

Contributions to Finance and Accounting

Peter Brusov
Tatiana Filatova
Natali Orekhova

Ratings

Critical Analysis and New Approaches of
Quantitative and Qualitative
Methodology

 Springer

Contributions to Finance and Accounting

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*Dedicated to our dear children and to our
nice grandchildren*

Preface

The monograph develops new modern methodologies for rating of non-financial issuers and of project ratings based on the use of the modern theory of capital cost and capital structure (BFO theory—Brusov–Filatova–Orekhova theory) and of its two perpetuity limits (Modigliani–Miller theory (MM theory) and the modified Modigliani–Miller theory (MMM theory)), as well as modern investment models created by the authors.

In order to modify and improve existing rating methods to increase the objectivity and correctness of rating estimates, the monograph critically analyzes the methodological and systemic shortcomings of the existing credit rating of non-financial issuers and project rating. The modern theory of capital cost and capital structure (BFO theory) for companies of arbitrary age and its two perpetuity limits (Modigliani–Miller theory and modified Modigliani–Miller theory) have been modified for rating needs. The incorporation of financial ratios used in the rating methodology was carried out both in the BFO theory and in its perpetuity limits: in the Modigliani–Miller theory and in the modified Modigliani–Miller theory. A fundamentally new approach to the rating methodology has been developed, which includes the adequate application of discounting, which is practically not used in existing rating methodologies, when discounting the financial flows; the use of rating parameters under discounting of financial flows; and the correct determination of discount rates taking into account the financial ratios.

The proposed improvement of the rating methodology of existing rating systems will improve the accuracy of issued ratings and make them more objective. Using in rating methods the modern theory of corporate finance, tools of well-developed theories of corporate finance (BFO theory and its perpetuity limits) allow us to move in the rating industry from the use of mainly qualitative rating methods to the use of mainly quantitative methods, which opens up new horizons in issuer rating and in determination methods their creditworthiness.

This book is intended for managers and analysts of rating agencies, students, both undergraduate and postgraduate, students of MBA program, teachers of economic and financial universities, students of MBA program, scientists, financial analysts, financial directors of company, managers of insurance companies, officials of regional and federal ministries and departments, and ministers responsible for economic and financial management.

Kronburg, Moscow, Russia
20 June 2020

Peter Brusov

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About the Authors



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Chapter 1

Introduction



New modern methodologies for rating of non-financial issuers and project ratings have been developed, based on the application of the modern theory of cost and capital structure (BFO theory—Brusov–Filatova–Orekhova theory) and its perpetuity limits (Modigliani–Miller theory (MM theory) and new modified Modigliani–Miller theory (MMM theory)), as well as modern investment models created by authors.

In order to modify and improve existing rating methodologies, to increase the objectivity and accuracy of rating assessments, a critical analysis of the methodological and systemic shortcomings of the existing credit ratings of non-financial issuers and project rating has been carried out. The modern theory of capital cost and capital structure (BFO theory) (Brusov 2018a, b; Brusov et al. 2015, 2018a, b, c, d, e, f, 2019, 2020; Filatova et al. 2008, 2018) has been modified for companies of arbitrary age and its perpetuity limits (Modigliani–Miller theory (MM theory) (Modigliani and Miller 1958, 1963, 1966) and new modified Modigliani–Miller theory (MMM theory)) for rating needs. The incorporation of financial indicators used in the rating methodology, both into the BFO theory and into the Modigliani–Miller theory, has been carried out. Within the framework of the modified BFO theory for rating needs, a complete and detailed study of the dependence of the weighted average cost of capital of WACC, used as the discount rate for discounting financial flows, on the financial ratios used in the rating, on the age of the company, on the leverage level, and on the level of taxation was conducted in a wide range of values of equity cost and debt cost for companies of arbitrary age. This allows us to carry out the correct assessment of the discount rate, taking into account the values of financial ratios.

To assess the creditworthiness of issuers, two models have been created that take into account the discounting of financial flows: a single-period model and a multi-period model.

The incorporation of rating ratios into the modern theory of capital cost and capital structure, the BFO theory, and its perpetuity limit allows the use of powerful tools of these well-developed theories for credit rating of non-financial issuers, while

discounting financial flows using the correct discount rates taking into account the values of financial ratios. The quantitative analysis in the rating has been expanded by expanding the range of financial indicators, introducing a number of new financial indicators. All this is a qualitatively new basis for creating a modern methodology for rating of non-financial issuers, and it increases the objectivity and accuracy of ratings.

