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The Impact of Basel III on Lending Rates of EU Banks*

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Abstract

In this paper we focus on practical aspects of the new framework for banking regulation in the European Union as defined in Basel III and Capital Requirements Directive IV. We employ a simultaneous equations model where banks choose the optimal level of capital, which is seen as a call option. In our modeling, we employ data on 594 banks in the European Union during the 2006–2011 period. Our results predict a modest drop in the level of loans provided of about 2% from the current level. The drop in loans is not expected to be large because (i) many European banks are already complying with the capital requirements even though they are not yet fully compulsory, (ii) the impact of a one percentage point increase in the common equity ratio should lead to an increase in lending rates of only 18.8 basis points, and (iii) the elasticity of demand for loans in the EU is reported to be relatively low. Taking into consideration the seven-year implementation period for the new capital requirements, the impacts should not be very perceptible for the EU economies.

1. Introduction

This paper focuses on practical aspects of the new framework for banking regulation in the European Union. As the ongoing Eurozone crisis has shown, the role of bank regulation is vital because of its severe potential impact on economies. Reinhart and Rogoff (2009) describe the historical experience that regulation, surveillance, and sound macroeconomic policy are not enough to prevent crises. A similar result might be expected from the new regulatory framework on bank capital requirements defined in the Basel III accords proposed by BCBS (2010). On the one hand, there are logical points of view that higher capital requirements lead to (i) a healthier financial system through a reduced risk of bank failure, (ii) lower systemic risk, and (iii) lower social costs as a result of the elimination of moral hazard. These positive outcomes could substantially offset the negative impacts deriving from the stricter capital rules in Basel III. On the other hand, the counter-arguments emphasize that higher capital requirements will increase the costs of financing for banks (equity financing is more expensive than debt financing), leading to (i) a slowdown in loan growth and potential detrimental effects on the economies concerned, and (ii) a decrease in profitability, preventing future accumulation of capital via retained earnings and ruling out future expansion of banks' operations (Cosimano and Hakura, 2011).

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The overall objective of Basel III is to strengthen the global capital, liquidity, and risk assessment rules and enhance the resilience of the banking sector. The reason for changing and complementing the previous rules (Basel II) was to prevent the consequences of market failures revealed by the crisis and to improve the banking sector's ability to absorb shocks arising from financial and economic stress (BCBS, 2010). The main channels for accomplishing these goals include increasing the quantity and enhancing the quality of capital, enhancing risk coverage, and introducing liquidity requirements. All of these measures are supported by defining tighter and more precise market discipline and supervision (BCBS, 2011). The new capital requirements set by the European Commission (2011) and the European Banking Authority (2011) in Capital Requirements Directive IV (CRD IV) require EU banks to increase their common equity ratio to 7%, their Tier 1 ratio to 9%, and their total capital ratio to 10.5% plus an additional countercyclical buffer of 2.5% by 2019, by which time the Basel III rules should be fully implemented.

The aim of this paper is to take a closer look at the potential negative impacts cited by the critics of capital regulation and, based on econometric modeling, to decide whether their concerns are justified or not. In our modeling, we employ data on 594 commercial banks, savings banks, cooperative banks, mortgage banks, and bank holdings in the European Union obtained from the Bankscope database. We will quantify to what extent European banks will increase their lending rates as a result of their desire to compensate for more expensive sources of financing, as argued by LEI Group (2010), MAG (2010a), and MAG (2010b). In this context, we will also focus on the elasticity of demand for loans in the EU, because that can determine the magnitude of the drop in the volume of loans provided. To analyze this, we employ a simultaneous equations model where banks choose the optimal level of capital, which is seen as a call option.

The paper continues as follows. In Section 2, we present a review of the literature dealing with the impact of stricter capital regulation on loan interest rates and loan volumes of banks. Section 3 presents the econometric model. Against this backdrop, in Section 4 we provide empirical research and analyze the impact of the higher capital requirements under Basel III on the loan interest rates and loan volumes of EU banks. For this purpose, we conduct a pooled data analysis for 594 European banks during the 2006–2011 period and employ the simultaneous equations model. Section 5 concludes the paper and gives some final remarks.

2. Literature Review

The majority of studies analyzing the consequences of the stricter capital requirements under Basel III try to identify their impact on economic output, while interest rate changes and volumes of loans provided are considered to be a channel toward a potential decline in output. LEI Group (2010) based its analysis of change in lending spreads on the income and balance-sheet data of a representative bank. It concludes that if banks want to keep their profitability as measured by return on average equity (ROAE) stable, each percentage point increase in the ratio of tangible common equity to risk-weighted assets (TCE/RWA) results in a median increase in lending spreads of 13 basis points. MAG (2010), estimating the timing of impacts of compulsory changes to capital adequacy standards, concluded that for a one percentage point increase in the TCE/RWA ratio, lending spreads are expected to widen by 15.5 basis points by the 35th quarter after the first implementation, and to narrow somewhat thereafter. Additionally, MAG (2010) estimated a decline in lending volumes of 1.4% relative to the baseline at the 35th quarter, and of 1.5% by the end of the simulation.

