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## DETERMINANTS OF INTEREST RATES ON CORPORATE DEBT

**Abstract.** The *objective* of this article is theoretical and methodological justifying of determining algorithm of the cost of debt capital for enterprises functioning in emerging markets (EM). The *methods* of research: analysis and synthesis, system analysis, comparative analysis, empirical and statistical methods, factor analysis.

*Results.* In this article key determinants of interest rates on debt capital for enterprises and their impact on the procedure of discount rate calculation are determined. The issue of the cost of debt calculation of enterprises in condition of absence of complete information concerning systematic and non-systematic crediting risks is studied. Differences between interest rate on the loan fixed in credit agreement and expected by creditors the cost of debt are identified. It is determined that the key factor impacting the deviation level of market value of debt capital from the nominal, and respectively, deviation of the cost of debt from the cost of capital is probability of default (PD). At the minimum values of PD, the contract interest rate corresponds to the rate of cost of debt and it is advisable to use it for discount rate calculation. Critical analysis of alternative methodological approaches of the cost of debt calculation is made. Ways of integrating of market information concerning credit default swaps into the process of expected cost of debt calculation are justified. Factors of shadowing of rates of the cost of debt and ways of reducing of shadow transactions' level in the credit market are identified.

*Conclusions*. At high PD values, expected by market premium for default risk may exceed the contract interest rate, which necessitates constant monitoring of credit risks and appropriate adaptation of interest rates. In the paper the algorithm of such adaptation are proposed. It is shown that in the case of non-use of interest rates adjustment taking into account changes in PD, CDS and LGD, premium for creditors' systematic risk can differ significantly from market values of similar enterprises (peer-group), and estimated value of the cost of debt can acquire negative values. Contract (promised) interest rate should be set in such way that the premium for systematic risk of providing debt capital will be at the level of similar companies and does not change significantly as a result of probability of default changes. If in practice the opposite situation occurs, it is the evidence of contract interest rate shadowing, absence of effective system of assessment and management of credit risks. For solving the problem of interest rate transparency


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and filling of information gaps concerning PD borrowers in EM countries, should intensify CDS market.

***Keywords:*** debt capital, default probability, non-performing loans, credit default swap, credit spread, debt capital premium, shadow economy.

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## ДЕТЕРМІНАНТИ ПРОЦЕНТНИХ СТАВОК НА БОРГОВИЙ КАПІТАЛ ПІДПРИЄМСТВ

**Анотація.** *Метою* статті є теоретичне і методичне обґрунтування алгоритму визначення ставки витрат на борговий капітал для підприємств, які функціонують на ринках, що розвиваються (EM). *Методи дослідження*: аналізу і синтезу, системний аналіз, компаративний аналіз, емпіричні та статистичні методи, факторний аналіз.

*Результати.* Визначено ключові детермінанти процентних ставок на борговий капітал підприємств та їхній вплив на порядок обчислення ставки дисконтування. Досліджено питання розрахунку ставки витрат на борговий капітал підприємств за відсутності повної інформації щодо систематичних і несистематичних ризиків кредитування. Ідентифіковано відмінності між зафіксованою у кредитній угоді ставкою відсотка за кредит та очікуваною кредиторами ставкою витрат на борговий капітал. Визначено, що ключовим фактором, який впливає на рівень відхилення ринкової вартості боргового капіталу від номінальної, відповідно, відхилення ставки відсотка на позиковий капітал від ставки витрат капітал є ймовірність дефолту (PD). За мінімальних значень PD договірна процентна ставка відповідає ставці витрат на борговий капітал і її доцільно використовувати для обчислення ставки дисконтування. Проведено критичний аналіз альтернативних методичних підходів до розрахунку ставки витрат на борговий капітал. Обґрунтовано способи інтегрування ринкової інформації щодо кредитних дефолтних свопів у процес розрахунку очікуваної ставки витрат на борговий капітал. Визначено фактори тінізації процентних ставок на борговий капітал і способи зменшення рівня тіньових трансакцій на кредитному ринку.

