



Munich Personal RePEc Archive

# **Interdependencies between Leverage and Capital Ratios in the Banking Sector of the Czech Republic**

Janda, Karel and Kravtsov, Oleg

Charles University, University of Economics, Prague

11 October 2016

Online at <https://mpra.ub.uni-muenchen.de/74457/>

MPRA Paper No. 74457, posted 11 Oct 2016 14:06 UTC

# Interdependencies between Leverage and Capital Ratios in the Banking Sector of the Czech Republic<sup>#</sup>

*Karel Janda\* – Oleg Kravtsov\*\**

## 1 Introduction

It is widely believed that one of the causes of the latest financial crisis was the excessive build-up of the on and off-balance sheet leverage in the banking system. In some cases, the banks accumulated excessive leverage while evidently maintaining strong risk-based capital ratios BCBS (2014a). To address this issue and enhance the banks' resilience to crisis, the Basel Committee in 2010 introduced a minimum leverage ratio as an additional prudential tool to complement minimum capital adequacy requirements. The leverage ratio is defined as a Tier 1 capital divided by on and off-balance sheet exposure. The leverage ratio should be disclosed in the public reports of financial institutions from 1st of January 2015 onwards and fully implemented at the start of 2018 after appropriate review and calibration.

In our paper we discuss the implications of leverage and capital requirements for the banking sector in the Czech Republic. We identify the potential binding constraints from regulatory limits and analyze the interactions among ratios over the country's economic cycle (during the period 2007-2014). The following questions are of primary focus of our analysis. Which regulatory ratio in the Basel III regime (i.e. Tier 1 capital ratio, capital adequacy or leverage ratio) represents a main binding constraint in the country's banking sector during the crisis and recovery periods (over the years 2007 to 2014)? What degree of correlation exists between leverage and capital ratio, and their variables over the economic cycle (2007-2014)?

---

<sup>#</sup> This project has received funding from the European Union's Horizon 2020 Research and Innovation Staff Exchange programme under the Marie Skłodowska-Curie grant agreement No 681228. We also acknowledge support from the Czech Science Foundation (grant 15-00036S) and from University of Economics, Prague (institutional support IP100040). Karel Janda acknowledges research support provided during his long-term visits at Australian National University and McGill University. The views expressed in the paper are those of the authors and not necessarily those of our institutions.

\* Karel Janda, Department of Banking and Insurance, University of Economics, Prague, W. Churchill 4, 13067 Praha 3, Czech Republic and Institute of Economic Studies, Charles University, Opletalova 26, 11000 Praha 1, Czech Republic, [Karel-Janda@seznam.cz](mailto:Karel-Janda@seznam.cz)

\*\* Oleg Kravtsov, Department of Finance & Accounting, University of Economics in Prague, [krao02@vse.cz](mailto:krao02@vse.cz)

What leverage and capital ratios can say about the behavior and strategy of the banks in the Czech Republic?

In the debate about financial market regulations and their impact on the economies Musílek (2011), Teplý, Šobotníková and Černohorský (2011) in their works are dealing with the challenges of the Basel III guidelines for the EU and Czech banking sector. The banking regulations and systematic risk in financial market systems are investigated by Klinger and Teplý (2016) with special focus on the capital regulations in studies of Avery and Berger (1991), Gropp and Heider (2009), Estrella, Park and Peristiani (2000). Notably few studies are focusing on the implications caused by interactions among regulatory ratios for example between capital and leverage ratios as risk and non-risk based measures. In the analysis by Adrian and Shin (2008;2010), Kalemli-Ozcan, Sorensen and Yesiltas (2011), Brei and Gambacorta (2014), the cyclical properties of the ratios are tested taking into account structural shifts in banks' behavior during the global financial crisis and its aftermath. They suggest that in normal times the new leverage ratio based on the exposure measure is always more countercyclical than the other ratios. In contrast to capital ratios, it is a tighter constraint for banks in economy upturn and a looser constraint in recession. Nuno and Thomas (2013) argue that bank's leverage is endogenously determined by market forces. They found that leverage contributes at least as much as equity to the cyclical movements in total assets and leverage is negatively correlated with equity. Apparently it is positively correlated with assets growth and to a lesser extent with GDP. The impact of capital on bank survival during financial crises and normal times is examined by Berger and Bouwman (2013). Mainly focusing on the economic roles of capital depending on bank size and time period they indicate that the capital helps to enhance the survival probabilities of small banks at all times and for medium/large banks primarily during the banking crises and with limited government support. They note similarly that the off-balance sheet activities of banks are impacting the capital and consequently survivability of banks over the crisis.

The effectiveness of the Basel Accords as a regulatory framework and its implications on the Czech banking sector were investigated by Šútorová and Teplý (2013; 2014) or Teplý and Vejdovec (2012). In country specific case study, Kellermann and Schlag (2013) examine the binding constraint factors of ratios on the Swiss banking sector. From their analysis it is evident that the minimum leverage ratio shows a strong tendency to undermine the risk-based requirements. Since at least during the period 2009 to 2011 the minimum leverage ratio requirement became a binding rule for the major Swiss bank UBS. Furthermore, they pointed

out that this fact might adversely encourage banks to take greater risks. Cathcart, El-Jahel and Jabbour (2013) investigate the interdependencies and pro-cyclical nature of capital and leverage ratios of the US banking institutions prior to the first 1990-1991 and the second credit crunch of 2007-2009. Their results demonstrate that unlike during the first credit crunch, the leverage ratio during the crisis of 2007-2009 was a binding constraint and generally more to blame for triggering the subprime crisis. Furthermore, they argue that the reversal in correlation patterns between the two ratios was a main reason of the change in binding constraint. The correlation patterns of the ratios are seemingly related to loan growth and GDP market signals.