However, not many published papers assess the impact of Basel III on European banks. A good representative of such literature is the paper by Roger and Vlček (2011), who analyze various channels by which banks can increase their capital adequacy ratios. For the strategy where banks increase their capital by means of retained earnings collected from raised lending margins, they calculated that European banks would need to increase their lending spread by 120 basis points (assuming a gradual increase in the TCE/RWA ratio of 2 percentage points over two years). All of the above studies use a simulation methodology to estimate the potential impacts on interest rates and loan volumes, and consequently, the potential economic downturn. In this context, modeling based on a different logic is employed by Cosimano and Hakura (2011), who perform a cross-country analysis using a simultaneous equations model. The data used in their modeling showed that the world's 100 largest banks (in terms of assets) would, on average, need to increase their equity-to-asset ratio by 1.3 percentage points under the new Basel III framework. This would make them increase their lending rates by 16 basis points, causing the volume of loans provided to decline by 1.3 percentage point in the long run.

3. Model Description

In this paper we follow the model developed by Chami and Cosimano (2001, 2010) in order to evaluate how the new banking regulations will affect European banks and their decisions about the volume of loans they provide and their loan interest rates. Consequently, our model of the banking industry is based on two main principles that explain the level of capital and loan rate setting.

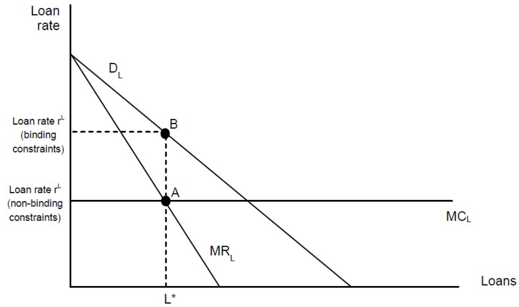
3.1 Loan Rate Setting and Provision of Loans

The model assumes that banks enjoy some market power and display oligopolistic behavior. Their decisions follow the principles of Bertrand competition. This means that each bank follows a coordinated policy for setting its loan rate as long as other banks follow the same policy. If any bank sets a lower rate, it is penalized by Bertrand competition (i.e., in the case of breaking the rules of coordinated policy, the bank's net interest margin between loans and deposits is set equal to its marginal non-interest resource costs). In equilibrium, the competitive loan rate r^L is equal to the marginal cost of loans MC_L.[1] However, this holds only for the situation where the capital requirements are not binding. In this case, the optimal loan rate and level of loans is at point A in *Figure 1*. Here, an increase in the demand for loans D_L [2] or a decrease in the marginal costs of loans leads to an increase in the optimal amount

[1] $MC_L = C_L + C_D + r^D$, where C_L are the non-interest costs of loans, i.e., the cost of monitoring and screening loans, the costs of non-performing loans, etc., C_D are the non-interest costs of deposits, and r^D is the interest rate on deposits.

[2] Demand for loans is positively dependent on the fixed demand for loans l_0 and the effect of economic activity $(g + \pi)$ and negatively dependent on the loan interest rate r^L.

Figure 1 Loan Rates and Loan Volumes When Capital Requirements Are (Not) Binding



Source: Authors based on Chami & Cosimano (2001).

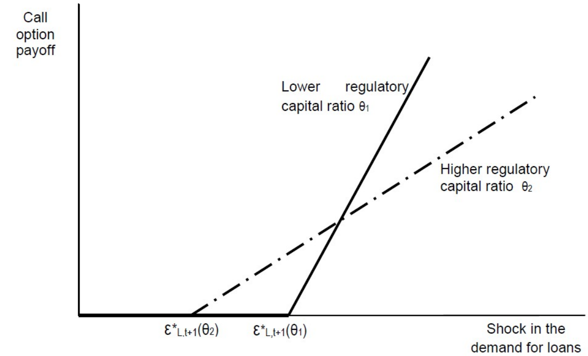
of loans. On the other hand, when the capital constraints are binding, the equilibrium moves to point B, where any additional demand for loans does not have any positive quantitative impact on the amount of loans but leads to a higher loan rate. This principle is in accordance with the argument presented by the critics of stricter banking regulation, who complain that higher capital requirements lead to higher interest rates on loans and possible adverse impacts on economic output ("bad deleveraging").

3.2 The Choice of Capital

The basic idea behind the choice of capital by banks in this model implies that capital is seen as a call option (depicted in *Figure 2*), where the strike price $\varepsilon^*_{L,\, t+1}$ equals the difference between the expected optimal future amount of loans L^*_{t+1} and the amount of loans satisfying the condition of the current capital level L^*_t (i.e., the strike price is simply a shock to the demand for loans). If no significant increase in the demand for loans is expected, the shock to demand is below its critical level $\varepsilon^*_{L,\, t+1}$ and the payoff of the capital is zero, as the capital serves no purpose. But if the future demand for loans is expected to increase considerably, the capital has a positive payoff and the bank wants to hold more capital in order to be able to meet the future loan demand. The payoff is smaller and the strike price is lower when the regulatory capital ratio θ increases. As a result, banks tend to hold more capital, the stricter is the regulatory requirement and the higher is the volatility of the demand for loans caused by greater and more frequent shocks.

