How to Deal with Basel II Procyclicality in Russia?

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Abstract

The Central Bank of Russia initiated introduction of the Basel II basic indicator approach to operational risk measurement of banking institutions starting form July 01, 2010. The complete set of Basel II rules is expected to be introduced in the nearest future. Given the during-the-crisis consequences of Basel II regulation, its impact on Russian banking system is to be tested in order to work out policy options for maintaining the stability of the banking system of Russia.

For the purpose two hypotheses are examined and two policy options are calibrated to the obtained results. Primarily, the procyclicality effect of capital adequacy ratio for the whole banking system as if Basel II was introduced is analyzed. Secondly, the procyclicality of risk components is verified. Based on the findings two policy options are regarded in order to dampen the volatility of the system's capital adequacy dynamics.

The research is based on the publicly available and disclosed by the Central Bank of Russia financial statements of the Russian banks (forms F-101 and F-102). The data set includes quarterly data from 2004Q1 to 2010Q1 for all the 1200 banks. 1.5% of datapoints was omitted as outliers.

The methodology to test for the procyclicality of the capital adequacy ratio comported using the empirical joint distribution of risks using the proxies for the credit, market, and operational risks. The value-at-risk methodology was applied using the confidence level of 99.5% following from Basel II recommendations.

The retrospective analysis has revealed the procyclical nature of Basel II capital requirements when capital adequacy could have reached 4.5% in the recession periods and 15% in the boom times (given the official ratio based on Basel I rules to slightly move in the nearby of 17%). Given the estimated results capital buffer creation of RUB 2.1 trln (EUR 52 bn) and IRB-models confidence level calibration in-between 98.1% and 99.9% are proposed to stabilize the system's capital adequacy at the level of 10%.

The research undertaken has highlightened the necessity for further analysis of Basel II implementation consequences in Russia including the alternative measures of Central Bank to dampen the procyclicality within the current trends. The trends to be accounted for are banking institutions' consolidation and the improvement in the efficiency of the lending mechanism to redistribute the Central Banks funds to the industrial enterprises and SMEs.

JEL Classification Codes: G10, G20, G28

Keywords: Basel II, Russia, procyclicality, capital adequacy ratio, risk

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1. Introduction[2]

> "One of the most destabilising elements of the crisis was procyclicality – the amplification of financial shocks throughout the financial system and the broader economy. Procyclicality arose through a variety of channels, including accounting standards for both mark to market assets and held-to-maturity loans, margining practices, and the build-up and release of leverage among financial institutions, firms and consumers."
>
> *BIS 80th Annual Report, 2010*

The current economic crisis has revealed weaknesses in the existing approach to banking regulation all over the world. In particular this refers to excessive procyclicality imposed by the Basel II methodology of capital requirements. This is currently an important issue for the Russian banking system due to planned implementation of Basel II models[3].

The issue of procyclicality arose long before the introduction of Basel II (cf. [Turner, 2000]). However only after the crisis 2007-2009 it has come to fore, when banking systems of different countries experienced huge undercapitalization. One of the reasons for such a situation was the procyclical nature of capital regulation.

The aim of this paper is to analyze the cyclical effect of Basel II for the Russian banking system. Our study is the first to examine this problem using Russian banking sector's data. The analysis reveals some drawbacks of the Basel II approach when applied in a developing country. In particular we find excess volatility and procyclicality of the capital requirements under Basel[4] II. Moreover, we discuss possible ways to dampen the cyclical effect of Basel II. The findings of our analysis provide an empirical basis for making policy proposals for both modifying Basel II and its implementation in developing countries.

There are two main hypotheses we want to test. The first one states that Basel II creates procyclicality of the capital adequacy ratio. The ratio increases during expansion, and decreases during recession. The second one refers to the behavior of individual risks and states that

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[3] On the 20th of October 2009 the Central Bank of Russia announced the introduction of Basel II approaches for operational risk assessment, which is due in July 2010.

4 More on drawback of Basel II (e.g. reduced credit levels to developing economies, discouraged lending to SME and etc.) for developing countries see [Griffith-Jones, 2007].

contribution of credit and market risks has procyclical nature. Their contribution rises in times of expansions, while the contribution of operational risk falls.

In order to carry out our analysis we estimate risk according to IRB approach proposed by Basel II, using empirical distributions for each risk type and for the aggregate risk in the system. We calculate risk-weighted assets for the whole sector and analyze the capital adequacy level according to Basel II. We also determine the adequacy of the actual capital (calculated in line with Basel I).

Moreover, we examine such ways to dampen the cyclicality of the capital requirements as the change in confidence level depending on the phase of the cycle; and the creation of capital buffer.

The paper is organized as follows. Section 2 provides literature overview. Data and methodology are described in section 3 and 4, respectively. The main results are presented in section 5. Policy options for dampening the cyclical effect of Basel II are discussed in section 6. Section 7 concludes.

2. Literature Overview

The financial system plays an important role for the development of the whole economy. However, it may also be a major source of intensifying business cycles (cf. [Borio, Furfine, Lowe, 2001]) due to inappropriate responses of participants on the financial market to the changes in risks over time. Risks are underestimated in booms, and overestimated in recessions.

With the introduction of the Basel capital requirements the issue of procyclicality has received a particular attention. Empirical evidence confirms the procyclical nature of Basel II approaches. In a paper [Kashyap, Stein, 2004] the authors find that Basel II creates additional procyclicality in capital charges (in comparison with Basel I calculations) for the North America's and Europe's banking systems. They consider the period from 1998 to 2002 and use three types of models that are usually applied by banks to estimate PDs (a model based on S&P ratings, KMV model and Deutsche Bank's internal credit-rating model). A similar conclusion for the Canadian banking sector is reached in [Illing, Paulin, 2005]. The authors analyze a dataset of Canadian banks' corporate and sovereign exposures for the period 1984-2003. According to their results the cyclicality does not vary considerably for the corporate portfolio capital requirements under Basel II as compared with Basel I if the TTC estimation of PD is used. However under Basel II PIT approach the volatility is two or three times higher than under Basel I. While for the sovereign portfolio, on the contrary, the Basel II capital requirements are generally higher, but less volatile. Moreover, the authors find the negative correlation between the economic cycle (in terms of GDP

assessment) and the minimum required capital under both Basel I and Basel II, which confirms the existence of procyclicality.

