The effects of capital on bank lending of EU large banks – The role of procyclicality, income smoothing, regulations and supervision.

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Abstract

This paper aims to find out what is the impact of bank capital ratios on loan supply in the EU and what factors explain potential diversity of this impact. Applying Blundell and Bond (1998) two step GMM estimator, we show that, in the EU context, the role of capital ratio for loan growth is stronger than previous literature has found for other countries. Our study sheds some light on whether procyclicality of loan loss provisions and income smoothing with loan loss provisions contribute to procyclical impact of capital ratio on loan growth. We document that loan growth of banks that have more procyclical loan loss provisions and that engage less in income smoothing is more sensitive to capital ratios. This sensitivity is slightly increased in this sample of banks during contractions. Moreover, more restrictive regulations and more stringent official supervision reduce the magnitude of effect of capital ratio on bank lending. Taken together, our results suggest that capital ratios are important determinant of lending in EU large banks.

Keywords: loan supply, capital crunch, procyclicality of loan loss provisions, income smoothing, bank regulation, bank supervision

JEL Classification E32, G21, G28, G32

1. Introduction

Bank capital may be all that makes a bank unwilling to extend credit, in particular during recessions. In the wake of the recent financial crisis, the problem has attracted a renewed attention as concerns arose that large losses at banks would reduce their capital and restrain their lending. The magnitude of the effect of changes in bank capital in the extension of bank credit has been one of the most important questions of the crisis, due to role that banks play in the economy. In the aftermath of the 2007/8 financial turmoil, Basel Committee proposed significant changes to previously accepted capital standards. The set of new rules has been named Basel III. It covers substantial increases in regulatory capital ratios and in the quality of bank capital. By introducing countercyclical capital buffers and promoting forward – looking provisioning, it attempts to counteract inherent procyclicality of banking sector. Proposed increases in the capital ratios of systemically significant financial institutions (the so called SIFIs), should help to resolve the moral hazard problem posed by banks deemed Too-Big-To-Fail.

In the European Union (EU) context, with banking oriented financial systems, bank capital may be even more salient, as capital losses may result in reduced lending and therefore be a hindrance to real economy investment activity and thus economic growth. As implementation of more restrictive Basel III capital standards in the EU is accelerating, due to formal acceptance of its

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rules in directive[2] and in regulation[3] in 2013 and due to relatively scant evidence on the role of bank capital in lending activity in the EU, it seems vital to answer the question what is the impact of capital ratios on lending of UE banks.

Economic theory and empirical evidence suggests a very wide range of possible values of the impact of a change in bank capital on bank's assets (in particular their composition) and consequently its lending (for a review see e.g. Borio and Zhu, 2012; Berrospide and Edge, 2010). On the one hand, there is the possibility that a reduction in bank capital, which results from serious losses, can be absorbed without any change in bank assets – and thereby in bank lending – probably due to the high capital buffer[4] the bank has both before and after the losses and because capital decline can be offset by supplementary sources of funding. In this extreme, a 1 euro reduction in bank capital results in no reduction in bank lending. On the other hand, there is a possibility that banks very actively manage the composition of their assets to keep a stable relationship between capital and assets (i.e. a constant capital-to-assets ratio, henceforth capital ratio), since they have very limited access to external financing, and thus have difficulties in raising equity to offset declines in bank capital. In this case, a bank attempting to maintain a constant capital ratio, must reduce its assets levels or change their composition, by decreasing the amount of risky loans and investing more in risk free government bonds (Berger and Udell, 1994; Wagster, 1999). Irrelevant of the method the bank chooses to keep the relationship between capital and assets fixed, the amount of risky assets, i.e. loans, must be adjusted. If the bank faces a capital loss, the decrease in loans must equal to the size of its capital loss scaled up by the inverse of the bank's capital ratio (i.e. its leverage ratio). Since bank capital ratios usually range between 8.00% and around 12.50%, leverage ratios take values between 8 (i.e. 100%/12.5%) and 12.5 (i.e. 100%/8.00%). This means that a 1 euro reduction in capital results in an 8 euro to 12.5 euro reduction in lending. It therefore important to assess what is the size of capital effect, not only the sing of this effect.

Despite the importance of the magnitude of the effect of bank capital on bank lending in the 2007 financial crisis, few recent estimates of this effect exist. These estimates are usually focused on the US banks (Beatty and Liao, 2011; Berrospide and Edge, 2010). Some papers investigate EU banks and US banks (dominating in the sample) (Gambacorta and Marquez-Ibanez, 2011). Mora and Logan (2011) and Bridges et al (2014) analyze the effects of shock to bank capital for the United Kingdom (UK) banks and Labonne and Lame (2014) focus on the French banking market. The evidence on the single market in the European Union (henceforth EU) is scant. Therefore in this paper we aim to find out what is the impact of bank capital ratios on loan supply in the EU.

Banks facing external-financing frictions, such as the Myers and Majluf (1984) adverse-selection problem, cannot immediately restore equity capital reductions. If many banks face similar face similar constraints on capital and decide to diminish their lending, a capital crunch can arise (Bernanke and Lown, 1991), which means that the scarcity of capital constraints the aggregate bank loan supply (Mora and Logan, 2011). The capital crunch theory highlights that capital adequacy regulation combined with market imperfections leads to pro-cyclical bank lending. Specifically, banks reduce lending to avoid potential future violations of capital minimums set by supervisors (and market stakeholders). Some authors suggest that this reduction due to insufficient capital is stronger in recessionary than in expansionary periods (Beatty and Liao, 2011; Gambacorta and

[2] See DIRECTIVE 2013/36/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC ((L 176).

3 REGULATION (EU) No 575/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (L 176).

[4] Although as a regulatory requirement banks should keep their capital ratios at a level that equals at least 8%, in practice their capital ratios are much higher than the minimum, with the amount of capital in excess of the minimum called capital buffer (Fonseca and Gonzalez, 2010). Some authors find that the level of capital ratios, and obviously of capital buffers, fluctuates through the business cycle, with highest level during upturns and the lowest level during recessions (see Ayuso et al., 2004; Lindquist, 2004; Klaasen et al., 2005, Jokipii and Milne, 2008). Notwithstanding these observations, Fonseca and Gonzalez (2010) conduct a cross country study and find that the relationship between capital buffers and business cycle is ambiguous.

Marquez-Ibanez, 2011; Borio and Zhu, 2012). Our objective is to test if such effect exists in the case of EU banks.

The size of effect of changes in bank capital on the extension of bank credit may be enforced by backward-looking loan loss provisioning rules. For example, Beatty and Liao (2011) investigate the impact of delayed recognition of expected losses on the size of effect of bank capital on bank lending in US publicly traded banks and find that banks that smaller delays reduce the recessionary capital crunch effect. We ask whether Beatty and Liao's findings (2011) on the role of delayed expected loss recognition in bank lending, are applicable to EU large banks, of which most are not publicly traded. Our analysis uses a panel database of 20429 bank year observations for the full sample, and 6068 observations for large banks, to analyze the influence of loan loss provisioning accounting (i.e. procyclicality and income smoothing) on the size of effect of capital ratio on bank loan supply in both normal times and in contraction periods. We posit that banks with both more procyclical loan loss provisions and less practicing income smoothing are more capital constrained.

As previous cross-country studies suggest that procyclicality of loan loss provisions in affected by regulations and supervision in the EU (see Olszak, Pipień, Roszkowska and Kowalska, 2014) and that income smoothing differs across countries due to regulatory and supervisory environment (see Fonseca and González, 2008), we ask whether those factors influence the size of the effect of bank capital on bank lending during contractions in the EU. We hypothesize that in countries with more stringent bank regulations and supervision, the impact of capital ratio on loan supply in contractions is reduced.

Our study makes several significant contributions relative to the literature. First, we focus on the EU single market, which thus far has not been investigated with respect to the influence of bank capital on loan supply. In this area, we aim to estimate what is the size of the impact of capital ratio on lending in the EU largest banks. Second, we exploit differences in the application of loan loss accounting rules across EU largest banks to estimate the extent to which individual banks use loan loss provisions to smooth their income and to which individual banks' loan loss provisions are sensitive to business cycle. To study the diversity in income smoothing as well as in procyclicality of loan loss provisions we develop two measures, income smoothing index (ISI) and procyclicality index (PROCI). Using these measures, we investigate the extent to which ISI and PROCI increase the risk of severe bank lending contractions by simultaneously increasing capital inadequacy concerns. Third, in our analysis we control for the influences of bank regulations and supervision, because they can affect both the strength of impact of capital rations on bank lending, in particular during contractions.

To test our hypotheses we apply two-step GMM robust estimator (Arrelano and Bond, 1991, Blundell and Bond, 1998) for data spanning the years 1996 – 2011 on individual banks available in the Bankscope database. To control for the role of financial statements consolidation, we conduct separate analysis for both unconsolidated and consolidated balance sheet and profit and loss account information. We find that, in the EU context, the role of capital ratio for loan growth is stronger than previous literature has found for other countries. We provide empirical support that the relatively weak impact of capital ratios identified in previous papers may be a result of the specificity of a research sample, i.e. inclusion of only publicly traded banks. Our study sheds some light on whether procyclicality of loan loss provisions and income smoothing with loan loss provisions contribute to procyclical impact of capital ratio on loan growth. We document that loan growth of banks that have more procyclical loan loss provisions and that engage less in income smoothing is more sensitive to capital ratios. This sensitivity is slightly increased in this sample of banks during contractions. We also find that more restrictive regulations and more stringent official supervision reduce the magnitude of effect of capital ratio on bank lending. In supplemental tests conducted using consolidated financial statements we show that the impact of capital on loan growth is statistically insignificant, although relatively (compared to individual data available in unconsolidated statements) stronger in contractions. Taken together, our results suggest that capital ratios are important determinant of lending in the EU large banks. Their effect is more salient for banks with more procyclical loan loss provisions and for those banks which smooth their income less. The sensitivity of loan growth to capital ratio in contractions may is dampened with more restrictive regulations and more stringent official supervision.

The rest of the paper is organized as follows. Section 2 puts our study in the extant research on the role of bank capital for loan supply and thus develops our hypotheses. We describe our sample and research design in Section 3. We discuss results and supplemental analyses in Section 4. Section 5 concludes our work.

2. Related literature and hypotheses development

In this section, we review some of the previous empirical literature that has examined the question of whether bank capital affects bank lending decisions. We first describe some of the approaches used to distinguish demand effects on bank lending from supply effects. In the next stage we focus on the literature which investigates the role of bank capital in loan supply of EU banks, as well as the role of income smoothing and procyclicality of loan loss provisions for bank lending. We then proceed to studies focusing on the role of procyclicality of loan loss provisions and income smoothing in banking, in particular in bank risk taking and bank lending. Finally, as the previous studies suggest that income smoothing and procyclicality of loan loss provisions may be affected by country specific environment (i.e. regulations and supervision), we analyze the literature which focuses on this problem.

2.1. Identification of loan supply versus loan demand effects

The most problematic issue in the measurement of the impact of bank capital on loan extension is the identification of supply and demand factors, which affect lending activity. Kashyap and Stein (2000) and Carlson, Shan and Warusawitharana (2013) review the difficulties in determining whether bank capital affects the supply of bank loans when controlling for changes in loan demand. The problem is that the same conditions that lead to reduced bank capital, such as the macroeconomic conditions, also reduce the demand for bank loans and in effect create alternative link between capital and lending. As Carlson et al. (2013) posit, such a link makes assessment of the size and significance of any relationship more difficult. Several approaches have been used in the literature in this respect, the most common one being to explicitly take into account economic conditions linked to loan demand such as inflation, gross domestic product growth or unemployment rate (see e.g. Gambacorta and Mistrulli, 2004; Berrospide and Edge, 2010; Beatty and Liao, 2011). Other papers use regional variations of bank health and economic conditions to differentiate between supply and demand effects (Hancock and Wilcox, 1998). Several papers tackle the issue of separating supply from demand with questions extracted from national bank lending surveys (Blaes, 2011; Del Giovane, Eramo and Nobili; 2011, Bassett et al., 2014 and Labonne and Lame, 2014). In this literature, researches combine bank-level data with individual responses to the lending survey and study the dynamics of credit in Germany (Blaes, 2011), Italy (Del Giovane et al., 2011), US (Bassett, Chosak, Driscoll and Zakrajasek, 2014) and French (Labonne and Lame, 2014). These studies reveal significant contribution of bank lending surveys in disentangling credit supply shocks from demand shocks, especially during the financial crisis. For example, Labonne and Lame (2014) find that both lending standards and bank capital affected loan extension in the French banking sector. However, the elasticity of lending to capital depends on the intensity of the supervisory capital constraint.