*Висновки.* За високих значень PD очікувана ринком надбавка за ризик дефолту може перевищувати договірну процентну ставку, що зумовлює необхідність постійного моніторингу кредитних ризиків і відповідної адаптації процентних ставок. Запропоновано алгоритм такої адаптації. Показано, що в разі незастосування механізму коригування процентних ставок з урахуванням змін у PD, CDS та LGD, премія за систематичний ризик

кредиторів може суттєво відрізнятися від ринкових значень по підприємствах-аналогах (peer-group), а розрахункова величина ставки витрат на борговий капітал може набувати від'ємних значень. Договірна (обіцяна) процентна ставка має встановлюватися таким чином, щоб премія за систематичний ризик надання боргового капіталу була на рівні підприємств-аналогів і суттєво не змінювалася в результаті зміни ймовірності дефолту. Якщо ж на практиці має місце протилежна ситуація, то це є свідченням тінізації договірної процентної ставки, відсутності ефективної системи оцінювання та управління кредитними ризиками. Для розв'язання проблеми транспарентності процентних ставок і заповнення інформаційних дефіцитів щодо PD позичальників у країнах, що належать до EM, слід активізувати ринок CDS.

***Ключові слова:*** борговий капітал, імовірність дефолту, непрацюючі кредити, кредитний дефолтний своп, кредитний спред, премія за надання боргового капіталу, тіньова економіка.

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**Introduction.** Qualitative assessment of assets, financial instruments and investment projects is impossible without a discount rate, which is mostly determined using WACC algorithm. The key input parameters of WACC are costs of equity and debt capital. In the context of discount rate calculation, a distinction should be made between the contract interest rate which is expected by creditors, and should be equivalent to the cost of debt. Each of these rates has its own characteristics and features of formation and use. In EM countries, in particular in Ukraine, mostly used approach for calculation of discount rate, according to which the rate of return on debt capital is not the expected rate of return on invested capital, but interest rates fixed in appropriate agreements.

These rates correspond to so-called promised yield and based on ex-post assessments, take into account non-systematic risks and cause erroneous calculations of discount rate. From both theoretical and practical point of view, the cost of debt for enterprise will always be lower than contract interest rate. This is due to both tax shield factor and other factors, including default probability of borrower and estimated amount of possible creditor'slosses in the case of borrower default. Usage of contract interest rates leads to incorrect (usually understated) assets' valuation. The problem of correct calculation of discount rates in the EM countries is escalated by absence of effective stock market in which debt financial instruments can be traded, as well as financial relations' shadowing [13].

For solving outlined problems it is necessary to build clear algorithms that will differentiate between contract interest rate and cost of debt, to identify a market instrument that with a high level of accuracy and efficiency could signal about default probability of the borrower, determine the order of adaptation of fixed interest rates to changes in risk parameters. This article is devoted to the study of specifics of cost of debt determining, taking into account above mentioned factors.

**Literature review and the problem statement.** The rate of cost of debt for the borrower corresponds to expectations concerning the return on investment of appropriate capital for the creditor (with the correction on tax shield). The issue of capital expenditures, equity cost and debt financing in the vast majority of scientific papers is studied through the prism of the concept of F. Modigliani and M. Miller (M — M), as well as R. Merton's model for assessment of debt market value. While justifying M — M's theorem, the authors proceeded from assumption that debt capital of enterprise is risk-free, i. e. there is no risk of bankruptcy and late payments as a part of debt service or this risk is completely diversified [10].

However, in practice, assumption of bankruptcy costs' absence is quite often not right;enterprises have low credit ratings and do not meet their debt service obligations in time. According to Merton's model, volume of credit spread is determined by such key parameters as ratio of equity and debt capital, volatility of the company''s value andrisk-free rate. Basis of this model is concept of Black — Scholes option pricing. Restrictiveness of fundamental assumptions, which is the basics of Merton's model, makes it difficult to use it to assess default probability of


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borrowers on EM. Thus, controversial assumption of bankruptcy, as situation in which assets'market value is less than debts' value at the time of their repayment is due to the fact that in practice, borrowers may be insolvent even for failure to meet this criterion. In addition, the model assumes that basic asset can always be qualitatively secured, although practice shows that this assumption is unrealistic. Ignoring to consider these circumstances in the process of determining of costs of capital leads to incorrect discount rate calculation, erroneous assessments of companies' value, debt, investment and assets [9].

Another controversial point is that in most scientific research and practice, there is a sign of equality between the cost of debt and contract interest rate at which capital is raised. The latter (effective interest rate) is mostly accepted as rate of cost on debt capital, although it is based on credit agreements concluded in the past [14]. This approach ignores the possible losses incurred by creditor in the case of borrower default. Orienting on market interest rates, banks that are providing loans, do not make sufficient differentiation of interest rates depending on default probability of the borrower. The consequence of this is the problem of a high share of nonperforming loans (NPLs) in the banking system. According to the World Bank, in Ukraine the NPL is consistently one of the highest among emerging countries [3].

