Rating Methodology: New Look and New Horizons

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Abstract: In the previous paper a new approach to rating methodology has been suggested. Key factors of a new approach were the following: 1) The adequate use of discounting of financial flows virtually not used in existing rating methodologies, 2) The incorporation of rating parameters (financial "ratios") into the perpetuity limit of modern theory of capital structure (Brusov–Filatova–Orekhova (BFO) theory): for companies with infinite lifetime.

In current paper further development of a new approach has been done. We have generalized it for the general case of modern theory of capital structure (Brusov–Filatova–Orekhova (BFO) theory): for companies of arbitrary age. A serious modification of BFO theory in order to use it in rating procedure has been required. It allows to apply obtained results for real economics, where all companies have finite lifetime, introduce a factor of time into theory, estimate the creditworthiness of companies of arbitrary age (or arbitrary lifetime), introduce discounting of the financial flows, using the correct discount rate etc. This allows use the powerful tools of BFO theory in the rating. All these create a new base for rating methodologies.

Keywords: Rating, rating methodology, discounting of financial flows, Brusov–Filatova–Orekhova theory, coverage ratios, leverage ratios.

1. INTRODUCTION

In a previous article we have offered fundamentally new approach to rating methodology, which includes adequate application of discounting of financial flows virtually not used in existing rating methodologies. The incorporation of rating parameters (financial "ratios") into the perpetuity limit of modern theory of capital structure by Brusov–Filatova–Orekhova (BFO) theory has been done: it required a modification of perpetuity limit of BFO theory for rating needs. Two models (one–period and multi–period) for accounting of discounting of financial flows were discussed. An algorithm of valuation of discount rate, accounting rating ratios has been suggested. We discussed also the interplay between rating ratios and leverage level which can be quite important in rating.

As we discussed in a number of works (Brusov *et al.* 2011-2015) perpetuity limit of BFO theory –Modigliani–Miller theory–underestimated the assessment of the attracting capital cost and therefore overestimated the assessment of the capitalization of the company. Besides the time factor, which is very important, does not exist in the perpetuity limit. And therefore in this limit there is no concept of the age of the company, and their lifetime is infinite (perpetuity).

In the present work the generalization of the developed by us approach for the case of modern theory of capital structure and capital cost by Brusov–Filatova–Orekhova (BFO theory) for companies and corporations an arbitrary age, i.e., for general case of BFO theory.

This has required the modification of the BFO theory for the rating needs (much more complicate then it was done in case of perpetuity limit – Modigliani – Miller theory), as used in financial management the concept of "leverage" as the ratio of debt value to the equity value substantially differs from the concept of "leverage" in the rating, where it is understood as the direct and inverse ratio of the debt value to the generated cash flow values (income, profit, etc.). We introduce here some additional ratios, allowing more fully characterize the issuer's ability to repay debts and to pay interest thereon.

As we mentioned in the previous paper, the bridge is building between the discount rates (*WACC*, *ke*) used when discounting of financial flows, and "ratios" in

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the rating methodology. The algorithm for finding the discount rates for given ratio values is developed.

Application of BFO theory modified for rating purposes allow adequately produce the discounting of financial flows by using the correct discount rates with taken into account when discounting the magnitude of rating ratios, and take into account the time factor missing in perpetuity limit and being the vital, i.e. to take into account the company age (in BFO–I theory) or the company life–time (in the BFO–II theory).

2. THE ANALYSIS OF METHODOLOGICAL AND SYSTEMIC DEFICIENCIES IN THE EXISTING CREDIT RATING OF NON–FINANCIAL ISSUERS

The analysis of methodological and systemic deficiencies in the existing credit rating of non–financial issuers has been conducted by us. We have analyzed the methodology of the big three (Standard & poor's, Fitch and Moody's) and Russian national rating agency.

2.1. The Closeness of the Rating Agencies

The closeness of the rating agencies has been discussed by us in a previous paper (Brusov *et al*. 2018) and is caused by multiple causes.

1. The desire to preserve their "know how". Rating agencies get big enough money for generated ratings (mostly from issuers) to replicate its methodology.

2. The desire to avoid public discussion of the ratings with anyone, including the issuer. It is very convenient position – rating agency "a priori" removes himself from beneath any criticism of generated ratings.

3. The absence of any external control and external analysis of the methodologies is resulted in the fact that shortcomings of methodologies are not subjected to serious critical analysis and stored long enough.

2.2. Discounting

One of the major flaws of all existing rating methodologies is a failure or a very narrow use of discounting. But even in those rare cases where it is used, it is not quite correct, since the discount rate when discounting financial flows is chosen incorrectly.

The need to take into account the time factor in terms of discounting is obvious, because it is associated with the time value of money. The financial part of the rating is based on a comparison of generated income with the value of the debt and the interest payable. Because income and disbursement of debt and interest are separated in time, the use of discounting when comparing revenues with the value of debt and interest is absolutely necessary for assigning credit ratings for issuers.

1. In existing rating methodologies, despite their breadth and detail, there are a lot of shortcomings. One of the major flaws of all existing rating methodologies, as mentioned in our previous paper, is a failure or a very narrow use of discounting. But even in those rare cases where it is used, it is not quite correct, since the discount rate when discounting financial flows is chosen incorrectly.

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This raises the question about the discount rate. This question has always been one of the major and extremely difficult in many areas of finance: corporate finance, investment, it is particularly important in business valuation, where a slight change in the discount rate leads to significant changes in estimates of capitalization of the company, that is used by unscrupulous appraisers for artificial bankruptcy of companies. As well it is essential in rating, and when assigning a rating to an issuer, and forecasting.

Therefore, as soon as we are talking about financial flows, it is necessary to account discounting, otherwise the time value of money does not take into account, i.e., any analysis of financial flows should take account of discounting.

2. When we talk about using the rating reports for the three or five (GAAP) years, assuming the

behavior indicators beyond that period " a flat ", discounting must be taken into account.

2.3. Dividend Policy of the Company

1. Dividend policy of the company must take into account (and account) when rating, because the financial policy is taken into account in rating. However, the existing methodologies for ranking estimate only the stability of the dividend policy and do not estimate its reasonableness, how reasonable is the value of dividend payouts, how do they relate to the economically reasonable dividend values.

2. The reasonableness of dividend policy, its score is determined by comparing of the values of paid dividends with their economically reasonable value, which is the cost of equity capital k_e of the company. The calculation of k_e is a rather difficult task.

BFO theory allows you to make the correct assessment of the value of the equity capital cost of the company and thus to compare values of the paid by the company dividend to their economically reasonable value, it allows you to assess the reasonableness of dividend policy, which is clearly linked to the creditworthiness of the issuer.

3. For example, one of the varieties "cash flow", taking into account the amount of paid dividends (Discretionary cash flow (DCF) S & P), should be compared with the "economically reasonable dividend values, and this will affect the rating.

2.4. Leverage Level

1. Currently the rating agencies take into account the leverage level only from the perspective of assessing of financial stability and risk of bankruptcy. In fact the leverage level significantly affects the main financial indicators of the company's activity: the cost of equity capital, WACC, in other words, the cost of attracting of capital, as well as the capitalization of the company. The failure of this effect in the analysis of financial reports leads to incorrect conclusions based on it.

Evaluation (by the BFO method) of the influence of the debt financing level on the effectiveness of investment projects for different values of capital costs can be used in the rating of investment projects and investment programs of companies.

2.5. Taxation

1. Taxation affects the rating of the issuers. Evaluation (by the BFO method) of the influence of taxation (tax on profit organization rate) on the financial performance of the company, on the effectiveness of investment projects can be used when rating companies and their investment programs, investment projects, as well as in the context of change of tax on profits of the organization rate for forecast predictions and in analysis of country risk.

2. Evaluation (by BFO the method) of the influence of the Central Bank base rate, credit rates of commercial banks on the effectiveness of investment projects, creation of a favourable investment climate in the country can be used to forecast predictions, as well as in country risk analysis.

2.6. Account of the Industrial Specifics of the Issuer

Industrial specifics of the issuer in the existing rating methodologies, especially in newly established and taking into account the experience of predecessors, ignored. So in " The methodology of ACRA for assigning of credit ratings for non–financial companies on a national scale for the Russian Federation " "own creditworthiness is determined by taking into account the characteristics of the industry in which the company operates. To assess of the factor of the industry risk profile ACRA subdivides the industry into five groups according to their cyclical, barriers to entry, industry risk statistics, as well as trends and prospects.

The weight of the factor of industry risk–profile is determined individually for each group and varies depending on the level of credit risk. This creates a certain rating threshold for companies from industries with high risk and slightly rewards low risk industry".

However, the existing accounting of industry specifics of issuer is clearly insufficient. Ranking methodologies should better integrate industry peculiarities in the organization of finance of issuers. In particular, it is very important to define business needs in working capital, from the size of which financial soundness indicators, solvency and creditworthiness depend directly. The latter is the key indicator in rating.

2.7. Neglect of Taking into Account the Particularities of the Issuer

In existing rating methodologies the taking into account the particularities of the issuer, features of financial reports, taxation, legal and financial system is neglected in favor of achieving full comparability of financial reports, they smooth the distinctions (see Moody's rating methodologies).

2.8. Financial Ratios

1. A necessary and sufficient quantity and mix of financial ratios are not determined, it appears that such questions are even not raised, aunque valuation of the financial risk, the financial condition of the issuer largely depend on the quantity and quality of financial ratios, their correlation or independence.

2. Some financial ratios define ambiguously the state of the issuer. For example, the ratio of cash flow/leverage is high at high cash flow value as well as at low leverage value. The question is how these two different states of the issuer, which is attributed to one value of financial risk, is really equally relate to credit risk.

3. As recognized in the ACRA methodology "in some cases it is possible a formal hit of individual characteristics of factor/subfactor simultaneously in several categories of evaluation, particularly for qualitative factors. In this case, the score is based on expert opinion, taking into account the most important parameters".

4. In connection with paragraph 3 it should be noted that the formalization of expert opinions is one of the most important tasks in improving of the rating methodology, in making a peer review process more objective. There are a few ways to solve this problem: using results of modern theory of measurement, using of the formalism of fuzzy sets, fuzzy logic, and others.

5. Tabulate the composition of various risks, for example, CICRA (in S&P methodology) gives 6 x 6 matrix, which has 36 elements, i.e. generally CICRA should have 36 different values, but their total number is equal to 6. The question is how this is justified. The fact that total number is equal exactly to 6 shows that not very justified, or there are other considerations, but they must be well grounded.