The authors have modified created by them models of long-term (perpetuity) investment projects and projects of arbitrary duration with various debt repayment schemes (at the end of the project duration, uniform payments of debt) for rating needs.

The incorporation of financial indicators used in the rating methodology (coverage ratios and leverage ratios) into the model of long-term (perpetuity) investment projects and projects of arbitrary duration with various debt repayment schemes (at the end of the project duration, uniform payments of debt) was carried out.

For long-term (perpetuity) investment projects and projects of arbitrary duration with various debt repayment schemes (at the end of the project duration, uniform payments of debt), a complete and detailed study of the dependence of the main performance indicator, NPV, on financial ratios used in the rating (coverage ratios and leverage ratios), on the level of debt financing, and on the project duration in a wide range of values of equity cost and debt capital cost was carried out. This creates a new methodological basis for modern project rating.

The use of tools of well-developed corporate finance theories (BFO theory and its perpetuity limits) opens up new horizons in the rating industry, which gives the opportunity to switch from using mainly qualitative methods for determining the creditworthiness of issuers to using mainly quantitative methods in rating, which will undoubtedly improve the quality and accuracy of the rating score.

Recommendations have been developed to the rating agencies: the Big Three (Standard & Poor's, Fitch, and Moody's), ACRA, European, Chinese, and others on modifying the methodologies for rating of non-financial issuers and for project rating.

1.1 Monograph Structure

The monograph has the following structure. After the Introduction (Chap. 1), the importance of rating and the limitations of existing rating methodologies are discussed (Chap. 2). Chapters 3, 4 and 5 are devoted to an overview of the two main theories of capital cost and capital structure of the company—the Brusov–Filatova–Orekhova theory (BFO theory) (Chap. 5) and its perpetuity limit—the Modigliani–Miller theory (MM theory) (Chap. 3), which are used in the subsequent chapters to modify the currently accepted methodologies for rating of non-financial issuers and project ratings. In Chap. 4 for the first time, results are presented on the modification of the Modigliani–Miller theory to the case of advance tax payments accepted in practice (MMM theory). This modification substantially changes all the main statements of the classical Modigliani–Miller theory.

In the following Chaps. 6, 7 and 8, both theories are used for rating purposes, for which the incorporation of rating coefficients is carried out both within the modern theory of capital cost and capital structure, the BFO theory, and within two perpetuity limits: the Modigliani–Miller theory (MM theory), including the modified Modigliani–Miller theory (MMM theory). This incorporation allows us to use the powerful tools of these well-developed theories for credit rating of non-financial issuers, while discounting the financial flows using the correct discount rates, taking into account the financial ratios.

Within the framework of the modified for rating needs BFO theory, Modigliani–Miller theory (including the modified one), a complete and detailed study was conducted of the dependence of the weighted average cost of capital, WACC, and the cost of equity, k_e , used as discount rates for discounting financial flows, on financial ratios used in the rating, depending on the company age (for the BFO theory), of the level of borrowed financing, and the level of taxation in a wide range of values of equity and debt capital costs for perpetuity companies as well as for companies of arbitrary age. This allows for the correct assessment of discount rates taking into account the financial ratios, which is extremely important for issuing the correct credit ratings of issuers.

To assess the creditworthiness of issuers, two models have been created that take into account discounting of financial flows: a single-period model and a multi-period model, which are described in the monograph.

Chapters 9 and 10 describe the modern investment models, created by the authors of the monograph and well tested in the real sector of the economy. These models are modified in Chaps. 11, 12 and 13 for the needs of rating. These chapters are devoted to the analysis of existing project rating. The effectiveness of investment models (both long-term and arbitrary duration) is considered from the point of view of owners of equity capital as well as from the point of view of owners of both equity and debt capital. In this case, the consideration is conducted for two different methods of discounting. In the first method of discounting, operating and financial flows are not separated and both are discounted at the general rate (which, obviously, can be chosen as the weighted average cost of capital WACC). For perpetuity projects for WACC, the Modigliani–Miller formula is used, and for projects of arbitrary duration the famous Brusov–Filatova–Orekhova formula for WACC is used. In the second method of discounting, operating and financial flows are separated and discounted at different rates: operating flows at a rate equal to the equity cost, depending on the leverage level, and credit (or financial) flows at a rate equal to the debt cost, which up to sufficiently large leverage levels remains constant and begins to grow only at sufficiently high leverage level L , when there is a danger of bankruptcy.

