Contributions to Finance and Accounting

Peter Brusov
Tatiana Filatova
Natali Orekhova

Generalized Modigliani–Miller Theory

Applications in Corporate Finance, Investments, Taxation and Ratings

Springer

Contributions to Finance and Accounting

The book series ‘Contributions to Finance and Accounting’ features the latest research from research areas like financial management, investment, capital markets, financial institutions, FinTech and financial innovation, accounting methods and standards, reporting, and corporate governance, among others. Books published in this series are primarily monographs and edited volumes that present new research results, both theoretical and empirical, on a clearly defined topic. All books are published in print and digital formats and disseminated globally.

More information about this series at https://link.springer.com/bookseries/16616

Peter Brusov • Tatiana Filatova • Natali Orekhova

Generalized Modigliani–Miller Theory

Applications in Corporate Finance, Investments, Taxation and Ratings

Springer

Peter Brusov
Financial University under the
Government of Russian Federation
Moscow, Russia

Tatiana Filatova
Financial University under the
Government of Russian Federation
Moscow, Russia

National Chung Cheng University
Jiayi City, Taiwan

Natali Orekhova
Southern Federal University
Rostov-on-Don, Russia

ISSN 2730-6038 ISSN 2730-6046 (electronic)
Contributions to Finance and Accounting
ISBN 978-3-030-93892-5 ISBN 978-3-030-93893-2 (eBook)
https://doi.org/10.1007/978-3-030-93893-2

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

With nostalgia for pre-covid time, when we been young and happy and with hope that normal life will return
Dedicated to our children and nice grandchildren and their future

Preface

In modern conditions, the requirements increase for the quality of the company's financial management, for the efficiency of corporate finance management, for improving the quality of assessing the effectiveness of investments, for improving the taxation and tax control system, for developing an adequate system of business assessment, and for increasing the objectivity of ratings. In the financial management of a company, the management of the cost of raising capital and the structure of the company's capital play a fundamental role.

Historically, the first quantitative theory of the capital structure of a company–the theory of Nobel laureates Modigliani and Miller, due to the large number of limitations of this theory, had a very distant relationship to economic practice. Since the creation of the theory of Modigliani and Miller, numerous attempts have been made to modify it, the analysis of which is given in the monograph. Of all the modifications, we mention the two most important ones that brought the theory closer to economic practice: accounting for corporate and individual taxes (carried out by the authors Modigliani and Miller themselves) and generalization to the case of companies of arbitrary age and arbitrary lifetime, performed by the authors of this monograph, who created the Brusov–Filatova–Orekhova (BFO theory). The rest of the modifications, although some of them are interesting from a theoretical point of view, have little effect on the possibility of the practical application of the Modigliani–Miller theory. Note that the importance of the Modigliani–Miller theory is determined by the fact that, despite its many limitations (the most significant of which is the perpetuity of companies), it is still widely used in practice, and also by the fact that it is, due to its simplicity and that it is the perpetuity limit of the BFO theory, serves as a good testing ground for new modifications, which, after verifying their significance for practical application, are then used in the Brusov–Filatova–Orekhova theory (BFO theory).

In this monograph, the Modigliani–Miller theory is generalized and modified taking into account the conditions of the real functioning of companies: for the case of variable income of companies, for the case of payment of income tax with an arbitrary frequency (monthly, quarterly, semiannual or annual payments), both for

advance payments of income tax and for payments at the end of the period, for the case of payment of interest on a loan with an arbitrary frequency, to simultaneously take into account the above conditions, as well as other conditions of the actual functioning of companies.

These generalizations lead to very important consequences: all statements and all formulas by Modigliani and Miller change significantly.

For example, in the case of variable profit:

- *Discount rate changes from the weighted average cost of capital, WACC, to WACC–g (where g is growing rate).* WACC grows with g, while real discount rates WACC–g and k_0–g decrease with g. This leads to an increase of company capitalization with g.
- *The tilt angle of the equity cost ke(L) grows with g*. This should change the dividend policy of the company, because the economically justified value of dividends is equal to equity cost.
- *The qualitatively new effect in corporate finance has been discovered:* at rate $g < g^*$ the slope of the curve ke(L) turns out to be negative that could significantly alter the principles of the company's dividend policy.