## 2 Leverage Ratio under the Basel III

The Basel III leverage ratio (LR) is defined as the capital measure (the numerator) divided by the exposure measure (the denominator), with this ratio expressed as a percentage

$$LR = \frac{K_t}{Exp_t} \quad (1)$$

Where  $K_t$  - denotes a Tier 1 capital and  $Exp_t$  - the exposure measure, at the end of reporting period  $t$

The capital measure represents the numerator of the leverage ratio and is based on the new definition of Tier 1 class of capital as set out by Basel Committee BCBS (2011). Under Basel III, the Tier 1 capital includes: the common equity Tier 1 (CET1) and the additional Tier 1. CET1 refers to loss-absorbing equity capital of the highest quality and consists of paid-in capital, disclosed reserves and retained earnings. The exposure represents the denominator of the leverage ratio. The exposure measure in definition of the Basel Committee on Banking Supervision BCBS (2014a,b) is the sum of the following exposures: on-balance sheet exposures; derivative exposures; securities financing transaction exposures and off-balance sheet items. During the transition period from January 1, 2013 to January 1, 2017, Basel Committee will test a minimum Tier 1 leverage ratio  $> 3\%$ . The disclosure requirements of the ratio and its components at the bank level started on January 1, 2015.

### 3 Data

The data sample comprises of data of the main banking institutions and subsidiaries of international banks which operate in the Czech Republic on standalone basis and provide a standard range of banking services, i.e. units in the sample are comparable. It consists of 15 main Czech banks and covers the period of 8 years from 2007 to 2014 that refers to the full economic cycle with financial crisis, aftermath and recovery. The financial data has been extracted directly from the annual reports of the financial institutions to provide the best possible estimates of banks' exposure measures for the leverage ratio calculation according to the Basel III definition. In the data sample, two small size banks did not report all data over the period, since they were established at later period (e.g. Airbank established in 2010).

**Tab. 1: Statistics Summary**

Variable	Obs	Mean	Std Dev	Min	Max
Leverage Ratio (%)	111	8.3	6.2	1.9	43.6
Capital Ratio Tier 1 (%)	110	18.6	22.6	7.4	211.6
Exposure (CZKm)	113	279,041	360,007	331	1,167,064
Tier 1 capital (CZKm)	112	17,814	20,713	80	76,164
Risk Weighted Assets (CZKm)	110	133,386	151,282	284.2	503,360
Total Assets (CZKm)	115	245,222	323,855	331	968,723

Source: Annual financial reports (own calculation)

### 4 Binding Constrains from Capital and Leverage Ratios over the Cycle

By introducing a leverage ratio the Basel Committee pursued several goals. The minimum leverage provides a simple and transparent accounting measure that serves as a non-risk based „backstop“ which ultimately serves to protect against model risk, and the reduction of capital requirements and generally it reinforces risk based requirements BCBS (2014a). It captures both the on-and off balance sheet exposure which in fact could bear significant risks due to the complex and not fully transparent derivative and guarantees exposures. Finally the primary goal of leverage is to constraint a build-up of excessive leverage in banking system during the times of credit boom and help to soften the deleveraging processes in downturn economy cycle. These cyclical qualities of the leverage and capital ratios have been indicated

