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Leverage Ratio and its Potential For Enhancing the Effectiveness of Capital Regulation

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Abstract: The article deals with the procyclical development of risk weights and hence the risk-weighted capital ratio. The leverage ratio should be included in the regulatory reform package (CRR2) as a (non-risk-weighted) prudential backstop. The article defines the complementary relationship of capital and leverage by describing their different responses to the cyclical development associated with the change in the quality of assets in the various phases of the financial cycle. The results of the panel regression on a sample of selected countries illustrate: (i) that the banking sectors with lower capital adequacy relatively more increased the capital ratio in the period of financial stress and more often changed the structure of the assets into less risky assets for the improvement of the capital ratio, with a negative impact on profit; (ii) significantly lower pro-cyclicality of the leverage ratio than the capital ratio.

Keywords: macroprudential policy, leverage ratio, capital requirements

JEL Classification: G2, G18, G21

Introduction

The financial crisis of 2008 revealed the deficiencies in regulatory capital divided by risk weighted assets, respectively indicated the inadequate capability of its denominator in the form of risk weighted assets to reflect the development of the systemic risks (Aikman et al., 2014; Vallascas and Hagendorff, 2013). After the recent financial crisis, the development of the banking sector was accompanied by significant reform efforts. An important element of the new Basel III regulatory framework is strengthening of the total level and quality of capital. Especially in this respect, the risk weighted capital requirement was broadened by the macroprudential capital buffers whose objective is to increase the loss absorption capacity of the banks during a stable period coupled with a low level of systemic risk.

The Basel Committee on Banking Supervision continues to review the capital framework and part of this process is review of the approaches to the management of risk weights and the introduction of a requirement for the leverage ratio (Tier 1 capital overexposure) as a complement to the existing requirement for capital ratio (ESRB, 2015; Pfeifer et al., 2017). Brei and Gambacorta (2016) state that the leverage ratio is more countercyclical capital regulation instrument as compared to the capital ratio because it does not take the risk weights into consideration. This is also reflected in the conclusions of Gambacorta and Sudipto (2016), who demonstrate that the leverage ratio is a tight constraint during a boom and a soft constraint in a bust.

The article discusses the potential of the leverage ratio to reduce the risks associated with the procyclical development of risk weights and its impact on the efficiency of macro-prudential policy. In the first part, the article describes the procyclical development of risk weights and beyond the existing researches (Brei and Gambacorta, 2016), also the impact of the cycle on the individual variables, which subsequently impact the development of the capital and leverage ratio. In the second part on the panel of countries divided according to various risk characteristics, it reviews the impact of the individual variables on the capital and leverage ratio on the data between 2007 and 2015. Besides availability of data, the given period was also selected because Brei and Gambacorta (2016) demonstrate that the development of the capital and leverage ratio is more procyclical in the contraction phase as compared to the cycle expansion phase.

1. Capital ratio and procyclical development of risk weights

Within the framework of Basel II, a new approach to the management of credit risk was conceptually based on internal rating (IRB approach), which according to many authors increased procyclical character of capital regulation (Jimenez and Saurina, 2006). Based on the IRB approach, banks determine risk weights according to internal models based mainly on the probability of default (PD) and loss given default (LGD). Banks should set the values of these parameters on the basis of the through-the-cycle approach. However, it differs in terms of the cycle duration, which the banks include in the model. According to the CRR, it should be at least 5 to 7 years. In the event that a given type of exposure in the considered period was not prone to a statistically significant number of defaults (or loss given defaults), the modelled PD and LGD parameters may be undervalued. This naturally also results in the undervaluation of the level of risk weights (or the risks of the given portfolio). On the contrary, in a time of prolonged recession when exposures fail to a larger extent, the PD will rather be overvalued as compared to the long-term average, and for this reason the level of the risk weights shall also be overvalued as compared to the long-term average.[1]