Table 1: (after ACRA)

	liquidity assessment					
assessment of funding		**1**	**2**	**3**	**4**	**5**
	1	1	2	2	3	4
	2	1	2	3	3	4
	3	2	2	3	4	5
	4	3	3	3	4	5
	5	3	3	4	5	5

6. Tabulate of mixes of different ratios in determining the financial risk has been done not quite correctly:

	FFO/debt (%)	**Debt/EBITDA(x)**	**FFO/cash interest(x)**	**EBITDA/interest(x)**	**CFO/debt(%)**	**FOCF/deb(%)**	**DCF/debt(%)**
Minimal	60+	Less than 1.5	More than 13	More than 15	More than 50	40+	25+
Modest	45–60	1.5–2	9–13	10–15	35–50	25–40	15–25
Intermediate	30–45	2–3	6–9	6–10	25–35	15–25	10–15
Significant	20–30	3–4	4–6	3–6	15–25	10–15	5–10
Aggressive	12–20	4–5	2–4	2–3	10–15	5–10	2–5
Highly leveraged	Less than 12	Greater than 5	Less than 2	Less than 2	Less than 10	Less than 5	Less than 2

ratios at least not completely correlated but used as fully correlated. So, one can see that the two lines

Minimal	60+	Less than 1.5	More than 13	More than 15	More than 50	40+	25+
Modest	45–60	1.5–2	9–13	10–15	35–50	25–40	15–25

do not allow mixing between parameters of lines, although such mixing can occur, for example,

	60+	1.5–2	More than 13	More than 15	More than 50	40+	25+

Similar examples abound. So in "The ACRA methodology for assigning of credit ratings for microfinance organizations on a national scale for the Russian Federation "Table **10**" Score of funding and liquidity" provides 5 x 5 matrix that has 25 elements, i.e. generally should be 25 different states but their total number is equal to 5. The question is whether it is justified. The fact that total number is equal exactly to 5 shows that not very justified.

All these points are limiting the applicability of rating agencies methods. They were introduced by the rating agencies for the purpose of simplifying of the procedure of ranking (with or without understanding), and with a view of unification of methods to different reporting systems, different countries, with the objective of comparability of results.

Mentioned ambiguity of evaluations already occurred when S&P has assigned a rating to Gazprom.

3. MODIFICATION OF THE BFO THEORY FOR COMPANIES AND CORPORATIONS OF ARBITRARY AGE FOR PURPOSES OF RANKING

We will conduct below the modification of the BFO theory for companies and corporations of arbitrary age for purposes of ranking, which proved much more difficult than modification of its (BFO theory) perpetuity limit.

As it turned out, use of the famous BFO formula

$$\frac{\left[1-\left(1+WACC\right)^{-n}\right]}{WACC}=\frac{\left[1-\left(1+k_0\right)^{-n}\right]}{k_0\left[1-\omega_d T\left(1-\left(1+k_d\right)^{-n}\right)\right]} \quad (1)$$

not possible, since it no longer includes cash flows *CF* and debt value *D*, and the leverage level *L=D/S* (in the same sense as it is used in financial management) is included only through the share of leveraged $w_d = L/(L+1)$.

For the modification of the general theory of BFO for ranking purposes, one must return to the initial assumptions under the derivation of the BFO formula.

Modigliani–Miller theorem in case of existing of corporate taxes, generalized by us for the case of finite company age, states that capitalization of leveraged company (using the debt financing), V_L, is equal to the capitalization of non–leveraged company (which does not use the debt financing), V_0, increased by the amount of the tax shield for the finite period of time, TS_n,

$$V_L = V_0 + TS_n . \quad (2)$$

where

the capitalization of leveraged company

$$V_L = \frac{CF}{WACC}\left(1-\left(1+WACC\right)^{-n}\right); \quad (3)$$

the capitalization of non–leveraged company

$$V_0 = \frac{CF}{k_0}\left(1-\left(1+k_0\right)^{-n}\right); \quad (4)$$

and the tax shield for the period of n years

$$TS_n = tD\left(1-\left(1+k_d\right)^{-n}\right). \quad (5)$$

Substituting equations (3) – (5) into equation (2), we obtain the equation (6), which will be used by us in the future to modify the BFO theory for the needs of the ranking.

$$\frac{CF*(1-(1+WACC)^{-n})}{WACC}= \frac{CF}{K_0}*(1-(1+k_0)^{-n})+t*D*(1-(1+k_d)^{-n}) \quad (6)$$

Below we fulfill the incorporation of rating parameters (financial "ratios") into the modern theory of capital structure (Brusov–Filatova–Orekhova (BFO) theory).

As we noted in a previous paper (Brusov *et al*. 2018), in quantification of the creditworthiness of the issuers the crucial role belongs to the so–called financial "ratios", constitute a direct and inverse ratios of various generated cash flows to debt values and interest ones. We could mention such ratios as $DCF/Debt$, $FFO/Debt$, $CFO/Debt$, $FOCF/Debt$, $FFO/cash\ interest$, $Interests/EBITDA$, $Debt/EBITDA$ and some others.

Let us consider two kind of rating ratios: coverage ratios and leverage ratios.

4. COVERAGE RATIOS

We start from the coverage ratios and will consider three kind of coverage ratios: coverage ratios of debt, coverage ratios of interest on the credit and coverage ratios of debt and interest on the credit. Note, that last type of ratios has been introduced by us for the first time for a more complete valuation of the issuer's ability to repay debts and to pay interest thereon.

4.1. Coverage Ratios of Debt

Here $i_1 = CF/D$

Let us consider the coverage ratios of debt first.

Dividing the both parts of the formula (6) by the value of the debt *D*, enter the debt coverage ratio into the general BFO theory

$$i_1 = CF/D \quad (7)$$

$$\frac{i_1 * (1-(1+WACC)^{-n})}{WACC} = \frac{i_1 * (1-(1+k_0)^{-n}}{k_0} + t * (1-(1+k_d)^{-n}) \quad (8)$$

$$i_1 * A = i_1 * B + t * C \quad (9)$$

$$A = \frac{(1-(1+WACC)^{-n}}{WACC}; \quad (10)$$

$$B = \frac{(1-(1+k_0)^{-n}}{k_0}; \quad (11)$$

$$C = (1-(1+k_0)^{-n}); \quad (12)$$

This ratio (i_1) can be used to assess of the following parameters used in rating, $DCF/Debt$, $FFO/Debt$, $CFO/Debt$, $FOCF/Debt$ and some others. We will use formula (8) to study the dependence *WACC*(i_1) and to build a curve of this dependence.

Let us analyze the dependence of the weighted average cost of capital (WACC) on debt coverage ratio i_1. We consider the case k_0=8%; k_d=4%; t=20%; i_1 is changed from 1 up to 10, for two company ages n=3 and n=5.

Table 2: (n=3)

t	ko	kd	i_1	WACC
0,2	0,08	0,04	1	0,075356711
0,2	0,08	0,04	2	0,077705469
0,2	0,08	0,04	3	0,078412717
0,2	0,08	0,04	4	0,078808879
0,2	0,08	0,04	5	0,079046807
0,2	0,08	0,04	6	0,079205521
0,2	0,08	0,04	7	0,079318935
0,2	0,08	0,04	8	0,079404022
0,2	0,08	0,04	9	0,079470216
0,2	0,08	0,04	10	0,07952318

Table 3 (n=5)

t	ko	kd	i_1	WACC
0,2	0,08	0,04	1	0,07663868
0,2	0,08	0,04	2	0,0783126
0,2	0,08	0,04	3	0,0788732
0,2	0,08	0,04	4	0,079154
0,2	0,08	0,04	5	0,07932264
0,2	0,08	0,04	6	0,07943518
0,2	0,08	0,04	7	0,0795156
0,2	0,08	0,04	8	0,07957594
0,2	0,08	0,04	9	0,07962287
0,2	0,08	0,04	10	0,07966043

The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on debt i_1 is shown at Figures **1** and **2**.

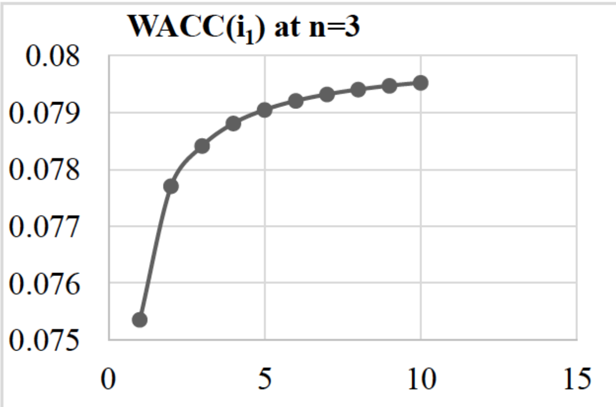


Figure 1: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on debt i_1 at n=3.

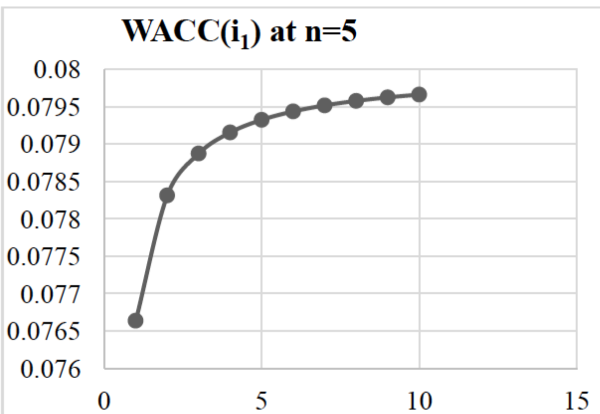


Figure 2: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on debt i_1 at n=5.

4.2. The Coverage Ratio on Interest on the Credit

Let us analyze now the dependence of company's weighted average cost of capital (WACC) on the coverage ratio on interest on the credit i_2 .

Dividing the both parts of the formula (6) by the value of the interest on the credit k_dD, enter the coverage ratio on interest on the credit i_2 into the general BFO theory

$$\frac{i_2 * (1-(1+WACC)^{-n}}{WACC} = \frac{i_1 * (1-(1+k_0)^{-n}}{k_0} + \frac{t*(1-(1+k_d)^{-n})}{k_d}$$

Here

$$\frac{CF}{D * k_d} = i_2$$

$$i_2 * A = i_2 * B + \frac{t*C}{k_d}$$

Table 4: (n=3)

t	k_o	k_d	i_2	WACC
0,2	0,08	0,04	1	–0,021238089
0,2	0,08	0,04	2	0,02529016
0,2	0,08	0,04	3	0,042483465
0,2	0,08	0,04	4	0,051456351
0,2	0,08	0,04	5	0,056965593
0,2	0,08	0,04	6	0,060692181
0,2	0,08	0,04	7	0,063380861
0,2	0,08	0,04	8	0,065412245
0,2	0,08	0,04	9	0,067001115
0,2	0,08	0,04	10	0,068277865

Table 5: (n=5)

t	ko	kd	i	WACC
0,2	0,08	0,04	1	0,00793717
0,2	0,08	0,04	2	0,04111354
0,2	0,08	0,04	3	0,0533843
0,2	0,08	0,04	4	0,05974575
0,2	0,08	0,04	5	0,06365738
0,2	0,08	0,04	6	0,06630611
0,2	0,08	0,04	7	0,06821315
0,2	0,08	0,04	8	0,06966377
0,2	0,08	0,04	9	0,07078076
0,2	0,08	0,04	10	0,07168658

The dependences of company's weighted average cost of capital (WACC) on the coverage ratio on interest on the credit i_2 at company ages n=3 and n=5 are shown at Figures **3** and **4**.

This ratio (i_2) can be used to assess of the following parameters, used in rating, $FFO/cash\ interest$, $EBITDA/interest$ and some others. We will use last formula to build a curve of dependence *WACC*(i_2).