The cyclical effect of Basel II is also analyzed in theoretical works. Such studies usually construct a model or a representative portfolio in order to examine the behavior of capital charges over the business cycle. For example, [Repullo, Suarez, 2008] proposes a dynamic equilibrium model of relationship banking. The authors consider entrepreneurs, banks (with recapitalization constraints which force them to create a capital buffer) and investors. The state-contingent probability distribution of a default rate is based on the single-risk factor model, which is also the basis for the IRB approach of Basel II. The same one-factor model is used in [Hofmann, 2005]. In this paper risk is calculated for a simple credit portfolio (which consists of obligors with identical exposures), a particular level of default threshold and one-year maturity. Loss given default is assumed to be 100%, while default probability (PD) depends on the threshold and is calculated using standard normality assumption of returns. Moreover, the author uses a time-varying macroeconomic factor, which influences the default threshold (in booming economy the threshold is decreased). This, in turn, is reflected in PD and so in the capital requirement calculations. In both papers it is found that the risk-sensitive capital requirements imply an increase in the procyclicality of bank's credit supply. The lending capacity of the banks is significantly reduced during recessions even despite the existence of the capital buffer in times of expansion (as in the model of [Repullo, Suarez, 2008]).

There are different ways to dampen the effect of procyclicality of the Basel II capital requirements. The first one is to adjust the input to the Basel II IRB formula. In particular it refers to how PDs should be estimated. In a research by [Gordy, Howells, 2006] the authors find that TTC rating system is an efficient measure to dampen the cyclicality. However market participants are not able to observe the real change in portfolio risk. While according to [Ozdemir, Miu, 2009] it makes more sense to use PIT approach and then smooth results based on the phase of the cycle.

In order to analyze which approach (PIT or TTC) works better [Pederzoli, Torricelli, Tsomocos, 2010] proposes a general equilibrium model of an exchange economy with banking sector (two banks and a central regulator), corporate sector (two corporates) and one household. The authors find that the choice of the rating system depends on the bank's characteristics and business cycle expectation. For example, the net lender bank prefers TTC, while the net borrower bank chooses PIT system when the recession is expected. Moreover, they conclude that the adoption of TTC method would lead to higher defaults and low profits in recession.

The second possible way to decrease the procyclicality of the risk-sensitive capital requirements is to adjust the output of the IRB formula. For example, [Gordy, Howells, 2006] considers the use of autoregressive filter (AC) and counter-cycle smoothing (CC rule) as ways to

influence the capital requirements estimations. The intuition behind the AC method is that shocks to unsmoothed output from IRB capital formula are absorbed into the regulatory minimum capital requirements over several years rather then all at once. While the idea of CC rule is to use the multiplier (large in good times, and small in bad times), announced by the regulator and applied to the output from IRB capital formula. And according to the authors for smaller bank-dominated markets the most suitable method is the AC. The main advantage of it is its decentralization as it depends only on bank's own time-series and does not require the regulator to make any statements about the macroeconomic situation. However it can be used only when the lending strategy of a bank is stationary. CC rule, in turn, is robust to changing business mix. However the regulator has to assign the value of the multiplier. So, this method should be used in countries with well-developed financial markets.

The comparison of these two broad approaches (input and output smoothing) based on empirical data is carried out in [Repullo, Saurina, Trucharte, 2009]. The authors use the logistic model with dependent variable being the probability of default for commercial and industrial loans. They consider Spanish banks for the period 1986-2007. In order to calculate the TTC PDs the macroeconomic variables used in the logistic regression are replaced by their average values during the sample period. While for adjusting the output of Basel II formula the authors use the multiplier approach (with the proxy for business cycle being the GDP growth rate) and autoregressive filter. Other proxies like credit growth or stock market returns turn out to be quite useless in smoothing the capital requirements. In order to understand which technique works better the results are compared to the trend of the Basel II capital requirements received using the Hodrick-Prescott filter. According to the findings the best way is to use the multiplier approach with GDP being the proxy for the business cycle. During expansions the multiplier rises by 7.2% for each standard deviation in the growth rate of GDP.

Other ways to dampen the procyclicality of the risk-sensitive capital requirements include the use of several "risk curves" so that capital charge is reduced during economic slowdown (cf. [Kashyap, Stein, 2004]) or time-varying confidence levels (cf. [Committee of European Banking Supervisors, 2009]), creation of counter-cyclical "prudential provisions", assigned by the authorities based on some objective criteria (e. g., growth rate of credits, bias in lending to sectors characterized by systemic risks and so on) (cf. [Ocampo, 2003]), establishment of capital buffer during expansions (cf. [Borio, Furfine, Lowe, 2001], [Illing, Paulin, 2005], [Committee of European Banking Supervisors, 2009], [Financial Stability Forum, 2009], [BIS 80th Annual Report, 2010]), introduction of non-risk based measure of the capital requirements to put a simple floor under the risk-based measure, which could become binding when banks take on excessive leverage

(cf. [Financial Stability Forum, 2009]), set up of ceilings on loan-to-value ratios for mortgage lending (cf. [BIS 80th Annual Report, 2010])

In the paper [Committee of European Banking Supervisors, 2009] the authors propose that the capital buffer can be estimated as the difference between the minimum required capital calculated using the current PD and PD which corresponds to the economic downturn. The research also suggests using time-varying confidence level for assessing the capital buffer. The idea of this approach is that the confidence level has to be adjusted, so that at each point in time the regulatory IRB minimum capital equals its value in the worst period during the business cycle. So, in good times the confidence level becomes higher than 99.5%.

Moreover, according to [Danielsson, Jonsson, 2005] in order to decrease the procyclicality capital charges should be denominated in the same currency in which the lending is carried out. The authors argue that in currency dependent economies (in particular, in emerging markets and small open economies) introduction of risk-sensitive capital regulation intensifies the procyclicality induced by the exchange rate. For example, the appreciation of a foreign currency could lead to an insufficient regulatory capital of a bank, thus reinforcing the procyclicality.

An important issue for assessment of the cyclicality of the capital requirements refers to the measurement of aggregate risk within a bank and within the whole banking system. This issue is analyzed in [Schuermann, Kuritzkes, Weiner, 2003], [Rosenberg, Schuermann, 2006], [Elsinger, Lehar, Summer, 2003]).

In the research [Schuermann, Kuritzkes, Weiner, 2003] the authors suggest the "building block" approach that aggregates risks at three levels: the first level includes the standalone risks within a single risk factor (for example, credit risk in a commercial loan portfolio), the second level consists of diverse risk factors within a single business line (for example, credit, market and operational risks in a bank), and, finally, the third level aggregates risks across different business lines (banking and insurance subsidiaries). The authors assume that all risks are jointly normally distributed. Based on this assumption and using different levels of correlation (taken from different studies) and the appropriate risk weights they calculate the aggregate economic capital.