This model representing bank capital as a call option leads to a number of intuitive conclusions. First, the current level of capital held by banks depends on banks' expectations of their future optimal amount of loans (depending on the demand for loans), as the current level of capital is positively related to the expected need for capital in the future. Second, however, the capital limits the amount of loans provided, since a fraction of the total loans represented by the capital requirements must be held as capital. With the aim of empirically testing the model of Chami and Cosimano (2001, 2010), Barajas et al. (2010) designed the following system of simultaneous relations[3] describing the choice of capital (Equations (1) and (2)),

Figure 2 Bank Capital as a Call Option



Source: Authors based on Chami & Cosimano (2001).

the loan rate (Equation (3)), and the amount of loans provided (Equation (4)). The equation describing the choice of capital is as follows:

$$\begin{aligned} K/A &= a_0 + \left[a_1 + a_2 \left(K/A\right)_{t-1}\right]\left(\Delta K/A\right)_{t-1} + \left[a_3 + a_4\left(K/A\right)_{t-1}\right] r^D \\ &+ \left[a_5 + a_6\left(K/A\right)_{t-1}\right]\left(C_L + C_D\right) + a_7 \ln Assets + a_8 \ln Assets^2 + \varepsilon_1 \end{aligned} \qquad (1)$$

which, for the purposes of calculating the individual coefficients, can be rewritten as:

$$\begin{aligned} K/A &= a_0 + a_1\left(\Delta K/A\right)_{t-1} + a_2\left(K/A\right)_{t-1}\left(\Delta K/A\right)_{t-1} + a_3 r^D + \\ &+ a_4\left(K/A\right)_{t-1} r^D + a_5' C_L + a_6'\left(K/A\right)_{t-1} C_L + a_5'' C_D + a_6''\left(K/A\right)_{t-1} C_D + \\ &+ a_7 \ln Assets + a_8 \ln Assets^2 + \varepsilon_2 \end{aligned} \qquad (2)$$

where, for the purposes of empirical testing, the following observable variables (representing the original variables in the theoretical model) are used:

K/A – the common equity/Tier 1/total capital regulatory ratio, where K is the type of capital and A refers to risk-weighted assets;

$\left(\Delta K/A\right)_{t-1}$ – the lagged change in the common equity/Tier 1/total capital regulatory ratio;

$\left(K/A\right)_{t-1}\left(\Delta K/A\right)_{t-1}$ – the lagged change in the common equity/Tier 1/total capital regulatory ratio multiplied by the initial common equity/Tier 1/total capital regulatory ratio;

r^D – the interest expense ratio (originally the rate on deposits);

[3] This relation is a combination of the capital-as-a-call-option model of Chami and Cosimano (2001, 2010) and the logic behind the empirical test designed by Peek and Rosengren (1995) to test the crunch hypothesis that poorly capitalized institutions reduce their deposits more rapidly than better-capitalized institutions while keeping the loan demand effects constant (Barajas et al., 2010).

$\left(K/A\right)_{t-1} r^D$ – the interest expense ratio multiplied by the initial common equity/Tier 1/total capital regulatory ratio;

C_L – the ratio of non-performing loans to assets (originally the non-interest costs of loans);

$\left(K/A\right)_{t-1} C_L$ – the ratio of non-performing loans to assets multiplied by the initial common equity/Tier 1/total capital regulatory ratio;

C_D – the non-interest expense ratio (originally the non-interest costs of deposits);

$\left(K/A\right)_{t-1} C_D$ – the non-interest expense ratio multiplied by the initial common equity/Tier 1/total capital regulatory ratio;

$\ln Assets$ – the natural logarithm of assets (used to control for the size of the banks studied);

$\ln Assets^2$ – the natural logarithm of assets squared.[4]

Based on the logic behind the model of Chami and Cosimano (2001, 2010) and the fact that European call options are convex and decreasing in the strike price, we have certain expectations about the values of the parameters in Equation (2):

– A decrease in the total capital level in the past (i.e., $\left(\Delta K/A\right)_{t-1} < 0$) lowers the strike price of capital (increasing capital is more valuable for banks), which should lead to an increase in the current level of capital. Therefore, we expect that $\alpha_1 + \alpha_2 \left(K/A\right)_{t-1} < 0$. Moreover, this impact should be smaller for banks with a higher initial level of capital $\left(K/A\right)_{t-1}$ (as their strike price is higher), so we expect that $\alpha_1 < 0$ and $\alpha_2 > 0$.
– A decrease in interest costs r^D and non-interest costs C_D, C_L leads to a higher current optimal level of loans, which decreases the strike price. Hence, the current level of capital should increase and we expect that $\alpha_3 + \alpha_4 \left(K/A\right)_{t-1} < 0$ and $\alpha_5 + \alpha_6 \left(K/A\right)_{t-1} < 0$. Similarly to the previous case, this impact is expected to be smaller, the higher is the initial level of capital $\left(K/A\right)_{t-1}$, so $\alpha_{3,} \alpha_5 < 0$ and $\alpha_{4,} \alpha_6 > 0$.

[4] Even though the squared term was not included in the original model used by Chami and Cosimano (2001, 2010), we used it to control for the size of the banks studied and the potential convexity effect of asset value on banks' capital decisions, which proved to be significant in the equations describing the choice of capital.

