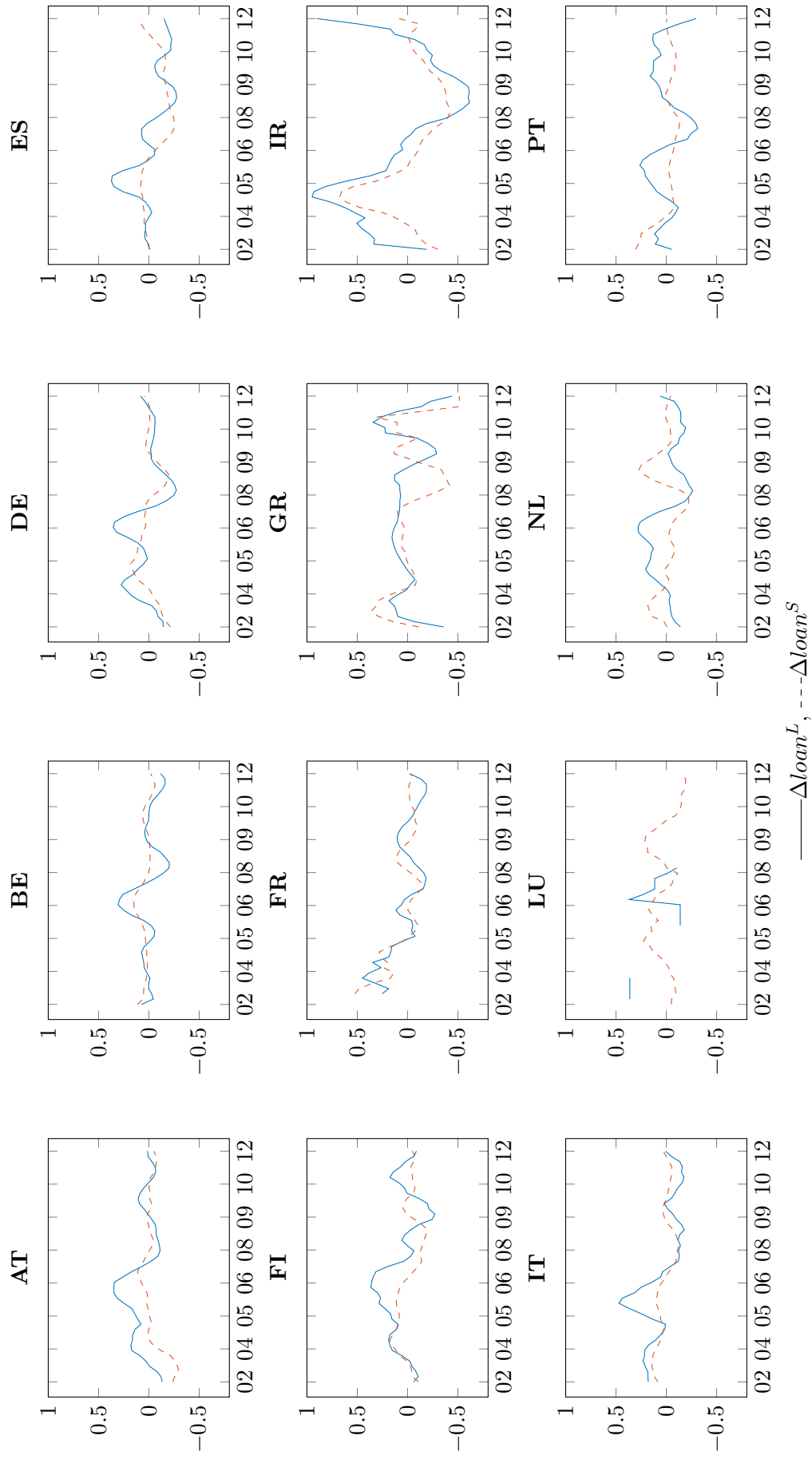
The paper is also linked to the literature which discusses the relation between financing and output growth. Cappiello et al. (2010) show that loan growth has been an important factor for output growth in the EA in the pre-crisis period. Klein (2014) shows that countries with a high share of SMEs suffered particularly from credit constraints and recovered slower from the crisis. Rondorf (2012) finds that bank lending is important for output growth in Europe while this connexion has disappeared in the US due to the better development of other financial instruments.

3 Empirical developments

A dataset with very specific indicators has been compiled for the investigation of this paper by the author. A first view on its indicators reveals a number of interesting facts:

First, as to the importance of large versus small scale loans, the data shows that small loans are much more important in Southern countries than in the other EA. SME lending is thus an important segment in these countries. The share of small loans is particularly high in Spain (43% pre- and 39% post crisis) and Portugal (45% pre- and 41% post-crisis) but also in Italy (43% pre- and 38% post crisis) and Greece (41% pre- and 38% post-crisis). In other EA countries the share of small loans stood at 37% in the pre-crisis and 33% in the post-crisis period. The share of small loan lending has thus dropped in all EA countries. Access to finance is reported as a key issue by SMEs in the peripheral EA countries and Italy (OECD, 2016).

Figure 1: Growth of large vs small loans in EA (year to year growth rate)



According to Figure 1, the development of loans in the EA generally follows the business cycle, increasing until 2008/09, dropping thereafter until about 2011/12 and remaining stagnant since then. Since the development is based on credit volume and not credit contracts, growth rates of large loans show higher amplitudes than small loans. In the pre-crisis period, loans grew in all EA countries to a similar extent, except for Ireland which clearly watched an unexperienced credit boom and a low credit growth in Greece after the Olympic games in 2004. Spanish and Portuguese credit growth was within the EA range. Since the economic crisis, credit growth became negative in all EA countries, however the decline was deeper in the periphery, above all in Ireland, but also in Greece. The decline is also longer in the peripheral countries Spain and Greece, but also in France and Italy. Also do small loans show a longer negative growth in the peripheral countries Spain, Greece and Portugal. However, since about 2012-2014 the stagnation in corporate lending is a general feature in the EA. In this stagnation period, often growth of small scale credits is better than that of large scale credit.

The availability of credit is a key source of financing for EA companies. While large companies have increased financing through debt securities and equity in recent years, these instruments are hardly a choice for SMEs (European Commission, 2014; EIB, 2014).

Figure 2: Real interest rates of large vs small loans in EA

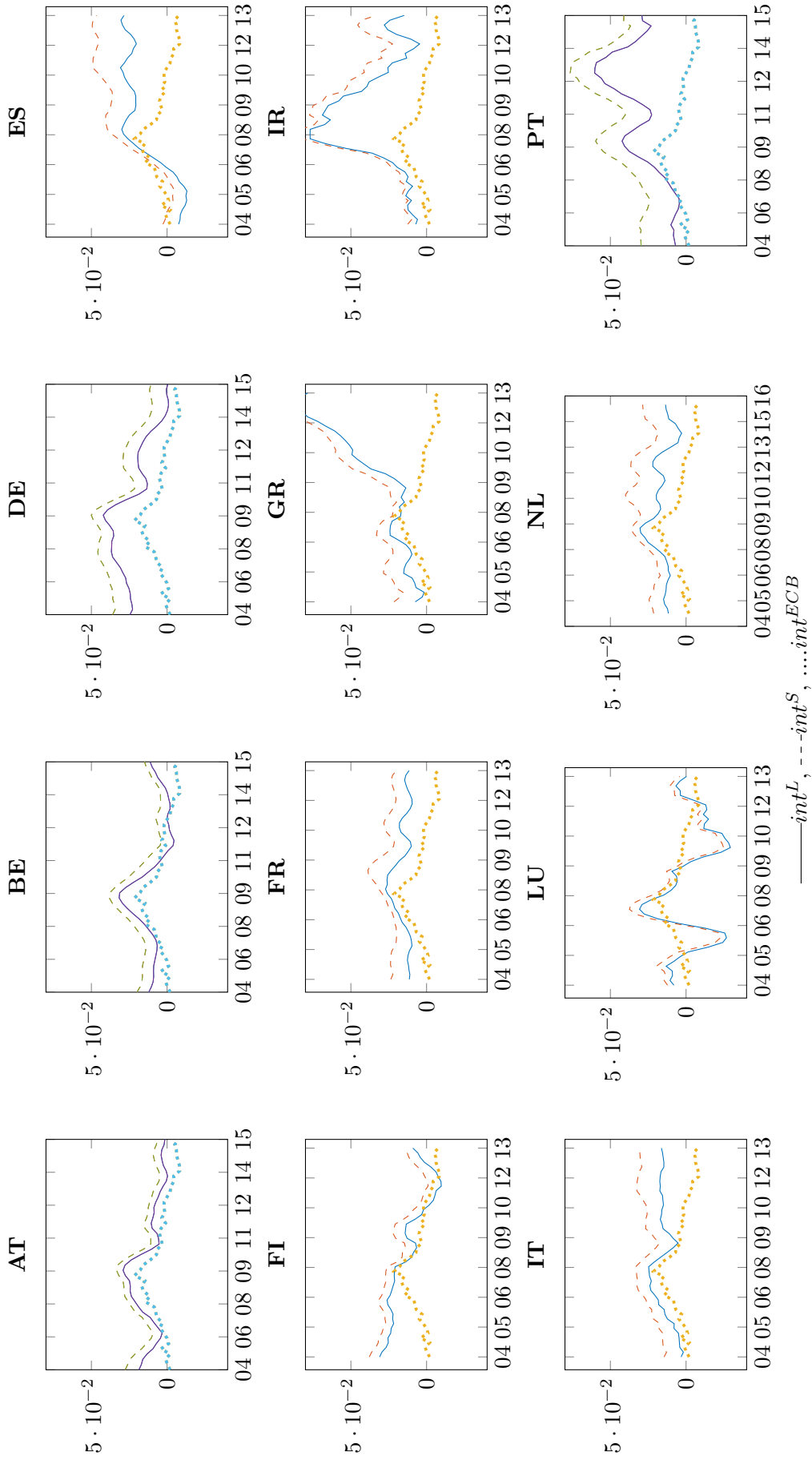


Figure 2 shows the real interest rates for large and small scale loans and the ECB's interest rate for main refinancing operations deflated by the EA inflation rate. By looking at real interest rates one can account for inflation differentials due to growth differentials across EA countries and over the business cycle. Looking at real interest rates will permit to compare the credit cost faced by companies across the EA and over the business cycle.