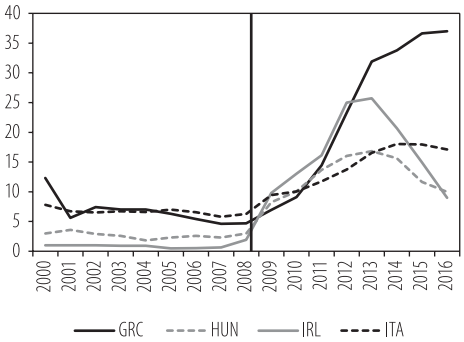
It can generally be stated that procyclicality of the IRB approach is increased by inclusion of a shorter cycle length (through-the-cycle method) in a situation where the amplitude of the financial cycle is longer in the given economy. Borio (2014) document that the average duration of financial cycles that peaked after 1998 is nearly 20 years. For this reason, during a prolonged boom the IRB approach indicates lower credit risks (or risk weights) and in a period of prolonged recession, on the contrary has a tendency to indicate their higher growth. In course of the financial cycle, the risk weights are impacted by the changing quality of the assets (growth and decline of non-performing loans - NPL), especially through the PD parameter[2] (described in detail in diagrams 1 and 2). The following graph illustrates the situation in selected European banking sectors, where there was a significant deterioration in the quality of assets (increase of NPL) for various reasons after the outbreak of the Great Recession. It is possible to deduce from the pre-crisis development of NPL that in the case of validity of the IRB ap-

[1] The changing quality of assets during the financial cycle also impacts the risk weights determined by means of the STA approach (through the impact of the cycle on rating and the security level) through a change in the asset structure. The cycle impact is however more significant in the case of the IRB approach.

[2] For simplicity, we abstract from the impact of the changing quality of assets on LGD, which may deepen below described cyclical factor of the development of risk weights.

proach[3] the level of the model parameter of PD as well as the risk weights would be low even in case of application of the through-the-cycle method because the period of a relatively low ratio of non-performing loans would be at least seven years. The model would thus not be capable of capturing credit risk, which would materialise after outbreak of the Great Recession.

Figure 1: Development of NPL during the cycle in selected European economies



Source: Worldbank, Global Financial Development

Note: The vertical black line represents the beginning of the Great Recession.

Behn et al. (2016), for instance, criticise the IRB approach. They arrived at the conclusion that for the bank portfolios, which changed to the calculation of the RW using the IRB approach, the PD and risk weights were substantially lower than that applied to the portfolios where the use of the STA approach continued. However, this did not match the failure rates of these portfolios. Using data from EBA stress tests Montes et al. (2017) demonstrate the significant difference in the use of the IRB approach of European banks. Ferri and Pesic (2016) for that matter state that regulatory arbitration takes place through the manipulation of internal models. The article further describes the inherent procyclicality of the IRB approach and its impact on the prudential capital regulation.

1.1. Cyclical factor of the development of risk weights during the financial boom

As a variable illustrating the financial cycle phase, we chose the proportion of non-performing loans (NPLs) to total loans. Figure 1 describes the financial boom, its effect on the NPL and subsequently other variables that impact capital requirements of banks. During financial boom, the NPL ratio declines. This is due to a decline in the absolute level of NPLs and also the growing dynamism of newly provided loans. At the same time, the risk rises because the level of losses (costs) associated with the impairment of loans is declining while the absolute

[3] The implementation of IRB in European banks did not start until sometime in 2006.

level of interest income is simultaneously rising (Albertazzi and Gambacorta, 2009). A bank either distributes the entire profit in the form of dividends or uses a part of profit to raise its capital. In this period, however, it is by no means motivated to increase capital through the capital ratio requirement. With a decline of NPLs, the probability of default (PD) also declines, and the cyclic factor thus applies pressure on a decline of risk weights and, under otherwise similar conditions, also on a rise in the capital ratio.[4] Given the same absolute level of bank capital, the capital surplus may rise. Regulation through the capital ratio may thus be "relatively less prudent" due to the impact of the procyclical development of risk weights. It is important to point out that it is actually in this period that accumulation of systemic risks usually occurs. This may result in lower resistance to the materialisation of risks during a period of financial stress. For this reason, macroprudential policy[5] should become stricter during the financial boom, which is accompanied by growth in the cyclic element of systemic risk. The countercyclical capital buffer is usually used for these purposes. By its implementation or increase, the risk weighted regulatory capital requirement also increases in percentage terms, and hence resulting in tightening of capital regulation. Under certain assumptions, the declining risk weights may however increase the capital surplus to such an extent that it exceeds the countercyclical capital buffer rate and the bank thus need not be compelled to respond to macroprudential tightening of capital regulation. Changes at the level of the countercyclical capital buffer, however, in this case fulfil the function of retention of the capital, which would otherwise be distributed in the form of dividends.