3.3 The Loan Rate

In this section we present the equation describing the loan rate (r^L):

$$r^L = \beta_0 + \beta_1 K/A + \beta_2 r^D + \beta_3 C_L + \beta_4 C_D + \beta_5 r^K + \beta_6 \ln Assets + \beta_7 g + \beta_8 \pi + \varepsilon_3 \tag{3}$$

where, for the purposes of empirical testing, the following observable variables representing the original variables in the theoretical model are used:

r^L – the interest income ratio, used as a proxy for the interest rate on loans provided;

$\left(K/A\right)$ – the common equity/Tier 1/total capital regulatory ratio;

r^D – the interest expense ratio (originally the rate on deposits);

C_L – the ratio of non-performing loans to assets (originally the non-interest costs of loans);

C_D – the non-interest expense ratio (originally the non-interest costs of deposits);

r^K – the cost of capital, represented by ROAE;

$\ln Assets$ – the natural logarithm of assets (used to control for the size of the banks studied); the squared term was not included, as it did not prove to be significant;

g, π – real GDP growth and inflation (CPI), respectively, representing the level of economic activity (included as control variables because the marginal revenue of loans depends on economic activity).

For this relation, we will define two expectations about the values of the parameters in Equation (3). First, an increase in the marginal costs of loans $MC_L = C_L + C_D + r^D$ and a higher cost of capital should lead to a higher loan rate, so $\beta_2, \beta_3, \beta_4, \beta_5 > 0$. A lower initial level of capital is in accordance with a higher strike price, which is driven by an increase in loan demand and leads to a higher current level of capital. Consequently, based on *Figure 1* and the convex properties of call options, we know that in the case of binding capital requirements, increased demand for loans implies a higher loan rate. Therefore, we expect $\beta_1 > 0$.

Second, higher real GDP growth g should have a negative impact on the interest revenue ratio because increased economic activity increases the demand for loans, which in the case of decreasing marginal revenues lowers the interest rates on loans. Inflation, on the other hand, leads to an increase in nominal interest rates on loans. Thus, we expect $\beta_7 < 0$ and $\beta_8 > 0$.

3.4 The Level of Loans

To complement the overall picture of loan provision under the new regulatory framework, the following Equation (4) is used to describe the level of loans provided, which depends on supply side factors influencing banks' decisions and demand side factors influencing customers' decisions (the elasticity of demand for loans). Supply side factors, such as the marginal costs of loans, given by $MC_L = C_L + C_D + r^D$, and the cost of capital r^K were included in Equation (3) describing the loan rate. Therefore, in the following equation, which is designed to estimate the elasticity of demand for loans, we include only the level of economic activity and the size of the bank.

$$\ln Loans = \gamma_0 + \gamma_1 \ln r^L + \gamma_2 g + \gamma_3 \pi + \gamma_4 \ln Assets + \varepsilon_4 \qquad (4)$$

where:

$\ln Loans$ – the natural logarithm of loans provided;

$\ln r^L$ – the natural logarithm of the interest income ratio;

g – real GDP growth, used as a proxy for the level of economic activity;

π – is the inflation rate, measured by the CPI;

$\ln Assets$ – is the natural logarithm of assets (used to control for the size of the banks studied).

For the coefficients in Equation (4), we have the following two expectations. First, an increase in the loan rate r^L should lead to a decrease in demand for loans, and the coefficient γ_1 is an exact measure of the demand elasticity for loans.[5] Second, real GDP growth and the level of inflation are, at first sight, expected to be positively related to the level of loans in the economy ($\gamma_3, \gamma_4 > 0$). However, the impact of inflation is questionable. On the one hand, inflation drives nominal interest rates, which, in turn, leads to a decrease in the volume of loans. On the other hand, it is positively related to economic activity. Consequently, a negative impact of inflation on the volume of loans provided would not be a surprising outcome. In this model, banks simultaneously decide about the optimal level of capital they will hold and the loan rate they will charge, which in turn influences the amount of loans provided. However, the amount of loans provided is to a significant extent given exogenously by the elasticity of demand for loans. Therefore, in the empirical econometric testing, equations describing capital and the lending rate are taken as simultaneous, where the capital level is an endogenous variable, while the equation describing the volume of loans is estimated separately. We employ the 2-Stage Least Square methodology (2SLS) to quantify the parameters of simultaneous Equations (2) and (3) and the heteroskedasticity-adjusted OLS model[6] to estimate Equation (4).

There is one important issue connected with our model that should be mentioned before we analyze the results. Roger and Vlček (2011), who also analyzed the impact of capital regulation on lending rates in Europe, stress that banks have many options for coping with the regulatory requirements. As a result, banks can (1) increase retained earnings by: (i) raising average interest rates on lending, (ii) reducing dividend payments and/or targeted ROE, (iii) increasing operating efficiency; (2) reduce risk-weighted assets by: (i) cutting the overall size of their loan portfolios, (ii) shifting the composition of loan portfolios toward less risky assets; and finally (3) issue new equity, implying a dilution of existing shareholder rights. However, the strategy used in Roger and Vlček (2011) is limited to examining the separate

[5] By definition, γ_1 is the elasticity of demand as it exactly represents the sensitivity of a percentage point change in loans to a percentage point change in the lending rate (here we use the logarithm of loans and the logarithm of interest rates).

[6] A test for multicollinearity of the variables in the equation is provided in the *Appendix*.

effect of increasing retained earnings by raising average lending rates. Nevertheless, the model used in our study basically allows us to examine all of the above-mentioned channels, since it models interest rates in such a way that they are dependent on the level of capital a bank chooses based on the call option principle. Therefore, our results should reflect the fact that the level of capital (the capital ratio) was achieved by raising interest rates, but this does not limit the other possible channels stated above. Considering this fact, we anticipate that the effects of increased capital ratios in European banks would be smaller than those calculated by Roger and Vlček (2011).