In order to avoid the assumption of joint normality [Rosenberg, Schuermann, 2006] develops a methodology for aggregating different risks using the method of copulas. The analysis is carried out for a bank sample containing quarterly data for 17 US bank holding companies for the period 1994-2002. To measure the marginal distributions for credit and market risks the authors model the return to each risk type as a function of observable risk factors. Based on these functions the simulated marginal empirical distributions are received. For operational risk it is proposed to use the exponential distribution. For aggregating purposes the authors employ the normal copula and the Student's copula with 5 and 10 degrees of freedom. And based on the computed joint

distribution it is now possible to estimate the total risk (in this case the 99.9% VaR is used). An interesting result refers to the comparison of the proposed method with alternative ways to estimate total risk widely used in practice. As shown by the authors the first approximation (Add-VaR), which just sums up marginal distributions, significantly overestimates the economic capital. On the other hand, Normal VaR, when all the margins are assumed to be normal, underestimates the risk. Finally, the third approach, Hybrid VaR, seems to be rather accurate.

By now only several countries have implemented countercyclical regulatory framework. The main examples are Spain and Colombia. The paper [Griffith-Jones, Ocampo, 2009] discusses the case of Spain, where starting from 2004 a new method for countercyclical provisioning is used. The idea is that in order to estimate provisions it is necessary to assess credit losses for a loan portfolio in "cycle neutral" year. Based on this estimations provisions would be about 40% lower than the traditional provisions during recessions, while during good periods they would be higher. However according to [Caprio, 2009] the relationship between credit and GDP in Spain has not changed.

The data from Colombia, where the authorities have introduced countercyclical requirements for loss estimation (in particular, banks have to calculate individual countercyclical provisions, the level of which depends on the state of the economy), also shows quite limited effect from the change in regulation (cf. [Caprio, 2009]).

3. Data

In order to carry out our analysis we use quarterly financial statements of all Russian banks for the period 2004-2010. The data is available on the website of the Central Bank of Russia[5]. Each quarter contains around one thousand and two hundred banks. Based on the availability and assumed reliability of the data we filtered for outliers. The criteria used included the cases when the amount of bad debts exceeds the loan portfolio, when excessive trading profits (losses) were observed given almost zero end-day position, total profit and loss amount was three times at least over the shareholders equity. Each of outliers accounted for no more than 0.1% of average assets-at-risk for non-outliers for the risk return the observation was consider as an outlier.

Russian Banking System

After the crisis of 1998 the economy of Russia started to grow quite rapidly at about 6-7% GDP growth rate annually. Growth was driven by a substantial rise in natural resource/energy prices and supported by overall macroeconomic stability. As a result the banking sector also showed relatively rapid growth rates. Total assets of the whole banking sector kept growing until

[5] URL-source: www.cbr.ru

about the end of 2009 and more than tripled during the period 2004-2009. Though at the end of 2009 there was a sharp decrease as a result of the financial crisis (Annex 2, Figure 14). On January 1st, 2010 total assets amounted to 75.3% of the GDP[6].

However the ratio of risk weighted assets to total assets started to decrease at the end of 2008 (Annex 2, Figure 15). This dynamics could be explained by the devaluation of trading portfolio and also by the "flight to quality" effect due to crisis, as banks reduced their risky positions in favor of safer ones.

Total capital in the system remained relatively low until 2007, when it significantly increased (by a little less than 4 times) and continued to rise till the end of 2009 (Annex 2, Figure 16). Such a rise in capital was due to sharply rising oil prices until September 2008 and also due to government injections in order to support the banking system during the deterioration of the macroeconomic environment.

Capital adequacy ratio (calculated in line with Basel I methodology) was, in turn, quite stable during the whole period (Annex 2, Figure 17). It decreased (however, not significantly) in the year 2008, but then continually rose. On the 31.03.2010 the ratio was 20.5%, which is far above the minimum required by the Russian regulation[7] of 10% (or 8% according to Basel II). Such dynamics of the ratio is again due to government interventions in order to support the financial system during hard times.

If we look at average levels of individual risks (Annex 1, Tab. 2), we can see that the highest levels are for market risk (even though they remain below 100%). What is necessary to emphasize is that volatility of market risk is huge: the standard deviation reaches more than 200% for some periods (Annex 1, Tab.2). While for credit risk it is less than 7%, for operational – less than 20%.

An important issue refers to the level of correlation among risks. As can be seen from Figure 12 (Annex 1) the correlation between credit and market risks and between operational and market risks significantly differs during the period in consideration. However it remains in the range $\pm 10\%$. While the correlation between credit and operational risk (Annex 1, Figure 13) has increased from -5% at the beginning of the period to 20% at the end of the period. The highest level of correlation (21.4%) between these risks was in the middle of 2009, when the crisis was at its peak.

[6] "Review of the Banking Sector of the Russian Federation", www.cbr.ru

7 According to the Instruction of CBR №110 "About the mandatory banks' ratios" (16.01.2004) the capital adequacy ratio for banks with capital more than 180 million rubbles (about 4.6 million Euros) should be 10%, while for banks with less amount of capital – 11%.

4. Methodology

We partially follow the approach proposed in [Rosenberg, Schuermann, 2006]. First of all, we assume that all banks use the same IRB models[8]. Secondly, we supposed no banks change their credit policy after the Basel II implementation. Of course, it is quite a restrictive assumption given the previous findings confirming the trends that banks are likely to change the behavior after Basel implementation (e.g. [Jackson, 1999], [Liebig et al, 2004], [Nachane et al, 2006], [Jablecki, 2009]). In fact, our assumption implies dealing with the-worst-case-scenatiro as all other things being equal banks on their own might be interested in catching up with Basel II capital adequacy standards without extra input from the Central Bank in order to be trustworthy in terms of investor relations.

It is also important to emphasize that it is difficult to speak about the cycles in quite a young Russian economy. However the procyclicality effect can be analyzed from the point of view of the dynamics of appropriate ratios during expansions and recessions.

Moreover, our aim is not to analyze whether Basel II intensifies or not phases of a cycle. We want to understand if capital requirements under Basel II when applied in the Russian banking sector are procyclical or not; and how the procyclicality might be dealt with in Russia.

In order to carry out our analysis we compare our estimated capital requirements (under Basel II) with the existing capital levels, which are calculated according to Basel[9] I.

For each quarter we assess the empirical distribution for individual risks based on the observations for all banks in the system. Each risk is estimated as described in section 2.

In order to assess the total risk we use the following logic.

$Risk(t)$ is the gross risk in time t, i.e. $Risk(t)$ is a random variable equaling the amount of probable gains (losses) in the whole banking system because of three major risks realization (credit, market and operational one).

$A_{ij}(t)$ is the amount of assets-at-risk (risk exposure) for risk j and bank i. For credit risk it equals to the value of credit portfolio; for market – to trading portfolio; and for operational – to total assets.

$R_{ij}(t)$ is the risk return for risk j and bank i.