Empirical studies show that contract interest rate and rate of cost of debt can approach only in the case of minimum values of probability of default (PD) of the borrower. Dietrich R. and Dierkes S. emphasize that the rate of cost on debt is defined as sum of risk-free rate and credit spread, which depends on borrower's credit rating. With speculative level credit ratings, there is necessity to adjust the cost of debt by the amount of PD [5]. Gleissner W. (2008) makes paradoxical conclusion, according to which the increase in risks and default probability of borrowers may not lead to an increase, but rather to reduction of costs of debt [7]. In extreme case, as I. Cooper and S. Davydenko point out, the use of promised return as rate of costs of debt can lead to situation when latter will exceed the rate of cost on equity [4]. Obviously, such situation contradicts rational economic logic. Therefore, we have a contradiction that needs a scientific and methodological solution.

The problem of cost of debt calculation in EM countries is further complicated with situation that vast majority of enterprises do not have credit ratings and do not issue debt obligations that have free circulation in the capital market. Scientific task here is to study the key characteristics of interest rates, by which debt capital is attracted and justify adequate way to calculate the rate of costs on debt in the context of discount rate calculation.

**The purpose of the article** is theoretical and methodological justifying of algorithm of determining rate of cost on debt capital for enterprises operating in emerging markets.

**Methodology and research methods.**To achieve authenticity and justification of the study, the following scientific methods were used: analysis and synthesis –while defining thema in determinants of interest rates on the cost of debt; systematic analysis – while calculating the cost of debt of enterprises in condition of absence of complete information concerning systematic and non-systematic crediting risks; comparative analysis – for comparing functioning of emerging and mature capital markets, as well as identifying differences between the interest rate fixed in the credit agreement and expected cost of debt; empirical and statistical methods – to assess the cost of capital; factor analysis — to assess the factors impacting the cost of debt.

**Research results.** Debt capital of enterprises is formed from different categories: as a result of obtaining bank loans, bond issues, obtaining commercial loans, internal payments. Each of these positions is characterized by different risks and individual interest rate on capital. Not uncommon cases when capital which belongs to same category, for example short-term bank loans, is raised by enterprise from different creditors and by different interest rates. Some components of debt represent capital for which interestsare paid directly, and others — liabilities, payment for which is reflected in the increase of purchase price of goods or decrease of selling prices for products (commercial loans). In addition, each enterprise has a number of items of debt capital, by which it is impossible to make conclusion concerning the value of interest rate, because the fee for the use of such capital is implicit. To determine the cost for serviceof such elements of debt capital

additionally should be conducted analysis of supply contracts, bonus systems and discounts for early payment of products, analyze contract relationship of enterprise with insurance companies, government agencies, shareholders, related parties, etc.

In the process of discount rate calculation, market values of debt capital should be operated, not balance sheet indicators. Amount of enterprise's debt, recorded in the balance sheet corresponds to its market value, if the interest on its use corresponds to the market. In this case, amount of loan received should correspond to market value of agreed interest payments and body of the loan that will be paid in the future. The value of debt instruments in the capital market corresponds to the present value of future cash flows by relevant instruments. In the case of significant deviation between market interest rates and those recorded in credit agreements, it is necessary to calculate the value of each of these components of debt capital. This can be made by discounting expected payments in favor of creditors with the use of market credit rate as discount rate. This rate should take into account current interest rates in appropriate market for financial instruments and borrowers with similar risk and debt maturities.

For the purposes of discount rate calculation, it is advisable to operate with so-called paid debt capital, for which enterprises make direct payments in favor of creditors and which is attracted in the case of bank crediting and (or) issue of debt securities. The interest rate for the use of such capital is mostly fixed in appropriatecredit agreements and (or) in the terms of bonds issue. To differentiate rate of cost of debt, which follows from credit agreements (representing the promised amount of interest payments), from interest expected by creditors, terms «interest rates on loans» and «cost of debt» are used. The latter characterizes the level of income expected by creditors from lending to the borrower, taking into account the current systematic risks. Systematic risks are risks that cannot be diversified in the understanding of the CAPM model [2]. However, in practice,value assessment, the difference between the cost of debt and interest rate on capital is often leveled and not taken into account. However, in most cases, these indicators differ significantly, similarly to the difference between the value cost of equity and the value of actual return on equity.