4. Empirical Results

This section presents the empirical results of our research. Equations (2) and (3) were estimated by employing the 2SLS methodology using all three types of capital adequacy ratio, and Equation (4) was estimated by the heteroskedasticity-adjusted OLS method. The data were obtained from the Bankscope database and cover 594 banks over the period 2006–2011. For better transparency, we have divided this section into three parts summarizing our results relating to the impact of Basel III on the following three variables: i) the choice of capital, ii) the loan rate, and iii) the level of loans.

4.1 The Impact of Basel III on the Choice of Capital

Table 1 reports the results for Equation (2) and describes whether European banks choose the amount of their capital optimally. For two out of the three ratios studied, the Tier 1 ratio and the total capital ratio, the choice of capital in the given period is negatively related (as expected $\alpha_1 + \alpha_2 \left(K/A \right)_{t-1} < 0$) to the prior change in the capital ratio. This means that banks reacted optimally—they increased their Tier 1 and total capital levels after experiencing losses. From the theoretical point of view, this effect should be lower for better capitalized banks. This was confirmed for both Tier 1 capital and total capital in our modeling, as $\alpha_1 < 0$ and $\alpha_2 > 0$. In the case of choosing the level of equity, the theory based on common equity as a call option was suppressed by persistence in the level of the common equity ratio. This persistence effect was higher for less capitalized banks $\alpha_2 < 0$, which is logical, as less capitalized banks probably have specific reasons for such a strategy. We conclude that the increase in the ratio was motivated by the Basel II regulation, since in the 2006–2011 period there was no new regulation of capital adequacy except for Basel II. However, banks could not have lowered their capital ratios, as they would probably have broken the regulatory rules valid at the time.

4.2 The Impact of Basel III on the Loan Rate

Table 2 shows the results for Equation (3) from the simultaneous equation system representing the setting of the loan rate. As for interest and non-interest costs, almost all the coefficients are significant and most of them correspond to our theoretical expectations. The interest expense of deposits has a negative sign for all three cases ($\alpha_3 < 0$). The same is true for the non-interest costs of loans—an increase

Table 1 The Results for Equation (2) Describing the Choice of Capital

Dependent Variable: Current Level of Capital K/A				
Variable	***Coefficient***	***Equity Ratio***	***Tier 1 Ratio***	***Total Capital Ratio***
constant	α_0	38.734*** (2.648)	104.414*** (5.370)	97.336*** (5.550)
$\left(\Delta K/A\right)_{t-1}$	α_1	0.615*** (0.129)	-0.550*** (0.090)	-0.300*** (0.065)
$\left(K/A\right)_{t-1}\left(\Delta K/A\right)_{t-1}$	α_2	-0.030*** (0.006)	0.016*** (0.001)	0.011*** (0.001)
r^D	α_3	-0.057*** (0.010)	-0.042** (0.020)	-0.059*** (0.020)
$\left(K/A\right)_{t-1} r^D$	α_4	0.001 (0.003)	-0.002 (0.003)	-0.027*** (0.005)
C_L	α_5'	0.016 (0.026)	-0.278*** (0.052)	-0.277*** (0.054)
C_D	α_5''	0.086*** (0.008)	0.023 (0.016)	0.050*** (0.017)
$\left(K/A\right)_{t-1} C_L$	α_6'	0.013 (0.014)	0.100*** (0.013)	0.066*** (0.013)
$\left(K/A\right)_{t-1} C_D$	α_6''	0.006*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)
$\ln Assets$	α_7	-2.910*** (0.349)	-10.657*** (0.707)	-9.784*** (0.731)
$\ln Assets^2$	α_8	0.060*** (0.011)	0.301*** (0.023)	0.282*** (0.024)
R^2		42.99%	43.73%	42.39%

Notes: Standard errors are in parentheses; ***/**/* indicate 99%/95%/90% level of significance.
Source: Authors calculations, using data from Bankscope.

in these costs, as expected, leads to a decrease in the level of Tier 1 capital and total capital (the coefficient in the case of the common equity ratio is not significant). Additionally, this effect proved to be lower for better capitalized banks, as their reaction is not so substantial. The non-interest costs of deposits C^D, however, yield surprising results. According to the model, a decrease in these costs should lead to a decrease in the strike price of capital and thus to an increase in the capital level (i.e., $\alpha_5'' < 0$) but the opposite was reported for European banks. This means that banks did not increase their level of capital in reaction to a reduction in deposit administration costs (which could potentially lead to higher future loans). However, this does not necessarily reduce the validity of the model, as administration costs can be regarded as only a marginal factor in loan pricing.

European banks, as naturally expected, incorporate the costs of financing into their loan pricing. In other words, a higher cost of capital and higher deposit costs (both interest and non-interest) lead to higher loan rates. Because of the higher proportion of deposits relative to capital on the balance sheet of a typical bank, the effect of deposit costs is higher than that of the costs of capital ($\beta2, \beta4 > \beta5$). The non-interest costs of loans C^L proved to have no significant effect on the loan