Investment models with various debt repayment schemes are considered: at the end of the project term, even repayment of debt during the project implementation period.

In Chaps. 11–13, the models created by the authors for long-term (perpetuity) investment projects and projects of arbitrary duration with various schemes for debt

repayment (at the end of the project term, uniform) were modified for the rating needs.

The incorporation of financial indicators used in the rating methodology (coverage ratios and leverage ratios) into the model of long-term (perpetuity) investment projects and projects of arbitrary duration with various debt repayment schemes (uniform and at the end of the project term) was carried out.

For long-term (perpetuity) investment projects and projects of arbitrary duration with various debt repayment schemes (uniform and at the end of the project term), a complete and detailed study was conducted of the dependence of the main performance indicator, NPV, on the financial ratios used in the rating (coverage ratios and leverage ratios), the level of borrowed financing, profitability ratio, cost of equity, and debt capital in a wide range of values of equity and debt capital. This creates a new methodological basis for modern project rating.

The monograph includes a description of qualitatively new effects in the BFO theory, which must be taken into account in the rating. Accounting for these effects is necessary for issuing the correct credit ratings of issuers. Such effects include the effects of the “golden” (Chap. 14) and “silver” (Chap. 15) age of the company and the anomalous effect of depending of the equity cost on the leverage level (Chap. 17), which can modify a company’s dividend policy, which may affect its creditworthiness. We describe as well the simultaneous effect of taxes and leverage on the financial condition of the company and its investment program (Chap. 18), and a number of others. When issuing ratings, accounting for inflation is also extremely important. Chapter 16 is devoted to the description of the correct accounting method. In conclusion, recommendations are given to the national rating agency ACRA and international rating agencies, including the Big Three on improving the rating methodology (Chap. 19).

The improvement of the rating methodology of the existing rating systems proposed in the monograph will improve the accuracy of ratings and make them more objective. Using in rating methods the modern theory of corporate finance, tools of well-developed theories of corporate finance (BFO theory and its perpetuity limits—MM theory and MMM theory) allow us to move in the rating industry from the use of primarily qualitative methods to the use of primarily quantitative methods, which opens up new horizons in the rating of issuers and methods for determining their creditworthiness.

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Chapter 2

The Importance of Rating and the Disadvantages of Existing Rating Systems



2.1 The Importance of Rating

Rating is one of the most important instruments for regulating financial markets, the main task of which is to assess the quality of assets taking into account risk factors, conducted by independent experts. Ratings characterize the creditworthiness of the borrower, predict trends in it, or characterize the investment attractiveness of the project. They play an important role in decision-making, in establishing and maintaining business relationships. We will consider two types of ratings: credit rating and investment attractiveness rating (although there are other types of credit ratings: ratings of banks and banking groups, insurance companies, issues of financial instruments, regional and municipal authorities, and others). A credit rating is a measure of a company's creditworthiness, which is calculated on the basis of its financial condition, security of assets and capital, and exposure to risks. The credit rating expresses the opinion of the agency on the ability and willingness of the creditor (issuer) to fulfill its financial obligations in full and on time.

A credit rating can also talk about the quality of a credit instrument, for example, a company bond, or other debt instrument. The presence of a credit rating gives the company a number of advantages, such as obtaining a bank loan and other borrowed funds, and for the company with a high rating at a preferential rate, obtaining a commodity loan with a deferred payment and others.

The investment attractiveness rating of a project or company is an assessment of the level of satisfaction of financial, production, organizational, marketing, legal and other requirements, or interests of an investor with respect to a specific investment project or company. This type of rating allows you to evaluate the advantages and disadvantages of the investment project, as well as the state of the investment climate in a particular industry or region. As in the case with a credit rating, the presence of an investment attractiveness rating provides several advantages: obtaining financing for an investment project, obtaining a loan, and other types of attracting investments

and others. Its presence allows, for example, federal, regional, or municipal authorities to rank the presented investment projects in order to select the pool of the most attractive ones with a view to selecting and financing them.