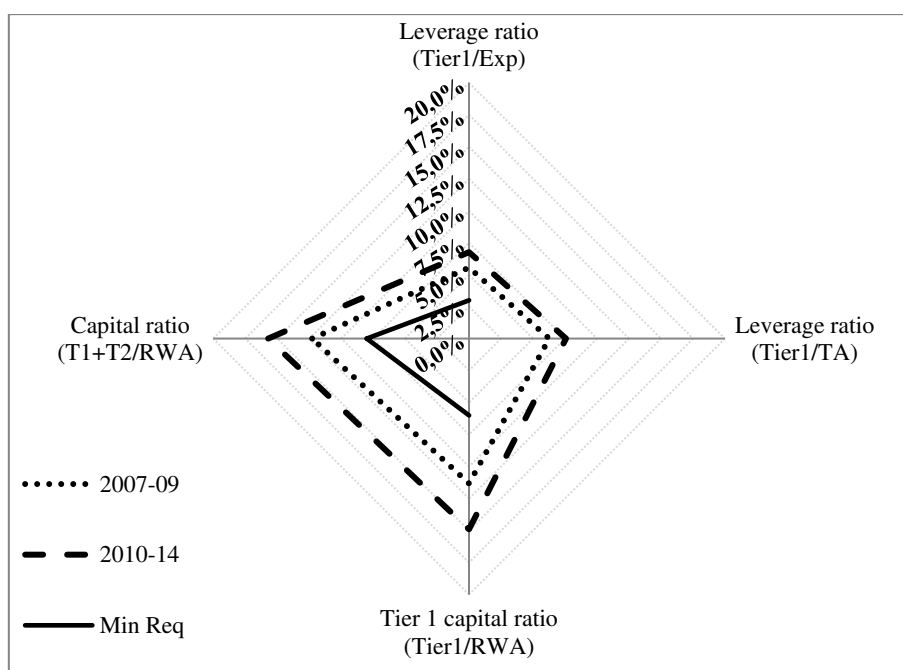
in several studies. The evidences by Adrian and Shin (2008;2010), Nuno and Thomas (2013) are based on the empirical analysis of the US financial intermediaries that operate primarily through the highly liquid and dynamic capital markets. They suggest that these financial institutions are adjusting their balance sheets actively in such way that leverage tends to be higher during the economy booms and lower during the slowdown and recession. In normal times however, leverage is less cyclical. The capital ratios reveal opposite counter-cyclical qualities and seem to be more stable and less procyclical in the crisis times Brei and Gambacorta (2014), Kellermann and Schlag (2013). According to this logic, both leverage and capital measures might represent a binding constraint for the banks in various economy cycles. Depending on which one of the two ratios is the stricter binding constraint, the incentive for the bank strategies might have different approach according to Blundell-Wignall and Atkinson (2010), Cathcart, El-Jahel and Jabbour (2013). It implies that the management of bank capital and leverage ratios over the course of the business cycle might be as important as the risk-based capital requirements particularly by determining the cyclical impact of capital regulation.

In the Figure 1 and Table 1, we summarize the historical evolution and potential regulatory constraints on the capital and leverage ratios for the largest Czech banks over the economic cycles. The period 2007-2009 refers to crisis period and years of 2010-2014 as a recovery and normal times. The following ratios are evaluated: (a) the new Basel III leverage ratio (as Tier 1 / Exposure measure); (b) the accounting leverage ratio (Tier 1/ Total assets); (c) the capital-to-risk-weighted-assets ratio (Tier 1/ Risk-weighted assets); (d) the capital adequacy (Total capital / Risk weighted assets). The first three ratios (a), (b), (c) have different denominators but relate to each other with the same numerator - Tier 1 capital. We have included into our review an accounting leverage (b) which has total assets on balance sheet in denominator instead of exposure. This helps us to separate the impact of off- balance sheet exposures, derivatives and guarantees on the Basel III leverage ratio and additionally to judge the risks stemming from off balance transactions that we are discussing later in the paper. The capital ratio (d) has been added to estimate the development of the banks' capital adequacy over the period. The regulatory guidelines on minimum requirements under the Basel III regime are the following: minimum leverage requirement  $\geq 3.0\%$  during the testing period from 1st January 2013 to 1st January 2017 with disclosure requirement starting from 1st January 2015 BCBS (2014a,b) and BCBS (2011); minimum requirement for Tier 1 capital (incl. Tier 1 additional capital)  $\geq 6.0\%$  of Risk Weighted Assets (RWA) with minimum Tier 1 capital ratio

in Basel III phase-in arrangements in 2013  $\geq 4.5\%$  , in 2014  $\geq 5.5\%$  and starting from 2015  $\geq 6.0\%$ ; minimum total capital requirement (sum of total Tier 1 and Tier 2 capital)  $\geq 8.0\%$  of RWA.

The weighted median of all risk and non-risk based ratios reveal an upward trend during the various economic cycles, newly analyzed by Stadnik and Miecinskiene (2015). Between the crisis period of 2007-09 and recovery years 2010-14, the median of the risk-weighted Tier 1 capital ratio increased from 11.3% to 14.9%, while the leverage ratio in the Basel III regime increased very moderately from 5.6% to 6.8%. The total capital ratio (capital adequacy) increased even at larger extent from 12.3% to 15.8%. Teplý, Šobotníková and Černohorský (2011), Matejašák (2015) similarly noted that Basel III requirements on capital are not presenting a larger constraint because of the historically high capital ratios of the Czech banks. The data show that contrary to the capital ratios, the leverage of the Czech banks might represent potentially larger constraint in terms of meeting the transitional minimum regulatory limits. We observe that only in 5% of cases from total sample the leverage of few banks has happened to be lower than the regulatory guidelines at some point of time. The mean of the leverage ratio across the sample is around 8.3% that is overall higher than leverage level referred as a minimum requirements  $\geq 3.0\%$ .

