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Estimation of the Probability of Default of Corporate Borrowers

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ABSTRACT

Lending to the corporate sector represents a significant part of the activities of the Russian banking sector. At the beginning of 2014 the volume of lending to non-financial organizations amounted to about 56% of the value of the loan portfolio and 39% of the value of Russian banks' assets. Meanwhile, the level of outstanding debt of the corporate loan portfolio tends to increase. A further increase in the share of corporate defaults in the portfolios of banks may cause instability in the banking sector and the financial system as a whole. A large proportion of lending in the Russian market represented lending construction companies. The crises of 2007-2009, 2015-2016 shows that companies in this industry is largely affected by macroeconomic shocks, which leads to interest in the construction of a model/estimation of default probability is for construction industry. In this article we consider one of the approaches to modeling the probability of default of construction companies use logit-models of binary choice on the basis of financial reporting data, institutional characteristics, as well as macroeconomic indicators, as a tool for accounting effect of cyclic economy.

Keywords: Probability of Default, Credit Risk, Logit Model
JEL Classifications: E50, L79, G30

1. INTRODUCTION

Russian entry into the global system of economic and financial relations set the task not only to develop the infrastructure, the relevant market principles of management, but also practical actions directly enter and actually operate on a single global market for financial services, leaving the state production of financial and monetary policy based which is the tax laws, the refinancing rate of the Central Bank of Russia (or the discount rate in other countries), the open market operations, other economic, less administrative sanctions as the market itself and its members, in particular, through the production, coordination and the unconditional implementation of the professional community level playing field in the securities market in general in the financial markets (Barton et al., 2003; Yiping, 2008). At the same time, as a result of the limited historical statistical data, closed markets and the existence of institutional and legal barriers, reducing the predictive power of market signals, the number of research and evaluation of default probability models for the Russian corporate lending sector is very limited. Using the tools that are based on foreign data and the markets do not always

provide adequate results, as in this case, does not take into account the peculiarities of Russia's institutional and financial environment. One of the special tasks of the state policy in the financial services market is to protect the rights and legitimate interests of investors (Nikolaeva et al., 2015; Pomazanov and Kolokolova, 2004). Measures herein may be, on the one hand, the administration, which is somewhat easier in terms of their enforcement practices to achieve ongoing proactive results, but they are ineffective in the long term because of their inconsistency with the terms of the functioning of market mechanisms, on the other hand, it is the everyday actions of the state, aimed at the adoption and acceptance of society a kind of "code of conduct of the investor," where the motives of investors will be elaborated by the issuers in the markets, in particular, to achieve a reduction of investment risks. Of course, this is not a regulatory document, but if it is recognized by issuers in prospectuses, they will follow those rules.

In this regard, of particular scientific interest in the problem of risk management and the use of these purposes firmware and mathematical methods for studying the processes in the financial

markets once again gives grounds to confirm that in the last two decades, investors around the world are interested not so much diversifiable risks as systematic or market risks associated with general economic problems, the increasing globalization of the economy. For this reason, investors are suffering from "market uncertainty" whether shares how many companies they own, it is for this reason increases dramatically since October 1997 volatility (volatility - volatility of prices or the amplitude of oscillation within a certain period of time, equity prices) securities market, not only in emerging markets, which include Russia, but also in countries with so-called "stable economy" (The United States, Western Europe, South-East Asia). World Bank analysts argue that "in the I quarter. 2000 daily fluctuations in the US stock markets increased by 44% compared to the IV quarter. 1999" and this trend continued throughout 2000. Significant changes in the economy of one of the most stable countries (often even the prerequisites for this) in the chain affects all others, first of all reflected on the sudden changes in their stock markets and, as a rule, lead to a decrease in the market capitalization of the leading national (multinational companies).

According to the requirements of the Basel Committee on Banking Supervision (hereinafter - the BCBS) released a few main components that determine the level of credit risk: The probability of default (PD), the level of losses in case of default loss given default, the magnitude of the loss in case of default (exposure at default), the effective (maturity) (Bis.org, 2004; Bis.org, 1999; Valles, 2006). In this regard, one of the most important areas of risk management of modern commercial bank is to assess the TD of the borrower.

These systemic risks imposed Russian problems associated with both the creation of efficient markets themselves and with the actions on them professional participants, often, is not in the interests of their clients (investors) that gives rise to increased uncertainty in the market as compared to the stable economy countries.