Thus, credit rating and investment attractiveness ratings issued by rating agencies have a wide range of applications and are an aggregate indicator reflecting the creditworthiness of a company or the investment attractiveness of an investment project.

So, issuer rating plays an important role in the modern economy and finance. At the same time, occasional scandals related to the work of rating agencies indicate serious problems in the rating industry. The subject of the current research is the existing rating systems, their methodologies, and the shortcomings of these methodologies.

The purpose of this monograph is to modify the methodologies of existing rating systems to develop a fundamentally new approach to the rating methodology, the key factors of which are (1) adequate use of discounting when discounting the financial flows, which is practically not used in existing rating methodologies; (2) use when discounting rating parameters; and (3) the correct determination of the discount rate, taking into account financial ratios.

The monograph uses the modern theory of capital structure, the BFO theory (Brusov (2018a, b), Brusov et al. (2015), Brusov et al. (2018a, b, c, d, e, f, g), Brusov et al. (2019), Brusov et al. (2020), Filatova et al. (2018a, b), as well as its perpetuity limit, the Modigliani–Miller theory (MM theory) (Modigliani and Miller (1966), Myers (2001), Modigliani and Miller (1958), Modigliani and Miller (1963)), including the modified Modigliani–Miller theory (MMM theory) (Brusov et al. (2020)). All three theories have been modified for rating needs. As a result of the modification of the methodologies of the existing rating systems, a fundamentally new approach to the rating methodology has been developed, which includes adequate use of discounting when discounting financial flows, which is practically not used in existing rating methodologies; the use of rating parameters for discounting; and the correct determination of discount rates taking into account financial ratios.

The developed approach should be applied by rating agencies throughout the world, both international and Russian, in assessing the creditworthiness of issuers.

A modification of the methodology of existing rating systems will improve the accuracy of ratings and make them more objective. The use of tools of well-developed theories opens up new horizons in the rating industry, which gets the opportunity to switch from using mainly qualitative methods for determining the creditworthiness of issuers to using mainly quantitative methods in rating.

2.2 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 ACRA.

2.2.1 The Closeness of the Rating Agencies

The closeness of the rating agencies has been discussed by us in a paper (Brusov et al. 2018d) 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 a very convenient position—rating agency “a priori” avoids any criticism of generated ratings.
3. The absence of any external control and external analysis of the methodologies results in the fact that shortcomings of methodologies are not subjected to serious critical analysis and stored long enough.

2.2.2 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 papers concerning ratings, 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 and 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, which 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 take account of discounting; otherwise, the time value of money is not taken 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 that the behavior indicators beyond that period are “equal,” discounting must be taken into account.

2.2.3 Dividend Policy of the Company

1. Dividend policy of the company must be taken 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 and how do they relate to the economically reasonable dividend values.

2. The reasonableness of dividend policy, its score, is determined by comparing 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 dividend paid by the company 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.

2.2.4 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.

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

2.2.6 Accounting of the Industrial Specifics of the Issuer

Industrial specifics of the issuer in the existing rating methodologies, especially in newly established ones and taking into account the experience of predecessors, are ignored. So in “The methodology of ACRA for assigning of credit ratings for non-financial companies on a national scale for the Russian Federation,” 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, and 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, the size of which directly depends on financial soundness indicators: solvency and creditworthiness. The latter is the key indicator in rating.

2.2.7 Neglect of Taking into Account the Particularities of the Issuer

In existing rating methodologies, taking account of the particularities of the issuer, features of financial reports, and 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).

2.2.8 Financial Ratios

1. A necessary and sufficient quantity and mix of financial ratios are not determined; it appears that such questions are not even raised when evaluating the financial risk; the financial condition of the issuer largely depends 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, really equally relate to credit risk.

3. As recognized in the ACRA methodology "in some cases it is possible that individual characteristics of factor/subfactor simultaneously fall into 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 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 6×6 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 the total number is exactly equal to 6 shows that it is not very justified, or there are other considerations, but they must be well grounded.

Table 2.1 Score of funding and liquidity (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

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 2.1) “Score of funding and liquidity” provides 5 × 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 the total number is exactly equal to 5 shows that it is not very justified.