In the pre-crisis period, interest rates gradually increased in the EA but laid within the same range. Since the crisis, interest rates increased in all peripheral EA countries and also slightly in Italy while they dropped in the other EA core, although to a different extent. Interest rates for small loans exceed constantly those for large loans. In Spain, Ireland, but also in Italy, the Netherlands and France this differential seems to increase (see also Table 1 which suggests that the spread between small and large loan interest rates increases even more in the core).³ In summary, clearly, since the crisis the gap between the ECB interest rate and interest rates for company lending have been increasing particularly in the periphery, but also in Italy, the Netherlands and France.

Table 1: Data - Descriptive Statistics

| Indicator | Mean value pre-crisis | Mean value post-crisis | Mean value EA core | Mean value EA periphery |
|-------------------------|-----------------------|------------------------|--------------------|-------------------------|
| Δgdp | 0.0241 | -0.0048 | 0.0119 | 0.0042 |
| $\Delta loan^L$ | 0.1342 | -0.0742 | 0.0317 | 0.0245 |
| $\Delta loan^S$ | 0.0548 | -0.0633 | 0.0117 | -0.0402 |
| int^L | 0.0171 | 0.0171 | 0.0123 | 0.0268 |
| int^S | 0.0255 | 0.0281 | 0.0205 | 0.0394 |
| int^{ECB} | 0.0078 | -0.0010 | 0.0033 | 0.0033 |
| $\Delta(int^S - int^L)$ | -0.0165 | 0.0480 | 0.0199 | 0.0095 |
| $\Delta debtsec$ | 50.3688 | 246.9296 | -2.5604 | 419.2722 |
| $banksize$ | 23.2453 | 24.3419 | 27.3537 | 16.7101 |
| $internat$ | 0.2182 | 0.1752 | 0.2014 | 0.1861 |
| $bank_conc$ | 0.5443 | 0.5686 | 0.5407 | 0.5864 |
| $capital_loan$ | 0.1085 | 0.1380 | 0.1098 | 0.1510 |
| $loan^{NP}$ | 0.0252 | 0.0648 | 0.0308 | 0.0749 |
| $lend_marg$ | 0.0146 | 0.0163 | 0.0129 | 0.0206 |
| $bond_rate$ | 0.0173 | 0.0348 | 0.0175 | 0.0422 |
| $scomp_clos$ | 0.0109 | 0.0090 | 0.0073 | 0.0141 |

A few structural banking characteristics, their development and their difference across EA countries are worth noting: The average branch size in the banking sector, i.e. the average number of employees per branch, the concentration in the banking sector (measured by the share of the 5 largest banks in total deposits), and the degree of internationalization (measured by the share of deposits from other EA countries in total deposits in the banking sector). Table 1 shows that the average size of bank branches slightly increases between the pre- and post-crisis period. Also does the concentration in the banking sector increase, indicating that competition in the banking sector has declined. Internationalization, i.e. the use of cross border deposits in the EA, has slightly decreased since the crisis. This is evidence for an important restructuring that has gone on in the banking sector in the EA over time. Furthermore, Table 1 shows that banking concentration is lower in the EA core than in periphery. However, the branch size in banking is substantially higher in the core. The

³This evidence is different from Beck et al. (2008) who watch the lending behavior of only large bank and for a few EU countries only and find that those do not differentiate their pricing between small and large enterprises.

banking sector is less internationalized in the periphery (exception Ireland) than in the core where Belgium, the Netherlands and Luxembourg in particular have a highly internationalized banking sector. This suggests, that the core, hosting a banking sector with larger units, more competition and higher internationalization, can benefit from banks with larger financial capacity which would be less vulnerable to cyclical fluctuations and banks with a larger set of financial instruments and more efficient managerial practices which competition and internationalization would generate. In contrast, in the periphery, smaller units in the banking sector would indicate a lower efficiency, a lower capacity for controlling and monitoring of market and client developments. The dominance of a few banking institutions in the periphery countries would seriously restrict competition and make the financial system more vulnerable if one institution faces solvency problems.

Table 1 suggests that the capital basis of banks has improved since the crisis, as the capital to loan ratio has increased in the post-crisis period. However, the figures indicate that the capital to loan ratio is on average higher in the periphery than in the core. The figure is strongly influenced by Ireland and Greece in the post-crisis period where the capital to loan ratio increased substantially. However, one has to note that the indicator changes due to 2 different developments: either by a change in the capital basis or in the loan volume. The observed increase in the capital to loan ratio is, first, the result of stricter capitalization requirements, such as the Basle III Accord (minimum risk adjusted capital requirements), which were initiated after the financial crisis and, second, of the deleveraging that happened in the periphery after the financial crisis as described in Louri and Migiakis (2016). An alternative indicator, the capital to assets ratio reveals a similar pattern.

The share of non-performing loans, an indicator of financial stress in the credit sector and credit risk, has almost tripled in the post-crisis period, particularly in the EA periphery, in Greece and Ireland, but also in Italy. The ratio was much more stable in the other EA countries.

Another indicator of risk, the margin between interest rates for loans and deposits, in short lending margin, is almost twice as high in the periphery than in the core. However, there is also heterogeneity within the periphery. Portugal has constantly higher lending margins, Spain has only higher margins since 2013. In Greece and Ireland lending margins have converged to EA average during the crisis, but are again higher since 2013. Lending margins have generally increased during the economic crisis as a sign of the increased risk for banks.

4 Model Specification

The context between monetary policy, bank lending and output, following the arguments of Bernanke and Blinder (1992), is often analysed in a SVAR model. Cevik and Teksoz (2013) consider a SVAR with 4 endogenous variables including output, prices, short term interest rate as a proxy for the policy rate and a measure of domestic credit. Output and consumer prices are assumed to react to domestic credit. Credit demand responds to interest rates and output. Ciccarelli et al. (2013) also use a SVAR to assess the monetary transmission mechanism in the EA during and after the economic crisis. Their endogenous variables include output, prices, monetary policy interest, and to account for the financial sector: interbank lending volumes, long-term ECB lending to the banking sector, loan demand and credit conditions.

This paper wishes to concentrate on two distinct periods in the 2000s, the boom before 2008 and the post-crisis period in order to account for the structural break due to new financial regulations in the banking sector and the sovereign debt crisis after 2008 and for the different business cycle stages in the 2000s. Considering two rather short periods, the first before the great economic crisis from the third quarter of 2003 to the fourth quarter of 2008

and the second from the first quarter of 2009 to the first quarter of 2015, the SVAR approach requiring longer time series is less suitable. Therefore this paper will use a simultaneous equations approach where the two-sided relationship between output and loans is modelled. This model is separately estimated for large and small loans.

In the principal Equation output growth is regressed on loan growth as in Capiello et al. (2010)(see Equ. 1 and 3).

The loan equation (see Equ. 2 and 4) is a reduced form of the demand and supply for loans and comes close to the specification derived in Ehrmann et al. (2001) from the bank lending model of Bernanke and Blinder (1988). However, unlike Ehrmann et al. (2001) I do not use the money market interest to indicate credit costs, but actual loan interest rates are taken.

Simultaneous equations system for large loans:

$$\Delta gdp_{it} = \alpha_1 \Delta loan_{it}^L + \mu_{1i} + \lambda_{1t} + \varepsilon_{1it} \quad (1)$$

$$\begin{aligned} \Delta loan_{it}^L = & \beta_1 \Delta gdp_{it} + \beta_2 int_{it}^L + \beta_3 \Delta debtsec_{it} + \beta_4 banksize_{it} + \\ & + \beta_5 internat_{it} + \beta_6 capital_loan_{it} + \beta_7 loan_deposit_{it} + \\ & + \beta_8 loan_{it}^{NP} + \mu_{2i} + \lambda_{2t} + \varepsilon_{2it}A \end{aligned} \quad (2)$$

Simultaneous equations system for small loans:

$$\Delta gdp_{it} = \gamma_1 \Delta loan_{it}^S + \mu_{3i} + \lambda_{3t} + \varepsilon_{3it} \quad (3)$$

$$\begin{aligned} \Delta loan_{it}^S = & \delta_1 \Delta gdp_{it} + \delta_2 int_{it}^S + \delta_3 \Delta (int^S - int^L)_{it} + \delta_4 banksize_{it} + \\ & + \delta_5 internat_{it} + \delta_6 bank_conc_{it} + \delta_7 capital_loan_{it} + \\ & + \delta_7 loan_deposit_{it} + \delta_8 loan_{it}^{NP} + \mu_{4i} + \lambda_{4t} + \varepsilon_{4it} \end{aligned} \quad (4)$$

In the loan equation 2 and 4, five categories of determinants of loans in EA countries are investigated:

1. output development signaling the business prospects
2. Interest rates reflecting the costs arising to the lending firm and reflecting the project risk for the bank
3. the extent of financing alternatives used by firms
4. financial stability in the banking sector, indicated by the capitalization and liquidity of banks
5. structural characteristics of the banking sector: size of banks, bank concentration and internationalization

First, the development of output, indicated by real GDP growth, Δgdp , should be a key factor both for credit demand and supply. On the firm side, investment and thus demand for credit will increase with favourable growth prospects. On the bank side, banks should be more open to provide credit when they consider that the general business climate is booming. However, GDP growth does not only signal favourable or unfavourable business prospects to companies and banks. It also gives an indication of the balance sheet effect that will arise from the growth development on the loan demand and supply side. A favourable/low growth development would increase/lower the asset value of the firm and thus its ability to provide collateral. Similarly, GDP growth influences the asset value of the bank and consequently its ability to obtain credit for refinancing. From these manifold relationships between output growth and loan growth, one should expect a positive coefficient of GDP growth in the loan equation.