Another solution is to use a natural experiment to overcome difficulties in identifying whether changes to bank lending reflect shocks to credit supply or credit demand. Such approach has been applied by Peek and Rosengren (1997) who analyzed the effects of capital shocks on the lending of the branches and subsidiaries of Japanese banks located in the United States. The parent Japanese banks were allowed to treat unrealized gains on equity investments as capital. In late 1980s the Japanese stock market collapsed, which lead to a large capital shock in these parent banks. Thus, by focusing on the transmission of the effects of Japanese stock market losses via the actions of Japanese bank branches and subsidiaries in the United States, Peek and Rosengren were able to isolate the credit supply effects of a fall in bank capital. In more recent study Mora and Logan (2011) use losses on UK banks' loan to non-UK residents and see how this affected lending to UK residents.

2.2. Empirical evidence on the effect of bank capital on bank lending

The empirical literature on the role of bank capital on loan supply[5] can be divided into basic two streams. The first one focuses on the impact of the Basel I Accord, which was implemented around the world in the beginning of 1990-ties. This research aimed at answering the question whether newly introduced uniform capital ratios had an effect on bank behavior (for a review see Chiuri, Ferri and Majnoni, 2002, p.884) and on the macro- economy. Most of those studies were analyzed by Jackson et al. (1999), thus here we focus particularly on those aspects of this research, which investigates the link between loan growth and capital ratios. A great part of this literature addressed the question of whether the sluggish recovery of the US economy out of the 1990-91 recession, was caused by a newly introduced bank capital regulations (i.e. adoption of Basel I), inhibiting lending activity of banks and consequently acting as a headwind to the economic growth. Various authors contribute to this interpretation. Bernanke and Lown (1991), using equations linking bank loan growth to bank capital ratios and employment found that bank loan growth at individual banks between 1990:Q2 and 1991:Q1 was positively linked to initial capital ratios. However, the impact of capital on lending was less notable than the impact of economic environment. This result has been attributed to the fact that Bernanke and Lown's analysis was based on data ending in the first quarter of 1991, which is before when the credit crunch took place (Berrospide and Edge, 2010). Berger and Udell (1994) admit that the expansion of loans was lower in 1990‑1992 for less-capitalized banks and attempt to measure the importance of various explanations for the slow growth of lending, but do not find a sensitivity of loans to capital ratios definitely higher than the one observed during the US recession of the early 1980s. Some support for the impact of bank capital on lending is found by Brinkman and Horvitz (1995), Peek and Rosengren (1995a, 1995b) and Hancock and Wilcox (1998).

In this vein, Peek and Rosengren (1997, 2000) investigate the role of capital ratios for lending activity of Japanese banks in the US (1997) and for the real activity in the United States. They find that binding risk-based capital requirements associated with the Japanese stock market decline resulted in a decrease in lending by Japanese banks in the United States that was both economically and statistically significant (see also Gibbon, 1995 and Owualah, 1999).

In emerging countries Chiuri et al. (2002) find that enforcement of capital adequacy regulations – according to the 1988 Basel Accord – significantly trimmed credit supply, particularly at less-well capitalized banks. Moreover, this negative impact has been stronger for countries enforcing capital adequacy regulation in the aftermath of a currency or financial crisis. In general, their results suggest that in several emerging economies the revision of bank capital adequacy regulations could well induce a credit supply retrenchment. Nag and Das (2002) found that Indian banks did asset reallocation as a result of introduction of minimum capital requirements. In a study focusing on Latin America, Barajas et al. (2005) identified positive statistically significant impact of capital ratio (i.e. equity to total assets) on loan growth, meaning the banks with higher capital ratios were able to extend more loans. However, this impact was relatively weak, as the coefficients between loan growth and bank capital ranged from 0.002 to 0.009.

The second stream of research on the role of bank capital in bank lending started flourishing in the first half of 2000-ds and can be roughly divided into two areas, one concentrating on the role of bank capital in bank lending under different monetary policy stances (see Blum and Nakane, 2005; Kishan and Opiela, 2006; Nier and Zicchino, 2008) and the other investigating more generally, the size of the effect of bank capital on loan supply (see e.g. Berrospide and Edge, 2010; Beatty and Liao, 2011; Gambacorta and Mistrulli, 2011; Carlson et al., 2013; Bridges et al., 2014

[5] For the general discussion on the role of bank capital see Dewatripont and Tirole (1994), Berger, Herrig and Szegö and Freixas and Rochet (1997) and Borio and Zhu (2012).

and Labonne and Lame 2014). As in our paper we aim to assess the role of bank capital in bank lending in the EU in general, we will focus here exclusively on the most recent research which relates bank lending growth to capital ratios (see Table A1 in Appendix). The contemporary research differs from previous studies as it attempts to identify the size of the effect of capital ratios on loan growth, and not only to focus on the direction of impact of capital on lending. Moreover, when data accessibility is not a hindrance, authors analyze the relative impact of different types of capital ratios, such as capital adequacy risk based ratio (i.e. the widely know Basel Committee ratio), Tier 1 CAP (i.e. ratio calculated with application of the most stable elements of bank capital divided by the sum of risk weighted assets), leverage ratio (i.e. equity capital to total assets) and TCE CAP (i.e. tangible common equity to risk weighted assets). For example, Berrospide and Edge (2010), using quarterly consolidated financial statements of Bank Holding Companies in 1992 – 2009 identify relatively weak impact of leverage ratio (coefficient 0.145), total capital ratio (coefficient 0.157), Tier 1 CAP (coefficient 0.167) and TCE CAP (coefficient 0.225) on loan growth. Generally, regardless of the capital ratio applied, Berrospide and Edge (2010) the effects of shocks to capital on the loan growth are small. Depending on the capital ratio employed, they find that 1 percentage point increase in the capital ratio leads to an increase in annualized BHD loan growth of only between 0.7 and 1.2 percentage points.

Beatty and Liao (2011) using quarterly data on US publicly traded banks identify that Tier1 capital ratio impacts bank lending only slightly with estimated coefficient equal 0.044 in general, and increased by 0.068 in recession, which means that if we take account of both coefficients, the impact of capital on loan supply in recession is around 0.11. The identified impact seems to be stronger in recession in the case of large banks (0.138). But the whole effect in this sample of banks is around 0.158 (i.e. 0.02 plus 0.138). Gambacorta and Marquez-Ibanez (2011) also focus on publicly traded banks in the US and 13 European countries and find weak impact of both capital adequacy ratio and Tier 1 CAP. In some of models which Gambacorta and Marquez-Ibanez analyze, the simultaneous impact on loan growth of capital ratio and interaction between capital ratio and crisis dummy measured with regression coefficient, it doesn't exceed 0.29.

Carlson et al. (2013) find that US commercial banks' loan growth was more responsive to capital ratios during and shortly after the recent financial crisis but not at other times. They also find that the leverage ratio had the strongest impact on loan growth compared to capital adequacy and Tier 1 CAP. As for the effect of leverage ratio on loan growth they find that the regression coefficient ranges between 0.127 and 0.159 in 2001-2011, and is higher in 2008 – 2011 (i.e. for large banks between 0.606 and 1.063 and for small banks takes values around 0.256 and 0.454). Moreover, there is nonlinear effect of capital ratio on lending, with as the elasticity of loan growth to capital ratios is definitely higher when capital ratios are relatively low.

Bridges et al. (2014) focus on 53 banking groups operating in the UK since 1990 to assess the role of four types of capital ratios (i.e. capital adequacy ratio, trigger capital ratio required by regulators, Tier 1 CAP and leverage), on loan growth. They find that capital ratios affect lending with heterogeneous responses in different sectors of the economy. The association between secured loan growth and capital adequacy ratio, Tier 1 CAP and leverage ratio is positive but statistically insignificant (coefficients range between 0.026 and 0.04). The effect of trigger ratio is negative, but turns positive, when we include two lags of it. The relationship between loan growth and leverage, capital adequacy ratio and lagged trigger ratios is strongest in the case of commercial real estate loans, and equals 0.175, 0.203 and 2.685, respectively.

Labonne and Lame (2014) concentrate on French banks and also find evidence of the significant positive effect of bank capital on loan growth. The interesting facet of their study is the relatively strong association between the variables of interest. Their study shows that as Tier 1 CAP ratio increases by one percentage points, then the loan growth increase ranges between 0.9 and 1.77 percentage points.

Generally, studies mentioned above have found that bank capital does indeed affect bank lending, though this impact is diversified. This diversity may be attributed to heterogeneity of samples which were analyzed (publicly traded banks, commercial banks, bank holding companies, banking groups, banks from France, UK, US, Japan) as well as to differences in the estimation methods which were applied to calculate the impact of bank capital on lending. Notwithstanding this diversity, the results of the above papers lead us to our primary hypothesis (H1), that:

H1: Loan growth is positively associated with bank capital ratios in the EU banks.

2.2.1. The role of bank size and publicly traded versus privately held

Some papers argue that bank size matters for the size of effect of capital ratio on loan supply. In this respect the results are ambiguous. For example, Hancock and Wilcox (1998) using data for 1989-1992 for the US individual banks, find that in response to declines in their own capital, small banks reduced their loan portfolios considerably more than large banks did. They also find that real economic activity was contracted more by capital declines and loan declines at small banks than at large banks. The importance of bank size was also researched by Bernanke and Lown (1991), Peek and Rosengren (1995b) and Kishan and Opiela (2006), who show that the capital crunch problem was greater for smaller banks relative to larger banks. Their findings may be attributable to regulatory capital regulations being more stringently applied to smaller relative to larger banks or to the extent to which small banks have more difficulty raising external financing during recessions. In contrast, Beatty and Liao (2011) and Carlson (2013) show that bank capital is more important as a loan supply determinant in large banks. This divergence in conclusions can be attributed to differences in the sample of banks and time periods that those papers analyzed. Early studies focused mainly on short recessionary period of the 1990s, thereby their conclusions may be relevant to this time only. Thus it seems that to inform the current debate on the role of bank capital in bank lending, more applicable are inferences drawn from more recent data, as presented by Beatty and Liao (2011) and Carlson et al. (2013). We therefore put forward following hypothesis (H2):

H2: The association between capital ratios and lending is greater for large banks than for other banks.

Considering the fact that banks can suffer from loan losses more during downturns, we hypothesize (H3) that:

H3: During downturns the impact of bank capital on bank lending is strengthened relative to expansionary periods.

As can be inferred from Gambacorta and Marquez-Ibanez (2011) as well as Beaty and Liao (2011) the impact of bank capital on loan supply is definitely stronger during recessionary and crisis periods in the case of publicly traded banks. We therefore assume (H4) that:

H4: The size of the effect of capital ratio on loan growth during economic downturns is positive and stronger in the case of publicly traded banks relative to privately held banks, which can be insensitive to the capital ratio in their lending extension.

2.3. The role of loan loss provisioning for capital effects on bank lending - income smoothing and procyclicality

Loan loss provisioning is a very important bank choice that directly impacts on the volatility and cyclicality of bank earnings. As banks have some discretion over the amount of loan loss reserves they put aside, the empirical literature for last two decades deals with the issue of purposes for which those provisions are applied (Greenawalt and Sinkey,1988; Collins et al., 1995; Healy and Whalen, 1999; Dechov and Skinner, 2000; Wall and Koch, 2000; Beatty et al., 2002; Kanagaretnam, Lobo, and Mathieu, 2003; Goel and Thakor, 2003; Liu and Ryan, 2006, Bushman and Williams, 2012, 2013). As Wall and Koch (2000) show there are two such choices: income smoothing and capital management. Some other authors suggest that loan loss provisions may be used as prudential risk management tool (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and González, 2008). Of those three uses of loan loss provisions, the most controversial is income smoothing. Therefore it is under continuous research in banking (for most recent studies refer to Fonseca and González, 2008; Bushman and Williams, 2012, 2013; Norden and Stoian, 2013; Skała, 2013; Olszak et al., 2014). The most important question in this research is the role of income smoothing in bank risk management[6] process, and thus in procyclicality of loan loss provisions and bank lending.

The literature dealing with income smoothing can be roughly divided into two basic streams. For lack of better words, we term them respectively regulatory intervention and free market. The regulatory banking literature assumes that smoothing is implicitly forward - looking[7] and, as such, can reduce procyclicality (Borio et al., 2001; Laeven and Majnoni, 2003; Bikker and Metzemakers, 2004; Bouvatier and Lepetit, 2008; Fonseca and González, 2008). The notion is that income smoothing allows a buildup in reserves when profits are high and current loan losses are low (i.e. in expansionary periods), and a reserve draw down in future period when profits are low and loan losses are high (i.e. in contractions) (see also Liu and Ryan, 2006). Such approach, termed dynamic provisioning is applied in several countries, e.g. Spain, Colombia, Bolivia and Peru (see Fernandez de Lis and Garcia-Herrero, 2009 ; Wezel, 2010). Due to its regulatory and supervisory merits, forward looking provisioning such as the one currently in use in Spain, have been recommended by Basel Committee and other international institutions (i.e. International Monetary Fund, Financial Stability Board), as a tool of macroprudential (microprudential) policy (and supervision) which should mitigate procyclicality in banking, and therefore decrease the risk of financial instability (BCBS, 2010, 2011; FSB, BIS, IMF, 2011) at the same time diminishing systemic risk.