2. MATERIALS AND METHODS

The basis of the information base of research served multiple sources: Information analytical system FIRA PRO, data posted on the websites: Bank of Russia, Federal State Statistics Service, the Supreme Arbitration Court of the Russian Federation, the International Monetary Fund, Bank for International Settlements.

Scientific position of the research based on the works of foreign (Altman, Beaver, Merton, and others) and Russian (Karminsky, Peresetsky, Pomozanov, and others) authors. The paper used methods such as a review of the scientific analysis, synthesis, classification, comparative analysis and classification in the practical part of the used methods of statistical analysis and econometric modeling.

For the purposes of multivariate modeling default probability model used in binary choice on the basis of specifications for the type of logit-model.

Taking into account the application of these approaches on the basis of publicly available data on Russian companies (for

example, the construction industry companies) was carried out to select the most dominant risk indicators (financial, macroeconomic and institutional) and implemented multifactor modeling default probability based on the selected issues. Systematization and structuring of various methodological aspects of the assessment of the PD, allowed to form a comprehensive view of the existing methods for estimating the PD, taking into account the advantages and disadvantages of these methods and the extent of their applicability to the Russian practice. The results of this analysis were the basis and were used in selecting approaches and modeling tools as part of building their own models to estimate the PD for the Russian companies.

3. RESULTS

There are several basic approaches to the definition of "default." Most of the scientific articles dealing with the assessment of default probabilities, suggests the identification of event of default of the borrower with the implementation of the credit risk, the authors estimate the PD, the probability of failure conditions of the loan agreement by the borrower due to its inability or unwillingness to follow the contract (Pomazanov and Kolokolova, 2004; Pomazanov and Petrov, 2008; Pomazanov, 2004).

In the terminology of the "International Association for swap dealers and derivative securities: International Swap and Derivatives Association, default is one of the criteria of a credit event, which includes (Razumovsky, 2010):
• Bankruptcy of the borrower;
• Early maturity of the obligations;
• Default on the obligation;
• Reducing the solvency of the borrower;
• Failure to fulfill obligations;
• Restructuring of the debt.

The Basel II 24 (Bis.org, 2004; Bis.org, 1999) default particular counterparty is considered to have occurred if there had been a single (or a few at a time) of the following events:
• Bank believes that the borrower is unable to repay its credit obligations without taking a decision on the implementation of the bank security;
• The borrower is late more than 90 days to repay any significant obligations to the bank.

BCBS has also identified what events might be considered by the bank as sufficient from the point of view of the borrower defaulted recognition (Valles, 2006):
1. The credit demand has the status of the claim for which there is no interest payment
2. There is a significant reduction in debt service as a result of the bank is forced to write off debt or to create a significant amount of reserves
3. The bank has decided to sell at a significant discount requirements and/or the magnitude of economic losses
4. The bank has decided to restructure the debt, resulting in a significant reduction of its cost may occur
5. The bank has filed a lawsuit on the recognition of the borrower's bankruptcy

6. The borrower filed for bankruptcy or been declared bankrupt
7. In the event that the borrower is a credit institution, an event of default can be considered an event of license revocation by the supervisory authority.

Moreover, according to the Basel Committee requirements, if at least one transaction with the corporate borrower default event occurs, the borrower defaulted generally recognized, as well as all transactions that are carried with him. Thus, according to the PD position BCBS it is primarily an attribute of a particular corporate borrower, not the totality of transactions.

In the Russian legislation the term "default" more often associated with defaults on debt securities or loan agreement. In accordance with Art. 7.2.16 "Standards of securities issue and registration of securities prospectuses" No. 29800 from 30.08.2013 default of the Issuer's obligations on the bonds is a default in the case of:
• Delay the fault of the issuer's performance of the obligation to pay regular interest (coupon) on the bonds for more than 10 working days of the issuer or refusal to fulfill such obligations;
• Delay on the issuer's fault performance of the obligation to repay the face value (face value in case the repayment of the nominal value is carried out in parts) bonds for a period exceeding 10 working days or failure of the issuer to fulfill such obligations;
• Delay on the issuer's fault performance of the obligation to acquire bonds for a period exceeding 10 working days or failure of the issuer to fulfill such obligations;
• In this category stands alone "technical default;"
• Compliance with the relevant obligations overdue for the periods indicated in the upcoming paragraphs.