Alternatively to GDP growth, the development of share values could be used as an indicator of the business development in the large company sector.

Second, the effect of different interest measures is investigated. For large loans, the impact of the real interest rate for large loans above 1 mio Euro, int^L , is considered. Alternatively to estimating the effect of the real interest rate one could also use the differential of the national real interest and the real ECB interest rate as a direct measure of the country premia. However, since the differential refers to a common value for all cross sections, the coefficient of that variable would be identical. The real interest level indicates the credit costs arising to firms but also the risk for banks. This variable involves thus both the demand and the supply side.

For small loans lending, in addition to the real interest rate, int^S , the growth of the interest differential between small and large loans, $\Delta(int^S - int^L)$, is considered. The differential between interest rates for small and large loans indicates the surplus in financing costs that small firms face, but also the higher risk that banks perceive in financing loans to small scale business.

It is expected that high interest rates discourage loan growth. Moreover it is expected that the effect of changes in interest rates may turn out with a delay, Thus lags of these variables will be used.

The factors influencing in turn the level of interest rates will involve several indicators that capture the level of risk and the creditworthiness and will be investigated in a second estimation (see below).

Since there is a rather high correlation of output growth and interest growth, the level of interest rates and not their growth rate is taken. Moreover, to account for inflation differentials across countries and time, the real interest rate is considered. Real interest rates are gained with GDP deflators. This transformation takes off the cyclical component of interest rates. Nominal interest rates increase in the boom when inflation is increasing and drop in the decline when inflation goes down. Consequently one observes a cyclical development in nominal interest rates. This is reflected in a co-movement of the loan volume and nominal interest rate.

Third, the demand of companies for loans will depend on the extent to which other instruments of financing are used. For the extent of financing alternatives available to firms 2 indicators are considered: the growth of the ratio of the volume of new issues of debt securities, i.e. corporate bonds, to loans, $\Delta debtsec$, and the ratio of new share issues to loans. If these are a financing alternative the estimates should show a negative coefficient since it would lead to less credit demand and reduce loan growth.

Fourth, the capacity of banks to provide loans will depend on the capitalization and liquidity of banks. For the capitalization of the bank, the capital to loan ratio, $capital_loan$, is an indicator. Decreasing ratios should reduce the ability of banks to provide further loans. This should show in a negative coefficient. In general the capitalization of banks has increased over the whole period considered, probably due to the Basel 2 agreement, although some opposite episodes can be watched in several member states. The liquidity of banks is captured by the loan to deposit ratio, $loan_deposit$ as in Louri and Migiakis (2016).

Alternatively to capitalization, one could also think of the ratio of the non-performing loans ratio, $loan^{NP}$, which reduces liquidity and financial stability as an indicator of financing restrictions in the banking sector. Countries with a high ratio of non-performing loans are expected to watch lower loan growth.

Fifth, we consider whether the structural characteristics of the banking sector, namely the average size of bank branches, $banksize$, the concentration in the banking sector (share of 5 largest banks in deposits), $bank_conc$, and internationalization of the banking sector, $internat$, play a role for loan growth. Internationalization is captured by the ratio of foreign

corporate deposits from other EA countries to domestic corporate deposits that the banking sector holds. The hypothesis is that more bank concentration, larger banks size and more internationalization is paired with more efficiency, better technology, better access to refinancing in the banking sector. This can be beneficial for the provision of loans, but it could also mean that banks are more strict with loan restrictions in turbulent times. A high concentration of banks will also be an indication of less competition in the credit sector and should lead to higher interest rates.

In a second set of estimations, I investigate which factors determine the real interest level (see Equ. 5 and 6).

$$int_{it}^L = int_{it}^{ECB} + \Delta gdp_{it} + loan_{it}^{NP} + lend_margin_{it} + bond_rate_{it} + bank_conc_{it} + banksize_{it} + \mu_{5i} + \lambda_{5t} + \varepsilon_{5it} \quad (5)$$

$$int_{it}^S = int_{it}^{ECB} + \Delta gdp_{it} + loan_{it}^{NP} + lend_margin_{it} + bond_rate_{it} + bank_conc_{it} + banksize_{it} + scomp_clos_{it} + \mu_{6i} + \lambda_{6t} + \varepsilon_{6it} \quad (6)$$

First, an important aim of this study is to investigate to which extent different corporate loan interest rates reflect the ECB rate, int^{ECB} , and thus to assess how the interest pass-through in the EA has changed in recent times. It is assumed that the corporate lending rates do not follow the ECB rate one to one. Second, it is estimated to which extent corporate loan rates reflect the long term government bond rate, $bond_rate$. Since bond rates reflect the general financial situation in a country and vary across the EA members I expect that this is reflected in the level of corporate loan interest rates.

Third, it is expected that the interest rate will also depend on the general economic situation indicated by the economic growth rate, Δgdp . First, in a poor growth period the sales prospects for firms are reduced and so is its solvency, which increases the risk for the bank. Thus the bank will demand higher interest rates (balance sheet channel). Second, in a poor growth period the solvency of the bank may suffer as well so that it incurs higher refinancing costs which are handed over to loan interest rates.

Fourth, two other even more specific indicators reflecting the lending risk for the bank as well as its refinancing cost based on its own stability and solvency, are the rate of non-performing loans, $loan^{NP}$, and the lending margin, $lend_margin$. The rate of non-performing loans can be considered as an indicator for the potential risk incurred by the lending bank. (Note that the measure is an overall rate of non-performing loans). A high rate increases the likeliness of credit default and banks will pass this higher risk through higher interest rates to loans. Furthermore, in a situation of a high rate of non-performing loans banks would face solvency problems and high refinancing costs. Thus it can be expected that a high rate of non-performing loans leads to an increase of corporate loan interest rates. The lending margin, i.e. the interest spread between loan and deposit rates should be an additional indicator of the risk level incurred by banks and its refinancing cost and should thus be a potential factor explaining the interest level. In the case of perceived higher risk, banks should increase their lending margins which should raise interest rates. The lending margin can be considered as an indicator that mirrors the development of deposits in relation to loans. With declining deposits banks would demand higher interest on loans since refinancing becomes more costly to them.

Ideally, one should use an indicator that addresses more directly and precisely the risk in economic development at the firm side. And moreover, one would welcome to be able to use an indicator specifically showing the risk in different firm size classes. Unfortunately, there is no rate of non-performing loans of corporations by loan volume. Solvency data of firms, indicated by size class would be an ideal indicator. However, national insolvency statistics are often not comparable across EA members and are not available for all countries. The data

of Eurostat on company closures by size class did not prove to be fully reliable. However, a calculated rate of small non financial company closures, *scomp_clos*, based on Eurostat data provided plausible information and is used in the estimation of the small loan interest rate.

Since the risk for the bank declines in the case of mortgages, it would be interesting to test the effect of the share of loans with mortgages on corporate loan interest rates, particularly with small scale loans. Unfortunately, the ECB MFI statistics do not report on mortgages with corporate loans of different volumes.

Finally, we expect, that bank characteristics do not only determine the capacity of banks for loans but also the interest rate charged. Since large banks would have better access to finance they might charge lower interest rates. A higher concentration and larger credit institutions could mean a stronger market position which might result in higher interest rates.

5 Data

Despite the availability of firm level data on lending practices this paper I decided not to use this type of data. The bank lending survey of the ECB would be a potential source. I studied this data set and realized that it shows several weaknesses, above all the picture provided by that data is very volatile and often conflicts the data used here. The survey nature of the ECB bank lending survey creates problems of data reliability. Particularly in small countries the sample of interviewed enterprises is not representative. The answers reported by firms are judgments but no quantitative indication. The survey relates to single years starting in 2007, so that one cannot make observations over a sufficiently long period of time. Other micro level data used in the literature is Bankscope which provides data from the larger banks of a country on an annual basis (the data set is described in Ehrmann et al., 2001), some use credit-file data (for example Elsas and Krahnen, 1998) reported by banks.

This paper uses data reported from national central banks to the ECB and published as monetary and financial institutions (MFI) data. The advantage is that it covers all banks of EA countries and reports quarterly data. Thus the data is fully representing all banking activities in a country and provides rich information on short term developments. This is particularly important since I wish to study the effects in the pre- and post-crisis period and capture the rich dynamics in these periods. The ECB MFI data set reports loan volumes provided to different sectors so that one can use loan volumes to non-financial corporations. Furthermore it is distinguished between large scale (above 1 million Euros) and small scale loans (below one million Euros). This is another reason why this data set is perfectly suitable for our purpose since these loan categories can be used as a proxy for lending to large corporations and the SME sector. Correspondingly, it reports the interest rates for these loan types.

The exact definition of variables is given in Table 5 in the Annex. All variables are in shares or growth rates.

A few series of banking characteristics in this paper are obtained by interpolation from annual data. Since bank characteristics will most likely change smoothly this appears as a suitable procedure. This procedure has been also chosen by other authors in this field to obtain higher frequency data from annual data, for example by Hubert and Viennot (2013) and Louri and Migiakis (2016).