4.3. Coverage Ratios of Debt and Interest on the Credit (New Ratios)

Let us now study the dependence of the company's weighted average cost of capital (WACC) on the coverage ratios of debt and interest on the credit simultaneously i_3: this is new ratio, introduced by us for the first time here for a more complete description of the issuer's ability to repay debts and to pay interest thereon.

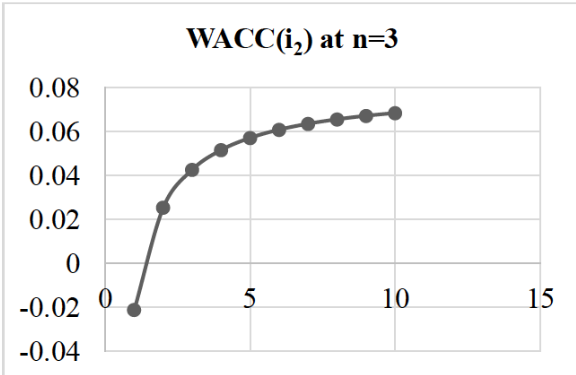


Figure 3: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on interest on the credit i_2 at company age n=3.

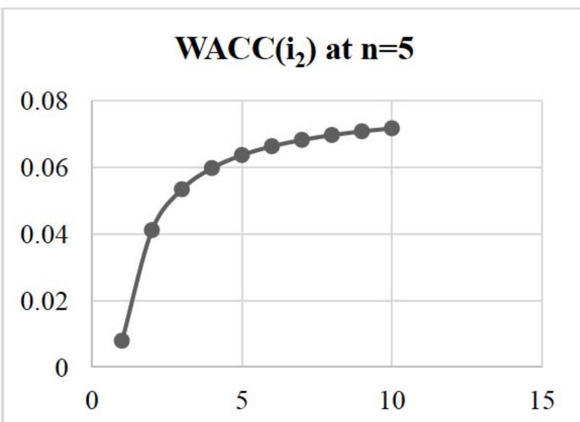


Figure 4: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on interest on the credit i_2 at company age n=5.

Dividing the both parts of the formula (6) by the value of the debt and interest on the credit $(1+k_d)D$, enter the coverage ratio on debt and interest on the credit i_3 into the general BFO theory

$$\frac{CF}{D*(1+k_d)} = i_3$$

$$i_3 * A = i_3 * B + \frac{t*C}{1+k_d}$$

$$\frac{i_3*(1-(1+WACC)^{-n}}{WACC} = \frac{i_3*(1-(1+k_0)^{-n}}{k_0} + \frac{t*(1-(1+k_d)^{-n})}{k_d}$$

Table 6: (n=3)

t	ko	kd	i_3	WACC
0,2	0,08	0,04	1	0,075536724
0,2	0,08	0,04	2	0,077796177
0,2	0,08	0,04	3	0,078473634
0,2	0,08	0,04	4	0,078854621
0,2	0,08	0,04	5	0,079083426
0,2	0,08	0,04	6	0,079236052
0,2	0,08	0,04	7	0,079345114
0,2	0,08	0,04	8	0,079426934
0,2	0,08	0,04	9	0,079490586
0,2	0,08	0,04	10	0,079541516

Table 7: (n=5)

t	ko	kd	i_3	WACC
0,2	0,08	0,04	1	0,07676703
0,2	0,08	0,04	2	0,07837722
0,2	0,08	0,04	3	0,07891638
0,2	0,08	0,04	4	0,07918642
0,2	0,08	0,04	5	0,07934861
0,2	0,08	0,04	6	0,07945683
0,2	0,08	0,04	7	0,07953417
0,2	0,08	0,04	8	0,07959218
0,2	0,08	0,04	9	0,07963732
0,2	0,08	0,04	10	0,07967343

The dependences of company weighted average cost of capital (WACC) on the coverage ratio on debt and interest on the credit i_3 at company age n=3 and n=3 are shown at Figure**s 5** and **6**.

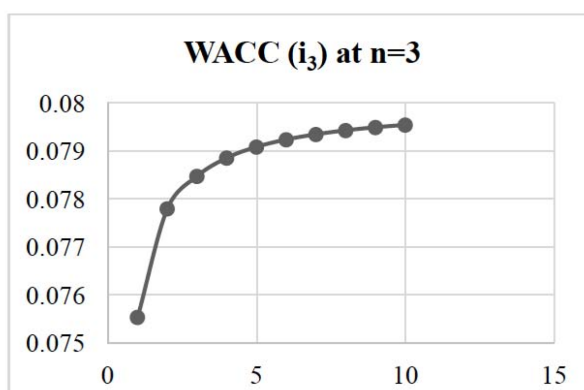


Figure 5: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on debt and interest on the credit i_3 at company age n=3.

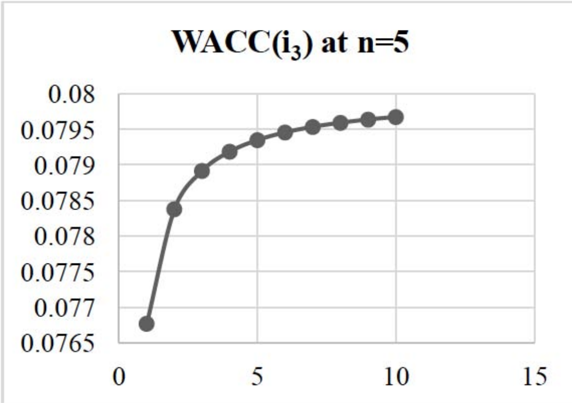


Figure 6: The dependence of company's weighted average cost of capital (WACC) on the coverage ratio on debt and interest on the credit i_2 at company age n=5.

4.4. All Three Coverage Ratios Together

Consolidated data of dependence of WACC on i_1, i_2, i_3, at company age n = 3 and n = 5 are shown at Figures **7** and **8**.

The analysis of the Tables **1-7** and Figures **1-8** as well as conclusions will be made at the end of next paragraph.

5. COVERAGE RATIOS (DIFFERENT CAPITAL COST VALUES)

Let us analyze the dependence of company weighted average cost of capital (WACC) of coverage ratios (i_1, i_2, i_3), for different capital cost values k_0 = 14%, k_d = 8%.

Here as before t = 20%, n = 3; 5, the value of coverage ratios *i* is in the range from 1 to 10.

5.1. Coverage Ratios of Debt

As we have derived above the dependence of the weighted average cost of capital (WACC) on debt coverage ratio (i_1) in the BFO theory is described by the following formula:

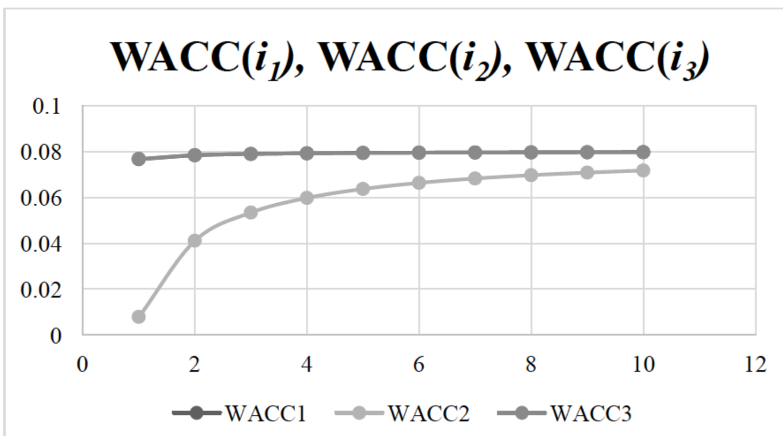


Figure 7: Consolidated data of dependence of WACC on i_1, i_2, i_3, at company age n = 3.

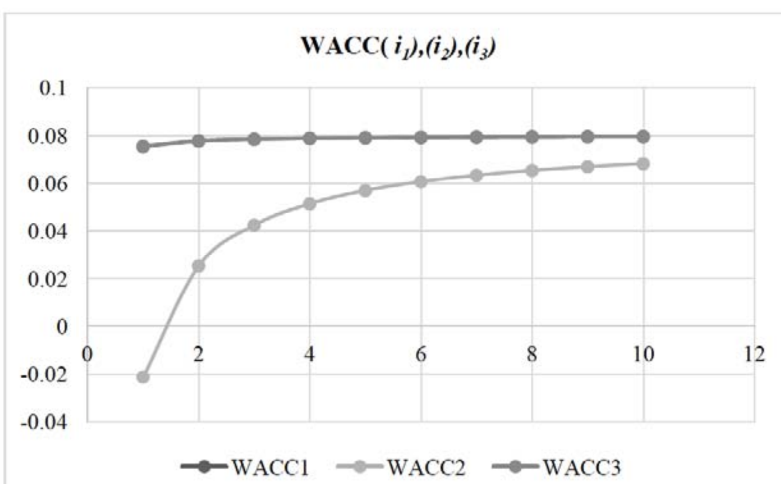


Figure 8: Consolidated data of dependence of WACC on i_1, i_2, i_3, at company age n = 3.

Table 8

i_1	t	k_0	k_d	WACC	n	BFO
1	0,2	0,14	0,08	0,1298	3	0,00
2	0,2	0,14	0,08	0,1347	3	0,00
3	0,2	0,14	0,08	0,1365	3	0,00
4	0,2	0,14	0,08	0,1374	3	0,00
5	0,2	0,14	0,08	0,1379	3	0,00
6	0,2	0,14	0,08	0,1382	3	0,00
7	0,2	0,14	0,08	0,1385	3	0,00
8	0,2	0,14	0,08	0,1387	3	0,00
9	0,2	0,14	0,08	0,1388	3	0,00
10	0,2	0,14	0,08	0,1389	3	0,00

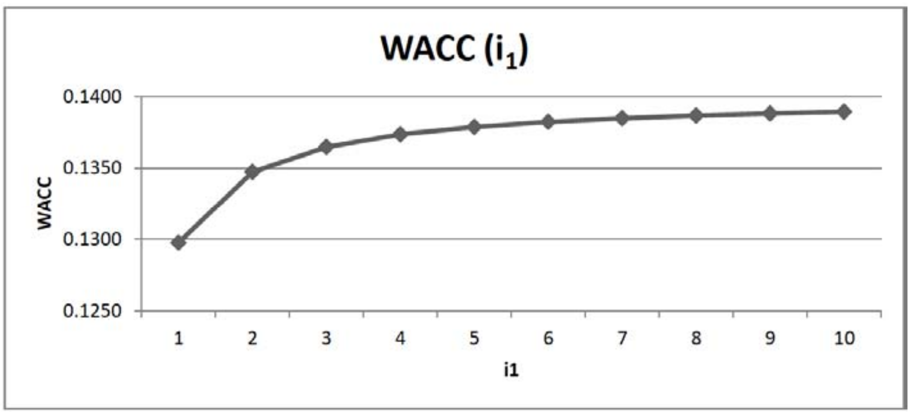


Figure 9: The dependence of the weighted average cost of capital WACC on debt coverage ratio i_1 at company age n=3.

