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The Impact of CRD IV on Bank Lending

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Abstract. This study addresses the post-financial crisis EU banking regulation reform CRD IV. The specific focus is on the relationship between increased capital requirements and the subsequent change in both supply and the price of bank credit. This study employs a twofold data consisting of a panel of Finnish unlisted savings and cooperative banks' key figures over the period 2002-2018 and a representative survey conducted with personnel of Finnish institutions. In addition to the consistent finding in regards to the effect of bank profitability as well as fairly consistent findings in regards to the effect of bank size and GDP growth, the key finding suggests a slight decrease in loan supply under the CRD IV.

1. Introduction

The somewhat informal group of regulators and central bankers that had been collaborating prior to the 2008 financial crisis, became more formal after the establishment of the Financial Stability Board (FSB) in 2009. The FSB was handed the responsibility to coordinate the work at the international level and together with the Basel Committee on Banking Supervision (BCBS), they prepared the first draft of the Basel III Rules. The draft was first endorsed by the Group of 20 in November 2010 and then finalized later in December (Howarth & Quaglia, 2016; Walker, 2011). Basel III effectively imposes minimum standards for capital requirements, supervision and market discipline in order to provide "a foundation for a resilient banking system that will help avoid the build-up of systemic vulnerabilities". (Bank of International Settlements, 2017).

The European Union has participated in and advocated the regulatory reform. In consequence, the EU implemented the Basel III framework into the EU legislation through *Capital Requirements Directive* 2013/36/EU and the *Capital Requirements Regulation* (EU) No 575/2013. Together they form a regulatory package known as CRD IV, which replaced the former directives 2006/48/EC and 2006/49/EC. The provisions have applied to institutions since 1 January 2014, though the scheduled implementation phase-in period extends to 2019. As Basel III rules are, in essence, internationally-agreed industry standards, they rather provide a basis on which the EU is building its own regulatory and supervisory infrastructure. Through Single Rulebook, the EU seeks to facilitate banking sector consolidation, increase transparency

and enhance cross-border activity in order to expand financing capabilities and reduce intermediation costs. The European Commission (2016) has depicted deeper integration to be a necessary action to restore market confidence and solve those shortcomings that were first exposed by the financial crisis and then by the subsequent euro area debt problem.

Meanwhile, the EC (2016) has also urged that stability should not come with the price of economic stagnation. Instead, the regulatory objectives need to be achieved in a way that is fully supportive of the ongoing recovery in the EU. The EC further noted that despite technological disruption within the lending business, banks continue to act as the key source of funding for businesses and households. For banks to serve this function, the regulatory environment should in a proportionate manner consider banks' complexity, size, business profile and specificities. In accordance, the purpose of this study is to analyze the impact of the renewed EU capital requirements on bank lending in the context of the Finnish banking sector. The empirical strategy relies on a twofold data, and the specific aim of this study is provided by the following research problems:

1. The relationship between increased capital requirements and the corresponding change in credit supply.

2. The relationship between increased capital requirements and the corresponding change in price of credit.

The paper is structured as follows. The next chapter introduces the main elements of capital requirements under the CRD IV regulation. Datasets and methods are described in more detail in chapter 3. Results are reported and discussed in chapter 4, after which the paper is concluded in chapter 5.

2. The EU capital rules revisited

CRD IV imposes general requirements regarding the quality and the minimum level of capital. As reflected by Table 1, the qualitative approach allocates capital into different layers in order to reflect differences in sustainability, liquidity and predictability between different asset classes. Consequently, the two main components are Tier 1 and Tier 2. The preferred component Tier 1 is further divided into Common Equity Tier 1 (CET1) and an Additional Tier 1 (AT1). The mandatory capital components are supplemented with macroprudential capital buffers, whose implementation depends on certain institution and market environment-related factors.

The second element of the capital framework constitutes of liquidity regulation. The importance was emphasized by the financial crisis during which the acute problem at first was not the insufficient amount of capital, but the increasing uncertainty, which forced banks to become defensive and in consequence, hoard liquidity.

Table 1. A review of the CRD IV capital rules.

Capital Component	Amount, % of Risk-Weighted Assets	Eligible Capital
CET1	4,5 %	Cash, common shares issued by the bank, retained earnings, other comprehensive income and reserves
AT1	1,5 %	Perpetual paid-up capital instruments and their associated share premium accounts. Assets shall not be purchased by the institution nor be subject to any arrangement that enhances the seniority of the claim by the institution or under the instruments in insolvency or liquidation
Tier 1	6 %	
Tier 2	2 %	Capital instruments and subordinated loans and share premium accounts. Tier 2 instruments are issued, or the subordinated loans are raised and fully paid-up, but not purchased nor funded either directly or indirectly by the institution. The claim must be wholly subordinated to the claims of all non-subordinated creditors, and should not be secured or subject to a guarantee that enhances the seniority of its claim
Total	8 %	
Additional Capital Buffers		
Capital Conservation Buffer	2,5 %	CET1 Capital
Countercyclical Capital Buffer*	0-2,5 %	CET1 Capital
G-SII Buffer**	1-3,5 %	CET1 Capital
O-SII Buffer***	0-2 %	CET1 Capital
Systemic Risk Buffer****	0-5 %	CET1 Capital