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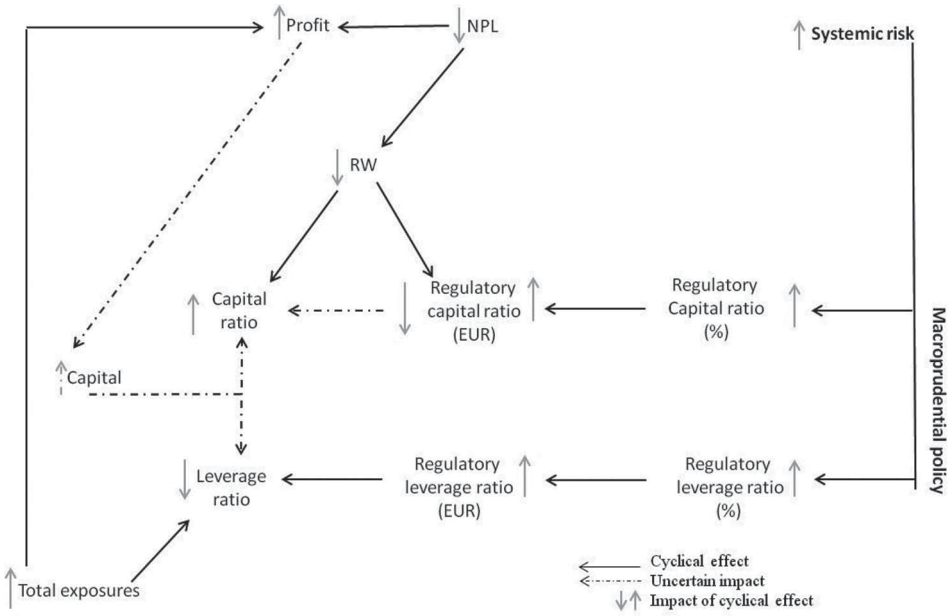
[4] The final impact on the capital ratio impacts the specific decline in the NPL (or the risk weights) and asset growth rate

[5] The aim of macroprudential policy is thus to mitigate procyclicality of behaviour of financial institutions (Dumičić, 2017). Based on econometric analysis, Shijaku (2017) suggests that sufficient bank capital plays the main role in bank sector stability over the economic cycle. Instability of banks might be further deepened by problems with liquidity (Abdul-Rahman et al., 2017).

Figure 2: The cyclical factor of the development of the capital regulation instruments during the financial boom and efficiency of macro prudence policy



Source: Compiled by authors

Financial boom is generally associated with growth of total exposures, i.e. the denominators of the leverage ratio. For this reason, the leverage ratio level should rather decline due to the impact of the cyclic factors. The requirement for a minimal leverage ratio could thus lead to the fact that banks are likely to increase the absolute capital volume during the financial boom.

Some voices recommend the introduction of the macroprudential character of the leverage ratio (see ESRB, 2015). In the event that a bank is restricted by the microprudential leverage ratio and its CARW[6] remains above the level of the average risk weight even after increase of the CCyB, then an increase in the rate practically has no impact on the bank (for details, see Pfeifer et al., 2017). Table 1 illustrates an example where even an increase in CCyB from 0 % to 2.5% need not practically impact the bank's capital requirement. At the same time, it illustrates the impact that this increase would have in case of activation of the macropru-

[6] The CARW is the average risk weight at which the bank is equally constrained by the capital and leverage ratio, or at which the bank must maintain the same capital requirement to comply with both tools (see Pfeifer et al. 2017).

dential leverage ratio. While upon application of only the microprudential leverage ratio, the rise in the CCyB in the given case would not lead to an increase in the absolute size of capital, in case of activation of the micro-prudential leverage ratio it would entail the need to raise the capital. This instrument of microprudent policy thus ensures the real increase in capital in a situation of very low or declining risk weights.

Table 1: Efficiency of CCyB in reduction of the leverage ratio

	%	CZK
Minimum capital ratio (MCR)	8,5	21,3
MCR + CR countercyclical buffer	11,0	27,5
Microprudential leverage ratio (MLR)	3,0	30,0
MLR + LR countercyclical buffer	3,9	39,0
Total exposures		1000
RWA		250

Source: Compiled by authors

It is suitable to state that the procyclical character of risk weights in the case of banks that apply the IRB approach need not necessarily be manifested in their decline during a financial boom. Besides the cyclic factor, the development of the total risk weights is also impacted by the structural factor, i.e. the changing structure of assets. During a financial boom, banks have more investment opportunities and the ratio of loans to assets grows at the expense of assets with lower risk weights (government bonds, receivables from institutions), whose loans to assets ratio is usually higher during a period of financial stress. Under certain conditions, the asset structure factor can thus lead to an increase in the aggregate risk weights during the financial boom, whereas the cyclic factor leads to the opposite, i.e. to their decline. Both factors are always present, and it subsequently depends on their intensity, which decides whether the total risk weights will decline or increase.[7]