The free market literature posits that providing more discretion to smooth provisions permits opportunistic earnings management that may obscure fundamentals and decrease earnings informativeness, leading to poor market discipline and excessive risk-taking by banks (Stephanou, 2010; Bushman and Williams, 2012). Bushman and Williams show that publicly traded banks that operate in countries which exhibit more income smoothing in their banking sector take on more risk, which is consistent with the notion that forward-looking provisioning designed to smooth earnings dampens discipline over risk taking, because of diminished transparency inhibiting outside (market) monitoring. Taking this into account, they conclude that proposals to change loan loss accounting to make them more discretionary, embed a significant risks of unintended consequences, since gains from reduced procyclicality may be eaten up by losses in transparency that hinder market discipline and increase the scope of imprudent risk-taking. We would like to challenge this inference due to several shortcomings of Bushman and Williams (2012) empirical approach. Most importantly, from the research on income smoothing and procyclicality of loan loss provisions, it seems obvious that both phenomena differ for publicly traded and privately banks (see Fonseca and González, 2008; Olszak et al., 2014). Bushman and Williams measure the income smoothing applying regression coefficient obtained with the use of financial statement data of all banks in a country, both private and public. Their initial research sample includes 55236 bank year observations. To investigate the role of income smoothing in the risk taking and risk shifting behavior, they require banks to have available equity market data to estimate changes in the implied market value of banks' assets, the volatility of bank's assets and the value option on the deposit insurance put option. This requirement implies inclusion of only publicly traded which yields a sample of 3091 bank year observations (Bushman and Williams, 2012, p. 6). Considering the fact that publicly traded banks may exhibit different income smoothing approach than other banks, it is likely that research results obtained by Bushman and Williams do not apply to the whole banking sector, but only to publicly traded banks.

[6] The notion of procyclicality of loan loss provisions, as a consequence of changes in bank risk, has been introduced in a work by Borio et al. (2001). The research on this phenomenon includes examination of the strength of the relationship between economic conditions and the level of loan loss provisions.

[7] Wilson et al. (2010) elaborate more on the issue of forward looking and backward looking provisioning in banking.

On the theoretical side, Van del Heuvel (2009) and Disyatat (2010) show that shocks to bank capital resulting from loan losses may significantly affect bank lending. Beatty and Liao (2011) test this explanation and exploiting variation in the delay in expected loss recognition under the incurred loss model, they find that smaller delays reduce the recessionary capital crunch effect.

Bushman and Williams (2013), applying the notion of delayed loan loss recognition introduced by Nichols, Wahlen and Wieland (2009) and Beatty and Liao (2011), investigate the extent to which delayed loan loss recognition impacts the drivers of balance sheet contraction by increasing both capital inadequacy concerns and the equity financing frictions during economic downswings. They find that US banks that exhibit delayed expected loss recognition, during recessions are more prone to severe balance sheet contractions. Moreover, banks with high delay in expected loss recognition, are relatively more sensitive to the distress of the banking system.

This is the first paper to explore consequences on procyclicality of loan loss provisions and income smoothing for the importance of capital ratio in bank lending. Relating the phenomenon of procyclicality and income smoothing to the more or less prudent risk behavior of banks, in our study we aim to substantiate empirically that both procyclicality and income smoothing do influence sensitivity of lending to capital in the EU. We put forward following hypotheses:

H5: Lending of banks with more procyclical loan loss provisions is more capital constrained than lending of banks with less procyclical loan loss provisions

H6: Lending of banks with less income smoothing is more capital constrained than lending of banks with more income smoothing

2.4. Country specific factors affecting procyclicality and income smoothing as determinants of effects of bank capital on lending

To properly estimate economic consequences of the role of banking capital in bank lending, it is crucial to control for other key aspects of countries' bank regulatory and supervisory regimes. Previous studies find that bank income smoothing is affected by stringency of bank regulations and on the efficiency of banking supervision in limiting banking risk (Fonseca and González, 2008). Other research focuses on the determinants of procyclicality of loan loss provisions in the EU, and implies that diversity of this procyclicality can be explained by differences in regulations and supervision (Olszak et al. 2014).

On the one hand, more stringent capital regulation should reduce the level of risk taken by banks (Barth et al., 2006), and therefore should have negative impact on association between loan supply and bank capital. The opposite prediction could be made if stringent capital regulation makes banks unwilling to extend loans during recessions, therefore accentuating the relationship between capital and loan supply. Therefore, we are unable to predict a clear influence of stringent capital regulation on the relationship between capital and bank lending and put forward following hypothesis:

H7: If bank regulations and bank supervision prevent banks from taking on excessive risk, this may make their earnings, loan loss provisions and finally their capital more stable. Stable level of capital ratios may result in a weaker impact of bank capital on bank lending, even during recessionary periods.

3. Data and research methodology

3.1. Data

We use pooled cross-section and time series data of individual banks' balance sheet items and profit and loss accounts from 27 EU countries and country-specific macroeconomic indicators for these countries, over a period from 1996 to 2011. The balance sheet and profit and loss account data are taken from unconsolidated financials available in the Bankscope database, whereas the macroeconomic data were accessed from the EUROSTAT and the IMF web pages. As we are interested in in the impact of capital ratio on lending of the core banking institutions, huge part of our study focuses on unconsolidated financial statements data. However, to take into account the fact that consolidation of heterogeneous areas of financial services may result in differences in responses of lending to bank capital, we will do the analysis for banks that report consolidated statements and present results relevant to this sample in supplemental tests. We exclude from our sample outlier banks by eliminating the extreme bank-specific observations when a given variable adopts extreme values. Since most of these institutions are located in Ireland, the number of countries included in the final sample drops to 26. Based on this selection strategy, the number of banks included in our sample is 2523 in the case of unconsolidated data (27359 observations and 26 countries) and 357 banks (3776 bank year observations) in the case of consolidated financial data.

Barth et al. (2006) assemble a detailed database on bank regulation and supervision in over 150 countries. This database covers also information on regulatory and supervisory practices in the EU countries. We therefore refer to this database (and its update) to identify differences in regulations across EU. We control for the following characteristics of regulations and supervision:

The characteristics of bank regulation in each country will be incorporated through a measure of the scope of activities permitted to banks (REGRESTR) constructed by Barth et al. (2004, 2006, 2008 and 2011). We measure the **regulatory restrictiveness** using an index comprising four variables and including restrictions on securities, insurance, real estate activities plus restrictions on bank ownership and control of non-financial firms. We use an overall bank restrictiveness variable, whose values are between 4 – 16, where higher values indicate higher restrictiveness. Following arguments for the usage of principal components of multidimensional variables, given by Barth et al. (2006), in our quantitative analysis we chose to use the first principal component of the above-mentioned variable. This variable ranges from -0.3 to 0.5 with higher values indicating wider range of activities permitted to banks.

We also incorporate the capital regulatory index constructed by Barth et al. (2006) as a measure of the **stringency of capital requirements**. We explore the role of two such indices. First, the overall capital regulatory index (CAPREG), which is simply the sum of two components: overall capital stringency and initial capital stringency. Its values range from 0 to 7, with higher values indicating greater stringency. The other, is the **initial capital stringency** index (INITCAPSTRINGENCY), which shows whether certain funds may be used to initially capitalize a bank and whether they are officially verified. Higher values of this index, which range from 0 to 3, suggest more restrictive capital regulations.

As the supervisory effectiveness variable we incorporate two measures developed by Barth et al. (2006, 2008): the **official supervisory power** (OFFSUP) and the **private sector monitoring** (PRIVMON). The official supervisory power, ranging from 0 to 14, measures whether the supervisory authorities have the authority to take specific actions to prevent and correct problems in a bank, and indicates the power of banking supervisors to take prompt corrective action, to restructure and reorganize a troubled bank, and to declare a bank insolvent. Private monitoring is measured by private monitoring index, ranging between 0 and 11. The construction of this index is based on various types of information the public can rely on to influence bank behavior (see Barth et al., 2006). Higher values for both indices suggest higher supervisory powers.

The deposit insurance scheme prevailing in a given country is a very important determinant of banks' moral hazard, and therefore bank risk taking behavior. In our study we adopt **the power of the deposit insurer** index (DEPINSURANCE) developed by Barth et al. (2006), which captures the ability of this authority to protect the deposit insurance fund. It measures whether the deposit insurer has the authority to make the decision to intervene in a bank, to take legal action against bank directors or officials, and whether it has ever taken any legal action against bank directors or officers. The values for this index range from 0 to 4, with higher values indicating more power.

Due to the fact that deposit insurance schemes do vary across countries and across the EU countries in particular, we additionally include an index which incorporates various factors mitigating **the moral hazard** (MORALHAZARD) developed by Barth et al. (2006). This variable ranges from 0 to 3, with higher values indicating stronger risk-mitigating factors, and measures whether banks fund the deposit insurance scheme or risk-based premiums as well as whether there is a formal coinsurance component.

3.2. The econometric model and variables description

The empirical models that addressed the question of whether a bank-capital induced credit crunch was hindering the recovery were developed in the early- and mid-1990s in the US. We follow contemporary adoptions of those models available in several studies (Berrospide and Edge, 2010; Beatty and Liao, 2011; Carlson et al., 2013; Labonne and Lame, 2014; Bridges et al., 2014). Our basic model applied to test our hypotheses reads as follows:

$$\Delta Loan_{i,t} = \beta_1 + \beta_2 Contraction + \beta_2 CAP_{i,t} + \beta_3 Contraction * CAP_{i,t} + \beta_4 LIQGAP_{i,t} + \beta_5 DEPBANKS_{i,t} + \beta_6 \Delta CAP_{i,t} + \beta_7 QLP_{i,t} + \beta_8 size + \beta_9 \Delta UNEMPL_{j,t} + \beta_{10} \sum_{j=1}^{27} Country_j + \beta_{11} \sum_{t=1996}^{2011} T_t \, \vartheta_{i,t} + \varepsilon_t \qquad (1)$$

where:
i- the number of the bank;
j-the number of country;
t- the number of observation for the i-th bank
ΔLoan – annual loan growth rate (real, calculated using Fisher formula)
CAP – capital ratio, i.e. equity capital divided by total assets.
LIQGAP –liquidity gap, calculated as (loans to nonfinancial sector subtract deposits of nonfinancial sector subtract interbank deposits)/loans to nonfinancial sector; this variable measures the extent to which bank loans are financed by unstable funding (i.e. securitizations, etc.);
DEPBANKS – deposits from banks divided by total assets
ΔCAP – annual change in capital ratio
QLP – is quality of lending portfolio; it equals loan loss provisions divided by average loans;
size – logarithm of assets
ΔUNEMPL- annual change in unemployment rate.

In our research we focus on only one capital ratio, i.e. leverage ratio. Our choice is motivated by a large number of missing data on capital adequacy ratio and Tier 1 CAP in the Bankscope database.

Annual change in unemployment rate is our measure of demand for loans. The unemployment rate is included because it not only reflects the business cycle but also longer term and structural imbalances in economies. We hypothesize that microprudential behaviour by banks is reflected by a positive correlation with unemployment. One can also expect banks operating in countries with lower unemployment to meet higher credit demand as the income may be considered as more stable (Bikker et al., 2005; Dell'Ariccia et al., 2012).

Elements $\sum_{j=1}^{27} Country_j$ *and* $\beta_{11} \sum_{t=1996}^{2011} T_t$ are a set of country and time dummy variables aϑ are unobservable bank-specific effects that are not constant over time but vary across banks. Finally, ε is a white-noise error term.

In Table 1 we present all variables applied in our econometric model with expected impact they have on loan growth. We predict a negative coefficient on Contraction if loan supply declines during contractions for reasons other than capital and liquidity constraints (as do Beatty and Liao, 2011, p. 7). Further, if external financing is not frictionless, and banks are concerned that they might violate capital requirements, then the coefficient on CAP is expected to be positive. That is banks with higher capital ratio will extend more loans.

To test the impact of regulations and supervision on loan growth, in particular during contraction periods, we include in equation (1) regulatory and supervisory indices as well as interaction terms between each of those indices and ContractionxCAP. Following Barth et al. (2006) we will run separate regression for each of these indices and interaction terms between regulations, supervision and ContractionxCAP.