Both the cost of debt ($R_d$) and interest rate fixed in the contract ($R_d^c$) are mostly calculated on the basis of two parameters: risk-free interest rate and the risk premium. In the first case, the risk premium is the value expected by the market, and in the second — realized rate in the contract (promised). The problem is that the amount and composition of risk premium in the cost rate and the rate fixed in the contract differ significantly. Depending on the risks'nature, which are expressed in the interest rate on loan capital, the risk premium can take such forms:

– credit spread (CS), which includes risk premium for full or partial non-compliance of obligations by client, premium for the systematic risk of creditor and premium for the loan term (characterizes the risks associated with the terms of loan);

– spread of cost of debt – expected market premium for systematic risks associated with the provision of debt capital (MRPd);

– expected default risk premium (EDL).

Differences in these premiums depend on the situation on the debt capital market, in particular on the volume of market interest rates, risks' composition that included in them, as well as default probability of the debtor. According to S. Dierkes and R. Dietrich conclusions, the interest rate on loan capital fixed in the contract can be used as cost of debt in the case when credit risk level is low (low PD). In particular, in the case of assigning investment level ratings (from AAA to -BBB) [5]. It can be explained that promised yield spread in the agreement includes the creditors' expected return for the non-diversified (systematic) risk (expected return premium) and the default risk premium (Expected default effect):

Promised yield spread = Expected return premium + Expected default loss (EDL)

або Cost of debt = Promised yield – Yield equivalent of expected default loss [4].

Because of expected maximum value of payments in favor of creditors corresponds to the amounts fixed in agreements, the interest rate on debt capital will be higher (or equal to) than the cost of debt. This is due to the enterprise-debtorwill not pay more payments for the use of credit than provided for in the credit agreement. In the case of a difficult financial situation of the debtor,


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the emergence of problem debt, the real cost of debt of enterprise may be less than the interest provided in the loan agreement. The difference between the interest rate and real cost of capital of enterprise is covered by the fund holder due to the formed reserves. That is why in the process of forming reserves banks should take into account credit risks based on determining the of default probability of the borrower. Therefore, the interest rate fixed in the agreement is equal to the sum of expected market interest rate and default risk premium. This corresponds to the sum of risk-free rate and credit spread:

$$R_d^c = Rd + EDL = rf + CS. \quad (1)$$

Cost of debt (Rd) can be interpreted as expected return on invested capital by creditors (Expected Yield). According to I. Cooper and S. Davydenko, expected return on debt liabilities is in the range between promised return (fixed in the contract) and risk-free rate of return (riskless interest) and corresponds to the difference between promised rate of return and amount of possible losses in the case of default . The latter are function of expected probability of default [4].Expected premium for risk default is equal to the difference between promised credit spread and expected market premium risk for debt capital (Expected return premium):

$$EDL = R_d^c - R_d = CS - MRPd. \quad (2)$$

In international markets, default risks in the first-class borrowers with a high credit rating are minimal, so EDL is going to zero, and promised interest rate is almost the same as cost of capital. The differences between these rates increase with the probability of default.

Expectedby the market interest rate for provision of debt capital is nothing else than expected amount of compensation by debtor for systematic risks and risk-free rate, i. e. it is cost of debt. This compensation does not include the risk of default and represents a market premium for debt capital, which is adjusted for systematic risks of crediting to particular borrower:

$$Rd = R_d^c - EDL = rf + MRPd. \quad (3)$$

By logic of CAPM model, the criterion of systematic risk of investments in debt capital is beta debt (βd). Model of determining of cost of debt in this approach is next:

$$Rd = rf + (Rm - rf) \cdot \beta d. \quad (4)$$

Value of average market return of diversified investment portfolio (Rm) is taken at the same level as in classic CAPM for calculation of cost of equity. The difficulty of practical use of model (4) for determining of cost of debt of enterprises operating on EM is in the lack of empirical information to determine the parameter βd. The most accessible is the indirect method of calculating βd, as ratio of credit spread of debt capital cost rate (*Rd — rf*) to market risk premium (*Rm — rf*). As this method assumes that value of *Rd* is given, for calculation purposes of cost of debt, it is unacceptable. That is why in practice, alternative approaches to model (4) are used.