Table 9:

i_1	t	K_0	K_d	WACC	n	BFO
1	0,2	0,14	0,08	0,1324	5	0,00
2	0,2	0,14	0,08	0,1362	5	0,00
3	0,2	0,14	0,08	0,1374	5	0,00
4	0,2	0,14	0,08	0,1381	5	0,00
5	0,2	0,14	0,08	0,1385	5	0,00
6	0,2	0,14	0,08	0,1387	5	0,00
7	0,2	0,14	0,08	0,1389	5	0,00
8	0,2	0,14	0,08	0,1390	5	0,00
9	0,2	0,14	0,08	0,1391	5	0,00
10	0,2	0,14	0,08	0,1392	5	0,00

$$i_1 * \frac{(1-(1+WACC)^{-n})}{WACC} - i_1 * \frac{(1-(1+k_0)^{-n})}{k_0} - t*[1-(1+k_d)^{-n}] = 0$$

Here

$$i_1 = \frac{CF}{D}.$$

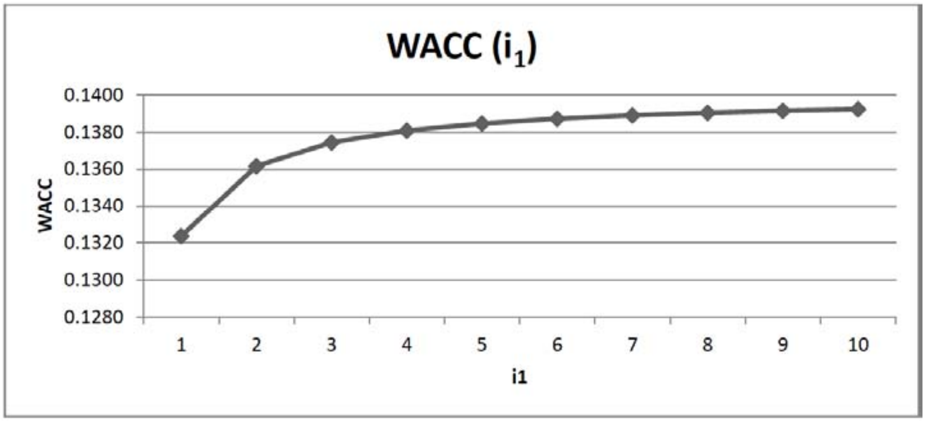


Figure 10: The dependence of the weighted average cost of capital WACC on debt coverage ratio i_1 at company age n=5.

By use it we get the following results, representing in Table **8** and Figure **9** for company age n=3 and in Table **9** and Figure **10** for company age n=5.

5.2. The Coverage Ratio on Interest on the Credit

As we have derived above the dependence of the weighted average cost of capital (WACC) on interests on credit coverage ratio (i_2) in the BFO theory is described by the following formula:

$$i_2 * \frac{(1-(1+WACC)^{-n})}{WACC} - i_2 * \frac{(1-(1+k_0)^{-n})}{k_0} - \frac{(t*[1-(1+k_d)^{-n}])}{k_d} = 0$$

Here

$$i_2 = \frac{CF}{k_d * D}.$$

By use it we get the following results, representing in Table **10** and Figure **11** for company age n=3 and in Table **11** and Figure **12** for company age n=5.

5.3. Coverage Ratios of Debt and Interest on the Credit (New Ratios)

As we have derived above the dependence of the weighted average cost of capital (WACC) on debt and interests on credit coverage ratio (i_3) in the BFO theory is described by the following formula:

$$i_3 * \frac{(1-(1+WACC)^{-n})}{WACC} - i_3 * \frac{(1-(1+k_0)^{-n})}{k_0} - \frac{t*[1-(1+k_d)^{-n}]}{(k_d+1)} = 0,$$

Here

$$i_3 = \frac{CF}{(k_d+1)*D}.$$

Table 10:

i_2	t	K_0	K_d	WACC	n	BFO
1	0,2	0,14	0,08	0,0285	3	0,00
2	0,2	0,14	0,08	0,0795	3	0,00
3	0,2	0,14	0,08	0,0985	3	0,00
4	0,2	0,14	0,08	0,1084	3	0,00
5	0,2	0,14	0,08	0,1145	3	0,00
6	0,2	0,14	0,08	0,1186	3	0,00
7	0,2	0,14	0,08	0,1216	3	0,00
8	0,2	0,14	0,08	0,1238	3	0,00
9	0,2	0,14	0,08	0,1256	3	0,00
10	0,2	0,14	0,08	0,1270	3	0,00

Table 12:

i_3	t	K_0	K_d	WACC	n	BFO
1	0,2	0,14	0,08	0,1303	3	0,00
2	0,2	0,14	0,08	0,1351	3	0,00
3	0,2	0,14	0,08	0,1367	3	0,00
4	0,2	0,14	0,08	0,1376	3	0,00
5	0,2	0,14	0,08	0,1380	3	0,00
6	0,2	0,14	0,08	0,1384	3	0,00
7	0,2	0,14	0,08	0,1386	3	0,00
8	0,2	0,14	0,08	0,1388	3	0,00
9	0,2	0,14	0,08	0,1389	3	0,00
10	0,2	0,14	0,08	0,1390	3	0,00

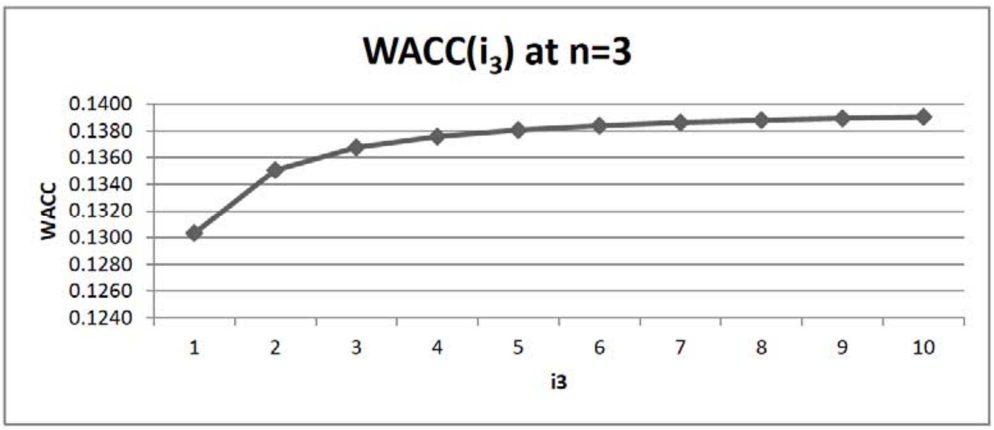


Figure 13: The dependence of the weighted average cost of capital (WACC) on debt and interests on credit leverage ratio (i_3) at company age n=3.

Table 13:

i_3	t	K_0	K_d	WACC	n	BFO
1	0,2	0,14	0,08	0,1329	5	0,00
2	0,2	0,14	0,08	0,1364	5	0,00
3	0,2	0,14	0,08	0,1376	5	0,00
4	0,2	0,14	0,08	0,1382	5	0,00
5	0,2	0,14	0,08	0,1386	5	0,00
6	0,2	0,14	0,08	0,1388	5	0,00
7	0,2	0,14	0,08	0,1390	5	0,00
8	0,2	0,14	0,08	0,1391	5	0,00
9	0,2	0,14	0,08	0,1392	5	0,00
10	0,2	0,14	0,08	0,1393	5	0,00

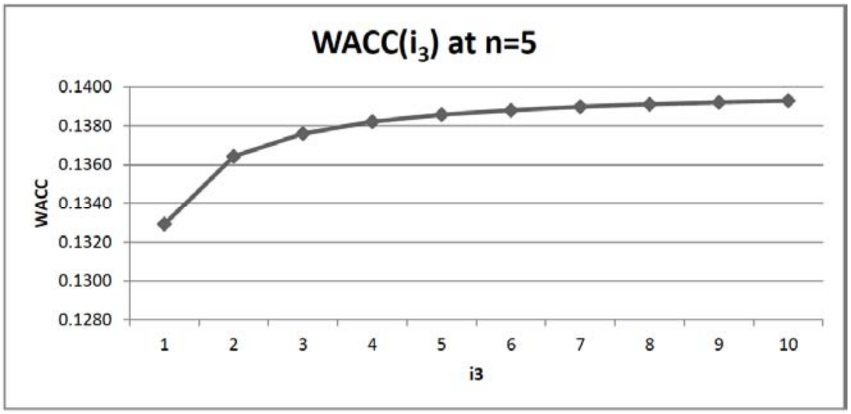
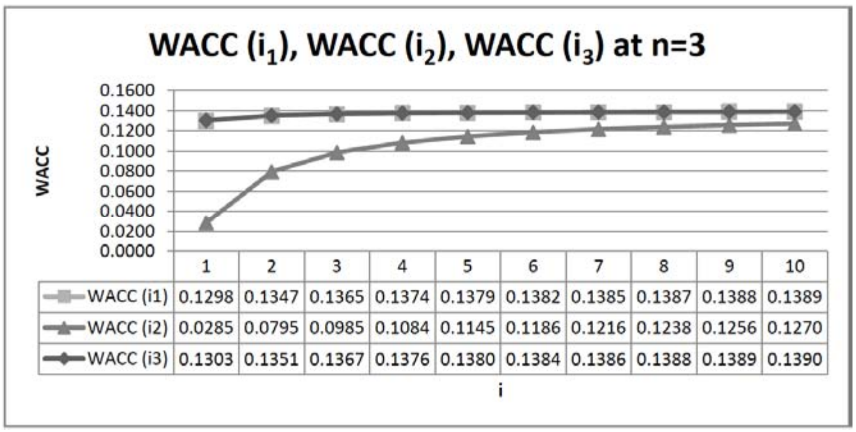
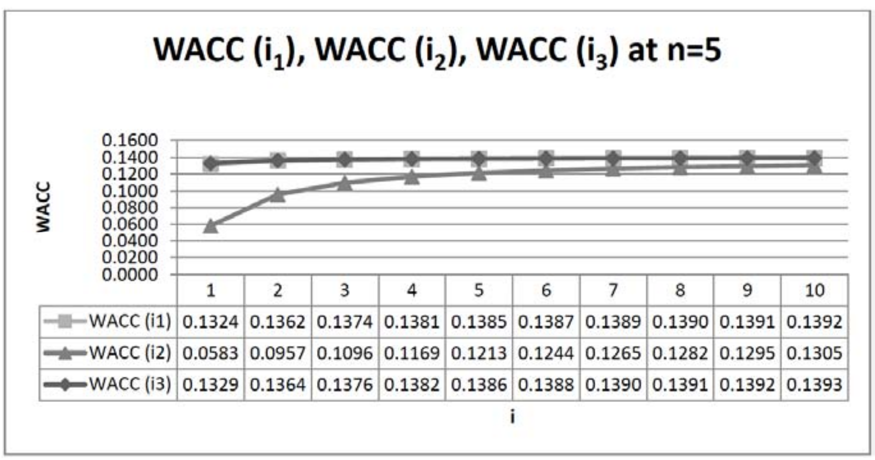


Figure 14: The dependence of the weighted average cost of capital (WACC) on debt and interests on credit leverage ratio (i_3) at company age n=5.