Table 2 The Results for Equation (3) Representing Loan Rate Setting

Dependent Variable: Interest Income ratio r^L				
Variable	**Coefficient**	**Equity Ratio**	**Tier 1Ratio**	**Total Capital Ratio**
constant	β_0	1.907 (1.689)	4.983*** (0.502)	5.415*** (0.474)
K/A	β_1	0.188*** (0.068)	0.038*** (0.009)	0.028*** (0.009)
r^D	β_2	0.025*** (0.007)	0.015** (0.006)	0.015** (0.006)
C_L	β_3	-0.045** (0.018)	-0.018 (0.017)	-0.021 (0.017)
C_D	β_4	0.009 (0.008)	0.024*** (0.004)	0.024*** (0.005)
r^K	β_5	0.004** (0.003)	0.008*** (0.002)	0.009*** (0.002)
$\ln Assets$	β_6	0.072 (0.075)	-0.068*** (0.025)	-0.090*** (0.024)
g	β_7	-0.312*** (0.020)	-0.323*** (0.020)	-0.321*** (0.020)
π	β_8	0.273*** (0.037)	0.2868*** (0.037)	0.285*** (0.037)
R^2		14.74%	17.13%	18.04%

Notes: Standard errors are in parentheses; ***/**/* indicate 99%/95%/90% level of significance.
Source: Authors calculations, using data from Bankscope.

rate when the total capital ratio and Tier 1 ratio were employed in the equations, and a negative effect when the common equity ratio was used. This result is surprising, as we expected a positive relationship between loan rates and the individual components of the marginal costs of loans, including the non-interest costs of loans (the effects of other components are as expected). However, a thorough analysis of the mechanism of operation of financial product intermediaries yields a logical explanation. The non-interest costs of loans are proxied by the ratio of non-performing loans to total loans. Our results reveal that the higher is this ratio, the lower is the loan rate. This relationship occurs because lower loan rates facilitate borrowing by less solvent clients, who are not able to pay back in the future (this was one of the reasons for the mortgage crisis in the USA). This leads to a proportionately higher volume of non-performing loans, leading to an increase in the ratio. As a result, because of the nature of the proxy used, there is a potential negative relationship between non-interest loan costs and the loan rate. The effects of economic activity proved to have the expected impact on loan rates, i.e., real GDP growth reduces them and inflation increases them.

The most important results of this model—the impact of capital ratios on the loan rate—are the following:

i) The relationship between the common equity ratio and the loan rate is significant and positive. A one percentage point increase in the common equity ratio makes European banks increase their interest rates on loans by 18.8 basis points.

Table 3 Comparison of Our Results on the Impact of Higher Capital Requirements on Interest Rates with Those of Other Researchers

Authors	Type of studied ratio	Country	Impact of 1 % on loan interest rates/loan rate spreads
Stein, Kasyap, & Hanson (2010)	Total capital ratio	USA	2.5–4.5 bps
Cosimano & Hakura (2011)	Common equity ratio	Globally	12.2 bps
LEI Group (2010)	TCE*/RWA	Globally	13.0 bps
MAG (2010a)	TCE*/RWA	Globally	15.0 bps
MAG (2010b)	TCE*/RWA	Globally	15.5 bps
This study (2012)	Common equity ratio	EU	18.8 bps
Elliott (2009)	Common equity ratio	USA	19.0 bps
Slovik & Cournede (2011)	Common equity ratio	USA, Euro Area, Japan	23.4 bps (USA), 14.3 bps (Euro Area) 8.4 bps (Japan)
Roger & Vlček (2011)	TCE/RWA	Globally	60 bps (USA) 65 bps (EU)

Note: *TCE = tangible common equity.
Source: Authors calculations.

ii) An increase in the Tier 1 ratio of one percentage point causes an increase in interest rates of 3.8 basis points.

iii) The reaction of lending rates to an increase in the total capital ratio is significant, but is the lowest value of all the ratios, i.e., a one percentage point increase in the total capital ratio results in an increase in loan interest rates of 2.8 basis points.

These quantifications are in accordance with the presumption that the costs of capital are proportionate to the quality of capital, so an increase in the common equity ratio—the highest-quality capital—would lead to a substantially higher impact on lending rates in comparison with the effects of the Tier 1 and total capital ratios. *Table 3* compares our findings with those calculated in previous papers on this topic. Our results on the impacts of increased capital requirements on interest rates are at the average level.

4.3 The Impact of Basel III on the Level of Loans Provided

Table 4 summarizes the results for Equation (4), which was estimated using the heteroskedasticity-adjusted OLS model. The table shows that an increase in the interest rate on loans leads to a decrease in loans provided, which corresponds to our expectation, as this relationship demonstrates the elasticity of demand for loans. If a bank increases its interest rates on loans by 1% (where the base is the current interest rate), its level of loans decreases by 0.156% (from its current level) as a result of the negative elasticity of demand for loans. The elasticity is lower than 1%, indicating inelastic demand for loans in the EU. Inflation has a positive relationship to the value of loans provided. On the other hand, GDP, contrary to expectations, has

Table 4 The Results for Equation (4) Describing the Level of Loans Provided

Dependent variable: lnLoans	
γ_0	-0.005*** (0.059)
$\ln r^L$	-0.156*** (0.023)
g	- 0.012 (0.002)
π	0.013*** (0.005)
$\ln Assets$	0.984*** (0.003)
R^2	97.92%

Notes: Standard errors are in parentheses; ***/**/* indicate 99%/95%/90% level of significance.
Source: Authors calculations, using data from Bankscope.

a negative relationship. This is surprising at first sight, but it can be interpreted in a logical way. The situation in Europe has been problematic in recent years, as the level of indebtedness (both public and private) has been rising faster than the real productive capacity of European economies. As a result, Equation (4) reports a negative relationship between the volume of loans and the real GDP growth rate, since real GDP growth decreased in some years of the observed period. On the other hand, inflation shows a positive relationship between nominal economic activity and the level of loans. Additionally, the absolute value of the coefficient on inflation is higher than the coefficient on real GDP growth. This indicates that in nominal terms, the condition that the volume of loans is driven by economic growth is satisfied.

