Methods of credit risk mitigation and its impact on the capital requirements of banks

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Summary

The aim of this article was to quantify capital requirement for individual methodologies of credit risk management on the designed portfolio with corporate loans without and with use of collateral using collaterals as techniques to reduce credit risk of commercial bank. Firstly, the aim of this article is to quantify the capital requirements using the Internal Rating Based Approach with collateral usage. Afterwards, achieved results have been compared with the methodology of the Standardized Approach and Internal Based Approach without and with collateral usage. The article is highlighted aspects of transition to developed methods of Internal Rating Systems with significant savings on equity, which allows banks accelerate lending activities. To set an optimal equity amount toward the risk portfolio is an important precondition to increase efficiency and competitiveness of commercial banks.

The credit risk is the most significant risk for the commercial bank. The commercial bank uses a whole range of methods and procedures in credit risk management. The most important approach how to manage credit risk is the capital adequacy approach which sets the minimal amount of equity in relation to the risk profile of credit claims.

The aim of this article was to quantify capital requirements of the designed portfolios with corporate loans using selected approaches of credit risk management with variable types of collaterals. Next aim was to show possibilities how to potential mitigates capital requirements in the case of transition on sophisticated methods of credit risk management.

Nowadays it is prevailing opinion that new regulatory rules for the banking sector, known as Basel III (Basel 2010; Basel 2009), bring significant increase in costs for commercial banks. For example, according to McKinsey & Company research, suggested changes of Tier 1 composition will cause a significant shortage in European banking capital of € 700 billion. If a suggested leverage ratio would be adopted then the growth of equity Tier 1 by up to 70 % will be required. New standards for liquidity will probably means an increase in long-term financing from € 3,5 to € 5,5 trillion and banks will have to hold another € 2 trillion in highly liquid assets. The overall impact on costs of European banks is estimated at € 190 billion by this objective study (Härle,Heuser, Pfetsch a Poppensieker, 2010). Other authors which are focus on Basel III problematic are (Izzi, Oricchio, Vitale, 2012), (Caoette, Altman, Narayanan, Nimmo, 2008).

In this context it is obvious that appropriate selected approaches for credit risk management can significantly support long –term profits and competitive advantage of the bank through the optimal usage of bank equity.

The benefit of this article is impacts quantification of the implementation of sophisticated approaches to credit risk management. In the article, the structure of elemental designed portfolio is calibrated and appropriate capital requirements in order to optimize the equity usage in banks are gradually quantified (Belás, Cipovová, Novák, Polách 2012).

The current results demonstrate that the requirement of capital could decrease by approximately 30 %, which means using of an internal rating model could increase the profitability on equity up to 13 %, depending on the structure of the assets, the amount of the interest margins and the profitability ratio. Even saving capital through "the improved credit risk management", which was considered one of the important stabilizing elements in this system, does not work in banking practice and therefore the system of internal ratings should be adjusted to the new regulatory conditions (Belás, Cipovová, 2013).

1. Problem formulation

For the purposes of calculating the capital requirement is necessary the cover of credit risk divides to the concepts of expected loss and the unexpected. The expected loss of an existing financial loss, according to Czech National Bank No. 9 / 2002 on the loss of the bank must make adjustments and reserves, which form a "cushion" to cover expected losses. Unexpected loss means the bias actually realized losses from unexpected losses (see Fig. 1.)