1.2. The cyclical factor of RW development during financial stress

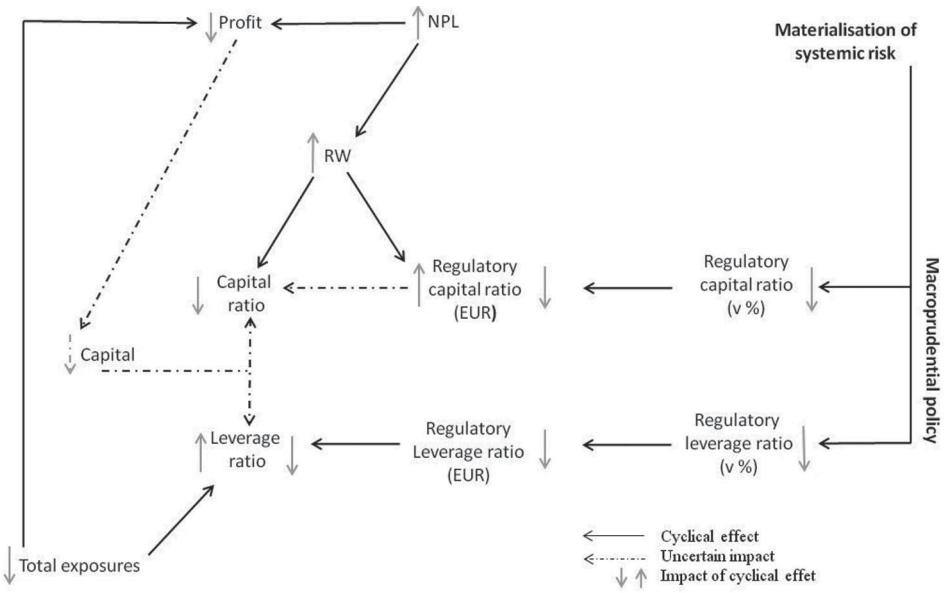
The quality of the credit portfolio deteriorates during financial stress and the NPL ratio rises; its absolute level rises while the dynamic growth of new loans simultaneously declines. Their volume may also decline. The declining interest income and rising impairment costs reduce the profit. In a case where the profit

[7] The article discusses only the impact of the cyclic factor.

after-tax drops below zero, a bank must use capital to absorb credit losses. NPL growth increases PD and in the case of the IRB banks it results in growth of risk weights (see diagram 2).[8]

During a period of financial stress, the cyclic factor increases the denominator of the capital ratio and thus reduces the capital ratio of the bank. The capital requirement in money terms increases with growth in risk weighted assets and any capital surplus thus declines while the capital level remains unchanged. Thus under certain conditions, the cyclic development of risk weights may cause the "tightening of capital regulation" during a period of materialisation of credit risk. If risk weights substantially increase due to deterioration of the quality of assets, banks with a small capital surplus ratio above the regulatory requirement may have a problem with top-up of capital. It is also for this reason that the macroprudential authority has the power to lower the CCyB up to zero immediately.

Figure 3: Cyclic factor of the development of capital regulation instruments during contraction of the financial cycle



Source: Compiled by authors

[8] The structural factor just like during the financial boom period acts on the contrary; it increases the ratio of lower risk assets and the total risk weight thus declines.

The leverage ratio does not drop during the period of financial stress because stagnation or even decline of assets usually occurs in this phase. Capital regulation thus does not tighten further, on the contrary, any decline in the exposures leads to a rise in the leverage ratio. If the CCyB would be tied to the macroprudential leverage ratio, dissolution of this reserve would also result in a decline of the leverage ratio requirement, and hence lead to a rise in its surplus[9]. Therefore, leverage ratio is a tight constraint during a boom and a soft constraint in a bust (Gambacorta and Sudipto, 2016).