Notes. *Implemented by National Authority based on (excessive) aggregate credit growth, **Mandatory buffer for banks that are identified by the relevant authority as globally systemically important institutions, ***Optional buffer on "other" systemically important institutions: either domestically important or EU important institutions, ****Member State may introduce a Systemic Risk Buffer for the sector or one or more subsets of the sector, in order to prevent and mitigate systemic or macro-prudential risks. The buffer may exceed 5 % should circumstances call for it.

As a result, banks found themselves unable to honor their obligations in frozen interbank markets. In order to cope with the situation, banks engaged in coincidental fire sales of non-liquid assets, which generated a steep fall in asset prices (Aldasoro et al., 2017; Berrospide, 2013). To address the witnessed shortfalls, the EU adopted two specific measures to correspond with the Basel work. First, BSCS introduced Liquidity Coverage Ratio, which aims to provide protection against severe short-term liquidity shocks. Accordingly, banks are now required to hold *High Quality Liquidity Assets*[1] ("HQLA") against anticipated net outgoing cash flows over a 30-day severe stress period. The ratio shall equal to or exceed 100 % in any given

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[1] The category HQLA includes assets that enjoy sufficient trading volume, low volatility, transparent pricing and post-trade information, and are not correlated with high-risk asset classes.

time. The second tool, Net Stable Funding Ratio, has a time horizon of one year. As banks are exposed to funding liquidity risk arising from their funding structures and the maturity mismatch in their balance sheet, NSFR targets to secure a more sustainable long-term maturity structure of assets and liabilities (Gobat et al., 2014). The NSFR is calculated as a ratio of available stable funding (ASF) against the amount of required stable funding (RSF). The ASF is defined as the portion of capital and liabilities expected to be reliable over the target time horizon. The amount of RSF is a function of liquidity characteristics and residual maturities of the various assets held by the institution.

Thirdly, the BCBS introduced a completely new non-risk based leverage constraint to complement the remaining risk-based capital framework. BCBS (2014) concluded that the underlying cause for the meltdown had been the build-up of excessive on- and off-balance sheet leverage in the banking system. Following the adoption, the binding 3 % Leverage Ratio (LR) became fully applicable in the EU in January 2018. In accordance with the BCBS proposal, LR is calculated as the amount of CET1 capital against bank's all non-risk weighted assets. Indeed, this contradicts other capital provisions, as LR does not consider any risk weights or risk models. Furthermore, banks are expected to meet the requirement *in addition* to their risk-based capital requirements.

3. Data and methods

3.1. Key financial figures

We estimate the effect of several bank-specific and macroeconomic factors on banks' annual loan growth by employing a panel data of Finnish unlisted savings and cooperative banks' key figures over the period 2002-2018. The specific interest is on the regulation dummy variable "CRD IV", which takes on the value of 0 for period 2002-2013 and 1 otherwise. Although CRD IV is an encompassing regulation, this study applies it solely as a proxy for "increased capital requirements". The dependent variable "Loan growth" is the annual logarithmic change of banks' total loans to the public (excluding loans to other institutions). Hence, the econometric part of this study is solely focused on the first research problem.

While the macroeconomic data was retrieved from Statistics Finland (Tilastokeskus), the bank key figure data was obtained from the Finnish Financial Supervisory Authority's (Finanssivalvonta) website. In total, 339 unique bank identifiers exist in the dataset, though only 188 of them are identified and measured *each* year (17 times). Hence, while 38 savings banks and 279 cooperative banks existed in 2002, the corresponding numbers in 2018 totaled at "just" 23 and 182 banks, respectively. Namely, the change in individual bank's status occurs in two primary ways: either the bank is acquired by another bank, which absorbs the business and proceeds as a larger entity, *or* it joins a merger of equals, where a new bank is established after two or more banks come together and cease to exist as separate, independent entities. A dummy variable "Consolidation" is used to control acquiring bank's consolidated figures in order to avoid spurious jumps following the acquisition.

Table 2. Variables and descriptive statistics.