6. Tabulation 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+
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All these points are limiting the applicability of rating agencies methods. They were introduced by the rating agencies for the purpose of simplifying the procedure of ranking (with or without understanding) and unifying the methods used in different reporting systems of different countries, with the objective of making results comparable.

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

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Part I
Corporate Finance Theories Used in
Ratings and in Rating Methodologies

Chapter 3

Capital Structure: Modigliani–Miller Theory



3.1 Introduction

Capital structure is understood as the relationship between equity and debt capital of the company. Does capital structure affect the company's main settings, such as the cost of capital, profit, value of the company, and the others, and, if it affects, how? Choice of an optimal capital structure, i.e., a capital structure, which minimizes the weighted average cost of capital, WACC, and maximizes the value of the company, V , is one of the most important tasks solved by financial manager and by the management of a company. The first serious study (and first quantitative study) of the influence of capital structure of the company on its indicators of activities was the work by Modigliani and Miller (1958). Until this study, the approach existed (let us call it traditional), which was based on empirical data analysis.

One of the most important assumptions of the Modigliani–Miller theory is that all financial flows are perpetuity. This limitation was removed by Brusov–Filatova–Orekhova in 2008 (Filatova et al. 2008, Brusov et al. 2018a, b, c, d), who have created BFO theory—modern theory of capital cost and capital structure for companies of arbitrary age (BFO–1 theory) and for companies of arbitrary lifetime (BFO–2 theory) (Brusov et al. 2015). In Fig. 3.1 the historical development of capital structure theory from the traditional (empirical) approach, through perpetuity Modigliani–Miller approach, to general capital structure theory—Brusov–Filatova–Orekhova (BFO) theory—is shown.

In 2001, Steve Myers has considered the case of one-year company and shows that in this case the weighted average cost of capital, WACC, is higher than in the Modigliani–Miller case, and the capitalization of the company, V , is less than in the Modigliani–Miller case.

So, before 2008 only two results for capital structure of the company were available: Modigliani–Miller for perpetuity company and Myers for one-year company (see Fig. 3.2). BFO theory has filled out the whole interval between $t = 1$ and



Fig. 3.1 Historical development of capital structure theory (here *TA* traditional (empirical) approach, *MM* Modigliani–Miller approach, *BFO* Brusov–Filatova–Orekhova theory)

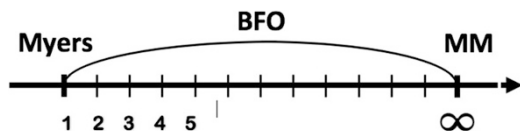


Fig. 3.2 *MM* theory describes perpetuity limit, Myers' paper describes one-year company, and *BFO* theory fills the whole numeric axis (from $n = 1$ up to perpetuity limit $n = \infty$)

$t = \infty$. It gives the possibility of calculating the capitalization V , the weighted average cost of capital, $WACC$, equity cost k_e , and other financial parameters for companies of arbitrary age and for companies of arbitrary lifetime. *BFO* theory has led to a lot of new meaningful effects in modern capital structure theory, discussed in this monograph.

3.2 The Traditional Approach

According to the traditional (empirical) approach, the weighted average cost of capital, $WACC$, and the associated company capitalization, $V = CF/WACC$, depend on the capital structure and the level of leverage, L . Debt cost always turns out to be lower than equity cost because the former has lower risk, since in the event of bankruptcy creditor claims are met prior to shareholders claims.

As a result, an increase in the proportion of lower-cost debt capital in the overall capital structure up to the limit which does not cause violation of financial sustainability and growth of risk of bankruptcy leads to lower weighted average cost of capital, $WACC$.

The profitability required by investors (the equity cost) is growing; however, its growth has not led to compensation of benefits from the use of lower-cost debt capital. Therefore, the traditional approach welcomes the increased leverage $L = D/S$ and the associated increase of company capitalization. The traditional (empirical) approach has existed up to appearance of the first quantitative theory by Modigliani and Miller (1958).