**Fig. 1: Average leverage and capital ratios in crisis (2007-09) and recovery period (2010-14)**



Source: annual reports and own calculation (**note:** all ratios are weighted average by respective denominator i.e. RWA, exposure or total assets)

**Tab. 2: Capital and leverage ratios for the banks in the Czech Republic (2007-2014)**

Ratios	(a) Leverage (Tier 1 / Exposure)	(b) Leverage (Tier 1 / Total assets )	(c) Tier 1 Capital Ratio ( Tier 1 / RWA )	(d) Capital Adequacy ( Tier 1+ Tier 2 / RWA)
	median <3.0%	median <3.0%	median <6.0%	median <8.0%
Top 5 largest banks	6.3%	7.0%	12.7%	13.7%
All banks	8.3%	10.7%	18.6%	19.3%
As a % from total observations	4.5%	2.7%	0.0%	0.0%

Source: annual reports and own calculation (**note:** all ratios are mean weighted by respective denominator i.e. RWA, Exp or TA)

In order to assess the strategies of banking sector towards adjustments in capital and leverage ratios, we take a closer look into interdependencies between the components of the leverage ratio and the Tier 1 capital ratio. Since both of them have the same numerator (Tier 1 Capital), it allows us to relate and analyze changes in their denominators - risk weighted assets versus exposure or total assets Berger and Bouwman (2013), Cathcart, El-Jahel and Jabbour (2013). We rearrange the relation of Tier 1 capital ratio to leverage ratios (both ratios with exposure based and accounting measure of total assets) as follows:

$$\frac{LR}{CR} = \frac{\frac{K_t}{Exp_t}}{\frac{K_t}{RWA_t}} = \frac{RWA_t}{Exp_t} \quad (2)$$

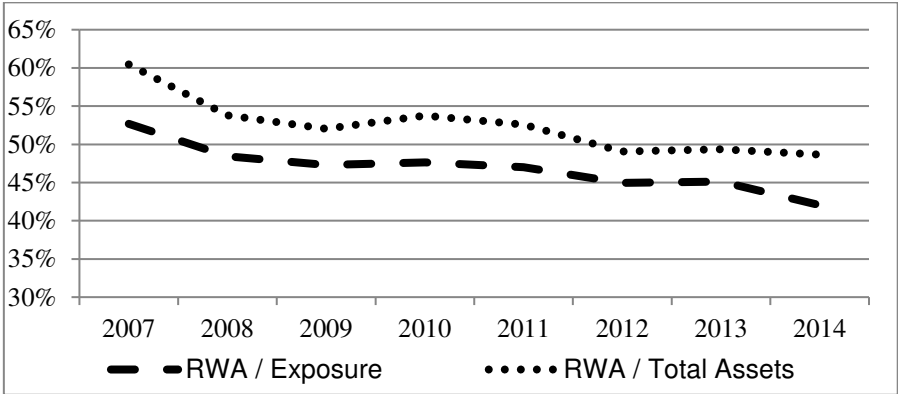
where  $K_t$  - denotes a Tier 1 capital,  $RWA_t$  stands for risk-weighted assets and  $Exp_t$  - the exposure measure (or total assets on the balance sheet), at the end of reporting period  $t$ .



The relationship of risk weighted assets to exposure (or total assets) captures also the riskiness of the business model of the banks. The higher ratio of risk weighted assets to total assets suggests that the portfolio contains more risky assets. For example the sovereign bonds portfolio has usually the lowest risk, depending significantly on the level of interest rates – Stadnik (2014), weight up to 0.0% (in standardized approach of credit risk measurements under the Basel II capital adequacy guidelines), since this asset class is considered to be the safest and on opposite, traded securitization products have the highest up to 1250% risk weight.

In the Figure 2, we exhibit the historical evolution of risk weights over the period of 2007-2014 of the largest Czech banks. The notable trend is that both risk weights tend to decline steadily during the entire period. Apparently the Czech banks are focusing more on the optimization of risk weighted assets and structuring portfolios with lower risk weights. The banks by adjusting their business model are changing their activities and asset structure, so their income might be impacted too. For the banks with a higher leverage level, it could lead to reduction in lending volumes and hence poses risks for the income growth and profitability. As a result of inclusion into the Basel III leverage exposure the off balance sheet items with 100% credit conversion factor, the trade finance transactions and hedging activities of the Czech banks will be affected by higher capital requirements noted by Teplý, Šobotníková and Černohorský (2011).

**Fig. 2: Historical evolution of risk weights to exposure and total assets (2007-2014)**

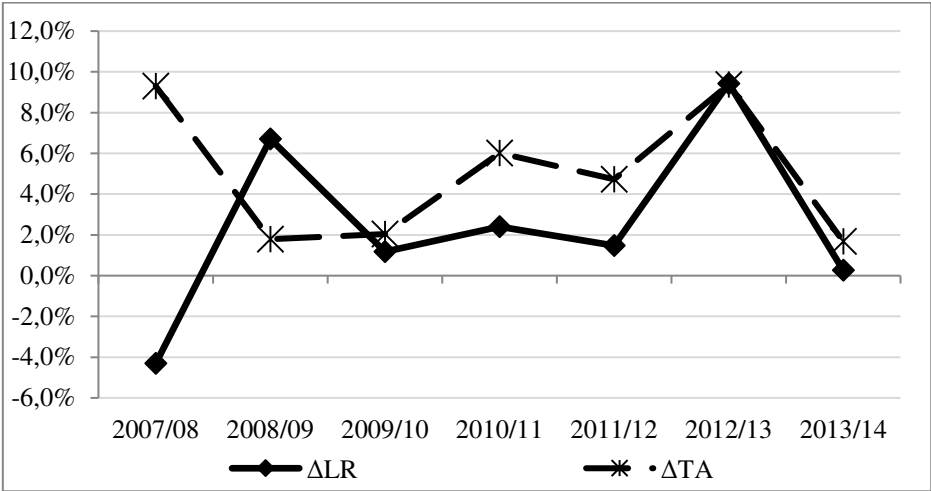


Source: annual reports and own calculation

Other remarkable observation from the Figure 2 is that the off balance sheet exposure, which is mostly stemming from complex derivative transactions and other guarantees has a stable proportion to total assets over the 8 year horizon. This fact suggests that the banks in the

sample are not shifting significant risks off balance sheets in times of economic distress. The off balance-sheet items of the Czech banks constitute a relative small fraction to total assets on average (10%). In comparison, the data across the top EU and US banks (over the period of 2000-2009) presented by Kalemlı-Ozcan, Sorensen and Yesiltas (2011) shows that the maximum amount of the off-balance sheet items was 65% of assets with a mean of 10%.