	Obs.	Mean	Standard deviation	Min	Max	Description
Dependent variable						
Loan growth	4,361	.06788	.08083	-.2653	1.7481	Annual change in bank lending
Independent variables						
Consolidation				0	1	A dummy to capture jumps in acquiring bank's figures after an absorption
CRD IV				0	1	Bank regulation dummy: 0 = 2002-2013, 1 = 2014-2018
GDP growth rate	4,700	1.3530	3.0626	-8.3	5.2	Annual percentage change
Interest rate	4,700	1.6300	1.5540	-.329	4.644	3 month Euribor, annual average of the daily values
Household indebtedness	4,700	106.98	17.157	72.1	128.6	Annual
Total assets	4,700	198494.7	421470.7	4008	1.01e+07	A proxy for size
Off-balance sheet items/assets	4,700	4.7969	2.1002	.31371	18.258	A proxy for off-balance sheet activity, % of total assets
Equity/assets	4,700	12.088	4.2965	.33770	29.742	Equity capital, % of total assets
Return on assets	4,698	1.0753	.6413	-5.1868	6.5713	Operating income (pre-tax), % of total assets
Cost/income ratio	4,700	63.108	15.814	10.405	518.8	A proxy for efficiency

Note. The descriptive statistics do not take into account the panel data structure. That is, the means and standard deviations have been calculated across all banks in all years.

Table 2 presents the variables and descriptive statistics.

We estimate the following baseline model:

$$\Delta y_{it} = \alpha_0 + X'_{i,t-1}\beta + X'_{t-1}\gamma + W'_{it}\zeta + \mu_{it} \qquad [1]$$

where Xs include the once-lagged bank-specific and macroeconomic explanatory variables, W is the set of dummy variables and μ is the error term. All bank-specific variables are in natural logarithms.

3.2. Survey

The second part of the study tackles both research problems. The data is based on the relevant parts of a bank survey conducted in 2016 with personnel of Finnish institutions. Respondents included business area directors, risk officers and in one case, a chief executive officer. They represented commercial, cooperative and savings banks as well as one credit institution. Three bank groups are involved in both datasets.

The survey consists of four thematic parts and a total of 27 individual items. First, the respondents were asked to examine the change in loan terms for different lending scenarios. This study interprets the expression "loan term" as a proxy for loan supply. Further, the second and third question sets considered changes in both supply and the price of credit. Lastly, the respondents were asked to assess the importance of different factors on the recent development of their profitability.

Although the survey is near fully representative of the Finnish banking sector in terms of aggregate capital and market value, the small N (= 7) provides the analysis is entirely qualitative. Secondly, respondents' answers shall not be considered an accurate and objective reflection of the banks' actual strategic behavior. Rather, the answers are suggested to reflect personal, subjective views on issues brought up in the survey. Thus, the paper only reports descriptive statistics, including the median, mode and the range of the numerical values assigned to different answer options. Results are discussed together with and analyzed against the findings from prior studies.

4. Results

4.1. Key financial figures

At first, a naïve pooled OLS estimator is employed. Results are reported in Table 3. Since the acquisition of another bank is expected to increase the value of acquirer's loan portfolio, it is fairly unsurprising that the dummy variable Consolidation enters positive and statistically highly significant in each specification. Interestingly though, the results suggest a negative relationship between bank size (proxied by total assets) and loan growth. The regulation dummy CRD IV enters negative and statistically significant, suggesting a decrease in bank lending under the renewed regulatory environment. Although this result does not necessarily contradict the European Central Bank (2016), it is nevertheless noteworthy that the ECB noted a shift among euro area banks from investment banking, wholesale lending and lending in higher-risk sectors towards retail businesses, as CRD IV has made riskier business activities costlier.

Table 3. OLS estimations.

	I	II	III	IV	V
Consolidation	.07202***	.07342***	.08054***	.08017***	.07999***
	(.01405)	(.01400)	(.01423)	(.01413)	(.01432)
CRD IV	-.04720***	-.0355***	-.01289**	-.00802	-.01415**
	(.00297)	(.00387)	(.00443)	(.00458)	(.00510)
GDP growth rate, t-1		.00193***	.00098**	.00083*	.00073*
		(.00034)	(.00034)	(.00034)	(.00035)
Interest rate, t-1		.00410***	.00176	.00221*	-.00048
		(.00101)	(.00101)	(.00101)	(.00118)
Household indebtedness, t-1			-.0012***	-.0012***	-.00107***
			(.00008)	(.00008)	(.00009)
Total assets, t-1			-.00081	-.00478**	-.00633***
			(.00143)	(.00170)	(.00161)
Off-balance sheet items/assets, t-1				.02018***	.01792***
				(.00432)	(.00386)
Equity/assets, t-1				.00382	-.00645
				(.00441)	(.00445)
Return on assets, t-1					.01012*
					(.00397)
Cost/income ratio, t-1					-.00535
					(.01053)
Constant	.07538***	.06252***	.20321***	.20948***	.26425***
	(.00124)	(.00253)	(.01678)	(.02262)	(.05533)
Model diagnostics					
No. of obs.	4361	4361	4361	4361	4308
R-squared	0.0860	0.0974	0.1382	0.1471	0.1518
F	140.41***	100.90***	111.01***	86.89***	84.88***
Root MSE	.0773	.07683	.0751	.07473	.07332

Note. *, **, *** significant at the 5 %, 1 % and 0,1 % level, respectively. Clustered robust standard errors reported in the parentheses.