Similar important consequences take place for all considering cases of generalization of Modigliani–Miller theory. Accounting them leads to a lot of quite important results, which allows developing a new approach to financial policy and financial strategy of the company.

We investigate the applications of obtained theoretical results in corporate finance, investments, taxation, and ratings, where using of generalized Modigliani–Miller theory will be quite useful. In business valuation, it allows to determine the correct value of discount rate, company capitalization, and other financial indicators of the company.

New modern investment models have been created, as close as possible to real investment conditions, both long-term and arbitrary duration, with various debt repayment schemes (at the end of the term, a few payments per period, advance payments, etc.) and interest on debt (a few payments per period, advance payments, etc.), with variable income from investments, as well as taking into account the various tax payment options adopted in different countries. Their verification will lead to the creation of a comprehensive system of adequate and correct assessment of the effectiveness of the company's investment program and its investment strategy. One of the most important elements of calculating the effectiveness of investment projects is the assessment of the discount rate, the calculation methods of which have been generalized for the real conditions of the implementation of investment projects.

The development of modern methods of studying the impact of taxation on business and investment in different countries has been carried out using the generalized Modigliani–Miller theory and modern investment models created within the monograph. This will make it possible to develop recommendations to the Regulators of different countries on the amount of corporate income tax, and to the Central Banks of different countries on loan rates.

New innovative methodologies for rating nonfinancial issuers and project rating have been developed based on the application of the generalized Modigliani–Miller theory, as well as new investment models created by the authors within the monograph. For this, modifications of the generalized Modigliani–Miller theory, as well as modern investment models for rating needs, have been carried out. The financial ratios used in the rating methodology have been incorporated into the generalized Modigliani–Miller theory, as well as into modern investment models. A complete and detailed study of the dependence of the weighted average cost of capital of the company WACC, used as the discount rate for discounting financial flows, on the financial ratios used in the rating, on the level of debt financing, the level of profitability, the profit tax rate, the frequency of payment of income tax and interest on a loan, on the growth rate of profit in a wide range of values of the cost of equity and debt capital has been done. This will allow for a correct assessment of discount rates taking into account the values of financial ratios.

For project rating within the framework of the created new modern investment models of arbitrary duration, a complete and detailed study of the dependence of the main efficiency indicator, NPV, on the level of debt financing, the level of profitability, the profit tax rate, the frequency of payment of income tax and interest on a loan, the growth rate of profit has been carried out in a wide range of values of the cost of equity and debt capital. This creates a new methodological basis for modern project rating.

The monograph uses a fundamental approach associated with the generalization, further development and application of the Modigliani–Miller theory, with the generalization and further development of modern investment models created by the authors and well tested in the real sector of the economy, with the creation within the monograph of innovative modified investment models, taking into account the payment of income tax with an arbitrary frequency, various options for payment of debt and interest on debt.

The use of a fundamental approach will allow a deeper and more comprehensive study of the studied problems of the theory of corporate finance and corporate governance, as well as problems in the field of investments, business valuation, taxation and tax control, and rating.

The relevance of solving the problems discussed is associated with the increase in modern conditions of requirements for the quality of financial management of the company, for the efficiency of corporate finance management, for improving the quality of assessing the effectiveness of investments, for improving the taxation and tax control system, for developing an adequate business assessment system, requirements for increasing the objectivity of ratings. The implementation of the results of the monograph will greatly contribute to the solution of the discussed problems, which determines the practical significance of these results.

The scientific novelty of the research is associated with the world's first generalization, taking into account the conditions of the real functioning of companies, the Modigliani–Miller theory.

This book is intended for 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, managers and analysts of rating agencies, officials of regional and federal ministries and departments, and for ministers responsible for economic and financial management.