4.4 Summary of Results

The results obtained by estimating Equations (2), (3), and (4) allow us to assess the impact of regulation on interest rates and loan volumes. As mentioned above, the new capital requirements require EU banks to increase their common equity ratio to 7%, their Tier 1 ratio to 9%, and their total capital ratio to 10.5% plus an additional countercyclical buffer of 2.5% by 2019, by which time the Basel III rules should be fully implemented.[7] In our further calculations, we will suppose that the countercyclical buffer is fully composed of common equity and banks will therefore have to increase their common equity ratio (CET) to 9.5%. In order to quantify the overall effect of the new capital requirements on loan markets, we will use only the relationship identified by Equations (3) and (4) using the common equity ratio. We consider it sufficient to use this approach for three reasons. First, the nature of the outcomes as regards the positive/negative relationships between the key variables studied is consistent across all results (the relationship of all types of capital levels to interest rates is positive). Second, if we wanted to assess the impact of an increased Tier 1 ratio or total capital ratio on interest rates, we would have to identify to what extent the level of these ratios will be increased using common equity, additional

[7] For more details on the capital requirements under Basel II—the predecessor of Basel III—we refer, for example, to Matejašák (2009) or, more recently, Lall (2012) and Teplý (2012).

Table 5 The Impact of the Increased Common Equity Ratio on Loan Rates and the Volume of Loans Provided in Europe

	All	E/A < 9.5%	E/A > 9.5%
#of banks	594	353	241
% share of banks	100.00%	59.43%	40.57%
Loans value (mill €)	17,349,062	16,899,515	449,548
% share of loans	100.00%	97.41%	2.59%
Mean Common equity ratio	9.28%	6.58%	13.23%
Median Common equity ratio	8.77%	7.04%	12.13%
Need to increase Common equity ratio	0.22%	2.92%	X
Current average loan rate	4.29%	4.18%	4.43%
Impact on loan rate (bps)	X	54.954	X
% impact on loan rate	X	13.15%	X
% impact on loans	-2.00%	-2.06%	X
Absolute impact on loans (€ mio)	-347,487	-347,487	X

Source: Authors calculations.

Tier 1, or additional Tier 2 capital. As this decision is specific to each bank, we are not able to anticipate what the changes in each individual type of capital will be. Third, common equity forms a substantial part of Tier 1 and total capital. Consequently, we perform our analysis using only the common equity ratio, while employing the following principles:

– Some European banks are already complying with the requirements of the new stricter regulation even though it is not valid yet. Therefore, we will divide all banks (both the complete database and the banks used in the regressions) into two groups—one composed of banks with a common equity ratio lower than 9.5% and the other one of banks with a common equity ratio higher than or equal to 9.5%.
– We calculate the percentage change in the common equity ratio required in order to ensure compliance with the requirement for those banks that are not compliant according to the latest available data.
– We employ the result of Equation (3)—a one percentage point increase in the common equity ratio makes European banks increase their interest rates on loans by 18.8 basis points—to quantify the overall impact on loan rates.
– We then use the computed change in interest rates to calculate the impact on the volume of loans provided, employing the finding that when the interest rate on loans increases by 1% (from its original value), the level of loans decreases by 0.156% (from its original level).
– Those banks which have already met the capital adequacy requirements are expected not to change their interest rates and the volume of loans they provide in reaction to the stricter requirements.

The impact of the increased common equity ratio on the loan rate and the volume of loans provided in Europe computed using the procedure described above is reported in *Table 5*.

Under the assumption that the banks included in the modeling are representative of all Europe banks, we conclude that the impact of the strengthened capital requirements on the level of loans provided in the EU may be as follows.[8] As for the number of banks, 59.43% of banks, and as for the volume of loans provided, 97.41% of banks, are not currently compliant with the common equity ratio requirement of Basel III. These banks will have to increase this ratio by 2.92 percentage points on average. This increase will lead to an increase in the loan rate of 54.945 basis points, which represents an increase of 13.15% in the current average lending rate, which is 4.18%. Taking the elasticity of demand for loans to be 0.156, such an increase in lending rates will, in turn, lead to a decrease in the volume of loans provided of about 2% from the current level.

Considering our findings in this section, if we want to objectively assess the legitimacy of the argument that higher capital requirements will considerably reduce the level of loans provided in the EU, we have to take a few facts into account. First, only about 60% of European banks (as regards the number of banks) will be effectively forced to increase their common equity ratios. Second, those banks which will have to do so are expected to reflect this by increasing their loan rates by about 54 basis points, which will lead to a reduction of about 2% in all loans provided in European economies. Third, this process will happen continuously over the next seven years (2013–2019). Consequently, it is reasonable to believe that these relatively small changes in lending rates and loan volume (the decrease in the volume of loans per year, if continuous, will be only 0.25%) can be absorbed painlessly without any significantly negative effects on the economies concerned. Taking into consideration the current worries about the detrimental impacts of higher capital requirements on interest rates and loan volumes expressed by the critics of capital regulation, the magnitude of the impact of the higher capital requirements reported by our study may seem relatively low. Our results correspond to the findings of Elliott (2009), who arrived at very similar results for U.S. banks as we did for EU banks.