The results capture a negative and statistically highly significant coefficient of household indebtedness. However, solely based on these results alone, it is difficult to estimate to what degree this effect is related to supply and to what degree to demand side of bank lending. For other macroeconomic factors, the lagged GDP growth rate intuitively presents a positive effect on loan growth. This result is consistent, for instance, with Aiyar et al. (2016), Meriläinen (2016) and Berrospide and Edge (2010). On the contrary, the three-month Euribor interest rate does not reveal any unambiguous effect.

Table 4. Fixed effects estimations.

	I	II	III	IV	V
Consolidation	.09460***	.09658***	.16903***	.16248***	.15968***
	(.01926)	(.01899)	(.02893)	(.02966)	(.02978)
CRD IV	-.05094***	-.0395***	.00128	.00290	-.00238
	(.00308)	(.00394)	(.00513)	(.00563)	(.00605)
GDP growth rate, t-1		.00190***	.00080*	.00052	.00047
		(.00034)	(.00032)	(.00033)	(.00033)
Interest rate, t-1		.00428***	-.00183	-.00066	-.00265*
		(.00104)	(.00115)	(.00118)	(.00130)
Household indebtedness, t-1			.00096**	.00070*	.00072*
			(.00034)	(.00035)	(.00036)
Total assets, t-1			-.1954***	-.1836***	-.1732***
			(.02988)	(.03016)	(.02949)
Off-balance sheet items/assets, t-1				.02442***	.02208***
				(.00532)	(.00488)
Equity/assets, t-1				.02604	.01139
				(.01384)	(.01263)
Return on assets, t-1					.00797*
					(.00392)
Cost/income ratio, t-1					-.00416
					(.01043)
Constant	.07489***	.06183***	2.1897***	1.9816***	1.9245***
	(.00137)	(.00273)	(.30497)	(.31511)	(.31501)
Model diagnostics					
No. of obs.	4361	4361	4361	4361	4308
R-squared (overall)	0.0846	0.0959	0.0039	0.0052	0.0069
F	140.28***	95.65***	88.72***	67.99***	65.16***

Note. *, **, *** significant at the 5 %, 1 % and 0,1 % level, respectively. Clustered robust standard errors reported in the parentheses.

For the rest of bank-specific determinants, we confirm the findings by Bustamante et al. (2019) and Berrospide and Edge (2010) who find that more profitable banks tend to grant more credit. Meanwhile, the equity/assets ratio or the banks' operational efficiency (cost/income ratio) do not exhibit any consistent effects. Interestingly, the off-balance sheet activity (items as a percentage of total assets) enters positive and statistically highly significant in both specifications. Since the variable is once-lagged, one possible explanation is that customers draw on their lines of credit, converting the previously unused commitments into on-balance sheet loans, thus increasing the value of outstanding loans at t_n. However, this study unfortunately suffers from the lack of more detailed data on individual items within the total value of off-balance sheet exposures.

Next, we estimate the baseline model with a panel fixed effects estimator, which sweeps out the bank-specific heterogeneity by subtracting the cross-sectional mean from each observation. Results are reported in Table 4.

The regulation dummy variable CRD IV again suggests a negative effect on loan growth but does not remain statistically significant across the board. Interestingly, the household indebtedness flips the sign in fixed effects estimations. As concluded earlier, it is difficult to assess whether these findings, taken together, indicate an increase in demand or a decrease in supply since we should also expect banks to avoid granting more loans to already indebted customers. This severe problem with identifying causal impact between the internal and external balance sheet shocks and the corresponding change in credit supply is discussed in Peydro (2010) and Lambertini and Mukherjee (2016), who point out to the endogeneity bias between credit demand and credit supply.

On the contrary, the dummy variable Consolidation, bank size, off-balance sheet activity or profitability do not flip signs across estimations. The captured coefficient for bank size is consistent with Fungáčová et al. (2014). Similarly, in Accornero et al. (2017), bank size enters negatively when bank fixed effects are included in the estimation. According to their interpretation, those banks that have grown "too big" are relatively less willing to extend new credit. On the other hand, Cambacorta (2005) concludes the effect of bank size to be irrelevant on loan supply.

4.2. Survey

A rather rich research body is devoted to the relationship between capital requirements and the supply and price of bank credit. Starting with credit supply, De Jonghey et al. (2016) provide evidence on higher capital requirements corresponding with lower credit supply to corporations. In a similar vein, Bridges et al. (2014) capture a relationship between increased capital requirements and a corresponding decrease in lending to private non-financial corporations. Aiyar et al. (2014) conclude that U.K. banks to reduce lending in response to tighter capital requirements (1 percentage point increase in capital requirements reduced credit growth by 6.5-7.2 percentage points). Mesonnier and Monks (2015) estimate a 1 percentage point increase in Core Tier 1 ratio to be associated with a 1.2 percentage point reduction in credit growth. Similarly, the results by Noss and Toffano (2016) suggest a decrease in lending subsequent to an increase in aggregate bank capital requirement, but that the effect is larger in corporate lending vis-à-vis to the household lending.