For credit risk calculation we take into account only overdue indebtedness (overdue for more than 180 days). As we are interested in unexpected losses, we do not consider interest income. We also reduce the credit risk base for the amount of reserves, which are created to cover expected

[8] The assumption is reasonable as these models should be recommended by the Central Bank.

[9] Instruction of CBR №110 "About the mandatory banks' ratios" (16.01.2004), according to which the capital adequacy ratio should be calculated by banks in Russia, is based on Basel I.

losses. The credit risk return is then calculated as the ratio of overdue indebtedness to the credit portfolio.

For market risk assessment we use profits and losses arising from revaluation of a trading portfolio (which includes only instruments held for trading). We do not consider off-balance sheet positions at this stage. The analysis of these positions at the level of the whole banking system requires the development of a separate methodology. Thus, the market risk return is estimated as the ratio of profits and losses from mark-to-market to the amount of the trading portfolio.

Operational risk return, in turn, is calculated as the ratio of net income to the total assets. This approach makes our results comparable with those of other research (cf. [Illing, Paulin, 2005], [Rosenberg, Schuermann, 2006]).

Then the Z amount of total gains (losses) in the banking system arising from three major risks equals to the following:

$$Z(t) = \sum_j \sum_i R_{ij}(t) \cdot A_{ij}(t) \tag{1}$$

Recalling our assumption that all banks are guided by the same stress-testing principles on the same dataset, i.e. supposing $R_{ij}(t) = R_j(t)$, we might rewrite (1) in (2).

$$Z(t) = \sum_j R_j(t) \sum_i A_{ij}(t) \tag{2}$$

Then the amount of gross risk $Risk(t)$ given the α confidence level for the quarterly horizon for the whole banking system is calculated as follows.

$$Risk(t) = q_\alpha \left(\sum_j R_j(t) \sum_i A_{ij}(t) \right), \tag{3}$$

where $q_\alpha(\bullet)$ is the quantile function for the α confidence level.

Based on estimated empirical distributions for each date we calculate the level of gross risk for the system with 99.5% significance level. The capital adequacy ratio (CAR) is then estimated as the ratio of actual amount of capital in the system (K) to the evaluated gross risk (Risk) multiplied by the β coefficient representing the IRB-model backtesting quality check. For the time being we assume that it equals to 3.

$$CAR(t) = \frac{K(t)}{\beta \cdot Risk(t)} \tag{4}$$

5. Major Findings

We start by analyzing the behavior of each risk type. The hypothesis we want to test states that individual risks have procyclical nature. In particular this refers to credit and market risks, while operational risk shows countercyclical dynamics.

First of all, it is important to mention, that based on our estimations the distribution of credit risk is characterized by the skewness to the left, while the distribution of market risk is more or less symmetric. Moreover, market risk has the heaviest tails among all three risks (Figure 1, Figure 2 Figure 3).

According to the results we can confirm our hypothesis in part concerning credit and market risks. As can be seen from Figure 1 during the period from 2008 till the end of 2009 the tails of the distribution for credit risk became heavier, indicating the increase in the level of risk.

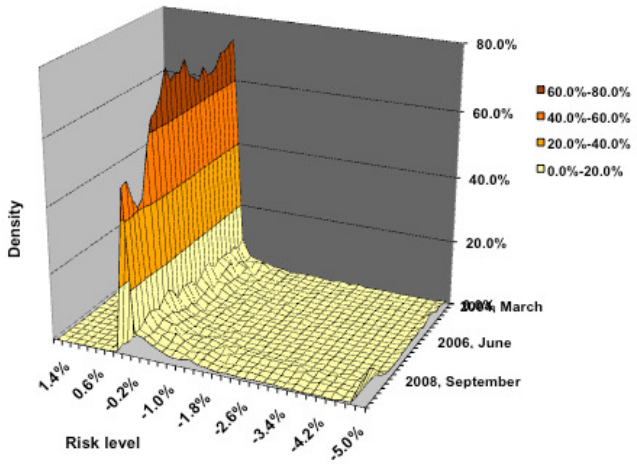

Figure 1 Dynamics of credit risk distribution

The same dynamics can be observed for market risk (Figure 2). The tails of its distribution became heavier during 2008-2009. This period is characterized by the significant deterioration of the macroeconomic environment. So, our results indicate the existence of procyclicality in these risks.

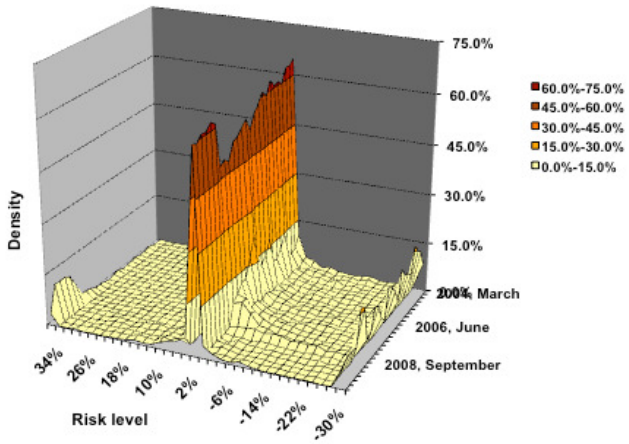

Figure 2 Dynamics of market risk distribution

The behavior of operational risk, in turn, does not have any pronounced nature. As can be seen from the Figure 3 the distribution of this risk is shifted to the positive part and the dynamics of the distribution does not depend on the phase of the cycle.

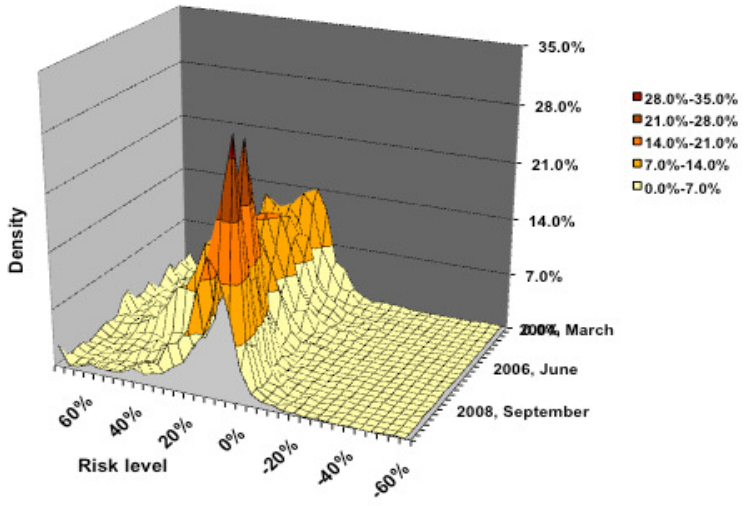

Figure 3 Dynamics of operational risk distribution

If we look at the contribution of each risk to the aggregate risk, we can see (Figure 4) that the share of operational and credit risks significantly rises during the period of recession, while the share of market risk falls. Such dynamics of market risk can be explained by devaluation of trading portfolio and reduction of limits during crisis. The share of operational risk reaches 60% in March 2010, which is in line with the results of [Rosenberg, Shuermann, 2006]. The authors find that the portion of operational risk is 67.8%. However this is different from the findings of other studies. In the paper [Schuermann, Kuritzkes, Weiner, 2003] the authors report the decomposition of total risk with about 25% attribution to operational risk. Even smaller share of operational risk (only 10.4%) is received in [Morone, Cornaglia, Mignola, 2007].