In order to show empirically how loan growth of banks of different size is affected by capital ratios, we divide our sample of banks into three subsamples: large, medium and small. Large banks include 30% of banks with largest assets within a given country. Small banks include 30% of banks with smallest assets. Medium banks include 40% of other banks.

Table

Variables description and expected signs in the regressions

Variable name	Variable description	Expected sign	Basic argument
Δloan	Loan growth rate		
Contraction	Dummy equal to one in contractions and 0 otherwise	-	A negative coefficient on Contraction is predicted if loan supply declines during contractions for reasons other than capital and liquidity constraints
ContractionxCAP	Interaction between contraction and capital ratio (CAP)	+/-	A positive sign is expected if banks' loan growth is constrained by capital in contractions, a negative sign is expected otherwise
CAP	Capital ratio, i.e. equity capital to total assets	+	A positive sign is expected if loan growth is constrained by capital ratio
LIQGAP	Loans less Total customer deposits less Deposits from banks divided by Loans	-	Banks which have more stable funding (deposits) relative to loans should be able to extend loans. The higher the LIQGAP the less loans are financed by stable deposits
DEPBANKS	Deposits from banks to total assets	+	A positive sign is expected if interbank deposits boost liquidity of a bank, and make lending easier
ΔCAP	Annual change in the capital ratio (i.e. and of year CAP subtract beginning year CAP)	-	To increase capital ratio a bank must either increase its capital (without changes in risk weighted assets) or decrease risky loans (without change in capital).
QLP	Loan loss provisions divided by average loans	-	The higher the share of loan loss provisions in bank loans the lower the loan growth
Size	Logarithm of total assets	+/-	On the one hand, large banks may benefit from too-big-to-fail position and thus might isolate better adverse shocks (a positive coefficient). On the other hand, in the case of small banks, strong relationships between banks and their borrowers may result in negative relationship (a negative coefficient)
ΔUNEMPL	Change in the annual unemployment rate	-	The higher the unemployment rate the lower is the demand for loans, and thus the loan growth is reduced

Our econometric model involves explanatory variables that may not be exogenous. This means that variables are correlated with the error terms, both current and lagged. Also one may observe heteroskedasticity effects and autocorrelation within individuals. Additionally, the dataset which is analysed in the empirical part is definitely an example of a "short" panel, namely the panel with a few time periods and many individuals observed. Consequently, the nature of variables applied in our econometric model given by equation (1) may cause serious problems with properties of standard OLS estimators (i.e. their efficiency, consistency and unbiasedness). Therefore, we apply an approach that involves instrumental variables. In order to limit the possible estimation bias we consider the system of generalised method of moments (GMM) proposed by

Blundell and Bond (1998). This method has a proven track record and seems to be the best approach to address three relevant econometric issues, that are inherent to our analysis: (1) the presence of unobserved bank specific effects, which is eliminated by taking first differences of all variables; (2) the inclusion of lags of the dependent variable needed to capture the dynamic nature of LLP, which brings about the autoregressive nature of the data regarding the behavior of LLP; and (3) the likely endogeneity of the explanatory variables, mentioned above.

We control for the potential endogeneity of CAP, LIQGAP, DEPBANKS, ΔCAP and QLP in the two step system GMM estimation procedure by the inclusion of up to eight lags of explanatory variables as instruments. The UNEMPL, as well as the country and the time dummy variables are the only variables considered exogenous. As the consistency of the GMM estimator depends on the validity of the instruments, we consider two specification tests. The first is the test verifying the hypothesis of absence of second-order serial correlation in the first difference residuals (AR(2)) and the absence of first-order serial correlation in the differentiated residuals (AR(1)). In particular, it is important that in the models applied there is no second-order serial correlation in error terms. The second test which we apply is the Hansen's J statistic for overidentifying restrictions, which tests the overall validity of the instruments tests. When interpreting the p-values of Hansen's J statistics we follow Roodman's warning (2009), that the Hansen test should not be relied upon too faithfully, as it is prone to weaknesses, the most serious of which is instrument proliferation. Usually a high p-value of the Hansen test is the basis of researchers' arguments for the validity of GMM results. Unfortunately, the instruments proliferation validates the test (see Roodman, 2009, p. 141). We take account of this problem by including up to eight lags of our explanatory variables. When the p value of the Hansen's J statistics reaches high levels, we reduce the number of lags. Such an approach should eliminate potential problems resulting from too many instruments relative to the number of observations.

3.2.1. Method for identification of procyclicality of loan loss provisions and income smoothing

We begin by estimating two aspects of loan loss provisioning practices in an individual bank, i.e. its income smoothing and procyclicality. We define the ISI as the coefficient from a individual bank's regression of loan loss provisions on contemporaneous earnings. The higher the sensitivity of current loan loss provisions to current period earnings levels is interpreted as greater discretionary smoothing (as in Bushman and Williams, 2012). The PROCI is defined as the coefficient from an individual bank's regression of loan loss provisions on contemporaneous economic growth (i.e. Gross Domestic Product, henceforth GDPG),. The more negative the sensitivity of current loan loss provisions to economic growth the more procyclical is loan loss provisioning of a given bank (Borio et al., 2001, p. 11; Laeven and Majnoni, 2003; Bikker and Metzemakers, 2004; Olszak et al., 2014).

To identify both PROCI and ISI we run a regression model in which we regress current values of the explanatory variable, we also include the lagged explanatory variable (see e.g. Olszak et al., 2014). As we have data on financials of banks operating in the EU in the period of 1996-2011, we conduct separate econometric models for each bank. As we are interested in the impact of business cycle on the formation of loan loss provisions, in this stage of research we consider only those banks, for which we have at least 10 years of observations. The model identifying PROCI reads as below :

$$\frac{\mathrm{LLP}_{i,t}}{\mathrm{Average\ TA}_{i,t}} = \alpha_{\mathrm{sensit}}\mathrm{GDPG}_{j,t} + \beta_{\mathrm{sensit}}\mathrm{GDPG}_{j,t-1} \qquad (2)$$

The model identifying ISI reads as follows :

$$\frac{\mathrm{LLP}_{i,t}}{\mathrm{Average\ TA}_{i,t}} = \alpha_{\mathrm{sensit}}\mathrm{PROFIT}_{i,t} + \beta_{\mathrm{sensit}}\mathrm{PROFIT}_{i,t-1} \qquad (3)$$

where:
LLP – loan loss provision;
Average TA – average total assets;
i- the number of the bank;
j-the number of country;
t- the number of observations for the i-th bank; t is not smaller than 10 years, and does not exceed 16 years;
α_{sensit}- the regression coefficient which is the measure of sensitivity of loan loss provisions (LLP/AverateTA) to:

- GDPG – real gross domestic product (the coefficient between LLP/AverageTA and GDPG is our procyclicality indicator, PROCI),
- PROFIT (the coefficient between LLP/AverageTA and PROFIT is our income smoothing indicator, ISI); the PROFIT equals profit before provisions and taxes normalized by average assets,

β_{sensit} – the regression coefficient between LLP/AverageTA and lagged GDPG and lagged PROFIT.

Looking at median values of PROCI and ISI we divide banks into four subsamples, i.e. high procyclicality and low procyclicality, income smoothing less and income smoothing more. First, banks that have PROCI lower than median are included in the high procyclicality banks (PROCI high), i.e. those banks with highly procyclical loan loss provisions. The banks that have PROCI over the median are included into low procyclicality subsample, i.e. banks with less procyclical or countercyclical loan loss provisions (PROCI low). Second, banks that have ISI below median, are deemed as income smoothing less or not employing income smoothing at all (ISI less). Banks that have ISI over median are included into subsample of more income smoothing banks (ISI more).

We then run regression specified by equation (1) separately for each the four subsamples of banks, to find out what is the effect of capital ratio on loan growth in each of those subsamples.

3.2.2. Econometric approach to identification of periods of contractions

Our research focuses also on the dynamic interaction between variables of interest and the variables describing changes in economic activity. In order to perform this task we had to assess the business cycle fluctuations for the whole set of countries being investigated. In spite of that for some countries one may find reference variables for the business cycle component and recession markup, we extracted this factor in each case separately with the use of the same methodology proposed by Lenart and Pipień (2013). Initially we estimated frequencies and amplitudes of the Almost Periodically Correlated (APC) stochastic process describing deviations from the long term trend of the GDP growth observed quarterly. In most cases our dataset consist of 72 observations covering the period from the 1st quarter of 1995 till the 4th quarter 2012. Only in case of Croatia, Cyprus, Czech Republic, Iceland, Ireland, Malta, Romania and Spain our analysis rely on a slightly shorter series. The cyclical component, estimated according to the subsampling scheme, described in details by Lenart and Pipień (2013), was utilized to assess whether in a particular year the economy has contracted or not. We defined contraction period (denoted as 1) in the case when at least two quarters in a year can be characterized by slowdown or recession. This means that in those quarters deviation from the long term growth trend may be positive or negative but the changes as compared to the previous quarter should be negative. In an opposite case we marked appropriate year as no contraction period (denoted by 0). In Table A2 we put the results of our contraction markup.

4. Empirical results

Table 2 reports descriptive statistics of the sample and Table 3 reports the correlation coefficients from the pooled estimation. Consistent with prior research (e.g. Berrospide and Egde, 2010; Beatty and Liao, 2011; Carlson et al., 2013; Labonne and Lame, 2014) we find positive and significant coefficient of 0.074 (p-value below 0.01) on CAP, indicating that on average loan growth of banks in the EU is positively related to capital ratio. The negative correlation coefficient between CAP and size suggests that banks with higher assets have lower capital ratios. Therefore, following Carlson et al. (2013) we expect that large banks will be more sensitive to capital ratio in their lending activity.

Table 4 reports values of indices measuring restrictiveness of regulations and supervision. Most of these indices were taken from Barth et al. (2006, 2013). Only REGRESTR equals first principal component of two variables: (1) summed index comprising three variables measuring restrictions on securities, insurance, real estate activities and (2) restrictions on bank ownership and control of non-financial firms. As can be inferred from the table, both regulations and supervision are heterogeneous in the EU.

In Table 5 we report descriptive statistics for our variables measuring individual banks procyclicality of loan loss provisions and income smoothing. Loan loss provisions are procyclical in an average bank, as the mean values of all PROCI indicators are negative. Positive maximum values of some PROCI suggest that in our EU sample we have banks whose loan loss provisions are countercyclical. Positive mean and median values of ISI indicators suggest that EU banks do apply earnings management. However, in the case of some banks the values of ISI are negative, suggesting no income smoothing.

Table 2.
Summary descriptive statistics of key regression variables (in percentage points).

	Δloan	CAP	ΔCAP	DEPBANKS	LIQGAP	size	QLP	ΔUNEMPL
No. of observations	31939	34398	31321	27366	32960	34888	32577	37175
mean	3.86	8.04	0.03	11.91	-78.71	13.54	0.82	-0.15
p50	2.21	6.35	0.07	11.68	-37.62	13.39	0.63	-0.26
sd	16.54	4.97	1.57	8.25	238.38	1.64	1.76	0.97
cv	4.28	0.62	52.56	0.69	-3.03	0.12	2.14	-6.45

Δloan – annual loan growth rate (deflated) CAP - capital ratio, i.e. equity capital to total assets; ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate.

Table 3.
Correlations of bank specific and macroeconomic variables.

	Δloan	CAP	ΔCAP	DEPBANKS	LIQGAP	size	QLP	ΔUNEMPL
Δloan	1							
CAP	0.074***	1						
ΔCAP	-0.076***	0.103***	1					
DEPBANKS	-0.053***	-0.438***	0.031***	1				
LIQGAP	-0.078***	0.076	-0.005***	0.008**	1			
size	0.032***	-0.286***	0.012*	0.268***	-0.036***	1		
QLP	-0.017***	-0.033	-0.094***	0.036***	-0.050***	-0.033***	1	
ΔUNEMPL	0.054***	-0.029***	0.027***	0.002	0.024***	0.055***	0.106***	1

Δloan – annual loan growth rate (deflated) CAP - capital ratio, i.e. equity capital to total assets; ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate.

*, **, *** denote significance at the 10%, 5% and 1% level, respectively.