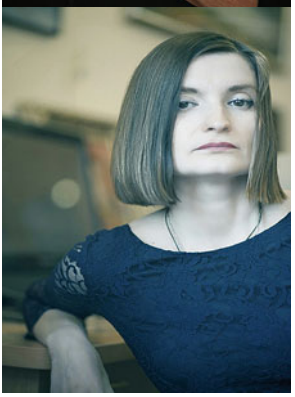
Moscow, Russia Peter Brusov
23 November, 2021

Contents

About the Authors

Peter Brusov is a professor at the Financial University under the Government of the Russian Federation (Moscow). Originally a physicist, he was the co-founder of (together with Victor Popov) the theory of collective properties of superfluids and superconductors. In the area of finance and economy, Peter Brusov has created a modern theory of capital cost and capital structure, the Brusov–Filatova–Orekhova theory, together with Tatiana Filatova and Natali Orekhova and modified the Modigliani-Miller theory in several directions: for an arbitrary company age (BFO theory), for an arbitrary life-time (BFO-2 theory), for rating needs (BFO-3), to account for variable profits, to account for frequent income tax payments with payment at the end of the periods and in advance. Peter Brusov has been visiting Professor of Northwestern University (USA), Cornell University (USA), Osaka City University (Japan), Chung–Cheng National University (Taiwan) among other places. He is the author of over 500 research publications including eight monographs, numerous textbooks and articles.

Tatiana Filatova is a professor at the Financial University under the Government of the Russian Federation (Moscow). In the last 20 years, she has been a Dean of the faculties of financial management, management, state and municipal government among others at the Financial University. Tatiana Filatova is co-author of a modern theory of capital cost and capital structure, the Brusov–Filatova–Orekhova theory, and the author of over 260 research publications including seven monographs, numerous textbooks and articles.



Natali Orekhova is a scientist of the Southern Federal University, Russia. Natali Orekhova has been the leading scientist of the Financial University under the Government of the Russian Federation. She is the co-author of a modern theory of capital cost and capital structure, the Brusov–Filatova–Orekhova theory, and author of over 110 research publications including five monographs, numerous textbooks and articles.

Chapter 1
Introduction

In modern conditions, as we mentioned in Preface, the requirements for the quality of the company's financial management, for the efficiency of corporate finance management, for improving the quality of assessing the effectiveness of investments, for improving the taxation and tax control system, for developing an adequate system of business assessment, for increasing the objectivity of ratings are increasing. In the financial management of a company, the management of the cost of raising capital and the structure of the company's capital plays a fundamental role. Historically, the first quantitative theory of the capital structure of a company—the theory of Nobel laureates Modigliani and Miller, due to a large number of limitations of this theory, had a very distant relationship to economic practice. Since the creation of the theory of Modigliani and Miller, numerous attempts have been made to modify it, the analysis of which is given in the monograph. Of all the modifications, we mention the two most important ones that brought the theory closer to economic practice: accounting for corporate and individual taxes (carried out by the authors Modigliani and Miller themselves) and generalization to the case of companies of arbitrary age and arbitrary lifetime, performed by the authors of this monograph, who created the Brusov–Filatova–Orekhova (BFO) theory. The rest of the modifications, although some of them are interesting from a theoretical point of view, have little effect on the possibility of the practical application of the Modigliani–Miller theory. Note that the importance of the Modigliani–Miller theory is determined by the fact that, despite its many limitations (the most significant of which is the perpetuity of companies), it is still widely used in practice, and also by the fact that it is, due to its simplicity and that it is the perpetuity limit of the BFO theory, serves as a good testing ground for new modifications, which, after verifying their significance for practical application, are then used in the BFO theory.

In monograph the Modigliani–Miller theory, which is the perpetuity limit of the BFO theory, is generalized taking into account the conditions for the actual functioning of companies: for the case of variable company income, for the case of income tax payments with an arbitrary frequency (monthly, quarterly, semiannual or annual payments), for advance tax for profit payments, as well as for payments at the

P. Brusov et al., *Generalized Modigliani–Miller Theory*, Contributions to Finance and Accounting, https://doi.org/10.1007/978-3-030-93893-2_1

end of the period, and for other conditions (Brusov et al. 2020a, 2020b; Brusov et al. 2021a, 2021b; Brusov and Filatova 2021; Filatova et al. 2022). The applications of the generalized Modigliani–Miller theory in corporate finance, investments, taxation, and ratings are developed.