In consequence, the bank lending capacity is of particular concern in the case of small and medium-sized enterprises, as they are typically the main contributors for economic growth and employment (European Banking Authority, 2012). Although capital requirements do not have the objective to affect credit supply *per se*, the increased capital requirements may nevertheless have indirect effects on lending, should raising capital become (too) costly (De Jonghey et al., 2016). In this vein, the survey first asked the respondents to assess whether their loan terms had tightened during the current decade. Secondly, respondents were asked to assess the magnitude of regulatory reform's direct impact on their loan terms. The results are reported in

Table 5. The impact of renewed regulation on loan terms.

		Loan portfolio as a whole	Loans for SMEs	Loans for large enterprises	Loans for households / personal loans	Short-term loans	Long-term loans	Loan portfolio as a whole	Loans for SMEs	Loans for large enterprises	Loans for households / personal loans	Short-term loans	Long-term loans
N	Valid	7	6	5	7	6	6	6	5	4	6	5	5
	Missing	0	1	2	0	1	1	1	2	3	1	2	2
Median		3	3	3	3	3	3	3,50	3	3,50	3	3	4
Mode		3	3	3	3	3	3	4	3	3ª	3	3	4
Range		2	2	2	2	2	3	2	1	1	3	1	1
Minimum		2	2	2	2	2	2	2	3	3	2	3	3
Maximum		4	4	4	4	4	5	4	4	4	5	4	4

Note. a. Multiple modes exist. The smallest value is shown. At first, respondents were presented the following statement: "Our loan terms have tightened notably during the current decade in the following cases". For the latter part, the statement was: "The direct impact of regulation on our loan terms has been notable in the following cases". Answers were coded as 1 = "Strongly disagree", 2 = "Disagree", 3 = "Neutral", 4 = "Agree", 5 = "Strongly agree".

Table 5. Accordingly, in case of both SME and large enterprise lending, the respondents were collectively neutral to slightly at one with the stance according to which the renewed regulation has had a notable impact on their loan terms. Identical, consistent agreement is captured for both short- and long-term loans (last two items):

Due to the potential endogeneity bias discussed earlier, the respondents were asked to assess the impact of different factors on the possible change in their credit supply for the past three years. The answers are rather diversified without any clear consistency. Hence, the previously voiced problems in regards to isolating the true regulatory effect are emphasized by the results reported in Table 6.

Thirdly, the respondents were asked to estimate the impact of increased capital requirements on the price of credit in different lending scenarios. For instance, Kisin and Manela (2016) estimated a 0.3 basis points increase in lending rates subsequent to a 1 percentage point increase in capital requirements. King (2010) concluded a 1 percentage point increase in capital requirements and a corresponding 15 basis points increase in lending rates. Consistent results are found in Corbae and D'Erasmo (2014), De Resende et al. (2010) and Hanson et al. (2011), although the latter ones propose the effect to be relatively small. In a similar vein, the responses shown in Table 7 are somewhat indicative of the linkage between capital requirements and the price of borrowing, though in a lesser extent in the case of personal and household loans.

Table 6. Impact of different factors on the possible change in credit supply.

		Changes in demand side	Capital requirements under the renewed regulation	Changes in supply side
N	Valid	7	7	7
	Missing	0	0	0
Median		3	3	3
Mode		3a	3	2
Range		4	3	3
Minimum		1	2	2
	Maximum	5	5	5

Note. a. Multiple modes exist. Respondents were asked if "in the last three years, our lending volume has been negatively affected by the following reasons". Answers were coded as 1 = "Strongly disagree", 2 = "Disagree", 3 = "Neutral", 4 = "Agree", 5 = "Strongly agree".

Thirdly, the respondents were asked to estimate the impact of increased capital requirements on the price of credit in different lending scenarios. For instance, Kisin and Manela (2016) estimated a 0.3 basis points increase in lending rates subsequent to a 1 percentage point increase in capital requirements. King (2010) concluded a 1 percentage point increase in capital requirements and a corresponding 15 basis points increase in lending rates. Consistent results are found in Corbae and D'Erasmo (2014), De Resende et al. (2010) and Hanson et al. (2011), although the latter ones propose the effect to be relatively small. In a similar vein, the responses shown in Table 7 are somewhat indicative of the linkage between capital requirements and the price of borrowing, though in a lesser extent in the case of personal and household loans.