Given the above, let's make critical analysis of alternative methodological approaches to calculationof cost of debt, which are postulated in theory and practice. Among the most common are following methodical approaches [1; 12]:

1). taking into account the current market yield to maturity, if they have a turnover on capital market or use of default spread by bonds of similar companies;

2). autonomous analysis of each component of debt capital and determination of costs for its use on the basis of analysis of credit agreements, conditions of issue of debt securities;

3). Recent Borrowing History: calculation of the weighted average cost of borrowed capital as ratio of total interest paid to the balance value of debt capital on which interest is accrued;

4). Synthetic rating: based on determination of synthetic rating on the basis of coverage ratio of interest payments for debt use;

5). calculation of credit spread, which provides determining of default probability based on the use of internal or external rating systems;

6). usage of the spread indicator by credit default swaps.

Ideally, current market yield to maturity (YTM) of debtor''s bonds is taken as cost of debt. As a rule, YTM indicator reacts to changes in default parameters almost in real time. However, in EM countries, a small number of enterprises issue debt instruments and there is no efficient market for such instruments. Therefore, the first of these approaches is not relevant for most enterprises. The second of these approaches is extremely labor consuming. To use it, you need access to internal information about enterprises' loan agreements, which is not available to most financial analysts. In addition, ex-post assessments are its' basis and furthermore they are based on historical data. Similar disadvantage is characteristic for the third of these approaches. Although, at first glance, it is quite easy to use. However, in addition to orientation to risks of previous periods, its disadvantage is possible mismatch between the balance and market value of debt capital. Interest rates that are basis of second and third approaches include the credit spread andrespectivelydefault risk premium. The focus on historical data and high level of subjectivity is disadvantage of synthetic rating approach.

The contract (promised) interest rate is adequate criterion for assessingof cost of debt, if the debtor is able to fulfill its contract obligations in full during the period of appropriate agreement. If the borrower belongs to a low rating class, in particular, the speculative level, the difference between the contract interest rate on loan and expected cost of debt will be relevant. Given that most enterprises that operate on EM are characterized by high credit risks, cost of debt for such enterprises should be calculated using information concerning default probability. The fifth and sixth methodological approaches to the calculation of cost of debt provide integration of PD value in Rd calculation model. External or internal ratings or spread of credit default swap by debt obligations are used to assess the probability of default.

Classic indicator of credit risks is rating of financial instruments or debtors: the better is enterprise's rating, than credit spread will be closer to premium for systematic risks. Rating is the result of assessing the probability of default, which is carried out in the process of empirical analysis of financial information using econometric methods, such as discriminant analysis, logistic regression, etc. According to rating approach, the probability of default in terms of individual rating classes is calculated as ratio of debtors' number who have defaulted to the total number of debtors who have appropriate rating class. By using of this approach, we assume that there is statistical relationship between the borrower's default in the future and its current rating, which is mostly based on ex-post analysis. The disadvantages of rating assessment are slow response of rating agencies to current risks and changes in debtors' financial condition. Partial solution to rating issues for EM countries is development of internal rating systems. First of all these are primarily banks and other institutional investors.

An alternative indicator of default probability to credit ratingis credit default swap (CDS). It is a financial instrument in the form of credit derivative or agreement, under which the buyer pays a premium to the seller in exchange for the latter assumes the risks of payment of third party obligations (debtor) in the case of credit event. The market price of CDS reacts to changes in debtor's credit risks almost in real time [11]. Therefore, the results of CDS trading affect the pricing in the bond market. Under certain circumstances, information about CDS price may provoke an increase of the cost of debt. The size of the CDS-spread depends on the probability of default (PD) and expected share of repayment in case of insolvency of the debtor (RR):

$$\text{CDS-spread} = (1 - RR)\,PD; \text{ so } PD = \text{CDS-spread} / (1 - RR). \quad (5)$$

RR parameter depends on the sums that creditor can receive as a result of credit security sale or liquidation procedure of insolvent debtor. Note that PD assessments obtained with the help of this approach are quite approximate, as they are the product of impact on CDS spread both quantitative and behavioral factors. The value of CDS-spread may be affected by information concerning changes in issuer's credit rating. It is confirmed by results of Wengner A., Burghof H. P. and Schneider J. studies (2015) [15]. At the same time, a number of empirical studies prove the existence of discrepancies between the values of probability of default, which follow from ratings and CDS-spread. It is explained by different level of response quickness to information about the


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debtor, as well as different perceptions of risk factors by rating agencies and credit market participants [8].