For the purpose of covering unexpected losses, the bank must keep its capital at least equal to regulatory capital requirements. To make concept of regulatory capital requirements really relevant, it is necessary to get near the concept of unexpected loss and economic capital. Capital Bank should in any case reflect an unexpected loss.
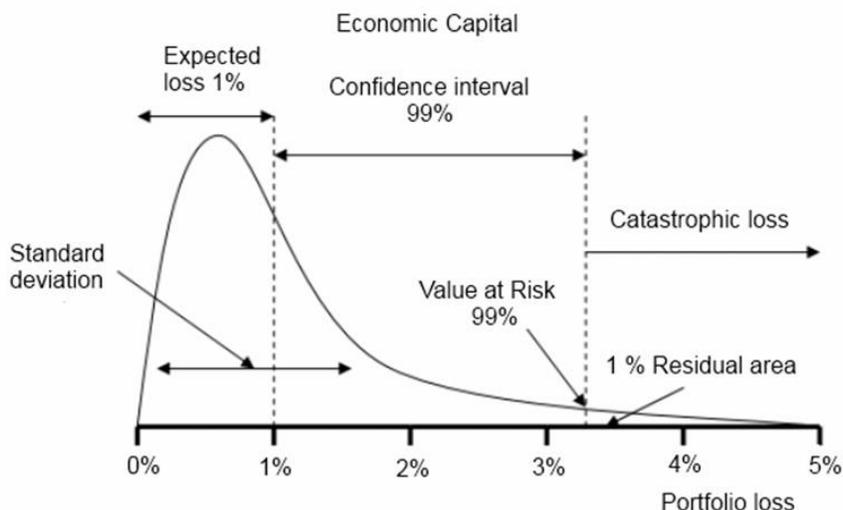
Fig. 1: Covering expected and unexpected losses. Source: Basel Committee on banking supervision, 2005

This figure shows that the portfolio expected loss is 1%. It is covered from reserves, which are counted as expenses. Unexpected losses can be covered by economic capital. VaR summarizes the worst loss for a specified time horizon at a given confidence interval (99%). Terminal region reflects catastrophic losses, its probability is 1%. Component of expected and unexpected loss is the credit spread components together, thus payment for taking credit risk.

2.   Techniques of credit risk mitigation

Techniques of credit risk mitigation use property and personal collateral and guarantee within the loan process in order to minimize credit risk of the client. The regulator defines differences between individual conditions of collaterals' eligibility within transition to IRB approaches and sophisticated methods for calculations of capital requirements. With this transition to advanced methods of IRB approaches, there are changing not only the methodology for calculation of the Probability of Default of the borrower, but also possibilities to decrease total costs in the case of actually occurred default. On the one hand, this fact increases the number of eligible types of collaterals but on the other hand the number of methods which are calculated capital requirements and expected losses are decreased. The aim is to effectively defend from counterparty default losses and decrease capital demanding possession. For STA and also for IRB approaches applies the same division of collaterals such as: property (counting, financial collaterals) and personal (bank guarantees, liabilities, and credit derivates). Using collateral, there have to be respected basic conditions which are common for both types of methodologies for calculation of credit risk (STA approach and also IRB approach): uniqueness, maturity mismatch, inconsistency names and combination techniques (Czech National Bank, 2007).

Differences between deductibility of techniques are not only in property collateral. Within IRB approach, banks can use other four types of collaterals where first two of them are very fundamental. Although real estate are not deductible within STA approach but their application is possible. Basel II sets risk weight of 35 % for exposures which are secured by residential real estate which is represented by a minimal required value and the regulator can this value adjust depending on the type and location of the property. It is distinguished within property collateral if they are or are not situated on the territory of a member state. Location outside of the territory of a member state is not taken into an account and assigned the risk weight of 100 %. Claims represent a whole new range of possible collaterals. This includes claims of deposit held by the bank or claims held by other financial institution from export, credit and life insurance, claims from securities, trade receivables claims from rent and other transactions within maturities no longer than one year. Movable assets are no appropriate type of collateral because of its easy mobility, rapid deterioration and high fluctuations of its market value. The possibility to set a market value very fast and sell it should be as the basic condition. Therefore, the dispersion of movables is limited to exchange traded commodities (crops, metals, raw material, etc.). Condition for real estate and movable property must meet also collaterals in the form of the subjects of lease (Czech National Bank, 2007a).