	1	2	3	4	5	6	7	8	9	10
WACC (i1)	0.1298	0.1347	0.1365	0.1374	0.1379	0.1382	0.1385	0.1387	0.1388	0.1389
WACC (i2)	0.0285	0.0795	0.0985	0.1084	0.1145	0.1186	0.1216	0.1238	0.1256	0.1270
WACC (i3)	0.1303	0.1351	0.1367	0.1376	0.1380	0.1384	0.1386	0.1388	0.1389	0.1390

Figure 15: Consolidated data of dependence of WACC on i_1, i_2, i_3, at company age n = 3.



	1	2	3	4	5	6	7	8	9	10
WACC (i1)	0.1324	0.1362	0.1374	0.1381	0.1385	0.1387	0.1389	0.1390	0.1391	0.1392
WACC (i2)	0.0583	0.0957	0.1096	0.1169	0.1213	0.1244	0.1265	0.1282	0.1295	0.1305
WACC (i3)	0.1329	0.1364	0.1376	0.1382	0.1386	0.1388	0.1390	0.1391	0.1392	0.1393

Figure 16: Consolidated data of dependence of WACC on i_1, i_2, i_3, at company age n=5.

By use it we get the following results, representing in Table **12** and Figure **13** for company age n=3 and in Table **13** and Figure **14** for company age n=5.

5.4. Analysis and Conclusions

It is seen from the Tables **1-13** and Figures **1-16** that $WACC(i_j)$ is increasing function on i_j with saturation $WACC = k_0$ at high values of i_j. Note, that this saturation for companies of finite age is a little bit more gradual than in case of perpetuity companies: in latter case the saturation takes place around i_j value of order 1 for ratios i_1 and i_3 and of order 4 or 5 for ratios i_2. In perpetuity case as well as in case of companies of finite age at saturation *WACC* reaches the value k_0 (equity value at zero leverage level). This means that for high values of i_j one can choose k_0 as a discount rate with a very good accuracy in perpetuity case and with a little bit less accuracy in general case (companies of arbitrary ages). Thus the role of parameter k_0 increases drastically. The method of determination of parameter k_0 has been developed by Anastasiya Brusova (Brusova A (2011)). So, parameter k_0 is the discount rate for case of high values of i_j. In case of ratio i_2 in general case as well as in perpetuity case the saturation of *WACC* (i_2) takes place at higher values of i_2.

In opposite to perpetuity case within BFO theory one could make calculations for companies of arbitrary age because a factor of time presents in this theory. Our calculations show that curve *WACC* (i_j) for company of higher age lies above this curve for younger company. And with increase of i_j value the WACC values for different company ages n become closer each other.

Note that curves WACC(i_1) and WACC(i_3) are very close each other at small enough credit rates, but difference between them will become bigger at higher values of credit rates.

Curve WACC(i_2) turns out to be enough different from WACC(i_1) and curves WACC(i_3).

6. LEVERAGE RATIOS

6.1. Leverage Ratios for Debt

We will analyze the dependence of company weighted average cost of capital (WACC) on leverage ratios (l_1, l_2, l_3). We will make calculation for capital costs k_0 = 10%, k_d = 6%, t = 20%, n = 3; 5; *l* values range from 0 to 10.

Dividing the both parts of the formula (6) by the income value for one period *CF*, we enter the leverage ratios l_1 for debt into the general BFO theory

$$\frac{(1-(1+WACC)^{-n})}{WACC}-\frac{(1-(1+k_0)^{-n})}{k_0}-t*[1-(1+k_d)^{-n}]*l_1=0,$$

Here

$$l_1=\frac{D}{CF}.$$

Remind, that here *WACC* is the weighted average cost of capital of the company, l_1 – the leverage ratios l_1 for debt, t is the tax on profit rate for organizations (t=20%), k_0 – equity cost of financially–independent company, k_d is the debt capital cost; n is the company age, CF–income value for one period; D – debt capital value.

The ratio (l_2) can be used to assess of the following parameters used in rating, $Interests/EBITDA$ and some others.

By use the above equation we get the following results, representing in Table **14** and Figure **17** for company age n=3 and in Table **15** and Figure **18** for company age n=5.

Table 14:

l_1	t	k_0	k_d	WACC(l_1)	n	BFO
0	0,2	0,1	0,06	0,1000	3	0,00
1	0,2	0,1	0,06	0,0928	3	0,00
2	0,2	0,1	0,06	0,0857	3	0,00
3	0,2	0,1	0,06	0,0787	3	0,00
4	0,2	0,1	0,06	0,0720	3	0,00
5	0,2	0,1	0,06	0,0654	3	0,00
6	0,2	0,1	0,06	0,0587	3	0,00
7	0,2	0,1	0,06	0,0523	3	0,00
8	0,2	0,1	0,06	0,0461	3	0,00
9	0,2	0,1	0,06	0,0399	3	0,00
10	0,2	0,1	0,06	0,0339	3	0,00

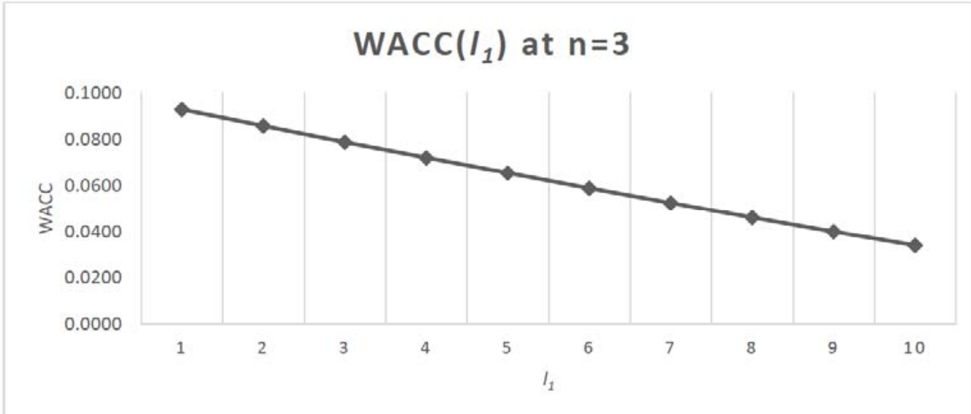


Figure 17: The dependence of company weighted average cost of capital (WACC) on debt leverage ratio at n=3.

Table 15:

l_1	t	k_0	k_d	WACC(l_1)	n	BFO
0	0,2	0,1	0,06	0,1000	5	0,00
1	0,2	0,1	0,06	0,0948	5	0,00
2	0,2	0,1	0,06	0,0898	5	0,00
3	0,2	0,1	0,06	0,0848	5	0,00
4	0,2	0,1	0,06	0,0799	5	0,00
5	0,2	0,1	0,06	0,0752	5	0,00
6	0,2	0,1	0,06	0,0705	5	0,00
7	0,2	0,1	0,06	0,0660	5	0,00
8	0,2	0,1	0,06	0,0615	5	0,00
9	0,2	0,1	0,06	0,0571	5	0,00
10	0,2	0,1	0,06	0,0528	5	0,00

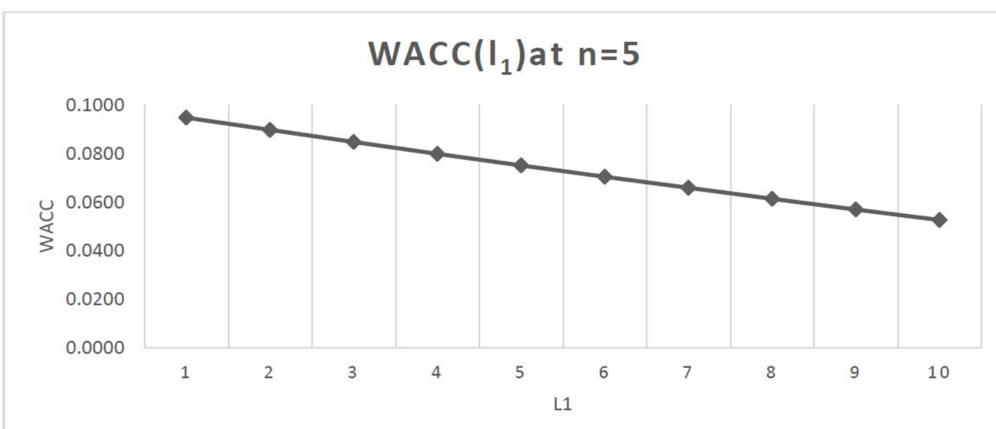


Figure 18: The dependence of company weighted average cost of capital WACC on debt leverage ratios at n=5.

Table 16:

l_2	t	k_0	kd	WACC(l_2)	n	BFO
0	0,2	0,1	0,06	0,0998	3	0,00
1	0,2	0,1	0,06	–0,0036	3	0,00
2	0,2	0,1	0,06	–0,0804	3	0,00
3	0,2	0,1	0,06	–0,1403	3	0,00
4	0,2	0,1	0,06	–0,1888	3	0,00
5	0,2	0,1	0,06	–0,2289	3	0,00
6	0,2	0,1	0,06	–0,2629	3	0,00
7	0,2	0,1	0,06	–0,2922	3	0,00
8	0,2	0,1	0,06	–0,3178	3	0,00
9	0,2	0,1	0,06	–0,3404	3	0,00
10	0,2	0,1	0,06	–0,3605	3	0,00

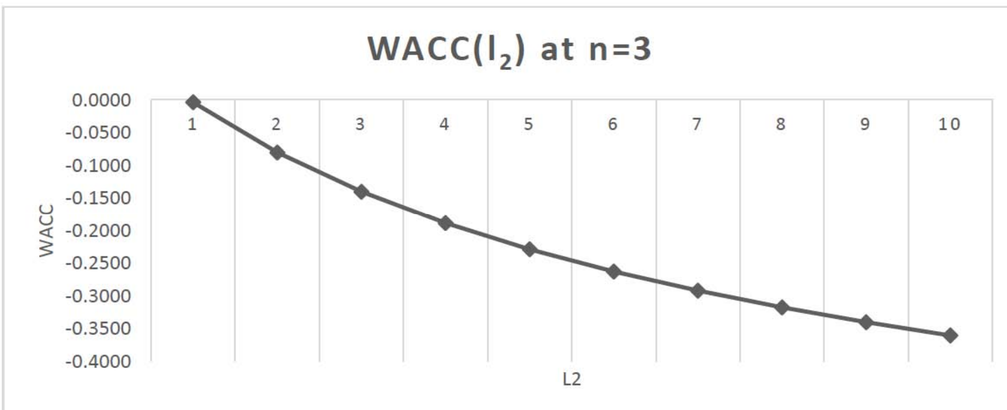


Figure 19: The dependence of company weighted average cost of capital (WACC) on leverage ratio of interests on credit at company age n=3.