4.5 Further Research Opportunities

Despite the findings cited above, there are still several ways in which our research can be improved. Our paper deals mainly with the critics' points of view and verifies in more detail just the potential negative impacts of the new capital rules applicable to normal banks within the European Union. Therefore, for further research, we propose to extend the current analytical scope of this study by (i) taking a closer look at some of the arguments made by the supporters of stricter capital regulation and quantitatively scrutinizing, for example, to what extent these supporters are right when claiming that higher capital requirements reduce the social costs via decreased moral hazard; (ii) comparing the impact of the Basel III rules on lending rates of different types of financial institutions, such as commercial banks, savings banks, credit unions, or mortgage banks; (iii) looking at the capital requirements specific to SIFIs and analyzing the impact of these stricter rules on such banks in more detail; (iv) examining the impacts of the capital requirements separately for more geo-

[8] The point estimates should be viewed within the context of the cumulative statistical significance of the estimated equations, i.e., 99% in the case of all three equations.

graphic areas (the USA, Asia, Australia, and New Zealand) and comparing them in order to give an unrestricted global view of the issue studied.

5. Conclusion

In this paper we focused on practical aspects of the new framework for banking regulation in the European Union as defined by Basel III and CRD IV. Despite the fact that Basel III represents an improvement on the Basel II capital accord, we agree with Lall (2012) and Teplý et al. (2012), who state that the Basel III regulation is not sufficient and will not protect financial markets from future crises due to its expected calibration, its delayed implementation, and strong pressure from banks' lobbyists. In the empirical part we employ a simultaneous equations model where banks choose the optimal level of capital on the principle of a call option. In our modeling, we employ data on 594 banks in the European Union during the 2006–2011 period. The outcomes of our models imply that the critics of the new Basel III capital regulation are right, but only partially. The greatest concern of those who criticize the rule to increase capital levels is the potential detrimental impact on the economies concerned through increased interest rates and a reduced volume of loans provided. Our results, however, do not justify these concerns and predict only a modest drop in loans provided of about 2% from the current level. The drop in loans is not expected to be large because (i) many European banks are already complying with the capital requirements even though they are not fully compulsory yet, (ii) the impact of a one percentage point increase in the common equity ratio should lead to an increase in lending rates of only 18.8 basis points, and (iii) the elasticity of demand for loans in Europe is reported to be relatively low. Moreover, taking into consideration that the implementation period for the new capital requirements will be seven years, the impacts should not be very perceptible for the economies concerned.

APPENDIX

Tests for Endogeneity of Capital in Interest Rate Equations (2) and (3)

Hausman test—testing the significance of residuals from Equation (2) in Equation (3)
H_0: A given variable is exogenous
H_A: A given variable is endogenous

Table A1

Type of Ratio used in an equation	*t*-stat	*p*-value
Interest rate Equation (H_0 = EA is exogenous)	1.13	0.096
Interest Rate Equation (H_0 =Tier 1 is exogenous)	-7.96	0.000
Interest Rate Equation (H_0 = Total capital is exogenous)	0.71	0.477

The magnitudes of the *p*-values indicate endogeneity of the common equity ratio and the Tier 1 ratio at the 10% level of significance.

Tests for Loan Volume Equation (4)

Multicollinearity test for Equation (4):
Variance Inflation Factors
Minimum possible value = 1.0, values > 10.0 may indicate a collinearity problem

Table A2

Variable	VIF
ln r^L	1.074
GDP	1.288
INF	1.219
ln *Assets*	1.050

$VIF(j) = 1/(1 - R(j)^2)$, where $R(j)$ is the multiple correlation coefficient.

Normality test for Equation (4):
Based on the p-value of the normality test (0.00000), the residuals are not normally distributed. However, according to Wooldridge (2009), it is fairly well known that normality plays no role in showing that OLS estimators are the best linear unbiased estimators.

Order Condition for Identification (Necessary Condition)

Equation (2):

$$K/A = \alpha_0 + \alpha_1 \left(\Delta K/A\right)_{t-1} + \alpha_2 \left(K/A\right)_{t-1} \left(\Delta K/A\right)_{t-1} + \alpha_3 r^D + \alpha_4 \left(K/A\right)_{t-1} r^D +$$
$$+ \alpha_5' C_L + \alpha_6' \left(K/A\right)_{t-1} C_L + \alpha_5'' C_D + \alpha_6'' \left(K/A\right)_{t-1} C_D + \alpha_7 \ln Assets + \alpha_8 \ln Assets^2 + \varepsilon_2$$

Number of right-hand-side endogenous variables (g_2) = 0
Number of right-hand-side excluded exogenous variables (k_2) = 3
$k_2 > g_2 \Rightarrow$ Equation (2) is overidentified

Equation (3):

$$r^L = \beta_0 + \beta_1 \left(K/A\right) + \beta_2 r^D + \beta_3 C_L + \beta_4 C_D + \beta_5 r^K + \beta_6 \ln Assets + \beta_7 g + \beta_8 \pi + \varepsilon_3$$

Number of right-hand-side endogenous variables (g_3) = 1
Number of right-hand-side excluded exogenous variables (k_3) = 6
$k_3 > g_3 \Rightarrow$ Equation (3) is overidentified

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