3.3 Modigliani–Miller Theory

3.3.1 Modigliani–Miller Theory Without Taxes

Modigliani and Miller (MM) in their first paper (Modigliani and Miller 1958) have come to conclusions which were fundamentally different from those of the traditional approach. Under assumptions (see Sect. 3.3.3 for details) that there are no taxes, no transaction costs, and no bankruptcy costs, perfect financial markets exist with symmetry information, there is equivalence in borrowing costs for both companies and investors, etc., they have showed that choosing the ratio between the debt and equity capital does not affect company value as well as capital costs (Fig. 3.3).

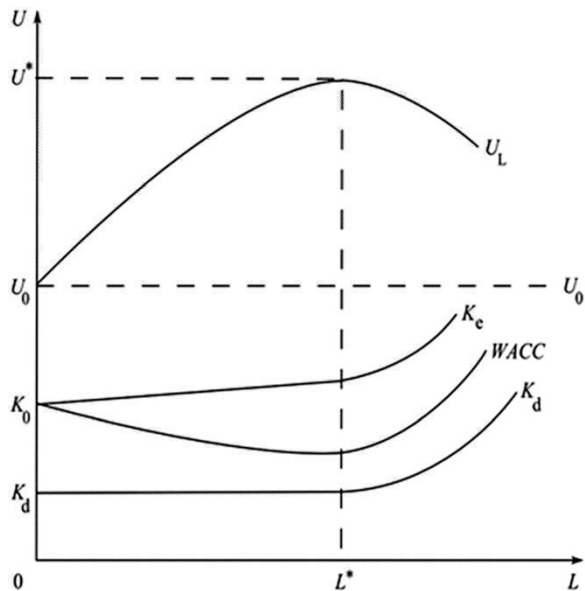
Under above assumptions, Modigliani and Miller have analyzed the impact of financial leverage, supposing the absence of any taxes (on corporate profit as well as individual one). They have formulated and proven the following two statements.

Without taxes, the total cost of any company is determined by the value of its EBIT (earnings before interest and taxes), discounted with fixed rate k_0 , corresponding to the group of business risk of this company:

$$V_L = V_U = \frac{EBIT}{k_0}. \tag{3.1}$$

Index L means a financially dependent company (using debt financing), while index U means a financially independent company.

Fig. 3.3 Dependence of company capitalization, U_L , equity cost, k_e , debt cost, k_d , and weighted average cost of capital, WACC, in traditional (empirical) approach



Authors supposed that both companies belong to the same group of business risk, and k_0 corresponds to the required profitability of financially independent company, having the same business risk.

Because, as it follows from the formula (Eq. 3.1), the value of the company does not depend on the value of debt, then according to Modigliani–Miller theorem (Modigliani and Miller 1958), in the absence of taxes, the value of the company is independent of the method of its funding. This means as well that weighted average cost of capital, WACC, of this company does not depend on its capital structure and is equal to the capital cost, which this company will have under the funding by equity capital only.

$$V_0 = V_L; \quad CF/k_0 = CF/WACC, \quad \text{and thus } WACC = k_0.$$

Note that the first Modigliani–Miller theorem is based on suggestion about independence of weighted average cost of capital and debt cost on leverage level.

From the first Modigliani–Miller theorem (Modigliani and Miller 1958), it is easy to derive an expression for the equity capital cost

$$WACC = k_0 = k_e w_e + k_d w_d. \quad (3.2)$$

Finding from here k_e , one gets

$$\begin{aligned} k_e &= \frac{k_0}{w_e} - k_d \frac{w_d}{w_e} = \frac{k_0(S+D)}{S} - k_d \frac{D}{S} = k_0 + (k_0 - k_d) \frac{D}{S} \\ &= k_0 + (k_0 - k_d)L \end{aligned} \quad (3.3)$$

Here,

D	Value of debt capital of the company
S	Value of equity capital of the company
$k_d, w_d = \frac{D}{D+S}$	Cost and fraction of debt capital of the company
$k_e, w_e = \frac{S}{D+S}$	Cost and fraction of equity capital of the company
$L = D/S$	Financial leverage

Thus, we come to the second statement (theorem) of Modigliani–Miller theory about the equity cost of financially dependent (leverage) company (Modigliani and Miller 1958).

Equity cost of leverage company k_e could be found as equity cost of financially independent company k_0 of the same group of risk, plus premium for risk, the value of which is equal to production of difference $(k_0 - k_d)$ on leverage level L :

$$k_e = k_0 + (k_0 - k_d)L. \quad (3.4)$$