Table 4.
Indices measuring regulatory restrictiveness and stringency of supervision

Country	Regrestr	Capreg	Initialcapstringency	Offsup	Privmon	Depinsurance	Moral hazard
Austria	-0,94	5	2	10	8	2	2
Belgium	-0,94	6	0	13	9	.	.
Bulgaria	1,05	5	1	10	6	1	1
Cyprus	1,49	3	2	11	7	2	2
Czech Republic	1,92	6	3	12	10	4	.
Denmark	-0,06	4	2	14	9	0	1
Estonia	-0,50	8	2	8	7	1	2
Finland	-0,06	8	3	11	7	0	1
France	-0,06	4	2	6	7	4	2
Germany	-0,94	6	3	11	7	1	2
Greece	-0,50	3	2	11	11	.	.
Hungary	0,82	5	2	15	9	0	2
Ireland	-0,94	5	2	10	7	2	1
Italy	1,92	8	3	12	.	0	1
Latvia	-0,50	4	3	10	7	1	2
Lithuania	0,82	4	1	10	10	1	1
Luxembourg	-0,06	9	.	15	.	1	.
Malta	-0,72	5	3	14	9	.	.
Netherlands	-2,04	3	2	11	10	0	0
Poland	-1,16	5	2	13	.	0	2
Portugal	1,92	4	0	9	8	.	2
Romania	1,49	8	3	9	8	3	2
Slovak Republic	1,05	7	2	8	9	0	2
Slovenia	0,38	7	2	13	4	.	.
Spain	-0,94	4	1	10	9	1	1
Sweden	0,38	4	1	11	8	1	2
United Kingdom	-2,92	10	3	15	9	2	3

Values of REGRESTR, CAPREG, INITCAPSTRINGENCY, OFFSUP, PRIVMON, DEPSINURANCE and MORALHAZARD are drawn from Barth et al. (2006, 2013). REGRESTR equals to first principal component of two variables, i.e. (1) summed index comprising three variables measuring restrictions on securities, insurance, real estate activities and (2) restrictions on bank ownership and control of non-financial firms.

Table 5.
Descriptive statistics of income smoothing and procyclicality of LLP indicators.

	Mean	Median	Min.	Max.	S.E.	Skew	Kurtosis	No. of banks
PROCI	-0.013	-0.005	-1.87	0.83	0.09	-7.49	156.54	1120
ISI	0.313	0.300	-3.81	4.32	0.54	-0.63	8.44	1120

PROCI – an individual bank's measure of the sensitivity of LLP to the business cycle. ISI – an individual bank's measure of income smoothing.

4.1. Effect of capital ratio on loan growth – role of bank size, publicly traded versus privately held

Results using observations for the whole period of 1996-2011 are shown in Table 6. To provide an overview of specification, we first estimate equation (1) using a pooled, time series regression including all banks in all EU countries for the whole period. We find evidence in favor of our first hypothesis (H1) as capital ratios have impact on loan growth. This effect is statistically significant and positive, which means that banks with higher capital ratios extend more loans. The impact is strongest in the case of large (which supports our hypothesis H2) and medium size banks. Small banks' lending seems to be least affected by capital ratio.

In contrast to the results of previous literature, the magnitude of our estimates is higher. For example, while previous studies found regression coefficients ranging between 0.10 and 0.25 (see Table A1 in Appendix), our estimates take values between 0.215 in the case of publicly traded banks, and 0.53 for the largest banks.

The results give also some evidence in favor of capital crunch hypothesis for large banks (hypothesis H3) and publicly traded banks (hypothesis H4). For the sample of large banks, we find that the coefficient on ContractionxCAP is positive (although not statistically significant). Specifically, in the case of large banks, for every one percentage increase in capital ratio leads to 0.53 plus 0.069, which equals 0.6 increase in loan growth. As for publicly traded banks, the impact of capital ratio on lending is positive and statistically significant and adds to the total effect of capital on loan growth. In this case, every one percentage increase in capital ratio results in 0.47 (i.e. 0.254 plus 0.215) percentage point increase in loan growth rate. As seen from the table, capital ratio is more important supply side determinant in non-contraction periods in the case of privately held banks than publicly traded banks (estimated coefficient equal, 0.215 and 0.345, respectively), which, for publicly traded banks, may be associated with easier access to stock markets to get external financing. However, the role of capital is not so salient for privately held banks in contraction periods, because the regression coefficient on ContracionxCAP is negative.

Our results for the role of capital ratios on lending in contractions for publicly traded banks, are in line with previous evidence (see Beatty and Liao, 2011; Gambacorta and Marquez-Ibanez, 2011). In contrast to previous literature, we find stronger impact of capital ratio on loan growth in this subsample of banks.

With respect to the other variables, we find that liquidity stemming from stable financing (measured with LIQGAP) plays some role in the case of large banks. Better access to retail interbank financing affects lending capacity of publicly traded banks, but not of others. Increases in capital ratios, as expected, lead to decreased loan growth in all types of banks. Relatively poor performance of loans, as measured by loan loss provisions over average loans (QLP), tends to be associated with slower loan growth rates. Size also matters for the lending capacity of banks, but for publicly traded banks. On average, banks with larger assets extend more new loans, as the regression coefficient of size is positive and statistically significant. Such result support the view that big banks should be less prone to adjusting their credit portfolio in the event of external shocks (such as monetary policy changes or crises). We also find that loan growth is lower when unemployment rate is higher for publicly traded banks, but not for the rest of banks. This supports our view that in the case of most banks, supply factors are more important for loan growth, than demand effects.

Table 6.
Results for large, medium, small, publicly traded and privately held banks

	1		*2*		*3*		*4*		*5*		*6*	
Dependent variable: ***loan growth(*** *Δloan)*	*Full sample - contraction*		*largea30*		*mediuma40*		*smalla30*		*publ_trad*		*priv_held*	
		p-val		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*
Δloan(-1)	-0.074	**0.00**	-0.080	**0.04**	-0.044	0.14	-0.048	0.23	0.222	**0.04**	-0.071	**0.00**
	(-3.64)		(-2.10)		(-1.48)		(-1.19)		(2.04)		(-3.44)	
Δloan(-2)	-0.061	**0.01**	-0.103	0.17	-0.017	0.60	-0.043	0.52	0.043	0.52	-0.099	**0.00**
	(-2.56)		(-1.38)		(-0.53)		(-0.64)		0.64)		(-3.76)	

Contraction	-1.383	**0.00**	-1.443	0.12	-1.390	**0.05**	-1.818	**0.00**	-0.375	0.88	-1.792	**0.00**
	(-2.99)		(-1.57)		(-1.97)		(-3.09)		(-0.16)		(-3.61)	
CAP	0.367	**0.00**	0.530	**0.01**	0.427	**0.00**	0.251	**0.01**	0.215	0.36	0.345	**0.00**
	(4.86)		(2.72)		(3.85)		(2.73)		(0.92)		(3.88)	
ContractionxCAP	-0.050	0.40	0.069	0.61	-0.133	0.13	0.013	0.85	0.254	**0.03**	-0.042	0.52
	(-0.84)		(0.51)		(-1.52)		(0.18)		(2.13)		(-0.64)	
LIQGAP	0.001	0.75	-0.007	0.23	0.000	0.98	0.003	0.32	0.007	**0.03**	0.002	0.54
	(0.32)		(-1.20)		(-0.02)		(0.99)		(2.12)		(0.62)	
DEPBANKS	-0.072	**0.08**	-0.019	0.80	-0.023	0.71	-0.126	**0.03**	0.294	0.16	-0.100	**0.03**
	(-1.78)		(-0.25)		(-0.37)		(-2.20)		(1.40)		(-2.17)	
ΔCAP	-1.022	**0.00**	-1.477	**0.05**	-0.844	**0.00**	-0.891	**0.00**	-1.913	**0.10**	-0.881	**0.00**
	(-5.09)		(-1.99)		(-3.47)		(-5.26)		(-1.65)		(-4.90)	
QLP	-0.720	**0.00**	-0.364	0.51	-0.636	**0.05**	-0.725	**0.00**	-2.170	**0.02**	-0.637	**0.00**
	(-3.75)		(-0.66)		(-1.98)		(-3.73)		(-2.28)		(-3.00)	
size	0.517	**0.02**	0.828	**0.00**	0.543	**0.06**	0.920	**0.01**	-0.291	0.32	0.482	**0.07**
	(2.41)		(3.92)		(1.86)		(2.56)		(-1.00)		(1.79)	
ΔUNEMPL	2.428	**0.00**	2.167	**0.00**	2.731	**0.00**	2.350	**0.00**	-0.958	**0.04**	2.917	**0.00**
	(13.40)		(5.23)		(8.68)		(8.56)		(-2.04)		(13.67)	
intercept	-3.355	0.31	-11.116	**0.01**	-4.505	0.29	-6.746	0.15	3.559	0.58	-2.096	0.60
	(-1.03)		(-2.51)		(-1.05)		(-1.45)		(0.55)		(-0.53)	
AR(1)	-3.87	**0.00**	-1.63	**0.10**	-7.92	**0.00**	-7.21	**0.00**	-3.37	**0.00**	-3.9	**0.00**
AR(2)	-3.31	**0.00**	-0.77	0.44	-2.98	**0.00**	-2.44	**0.02**	-0.75	0.45	-2.13	**0.03**
Hansen test		**0.00**		**0.00**		**0.00**		**0.00**		1.00		**0.00**
No. of lags (for levels)	10		4		4		4		2		4	
No. of banks	2310		657		972		681		113		2197	
No. of observations	20439		6068		9067		5304		963		19476	

The model is given by equation (1). The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP); ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. Coefficients for the country and time dummies are not reported. . Bank size is captured by total average assets in the whole research period: largea30=1 is a dummy variable equal to 1 if a bank belongs to the 30% sample with largest assets; medium_a40 is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; smalla30=1 is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets; publ_trad=1is a dummy variable equal to 1 if a bank is a listed company; priv_held=1 is a dummy variable equal to 1 if a bank is privately held. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. Values in bold denote statistically significant results. T-statistics are given in brackets. Data range 1996-2011.

4.2. Effect of capital ratios on loan growth of large banks– role of procyclicality and income smoothing

The results of our test examining the effect of procyclicality of loan loss provisions on lending in large banks are presented in table 7. The first column reports the results for "PROCI low" banks subsample, whereas the second column reports the results for "PROCI high" banks. As the reliability of estimated coefficients in GMM Blundell – Bond method (1998, see Roodman, 2009) depends on the number of instruments, we run additional regressions, in which we reduce the number of instruments by decreasing the number of lags for endogenous variables (see columns 3 and 5 for "PROCI low" banks and columns 4 and 6 for "PROCI high" banks). Following this procedure we find that loan growth of banks with more procyclical loan loss provisions is more affected by capital ratios, than loan growth of banks with less procyclical loan loss provisions. Impact of capital ratio is strengthened in contractions, especially in regression in which the number of instruments is lowest (i.e. number of lags for levels is declined to two). We thus provide empirical evidence for our fifth hypothesis (H5).

Table 8 reports the results of the effect capital ratio on loan growth for income smoothing more (columns 1, 3, 5) versus income smoothing less (columns 2, 4, 6) banks. To test the validity of estimated coefficients in columns 1 and 2, we run additional regressions in which we gradually decline the number of instruments (as suggested by Roodman, 2009, and elaborated in the previous paragraph). As can be inferred from the table, loan growth of banks engaging less in income smoothing (i.e. ISI less) is definitely more dependent on capital ratios, as the regression coefficient between loan growth and CAP is positive and statistically significant. This results gives empirical support in favor of our sixth hypothesis (H6).

As we discussed earlier, in analysis of loan growth rate and its determinants, it is important that empirical identification strategy distinguishes between loan demand and loan supply effects, as any reduction in lending during a contraction may be driven by a drop in demand for loans, rather than a decline in loan supply (e.g. Bernanke and Lown, 1991; Beatty and Liao, 2011; Carlson et al., 2013). As in this section we apply individual banks reaction to business cycle and to current levels of profits, measured with PROCI and ISI, respectively, we have empirical evidence for the role of supply side factors, because PROCI and ISI are a result of an internal accounting policy of the bank, and as such they are related to loan supply effects but not to loan demand effects.

With respect to the other variables, it deserves highlighting that access to liquid interbank market affects lending capacity of banks included in the "PROCI high" subsample, as the coefficient on DEPBANKS is positive and statistically significant. Relatively poor performance of loans tends to be associated with slower loan growth rates in the case of both, "PROCI high" and "ISI less" banks. We also find that big banks which fall into "PROCI low" and "ISI more" category extend more loans that banks with more procyclical loan loss provisions and that engage in income smoothing to a lesser extent.