2.1. Methods for calculation of capital requirements using collateral
2.1.1 Simple approach

Within Standardized Approach, simple method is divided the exposure on two parts – secured and unsecured by relevant collateral. Secured part of the exposure would be determined by risk weight, which has been given to collateral instrument. Unsecured part would be determined by original risk weight of the exposure. Final formula for risk-weighted assets calculation is given as follows:

$$RWA = (E - C) * RW_E + C * RW_C \qquad (1)$$

Where E is exposure value, C is value of the deductible collateral, RW_i are individual risk weights corresponding to exposure or collateral. Within a comprehensive method, same types of collateral as within the simple method are applicable except securities outside the main stock exchange index and participation in open-end mutual funds. (Czech National Bank, 2007)

2.1.2 Comprehensive approach

When the secured part of the exposure is determined in this approach, capital requirement is applied only on the unsecured value of the exposure. Both values are pre-processed by so-called haircuts. These coefficients are given in percent and reduce the collateral's value or exposure's value with respect to its volatility. After haircuts inclusion, adjusted exposure E* is calculated, for which a risk weight of counterparty is applied. The procedure for risk-weighted calculation is as follows:

$$E* = \max\{0; [E * (1 + H_E) - C * (1 - H_C - H_{FX})]\} \qquad (2)$$
$$RWA = RW * E* \qquad (3)$$

Where E* is exposure's value after inclusion techniques for reducing credit risk, E is exposure's value, C is collateral's amount and H_i are individual types of collateral:

H_E – haircut which is taken into account the exposure's volatility. Relevant only if the loan is given in securities, not cash. Reason is its possible increasing value during a period and therefore collateral would become less effective.

H_C – is taken into account the collateral's volatility

H_{FX} – is taken into account only in the case of currency mismatch of the exposure and claim

Haircuts are determined by regulator set value or by bank's own estimates. Regulator set haircut's aim is to evaluate the price volatility of the instrument as accurately as possible. It is divided by rating quality, remaining maturity and issuer's type. (Czech National Bank, 2007a)

Bank's own estimates of haircuts are conditional upon a certain quantitative and qualitative conditions and regulator's agreement. From a quantitative point of view, risk management system and measurement in the bank must be resistance and should pass regular re-validation. That's mean that bank's own estimates of market price's volatilities and exchange rates should be sufficiently effective and reflect reality. Quality requirements call for one-sided 99 % confidence internal, the minimum holding period, revaluation and regular updates of haircuts.

Within the possibility to estimates own LGD parameters for advanced IRB approach, there is no prescribed model and methodology. Banks have some flexible possibilities to configure this issue but sufficient quantity and quality data are for own bank's estimates a considerable obstacle. (Witzany, 2010)

Within IRB approach for financial collateral, haircuts is entered directly into LGD estimation and not only to exposure's adjustments. LGD of claim with collateral is calculated by formula as follows:

$$LGD^* = LGD * \left(\frac{E^*}{E} \right), \quad (4)$$

Where LGD is the original LGD of the senior unsecured exposure, ie. 45 %, E is the total exposure value, and E* is exposure value adjusted according to a comprehensive approach.

For specific collaterals, which is used in IRB approach (real estate, claims, movable assets, leasing assets), with respect on secured part of the exposure, where the minimum value of LGD is set, special methodology is established. In this case, effective adjusted LGD* value is computed but only on the condition that the exposure has sufficient amount of collateral, ie. ratio ensured value of C to the unadjusted value of E must reach certain minimum values for each individual exposure. (Czech National Bank, 2007d)

In the case where $\frac{C}{E} < C^*$, basic unadjusted LGD of 45 % to senior unsecured exposure and LGD of 75 % to subordinated unsecured exposure is assigned. There is also a second upper limit of the ration of C and E, concretely $\frac{C}{E} \geq C^*$ and is called over-collateralization. In case of exceeding this limit, LGD is determined in the following Tab. I. Providing $\frac{C}{E} \geq C^*$ or $\frac{C}{E} < C^{**}$, exposures are divided into two parts – secured one as $E^/$, where $\frac{C}{E^/} \geq C^{**}$, ie. (min $E^/ = \frac{C}{C^{**}}$) and unsecured one as $E^{//}$, where $E^{//} = E - E^/$. Secured par is determined by adjusted LGD* and unsecured part is determined by fixed values, ie. 45 % respectively 75 %. (Czech National Bank, 2007d)