**Fig. 3: Annual growth in total assets versus annual change in leverage for the top 10 Czech banks 2007-2014**



Source: annual reports and own calculations

The potential cyclical qualities of the leverage we observe by plotting the changes of mean leverage against the annual growth of total assets for the sample of the 10 largest Czech banks (Figure 3). The annual changes in the balance sheets over the observed period seemingly follow the economic cycle with “reverse” movement of leverage versus assets characteristic for the crisis years 2008-2009. In overall, the adjustments in the leverage (co-movement with total assets) reveal similar pattern described by Brei and Gambacorta (2014), Adrian and Shin (2010). As explained by these authors, such a strong co-movement signifies an active management of leverage as a means of expanding and contracting the size of balance sheets. They suggest that the largest banks might be able to use the increased equity as basis for further lending which will increase assets (and liabilities) relative to equity with the outcome that asset and leverage is no longer inversely related. In other words, the banks are attempting to maximize the capital utility and by doing so they increase their assets respectively. The potential risk is that this way the banks could be incentivized to increase their risk appetite. Given the actual level of capital and confronted with the choice between low risk and low

margin, and higher risk but higher margin most banks will likely opt for the second option according to European Banking Authority Report (2015)

## **5 Analysis of Correlation Patterns**

In this section of the paper, we investigate the correlation patterns between banks leverage and capital ratios over the economic cycle 2007-2014 in the Czech Republic. Building on the study and using similar methodological approach of Cathcart, El-Jahel and Jabbour (2013), Estrella, Park and Peristiani (2000), Nuño and Thomas (2013), we try to capture any patterns of co-movements of both ratios and interdependencies among their variables.

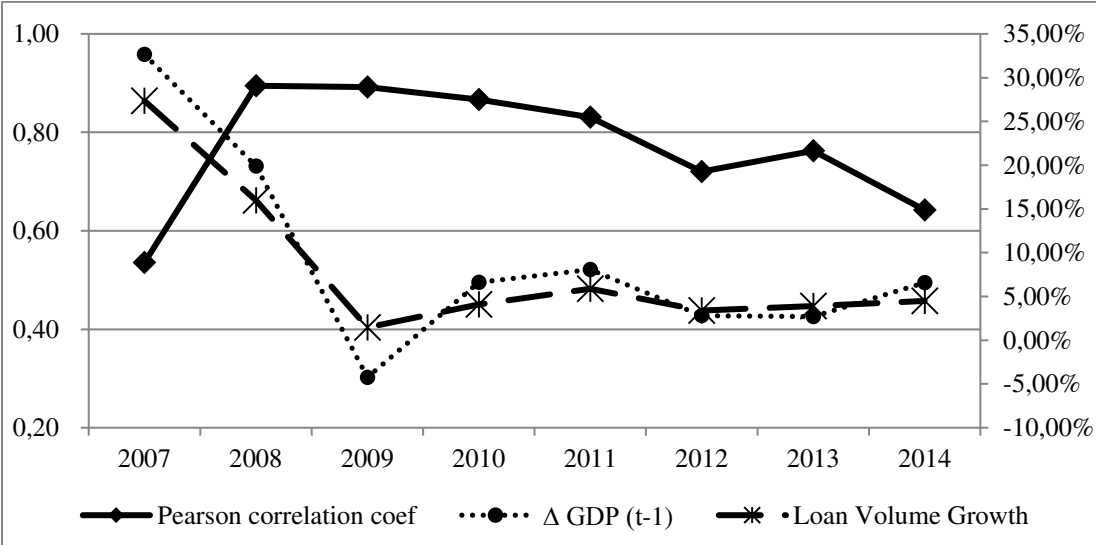
For the purpose of analysis, we use the Pearson correlation measure between leverage and capital ratio. The results depicted on the Figure 4 demonstrate that a high degree of positive correlation indeed exists between both ratios (with a range of coefficient from 0.6 to 0.9). The possible explanation for that lies in the components of the ratios and mostly attributable to the offsetting effect of increase in capital (Tier 1 capital is a numerator of both ratios) combined with the adjustments in the assets (described in previous section). The time horizon of our analysis covers the period of constantly increasing capitalization of the Czech banks driven by stricter regulatory requirements and business model. The findings by Teplý, Šobotníková and Černohorský (2011), Matejašák (2015) similarly confirm that capital basis of the Czech banks increased substantially over the period 2009-2013 and consequently improving on average regulatory capital ratios.