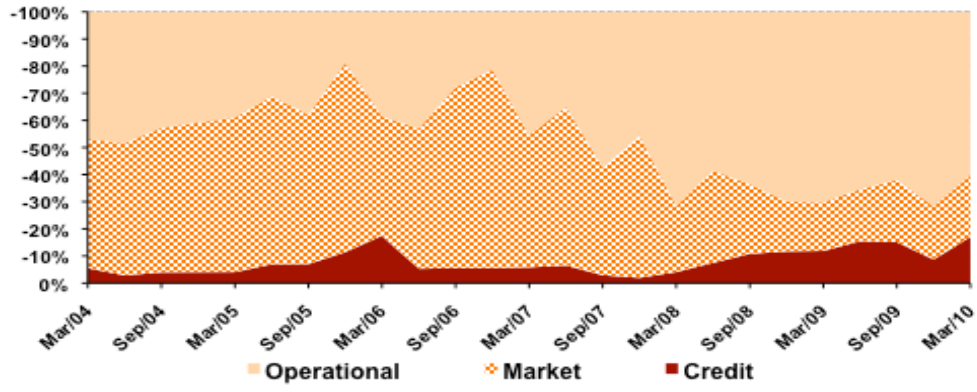

Figure 4 Dynamics of each risk's contribution

Moreover, it is important to emphasize, that VaR estimates for credit risk substantially rise during recession, while for operational risk the increase is in its risk base during this period (Figure 5).

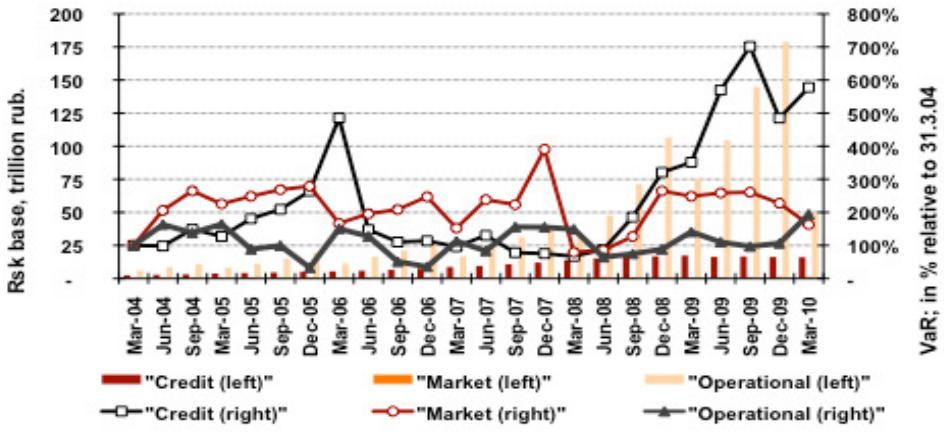

Figure 5 Dynamics of VaR and risk base

As can be seen from Figure 5 in the middle 2007-beginning of 2008 there was a rise in market VaR. The reason for such dynamics was due to substantial decrease in financing from foreign financial markets. Russian banks were forced to shift to domestic markets and as a result they used ruble interest rates for revaluation of their portfolios. These interest rates are significantly higher than the foreign ones, so the devaluation of banks' trading portfolios was rather huge.

We now turn to the first hypothesis, which states that Basel II creates additional procyclicality of the capital adequacy ratio. In order to examine this issue we have, first of all, to analyze the behavior of aggregate risk.

As can be seen from Figure 6 and Figure 7 (the latter is just the representation of the left-tail from the former) the total risk has a pronounced procyclical nature. During expansion, in particular in 2006 – beginning of 2007, the distribution of the total risk was shifted to the left (Figure 6). While when the macroeconomic environment deteriorated the right tail of the distribution became much heavier (Figure 7).

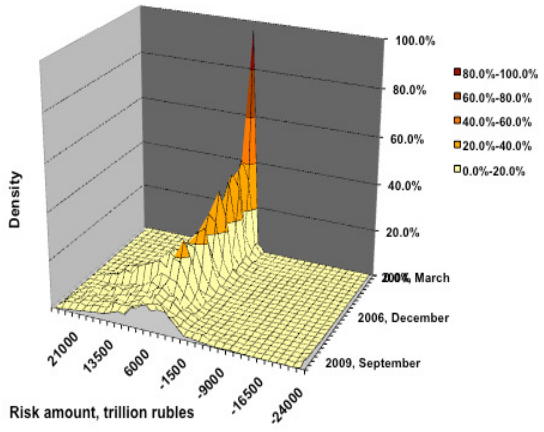

Figure 6 Dynamics of aggregate risk distribution

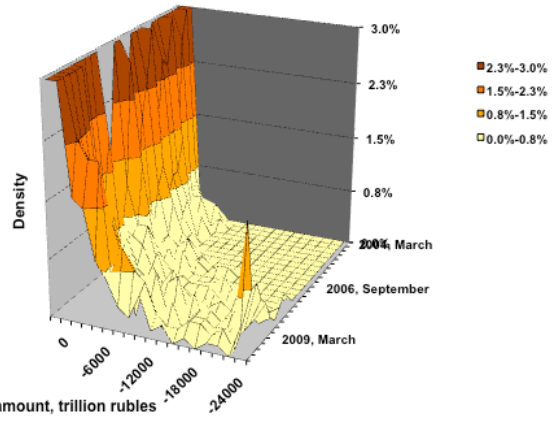

Figure 7 Dynamics of aggregate risk distribution (left tail)

The dynamics of capital adequacy ratio and the ratio of risk-weighted assets to total assets also confirms the procyclical nature of Basel II. In contrast to the actual values of the above

mentioned ratios (which are calculated according to Basel I and are relatively stable during the whole period) our estimates explicitly show the volatile and procyclical character (Figure 8 Figure 9). They are relatively high during the period of expansion and substantially decrease during bad times (2007-2009).