3. Results

Within the focus of this article, the issue of the resulting capital requirements diversity using the methodology of credit risk management of Basel II has been considered, where different types and levels of collateral and also varying degrees of rating quality has been changed. In this case, a simple and a comprehensive approach of Standardized Approach and foundation approaches of Internal Rating Based

Approach with and without collateral instruments have been put into this comparison. On the beginning of this research, four hypotheses have been set:

1. In the transition from STA approach to the foundation IRB approach with collateral instrument, saving of the capital requirement is less than 15 %
2. Increasing the ratio of collateral from 140 % to 210 %, there is a reduction of required regulatory capital by up to 10 %
3. The biggest saving on the equity will be achieved by the type of the collateral – cash.
4. In the transition from STA approach to the IRB approach with collateral, the largest saving of capital adequacy is reached only in the case where bank will keep exposures with AAA in its portfolio

Additional aim of our research was to compare changes that occur with different rules to ensure deductibility by using selected methods of credit risk management of Basel II. Firstly, four bank claims has been set, each worth of 5 million EUR with a maturity of 3 years. Each claim has different probability of default (see Table 1). On the base of second determined hypothesis, the basic amount of collateral in a ratio of 140 % of given exposure has been designed as follows: cash collateral (35 %), shares as collateral (35 %), real estate as collateral (35 %), and claim as collateral (35 %). Next procedure was to increase the collateral up to 210 % of given exposure where the composition of that collateral has been consisted of cash collateral (70 %), real estate as collateral (70 %), and claim as collateral (70 %). Information about the external rating assignment to each claim has been taken from S&P agency and is seen in the table below:

Tab. 1: Input data for research. Source: Own Source and modified by (S&P, 2010)

Claim	E	Rating	PD	Risk weight
1	5 000 000	AAA	0,03 %	0,2
2	5 000 000	AA	0,09 %	0,5
3	5 000 000	BB	0,21 %	1
4	5 000 000	B	3,7 %	1,5

Source: own source

Within given conditions, maturity mismatch and currency mismatch are not considered, ie. maturity of collateral is longer than maturity of claim that's mean haircut H_{FX} is not applied to our formulas. In the case, where these aforementioned mismatches would be included in the calculation, the total capital requirements for banks would be higher. Collateral amount, which is always higher in every circumstance than the amount of the exposure, is divided into relevant and irrelevant parts. To calculate capital requirements using only the relevant part of collateral, there is provided by risk managers and it is based on market valuation adjusted for price volatility (the volatility of prices and maturity mismatches are not considered). On our case, the amount of the relevant market value of the collateral is determined by ratio at 35 % and 70 % of given exposure, ie. 5 000 000 EUR. Reason for this determination is to compare changes of capital requirements amounts by changes of the collateral ratio.

According formula (2) and (4), parameters E* and LGD* are determined. By using real estate, claim and movable assets as the collateral, there is a condition to apply special methodology, where the over – collateralization is used and claim into secured $E^{\backslash}$ and unsecured $E^{\backslash\backslash}$ is divided.

Tab. 2: Types of collateral and their determination by ratio at 35 %.