As we can see from equation (3), cost of debt can be calculated as difference between the contract interest rate (or market rate of return of bonds) and default risk. The problem is that with probability of default increasing, the share of systematic risk premium in contract interest rate will decrease. There can be situation when this premium and the cost of debt of high-risk enterprises will be lower than enterprises with the minimum level of PD [6]. For demonstrationof the effect of reducing the cost of debt through the growth of PD, let's consider a conditional example of WACC calculation. Let the share of equity is 40%, cost of equity (Re) — 18%, and agreed interest rate on loan is 15%. *Table 1* shows how the increase of share of default risk premium (EDL) in credit spread affects the change in cost of debt and WACC, and the risk-free rate is 7%.

Table 1

**Influence of default probability on cost of debt and WACC**

| EDL (quotient) | Rf, % | Debt Risk Premium, % | Cost of Debt, % | Equity ratio, % | Re,% | WACC,% |
|---|---|---|---|---|---|---|
| 0 | 7 | 8 | 15 | 40 | 18 | 16,2 |
| 0,2 | 7 | 6,4 | 13,4 | 40 | 18 | 15,24 |
| 0,4 | 7 | 4,8 | 11,8 | 40 | 18 | 14,28 |
| **0,5** | **7** | **4,0** | **11,0** | **40** | **18** | **13,8** |
| 0,6 | 7 | 3,2 | 10,2 | 40 | 18 | 13,32 |
| 0,8 | 7 | 1,6 | 8,6 | 40 | 18 | 12,36 |
| 1,0 | 7 | 0 | 7 | 40 | 18 | 11,4 |

*Source*: compiled by the authors.

Assessments in the table confirm that amount of cost of debt coincides with contract interest rate only if the probability of default is close to zero. The higher the probability of default, the greater the difference between contract interest rate and expected cost of debt. Moreover, if for WACC calculation do not take agreed in the contract interest rates, but expected cost of capital, then with an increase of PD, both cost of debt and WACC will decrease. In this case, procedure of adjusting the interest rate on borrowed capital to risk of default is necessary. With this aim, first of all it is necessary to assess the PD and calculate the share of losses of creditor in case of full or partial default of debtor (Loss Given Default, LGD). LGD is calculated as complement to expected return (LGD = 1 – RR). Expected cost of payments in favor of creditor ($E\ [x^{FtD}]$)can be calculated by following algorithm [5]:

$$E\ [x^{FtD}] = x^{FtD,c}\ \cdot (1 - PD) + \ x^{FtD,c}\ \cdot RR \cdot PD = \ x^{FtD,c} \cdot (1 - PD \cdot LGD), \qquad (6)$$

$x^{FtD,c}$ — sum of payments in favor of creditors provided by agreement. Making a number of logical transformations, from expression (6) we can get algorithm of Rd calculation:

$$R_d = \ R_d^c \cdot (1 - PD \cdot LGD) - PD \cdot LGD. \qquad (7)$$

If LGD is expressed through the value of expected share of return (RR), then algorithm of calculation of cost of debt will have the next form:

$$R_d = \ [1 + \ R_d^c] \cdot [1 - \ PD \cdot (1 - RR)] - 1. \qquad (8)$$

To find out the effect of CDS spread influence on the cost of debt, in expression (7) the value of PD we can get through CDSspread and RR, as indicated in formula (5). After transformations, we get the following algorithm for calculation of cost of debt:

$$R_d = \ R_d^c - CDSspread\ (R_d^c + 1). \qquad (9)$$

Given the above, the difference between contract interest rate and expected interest rate by creditors shows premium for expected default risk (EDL). From equation (2) premium for default risk can be expressed in this way:

$$EDL = \frac{R_d + PD \cdot LGD}{1 - PD \cdot LGD} - R_d \quad \text{or} \quad EDL = \frac{R_d + CDSspread}{1 - CDSspread} - R_d. \tag{10}$$

If contract interest rate and CDS spread are given, EDL calculation algorithm will be next:

$$EDL = PD \cdot LGD \cdot (R_d^C + 1) \quad \text{or} \quad EDL = CDSspread \cdot (R_d^C + 1). \tag{11}$$

Under certain circumstances, default risk premium can exceed both expected cost of debt and contract interest rate. While equating expression (11) to zero, we can find algorithm for determining the critical value of CDS-spread (c), at which cost of debt is equal to zero

$$\text{CDSspread (c)} = \frac{R_d^c}{R_d^c + 1}. \tag{12}$$

Cost of debt will be positive until actial CDS-spread will be lower than its critical value, i. e. inequality will be fulfilled:

$$\text{CDS-spread} < \text{CDS-spread (c)}. \tag{13}$$

In *Table 2* dependence of difference between contract interest rate and cost of debt from probability of default in accordance with CDS-spread is given.