As part of the definition of default in the Russian banking practice, the term is defined in the default part of the letter CBR No. 192-T is considered a default occurred from the time when there has been any of the following events: According to internal documents of the bank determines that the debtor is unable to repay its credit obligations to the bank without taking special measures, such as the implementation of software and/or the debtor is declared bankrupt by the court and/or the debtor has delayed repayment of any material credit obligation to the bank for more than 90 days. The bank may use more stringent definition of default by introducing further refinements to various classes of credit claims.

As previously noted in the economic environment, there is often the identification of the concepts of default and bankruptcy. In accordance with Art. 2 of the Federal Law "On Insolvency (Bankruptcy)" dated 27.09.2002 number 127-FZ and art. 65 of the Civil Code of the Russian Federation under the "bankruptcy" means a failure to recognize the arbitration court of the debtor to fully satisfy the claims of creditors on its monetary obligations and (or) to fulfill the obligation to make compulsory payments.

The identification of the concepts of "default" and "bankruptcy" is not entirely correct, since the concept of "default" is broader and usually includes the bankruptcy of the borrower, but is not limited to them. There are many different models to estimate the PD, which are based on different approaches and assumptions.

The fundamental within this class of models is the work of Merton (Merton, 1974). As part of this work the firm payables is considered as a requirement that can be drawn to its cost. In general terms, within the framework of the proposed approach the provision of accounts payable is treated as a purchase of the assets of the firm and, through the pricing formula of Black-Scholes, is treated as the transfer of the company's shareholders a call option on the value of these assets with a strike price equal to the amount payable, and execution time equal to the term to maturity of the accounts payable (Pomazanov, 2004).

Unlike structural models, the reduced form models do not attempt to explain the nature of the occurrence of default of the company. Models of abbreviated forms do not consider the value of the company's value, or any other index, as the source of its PD. Models of abbreviated forms suggest that the borrower defaults may occur at any time, and in this respect we are not so much important to understand what caused it, how much it is important to model the conditional law of this process (Zadeh, 1965; Yang and Platt, 1999). These models are based on the assumption that the risk manager has less detailed information about the company than its owners or management, uses the information publicly available on the market as a whole, for example, the market value of the debt of the borrower, the yield spread, the structure of interest rates, the dynamics of credit default swaps, etc. Models of abbreviated forms are not considered structural factors that lead to a default. Therefore, these models will not be able to answer the question about the causes of default, but it can provide an estimate of the probability, based on data obtained from the market.

The underlying model in the framework of this subclass was the work of (Simanovsky, 2010; Treacy and Carey, 2000; Zicchino et al., 2005), where the authors, while continuing to develop the model of Merton, proposed a model of pricing derivative securities under the conditions of continuity and the random nature of the functions of default based on the term structure of interest rates.

The advantage of market models is the fact that this class of models is based on market data, thus we are "absorbing" the information on the borrower available to all players operating in the market. In terms of the ability of this class of models take into account the systemic risks of the economy, market models are highly sensitive, since the market in advance, "anticipates" downs/economic growth, which is reflected in the corresponding behavior of quotations and economic agents.

It should be noted that the market's reaction to the "downs" are usually more severe and "protracted" than on growth. In this case, if the market "expects" the economic downturn, and as a result, the quotations fall, the PD based on the market model will continue to grow, even if in fact the current economic conditions have stabilized and have a positive trend. Thus, this class of models with a high degree exposed to the effect of strengthening cyclical estimates the PD. Moreover, the correlation estimates obtained using these models, higher for bad borrowers. That is the average PD for borrowers with a high level of risk on the basis of market models will be significantly higher during periods of recession and lower in periods of economic recovery.

That is why supporters of market models underline the fact that for the fairness of the results obtained on the basis of market models, you need to perform a hypothesis about the effectiveness of the stock market, according to which all relevant information immediately and fully reflected in the behavior of the market and the dynamics of quotations. In fact, the Russian information available on the stock market is very limited, and in practice sometimes rather difficult to estimate the market value of the asset most borrowers (Pomazanov, 2004; Vasilieva and Petrovskaya, 2006; Vasilev et al., 2013). The cost of the firm and its volatility is required for the calculations are not always statistically observable and indicative in the Russian market.

Meanwhile, the market models were widely spread in the international practice. Merton model became the basis for the development of the rating agency Moody's KMV model, in which generally used a four-stage procedure for assessing credit risk of companies, whose shares are traded on the open market (Figure 1; Beloglazov et al., 2015):

1. Determine a certain critical point Default (Default point, DP). The threshold, if the value of the company falls below this threshold, the company falls into default.
2. Determine the magnitude of the value of the assets of its volatility.
3. Determine the value of the distance to default, which shows how to be a decrease in the value of the company's assets in order to declare a default.