Types of collateral	Deductibility of STA approach	Deductibility of IRB approach	Haircut H_C	Value of the collateral (C)	Adjusted value of the exposure		LGD* for IRB approach
Cash	Yes	Yes	0%	1 750 000	E*	3 250 000	0,2925
Monetary gold	Yes	Yes	21,213 %	1 750 000	E*	3 621 227,5	0,3259
Shares and exchangeable funds involved to the main index of the regulated market	Yes	Yes	21,213 %	1 750 000	E*	3 621 227,5	0,3259
Real estate	No	Yes	-	1 750 000	$E^{\backslash}$	1 250 000	0,35
					$E^{\backslash\backslash}$	3 750 000	0,45
Claim from commercial relation	No	Yes	-	1 750 000	$E^{\backslash}$	1 400 000	0,35
					$E^{\backslash\backslash}$	3 600 000	0,45
Movable assets	No	Yes	-	1 750 000	$E^{\backslash}$	1 250 000	0,35
					$E^{\backslash\backslash}$	3 750 000	0,45

Source: Own Source and modified by (Czech National Bank, 2007)

Tab. 3: Types of collateral and their determination by ratio at 70 %.

Types of collateral	Deductibility of STA approach	Deductibility of IRB approach	Haircut H_C	Value of the collateral (C)	Adjusted value of the exposure		LGD* for IRB approach
Cash	Yes	Yes	0%	3 500 000	E*	1 500 000	0,135
Monetary gold	Yes	Yes	21, 213 %	3 500 000	E*	2 242 455	0,2018
Shares and exchangeable funds involved to the main index of the regulated market	Yes	Yes	21, 213 %	3 500 000	E*	2 242 455	0,2018
Real estate	No	Yes	-	3 500 000	$E^{\backslash}$	2 500 000	0,35

					E \\	2 500 000	0,45
Claim from commercial relation	No	Yes	-	3 500 000	E \	2 800 000	0,35
					E \\	2 200 000	0,45
Movable assets	No	Yes	-	3 500 000	E \	2 500 000	0,35
					E \\	2 500 000	0,45

Source: Own Source and modified by (Czech National Bank, 2007)

Within tables 4 and 5, we can observe that in the case of financial collateral as monetary gold and shares and exchangeable funds involved to the main index of the regulated market, the same price volatility of the collateral (H_C) is assigned, which may be used in STA approach and IRB approach also. It follows that if a bank claim would be ensure by monetary gold or shares traded on the regulated market, than the same risk weight and adjusted LGD* to the collateral is assigned. In the case of collaterals which are used only within IRB approach, the same risk weight and adjusted LGD* is assigned providing ensuring by real estate or movable assets.
Based on established parameters, using complex STA approach and foundation IRB approach by different types of collateral by ratio at 105 % of the given exposure, capital requirements have been calculated. Results can be seen in Table 4 as follows:

Tab. 4: Estimates of capital requirement (CR) using the methodology of Basel II for the various types of collateral.

Types of collateral	CR by STA approach	CR by IRB approach	Percentage change between the STA and the IRB approach
Cash	1 216 000,00	901 296,94	**-26%**
Monetary gold; Shares and exchangeable funds involved to the main index of the regulated market	1 501 102,72	1 112 548,29	**-26%**
Real estate; Movable assets	2 560 000,00	1 739 344,97	**-32%**
Claim from commercial relation	2 560 000,00	1 720 370,30	**-33%**

Source: Own Source

An interesting tendency can be seen in Table 5, where in the transition from STA approach to foundation IRB approach, capital requirements is decreased in range from 26 to 33 %. Here the first set hypothesis is rejected. As shown Table 5, real estate such the most commonly used collateral in practice, considerable additional cost from holding equity to the bank is produced. Compare to the cash as the collateral, real estate brings up to 111 % higher capital requirements within STA

approach and up 97 % higher capital requirements within IRB approach. In the overall term, collaterals such as real estate, movable assets and claim from commercial relation are 2x more expensive than cash collateral (such as bill of exchange or exchange/traded shares) in the term of equity holding. The reason for the high capital requirements by using real estate collateral within STA approach is national regulatory settings where real estate collateral a 100 % risk weight is received, ie. credit risk reduction is not applicable in this case.

Capital requirements of the exposure value (5 000 000 EUR) by STA and IRB approach has been calculated. Within the calculation, credit quality changes in exposure using upper and lower ratio of collateral has been intended. Results can be seen in Table 5 and 6.