Finally, in order to smooth excessive short term fluctuations, the observations are taken as 5 quarter rolling windows. This assures that the patterns found in the estimations can be interpreted as longer term relationships.

6 Results

Estimation is performed for the full period 2003-2014, the pre-crisis and the post-crisis period, separately for large and small loans.

Investigating the determinants of loan growth, we have to take into account that several likely explanatory variables are correlated. (See Tables 6, 7, 8 in the Annex). To avoid problems of multi-collinearity we include collinear variables in separate estimations.

6.1 Results for large scale corporate loans

Let us first turn to the estimated systems explaining the impact of large loans on growth and the determinants of large loans (see Table 2).

In the estimates of the growth equation, the variable growth of large loans, $\Delta loan^L$, shows a significantly positive coefficient in all estimates. This provides strong evidence that economic growth in the EA is strongly linked to the development of large loans. This factor can very well explain GDP growth, shown by the high R^2 of the estimates of 0.7-0.8. However, the growth of large loans has driven GDP growth to a larger extent in the pre-crisis period than in the post-crisis period. This indicates that the importance of credit growth for economic growth has fallen in the post-crisis period. Apparently, in that period, other factors have emerged besides the credit channel that are also responsible for stagnant growth.

The estimates of the large loan equation yield a significantly negative effect of the real interest level for large loans, int^L , a positive coefficient of GDP growth, Δgdp , and in the full period estimates a positive coefficient of bank size and internationalization of the banking sector, a positive coefficient of the capital to loan share in the post-crisis period, and a negative of the growth of share of debt securities in company financing.

In the equation of large loans it appears that the level of real interest rates has a significantly negative effect on loan growth. This negative effect happens with a lag, of one quarter in the full period estimation and in the pre-crisis sample, but of 2 quarters in the post-crisis period. In summary, high interest rates discourage growth of large loans,

Estimations of the loan equation show further that loan growth depends positively on output growth. In periods of increasing economic growth the demand for credit and provided loans increase. This can be interpreted as evidence of the in the literature described balance sheet effect. When GDP declines corporate asset which serves as collateral value declines and consequently the credit volume that banks would be willing to supply. Similarly, the bank's asset value declines when GDP growth declines and banks will consequently reduce their lending. Besides these 2 supply side effects, firms will also show a smaller demand for credit when weak economic activity reduces the growth perspective of firms.

The loan estimations reveal a further interesting fact: the coefficient of the growth of the ratio of debt security issues to loan is significantly negative in the full sample period and in the post-crisis period. This indicates that in the large volume corporate credit market loan growth was increasingly lowered due to the increasing emergence of corporate financing with debt securities.⁴ In contrast, no statistically significant coefficients could be found for the variable "issue of new shares relative to loans". Therefore, the issue of new shares is no financing instrument that could substitute for large loans.

Concerning the variables of capitalization and liquidity, the estimates show in the post-crisis period a significantly positive coefficient of the capital to loan ratio. The loan to deposit ratio, in contrast is insignificant (not reported in Table 2). The positive coefficient of the capital to loan ratio would indicate that a banking sector that has lent excessively in the past and that observes a decline of the capital to loan ratio will provide less loans at

⁴There are some important extreme developments in Ireland, Greece and Finland. However, if excluding these observations from the estimation, the coefficient of *debtsec* remains negative and significant.

present and that countries with a more capitalized banking sector, watched a more dynamic development of large loans. A reason for the insignificant coefficient of the loan to deposit ratio can be that the measure has different implications. A high ratio can either mean that the banking sector is likely to have liquidity problems, but also that the sector makes full use of business opportunities. A low ratio in a country, as it is e.g. observed in Greece, would thus indicate that banks do not fully exploit business opportunities. Recently, Kapan and Minoiu (2013) suggested to use other liquidity measures like non-deposit funding to total funding to capture the extent a bank makes use of wholesale funding. The estimates also show a significantly negative coefficient of non-performing loans, an indicator of financial instability and restrictions in the banking sector, on loan growth in the full period. Since the share of non-performing loans shows a high correlation with interest rates, that variable is dropped in these estimations.

Finally, concerning the characteristics of the banking sector, the estimations show that countries with larger banks and a more internationalized banking sector have watched higher large loan credit growth. This confirms the hypothesis that larger and more internationalized banks would have better access to finance and thus would be better in a position to lend. A more internationalized banking sector is more active in its lending behavior. However, the contribution of both factors, bank size and internationalization of banking loses significance in the subperiods. In the pre-crisis period, only internationalization maintains a significantly positive coefficient, suggesting that in the in the pre-crisis period countries with an internationalized banking sector thus showed a more dynamic large volume credit growth. The significance of *banksize* and *internat* disappears completely in the post crisis period. Large banks and internationalized banks seized to be dynamic lenders to the large enterprise sector. They no longer show a higher propensity to finance.

Table 2: Results loans above 1 million (i.e. large loans)

| | | full sample period | | | | | pre-crisis | | | | | post-crisis | | | | | |
|------------------|--|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|----------------------|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | |
| | | GDP growth equation | | | | | | | | | | | | | | | |
| $\Delta loan^L$ | | 0.018825*** (0.00491) | 0.01524** (0.00470) | 0.01511** (0.00470) | 0.01523*** (0.00472) | 0.01372*** (0.00417) | 0.04364*** (0.00456) | 0.03388*** (0.00446) | 0.0334*** (0.00447) | 0.03388*** (0.00446) | $\Delta loan^L$ | 0.1427*** (0.00680) | 0.01805* (0.00805) | 0.01811* (0.00805) | 0.01775** (0.00805) | 0.01774** (0.00805) | |
| R^2 | | 0.68 | 0.70 | 0.70 | 0.69 | 0.68 | 0.68 | 0.68 | 0.80 | 0.80 | R-sqr | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | |
| N-obs | | 498 | 512 | 512 | 512 | 512 | 512 | 363 | 186 | 186 | N-obs | 187 | 123 | 123 | 123 | 123 | |
| | | loan equation | | | | | | | | | | | | | | | |
| Δgdp | | 1.52033*** (0.58624) | 1.37853* (0.60100) | 1.74367** (0.61220) | 1.75871** (0.62380) | 1.34622** (0.62203) | 1.23955*** (0.46037) | 7.11309*** (0.92422) | 6.09444*** (0.95143) | 6.3029*** (0.92205) | 6.24999*** (1.05197) | Δgdp | 1.19991 (0.78190) | 1.84436 (0.97630) | 1.98715* (0.97481) | 0.84722 (1.06000) | 0.84048 (1.06391) |
| int^L | | -1.14373 (0.69737) | -1.39130* (0.72265) | -1.38756* (0.71194) | -1.36076* (0.74296) | -1.42598* (0.74295) | - | int^L | - | 6.52488*** (1.10574) | - | int^L_{t-1} | -1.35440 (1.02300) | - | - | - | - |
| int^L_{t-1} | | - | - | - | - | - | 6.50488*** (1.17699) | - | 7.63403*** (1.24828) | 7.27123*** (1.28733) | int^L_{t-1} | - | - | - | - | - | |
| int^L_{t-2} | | - | - | - | - | - | 0.00003 (0.00000) | - | - | - | int^L_{t-2} | - | - | - | - | - | |
| $\Delta debtsec$ | | - | - | - | - | - | $\Delta debtsec$ | 0.00003 (0.00003) | -0.00741 (0.00447) | - | $\Delta debtsec_{t-1}$ | -0.0002*** (0.00000) | -0.01025 (0.01069) | - | - | - | |
| $banksize$ | | 0.00688* (0.00335) | 0.00688* (0.00335) | 0.00717* (0.00366) | 0.00717* (0.00366) | 0.00717* (0.00366) | $banksize$ | 0.00741 (0.00447) | - | - | $banksize$ | 0.00000 (0.00000) | -0.01025 (0.01069) | 0.05171 (0.58705) | 0.00086 (0.01177) | 0.00086 (0.01177) | |
| $internat$ | | 0.62223** (0.18893) | 0.62223** (0.18893) | 0.61412** (0.19956) | 0.61412** (0.19956) | 0.61412** (0.19956) | $internat_{t-1}$ | 1.2179** (0.39280) | 1.2179** (0.39280) | 0.61069 (0.42150) | $internat$ | 0.05171 (0.58705) | 0.05171 (0.58705) | 0.05171 (0.58705) | 0.05171 (0.58705) | 0.05171 (0.58705) | |
| $capital_loan$ | | -0.04259 (0.33775) | -0.04259 (0.33775) | -0.04259 (0.33775) | -0.04259 (0.33775) | -0.04259 (0.33775) | $capital_loan$ | - | 0.58552 (1.17129) | 0.58552 (1.17129) | $capital_loan$ | 1.33119** (0.57587) | 1.33119** (0.57587) | 1.33119** (0.57587) | 1.35245* (0.64506) | 1.35245* (0.64506) | |
| $loan^{pp}$ | | 0.86519*** (0.21415) | 0.86519*** (0.21415) | 0.86519*** (0.21415) | 0.86519*** (0.21415) | 0.86519*** (0.21415) | $loan^{pp}$ | 0.86519*** (0.21415) | 0.86519*** (0.21415) | 0.86519*** (0.21415) | $loan^{pp}$ | 0.23 (1.87) | 0.24 (1.23) | 0.24 (1.23) | 0.26 (1.23) | 0.27 (1.23) | |
| R^2 | | 0.41 | 0.36 | 0.38 | 0.37 | 0.37 | 0.41 | 0.41 | 0.47 | 0.49 | 0.47 | 0.23 | 0.24 | 0.24 | 0.26 | 0.27 | |
| N-obs | | 498 | 512 | 512 | 512 | 512 | 363 | 186 | 186 | 186 | N-obs | 187 | 123 | 123 | 123 | 123 | |

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
all estimations with time specific effects

6.2 Results for small scale corporate loans

Next I focus on the determinants of small scale loan growth (see Table 3).