2. Empirical part

First, the model of the capital ratio response to cyclical factors was estimated. The model of the capital ratio reaction with the level constant α capturing the specific fixed or random effect of individual influences, the delayed value of the capital ratio and the vector of the other variables X affecting the capital ratio has the form:

$$Capital\ ratio_{i,t} = \alpha_i + \beta\ Capital\ ratio_{i,t-1} + \gamma\ X_{i,t} + \varepsilon_{i,t};\ t=1, ..., T,\ i=1, ..., N \qquad (1)$$

The capital ratio is equity on risk-weighted assets. To remove the autocorrelation of residuals, the delayed value of the response variable was included into the model. Among explanatory variables are the leverage ratio as the ratio of Tier 1 capital to total exposures,[10] the ratio of non-performing loans to total loans, the return on assets, and the ratio of risk-weighted assets to total assets. In all cases, aggregate indicators of the entire banking sector in a particular country are used.

Data are downloaded from the Financial Soudness Indicators database of the International Monetary Fund for 14 countries with the longest time series. Data are available with a quarterly periodicity most frequently starting from 2007 (by country) until the end of 2015. Countries are divided into groups according to generally below-average and above-average values of each of monitored variables, see Table 2. List of examined countries consist of Portugal (PT), Greece (GR), Australia (AU), Cyprus (CY), Poland (PL), Canada (CA), Malta (MT), Netherlands (NL), Czech Republic (CZ), Lithuania (LT), Singapore (SG), Turkey (TR), Croatia (HR) and Estonia (EE).

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[9] Difference between the leverage ratio and regulatory requirement.

[10] Given the unavailability of Basel Committee methodology (2010) data, we replaced total exposures with total assets in the denominator and abstract from the off-balance sheet.

Table 2: Classification countries into groups according to the values of individual financial indicators (in %)

Order	Capital ratio		Leverage ratio		Non-performing loans / total loans		Return on assets		Risk weighted assets / total assets	
	Country	Value	Country	Value	Country	Value	Country	Value	Country	Value
1.	pt	11,41	nl	4,52	ca	0,81	gr	-0,40	nl	34,69
2.	gr	11,90	ca	4,65	sg	1,19	cy	-0,30	ca	38,22
3.	au	12,04	au	6,10	au	1,68	pt	0,02	ee	45,67
4.	cy	12,70	cz	6,76	nl	2,81	nl	0,33	au	46,97
5.	pl	14,12	pt	6,77	tr	3,22	lt	0,55	cz	47,15
6.	ca	14,39	gr	6,95	ee	3,27	hr	0,92	mt	52,39
7.	mt	15,10	cy	7,20	pl	4,61	ca	1,02	cy	57,18
8.	nl	15,15	mt	7,32	cz	5,11	pl	1,08	pt	59,95
9.	cz	15,39	pl	8,57	mt	7,59	au	1,14	sg	61,09
10.	lt	16,57	sg	8,60	pt	8,91	cz	1,30	gr	61,73
11.	sg	16,59	ee	9,82	hr	12,52	mt	1,31	pl	66,35
12.	tr	17,22	lt	10,70	lt	15,22	sg	1,34	lt	67,24
13.	hr	19,56	tr	11,75	cy	19,52	ee	1,55	hr	70,55
14.	ee	23,40	hr	13,81	gr	20,29	tr	2,45	tr	82,43

Source: International Monetary Fund

All indicators for each group of banks were differentiated by a simple difference from the previous quarter in percentage points to ensure time series stationarity. All series are sesionally adjusted. Stationary variability tests for input variables are shown in Table 3. The presence of the unit root has not been proved for any of variables.

Table 3: Fischer unit root ADF test

Group of countries by: / Variable		Capital ratio	Leverage ratio	Non-performing loans / total loans	Quick liquid assets / current liabilities	Return on assets	Risk weighted assets / total assets
Capital ratio	High	24,6598*	31,9256**	51,7354***	35,3117***	32,2235***	35,3117***
	Low	38,7301***	32,2692***	27,6899***	47,1383***	19,6399*	21,5574**
Leverage ratio	High	22,5795**	25,4750**	27,2867***	24,9609**	23,1772**	27,3802***
	Low	24,1244*	44,4295***	43,3788***	41,6675***	32,1579***	27,3645**
Non-performing loans/ total loans	High	38,5086***	19,5812*	26,8663***	26,4386***	32,4113***	32,1698***
	Low	25,5925*	44,6135***	41,6307***	38,2758***	38,4720***	32,1018***
Return on assets	High	24,4330**	39,4496***	25,0476**	31,9006***	36,6478***	29,7931***
	Low	40,7006***	24,7451**	43,4494***	32,8137***	37,3290***	37,5655***
Risk weighted assets / total assets	High	29,5640***	35,8704***	29,9221***	32,1832***	23,4236***	31,3158***
	Low	35,1695***	28,3243**	38,5749***	32,5312***	28,4398**	34,5391***

Notes: Fischer ADF is augmented Fischer Dickey-Fuller statistic used for panel data under the null of unit root. *, **, *** denote rejection of the null at 10%, 5% and 1% level of significance, respectively.