The commencement of the CRD IV, as well as this survey, coincided with somewhat weak macroeconomic and financial market conditions in Finland and the EU. Hence, in a further attempt to isolate the impact of different factors on banks' business environment, the respondents were asked to assess several influences from the perspective of their profitability. As reflected by Table 8, the respondents were particularly consistent regarding the negative impact of the low interest rate environment. Interestingly, in the case of loan supply, the earlier econometric findings suggested that the effect of the three-month Euribor rate was somewhat nonexistent.

Table 7. The impact of renewed regulation on the price of credit in different lending scenarios.

		Loans to SMEs	Loans to large enterprises	Loans to households / personal loans	Short-term loans	Long-term loans
N	Valid	6	6	7	6	6
	Missing	1	1	0	1	1
Median		4	4	4	4	4
Mode		4	4	4	4	4
Range		2	2	3	2	2
Minimum		3	3	2	3	3
Maximum		5	5	5	5	5

Note. Respondents were presented with a claim according to which "capital requirements have increased the cost of borrowing in the following cases". 1 = "Strongly disagree", 2 = "Disagree", 3 = "Neutral", 4 = "Agree", 5 = "Strongly agree".

Table 8. The assessment of different factors affecting banks' business environment.

		Economic development of households	Economic development of firms	Economic development of public sector	Developed or acquired product, technology or service-related innovations	Changing regulatory environment	Change in competitors' market share	Changes in most important reference rates
N	Valid	6	6	6	6	6	6	6
	Missing	0	0	0	0	0	0	0
Median		4	3,50	3	3,50	2	3	2
Mode		4	2[a]	3	3[a]	2	3	2
Range		3	3	2	5	2	2	1
Minimum		2	2	2	0	1	2	1
Maximum		5	5	4	5	3	4	2

Note. a. Multiple modes exist. The smallest value is shown. Respondents were asked to assess the impact each specified factor has had on the bank's profitability in the current decade. Answers were coded as 1 = "Highly negatively", 2 = "Somewhat negatively", 3 = "Neutral", 4 = "Somewhat positively", 5 = "Highly positively".

5. Discussion

This study contributed to the literature on bank capital requirements in two ways. After controlling for several bank-specific and macroeconomic factors with panel data, the key result indicated a slightly negative relationship between increased capital requirements (proxied by the CRD IV regulation dummy variable) and the Finnish unlisted savings and cooperative banks' credit supply. The study also captured consistent results in regards to the positive impact of both GDP growth and bank profitability on credit supply as well as somewhat consistent results in regards to the negative relationship between bank size and loan growth. In addition, the findings suggested that an increase in off-balance sheet items corresponds to an increase in credit supply. According to one possible explanation, the customers draw on their lines of credit, which converts the previously unused commitments into on-balance sheet loans in the subsequent period.

Secondly, this study conducted a representative survey with personnel of the Finnish institutions. The results suggested that the renewed EU banking regulation has had a slight direct impact on banks' corporate loan terms (for both SMEs and large enterprises), which was used as a proxy for credit supply. Further, the respondents were collectively neutral to slightly at one with a claim according to which the increased capital requirements have increased the price of credit for SMEs and large enterprises. However, direct conclusions are avoided in this regards. The survey, in particular, suffered from certain and in some cases, quite severe limitations. On the other hand, the survey also revealed other factors that have affected the banking business as a whole and lending in particular.

Clearly, neither these nor prior findings implicate a regulatory failure. As noted earlier, the direct objective of the capital rules is not to influence the supply or the price of credit *per se*. Rather, the current regulatory ambition is to increase systemic stability and address those shortcomings that led to the 2008 meltdown. Nevertheless, the regulation still has an important role in capital and risk decisions (Tanda, 2015). Since banks react to external shocks by adjusting their business models, the policy analysis should always focus on second-order (and potentially counterproductive) effects. While some evidence suggests that higher capital requirements reduce excessive risk-taking (Repullo, 2004) and that higher capital requirements correspond with a more resilient banking sector (Basten and Koch, 2015), the truly relevant question is whether regulation generates *unintentional* incentives to raise overall risk exposure (Adrian et al., 2015; Adrian and Shin, 2014; Blum, 1999), or incentives to shift towards shadow banking or off-balance sheet activities (Goodhart, 2008; Martin and Parigi, 2013; Plantin, 2015) or incentives to engage in regulatory arbitrage, that is, exporting the risk-taking to countries where regulation is less stringent (Ongena et al., 2013).