Table 17:

l_2	t	k_0	k_d	WACC(l_2)	n	BFO
0	0,2	0,1	0,06	0,1000	5	0,00
1	0,2	0,1	0,06	0,0259	5	0,00
2	0,2	0,1	0,06	–0,0296	5	0,00
3	0,2	0,1	0,06	–0,0732	5	0,00
4	0,2	0,1	0,06	–0,1089	5	0,00
5	0,2	0,1	0,06	–0,1388	5	0,00
6	0,2	0,1	0,06	–0,1643	5	0,00
7	0,2	0,1	0,06	–0,1865	5	0,00
8	0,2	0,1	0,06	–0,2061	5	0,00
9	0,2	0,1	0,06	–0,2235	5	0,00
10	0,2	0,1	0,06	–0,2391	5	0,00

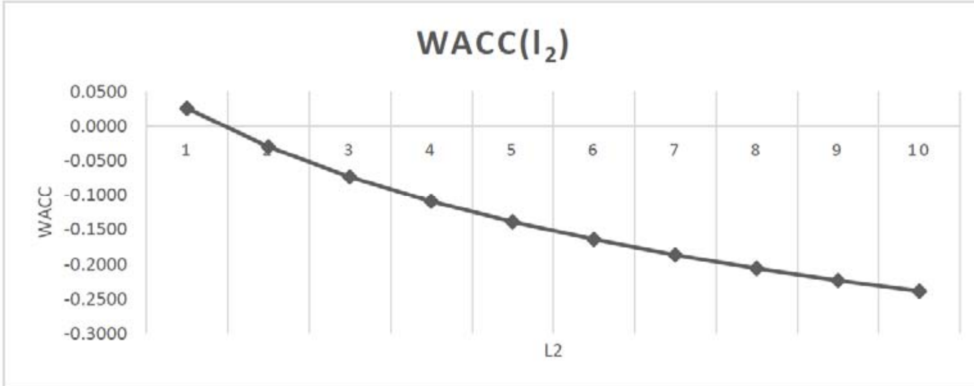


Figure 20: The dependence of company weighted average cost of capital (WACC) on leverage ratio of interests on credit at company age n=3.

6.2. Leverage Ratios for Interest on Credit

The dependence of company weighted average cost of capital (WACC) on leverage ratios on interests on credit l_2 is described within BFO theory by the following formula:

$$\frac{(1-(1+WACC)^{-n})}{WACC}-\frac{(1-(1+k_0)^{-n})}{k_0}-\frac{(t*l_2*[1-(1+k_d)^{-n}])}{k_d}=0,$$

Here

$$l_2=\frac{k_d*D}{CF}.$$

Using it, we find the dependence WACC(l_2) at company ages n=3 and n=5.

This ratio l_2 can be used to assess of the following parameters used in rating, $Interests/EBITDA$ and some others.

The dependence of company weighted average cost of capital (WACC) on leverage ratios on debt and interests on credit l_3 is described within BFO theory by the following formula:

$$\frac{(1-(1+WACC)^{-n})}{WACC}-\frac{(1-(1+k_0)^{-n})}{k_0}-\frac{t*l_3*[1-(1+k_d)^{-n}]}{(k_d+1)}=0,$$

Here

$$l_3=\frac{(k_d+1)*D}{CF}.$$

The ratio l_3 can be used to assess of the following parameters used in rating, *Debt+interest / FFO*, *Debt+interest / EBIT*, *Debt+interest / EBITDA(R)*, and some others.

Table 18:

l_3	t	k_0	k_d	WACC(l3)	n	BFO
0	0,2	0,1	0,06	0,1000	3	0,00
1	0,2	0,1	0,06	0,0930	3	0,00
2	0,2	0,1	0,06	0,0864	3	0,00
3	0,2	0,1	0,06	0,0798	3	0,00
4	0,2	0,1	0,06	0,0734	3	0,00
5	0,2	0,1	0,06	0,0671	3	0,00
6	0,2	0,1	0,06	0,0608	3	0,00
7	0,2	0,1	0,06	0,0548	3	0,00
8	0,2	0,1	0,06	0,0489	3	0,00
9	0,2	0,1	0,06	0,0430	3	0,00
10	0,2	0,1	0,06	0,0371	3	0,00

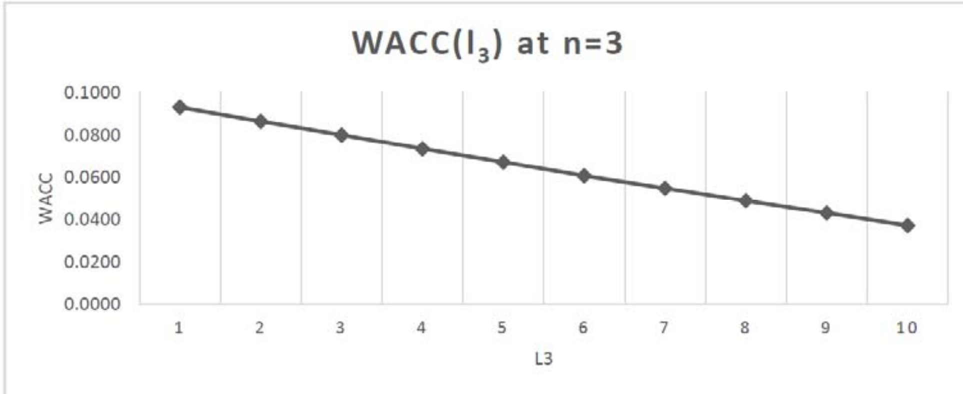


Figure 21: The dependence of company weighted average cost of capital (WACC) on leverage ratio on debt and interests on credit at company age n=3.

Table 19:

l_3	t	k_0	k_d	WACC(l3)	n	BFO
0	0,2	0,1	0,06	0,1000	5	0,00
1	0,2	0,1	0,06	0,0951	5	0,00
2	0,2	0,1	0,06	0,0903	5	0,00
3	0,2	0,1	0,06	0,0856	5	0,00
4	0,2	0,1	0,06	0,0810	5	0,00
5	0,2	0,1	0,06	0,0765	5	0,00
6	0,2	0,1	0,06	0,0721	5	0,00
7	0,2	0,1	0,06	0,0678	5	0,00
8	0,2	0,1	0,06	0,0635	5	0,00
9	0,2	0,1	0,06	0,0593	5	0,00
10	0,2	0,1	0,06	0,0552	5	0,00

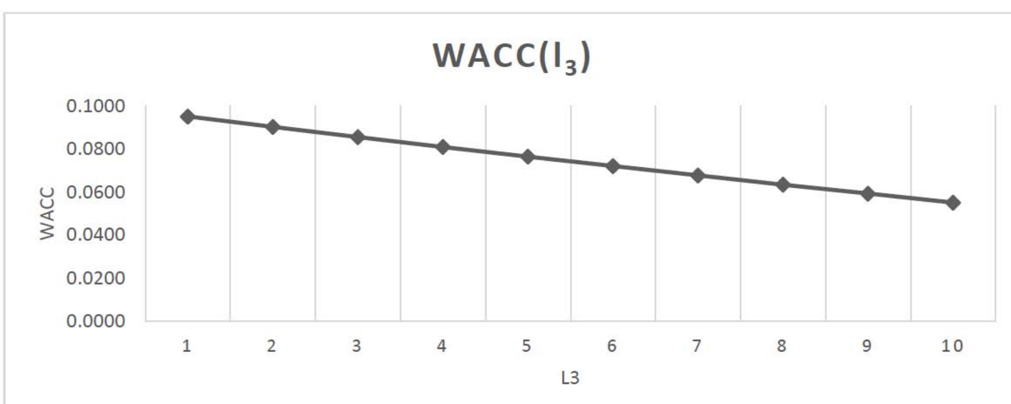


Figure 22: The dependence of company weighted average cost of capital (WACC) on leverage ratio of debt and interests on credit at company age n=5.

Using it, we find the dependence WACC(l_3) at company ages n=3 and n=5.

Below we represent the consolidated data of dependence of WACC on l_1, l_2, l_3, at company age n = 3 and n=5.

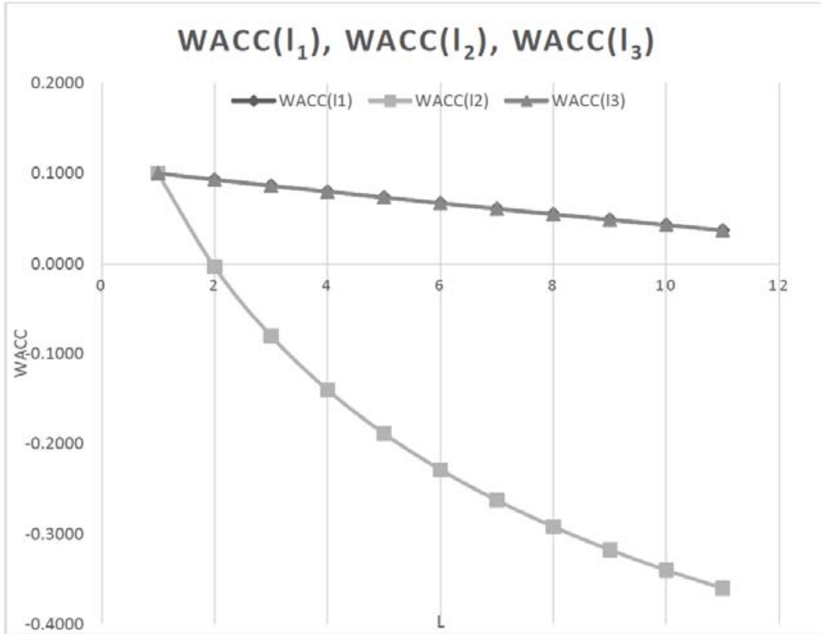


Figure 23: Consolidated data of dependence of WACC on l_1, l_2, l_3, at company age n = 3.

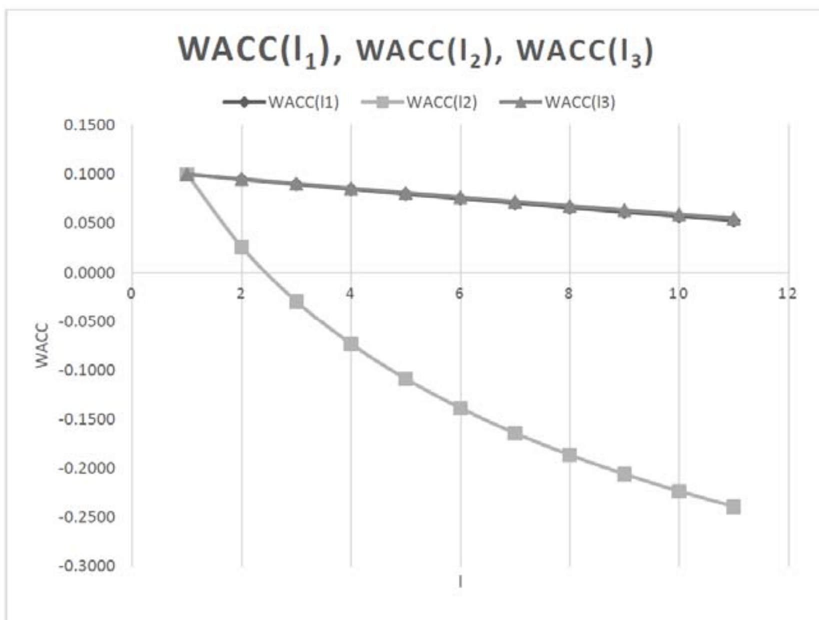


Figure 24: Consolidated data of dependence of WACC on l_1, l_2, l_3, at company age n = 5.