The regression model of panel data is applied using the generalized least squares method, taking into account the individual effects within the model. In order to choose between the use of fixed or random effects, the Hausman test under the null hypothesis on the non-correlation of individual influences with each of the explanatory variables was used. Rejection of the null hypothesis suggests inconsistency of random effects, while fixed effects are consistent. Rejection of the null suggests the consistency of random and fixed estimators, so results may not vary significantly. In this case, however, it is preferable to use a random effect model that provides more complete and effective information.

The model estimates in Table 4 show that the increase in asset profitability has a negative impact on the capital ratio in countries with above-average values of the monitored variables and a slightly positive impact on low leverage countries. This can be explained by the fact that the banking sectors with a high capital surplus do not need to raise capital through a profit, which is prefered to divide into dividends. It can be assumed that the dividend payment incentive instead of equity increase was evident during the expansion of the financial cycle prior to 2008. This is one of the reasons for introduction of macro-prudential policy that increases the capital requirement through a countercyclical capital buffer during the economic boom period. And thus banks with insufficient capital surplus have to use part of the profit to raise capital.

Banking sectors with sufficient capital surplus do not need to raise capital further and therefore the development of their capital ratio is influenced especially by the changing risk weights of the loan portfolio. Rising risk weights implicitly reduce the capital ratio in sufficiently capitalized banking sectors. The significant impact of the risk weights on the capital ratio is for the same reason also evident for the banking sectors showing further signs of stability, such as a low portion of loans in default, a low level of risk weights and a high level of return on assets. By contrast, lower-capital banking sectors had to raise the level of capital during the contraction of the financial cycle and therefore the impact of the increase in risk weights was not so significant.

In the case of banking sectors with a high level of risk weights and a share of non-performing loans, growth of risk weights leads to an increase in the capital ratio. Because of their instability, banks are forced to raise capital faster than the level of risk increases. The leverage ratio has always had a positive effect on the capital ratio with respect to the same numerator.

Increase of fast liquid assets influences the growth of the capital ratio highly positively for banking sectors with low capital adequacy and high profitability. This can be explained by the fact that the contraction phase of the financial cycle prevailed over the period which, due to deteriorating asset quality, pushed for a drop in the capital ratio. Thus banks limited their lending activity and allocated a portion of their resources to less risky assets. That led to risk weights decline, which had a positive impact on the capital ratio. This was used by less capital-equipped banks, which needed to increase the capital ratio. Increasing the capital ratio by changing the structure of assets toward lower risk exposures could be afforded rather by banks with higher profitability as this is associated with a fall in profit, which confirm the model estimates in Table 4.

Table 4: Determinants of capital ratio in the groups of countries

Dependent variable: Capital ratio										
Banks sorted by:	Capital ratio		Leverage ratio		Non-performing loans / total loans		Return on assets		Risk-weighted assets/total assets	
Individual effects	High random	Low fixed	High fixed	Low fixed	High fixed	Low random	High random	Low fixed	High fixed	Low random
Non-performing loans/ total loans	0,064	-0,001	0,097	0,001	0,039	-0,046	-0,103	0,040	0,100	0,007
	[0,049]	[0,020]	[0,063]	[0,026]	[0,023]*	[0,173]	[0,187]	[0,022]*	[0,037]***	[0,034]
Quick liquid assets/ current liabilities	-0,006	0,026	0,006	0,017	0,000	0,016	0,061	-0,001	-0,008	0,047
	[0,012]	[0,009]***	[0,041]	[0,007]**	[0,011]	[0,015]	[0,028]**	[0,009]	[0,008]	[0,016]
Return on assets	-0,690	0,094	-0,691	0,126	0,021	-0,888	-0,930	0,027	0,007	-0,756
	[0,108]***	[0,063]	[0,138]***	[0,069]*	[0,073]	[0,147]***	[0,016]***	[0,069]	[0,063]	[0,143]***
Risk-weighted assets/ total assets	-0,203	-0,011	-0,225	-0,037	0,001	-0,110	-0,098	-0,005	0,008	-0,095
	[0,024] ***	[0,012]	[0,035] ***	[0,015]***	[0,016]	[0,021]***	[0,023]***	[0,015]	[0,013]	[0,023]**
Leverage ratio	1,182	1,434	1,182	1,314	1,194	1,199	1,219	1,210	1,170	1,729
	[0,160]***	[0,105]***	[0,217]***	[0,108]***	[0,125]***	[0,213]***	[0,225]***	[0,118]***	[0,107]***	[0,175]***
Capital ratio (-1)	0,521	0,150	0,512	0,215	0,271	0,567	0,559	0,283	0,287	0,531
	[0,045]***	[0,045]***	[0,055]***	[0,051]***	[0,052]***	[0,048]***	[0,051]***	[0,049]***	[0,043]***	[0,053]***
Contries	8	6	6	8	6	8	7	7	7	7
Observations	192	144	140	187	144	192	168	168	168	168
Adj, R-squared	0,72***	0,84***	0,70***	0,70***	0,78***	0,67***	0,68***	0,76***	0,80***	0,68***
D-W stat	1,62	1,83	1,62	1,79	1,53	1,75	1,74	1,49	1,99	1,80
Hausman test	9,49	n/a	n/a	11,90	n/a	3,36	2,29	11,89**	16,17*	5,68