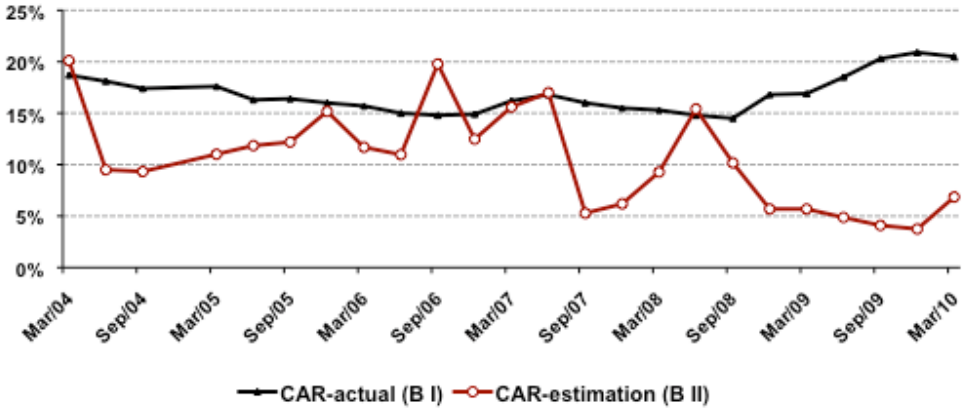

Figure 8 Dynamics of capital adequacy ratio

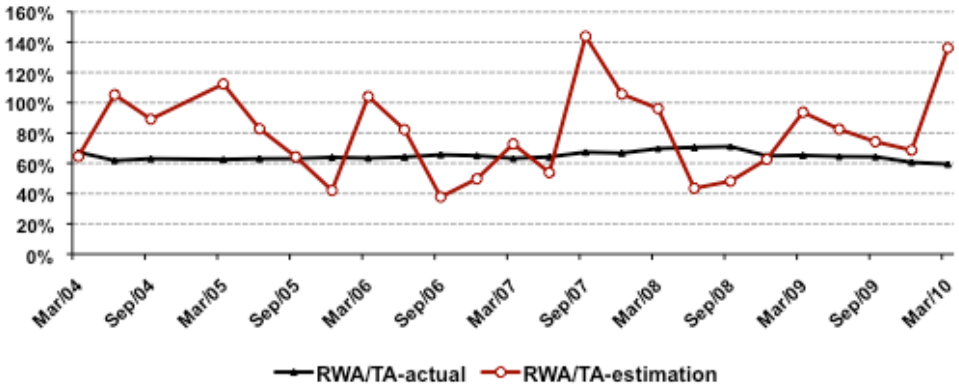

Figure 9 Dynamics of RWA/TA

An interesting result is that before the deterioration of macroeconomic environment the growth rate of capital was higher than the growth rate of aggregate risk (Figure 10). This means that banks augmented resources in order to create the capital buffer.

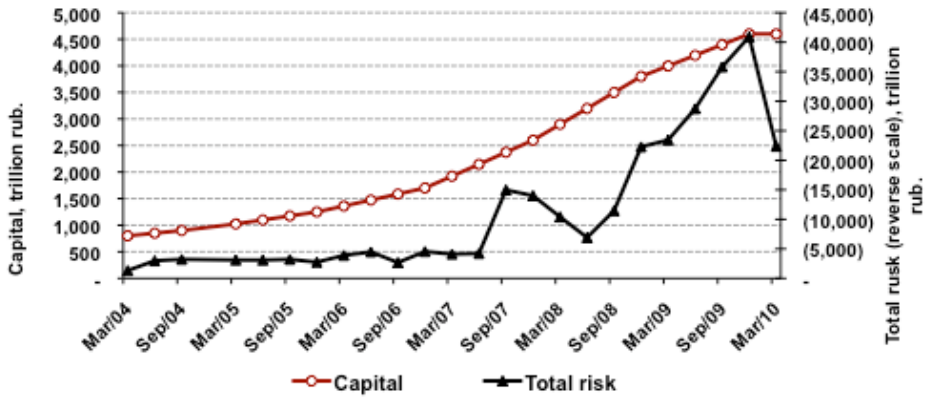

Figure 10 Growth rate of capital in comparison with growth rate of total risk

6. Policy options for dampening the procyclical effect of Basel II

> "In my opinion, if applied to significantly lower percentiles (of the order of 90% or below, say), economic-capital reasoning is much more intuitive, robust, and cognitively resonant-in short, much more appealing. It will not contain all the answers we need, but what it tells us can make sense and be useful. I am encouraged by the discovery that, at the time of writing, a major and sophisticated European bank has joined the ranks of those banks that deploy an economic-capital engine to manage their risk, but that it does so by focusing on the 75th percentile of the yearly profit-and-loss distribution"
>
> *Rebonato, 2007*

We now turn to possible ways, which can be used by the Regulator to dampen the procyclical nature of the Basel II capital requirements. In particular, we consider two approaches: the adjustment of confidence level and the creation of capital buffer.

In order to modify the confidence level when employing the VaR technique we use the methodology described in section 3. According to our results (Figure 11) the confidence level should not change significantly. During expansion it could reach 99.83%, while during hard times it lowers till 98.15%.

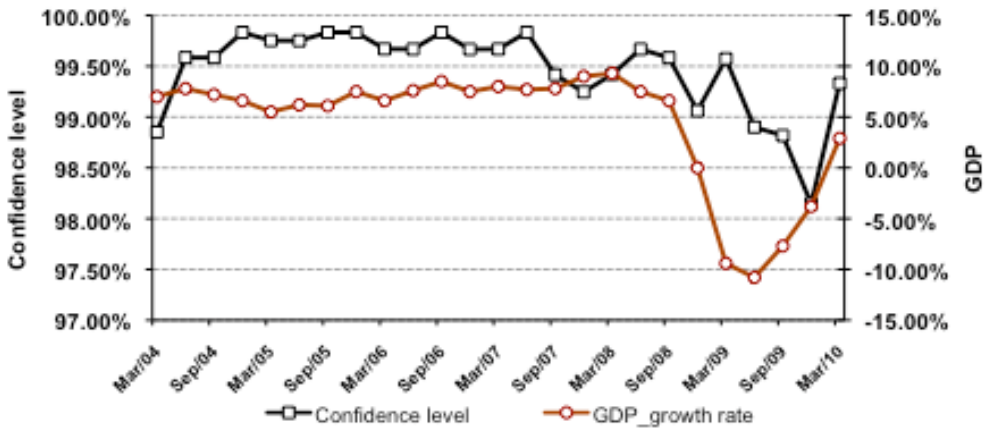

Figure 11 Dynamics of confidence level and GDP growth rate (*source*: Federal State Statistics Service, www.gks.ru)

An important question here is how to understand when the confidence level should be adjusted. The possible solution is to change it in line with macroeconomic variables. Probably the most easy and useful method is to employ the GDP growth rate. As can be seen from Figure 11 the dynamics of the confidence level and of the GDP growth rate is more or less similar. So, the growth rate of GDP can be used as a signal to appropriately change the confidence level. Another variable, which could also be applied in such an analysis, is the level of investments. They are very sensitive to macroeconomic environment and could be a proper indicator of the state of the economy. Asset

prices can also serve as a reliable signal for financial distress and so for the adjustment of the confidence level.