7. LEVERAGE RATIOS (DIFFERENT CAPITAL COSTS)

7.1. Leverage Ratios for Debt

Below we analyze the dependence of company weighted average cost of capital (WACC) on leverage ratios l_1, l_2, l_3, at capital costs values k_0 = 12%, k_d = 6%.

As before t = 20%, company age n = 3; 5, leverage ratios values range from 0 to 10.

The dependence of company weighted average cost of capital (WACC) on leverage ratios on debt l_1 is described within BFO theory by the following formula:

$$\frac{(1-(1+WACC)^{-n})}{WACC} - \frac{(1-(1+k_0)^{-n})}{k_0} - t*c*l_1 = 0$$

Here

$$l_1 = \frac{D}{CF}$$

Table 19:

L1	k0	kd	n1	t	WACC	БФО
0	0,12	0,06	3	0,2	0,119997	0,00
1	0,12	0,06	3	0,2	0,112294	0,00
2	0,12	0,06	3	0,2	0,104774	0,00
3	0,12	0,06	3	0,2	0,097444	0,00
4	0,12	0,06	3	0,2	0,090128	0,00
5	0,12	0,06	3	0,2	0,083078	0,00
6	0,12	0,06	3	0,2	0,076332	0,00
7	0,12	0,06	3	0,2	0,06959	0,00
8	0,12	0,06	3	0,2	0,062962	0,00
9	0,12	0,06	3	0,2	0,056492	0,00
10	0,12	0,06	3	0,2	0,050163	0,00

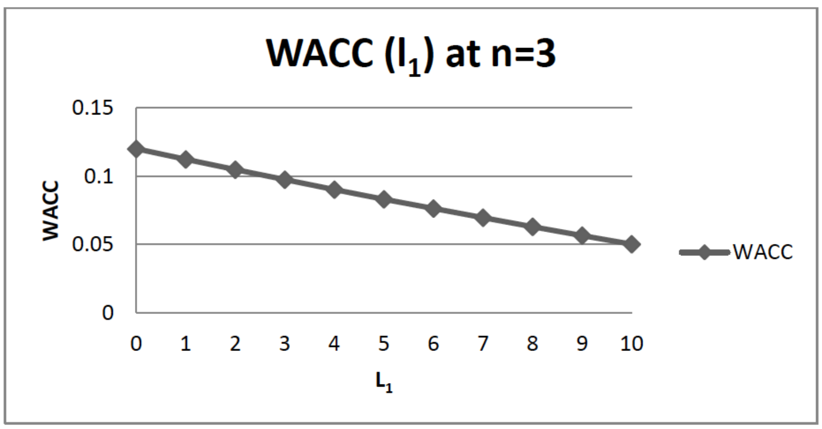


Figure 25: The dependence of company weighted average cost of capital (WACC) on leverage ratio of debt at company age n=3.

Table 20:

L1	k0	kd	n1	t	WACC	БФО
0	0,12	0,06	5	0,2	0,119994	0,00
1	0,12	0,06	5	0,2	0,114311	0,00
2	0,12	0,06	5	0,2	0,108927	0,00
3	0,12	0,06	5	0,2	0,103556	0,00
4	0,12	0,06	5	0,2	0,098332	0,00
5	0,12	0,06	5	0,2	0,093123	0,00
6	0,12	0,06	5	0,2	0,088164	0,00
7	0,12	0,06	5	0,2	0,083265	0,00
8	0,12	0,06	5	0,2	0,078452	0,00
9	0,12	0,06	5	0,2	0,073744	0,00
10	0,12	0,06	5	0,2	0,069	0,00

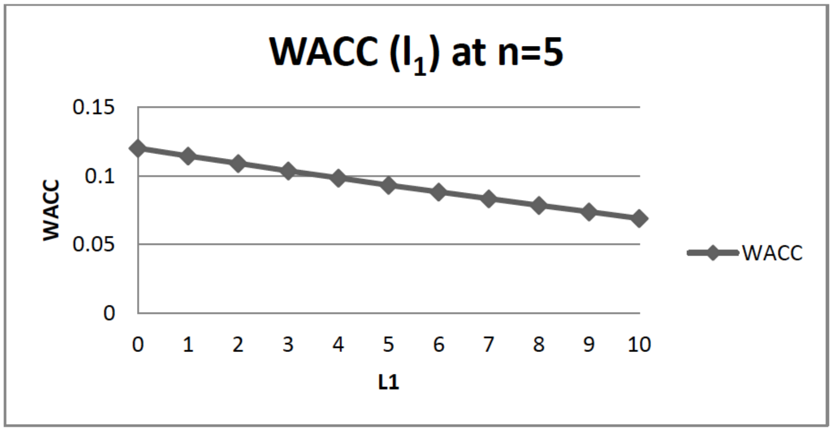


Figure 26: The dependence of company weighted average cost of capital (WACC) on leverage ratio of debt at company age n=3.

Using it, we find the dependence WACC(l_1) at company ages n=3 and n=5.

7.2. Leverage Ratios for Interests on Credit

The dependence of company weighted average cost of capital (WACC) on leverage ratios on interests on credit l_2 is described within BFO theory by the following formula:

$$\frac{(1-(1+WACC)^{-n})}{WACC}-\frac{(1-(1+k_0)^{-n})}{k_0}-\frac{t*l_2*(1-(1+k_d)^{-n})}{k_d}=0$$

Here

$$l_2=\frac{D*k_d}{CF}.$$

Using it, we find the dependence WACC(l_2) at company ages n=3 and n=5.

7.3. Leverage Ratios for Debt and Interests on Credit

The dependence of company weighted average cost of capital (WACC) on leverage ratios on debt and interests on credit l_3 is described within BFO theory by the following formula:

$$\frac{(1-(1+WACC)^{-n})}{WACC}-\frac{(1-(1+k_0)^{-n})}{k_0}-\frac{t*l_3*(1-(1+k_d)^{-n})}{1+k_d}=0$$

Here

$$l_3=\frac{D(1+k_d)}{CF}$$

Table 21:

l_2	k0	kd	n1	t	WACC	БФО
0	0,12	0,06	3	0,2	0,119997	0,00
1	0,12	0,06	3	0,2	0,010838	0,00
2	0,12	0,06	3	0,2	–0,06941	0,00
3	0,12	0,06	3	0,2	–0,13171	0,00
4	0,12	0,06	3	0,2	–0,18169	0,00
5	0,12	0,06	3	0,2	–0,22298	0,00
6	0,12	0,06	3	0,2	–0,25785	0,00
7	0,12	0,06	3	0,2	–0,28784	0,00
8	0,12	0,06	3	0,2	–0,31392	0,00
9	0,12	0,06	3	0,2	–0,33692	0,00
10	0,12	0,06	3	0,2	–0,35745	0,00

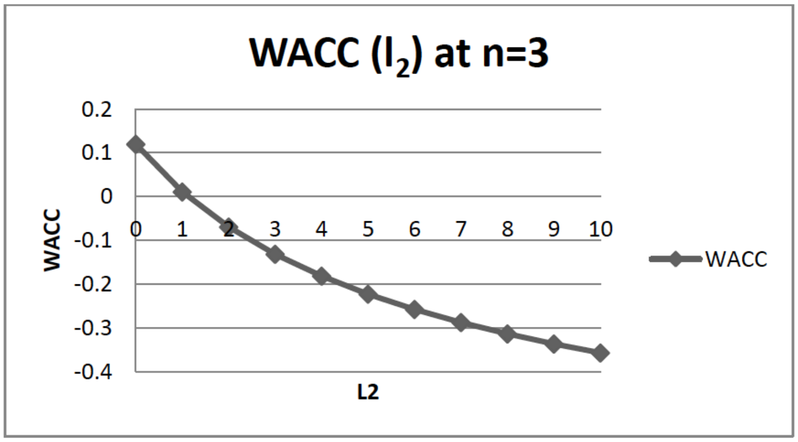


Figure 27: The dependence of company weighted average cost of capital (WACC) on leverage ratio of interests on credit at company age n=3.

Table 22:

L2	k0	kd	n1	t	WACC	БФО
0	0,12	0,06	5	0,2	0,119994	0,00
1	0,12	0,06	5	0,2	0,040367	0,00
2	0,12	0,06	5	0,2	–0,01846	0,00
3	0,12	0,06	5	0,2	–0,06439	0,00
4	0,12	0,06	5	0,2	–0,10159	0,00
5	0,12	0,06	5	0,2	–0,13262	0,00
6	0,12	0,06	5	0,2	–0,15899	0,00
7	0,12	0,06	5	0,2	–0,18185	0,00
8	0,12	0,06	5	0,2	–0,20194	0,00
9	0,12	0,06	5	0,2	–0,21978	0,00
10	0,12	0,06	5	0,2	–0,23578	0,00

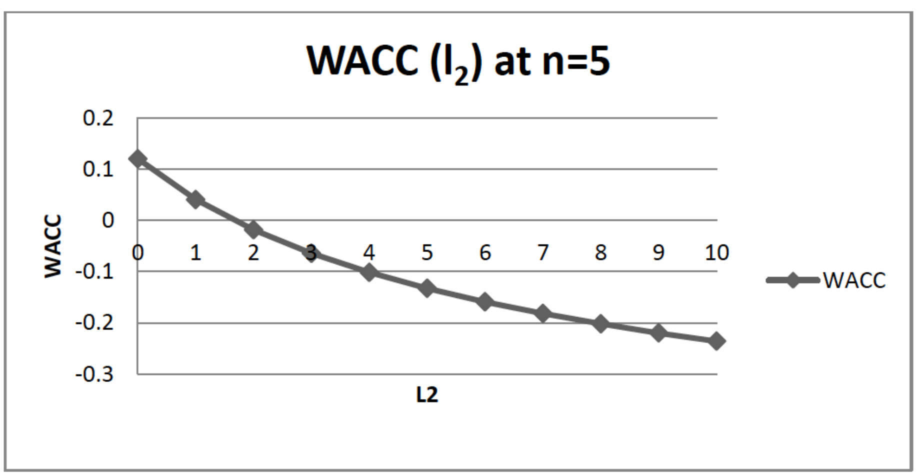


Figure 28: The dependence of company weighted average cost of capital (WACC) on leverage ratio of interests on credit at company age n=5.