Table 7
Effect of capital ratio on loan growth - role of procyclicality of loan loss provisions

Dependent variable: ***loan growth(Δloan)***	*1* *PROCI low*		*2* *PROCI high*		*3* *PROCI low*		*4* *PROCI high*		*5* *PROCI low*		*6* *PROCI high*	
		p-val		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*
Δloan(-1)	-0.025	0.45	0.004	0.89	-0.053	0.20	0.006	0.82	-0.075	**0.08**	0.005	0.86
	(-0.75)		(0.14)		(-1.29)		(0.23)		(-1.77)		(0.17)	
Δloan(-2)	-0.134	**0.00**	-0.197	**0.00**	-0.164	**0.00**	-0.206	**0.00**	-0.199	**0.00**	-0.248	**0.00**
	(-2.92)		(-6.66)		(-3.13)		(-6.15)		(-3.22)		(-6.81)	
Contraction	-1.869	**0.08**	-0.007	0.99	-1.342	0.26	-0.004	1.00	-1.156	0.36	-0.272	0.77
	(-1.75)		(-0.01)		(-1.13)		(-0.01)		(-0.92)		(-0.30)	
CAP	0.320	0.19	0.386	**0.00**	0.257	0.38	0.395	**0.00**	0.198	0.54	0.416	**0.00**

	(1.31)		(3.62)		(0.89)		(3.46)		(0.61)		(3.41)	
ContractionxCAP	-0.191	0.25	0.013	0.91	-0.265	0.15	0.001	0.99	-0.267	0.17	0.048	0.75
	(-1.16)		(0.12)		(-1.43)		(0.01)		(-1.37)		(0.32)	
LIQGAP	0.009	**0.07**	0.000	0.99	0.011	**0.09**	0.000	0.96	0.013	**0.07**	0.000	0.95
	(1.83)		(0.01)		(1.72)		(0.05)		(1.79)		(0.07)	
DEPBANKS	-0.166	**0.00**	0.205	**0.00**	-0.206	**0.00**	0.229	**0.00**	-0.222	**0.00**	0.257	**0.00**
	(-3.41)		(2.89)		(-3.18)		(2.88)		(-3.04)		(3.12)	
ΔCAP	-3.399	**0.00**	-0.802	**0.01**	-3.297	**0.00**	-0.814	**0.01**	-3.221	**0.00**	-0.817	**0.01**
	(-4.05)		(-2.63)		(-3.63)		(-2.67)		(-3.35)		(-2.60)	
QLP	0.518	0.16	-0.203	0.63	0.673	**0.08**	-0.268	0.52	0.766	**0.05**	-0.070	0.89
	(1.41)		(-0.48)		(1.73)		(-0.64)		(1.93)		(-0.14)	
size	2.333	**0.00**	0.914	**0.00**	2.604	**0.00**	0.965	**0.00**	2.761	**0.00**	1.053	**0.00**
	(5.65)		(3.00)		(5.83)		(3.02)		(5.87)		(3.07)	
ΔUNEMPL	4.004	**0.00**	1.116	**0.01**	4.149	**0.00**	1.250	**0.00**	4.223	**0.00**	1.452	**0.00**
	(13.08)		(2.70)		(13.18)		(3.09)		(12.16)		(3.66)	
intercept	-28.833	**0.00**	-16.456	**0.00**	-31.784	**0.00**	-17.558	**0.00**	-33.432	**0.00**	-19.568	**0.00**
	(-5.31)		(-3.32)		(-5.47)		(-3.34)		(-5.53)		(-3.52)	
AR(1)	-5.51	**0.00**	-5.06	**0.00**	-5.54	**0.00**	-5.07	**0.00**	-5.55	**0.00**	-5.06	**0.00**
AR(2)	-0.62	0.53	0.14	0.89	-0.34	0.74	0.37	0.72	0.04	0.97	1.21	0.23
Hansen test		1.00		1.00		0.98		0.96		0.36		**0.01**
No. of lags (for levels)	8		8		3		4		2		2	
No. of banks	173		224		173		224		173		224	
No. of observations	1760		2144		1760		2144		1760		2144	

The model is given by equation (1). Results are obtained for banks included in Largea30 subsample. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP)ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. PROCI high denotes banks for which the PROCI measure was below the median; PROCI low denotes banks with the PROCI higher than the median. Coefficients for the country and time dummies are not reported. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. T-statistics are given in brackets. Data range 1996-2011.

Table 8
Effect of capital ratio on loan growth - role of income smoothing

*Dependent variable: **loan growth(Δloan)***	*1 ISI more*		*2 ISI less*		*3 ISI more*		*4 ISI less*		*5 ISI more*		*6 ISI less*	
		p-val		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*
Δloan(-1)	-0.005	0.78	0.014	0.69	-0.016	0.43	0.011	0.78	-0.032	0.17	-0.006	0.84
	(-0.28)		(0.40)		(-0.78)		(0.29)		(-1.38)		(-0.20)	
Δloan(-2)	-0.185	**0.00**	-0.150	**0.00**	-0.208	**0.00**	-0.160	**0.00**	-0.246	**0.00**	-0.176	**0.00**
	(-4.53)		(-4.95)		(-4.98)		(-4.99)		(-5.29)		(-5.16)	

Contraction	-1.789	**0.04**	0.566	0.53	-1.869	**0.04**	0.549	0.58	-1.856	**0.11**	0.635	0.55
	(-2.08)		(0.63)		(-2.03)		(0.55)		(-1.61)		(0.60)	
CAP	0.048	0.79	0.361	**0.00**	0.018	0.93	0.367	**0.00**	0.005	0.99	0.348	**0.00**
	(0.27)		(3.59)		(0.09)		(3.65)		(0.02)		(3.32)	
ContractionxCAP	-0.018	0.91	-0.106	0.39	-0.005	0.98	-0.125	0.42	0.022	0.92	-0.147	0.38
	(-0.11)		(-0.87)		(-0.03)		(-0.81)		(0.10)		(-0.88)	
LIQGAP	0.008	0.14	0.001	0.76	0.007	0.25	0.002	0.71	0.005	0.51	0.002	0.70
	(1.49)		(0.30)		(1.16)		(0.37)		(0.65)		(0.39)	
DEPBANKS	-0.005	0.94	0.041	0.46	0.014	0.86	0.035	0.58	0.046	0.61	0.024	0.69
	(-0.07)		(0.74)		(0.18)		(0.56)		(0.52)		(0.40)	
ΔCAP	-1.093	0.16	-1.467	**0.00**	-1.080	0.16	-1.497	**0.00**	-1.032	0.16	-1.536	**0.00**
	(-1.39)		(-4.57)		(-1.42)		(-4.63)		(-1.41)		(-4.67)	
QLP	0.841	**0.01**	-0.542	0.18	0.849	**0.01**	-0.506	0.29	1.071	**0.01**	-0.486	0.30
	(2.48)		(-1.34)		(2.47)		(-1.06)		(2.73)		(-1.03)	
size	1.573	**0.01**	0.959	**0.00**	1.802	**0.00**	0.974	**0.00**	2.102	**0.00**	1.059	**0.00**
	(2.67)		(3.71)		(2.85)		(3.55)		(2.93)		(3.72)	
ΔUNEMPL	3.100	**0.00**	0.982	**0.03**	3.238	**0.00**	1.195	**0.00**	3.310	**0.00**	1.416	**0.00**
	(7.65)		(2.25)		(8.09)		(2.91)		(8.29)		(3.39)	
constant	-19.808	**0.02**	-13.698	**0.00**	-23.322	**0.01**	-13.709	**0.00**	-28.507	**0.01**	-14.565	**0.00**
	(-2.29)		(-3.24)		(-2.51)		(-3.10)		(-2.74)		(-3.23)	
AR(1)	-5.32	**0.00**	-5.46	**0.00**	-5.37	**0.00**	-5.41	**0.00**	-5.38	**0.00**	-5.46	**0.00**
AR(2)	-0.07	0.94	0.18	0.86	0.3	0.76	0.36	0.72	0.78	0.43	0.52	0.61
Hansen test		1.00		1.00		0.98		0.97		**0.02**		0.35
No. of lags (for levels)	8		8		4		3		2		2	
No. of banks	213		184		213		184		213		184	
No. of observations	2127		1777		2127		1777		2127		1777	

The model is given by equation (1). Results are obtained for banks included in Largea30 subsample. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP)ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. ISI less denotes banks for which the ISI measure was below the median; ISI more denotes banks with the ISI higher than the median. Coefficients for the country and time dummies are not reported. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. T-statistics are given in brackets. Data range 1996-2011.

4.3. Effects of bank regulation and supervision on loan growth of large banks

To investigate consequences of differences in regulatory and supervisory environment across EU countries we add regulatory and supervisory indices and interaction terms between those indices and ContracionxCAP to our basic loan growth model given by equation (1). In Table 9 we report empirical evidence for the role of regulations. As can be inferred from the table, inclusion of the regulatory variables which measure overall restrictiveness of bank regulations (REGRESTR), overall restrictiveness of capital regulations (CAPREG) and initial capital restrictions index (INITCAPSTRINGENCY), makes loan growth definitely more sensitive to bank capital both during normal times and contractions, relative to baseline results for large banks given in Table 7 in column 2. Coefficients of both CAP and ContractionxCAP are positive and statistically significant (but for REGRESTR regression model in which they are marginally significant). Moreover, coefficients on all regulatory variables are positive and statistically significant, which implies that on average in countries with more restrictive bank regulations, loan growth is higher. Additionally, as the coefficients on REGRESTRxContractionxCAP, CAPREGxContractionxCAP, INITCAPSTRINGENCYxContractionxCAP, are negative and statistically significant, we infer that more restrictive bank regulations reduce the magnitude of effect of capital ratio on loan growth.

With respect to the role of supervision for the loan growth, we find strong empirical support for the stimulating role of the official supervisory authorities. The results reported in Table 10 show that loan growth is generally higher in countries with more restrictive bank supervision, as the coefficient on OFFSUP is positive (but not statistically significant at conventional levels). Moreover, more stringent official supervision dampens (makes less positive) the sensitivity of loan growth to capital ratio, as the coefficient on the OFFSUP interaction term is positive (but only marginally significant, p-val equals 0.13). However, the other supervisory measures, i.e. private monitoring (PRIVMON), power of deposit insurer (DEPINSURANCE) and factors mitigating moral hazard (MORAL HAZARD) enter our loan growth model with negative coefficients, which means that loan growth in EU countries in which this aspect of supervision in more restrictive, is on average negative. Moreover, as the coefficients on interaction terms on those supervisory measures are positive, we infer that more stringent private monitoring and other supervisory powers increases the role of capital for loan growth in contractions. This result sheds some light on the problem analyzed by Neuberger and Rissi (2014), that in bank-based financial systems, like in most countries in the EU, market monitoring may be less effective in reducing risk sharing, and therefore the effect of capital ratios on loan growth is stronger in those countries.

Table 9
Effect of capital ratio on loan growth - role of regulation.

Dependent variable: ***loan growth(*****Δ*****loan)***	*1*		*2*		*3*	
		p-val		*p-val*		*p-val*
Δloan(-1)	-0.079	**0.05**	-0.075	**0.06**	-0.065	**0.10**
	(-1.98)		(-1.87)		(-1.62)	
Δloan(-2)	-0.115	0.13	-0.106	0.16	-0.047	0.47
	(-1.51)		(-1.41)		(-0.72)	
Contraction	-2.864	**0.02**	-1.593	**0.10**	-0.739	0.31
	(-2.34)		(-1.67)		(-1.02)	
CAP	0.249	0.14	0.493	**0.01**	0.520	**0.02**
	(1.46)		(2.65)		(2.43)	
ContractionxCAP	0.306	0.12	0.681	**0.04**	0.882	**0.03**
	(1.56)		(2.02)		(2.14)	
LIQGAP	-0.008	0.20	-0.007	0.26	-0.007	0.25
	(-1.29)		(-1.12)		(-1.15)	
DEPBANKS	0.049	0.61	-0.008	0.93	-0.030	0.69
	(0.51)		(-0.09)		(-0.40)	
ΔCAP	-1.291	**0.06**	-1.443	**0.05**	-1.436	**0.06**
	(-1.90)		(-1.98)		(-1.88)	
QLP	-0.353	0.49	-0.389	0.44	-0.504	0.26
	(-0.69)		(-0.77)		(-1.12)	
size	0.795	**0.00**	0.918	**0.00**	1.060	**0.00**
	(3.49)		(3.68)		(3.11)	

ΔUNEMPL	2.091	**0.00**	2.084	**0.00**	2.001	**0.00**
	(5.14)		(5.44)		(5.35)	
Intercept	-9.534	**0.05**	-15.675	**0.01**	-18.420	**0.03**
	(-1.94)		(-2.49)		(-2.24)	
REGRESTR	1.363	**0.00**				
	(2.93)					
ContractionxCAP x REGRESTR	-0.136	**0.01**				
	(-2.72)					
CAPREG			0.526	**0.05**		
			(1.96)			
ContractionxCAP x CAPREG			-0.091	**0.02**		
			(-2.35)			
INITCAPSTRINGENCY					1.423	**0.02**
					(2.25)	
ContractionxCAP x INITCAPSTRINGENCY					-0.341	**0.01**
					(-2.48)	
AR(1)	-1.64	**0.10**	-1.64	**0.10**	-1.6	**0.11**
AR(2)	-0.82	0.41	-0.85	0.40	-1.48	0.14
Hansen test		**0.00**		**0.00**		**0.00**
No. of lags (for levels)	4		4		4	
No. of banks	657		657		650	
No. of observations	6068		6068		6027	

The model is given by equation (1). Results are obtained for banks included in Largea30 subsample. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP)ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. REGRESTR is the measure of regulatory restrictions on bank activities. CAPREG is the measure of overall stringency of capital requirements. INITCAPSTRINGENCY is the initial capital stringency index. Coefficients for the country and time dummies are not reported. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. T-statistics are given in brackets. Data range 1996-2011.