Firstly, collateral by ratio at 140 % of the exposure has been set as follows: cash collateral (35 %), shares collateral (35 %), real estate (35 %) and claim collateral (35 %).

Tab. 5: Estimates of capital requirement (CR) using STA approach and IRB approach for the given types of collateral and by changing credit rating of the exposure (140 %).

Credit quality of the exposure	CR by STA approach	CR by IRB approach	Percentage change between the STA and the IRB approach
Rating AAA	269 939,64	199 427,02	-26%
Rating AA	674 849,10	384 961,86	-43%
Rating BB	1 349 698,20	622 331,04	-54%
Rating B	2 024 547,30	1 882 778,40	-7%
Total	4 319 034,24	3 089 498,32	-28%

Source: Own Source

If all exposure in the portfolio would have AAA rating, the capital requirement difference between STA approach and IRB approach would be about 26 %. Comparing best rated exposure with the worst rated exposure, escalating deterioration of credit quality will increase the capital requirements. Within STA approach, capital requirement of the exposure with a rating of B is 7,5 times higher than capital requirements of the exposure with a rating of AAA. Within IRB approach, this difference is 9,5 times higher. Using horizontal analysis, difference between STA approach and IRB approach is achieved. The percentage difference is ranged from 7 % to 54 %. The exposure quality is closer to default; the diversity of approaches would be smaller then. Even to the extent that capital requirement of the IRB approach will be higher than using STA approach. Here the principal character of Basel II is clarified, where only exposures with highest quality rating in bank's portfolio have to be hold. If the bank's portfolio is included only exposures with better rating than BBB (corresponding PD is less than 0,88 %), than more advanced methodologies of credit risk management can reduce capital requirements by tens of percent (Belas, Cipovová, 2013).

Secondly, collateral by ratio at 210 % of the exposure has been set as follows: cash collateral (70 %), real estate (70 %) and claim collateral (70 %). Estimates of capital requirement by STA approach and IRB approach are seen as follows:

Tab. 6: Estimates of capital requirement (CR) using STA approach and IRB approach for the given types of collateral and by changing credit rating of the exposure (210 %).

Credit quality of the exposure	CR by STA approach	CR by IRB approach	Percentage change between the STA and the IRB approach
Rating AAA	184 000,00	126 428,08	-31%
Rating AA	460 000,00	244 049,11	-47%
Rating BB	920 000,00	394 530,87	-57%
Rating B	1 380 000,00	1 193 599,79	-14%
Total	2 944 000,00	1 958 607,85	-33 %

Source: Own Source

Using both credit risk approaches by increasing collateral ratio from 140 % to 210 %, total amount of capital requirement is decreased in the range of 32 – 37 %. Percentage change between STA approach and IBR approach has been preserved, ie. the credit rating of the exposure is deteriorating, difference between capital requirements is decreasing in favor of STA approach then.

If **STA approach without assigned external rating** has been used, capital adequacy ratio of the selected exposure has been calculated by total amount of 400 000 EUR (CR = 100% * 5 mil. Kč * 8 %). In term of total exposure (20 mil. EUR), capital requirement would be **1,6 mil** EUR.

It's interesting to observe the fact that if the exposure is ensured by many smaller collateral ratios, resulting capital requirement would be much higher as in the case where the exposure is not ensured. But at the moment, where the exposure is ensured by only one type of collateral with a higher ratio, capital requirement would be smaller than in the case where the exposure is not ensured. Reason is the calculation of capital requirements, which is summed each case of collateral.

If STA approach **with assigned external rating** is used, capital adequacy ratio of the selected exposure is calculated as follows:

Methods of capital requirement using Standardized based approach are shown in Table 7. This approach is using the rating of recognized well know rating agency and therefore the individual claim portfolio have a risk weight assigned by Standard and Poor's. Total capital requirement is calculated as the sum of individual capital requirements of each rating class, which were calculated as the product of RWA (risk weighted assets) and credit risk coefficient (0,08).