References

Accornero, M., Alessandri, P., Carpinelli, L., & Sorrentino, A.M. (2017). *Non-performing loans and the supply of bank credit: evidence from Italy* (Banca D'Italia Occasional Papers No. 374). Retrieved from: https://www.bancaditalia.it/pubblicazioni/qef/2017-0374/index.html?com.dotmarketing.htmlpage.language=1. Doi: https://doi.org/10.2139/ssrn.2954995

Adrian, T., Friedman, E., & Muir, T. (2015). *The Cost of Capital of the Financial Sector.* Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2706614. Doi: https://doi.org/10.2139/ssrn.2706614

Adrian, T., & Shin, H.S. (2014). Procyclical Leverage and Value-at-Risk. *The Review of Financial Studies 27(2)*, 373-403. Doi: https://doi.org/10.1093/rfs/hht068

Aiyar, S., Calomiris, C.W., & Wieladek, T. (2016). How does credit supply respond to monetary policy and bank minimum capital requirements? *European Economic Review Vol. 82*, 142-165. Doi: https://doi.org/10.1016/j.euroecorev.2015.07.021

Aiyar, S., Calomiris, C.W., & Wieladek, T. (2014). Does Macro-Prudential Regulation Leak? Evidence from a UK Policy Experiment. *Journal of Money, Credit and Banking 46(1)*, 181-214. Doi: https://doi.org/10.1111/jmcb.12086

Aldasoro, I., Delli Gatti, D., & Faia, E. (2017). Bank Networks: Contagion, Systemic Risk and Prudential Policy. *Journal of Economic Behavior & Organization Vol. 142*, 164-188. Doi: https://doi.org/10.1016/j.jebo.2017.05.022

Basel Committee on Banking Supervision (2017). High-Level Summary of Basel III Reforms. Retrieved from https://www.bis.org/bcbs/publ/d424_hlsummary.pdf

Basel Committee on Banking Supervision (2014). *Basel III Leverage Ratio Framework and Disclosure Requirements.* Retrieved from https://www.bis.org/publ/bcbs270.pdf

Basten, C., & Koch, C. (2015). Higher Bank Capital Requirements and Mortgage Pricing: Evidence from the Countercyclical Capital Buffer (CCB). *BIS Working Papers, 511.* Retrieved from: https://www.bis.org/publ/work511.htm. Doi: https://doi.org/10.2139/ssrn.2473622

Berrospide, J.M. (2013). Bank Liquidity Hoarding and the Financial Crisis: An Empirical Evaluation. *FEDS Working Papers, 2013-03.* Retrieved from: https://www.federalreserve.gov/pubs/feds/2013/201303/201303abs.html. Doi: https://doi.org/10.17016/FEDS.2013.03

Berrospide, J.M., & Edge, R.M. (2010). The Effects of Bank Capital on Lending: What Do We Know, and What Does it Mean? *International Journal of Central Banking 6(4),* 5-54. Doi: https://doi.org/10.2139/ssrn.1670506

Blum, J. (1999). Do Capital Adequacy Requirements Reduce Risks in Banking? *Journal of Banking & Finance 23(5),* 755-771. Doi: https://doi.org/10.1016/S0378-4266(98)00113-7

Bridges, J., Gregory, D., Nielsen, M., Pezzini, S., Radia, A., & Spaltro, M. (2014). The Impact of Capital Requirements on Bank Lending. *Bank of England Working Paper, 486.* Retrieved from: https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2014/the-impact-of-capital-requirements-on-bank-lending. Doi: https://doi.org/10.2139/ssrn.2388773

Bustamante, J., Cuba, W., & Nivin, R. (2019). Determinants of credit growth and the bank lending channel in Peru: a loan level analysis. *BIS Working Paper, 803.* Retrieved from: https://www.bis.org/publ/work803.htm.

Cambacorta, L. (2005). Inside the bank lending channel. *European Economic Review, 49 (7),* 1737-1759. Doi: https://doi.org/10.1016/j.euroecorev.2004.05.004

Corbae, P.D., & D'Erasmo, P. (2014). Capital Requirements in a Quantitative Model of Banking Industry Dynamics. *FRP of Philadelphia Working Paper, 14-13.* Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2430778. Doi: https://doi.org/10.21799/frbp.wp.2014.13

De Jonghey, O., Dewachter, H., & Ongenax, S. (2016). Bank Capital (Requirements) and Credit Supply: Evidence from Pillar 2 Decisions. *National Bank of Belgium Working Paper Research, 303.* Retrieved from: https://econpapers.repec.org/paper/nbbreswpp/201610-303.htm

De Resende, C., Dib, A., & Perevalov, N. (2010). The Macroeconomic Implications of Changes

in Bank Capital and Liquidity Requirements in Canada: Insights from the BoC-GEM-FIN. *Bank of Canada Discussion Paper, 16.* Retrieved from: https://www.bankofcanada.ca/wp-content/uploads/2010/12/dp10-16.pdf

European Central Bank (2016). *Recent Trends in Euro Area Banks' Business Models and Implications for Banking Sector Stability.* Retrieved from: https://www.ecb.europa.eu/pub/pdf/other/sfcfinancialstabilityreview201605.en.pdf