4. DISCUSSION

In probability theory at risk mean "variation, volatility, volatility inherent in this type of asset." In economic theory, the risk is meant "an event or action that could potentially adversely affect the organization's ability to implement its strategies and achieve its objectives" (Pomazanov and Petrov, 2008; Simanovsky, 2008).

The most significant type of risk for the classic commercial bank is a credit risk. Credit risk arises from the possibility of loss due to non-performance or improper performance by the borrower of its obligations under the contract.

The models based on macroeconomic factors. At the heart of this subclass models on the premise that the PD is cyclical and increases during the economic recession. As a rule, these models use regression analysis, which involves macro-economic indicators such as gross domestic product, inflation, unemployment and others. With these models we can get not only a short-term assessment of the PD of the borrower, but also to estimate the PD based on a system level risk (Wilson, 1998, Yiping, 2008).

The strength of the model, taking into account macroeconomic factors, is that they can be used to take into account the cyclical behavior of the economy and the exposure to systemic risk. These models are suitable for the purpose of stress testing the quality of banks' loan portfolios. In addition, as macroeconomic indicators statistics available, this approach can be used for cross-analysis of the PD in various countries, regions, industries, sectors of the economy.

Figure 1: Classification assessment of default probability models
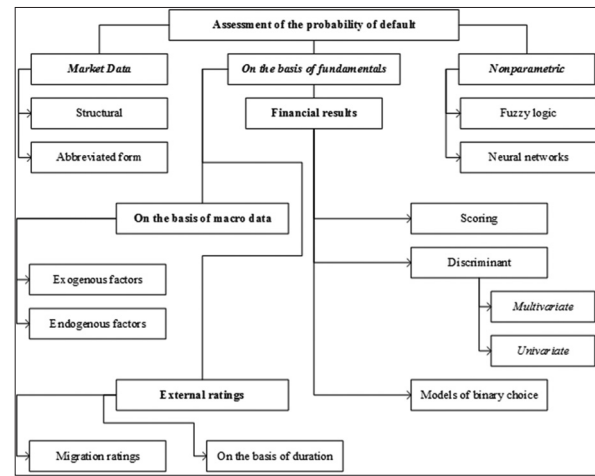
The disadvantage of these models is the fact that the inclusion of macroeconomic indicators can only serve as an extension of the model, because only on this basis is difficult to assess the PD of a particular borrower, not the industry or the banking system as a whole. Moreover, in the Russian practice, often on state companies, including the major backbone companies, macroeconomic shocks exert indirect influence, and paramount influence factors possible support from the state or the parent, if, for example, the company is a subsidiary of major foreign players.

Enough common is the class of models derived from these financial and accounting reports. In general terms, all the models presented in this class, depending on the statistical method can be divided into scoring models, linear discriminant analysis model (which in turn are divided into model one-variable and multiple discriminant analysis) and binary choice model.

Credit scoring was first introduced in works "Comprehensive Approach to risk management" and "stress tests of UK banks using a VAR approach" (Barton et al., 2003; Zicchino et al., 2005). The proposed model has been highly simplified. For each retail borrower to determine the final credit score, the author proposes to use the following characteristics: Gender, age, length of stay in the same place, a professional group, the financial condition, experience.

In general, the application of scoring models, each borrower is assigned a Speed-point, which characterizes the financial condition and ability to repay their obligations to the lender. Subsequently, the whole range of possible values is divided into intervals, the rating group. With the help of calibration model based on historical data for each rating point is assigned a PD, which, for the most part, is an estimate of the number of companies in this group have experienced a default within a year.

5. CONCLUSION

Timely and accurate assessment of the credit risk of corporate borrowers plays an essential role in ensuring the stability of the Russian banking sector and the financial system as a whole. At the same time lending to non-financial companies is a leader in

the structure of credit portfolio of Russian banks. Despite the fact that in recent years the share of overdue loans in the corporate loan portfolio decreases, the unstable economic situation recently, may adversely affect the trends and does not cause stability of the financial system.

At the same time, due to limited availability of statistical data, closed this segment of the market, the availability of institutional and legal barriers, reducing the predictive power of market signals, the number of research and evaluation of default probability models for the Russian corporate lending sector is very limited. Using the tools that are based on foreign data and the markets do not always provide adequate results due to the lack of attention to the characteristic features of the Russian institutional and financial environment.

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