Table 10
Effect of capital ratio on loan growth - role of supervision.

Dependent variable: ***loan growth(*****Δ*****loan)***	*1*		*2*		*3*		*4*	
		p-val		*p-val*		*p-val*		*p-val*
Δloan(-1)	-0.079	**0.05**	-0.093	**0.00**	-0.073	**0.08**	-0.070	**0.07**
	(-2.00)		(-3.28)		(-1.74)		(-1.79)	
Δloan(-2)	-0.107	0.17	-0.145	**0.03**	-0.123	0.12	-0.060	0.39
	(-1.39)		(-2.13)		(-1.55)		(-0.85)	
Contraction	-2.534	**0.08**	-1.356	0.38	-3.286	**0.06**	-2.631	**0.05**
	(-1.74)		(-0.88)		(-1.87)		(-1.99)	

CAP	0.536	**0.01**	0.385	**0.03**	0.447	**0.00**	0.485	**0.00**
	(2.80)		(2.16)		(2.88)		(2.84)	
ContractionxCAP	1.966	0.14	-1.391	0.25	0.077	0.57	-0.470	0.12
	(1.47)		(-1.15)		(0.57)		(-1.55)	
LIQGAP	-0.007	0.24	-0.010	0.24	-0.006	0.31	-0.007	0.29
	(-1.18)		(-1.18)		(-1.03)		(-1.07)	
DEPBANKS	0.000	1.00	-0.042	0.53	0.010	0.90	0.001	0.99
	(0.00)		(-0.63)		(0.12)		(0.02)	
ΔCAP	-1.473	**0.05**	-0.305	0.66	-1.433	**0.05**	-1.406	**0.07**
	(-1.97)		(-0.44)		(-1.92)		(-1.80)	
QLP	-0.319	0.52	-0.638	**0.04**	-0.333	0.53	-0.365	0.47
	(-0.64)		(-2.10)		(-0.63)		(-0.72)	
size	0.815	**0.00**	1.063	**0.00**	0.962	**0.01**	0.861	**0.00**
	(3.56)		(3.18)		(2.76)		(3.05)	
ΔUNEMPL	2.132	**0.00**	2.701	**0.00**	2.015	**0.00**	1.998	**0.00**
	(5.42)		(4.09)		(5.28)		(5.06)	
Intercept	-15.676	**0.02**	-4.655	0.36	-11.686	**0.07**	-9.401	**0.05**
	(-2.28)		(-0.92)		(-1.82)		(-2.00)	
OFFSUP	0.392	0.21						
	(1.24)							
ContractionxCAP x OFFSUP	-0.153	0.13						
	(-1.52)							
PRIVMON			-1.221	**0.08**				
			(-1.78)					
ContractionxCAP x PRIVMON			0.201	0.16				
			(1.40)					
DEPSINSURANCE					-1.540	**0.04**		
					(-2.05)			
ContractionxCAP x DEPISNURANCE					0.395	**0.05**		
					(1.93)			
MORALHAZARD							-1.656	0.37
							(-0.90)	
ContractionxCAP x MORALHAZARD							0.524	0.13
							(1.51)	
AR(1)	-1.63	**0.10**	-1.61	**0.11**	-1.64	**0.10**	-1.59	0.11
AR(2)	-0.89	0.37	-0.88	0.38	-0.86	0.39	-1.41	0.16
Hansen test		**0.00**		**0.00**		**0.00**		**0.00**
No. of lags (for levels)	4		4		4		4	
No. of banks	657		497		644		637	
No. of observations	6068		4688		5966		5921	

The model is given by equation (1). Results are obtained for banks included in Largea30 subsample. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP); ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets;

LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans; ΔUNEMPL – change in annual unemployment rate. OFFSUP is the measure of official supervisory power. PRIVMON is measured by private monitoring index. DEPINSURANCE is the index measuring the power of the deposit insurer. MORALHAZARD is the index which measures various factors mitigating moral hazard. Coefficients for the country and time dummies are not reported. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. T-statistics are given in brackets. Data range 1996-2011.

4.4. Supplemental analyses

There are several other aspects of the relationship between capital ratios and loan growth that we can investigate. One of these is whether the relationship between capital ratio and lending is driven by the financial statements consolidation. It seems interesting whether there are differences in the sensitivity of growth rates of different types of banks which are obliged to report in consolidated statements. In tables 11 and 12 we present results of such analysis. Before we begin interpreting these results, we would like to stress that the number of banks in the case of consolidated data is definitely smaller in comparison to unconsolidated data. This raises some problems with specification tests (i.e. makes Hansen p value statistically insignificant) and leads to statistical insignificance of estimated coefficients. However, the empirical evidence for consolidated data seems interesting. Our results presented in Table 11 in column 1 show that capital ratios are not important as driver of bank lending both in expansions and contractions. This is not true for large banks in contractions, as the coefficient on ContractionxCAP is positive and higher than in the case of unconsolidated data. In the case of publicly traded banks, the relationship between both capital ratio and interaction of capital ratio and contraction is positive, around 0.21 and 0.26, respectively, which is similar to banks reporting unconsolidated data. Loan growth of banks with more procyclical loan loss provisions (i.e. PROCI high) and banks that smooth income to a lesser extent (i.e. ISI less) is definitely more affected by capital ratio in contractions. Coefficient on ContractionxCAP is positive in both categories of banks.

With respect to the role of regulations and supervision we present the results in Table 12. As can be inferred from the table, more restricting the range of activities that can be conducted by banks, makes banks' loan growth more positively related to capital ratios in contractions – which is different from unconsolidated data. However, more restrictive overall capital standards (CAPREG) and initial capital requirements (INITCAPSTRINGENCY) diminish the effect of capital ratio on loan growth in contractions, as the coefficient on both ContractionxCAPxCAPREG and ContractionxCAPxINITCAPSTRINGENCY is negative (but not significant in statistical sense). The impact of supervisory powers is ambiguous too. In this group, only private market monitoring and regulations reducing moral hazard seem to affect significantly the association between loans and capital in contractions. More restrictive market monitoring increases the impact of capital on loan growth in contractions. In contrast, more stringent regulations reducing moral hazard that results from deposit insurance dampen the effect of capital ratio on loan growth in contractions, as the coefficient on ContractionxCAPxMORAL HAZARD is negative.

Table 11.

Effect of capital ratio on lending in large, medium, small, publicly traded and privately held banks as well as the role of procyclicality and income smoothing – consolidated data

Dependent variable: **loan growth (**Δ*loan*)	*1*		*2*		*3*		*4*		*5*		*6*		*7*		*8*		*9*		*10*	
	Full sample - contraction		*largea30*		*mediuma40*		*smalla30*		*publ_trad*		*priv_held*		*PROCI low*		*PROCI high*		*ISI more*		*ISI less*	
		p-val		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*		*p-val*
Contraction	0.208	0.91	-3.861	0.41	3.883	0.28	-1.917	0.24	-1.646	0.54	-0.626	0.80	-5.784	0.23	-0.800	0.84	-1.235	0.77	-6.391	0.41
	(0.12)		(-0.83)		(1.09)		(-1.17)		(-0.62)		(-0.26)		(-1.20)		(-0.20)		(-0.29)		(-0.82)	
CAP	-0.069	0.71	-0.949	0.34	0.341	0.27	-0.022	0.85	0.206	0.64	-0.297	0.17	-1.840	0.12	0.032	0.98	0.272	0.59	-2.025	0.17
	(-0.38)		(-0.95)		(1.10)		(-0.19)		(0.47)		(-1.39)		(-1.54)		(0.03)		(0.53)		(-1.38)	
ContractionxCAP	-0.188	0.34	0.715	0.39	-0.645	0.22	0.110	0.36	0.256	0.47	-0.117	0.55	0.353	0.56	0.532	0.53	0.252	0.72	0.922	0.37
	(-0.96)		(0.86)		(-1.23)		(0.91)		(0.73)		(-0.60)		(0.58)		(0.64)		(0.37)		(0.90)	
LIQGAP	0.004	**0.02**	0.001	0.90	0.001	0.39	0.007	**0.00**	0.009	0.54	0.004	**0.02**	0.007	0.47	-0.012	**0.06**	-0.015	**0.06**	0.011	**0.03**
	(2.31)		(0.13)		(0.85)		(3.08)		(0.61)		(2.26)		(0.72)		(-1.86)		(-1.85)		(2.15)	
DEPBANKS	0.027	0.50	-0.111	0.25	0.061	0.33	0.004	0.92	-0.023	0.60	-0.001	0.98	-0.070	0.72	-0.083	0.54	0.170	0.11	-0.280	0.15
	(0.68)		(-1.16)		(0.97)		(0.09)		(-0.52)		(-0.02)		(-0.35)		(-0.61)		(1.59)		(-1.44)	
ΔCAP	-0.440	0.16	0.420	0.48	-1.425	0.14	-0.515	**0.03**	-0.098	0.84	-0.563	**0.11**	0.628	0.55	1.809	0.17	1.170	0.31	0.988	0.25
	(-1.40)		(0.70)		(-1.46)		(-2.18)		(-0.20)		(-1.61)		(0.59)		(1.39)		(1.03)		(1.15)	
QLP	4.056	0.25	3.717	0.40	7.693	0.34	-0.802	0.21	-0.330	0.91	4.861	0.23	20.916	0.20	0.166	0.93	2.704	0.29	4.165	0.55
	(1.16)		(0.84)		(0.96)		(-1.25)		(-0.12)		(1.21)		(1.29)		(0.09)		(1.06)		(0.60)	
size	0.901	0.59	-1.046	0.71	1.930	0.60	1.914	0.25	1.423	0.27	0.733	0.75	-1.852	0.52	3.086	0.34	4.488	0.30	-4.498	0.15
	(0.53)		(-0.37)		(0.52)		(1.16)		(1.11)		(0.32)		(-0.65)		(0.95)		(1.04)		(-1.43)	
ΔUNEMPL	-1.339	0.15	-1.506	**0.03**	-1.067	0.44	-1.050	**0.05**	-1.447	**0.00**	-1.659	0.11	-1.888	0.32	-2.079	**0.03**	-1.780	**0.00**	-0.894	0.21
	(-1.45)		(-2.13)		(-0.77)		(-2.00)		(-3.29)		(-1.59)		(-1.00)		(-2.13)		(-3.16)		(-1.25)	
AR(1)	-2.41	**0.02**	-1.81	**0.07**	-1.4	0.16	-1.65	**0.10**	-1.3	0.20	-2.44	**0.02**	-2.61	**0.01**	-1.56	0.12	-1.26	0.21	-1.22	0.22
AR(2)	-1.35	0.18	-1.82	**0.07**	-0.56	0.58	-0.83	0.41	1.34	0.18	-1.27	0.20	-1.19	0.24	-0.62	0.54	0.27	0.78	-1.3	0.19
Hansen test		**0.00**		1.00		1.00		1.00		1.00		0.06		1.00		1.00		1.00		1.00
No. of banks	357		144		140		73		112		245		56		56		46		66	
No. of observations	3776		1588		1464		724		1218		2558		659		641		538		762	

The model is given by equation (1). Two lags of dependent variable and intercept were included but not reported. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP); ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by

Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. Coefficients for the country and time dummies are not reported. Bank size is captured by total average assets in the whole research period: largea30=1 is a dummy variable equal to 1 if a bank belongs to the 30% sample with largest assets; medium_a40 is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; smalla30=1 is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets; publ_trad=1is a dummy variable equal to 1 if a bank is a listed company; priv_held=1 is a dummy variable equal to 1 if a bank is privately held. Results in columns 7 – 10 are obtained for banks included in Largea30 subsample. PROCI high denotes banks for which the PROCI measure was below the median; PROCI low denotes banks with the PROCI higher than the median. ISI less denotes banks for which the ISI measure was below the median; ISI more denotes banks with the ISI higher than the median. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. Values in bold denote statistically significant results. T-statistics are given in brackets. Data range 1996-2011.