Tab. 7: The calculation of risk weighted assets and capital requirements using the Standardized Rating Based Approach.

	maturity	1			
EAD	PD	Rating Standard and Poor´s	RW_1	RWA	CR
5 000 000	0,0003	AAA	0,2	1000000	80000,000
5 000 000	0,0009	AA	0,5	2500000	200000,000
5 000 000	0,0021	BB	1	5000000	400000,000
5 000 000	0,037	B	1,5	7500000	600000,000
20 000 000				**16000000**	**1 280 000,000**

Source: own source

Tab. 8: The calculation of risk weighted assets and capital requirements using the Internal Rating Based Approach.

	LGD	0,45						
	maturity	2,5						
EAD	PD (%)	rating	correlation	N(x)	b	RW	RWA	CR
5 000 000	0,0003	AAA	0,238213	-2,204	0,317	0,153	8E+05	61 240,725
5 000 000	0,0009	AA	0,23472	-1,857	0,253	0,296	1E+06	118 215,394
5 000 000	0,0021	BB	0,228039	-1,579	0,208	0,478	2E+06	191 107,527
5 000 000	0,037	B	0,138868	-0,684	0,089	1,445	7E+06	578 169,973
20 000 000							1E+07	**948 733,619**

Source: own source

Legend:
PD is the probability of default , LGD is the loss given default, EaD is the exposure at default, N(x) is a function of normally distributed random variable (N(0;1)), b is the maturity, RW is the risk weight, RWA of risk weighted assets, CR is capital requirement

On the basis of given amount and structure of the portfolio, it can be stated that the total amount of equity is 0,948 mil. EUR using foundation IRB approach without any collateral in the first year of the credit relationship. That represents a value of 4,74 % of total claims. Results are shown in Table 8.

Table 8 shows that using Standardized approach with assigned external rating, the overall need for equity is 1,28 mil. EUR where the notional amount of exposures are EUR 20 million. But the amount of equity which has been calculated through the Internal Based Approach is about 26 % lower as in the case of above mentioned STA approach. If the bank wouldn't have any external rating by a recognized rating agency, the capital requirement would have to be calculated through the basic calculation of Standardized approach (such as claim volume x risk weight of 100 % x 0,08). In this case, the total amount of capital requirement is EUR 1.6 million.

Finally it can be seen, that usage foundation of IRB approach brings the saving on equity of 41 % to the bank.

It's interesting to observe the fact that if the exposure is ensured by many smaller collateral ratios, resulting capital requirement would be much higher as in the

case where the exposure is not ensured. But at the moment, where the exposure is ensured by only one type of collateral with a higher ratio, capital requirement would be smaller than in the case where the exposure is not ensured. Reason is the calculation of capital requirements, which is summed each case of collateral.

In the contrast to approaches where the collateral has not been used, approaches where the collateral has been used and is in the practice more common, it is clear that techniques of credit risk mitigation and sophisticated methods (fundamental IRB approach) could achieve significant saving on capital requirements for the bank than the STA approaches.

We found that loan portfolio which is consisted of assets with higher credit quality will have bigger saving on capital requirement and vice versa. Saving between selected approaches is ranged from 13% up to 48%.