Table 23:

l_3	k_0	k_d	n	t	WACC	BFO
0	0,12	0,06	3	0,2	0,119997	0,00
1	0,12	0,06	3	0,2	0,112716	0,00
2	0,12	0,06	3	0,2	0,105604	0,00
3	0,12	0,06	3	0,2	0,098686	0,00
4	0,12	0,06	3	0,2	0,091785	0,00
5	0,12	0,06	3	0,2	0,085114	0,00
6	0,12	0,06	3	0,2	0,078654	0,00
7	0,12	0,06	3	0,2	0,072249	0,00
8	0,12	0,06	3	0,2	0,065828	0,00
9	0,12	0,06	3	0,2	0,059771	0,00
10	0,12	0,06	3	0,2	0,053729	0,00

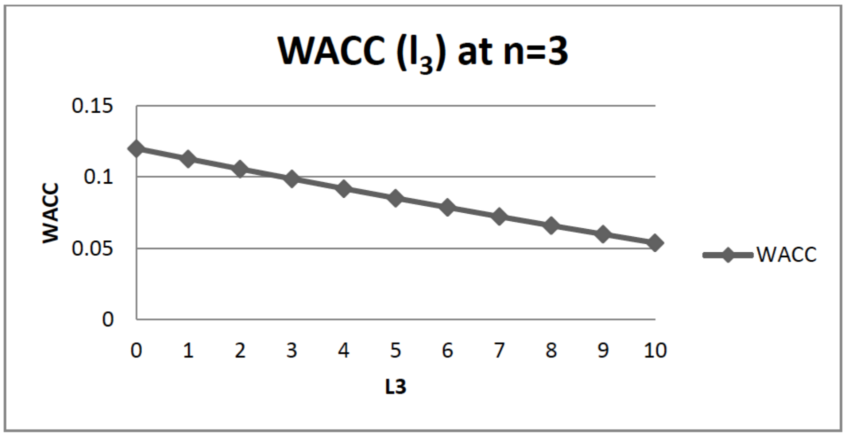


Figure 29: The dependence of company weighted average cost of capital (WACC) on leverage ratio of debt and interests on credit at company age n=3.

Table 24:

L3	k0	kd	n	t	WACC	BFO
0	0,12	0,06	5	0,2	0,119994	0,00
1	0,12	0,06	5	0,2	0,114614	0,00
2	0,12	0,06	5	0,2	0,10954	0,00
3	0,12	0,06	5	0,2	0,104444	0,00
4	0,12	0,06	5	0,2	0,099512	0,00
5	0,12	0,06	5	0,2	0,094598	0,00
6	0,12	0,06	5	0,2	0,08988	0,00
7	0,12	0,06	5	0,2	0,0852	0,00
8	0,12	0,06	5	0,2	0,080618	0,00
9	0,12	0,06	5	0,2	0,076129	0,00
10	0,12	0,06	5	0,2	0,071733	0,00

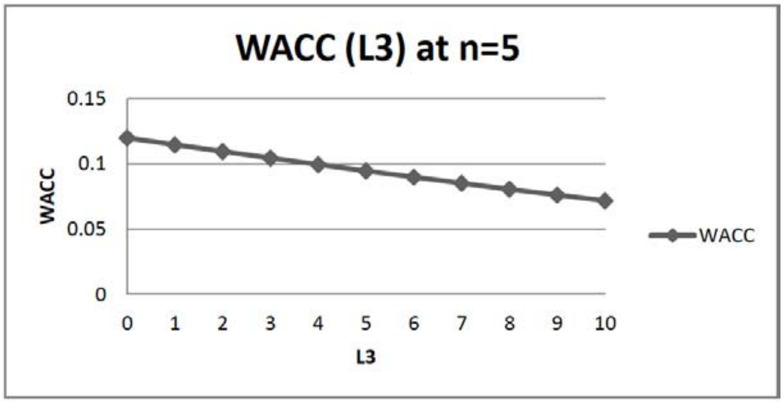


Figure 30: The dependence of company weighted average cost of capital (WACC) on leverage ratio of debt and interests on credit at company age n=5.

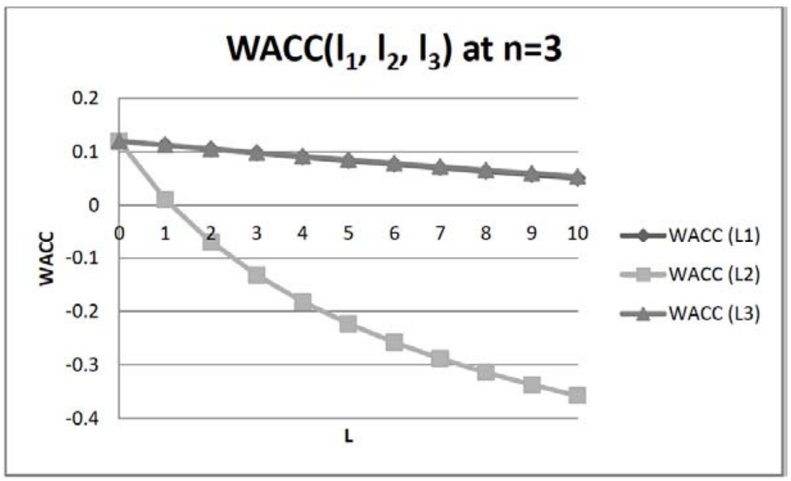


Figure 31: Consolidated data of dependence of WACC on l_1, l_2, l_3, at company age n = 3.

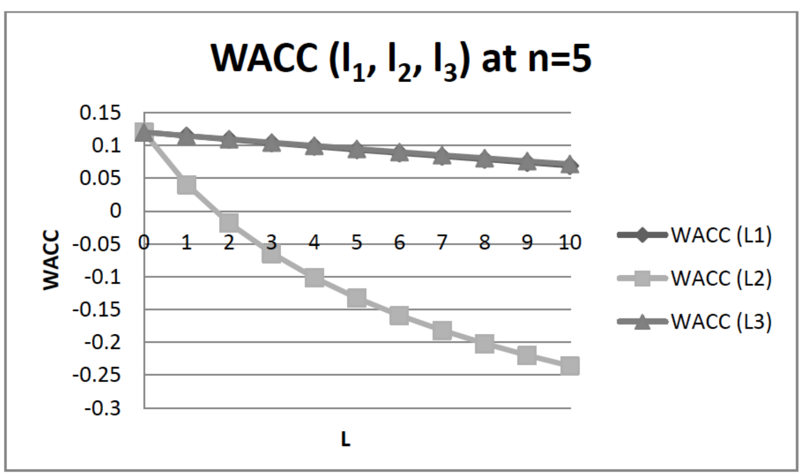


Figure 32: Consolidated data of dependence of WACC on l_1, l_2, l_3, at company age n = 5.

Using it, we find the dependence WACC(l_3) at company ages n=3 and n=5.

7.4. Analysis and Conclusions

It is seen from the Tables **14-24** and Figures **17-32** that *WACC*(l_j) is decreasing function on l_j. *WACC* decreases from value of k_0 (equity value at zero leverage level) practically linearly for WACC(l_1) and WACC(l_3) and with higher speed for WACC(l_2). In opposite to perpetuity case within BFO theory one could make calculations for companies of arbitrary age because a factor of time presents in this theory. Our calculations show that curve *WACC* (l_i) for company of higher age lies above this curve for younger company.

Note that curves WACC(l_1) and WACC(l_3) are very close each other at small enough credit rates, but difference between them will become bigger at higher values of credit rates.

Curve WACC(l_2) turns out to be enough different from WACC(l_1) and curves WACC(l_3).

8. CONCLUSIONS

In current paper further development of a new approach to rating methodology has been done. We have generalized it for the general case of modern theory of capital structure (Brusov–Filatova–Orekhova (BFO) theory): for companies of arbitrary age. A serious modification of BFO theory in order to use it in rating procedure has been required. It allows to apply obtained results for real economics, where all companies have finite lifetime, introduce a factor of time into theory, estimate the creditworthiness of companies of arbitrary age (or arbitrary lifetime), introduce discounting of the financial flows, using the correct discount rate etc. This allows use the powerful tools of BFO theory in the rating. All these create a new base for rating methodologies.

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REFERENCES

Brusov P, Filatova T, Orehova N, Kulik V Rating: New approach (2018) Journal of Reviews in Global Economics.

Brusov P, Filatova T, Orehova N, Eskindarov M (2015) Modern corporate finance, investment and taxation. Springer International Publishing, pp.1–368. https://doi.org/10.1007/978-3-319-14732-1

Brusov P, Filatova T, Orehova N, Brusova A (2011a) Weighted average cost of capital in the theory of Modigliani–Miller, modified for a finite life–time company. Applied Financial Economics 21(11): 815–824.

Brusov P, Filatova P, Orekhova N (2013a) Absence of an Optimal Capital Structure in the Famous Tradeoff Theory! Journal of Reviews on Global Economics 2: 94–116.

Brusov P, Filatova P, Orekhova N (2014a) Mechanism of formation of the company optimal capital structure, different from suggested by trade off theory. Cogent Economics & Finance 2: 1–13. https://doi.org/10.1080/23322039.2014.946150

Brusov P, Filatova T, Orehova N *et al*. (2011b) From Modigliani–Miller to general theory of capital cost and capital structure of the company. Research Journal of Economics, Business and ICT 2: 16–21.

Brusov P, Filatova T, Eskindarov M, Orehova N (2012a) Influence of debt financing on the effectiveness of the finite duration investment project. Applied Financial Economics 22 (13) : 1043–1052.

Brusov P, Filatova T, Orehova N *et al.* (2011c) Influence of debt financing on the effectiveness of the investment project within the Modigliani–Miller theory. Research Journal of Economics, Business and ICT (UK) 2: 11–15.

Brusov P, Filatova T, Eskindarov M, Orehova N (2012b) Hidden global causes of the global financial crisis. Journal of Reviews on Global Economics 1: 106–111.

Brusov P, Filatova T, Orekhova N (2013b) Absence of an Optimal Capital Structure in the Famous Tradeoff Theory! Journal of Reviews on Global Economics 2: 94–116.

Brusov P.N., Filatova T. V. (2011d) From Modigliani–Miller to general theory of capital cost and capital structure of the company. Finance and credit 435: 2–8.

Brusov P, Filatova T, Orekhova N, Brusov P. Brusova A. (2012). Modern approach to dividend policy of company. Finance and credit, v.18, issue 37, 2012.

Brusov P Filatova T Orehova N Brusov P.P Brusova N. (2011e) From Modigliani–Miller to general theory of capital cost and capital structure of the company. Research Journal of Economics, Business and ICT 2: 16–21.

Brusov P Filatova T Orehova N (2014b) Inflation in Brusov–Filatova–Orekhova Theory and in its Perpetuity Limit – Modigliani – Miller Theory. Journal of Reviews on Global Economics 3: 175–185.

Brusov P Filatova T Orehova N (2013c) A Qualitatively New Effect in Corporative Finance: Abnormal Dependence of Cost of Equity of Company on Leverage. Journal of Reviews on Global Economics 2: 183–193.

Brusova A (2011) A Comparison of the three methods of estimation of weighted average cost of capital and equity cost of company. Financial analysis: problems and solutions 34 (76): 36–42.

Filatova T Orehova N Brusova A (2008) Weighted average cost of capital in the theory of Modigliani–Miller, modified for a finite life–time company. Bulletin of the FU 48: 68–77.

Modigliani F, Miller M (1958) The Cost of Capital, Corporate Finance, and the Theory of Investment. American Economic Review 48: 261–297.

Modigliani F, Miller M (1963) Corporate Income Taxes and the Cost of Capital: A Correction. American Economic Review 53: 147–175.

Modigliani F, Miller M (1966) Some estimates of the Cost of Capital to the Electric Utility Industry 1954–1957. American Economic Review 56: 333–391.

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