The second approach to dampen the procyclicality is the creation of the capital buffer. We compare the estimated capital amount under Basel II with the actual capital in the system. The estimated level of CAR as on 31.03.2010 is 6.9% and the total actual capital amounts to 4.6 trillion rubbles. In order to reach the 10% level (which is required by the Russian regulatory authorities) the total capital should be increased by 2.1 trillion rubles. This amount could be considered as the capital buffer.

7. Conclusion

In this work we analyze the procyclical effect of the Basel II methodology and discuss the policy options to dampen it. This is an important issue for the Russian banking system due to planned implementation of Basel II in 2010.

We consider quarterly data of all Russian banks for the period 2004-2010. The two main hypotheses are tested in this study. The first one states that Basel II creates procyclicality of the capital adequacy ratio. The second one refers to the behavior of individual risks and states that contribution of credit and market risks has procyclical dynamics, while the contribution of operational risk has countercyclical nature.

In order to estimate the minimum capital requirements under Basel II we use empirical distributions for every risk type, based on which we construct the empirical distribution of the aggregate risk. And then using this distribution and applying VaR technique we calculate the amount of the total risk in the sector.

Our results confirm the procyclical nature of Basel II approaches when applied in the Russian Federation. However the possible changes in banks' behavior due to implementation of Basel II has not been analyzed.

For dampening the procyclicality the following measures can be employed: the adjustment of the confidence level when employing IRB models in the interval 98.1%-99.9% and the creation of the capital buffer in the amount of 45% of the current capital in the system.

The measures to dampen the procyclicality of the Basel II capital requirements requires further investigation. Our further research would have to take into account the experience of developed economies already working under Basel II. Moreover, it should take into consideration the current trends in the Russian economy. This refers, in particular, to the consolidation of financial institutions and the malfunctioning of the lending mechanism through banks, which receive credits from the CBR.

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Annex 1. Descriptive Statistics.

Table 1. Risk amount and risk base, billion rubles

Date	Credit Risk level (%)	Credit risk base	Market risk level (%)	Market risk base	Operational risk level (%)	Operational risk base	Total capital	CAR-actual (Б I)
Mar/04	-5.5	2,473.0	-60.8	378.2	770.6	6,163.1	162.8	18.7%
Jun/04	-6.1	2,846.2	-100.5	407.4	1,412.0	8,495.6	153.9	18.1%
Sep/04	-15.5	3,170.1	-121.7	423.9	2,325.9	10,823.2	157.6	17.4%
Dec/04	-14.8	3,482.5	-182.3	412.7	3,310.9	14,096.3	159.0	17.0%
Mar/05	-18.6	3,800.2	-40.6	532.0	1,095.7	8,279.2	171.0	17.6%
Jun/05	-18.0	4,185.0	-73.4	478.3	1,762.8	11,204.5	179.8	16.3%
Sep/05	-14.6	4,520.4	-133.2	485.4	2,733.6	14,986.7	183.1	16.4%
Dec/05	-12.4	5,023.3	-200.9	511.1	3,977.5	19,578.0	222.7	16.0%
Mar/06	-16.5	5,387.0	-56.7	695.4	1,386.0	11,184.8	274.7	15.7%
Jun/06	-17.0	5,921.4	-122.7	769.0	2,622.9	16,330.2	279.4	15.0%
Sep/06	-19.5	6,640.4	-172.9	748.6	3,972.8	21,262.3	229.0	14.8%
Dec/06	-19.9	7,595.8	-245.3	813.0	5,684.2	27,415.3	286.1	14.9%
Mar/07	-25.8	8,703.2	-78.6	807.9	2,105.3	16,922.3	1,014.3	16.2%
Jun/07	-29.5	9,514.5	-162.1	825.2	4,140.4	23,456.6	1,330.1	16.8%
Sep/07	-26.1	10,837.0	-371.7	906.0	6,394.5	31,214.7	1,418.7	16.0%
Dec/07	-24.6	12,028.9	-525.6	1,088.4	8,758.9	39,725.6	1,440.3	15.5%
Mar/08	-39.3	14,057.4	-27.8	1,243.9	3,372.1	32,481.2	2,075.3	15.3%
Jun/08	-43.9	15,273.4	-27.5	1,254.8	4,330.7	47,674.1	2,429.0	14.8%
Sep/08	-58.9	16,695.7	-77.1	1,021.7	4,931.2	71,426.7	2,565.0	14.5%
Dec/08	-111.1	16,806.3	94.5	564.8	4,768.2	106,721.0	2,650.1	16.8%
Mar/09	-237.4	17,397.0	290.6	653.1	3,156.3	75,031.2	2,881.7	16.9%
Jun/09	-299.6	16,302.3	84.8	790.7	2,817.9	104,518.3	3,055.5	18.5%
Sep/09	-315.4	16,692.9	-3.6	1,196.9	3,450.5	144,805.7	3,435.1	20.3%
Dec/09	-265.6	16,230.8	50.9	1,373.7	3,603.3	178,856.6	3,425.7	20.9%
Mar/10	-232.1	16,059.4	29.8	1,338.2	3,354.9	49,294.4	3,466.4	20.5%

Table 2. Average values and standards deviations of risk levels

Date	Descriptive statistics	Credit risk	Market risk	Operational risk
Mar/04	Medium	-0.33%	-24.01%	22.78%
	Standard Deviation	2.49%	86.23%	17.20%
Jun/04	Medium	-0.31%	-60.39%	24.75%
	Standard Deviation	1.56%	128.58%	16.93%
Sep/04	Medium	-0.43%	-78.42%	30.39%
	Standard Deviation	2.19%	172.56%	16.21%
Dec/04	Medium	-0.35%	-87.34%	31.93%
	Standard Deviation	1.38%	192.53%	13.81%
Mar/05	Medium	-0.40%	-36.39%	25.18%
	Standard Deviation	1.78%	105.67%	18.14%
Jun/05	Medium	-0.49%	-49.91%	27.01%
	Standard Deviation	1.78%	133.10%	16.36%
Sep/05	Medium	-0.45%	-54.56%	28.48%
	Standard Deviation	2.19%	172.18%	15.63%
Dec/05	Medium	-0.42%	-68.34%	29.85%
	Standard Deviation	1.89%	180.95%	14.50%
Mar/06	Medium	-0.66%	-18.74%	22.61%
	Standard Deviation	4.53%	68.41%	17.53%