Table 2

**Dependence of cost of debt on default probability and CDS-spread**

| PD, % | $R_d^c$, % | CDSspread, % | RR, % | $R_d$, % | EDL, % |
|---|---|---|---|---|---|
| 0 | 15 | 0 | 40 | 15 | 0 |
| 10 | 15 | 6 | 40 | 8,1 | 6,9 |
| 21,73 | 15 | 13,04 | 40 | 0 | 15,0 |
| 40 | 15 | 24 | 40 | -12,6 | 27,6 |
| 50 | 15 | 30 | 40 | -19,5 | 34,5 |
| 70 | 15 | 42 | 40 | -33,3 | 48,3 |
| 90 | 15 | 54 | 40 | -47,1 | 62,1 |
| 100 | 15 | 60 | 40 | -54 | 69 |

*Source*: compiled by the authors.

As given in *Table 2*, use of RR, PD and CDS spread factors for the cost of debt calculationhas the same trend as the use of default risk premium — with increase of probability of default and CDS spread, expected cost of debt decreases, and respectivelythe difference between the contract interest rate and the cost of debt increases. Under condition that the share of return in case of default is 40%, and contract interest rate is 15%, expected cost of debt is zero if the CDS spread reaches 13.04%, and respectivelythe probability of default is 21.73 %. Higher CDS spread value will result in negative cost of debt and default risk premium that exceeds the contract interest rate. Thus, if CDS-spread is 24%, cost of debt will reach 12.6%, and default risk premium will be 27.6%.

Sensitivity of the cost of debt and CDS-spread to the share of repayment (RR) is demonstrated in *Table 3*.

Table 3

**Sensitivity of cost of debt to the changes of share of repayment (RR) in case of default**

| PD | $R_d^c$, % | RR, % | CDS spread, % | $R_d$, % | EDL, % |
|---|---|---|---|---|---|
| 10 | 15 | 80 | 2,0 | 12,7 | 2,3 |
| 10 | 15 | 70 | 3,0 | 11,55 | 3,45 |
| 10 | 15 | 60 | 4,0 | 10,4 | 4,6 |
| 10 | 15 | 50 | 5,0 | 9,25 | 5,75 |
| 10 | 15 | 40 | 6,0 | 8,1 | 6,9 |
| 10 | 15 | 30 | 7,0 | 6,95 | 8,05 |

*Source*: compiled by the authors.


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Given table shows that increase of the share of creditor losses in the case of full or partial default of debtor (LGD), respectively, decrease in the share of return (RR) has the same consequences for CDS spread and costs of debt as increase in probability default. Thus, increase of default probability or share of losses in the case of default by 10% leads to increase of CDS-spread by 1% and to decrease of the cost of debt by 1.15 percent compared to the previous value. Demonstrated changes in the cost of debt confirm the effect of Expected default effect [4]. These changes in the cost of capital are identical to changes in the value of default risk premium.

In the case of crossing critical CDS-spread, which is a consequence of increase of PD and (or) decrease of RR, we get a negative cost of capital. Obtained resultscan be explained by understated contract interest rate on the loan or understated YTM, if the funds are raised on the basis of bonds issue. This situation is quite common in countries with a high share of shadow economy, an integral part of which are shadow interest rates [13]. If borrower fully or partially conducts his business in shadow, creditors will not be able objectively assess credit risks. This affects both the volume of credits and size of interest rates.

Assessments in *Tables 2* and *3* obtained by ignoring risk-free interest rate ($r_f$). As it was mentioned above, contract interest rate consists of risk-free interest rate and credit spread. The latter, in turn, is formed of two parts: expected premium for provision of credit resources and default risk premium. Obviously, contract interest rate should be selected in such a way that for given probability of default and share of returns in the case of default, systematic risk premium should have positive value. In other words, in case of risky credit operations, the cost of capital should exceed the risk-free interest rate, and premium for systematic risk should be at the level of similar companies with a low probability of default. In the case of creditingof enterprises with high level of PD, by which estimated value of the premium for systematic risks is less than corresponding indicator (calculated by peer-group method) of similar enterprises with insignificant PD, contract (promised) interest rate can be adapted by such algorithm:

$$\mathrm{R}_{\mathrm{d}}^{\mathrm{C}} = \frac{R_d + PD{\cdot}LGD}{1-PD{\cdot}LGD} = \frac{R_d + CDSspread}{1-CDSspread} = \frac{EDL}{CDSspread} - 1. \quad (14)$$