The interactions between macroeconomic conditions, bank regulations and governmental policies are relevant for all advanced economies and especially for newly EU integrated economies of Central and Eastern Europe (Cevik, Dibooglu and Kutan (2016), Janda (2011) and Janda, Michalikova and Skuhrovec (2013)). In particular, by introducing the leverage in the Basel III framework, the Basel Committee aimed exactly at reinforcing the capital requirements with non-risk measures and this way to mitigate the magnifying effect of the economic cycles. The interesting question is how the business cycles in the Czech Republic affect the interactions of both ratios. To exhibit the effect of business cycles we plot the correlation patterns altogether with the economic cycles' indicators such as loan volumes growth and GDP. The loan volume growth in the economy is represented by the "Loans to private sector - Annual growth rates" from the official statistics of the CNB. The annual

changes in gross domestic product relate to economy conditions and cycles Jakubik and Fungacova (2013), Izák (2011). To capture a lagged effect of macroeconomic factors on the microeconomic level of banking sector, we use a half year delayed GDP figures, i.e. a comparison of 2<sup>nd</sup> Quarter GDP annual change versus year end values of both ratios.

The results in the Figure 4 underline the fact that leverage and capital ratios have a tendency to co-movement in normal times and a slightly counter- movement in the time of downturn or upswing. Though, it does not reveal at all the negative correlation between leverage versus capital ratio in crisis period, which was described by Cathcart, El-Jahel and Jabbour (2013). It implies that the change in the binding constraint from one to another ratio does not explicitly occur during the period of our observation.

**Fig. 4: Correlation pattern changes in leverage/capital ratio versus loan volume and GDP growth during 2007-2014**



Source: Czech National Bank, annual reports and own calculations

At the beginning of this section we have been focusing on the correlation patterns between two ratios. In order to understand the contribution of the single factors to the fluctuations in the leverage ratio now we analyze and compare the cyclical qualities of the variables that we discussed earlier. We extract the cyclical components of the variables by applying the cycle band-pass filter for economic time series of Baxter and King (1999). Based on the statistics of previous US business cycles, they developed a set of approximate filters to measure the business cycles of macroeconomic activity. The procedure enables to isolate business cycle component transforming the macroeconomic data by applying the particular moving averages.

The filter allows extracting a cyclical component which persists for the periods of two to eight years, and leaves the characteristics of this component undistorted. The cyclical (de-trended) components of the variables were used to compare the volatility of the variables and plot their correlation patterns.

First of all, we try to assess the contribution of the total assets and Tier 1 capital to the cyclical fluctuations in the leverage ratio. Secondly, it is of interest for us to estimate how leverage and capital correlate with each other, and how each component correlates with total assets. A related question is how the leverage ratio and the assets of banks correlate with aggregate economic activity, as represented by annual GDP in constant prices and loan to private sector volumes from the official statistics of the CNB. Furthermore, the certain degree of volatility in leverage, assets and Tier 1 capital relative to those in real economic activity is itself a matter of empirical interest. The aggregated results are exhibited in the Table 3 and can be summarized in the following points. The leverage in the sample is less volatile than assets and equity capital, but it fluctuates stronger than economic indicators GDP and loan volumes growth. The standard deviation of leverage is more than twice of the capital and total assets. The higher volatility in a variable might suggest a larger possible error in evaluating the cyclical co-movement patterns with other variables. The total assets and exposure, in contrast to Tier 1 capital show the largest contribution to the cyclical movement of the leverage. The strong negative correlation with leverage (coefficient -0.540) reiterates the observations by Adrian and Shin (2010), Brei and Gambacorta (2014) and points out that the leverage ratio represents a tighter constraint in the upturn cycle by expanding balance sheet and a looser one in the recession period when assets are shrinking.

**Tab. 3: Business cycles and leverage components**

<i>Standard Deviations</i>		<i>Correlations</i>		
	Std.Dev		Coefficient	P-values
		Leverage - Total		
Leverage	0.5066	Assets	-0.540**	(0.000)
Tier 1	0.9559	Leverage - Exposure	-0.552**	(0.000)
		Leverage - Capital Tier		
TA	1.1831	1	-0.122	(0.200)
Exp	1.1511	Leverage - GDP	0.056	(0.556)

		Leverage - Loan		
GDP	0.0038	Volumes	-0.271	(0.004)
Loan	0.0102			
		Assets - Loan Volumes	0.645**	(0.000)
		Assets - GDP	0.084	(0.382)
NOTE:				
The sample period is 2007-2014. All variables are natural logarithms.				
For excel based add-in of the Baxter-King band-pass filter, we employ the standard settings Burns-Mitchell for annual data, i.e. min 2 and max 8 years, k=3 lowpass filter.				
Asterisks denote statistical significance of non-zero correlation at the 5% (**) confidence level.				
Significance 2 tailed tests are reported in parenthesis.				

Source: own calculation, data from CNB, annual reports

Moreover our findings suggest that the capital Tier 1 indicates a weak correlation with negative vector to the leverage ratio. That fact contradicts to the mathematical logic of ratio that implies a positive correlation. The explanation is that the data in our sample covers the period when the capital increase was accompanied mostly by growth in assets. A larger data sample or a comparison with other countries banking sectors would be useful to investigate further on this issue. The leverage and total assets as well show a strong positive correlation (coefficient 0.645) with economic cycle indicator “loans to private sector” that is quiet self-explanatory. However we observe weak correlation of leverage and total assets with GDP (coefficients 0.056 and 0.084 respectively). The degree of correlation is low possibly due to the delayed macro effect on the banking sector, however the positive vector points out the co-movement tendencies.