Jun/06	Medium	-0.48%	-36.32%	25.08%
	Standard Deviation	3.61%	108.18%	15.84%
Sep/06	Medium	-0.39%	-38.59%	27.62%
	Standard Deviation	1.14%	113.88%	15.07%
Dec/06	Medium	-0.32%	-52.72%	29.58%
	Standard Deviation	1.43%	160.15%	15.20%
Mar/07	Medium	-0.27%	-19.43%	24.04%
	Standard Deviation	2.17%	78.73%	17.96%
Jun/07	Medium	-0.36%	-28.03%	26.79%
	Standard Deviation	1.34%	110.69%	16.22%
Sep/07	Medium	-0.29%	-46.68%	28.61%
	Standard Deviation	1.17%	231.07%	15.67%
Dec/07	Medium	-0.21%	-45.39%	29.09%
	Standard Deviation	1.56%	159.36%	15.08%
Mar/08	Medium	-0.32%	-9.41%	15.95%
	Standard Deviation	0.80%	48.62%	14.89%
Jun/08	Medium	-0.35%	-9.18%	14.72%
	Standard Deviation	0.89%	63.06%	12.85%
Sep/08	Medium	-0.46%	-33.97%	13.22%
	Standard Deviation	1.35%	110.34%	11.70%
Dec/08	Medium	-0.92%	-45.05%	10.74%
	Standard Deviation	2.87%	244.18%	10.94%
Mar/09	Medium	-1.40%	8.81%	13.71%
	Standard Deviation	3.50%	190.77%	14.65%
Jun/09	Medium	-1.75%	19.03%	10.77%
	Standard Deviation	5.29%	162.38%	13.02%
Sep/09	Medium	-1.97%	-6.88%	9.71%
	Standard Deviation	6.44%	196.55%	12.52%
Dec/09	Medium	-1.55%	22.48%	8.67%
	Standard Deviation	4.78%	190.10%	12.99%
Mar/10	Medium	-1.64%	-4.21%	15.89%
	Standard Deviation	5.00%	103.09%	18.39%

Figure 12 Dynamics of correlation among risks

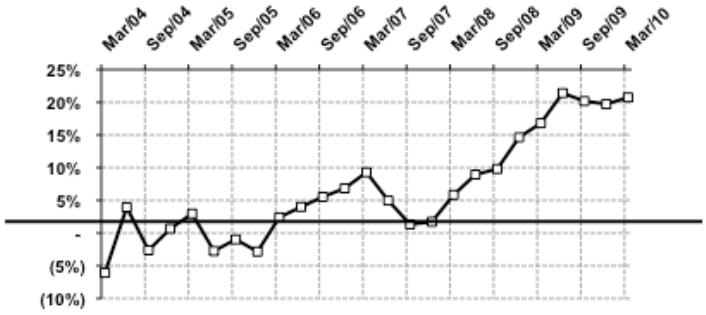

Figure 13 Dynamics of correlation between credit and operational risks

Annex 2. General Information on the Russian Banking Sector.

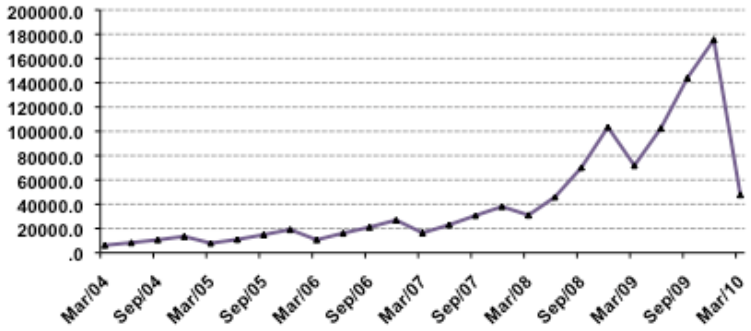

Figure 14 Dynamics of total assets adjusted for inflation (billion rubles), source www.cbr.ru

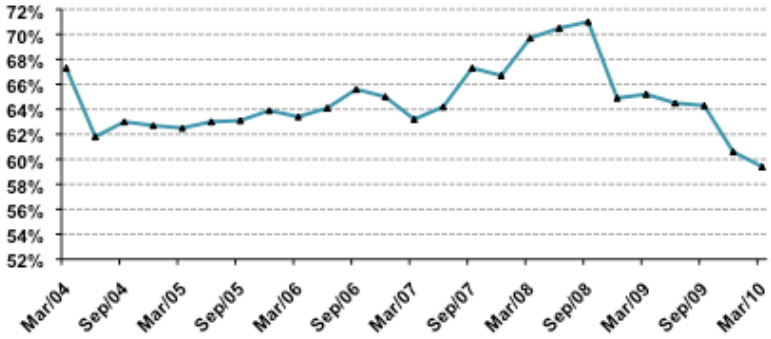

Figure 15 Dynamics of RWA/TA, source www.cbr.ru

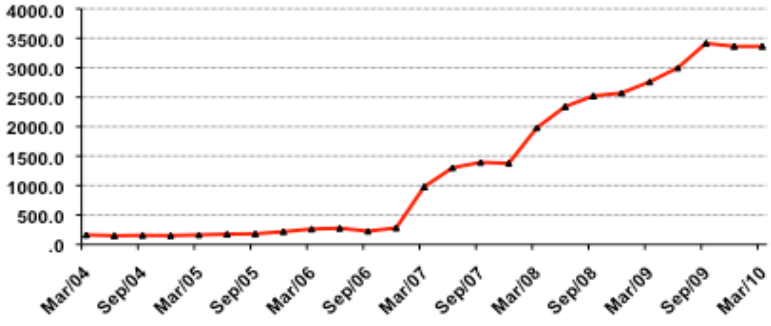

Figure 16 Dynamics of total capital adjusted for inflation (billion rubles), source www.cbr.ru

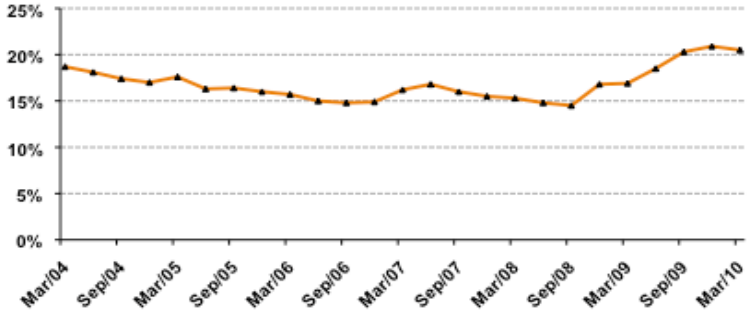

Figure 17 Dynamics of capital adequacy ratio, source www.cbr.ru