Value of Rd in formula (14) is taken at the level of indicators of similar enterprises (peer-group method). Taking into account equations (3) and (7), the credit spread of the cost of debt (expected by creditors premium for systematic risk) can be presented in the next way:

$$MRP_D = R_d^c \cdot (1 - PD \cdot LGD) - PD \cdot LGD - \mathrm{rf}. \quad (15)$$

Using equation (15), let's form algorithms of calculationof maximum values of PD and LGD, for which expected by creditors' premium for systematic risk of debt capital will be positive:

$$\mathrm{PD} \le \frac{\mathrm{R}_{\mathrm{d}}^{\mathrm{C}} - \mathrm{rf}}{\mathrm{LGD}(1+\mathrm{R}_{\mathrm{d}}^{\mathrm{C}})} \quad or \quad \mathrm{LGD} \le \frac{\mathrm{R}_{\mathrm{d}}^{\mathrm{C}} - rf}{\mathrm{PD}(1+\mathrm{R}_{\mathrm{d}}^{\mathrm{C}})}. \quad (16)$$

In analyzed example, by given contract interest rate (15%) and risk-free interest rate at the level of 7%, if default probability is 20%, maximum value of LGD when cost of debt is in the zone of positive values will be 0.35 (RR = 0.65). If the value of RR is given (for example 40%), then required limit value of PD will also be 11.6%.

Given the above, we can say that expected premium for the risk of default of enterprise is affected by such factors: value of PD, share of creditor's losses in the case of default and expected cost of debt. The latter, in turn, is determined by risk-free interest rate and expected premium for systematic risks connected with debt capitalprovision. Value of contractual (promised) interest rate should be set in the way, so premium for systematic risk of debt capital is at the level of similar companies and did not decrease as a result of defaultprobability increase. If in practice there is quite opposite situation, it may be a glow of contract interest rate shadowing or absence of effective assessment system and credit risks' management.

**Conclusions.** The cost of debt shows expected amount of debtor payments in favor of creditor and corresponds to the sum of risk-free interest rate and expected premium for systematic risk. The latter should not be equated with the credit spread, which is part of contract (promised) interest ratecalculation. The size of credit spread may be equal to expected credit risk premium only for borrowers with minimum probability of default. This is due to the fact that credit spread agreed in the contract, in addition to expected creditors' premium for systematic risk, also includes premium for default risk, which belongs to the group of diversified risks. Thus, contract interest rate differs from the cost of debt by percentage of possible losses of creditors in the case of borrower's default. Contract interest rate and cost of debt can coincide only if the probability of default is zero, as it can be in most companies with credit ratings of investment grade. With increase of PD, the impact of default risk on the cost of debt becomes more relevant. The article emphasizes that the vast majority of borrowers in the EM countries are characterized with speculative credit ratings, and respectively with significant probability of default. This means that PD parameter should be integrated into the cost of debt calculation model.

Expected rate of cost of debt is in the interval between two extremes: risk-free rate of return and interest rate fixed in the contract. At constant contract interest rate, with increase of PD value, estimated cost of debt will decrease. For promptconsideration changes of PD in interest rates, it is advisable to use market values of CDS-spread. The article proposes way of integrating market values of CDS-spread into the model of the cost of debt calculation. Calculation algorithm of critical value of default probability is justified, starting from which the cost of debt can become negative. The latter occurs in economies with a significant share of shadow sector, integral part of which is shadow crediting and shadow interest rates.

In case, when credit rating of the debtor belongs to speculative level, and the probability of default is significant in the credit spread, the share of possible losses in case of default increases. In some cases, expected premium for default risk may exceed the interest rate fixed in the credit agreement. At high risks, for realizationof expected risk premium, official or shadow crediting rates must increase. The paper proposes an algorithm for adjusting promised interest rate taking into account changes in PD, CDS and LGD values. Capitalfee shadowing is made by revaluation of credit collateral, underestimation of credit risks and understatement of reserves, use of informal compensation schemes through insurance instruments. Provided study shows that one of the ways of solving the problem of interest rate transparency and fulfillment of information gaps concerning PD borrowers in countries related to EM is developing of CDS market.

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