European Banking Authority (2012). *Assessment of SME Proposals for CRD IV/CRR.* Retrieved from: https://www.eba.europa.eu/documents/10180/16148/EBA-SME-Report.pdf

European Commission (2016). *Frequently Asked Questions: Capital Requirements (CRR/CRD IV) and Resolution Framework (BRRD/SRM) Amendments.* Retrieved from: http://europa.eu/rapid/press-release_MEMO-16-3840_en.htm

Fungáčová, Z., Solanko, L., & Weill, L. (2014). Does competition influence the bank lending channel in the euro area? *Journal of Banking & Finance 49*, 356-366. Doi: https://doi.org/10.1016/j.jbankfin.2014.06.018

Gobat, J., Yanase, M., & Maloney, J. (2014). The Net Stable Funding Ratio: Impact and Issues for Consideration. *IMF Working Paper No. 14/106.* Retrieved from: https://www.imf.org/external/pubs/ft/wp/2014/wp14106.pdf. Doi: https://doi.org/10.5089/9781498346498.001

Hanson, S.G., Kashyap, A.K., & Stein, J.C. (2011). A Macroprudential Approach to Financial Regulation. *Journal of Economic Perspectives 25(1),* 3-28. Doi: https://doi.org/10.1257/jep.25.1.3

Howarth, D., & Quaglia, L. (2016). *The Political Economy of European Banking Union.* Oxford, United Kingdom: Oxford University Press. Doi: https://doi.org/10.1093/acprof:oso/9780198727927.001.0001

King, M. (2010). Mapping Capital and Liquidity Requirements to Bank Lending Spreads. *BIS Working Paperr, 324.* Retrieved from: https://www.bis.org/publ/work324.htm. Doi: https://doi.org/10.2139/ssrn.1716884

Kisin, R., & Manela, A. (2016). The Shadow Cost of Bank Capital Requirements. *The Review of Financial Studies 29(7),* 1780–1820. Doi: https://doi.org/10.1093/rfs/hhw022

Lambertini, L., & Mukherjee, A. (2016). Is Bank Capital Regulation Costly for Firms? – Evidence from Syndicated Loans. *The École Polytechnique Fédérale de Lausanne Working Paper.* Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwjR87HK9bzeAhVwsosKHRYpA60QFjAAegQIARAC&url=https%3A%2F%2Fwww.aeaweb.org%2Fconference%2F2017%2Fpreliminary%2Fpaper%2F5TTRkzND&usg=AOvVaw0zZce25aLguKOy4M31L41

Martin, A., & Parigi, B.M. (2013). Bank Capital Regulation and Structured Finance. *Journal of Money, Credit and Banking 45(1),* 87-119. Doi: https://doi.org/10.1111/j.1538-4616.2012.00563.x

Meriläinen, J-M. (2016). Lending growth during the financial crisis and the sovereign debt crisis: The role of bank ownership type. *Journal of International Financial Markets, Institutions and Money, 41,* 168-182. Doi: https://doi.org/10.1016/j.intfin.2015.12.011

Mesonnier, J-S., & Monks, A. (2015). Did the EBA Capital Exercise cause a Credit Crunch in the Euro Area? *International Journal of Central Banking 11(3),* 75-117. Doi: https://doi.org/10.2139/ssrn.2451019

Noss, J., & Toffano, P. (2016). Estimating the Impact of Changes in Aggregate Bank Capital Requirements on Lending and Growth during an Upswing. *Journal of Banking & Finance, 62,* 15-27. Doi: https://doi.org/10.1016/j.jbankfin.2015.09.020

Ongena, S., Popov, A., & Udell, G.F. (2013). "When the Cat's Away the Mice Will Play": Does Regulation at Home Affect Bank Risk-Taking Abroad*? Journal of Financial Economics 108(3),* 727-750. Doi: https://doi.org/10.1016/j.jfineco.2013.01.006

Peydro, J-L. (2010). Discussion of The Effects of Bank Capital on Lending: What Do We Know, and What Does It Mean? *International Journal of Central Banking 6(4),* 55-69. Doi: https://doi.org/10.17016/FEDS.2010.44

Plantin, G. (2015). Shadow Banking and Bank Capital Regulation. *The Review of Financial Studies 28(1),* 146-175. Doi: https://doi.org/10.1093/rfs/hhu055

Repullo, R. (2004). Capital Requirements, Market Power, and Risk-taking in Banking. *Journal of Financial Intermediation 13(2),* 156-182. Doi: https://doi.org/10.1016/j.jfi.2003.08.005

Tanda, A. (2015). The Effects of Bank Regulation on the Relationship between Capital and Risk. *Comparative Economics Studies 57(1),* 31-54. Doi: https://doi.org/10.1057/ces.2014.35

Walker, G.A. (2011). Basel III Market and Regulatory Compromise. *Journal of Banking Regulation 12(2),* 95-99. Doi: https://doi.org/10.1057/jbr.2011.4