Notes: Values in the brackets show Standard Error of Mean, which measure the dispersion of the arithmetic mean of the file. *, **, *** denote rejection of the null of zero coefficients at 10 %, 5 % and 1 % level of significance, respectively.

Equivalent to the previous outcomes, the model of the leverage ratio response to the cyclic factors was estimated. The model of the leverage ratio response with the level constant α, capturing the specific fixed or random effect of individual influences, the delayed leverage ratio and the vector of other variables X affecting the leverage ratio, has the form:

$$Laverage\ ratio_{i,t} = \alpha_i + \beta\ Laverage\ ratio_{i,t-1} + \gamma\ X_{i,t} + \varepsilon_{i,t};\ t=1, ..., T,\ i=1, ..., N \qquad (2)$$

To remove the autocorrelation of residuals, the delayed value of the explanatory variable was included into the model. Other explanatory variables included the capital, the ratio of non-performing loans to total loans, return on assets, and the risk-weighted assets ratio on total assets, i.e. the same variables as in the capital ratio model.

Table 4 illustrates the complementary character of the leverage ratio in relation to the capital ratio given by the mostly opposite direction of the individual explanatory variables. The reason is different response of the numerator of both ratios to the development of the financial cycle, as described in Part 1. While the cyclical factor pushes to the decline in risk weights and hence risk-weighted assets during the financial boom period, total exposures respond rather to decrease (Figure 1). During financial stress, it is the opposite (Figure 3). Unlike the capital ratio, the impact of increase in risk weights on the leverage ratio is predominantly positive for unstable banking sectors with low capital, a high share of non-performing loans and low profitability. The low performance banking sectors are forced to raise capital more in the contraction of the financial cycle. On the contrary, in the banking sectors with above-standard values of these indicators, only a small increase in capital in response to the growth of risk weights is in line with the capital ratio responses (Table 3). This results in a more pronounced worsening of the capital ratio and a lower increase or even decrease in the leverage ratio.

The increase in the share of non-performing loans causes the leverage ratio to growth mainly for banking sectors with below-average values of indicators that are forced to refill capital in response to unfavorable development. Growth of asset profitability leads to an increase of leverage ratio in better capital-equipped banking sectors, and to a decline in the case of poorly capital-equipped ones. Capital-strong banks can cover a decline in profitability by equity, while capital-poor banking sectors are forced to refill capital stock. This is related to the conclusions of Albertazzi and Marchetti (2010) who examined that banks with a higher capital surplus were not forced to reduce credit supply substatially in times of financial stress. The high share of credit to assets, together with rising risk margins, increases the profitability of banks and, concurrently, leads to a rise in risk-weighted assets, which implies drop in the capital ratio (Table 4). Banks partly correct this decline by raising capital, resulting in a moderate increase of leverage ratio (Table 5). Banking sectors with a low capital surplus are forced to reduce the proportion of risk assets during financial stress, which is associated with the allocation of a larger amount of capital. Limiting the proportion of risk assets results in a fall in profit, a fall in risk weights, and a rise in the capital ratio. This is also evident from the capital ratio response to the fast liquid assets growth in Table 4.