The development of capital requirements using three different types of methods of credit risk management are seen in Graf 1.
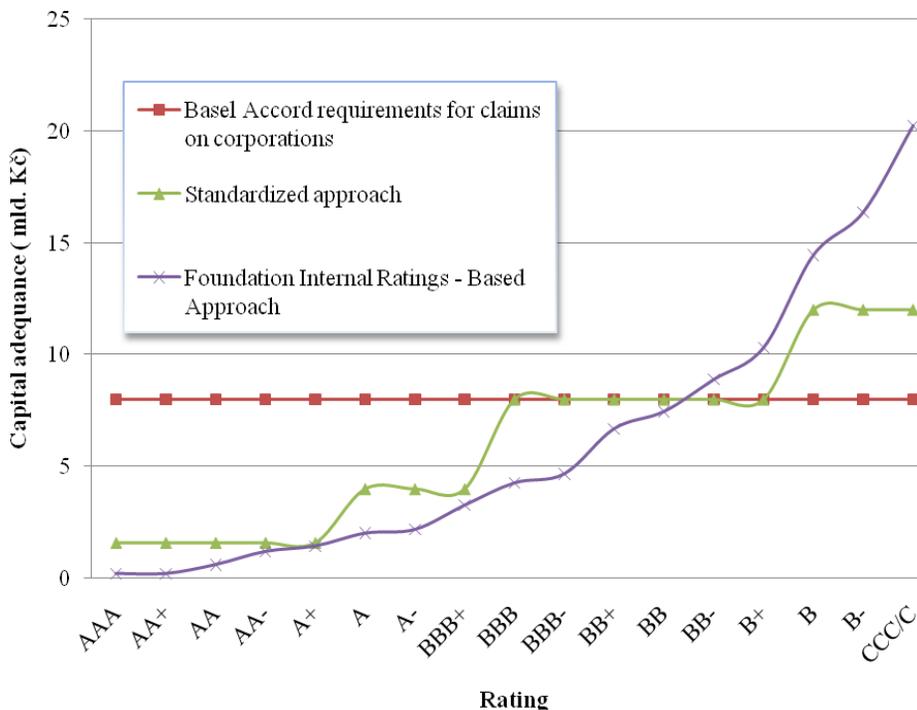
Fig. 2: Comparison of three approach of credit risk management. Source: own source

Acknowledgements

Conclusion

Aim of this article was to highlight the main changes in the capital requirement calculations by using advanced methodology of credit risk management under Basel II and also by using techniques to reduce credit risk with collaterals. First hypothesis, that in the transition from STA approach to the IRB approach with collateral instrument, saving of the capital requirement is less than 15 %, has been rejected. Reason is an percent change of induced saving which has been achieved in the range from 26 % to 33 %, what is 3 times larger savings as say QIS 5 issued by Basel Committee (Bank for International Settlement, 2005).

Second hypothesis, which argues that increasing the ratio of collateral from 140 % to 210 %, there is a reduction of required regulatory capital by up to 10 %, has been also rejected because of our achieved savings about more than $32 - 37$ %.
Hypothesis No 3 has been confirmed because the collateral which is provided the highest saving for the bank is cash then shares then real estate and the claim as the collateral which provided the lowest amount of saving on the equity in any cases of portfolios and any cases of rating quality.

Last hypothesis, that in the transition from STA approach to the IRB approach with collateral, the largest saving of capital adequacy is reached only in the case where bank will keep exposures with AAA in its portfolio, is also rejected. Reason is fact, that the largest capital savings have been achieved in the event when the bank in its portfolio only exposures with no worse than BBB rating (but still not the best exposure with AAA rating) have been held, which represents 0,88 % of PD (Engelmann, 2011).

It's interesting to observe the fact that if the exposure is ensured by many smaller collateral ratios, resulting capital requirement would be much higher as in the case where the exposure is not ensured. But at the moment, where the exposure is ensured by only one type of collateral with a higher ratio, capital requirement would be smaller than in the case where the exposure is not ensured. Reason is the calculation of capital requirements, which is summed each case of collateral.
Usage of own methodology for credit risk measurement can bring substantial saving on equity through which the bank can accelerate their performance. This approach is very current, because represents significant minimization effect in relation to impacts of new banking regulation of Basel III.
New regulatory agreements respond to the recent financial crisis in order to strengthen the resilience of the banking sector to sustainable economic growth through tighter capital adequacy and new standards for liquidity. It could cause financial problem for perspective banks due a business with growing volume of. However, correct settings of internal processes for capital requirement calculation and proper setup of collateral use as techniques to reduce credit risk in legislative term could significantly minimize the growth of equity.

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