In all estimations, the principal equation on GDP growth shows a high explanatory power with an R^2 of about 0.70-0.80, in the loan equation R^2 is between 0.30 and 0.50. Also small loans are important for growth as shown by the throughout positive significant coefficient in the GDP growth equation. The larger coefficient in relation to the estimates of large loans suggests an even higher importance of small loans for GDP growth. In the context of the literature this can provide an argument that policies to promote the supply of loans to small scale business are particularly important. In the related literature, Beck and Demirgüç-Kunt (2006) stresses the importance of SMEs for economic growth due to their propensity to operate in innovative and dynamic businesses but points to their financing constraints. Klein (2014) 2014 shows that countries with a large SME sector watched a worse growth performance in the post-crisis area and explains this by the limited access to finance of SMEs after the crisis.

In the loan equation the estimated coefficient of the real interest rate for small loans is throughout significantly negative. The size of the coefficient is similar to that in the loan equation for large loans. Also here, interest rates act with a lag on loan volumes. The significantly negative coefficient of $\Delta(int^S - int^L)$ suggests that a growing interest rate differential between small and large loans has a negative effect on small loan growth and that this becomes particularly high in the post-crisis period. Small companies seem to have been more and more discouraged by high interest rates and increasing interest margins between small and large loans. The increasing interest margin in the post crisis period is a strong factor for less dynamic small loan growth. In summary, the growth of small scale loans is discouraged by highly growing interest rates and increasing interest differentials to large loans.

Including the possibility of financing alternatives in the estimations of small scale loans, debt securities and shares, showed no significant coefficient (not reported in Table 3). Those are thus no financing alternatives for small scale enterprises. In search for an improved measure of financing alternatives, the instrument of small cap micro volumes was examined but it turned out that its financing volume starts with 65 millions so that it cannot be considered as an alternative to small scale loans. Small firms thus hardly have any financing alternatives to loans.

Finally, the variables capital to loan ratio receives a significantly positive coefficient in the whole sample period and in the post-crisis period. However, the coefficient is smaller than for large loans. A sound capital basis has been also an important prerequisite for small scale financing in the post crisis period, although less important than for large loans. A stagnation of small loan growth is thus attributable to a poor capitalization of the banking sector. Concerning the liquidity measure *loan_deposit* the estimates show no significant coefficient (not shown in Table 3). However, as with large loans, the estimates show a significantly negative coefficient of non-performing loans on small loan growth in the full period. Financial instability introduced by non-performing loans has also restricted the ability of banks to provide credit to the small enterprise sector.

The structural characteristics of the banking sector partly play a different role than with large loans. The coefficient of bank size is always significant, but changes sign. In the full period and the pre-crisis period the coefficient of bank size is positive, but it becomes significantly negative in the post-crisis period. An explanation can be that a banking sector with larger bank branches would have a better financial basis to provide loans, be more efficient in refinancing and thus provide also to the small company sector more credit. However, the stronger efficiency concern paired with larger bank branches may also increase their risk awareness, lower loyalty to small companies and thus reduce small scale credit in the

post-crisis period. The factor credit sector internationalization does not play a role for small scale credits in the whole period, but if, it has a negative impact as shown by the negative coefficient in the pre-crisis sample. More strongly internationalized banks may have been less enthusiastic to finance small scale companies in the boom period, because of a higher risk awareness, more sophisticated credit assessments and less care for local small scale companies. Consequently, we note that internationalization of the domestic banking sector promotes the agreement of large loans but not of small ones. For the variable concentration in the banking sector a significantly negative coefficient is found in the pre-crisis period. An interpretation can be that under the dominance of a few banks the sector will have less close relationships with small companies so that they would have less easy access to credit. It would also indicate that small companies would find better access to credit if the credit sector is operated by many small credit institutions which would assure close relationships with customers.

In summary, more competition in the banking sector and small credit institutes seem to be important to assure loan financing to small firms. The development of small scale loans is not favored by a stronger internationalization of the banking sector.

Let me summarize the results of the loan estimates and relate them to literature. Loan growth is an important factor for growth, a result which confirms the finding of Cappiello et al. (2010). The growth contribution of small loans is even higher than that of large loans. Improving the conditions for small scale lending to the SME sector would therefore have the highest effect on growth.

The development of agreed loans is co-moving with GDP development. In both loan segments, loans grow faster in periods of high growth and drop in periods of GDP decline. Low growth prospects and balance sheet effects lead to a pro-cyclical development of loan development. The development of both loan categories is highly sensitive to interest rates. An increase in real interest rates has a negative effect on loan development. Increasing interest rates in the periphery and the higher interest rates for small loans seriously constrain loan development. These results are in line with Hense (2015) who estimates the interest rate elasticity of total loans (not specified by borrowing sector) in the EA and finds that the volume of loans is positively related to GDP level and negatively to the level of interest rates

In the large loan sector the emergence of alternative financing instruments as debt securities and capitalization via the stock market can explain a part of the slow down in loan growth in the post-crisis period. However, this is not the case with small loans. This result supports the arguments found in the literature that small companies have little alternatives to loan financing and that unfavourable credit conditions are therefore particularly hard for the sector (Beck and Demirguc-Kunt, 2006; Klein, 2014).

The capitalization of banks has become a critical factor in the post-crisis period. Credit growth has developed more favourable in countries with a higher capitalization. Financial instability, as introduced by the financial crisis to a varying extent in the European banking system and in general reflected in the rate of non-performing loans is a major reason for stagnation of loan growth.

Characteristics of the banking sector are important for loan development. Large and more internationalized banks are favourable for large scale financing. In contrast, internationalization of the banking sector is not relevant for small loans, large banks have favoured the development of small loans in the pre-crisis period, but a large scale banking sector is hindering the development of small loans in the post-crisis period. Also is the dominance of a few credit institutions negative for small scale loan development. A banking sector comprising a variety of different types of banks would best serve the requirements of large and small scale enterprises.

Table 3: Results loans below 1 million (i.e. small loans)

| | | | full sample period | | | | | pre-crisis | | | | | post-crisis | | | | | |
|-------------------------|-------------------------|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------------|--|--|--|---------------|---------------------|--|--|--|--|
| | | | (1) | (2) | (3) | (4) | (5) | (6) | GDP growth equation | | | | | GDP growth equation | | | | |
| $\Delta loan^S$ | | | 0.04956*** (0.00563) | 0.04927*** (0.00564) | 0.05032*** (0.00562) | 0.04907*** (0.00564) | 0.04854*** (0.00564) | 0.04544*** (0.00469) | | | | | | | | | | |
| R^2 | | | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.69 | | | | | | | | | | |
| N-obs | | | 540 | 540 | 540 | 540 | 540 | 540 | | | | | | | | | | |
| | | | loan equation | | | | | loan equation | | | | | loan equation | | | | | |
| Δgdp | | | 3.25370*** (0.43413) | 3.08287*** (0.42507) | 3.02008*** (0.44245) | 2.83128*** (0.44231) | 3.06169*** (0.44604) | 3.36014*** (0.36378) | | | | | | | | | | |
| int_{t-1}^S | | | - | - | - | - | - | - | | | | | | | | | | |
| int_{t-2}^S | | | 1.48671*** (0.48377) | 1.29810*** (0.48628) | 1.69370*** (0.50262) | 1.61469*** (0.51383) | 1.41351*** (0.51197) | - | | | | | | | | | | |
| $\Delta(int^S - int^L)$ | | | - | - | - | - | - | - | | | | | | | | | | |
| $banksize$ | | | 0.33958*** (0.09498) | 0.00765*** (0.00180) | 0.00882*** (0.00190) | 0.00882*** (0.00190) | 0.00802*** (0.00190) | 0.28485*** (0.09391) | | | | | | | | | | |
| $internat$ | | | - | - | - | - | - | - | | | | | | | | | | |
| $bank_concentr$ | | | - | - | - | - | - | - | | | | | | | | | | |
| $capital_loan$ | | | - | - | - | - | - | - | | | | | | | | | | |
| $loan^{cp}$ | | | - | - | - | - | - | - | | | | | | | | | | |
| R^2 | | | 0.31 | 0.32 | 0.29 | 0.33 | 0.34 | 0.26 | | | | | | | | | | |
| N-obs | | | 540 | 540 | 540 | 540 | 540 | 540 | | | | | | | | | | |
| | $\Delta loan^S$ | | 0.02581*** (0.00943) | 0.02691*** (0.00942) | 0.02737*** (0.00942) | 0.02633*** (0.00942) | 0.02633*** (0.00942) | 0.02633*** (0.00942) | | | | | | | | | | |
| | R^2 | | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | | | | | | | | | | |
| | N-obs | | 204 | 204 | 204 | 204 | 204 | 204 | | | | | | | | | | |
| | Δgdp | | 1.52067*** (0.48189) | 1.00190* (0.50163) | 1.21716** (0.50726) | 0.21801 (0.54719) | 0.21801 (0.54719) | 0.21801 (0.54719) | | | | | | | | | | |
| | int_{t-1}^S | | - | - | - | - | - | - | | | | | | | | | | |
| | int_{t-2}^S | | 2.11474*** (0.63780) | 1.88338*** (0.66643) | 1.70357*** (0.70524) | 2.17960*** (0.65806) | 2.25936*** (0.60921) | - | | | | | | | | | | |
| | $\Delta(int^S - int^L)$ | | - | - | - | - | - | - | | | | | | | | | | |
| | $banksize$ | | 0.46455*** (0.08675) | 0.01868*** (0.00344) | 0.01868*** (0.00343) | 0.01868*** (0.00344) | 0.01868*** (0.00344) | 0.01868*** (0.00344) | | | | | | | | | | |
| | $internat$ | | - | - | - | - | - | - | | | | | | | | | | |
| | $bank_concentr$ | | - | - | - | - | - | - | | | | | | | | | | |
| | $capital_loan$ | | - | - | - | - | - | - | | | | | | | | | | |
| | $loan^{cp}$ | | - | - | - | - | - | - | | | | | | | | | | |
| | R^2 | | 0.43 | 0.38 | 0.35 | 0.40 | 0.40 | 0.49 | | | | | | | | | | |
| | N-obs | | 204 | 204 | 204 | 204 | 204 | 204 | | | | | | | | | | |