## 6 Conclusion

In this concluding section we summarize the main results of our analysis of the impact of the leverage Basel III requirements on the Czech banking sector. For our empirical study, we used a data sample of 15 major banks operating in the Czech Republic over the period 2007-2014. The historical data confirm stronger capital ratios of the banks and an overall solid

leverage level with only 5% of the total historical observations being lower than the regulatory recommendations.

By analyzing the components of ratios, we were able to learn more about the strategies of the Czech banks. We conclude that evidently the banks are focusing more on the optimization of risk weighted assets and structuring portfolios with lower risks. Strong co-movement patterns between leverage and assets also suggest the active management of leverage in terms of expanding and contracting the size of balance sheets and maximizing the utility of the capital. We found out that the banks in the sample are not shifting significant risks off balance sheet. The off balance-sheet items constitute a relatively small fraction of assets (mean of 10%) and are comparable to the average of the top EU and US banks.

The correlation patterns between leverage and capital ratios reveal mild pro-cyclical qualities. The economic cycle indicators such as a loan volume growth and GDP changes point to the countercyclical movements of the leverage versus capital ratio during the downward cycle in 2007-2008. The analysis of correlation patterns among the variables indicates that the total assets (and exposure) in contrast to Tier 1 capital are indeed the main contributors to the cyclical movements in the leverage. The leverage and the total assets also demonstrate a weak correlation with GDP, but a strong co-movement with loan volumes to the private sector.

The introduction of the Basel III regulations on leverage is another incentive for the Czech banks to strengthen more their capital position and reduce indebtedness. It is a major improvement over Basel II treatment of indebtedness and credit risk (Witzany 2010). On the other hand, it has certain implications. For the banks with a higher leverage level, it could lead to reduction in lending volumes and hence poses risks for the income growth and profitability. The risk appetite of the banks might increase, since the banks may be forced to choose how to optimize their capital usage. Furthermore, the banks might adjust their business model and change their activities and asset structure, so their income might be affected too (e.g. trade finance transactions and hedging activities of the Czech banks)

## **Acknowledgements**

This project has received funding from the European Union's Horizon 2020 Research and Innovation Staff Exchange programme under the Marie Skłodowska-Curie grant agreement No 681228. We also acknowledge support from the Czech Science Foundation (grant 15-

00036S) and from University of Economic, Prague (institutional support IP100040). Karel Janda acknowledges research support provided during his long-term visits at Australian National University and McGill University. The views expressed in the paper are those of the authors and not necessarily those of our institutions.



# *Interdependencies between Leverage and Capital Ratios in the Banking Sector of the Czech Republic*

## **Summary**

In this paper we discuss the implications of the Basel III requirements on the leverage ratio for the banking sector in the Czech Republic. We identify the potential binding constraints from regulatory limits and analyze the interactions among leverage and capital ratios over the country's economic cycle (during the period 2007-2014).

The historical data confirm stronger capital ratios of the banks and an overall solid leverage level with only 5% of the total historical observations being lower than the regulatory recommendations. By analyzing the components of ratios, we conclude that the banks are focusing more on the optimization of risk weighted assets. Strong co-movement patterns between leverage and assets point to the active management of leverage as a means of expanding and contracting the size of balance sheets and maximizing the utility of the capital.

The analysis of correlation patterns among the variables indicates that the total assets (and exposure) in contrast to Tier 1 capital are the main contributors to the cyclical movements in the leverage. The leverage and the total assets also demonstrate a weak correlation with GDP, but a strong co-movement with loans to the private sector.

**Key words:** Leverage ratio, capital ratio, Basel III, Czech Republic

**JEL classification:** G30

## **References**

- Adrian, T., Shin, H.S. (2008): *Financial intermediary leverage and value at-risk*. Federal Reserve Bank of New York, Report No. 338
- Adrian, T., Shin, H. S. (2010): *Liquidity and leverage*. Journal of Financial Intermediation, Elsevier, Vol. 19, Issue 3, Pages: 418–437
- Avery, R., Berger, A. (1991): *Risk-based capital and deposit insurance reform*. Journal of Banking and Finance 15, Pages: 847–874