Table 12
Effect of capital ratio on lending and regulations and supervision in consolidated financial data

Dependent variable: ***loan growth (Δloan)***	1		2		3		4		5		6		7	
		p-val		p-val		p-val		p-val		p-val		p-val		p-val
Contraction	-2.149	0.64	-6.354	0.27	-5.573	0.34	-3.774	0.41	-3.450	0.49	-4.329	0.49	-5.282	0.33
	(-0.47)		(-1.10)		(-0.96)		(-0.83)		(-0.70)		(-0.70)		(-0.97)	
CAP	-0.683	0.46	-1.297	0.26	-1.106	0.28	-0.938	0.36	-0.691	0.52	-1.012	0.32	-1.225	0.24
	(-0.73)		(-1.14)		(-1.09)		(-0.92)		(-0.65)		(-0.99)		(-1.18)	
ContractionxCAP	0.368	0.65	3.393	0.20	2.114	0.25	1.232	0.67	-6.216	**0.05**	0.805	0.26	3.481	**0.05**
	(0.45)		(1.28)		(1.16)		(0.43)		(-1.93)		(1.13)		(1.97)	
REGRESTR	-2.395	0.17												
	(-1.38)													
ContractionxCAP x REGRESTR	0.424	0.25												
	(1.14)													
CAPREG			1.598	0.13										
			(1.50)											
ContractionxCAP x CAPREG			-0.401	0.22										
			(-1.23)											
INITCAPSTRINGENCY					2.997	0.17								
					(1.37)									
ContractionxCAP x INITCAPSTRINGENCY					-0.560	0.33								
					(-0.97)									
OFFSUP							0.213	0.72						
							(0.36)							

ContractionxCAP x OFFSUP							-0.051	0.82						
							(-0.22)							
PRIVMON									-3.315	**0.09**				
									(-1.67)					
ContractionxCAP x PRIVMON									0.823	**0.07**				
									(1.80)					
DEPSINSURANCE											0.490	0.69		
											(0.40)			
ContractionxCAP x DEPISNURANCE											-0.114	0.74		
											(-0.33)			
MORALHAZARD													7.280	**0.02**
													(2.36)	
ContractionxCAP x MORALHAZARD													-1.647	**0.06**
													(-1.85)	
AR(1)	-1.85	**0.06**	-1.87	**0.06**	-1.79	**0.07**	-1.81	**0.07**	-1.85	**0.06**	-1.79	**0.07**	-1.9	**0.06**
AR(2)	-1.56	0.12	-1.67	**0.10**	-1.35	0.18	-1.82	**0.07**	-1.78	**0.08**	-1.78	**0.08**	-1.22	0.22
Hansen test		1.00		1.00		1.00		1.00		1.00		1.00		1.00
No. of banks	144		144		141		144		124		123		123	
No. of observations	1588		1588		1552		1588		1384		1350		1345	

The models are given by equation (1). To save space we present only results for the impact of capital ratio on loan growth and interactions with regulatory and supervisory indices. Results are obtained for banks included in Largea30 subsample. The symbols have the following meaning: Δloan – annual loan growth rate; Contraction - Dummy equal to one in contractions and 0 otherwise; CAP - capital ratio, i.e. equity capital to total assets; ContractionxCAP - Interaction between contraction and capital ratio (CAP); ΔCAP – annual change in capital ratio; DEPBANKS - Deposits from banks to total assets; LIQGAP - Loans less Total customer deposits less Deposits from banks divided by Loans; size - logarithm of total assets; QLP - Loan loss provisions divided by average loans ; ΔUNEMPL – change in annual unemployment rate. REGRESTR is the measure of regulatory restrictions on bank activities. CAPREG is the measure of overall stringency of capital requirements. INITCAPSTRINGENCY is the initial capital stringency index. OFFSUP is the measure of official supervisory power. PRIVMON is measured by private monitoring index. DEPINSURANCE is the index measuring the power of the deposit insurer. MORALHAZARD is the index which measures various factors mitigating moral hazard. Coefficients for the country and time dummies are not reported. The models have been estimated using the GMM estimator with robust standard errors. The p-val denotes significance levels. T-statistics are given in brackets. Data range 1996-2011.

5. Conclusions

The results of our study show that, in the EU context, the role of capital ratio for loan growth is stronger than previous literature has found for other countries. We provide empirical support that the relatively weak impact of capital ratios identified in previous papers may be a result of the specificity of a research sample, i.e. inclusion of only publicly traded banks.

This paper also explores consequences of differences in procyclicality of loan loss provisions and in income smoothing across large banks in the EU for the magnitude of effect of bank capital on lending. Using a large sample of banks from the EU, for each bank in the sample we identify two aspects of loan loss provisioning practices that, according to theoretical literature, reflect more or less forward-looking orientation. We estimate PROCI measure which determines individual bank's loan loss provisions sensitivity to business cycle, with values below median denoting greater procyclicality (i.e. backward-looking provisions), and otherwise suggesting lower procyclicality (i.e. forward-looking provisions). We also estimate ISI variable which measures sensitivity of loan loss provisions of an individual bank to current period profit before provisions and taxes. A bank with value of this index below median is deemed as backward-looking. Forward-lookingness is assumed to be typical of banks with ISI value over the median. Our study sheds some light on whether procyclicality of loan loss provisions and income smoothing with loan loss provisions contribute to procyclical impact of capital ratio on loan growth. We document that loan growth of banks that have more procyclical loan loss provisions and that engage less in income smoothing is more sensitive to capital ratios. This sensitivity is slightly increased in this sample of banks during contractions.

We further investigate the extent to which country specific bank regulations and supervision affect sensitivity of loan growth to capital ratio during contractions. We find that more restrictive regulations and more stringent official supervision reduce the magnitude of effect of capital ratio on bank lending.

In supplemental tests conducted using consolidated financial statements we find that the impact of capital on loan growth is statistically insignificant, although relatively (compared to individual data available in unconsolidated statements) stronger in contractions. This additional analysis gives further support for the role of procyclicality of loan loss provisions in shaping the magnitude of effect of capital ratio on loan growth.

Taken together, our results suggest that capital ratios are important determinant of lending in EU large banks. Their effect is more salient for banks with more procyclical loan loss provisions and for those banks which smooth their income less. The sensitivity of loan growth to capital ratio in contractions is dampened with more restrictive regulations and more stringent official supervision.

A main message of our study is that income smoothing with loan loss provisions may be beneficial for loan growth. It seems that profit stabilizing policy is important for the role of capital in bank lending, as it reduces loan growth reliance on capital ratios. Thus our paper provides empirical support to currently recommended standards on forward-looking provisioning (e.g. dynamic provisions or expected loss model introduced in the recent IFRS 9).

Showing that the limitation of the range of activities which the bank may conduct is dampening the procyclical impact of capital ratio on lending, we give evidence in favor of recommendations on division of banking activity from other financial services.

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8. Appendix

Table A1.
Contemporary research on the impact of capital ratio on bank lending

Research by:	*Bank type and country*	*Time period and frequency of data*	*Dependent variable and type of capital ratio*	*Estimated coefficient and its significance*	*No. of observations*	*Estimation method*
Blum and Nakane (2005)	Banks and financial conglomerates in Brasil; 118 banks	2001 - 2004, quarterly	Loan growth rate and logarithm of capital adequacy ratio	0.256 **	1732	GMM Arellano i Bond (1991)
Berrospide and Edge (2010)	Commercial banks operating in Bank Holding Companies in the United States; 165 banks	1992-2009; quarterly [consolidated)	Loan growth rate (quarterly) and four types of capital ratios:			OLS
			leverage, i.e. euqity capital to total assets	0.145***	8549	OLS
			total risk adjusted capital adequacy ratio	0.1572***	6658	OLS
			Tier 1 CAP	0.1674***	6658	OLS
			TCE CAP (tangible common equity)	0.2521***	8549	OLS
Beatty and Liao (2011)	Publicly traded banks in the United States; 1370 banks	1993-2009; quarterly	Loan growth rate (quarterly) and Tier1 CAP	0.044*** and interaction between CAP and RECESSION 0.068**; large banks 0.02* and interaction between CAP and RECESSION 0.138***	17384 (large banks); and 24788 (full sample)	OLS
Gambacorta and and Marquez-Ibanez (2011)	Publicly traded banks in Austria (11 banks), Belgium (6), Germany (34), Spain (14), Finland (7), France (33), United Kingdom (13), Greece	1999-2009; quarterly	Loan growth rate and two types of capital ratios:		30920	GMM two step (Blundell Bond, 1998)

	(14), Irleand (4), Italy (33), Netherlands (8), Portugal (5), Sweden (5) and the United States (777)		CAP (capital adequacy ratio)	Between -0.057*** and 0.062*; interaction with crisis dummy between 0.134* and 0.193***		
			Tier 1 CAP	Between 0.067** and 0.095***; interactions with crisis dummy between 0.196*** and 0.207***		
Carlson (2013)	Commercial banks in the United States;	2001-2011; annual (unconsolidated)	Loan growth rate and three types of capital ratios:			OLS
			CAP (capital adequacy ratio)	Between 0.034 and 0.136**; in crisis period between 2008-2011 between 0.513** and 0.623** (large banks) and 0.086 to 0.267** (small banks)	between 14231 and 51622	
			Tier 1 CAP	Between 0.036 and 0.139**; in crisis period between 2008-2011 between 0.515** and 0.634** (large banks) and between 0.088 and 0.266** (small banks)	large banks between 966 and 3449	
			leverage, i.e. equity capital to total assets	Between 0.127** and 0.159**; in crisis period between 2008-2011 between 0.606** and 1.063** (large banks) and between 0.256 and 0.454** (small banks)	small banks between 968 and 3451	

Bridges et al. (2014)	Banking groups operating in the United Kingdom with assets greater than 5 billion Pounds at any time since 1990; 53 such groups	1990-2011; quarterly	Loan growth rate (quarterly), measured used true lending flows instead of changes in stock of net loans and 4 types of lagged capital ratios:	Estimators differ due to application of different loan categories and take values as follows:	between 760 and 1358	OLS
			CAP (capital adequacy ratio)	between -0.149 and 0.348		
			CAP TRIG (capital ratio required by supervisory authorities)	between -4.044*** and -0.771**;		
			Tier 1 CAP	between -0.006 and 0.026		
			leverage, i.e. euqity capital to total assets	between -0.166 and 0.175		
Labonn and Lame (2014)	Banks in France	2003-2011; quarterly	Loan growth rate (quarterly) and Tier 1 CAP	between 0.901** and 1.77**	382	fixed effects panel estimator

Table A2.
Contractions in the EU countries in 1995-2012

Country	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Austria	0	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	1	1
Belgium	0	1	0	1	0	0	1	0	1	0	1	0	0	1	1	0	0	1
Bulgaria	0	1	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	1
Croatia				1	1	0	1	0	0	1	0	1	0	0	1	0	0	1
Cyprus		1	1	0	1	1	0	1	1	0	1	1	0	0	1	0	0	1
Czech Republic		0	1	1	0	0	1	1	1	1	0	0	0	0	1	0	0	1
Denmark	1	0	0	1	0	0	1	1	1	1	0	0	0	1	1	0	1	1
Estonia	1	1	0	1	1	0	1	0	0	1	0	0	0	1	1	0	0	1
Finland	1	1	0	1	1	0	1	0	1	0	1	0	0	1	1	0	0	1
France	1	1	0	1	0	0	1	1	1	0	1	0	0	1	1	0	0	1
Germany	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	0	1
Greece		1	1	0	1	1	1	1	0	0	1	0	0	1	0	1	1	0
Hungary		1	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	1
Iceland				0	1	0	0	0	1	0	0	1	0	0	1	0	0	1
Ireland				1	0	0	1	0	1	1	0	0	0	1	1	0	0	1
Italy	0	1	0	1	1	0	1	0	1	1	1	0	0	1	1	0	0	1
Latvia	1	0	0	1	0	1	0	0	1	1	0	0	0	1	1	0	0	1
Lithuania		1	0	0	1	0	1	0	0	1	1	1	0	0	1	0	0	1
Luxembourg		1	0	1	0	0	1	0	1	0	1	0	0	1	1	0	0	1
Malta							1	0	0	1	0	1	0	0	1	0	1	1
Netherlands	1	0	0	1	0	0	1	1	1	1	1	0	0	1	1	0	1	1
Norway	1	0	0	1	0	1	0	0	1	1	0	0	0	1	1	1	0	1
Poland		1	0	1	0	0	1	1	0	1	1	0	0	1	1	0	0	1
Portugal		1	1	0	1	0	0	1	1	0	1	0	0	1	1	0	1	1
Romania					0	1	0	0	1	0	1	0	0	0	1	0	0	1
Slovakia	0	0	0	0	1	0	1	0	1	1	1	0	0	0	1	0	0	1
Slovenia	1	0	1	1	0	1	1	0	1	1	1	0	0	0	1	0	0	1
Spain		1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	1
Sweden	0	1	0	0	0	0	1	0	1	1	1	0	0	1	1	0	1	1
Switzerland	0	1	0	1	1	0	1	1	1	1	0	1	0	0	1	0	1	1
United Kingdom	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	0	0	1