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
all estimations with time specific effects

6.3 Interest rate estimations

Concerning the estimation of the factors explaining the interest rate level, 3 set of estimates are performed. In the first, the ECB rate, GDP growth and non-performing loans are included as explanatories. In a second set of estimations the lending margin is used as a risk indicator instead of non-performing loans. In a third set of estimations, the ECB rate, the bond rate as an indicator for general financial stress in the banking market, the lending margin as a risk indicator and bank structure variables as bank concentration and bank size are included. A special risk indicator with small companies is the small company closure rate which is distinctly higher in the EA periphery than in the core. Since the estimated specifications are the same across periods and across the group of large and small loans, one can trace differences in the impact of single factors over time and between large and small loans. Finally the estimations are performed separately for the periphery and the core in order to find out why interest rates mostly have developed that differently in the periphery.

The results show in general a positive and significant coefficient for the ECB rate, of the bond rate, the lending margin and the ratio of non-performing loans, and a negative for GDP growth. The coefficient of bank size is positive, that of bank concentration negative. The explanatory power of these estimates is convincing.

First I discuss the results for the interest rates of both loan types in the whole period and pre- and post-crisis period. Then I consider differences when estimating separately for core and periphery.

The positive coefficient of the ECB interest rate indicates that loan interests rates, both for large and small loans closely follow the interest rate set by the ECB. Large loans follow the ECB interest closer than small loans. However, this linkage becomes much more weak in the post-crisis period, when the coefficient drops to half of the previous value, both with large and small loan interest rates. This result is in line with other authors, for example Al-Eyd and Berkmen (2013), who find that the interest rates pass-through from Euribor to corporate lending rates has declined. This indicates that the policy of the ECB to lower interest rates and promote investment has suffered from an insufficient interest rate pass-through. Banks are not passing the decline in the ECB rate sufficiently over to borrowers.

The negative coefficient of GDP growth indicates that interest rates of large as well as small loans develop anti-cyclical with GDP growth. Real interest rates increase in periods of weak growth when the asset value of companies falls and providing loans becomes more risky for banks. The estimated negative coefficient almost doubles in the post-crisis period with both small and large loan interest rates. The balance sheet effect becomes larger in the post-crisis period. This is one reason why interest rates in EA countries that watched a deeper recession have risen more. Furthermore, in the periphery interest rates of both loan types reflect the balance sheet effect to a higher degree. In the EA core, in contrast interest rates develop pro-cyclically, increasing in the boom and falling in periods of weak growth. Consequently, in the post-crisis period, companies in the core member states have enjoyed a decline in interest rates while they have mounted in peripheral countries particularly in deeper recession.

The lending margin shows a significantly positive coefficient in the full sample period suggesting that interest rates for loans closely follow the risk perceived by banks. The lending margin is a more important determinant for large than for small loans if the full period is considered. This result also holds if we consider only the periphery. The lending margin shows no significant coefficient in the pre-crisis period for both loan categories and also not in the EA core. In the post crisis period, its influence is slightly higher on small loans. The lower lending margin in the pre-crisis period and in the EA core constitutes no particular risk that results in higher interest rates. In the post crisis-period and in the EA periphery where the lending margin is significantly larger interest rates increase in countries with high

lending margins. This finding that credit risk explains divergence in lending rates in the EA is in line with ECB (2010) and Al-Eyd and Berkmen (2013).

The positive coefficient of the alternative risk indicator non-performing loans in all samples, suggests that loan interest rates reflect the risk associated with a high extent of non-performing loans in the banking sector. There seems to be no substantial difference in the impact of non-performing loans between large and small loan interests. However, we observe that the coefficient is substantially higher in the pre-crisis period than post crisis and slightly higher in the core than in the periphery. The risk awareness of credit institutions seems to be higher in the pre-crisis period and in the EA core. In the post-crisis period and in the EA periphery, when the rate of non-performing loans is much higher interest rates respond less to that higher risk. An explanation may be that the indicator "non-performing loans" is partly backward looking. Non-performing loans may already have been written off by banks. The estimates of the loan equation and the interest equation indicate that non-performing loans influence loan development in a twofold way. Directly, in preventing banks from supplying credit, and indirectly by inducing banks to raise interest rates.

In the post-crisis estimations of small loans, the closure rate in the small company sector was introduced as explanatory instead of GDP growth. The closure rate in the small company sector should be considered as an indicator for the particular risk banks face in the small loan segment since this indicator is more specific for the sector than GDP growth or the share of non-performing loans. This variable showed a significantly positive coefficient, suggesting that banks increase the interest rate of small loans according to the development of company failure. The high rate of company closures in the periphery is thus an important reason for higher small loan interest rates in that EA part.

With respect to the influence of banking sector characteristics on interests, two interesting facts appear. A higher concentration in the banking industry results in higher interest rates. The influence is similar for large as for small loans. However, concentration in the banking industry on the interest level was much more important in the post-crisis period than before the crisis. Moreover, the negative effect of bank concentration to raise interest rate is particularly high in the periphery. Recall that bank concentration has become higher in the post-crisis period and is higher in the periphery. Increasing concentration in the banking sector has thus contributed to interest divergence in the EA.

Another interesting result appears. In the pre-crisis period, large banks demand lower interest rates, shown by the significantly negative coefficient. In contrast, in the post-crisis period, we find a significantly positive coefficient. This indicates that after the financial crisis, the interest level increases in countries with a larger banking structure. A reason can be that large banks show a higher risk awareness and are more cautious.

Finally, a set of estimations was performed including real long-term government bond rates which were increasing in the peripheral countries while they decreased in the core EA. Since there appeared several correlations with other regressors (non-performing loans, output growth) those were dropped from the estimations. The estimations show a significantly positive coefficient of practically the same size as the ECB interest rate. This suggests that loan interest rates reflect the national budgetary financial situation to a similar extent as the ECB interest rate policy.

In summary, increasing interest spreads for corporate lending reflect a reduced degree of interest pass-through in the post-crisis area. Since long-term government bond rates have an equal influence on corporate loan rates as the ECB interest rate policy, one has to conclude that the ECB is unable to lower loan interest rates if the national debt situation is problematic. It requires both monetary and fiscal action to reduce interest rates. Risk factors, like poor output growth, high lending margins, a high share of non-performing loans,- and in the small loan segment the rate of small company closures, lead to higher interest rates. The impact

of the risk factor can well explain the increasing spread of corporate loan rates, particularly in the post crisis period. The generally perceived risk by banks and the particular risk of firm closure have a higher impact on the interest level in the small loan segment and thus for SMEs. Different characteristics of the banking sector in the EA explain spreads in corporate loan rates. A reduction in bank competition results in a higher interest level. A large scale banking sector leads to lower interest rates in times of prosperity when banks are eager to attract clients. In periods of stagnation larger banks are particularly cautious and demand higher interest rates. As the influence of ECB interest policy and of government bond rates has dropped in the post-crisis period, risk factors and banking characteristics have become more important in explaining the spread of corporate interest rates in the EA.

7 Conclusions

This paper has empirically investigated bank lending of large corporation vs SMEs in the Euro Area in the 2000s distinguishing between the pre- and post-crisis period. The effect of interest rates together with a number of other bank characteristics was tested. This was done in a simultaneous equations approach where not only the factors behind loan development, but also the effect of loans on output development was estimated. Since the developments of lending interest rates are a central explanatory in this assessment, the determinants of interest rates were investigated in a second step.

The investigation offers important results: First, it shows that loan development is very important for output growth. Stagnant growth in the EA is caused by weak corporate credit growth. Bank lending to SMEs is even more important for output growth than lending to large corporations. Second, loans in both sectors, small companies and large companies, follow a cyclical pattern, they prosper in booms and decline in recessions. Third, loans are strictly discouraged by high interest rates. Real lending rates have risen in the late boom years before the economic crisis, stopping the credit boom. Since the crisis, real interest rates have drifted apart among EA members. While they dropped in practically all core EA members, they rose in the periphery. Furthermore SMEs always have to pay higher lending rates. The interest premium of lending rates for SMEs discourages loans for that sector even further. Fourth, according to the results, a solid capitalization of banks has become a necessary prerequisite for sufficient bank lending to companies. Financial stress in the case that the banking sector is confronted with a high share of non-performing loans, decreases corporate credit growth. Both factors are worse in the EA periphery. Fifth, in the estimates, bank structures turn out to be another important factor. Larger banking units and more internationally operating banks as they prevail in the EA core, are essential for lending to large corporations. Larger banking units were eager to finance SMEs in the pre-crisis period, but in the post-crisis period, SMEs in countries with smaller banking units have been better served with credit. Finally, the estimates show that an unfavourable output development, partly rising real interest rates, and bank characteristics were not the only factors behind stagnant loan development in the post-crisis period. Large corporations have increasingly chosen alternative financing instruments, like debt securities, which resulted in less loan financing.