- Baxter, M., King, R. (1999): *Measuring business cycles: approximate band-pass filters for economic time series*. Review of Economics and Statistics, 1999, Vol. 81, Issue 4, Pages: 575-593
- BCBS, Basel Committee on Banking Supervision (2011): *Basel III: A global regulatory framework for more resilient banks and banking systems*. Revised version in June 2011
- BCBS, Basel Committee on Banking Supervision (2014a): *Basel III leverage ratio framework and disclosure requirements*. Bank for International Settlements. ISBN 92-9197-373-4
- BCBS, Basel Committee on Banking Supervision (2014b): *Frequently asked questions on the Basel III leverage ratio framework*. Published in October 2014 and updated in July 2015. ISBN 978-92-9131-884-1
- Berger, A., Bouwman, C. (2013): *How does capital affect bank performance during financial crises?* Journal of Financial Economics 109, Pages: 146–176
- Blundell-Wignall, A., Atkinson, P. (2010): *Thinking beyond Basel III: Necessary solutions for capital and liquidity*. OECD Journal Financial Market Trends 2010, Issue 1
- Brei, M., Gambacorta, L. (2014): *The leverage ratio over the cycle*. BIS Working Papers No. 471
- Cathcart, L., El-Jahel, L., Jabbour, R. (2013): *The Basel capital requirement puzzle: a study of changing interconnections between leverage and risk-based capital ratios*. Presented on European Financial Management Association Meeting on 10th of May, 2013
- Cevik, R.K., Dibooglu, C., Kutan, A.M. (2016): *Real and financial sector studies in Central and Eastern Europe: A Review*. Czech Journal of Economics and Finance (Finance a uver) 2016, Vol. 66, Issue 1, Pages: 2-31
- European Banking Authority Report (2015): *Overview of the potential implications of regulatory measures for banks' business models*. EBA Report from 9 February 2015
- Estrella, A., Park, S., Peristiani, S. (2000): *Capital ratios as predictors of bank failure*. Economic Policy Review, 2000, Issue July, Pages: 33–52
- Gropp, R., Heider, F. (2009): *The Determinants of bank capital structure*. ECB working paper series No. 1096, September 2009. ISSN 1725-2806
- Izák, V. (2011): *The Welfare state and economic growth*. University of Economics, Prague. Prague Economic Papers 2011, Vol. 2011, Issue 4, Pages: 291–308
- Jakubik, P., Fungacova Z. (2013): *Bank stress tests as an information device for emerging markets: The case of Russia*. Czech Journal of Economics and Finance (Finance a uver) 2013, Vol. 63, Issue 1, Pages: 87–105
- Janda, K. (2011): *Inefficient credit rationing and public support of commercial credit provision*. Journal of Institutional and Theoretical Economics (JITE), Mohr Siebeck, Tübingen, Vol. 167(2), Pages: 371-391, June
- Janda, K., Michalíkova, E., Skuhrovec, J. (2013): *Credit support for export: robust evidence from the Czech Republic*. The World Economy, Wiley Blackwell, Vol. 36(12), Pages: 1588-1610, December
- Kalemli-Ozcan, S., Sorensen, B., Yesiltas, S., (2011): *Leverage across firms, banks and countries*. Journal of International Economics, Elsevier, Vol. 88(2), Pages: 284–298

- Kellermann, K., Schlag, C-H. (2013): *Occupy risk weighting: how the minimum leverage ratio dominates capital requirements - a Swiss example*. Journal of Financial Regulation and Compliance Vol. 21.2013, 4, Pages: 353–372. ISSN 1358-1988, ZDB-ID 14007678
- Klinger, T., Teplý, P. (2016): *The Nexus between systemic risk and sovereign crises*. Czech Journal of Economics and Finance (Finance a uver) 2016, Vol. 66, Issue 1, Pages: 50–69
- Matejašák, M. (2015): *Did the Czech and Slovak banks increase their capital ratios by decreasing risk, increasing capital or both?* 16th ACFA Prague 2015, 29th May 2015. Procedia Economics and Finance, Vol. 25, 2015, Pages: 256–263
- Musílek, P. (2011): *European System of Financial Supervision*. Český finanční a účetní časopis. Vol. 6, No. 2, Pages: 7–17
- Nuño, G., Thomas, C. (2013): *Bank leverage cycles*. ECB Working Papers Series No. 1524
- Stadnik, B. (2014): *The Volatility Puzzle of Bonds*. Conference: 8th International Scientific Conference on Business and Management 2014, Location: Vilnius, LITHUANIA Date: MAY 15-16, 2014, Book Series: Business and Management-Spausdinta, Pages: 313-319 Article Number: bm.2014.039 Published: 2014
- Stadnik, B., Miecinskiene, A. (2015): *Complex Model of Market Price Development and its Simulation*. Journal of Business Economics and Management, Volume: 16, Issue: 4, Pages: 786-807, Published: JUL 4 2015
- Šútorová, B., Teplý, P. (2013): *The Impact of Basel III on Lending Rates of EU Banks*. Czech Journal of Finance, Vol. 63, No. 3, Pages: 226-243
- Šútorová, B., Teplý, P. (2014): *The level of capital and the value of EU banks under Basel III*. Prague Economic Papers, Vol. 23, No. 2, Pages: 143–161
- Teplý, P., Šobotníková, P., Černohorský, J. (2011): *The challenges of Basel III for the Czech banking sector*. 13th International Conference on Finance and Banking - Lessons Learned from the Financial Crisis. Publisher Karvina: Silesian University, School of Business Administration, 2011, Pages: 33-44. ISBN 978-80-7248-708-0
- Teplý, P., Vejdovec, O. (2012): *An Analysis of economic capital allocation of global banks*. International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, Vol. 6, No. 5
- Witzany, J. (2010) *On Deficiencies and Possible Improvements of the Basel II Unexpected Loss Single-Factor Model*. Czech Journal of Economics and Finance, Vol. 60, No. 3, Pages: 252–268.