Table 5: Determinants of leverage ratio in the groups of countries

Dependent variable: Leverage ratio										
Banks sorted by:	Capital ratio		Leverage ratio		Non-performing loans / total loans		Return on assets		Risk-weighted assets / total assets	
Individual effects	High fixed	Low fixed	High fixed	Low random	High fixed	Low random	High random	Low random	High random	Low random
Non-performing loans / total loans	-0,001	0,032	0,005	0,012	0,022	0,028	0,042	0,017	-0,017	0,039
	[0,014]	[0,010]***	[0,019]	[0,009]	[0,011]*	[0,042]	[0,044]	[0,009]*	[0,014]	[0,011]***
Quick liquid assets / current liabilities	0,001	-0,009	-0,001	-0,001	0,004	-0,005	-0,013	0,003	0,005	-0,003
	[0,004]	[0,005]*	[0,012]	[0,003]	[0,005]	[0,004]	[0,007]*	[0,003]	[0,003]	[0,005]
Return on assets	0,107	-0,055	0,065	-0,060	-0,026	-0,006	0,001	-0,016	0,016	0,123
	[0,033]**	[0,032]*	[0,043]	[0,031]*	[0,035]	[0,039]	[0,041]	[0,032]	[0,030]	[0,049]**
Risk-weighted assets / total assets	0,014	0,039	0,014	0,052	0,055	-0,002	-0,003	0,055	0,039	0,064
	[0,008]*	[0,005]***	[0,011]	[0,006]***	[0,006]***	[0,005]	[0,006]	[0,006]***	[0,005]***	[0,007]***
Capital ratio	0,056	0,373	0,050	0,291	0,274	0,039	0,040	0,276	0,304	0,148
	[0,016]***	[0,028]***	[0,019]**	[0,024]***	[0,031]***	[0,014]***	[0,015]***	[0,025]***	[0,024]***	[0,017]***
Leverage ratio (-1)	0,685	0,140	0,626	0,249	0,239	0,617	0,635	0,257	0,249	0,346
	[0,053]***	[0,042]***	[0,069]***	[0,043]***	[0,047]***	[0,054]***	[0,057]***	[0,042]***	[0,039]***	[0,068]***
Countries	8	6	6	8	6	8	7	7	7	7
Observations	192	144	140	187	144	192	168	168	168	168
Adj, R-squared	0,66***	0,88***	0,66***	0,77***	0,84***	0,54***	0,56***	0,83***	0,83***	0,74***
D-W stat.	1,63	1,43	1,69	1,46	1,09	1,63	1,65	1,05	1,75	1,39
Hausman test	10,91*	n/a	n/a	8,98	n/a	10,27	9,38	9,43	9,81	6,82

Notes: Values in the brackets show Standard Error of Mean, which measure the dispersion of the arithmetic mean of the file. *, **, *** denote rejection of the null of zero coefficients at 10 %, 5 % and 1 % level of significance, respectively.

Conclusion

The Great Recession highlighted the lack of ability of capital ratio to reflect the development of systemic risk in some banking sectors. The follow-up reform efforts, including introduction of macroprudential policy, might have identified and limited weaknesses in capital regulation. With the entry into force of the regulatory reform package (CRR2), a leverage ratio will be introduced. It differs from the capital ratio, in particular by the numerator, where the volume of total exposures is indicated instead of the risk-weighted assets. While risk weights (under the IRB approach) decline during a financial boom due to asset quality improvements (declining NPLs), the volume of exposures tends to grow during

this period. The development of the leverage ratio is therefore far less procyclical or even countercyclical.

Fall in risk weights during the financial boom increases the capital ratio and bank can thus hold a relatively lower level of capital to meet the capital requirement. In the period of financial stress, on the contrary, risk weights with rising non-performing loans grow significantly and the capital ratio decreases. The results of panel regression show that the capital ratio of banking sectors with above-average values of monitored indicators (more stable banking sectors), especially with high capital surplus, is influenced mainly by the development of risk weights: negatively in times of financial stress and vice versa. Banking sectors with lower capital adequacy must offset decline in the capital ratio due to deteriorating asset quality by reducing risk-weighted assets by shifting the exposure structure towards less risky assets. This is often associated with a reduction in credit activity with a negative impact on profit.

The countercyclical capital buffer should limit these negative effects to pressures on the capital ratio during financial stress. Banks will be able to dissolve the capital reserve created during the boom in the period of financial stress and use it to maintain and smooth credit activity. The leverage ratio should reduce the risks associated with the low level of capital due to a significant fall in risk weights and an increase the banks' resilience to less likely but highly correlated losses. The application of the macroprudential leverage ratio would further significantly increase the countercyclicality of capital regulation.

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