Having seen the importance of interest rates for corporate lending, which factors determine the level of corporate lending rates? The estimates show that in the early EMU years lending rates have much more followed the ECB monetary policy rate and long-term government bond rates. The different development of interest rates between core and periphery in the post-crisis period can be attributed to higher credit risk in the periphery, arising with deeper recessions, a higher rate of small company closures and a high rate of non-performing loans. The increasing concentration in the banking sector in the EA, and particularly in some periphery EA members, has contributed to interest rate differences. We see that a financial sector with multiple types of credit institutions, large and internationalized as well as small local institutions, and competition in the banking sector is necessary to guarantee that large as well as small firms are sufficiently supplied with loans at affordable prices.

Some policy conclusions are straightforward from these results: Initiatives to facilitate lending of SMEs has to remain a focus of policy makers because SME finance plays such an important role for output growth in most EA countries. Different financing instruments can be an interesting alternative to credit. Particular instruments for the SME sector, which cannot use equity or debt security financing, will be needed. A strict surveillance of the banking sector by monetary authorities, to assure its capitalization and that banks write off non-performing loans is an important mean to assure favorable credit development in the EA. Governments also have to guarantee competition in the banking sector and prevent

ongoing concentration to assure affordable access to finance to all sizes of companies. Finally, this study shows that policy makers indeed have to be aware that a low interest monetary policy cannot assure alone credit growth. Sustainable government debt in addition to the just named policy areas are equally important.

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Appendix A

Table 5: Definitions of variables

| Variable | Variable Definitions | Based on indicator | Source |
|-------------------------|--|--|-------------------------------------|
| Δgdp | quarterly year to year growth rate of real GDP (sesasonally adjusted) | quarterly GDP | Eurostat |
| $\Delta loan^L$ | quarterly year to year growth rate of loans to non-financial corporations above 1 million Euro | monthly new loans above 1 million Euro from monetary financial institutions, except central banks, to non-financial corporations, outstanding amount | ECB, MFI Interest rate statistics |
| $\Delta loan^S$ | quarterly year to year growth rate of loans to non-financial corporations below 1 million Euro | monthly new loans below 1 million Euro from monetary financial institutions, except central banks, to non-financial corporations, outstanding amount | ECB, MFI interest rate statistics |
| int^L | quarterly real interest rate (deflated with growth rate of GDP deflator) for loans over 1 million to non-financial corporations | monthly interest rate for loans over 1 million Euro to non-financial institutions | ECB, MFI interest rate statistics |
| $int^L - int^{ECB}$ | quarterly real interest differential between int^L and int^{ECB} | own calculations | |
| int^{ECB} | deflated with growth rate of EA deflator | ECB interest rate on main refinancing operations (MRO) | ECB, Financial Market Data |
| int^S | quarterly real interest rate (deflated with growth rate of GDP deflator) for loans up to 1 million to non-financial corporations | monthly interest rate for loans up to 1 million Euro to non-financial institutions | ECB, MFI interest rate statistics |
| $int^S - int^{ECB}$ | quarterly real interest differential between int^S and int^{ECB} | own calculations | |
| $\Delta(int^S - int^L)$ | year to year growth of interest rate differential between loans below and above 1 million Euro | difference between real interest for loan below and above 1 milion Euros | |
| $lend_marg$ | quarterly lending margin to non-financial corporations (difference between loan and deposit rate) | monthly lending margin to non-financial corporations | ECB, bank interest rates statistics |

MFI - monetary and financial institutions
all observations in 5 quarter rolling windows

Table 5 continued

| Variable | Variable Definitions | Based on indicator | Source |
|--------------------------|--|---|--|
| $\Delta debtsec$ | quarterly year to year growth rate of ratio of debt securities issues to loans, non-financial corporations | new issues debts securities by NFC; loans of NFC | ECB, monetary and financial statistics |
| <i>banksize</i> | quarterly no of employees per branch | interpolation from: annual number of employees in credit institutions, annual number of branches of credit institutions | ECB, banking structural financial indicators |
| <i>bank_conc</i> | quarterly share of deposits with 5 largest banks | interpolation from annual share of deposits with 5 largest banks | ECB, banking structural indicators |
| <i>internat</i> | quarterly ratio of deposits from other EA to domestic deposits in MFIs | MFI deposits domestic to unspecified sector; MFI deposits from other EA to unspecified sector | ECB, MFI statistics |
| <i>loan^{NP}</i> | quarterly share of non-performing loans to total gross loans | interpolation from non-performing loan, share of total gross loans | IMF, Financial Soundness Indicators |
| <i>capital_loan</i> | quarterly share of capital to loans | monthly capital and reserves and total loans | ECB, MFI balance sheet items |
| <i>scomp_clos</i> | quarterly rate of closure of small companies (1-9 employees) | calculated from annual no of active enterprises and business closures in economic business, various size classes | Eurostat, Structural Business Statistics |

MFI - monetary and financial institutions
all observations in 5 quarter rolling windows

Appendix B

Table 6: Correlations, fullperiod

| | Δgdp | $\Delta loan^L$ | $\Delta loan^S$ | int^L | int^S | int^L_{t-1} | int^S_{t-1} | int^L_{t-2} | int^S_{t-2} | int^{ECB} | $\Delta int^S - int^L$ | $\Delta debtsec$ | $banksize$ | $internat$ | $bankconc$ | $capital_loan$ | $loan^{NP}$ | $lend_marg$ | $bond_rate$ | $scomp_clos$ | |
|------------------------|--------------|-----------------|-----------------|---------|---------|---------------|---------------|---------------|---------------|-------------|------------------------|------------------|------------|------------|------------|-----------------|-------------|--------------|--------------|---------------|--|
| Δgdp | 1 | | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^L$ | 0.3 | 1 | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^S$ | 0.35 | 0.48 | 1 | | | | | | | | | | | | | | | | | | |
| int^L | -0.35 | -0.03 | -0.25 | 1 | | | | | | | | | | | | | | | | | |
| int^S | -0.38 | -0.08 | -0.28 | 0.98 | 1 | | | | | | | | | | | | | | | | |
| int^L_{t-1} | -0.42 | -0.11 | -0.28 | 0.92 | 0.98 | 1 | | | | | | | | | | | | | | | |
| int^S_{t-1} | -0.4 | -0.13 | -0.27 | 0.97 | 0.95 | 0.9 | 1 | | | | | | | | | | | | | | |
| int^{ECB} | -0.42 | -0.17 | -0.3 | 0.94 | 0.97 | 0.95 | 0.98 | 1 | | | | | | | | | | | | | |
| int^S_{t-2} | -0.45 | -0.2 | -0.31 | 0.89 | 0.94 | 0.97 | 0.93 | 0.98 | 1 | | | | | | | | | | | | |
| int^S_{t-2} | 0.21 | 0.34 | 0.14 | 0.23 | 0.2 | 0.15 | 0.14 | 0.11 | 0.06 | 1 | | | | | | | | | | | |
| int^{ECB} | 0.21 | 0.34 | 0.14 | 0.23 | 0.2 | 0.15 | 0.14 | 0.11 | 0.06 | 1 | | | | | | | | | | | |
| $\Delta int^S - int^L$ | -0.41 | -0.21 | -0.3 | -0.01 | 0.05 | 0.11 | 0.06 | 0.09 | 0.12 | -0.07 | 1 | | | | | | | | | | |
| $\Delta debtsec$ | -0.06 | -0.19 | -0.17 | 0.12 | 0.16 | 0.27 | 0.13 | 0.17 | 0.26 | -0.04 | 0.11 | 1 | | | | | | | | | |
| $banksize$ | 0.18 | 0.1 | 0.05 | -0.26 | -0.26 | -0.27 | -0.33 | -0.34 | -0.31 | -0.01 | -0.04 | 0.15 | 1 | | | | | | | | |
| $internat$ | 0.21 | 0.21 | 0.07 | -0.22 | -0.23 | -0.24 | -0.28 | -0.29 | -0.3 | 0.11 | -0.04 | 0.14 | 0.84 | 1 | | | | | | | |
| $bankconc$ | -0.1 | -0.06 | -0.03 | 0.14 | 0.13 | 0.12 | 0.16 | 0.16 | 0.15 | -0.05 | -0.01 | -0.03 | -0.13 | -0.07 | 1 | | | | | | |
| $capital_loan$ | -0.09 | -0.12 | -0.19 | 0.24 | 0.24 | 0.24 | 0.28 | 0.29 | 0.29 | -0.36 | -0.05 | 0.17 | -0.07 | -0.09 | 0 | 1 | | | | | |
| $loan^{NP}$ | -0.35 | -0.25 | -0.23 | 0.48 | 0.49 | 0.49 | 0.53 | 0.54 | 0.54 | -0.36 | -0.01 | 0.19 | -0.23 | -0.25 | 0.01 | 0.73 | 1 | | | | |
| $lend_marg$ | -0.11 | -0.01 | -0.05 | 0.31 | 0.32 | 0.33 | 0.4 | 0.42 | 0.43 | -0.23 | -0.09 | 0.05 | -0.04 | 0.06 | 0.11 | 0.38 | 0.39 | 1 | | | |
| $bond_rate$ | -0.55 | -0.23 | -0.28 | 0.78 | 0.77 | 0.75 | 0.79 | 0.78 | 0.75 | -0.1 | 0.03 | 0.1 | -0.15 | -0.13 | 0.18 | 0.33 | 0.61 | 0.24 | 1 | | |
| $scomp_clos$ | -0.23 | 0.05 | -0.23 | 0.39 | 0.37 | 0.35 | 0.39 | 0.37 | 0.36 | 0.13 | 0.01 | 0 | 0.08 | 0.25 | -0.16 | 0.35 | 0.11 | 0.25 | 0.56 | 1 | |

Appendix C

Table 7: Correlations, pre-crisis period

| | Δgdp | $\Delta loan^L$ | $\Delta loan^S$ | int^L | int^S | int^S | int^S | int^S | int^S | int^{ECB} | $\Delta int^S - int^L$ | $\Delta debt^sec$ | $banksize$ | $internat$ | $bankconc$ | $capital_loan$ | $loan^{NP}$ | $lend_marg$ | $bond_rate$ | $scomp_clos$ | |
|------------------------|--------------|-----------------|-----------------|---------|---------|---------|---------|---------|---------|-------------|------------------------|-------------------|------------|------------|------------|-----------------|-------------|--------------|--------------|---------------|--|
| Δgdp | 1 | | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^L$ | 0.22 | 1 | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^S$ | 0.22 | 0.35 | 1 | | | | | | | | | | | | | | | | | | |
| int^L | -0.27 | 0.03 | -0.16 | 1 | | | | | | | | | | | | | | | | | |
| int^L_{-1} | -0.4 | -0.04 | -0.21 | 0.97 | 1 | | | | | | | | | | | | | | | | |
| int^L_{-2} | -0.51 | -0.04 | -0.24 | 0.88 | 0.97 | 1 | | | | | | | | | | | | | | | |
| int^S | -0.35 | -0.08 | -0.15 | 0.96 | 0.93 | 0.86 | 1 | | | | | | | | | | | | | | |
| int^S_1 | -0.46 | -0.14 | -0.21 | 0.92 | 0.96 | 0.94 | 0.97 | 1 | | | | | | | | | | | | | |
| int^S_{-2} | -0.55 | -0.15 | -0.27 | 0.84 | 0.93 | 0.96 | 0.89 | 0.97 | 1 | | | | | | | | | | | | |
| int^{ECB} | -0.09 | 0.19 | -0.08 | 0.54 | 0.49 | 0.42 | 0.46 | 0.41 | 0.34 | 1 | | | | | | | | | | | |
| $\Delta int^S - int^L$ | -0.34 | -0.01 | -0.09 | 0.14 | 0.27 | 0.37 | 0.17 | 0.25 | 0.31 | -0.11 | 1 | | | | | | | | | | |
| $\Delta debt^sec$ | 0.16 | -0.01 | 0.21 | -0.11 | -0.12 | -0.14 | -0.06 | -0.08 | -0.09 | -0.15 | 0.04 | 1 | | | | | | | | | |
| $banksize$ | 0.26 | 0.15 | 0.05 | -0.08 | -0.09 | -0.09 | -0.18 | -0.13 | -0.18 | 0.02 | 0.13 | 0.01 | 1 | | | | | | | | |
| $internat$ | 0.16 | 0.2 | 0.02 | -0.07 | -0.08 | -0.09 | -0.12 | -0.13 | -0.14 | 0.04 | 0.08 | -0.16 | 0.74 | 1 | | | | | | | |
| $bankconc$ | 0.06 | -0.14 | -0.03 | 0.01 | 0.02 | -0.02 | 0.03 | 0.04 | 0.05 | 0.01 | 0 | 0.06 | -0.19 | 0 | 1 | | | | | | |
| $capital_loan$ | 0.22 | 0.12 | 0.11 | -0.03 | -0.03 | -0.04 | -0.04 | -0.03 | -0.04 | -0.04 | -0.13 | 0.13 | -0.08 | -0.18 | 0.11 | 1 | | | | | |
| $loan^{NP}$ | -0.31 | -0.17 | 0.08 | 0.04 | 0.07 | 0.11 | 0.15 | 0.18 | 0.21 | -0.13 | -0.02 | 0.3 | -0.39 | -0.46 | -0.29 | -0.03 | 1 | | | | |
| $lend_marg$ | -0.03 | 0.05 | 0.06 | 0.05 | 0.06 | 0.06 | 0.22 | 0.23 | 0.24 | -0.18 | -0.06 | 0.15 | -0.06 | 0.15 | -0.09 | 0.26 | 0.24 | 1 | | | |
| $bond_rate$ | -0.37 | -0.18 | -0.14 | 0.86 | 0.87 | 0.83 | 0.85 | 0.85 | 0.81 | 0.15 | 0.28 | -0.07 | -0.22 | -0.22 | 0.04 | -0.06 | 0.16 | -0.06 | 1 | | |
| $scomp_clos$ | 0.05 | -0.66 | -0.55 | 0.38 | 0.3 | 0.19 | 0.45 | 0.37 | 0.28 | 0.01 | 0.33 | 0.05 | 0.11 | -0.45 | 0.02 | 0.21 | 0.21 | 0.33 | 0.3 | 1 | |

Appendix D

Table 8: Correlations, post-crisis period

| | Δgdp | $\Delta loan^L$ | $\Delta loan^S$ | int^L | int^S | int_{t-1}^L | int_{t-2}^L | int_{t-1}^S | int_{t-2}^S | int^{ECB} | $\Delta int^S - int^L$ | $\Delta debtsec$ | $banksize$ | $internat$ | $bankconc$ | $capital_loan$ | $loan^{NP}$ | $lend_marg$ | $bond_rate$ | $scomp_clos$ | | |
|------------------------|--------------|-----------------|-----------------|---------|---------|---------------|---------------|---------------|---------------|-------------|------------------------|------------------|------------|------------|------------|-----------------|-------------|--------------|--------------|---------------|--|--|
| Δgdp | 1 | | | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^L$ | -0.1 | 1 | | | | | | | | | | | | | | | | | | | | |
| $\Delta loan^S$ | 0.19 | 0.38 | 1 | | | | | | | | | | | | | | | | | | | |
| int^L | -0.48 | -0.06 | -0.38 | 1 | | | | | | | | | | | | | | | | | | |
| int_{t-1}^L | -0.45 | -0.09 | -0.38 | 0.98 | 1 | | | | | | | | | | | | | | | | | |
| int_{t-2}^L | -0.44 | -0.15 | -0.36 | 0.94 | 0.98 | 1 | | | | | | | | | | | | | | | | |
| int^S | -0.46 | -0.09 | -0.38 | 0.98 | 0.96 | 0.93 | 1 | | | | | | | | | | | | | | | |
| int_{t-1}^S | -0.44 | -0.11 | -0.37 | 0.96 | 0.98 | 0.96 | 0.99 | 1 | | | | | | | | | | | | | | |
| int_{t-2}^S | -0.43 | -0.16 | -0.33 | 0.92 | 0.96 | 0.98 | 0.95 | 0.99 | 1 | | | | | | | | | | | | | |
| int^{ECB} | -0.19 | -0.13 | -0.15 | 0.06 | 0.07 | 0.08 | 0.05 | 0.05 | 0.06 | 1 | | | | | | | | | | | | |
| $\Delta int^S - int^L$ | -0.31 | -0.11 | -0.31 | -0.05 | -0.01 | 0.03 | 0.01 | 0.03 | 0.05 | 0.32 | 1 | | | | | | | | | | | |
| $\Delta debtsec$ | -0.06 | -0.26 | -0.29 | 0.16 | 0.21 | 0.34 | 0.15 | 0.2 | 0.3 | 0.05 | 0.1 | 1 | | | | | | | | | | |
| $banksize$ | 0.21 | -0.02 | 0.07 | -0.36 | -0.37 | -0.38 | -0.41 | -0.41 | -0.43 | -0.02 | -0.05 | 0.21 | 1 | | | | | | | | | |
| $internat$ | 0.19 | -0.09 | 0.04 | -0.31 | -0.32 | -0.33 | -0.36 | -0.36 | -0.37 | 0.09 | -0.03 | 0.43 | 0.92 | 1 | | | | | | | | |
| $bankconc$ | -0.2 | 0.07 | 0.02 | 0.25 | 0.23 | 0.2 | 0.25 | 0.24 | 0.22 | -0.06 | -0.05 | -0.06 | -0.05 | -0.15 | 1 | | | | | | | |
| $capital_loan$ | 0.06 | 0.03 | -0.18 | 0.34 | 0.35 | 0.34 | 0.36 | 0.37 | 0.36 | -0.38 | -0.17 | 0.16 | 0.16 | -0.08 | -0.09 | 1 | | | | | | |
| $loan^{NP}$ | -0.2 | -0.05 | -0.21 | 0.65 | 0.65 | 0.64 | 0.65 | 0.65 | 0.65 | -0.29 | -0.12 | 0.16 | -0.25 | -0.19 | 0.07 | 0.79 | 1 | | | | | |
| $lend_marg$ | -0.06 | 0.09 | -0.04 | 0.46 | 0.48 | 0.48 | 0.48 | 0.48 | 0.5 | -0.21 | -0.18 | 0.02 | -0.03 | 0.03 | 0.27 | 0.4 | 0.44 | 1 | | | | |
| $bond_rate$ | -0.55 | -0.11 | -0.26 | 0.85 | 0.83 | 0.8 | 0.82 | 0.81 | 0.78 | 0.09 | -0.11 | 0.09 | -0.13 | 0 | 0.24 | 0.3 | 0.6 | 0.3 | 1 | | | |
| $scomp_clos$ | -0.22 | 0.05 | -0.23 | 0.38 | 0.34 | 0.34 | 0.38 | 0.36 | 0.35 | 0.11 | 0.01 | 0 | 0.08 | 0.25 | -0.15 | 0.37 | 0.12 | 0.26 | 0.57 | 1 | | |