New modern investment models have been created that are as close as possible to real investment conditions, with various schemes for repaying debt and interest on it (frequent payments, advance payments, etc.), with variable income from investments, as well as for taking into account various options for paying taxes, adopted in various countries. Consideration is carried out both from the point of view of owners of equity capital, and from the point of view of owners of equity and debt capital. Within the framework of the created new modern investment models, a complete and detailed study of the dependence of the main efficiency indicator, NPV, on the financial ratios used in the rating (coverage ratios and leverage ratios), on the level of debt financing, on the profit tax rate, on the frequency of payment of income tax and interest on a loan, on the growth rate of profit in a wide range of values of equity and debt capital, and the level of profitability was carried out.

New modern methodologies for rating nonfinancial issuers and project rating based on the application of the generalized Modigliani–Miller theory, as well as investment models created by the authors of the monograph, have been developed. For this, the modification of the generalized Modigliani–Miller theory, as well as long-term investment models for the needs of rating, has been carried out. The incorporation of financial indicators used in the rating methodology into the generalized theory by Modigliani–Miller, as well as into modern investment models, has been done. Within this theory, a complete and detailed study of the dependence of the weighted average cost of capital of the WACC company, used as the discount rate for discounting financial flows, on the financial ratios used in the rating, on the level of debt financing and the level of taxation, on the frequency of payments of income tax and interest on a loan, on the growth rate of profit in a wide range of values of equity and debt capital costs was carried out for perpetual companies. This will make it possible to carry out a correct assessment of discount rates taking into account the values of financial ratios and to issue correct ratings for nonfinancial issuers. When developing a project rating methodology, a complete and detailed study of the dependence of the main performance indicator, NPV, on the financial ratios used in the rating (coverage and leverage ratios), on the level of debt financing, the level of profitability, income tax rate, frequency of payment of tax on profit and interest on a loan, the growth rate of investment profit in a wide range of values of the cost of equity and debt capital has been done.

The influence of taxation on business and investment has been investigated within the framework of the generalized theory of Modigliani–Miller.

The monograph has the following structure.

Chapter 2 is devoted to a detailed description of the classical version of the Modigliani–Miller theory and some of its known modifications. In Chap. 3, we describe the most important generalization of the Modigliani–Miller theory for the company of arbitrary age—the modern theory of capital cost and capital structure—the Brusov–Filatova–Orekhova theory. Chapter 4 is devoted to discussion of the

problem of the optimal capital structure and it is shown that the optimal capital structure is absent in modified Modigliani–Miller theory (MMM theory) (modified by taking off the suggestion about riskless of debt capital). In Chap. 5 the equity cost in the Modigliani–Miller theory is discussed in detail, including its dependence on tax on profit rate, on leverage level, and other parameters. In Chap. 6 the role of tax shield, taxes, and leverage in the Modigliani–Miller theory is investigated. Chapter 7 is devoted to the investigation of the influence of inflation on capital cost and capitalization of the company within Modigliani–Miller theory. By direct incorporation of inflation into Modigliani–Miller theory, it is shown that inflation not only increases the equity cost and the weighted average cost of capital but as well it changes their dependence on leverage. In particular, it increases the growing rate of equity cost with leverage. Capitalization of the company is decreased under the accounting of inflation.

Chapters 8–11 are devoted to the description of the generalization of the Modigliani–Miller theory taking into account the conditions for the actual functioning of companies: for the case of variable company income, for the case of income tax payments with an arbitrary frequency (monthly, quarterly, semiannual, or annual payments), as for advance tax payments for profit, and for payments at the end of the period, as well as other conditions. In Chap. 8 we generalize the Modigliani–Miller theory for the case of advance tax on profit payments, which is widely used in practice, and show that this leads to some important consequences, which change seriously all the main statements by Modigliani and Miller.

In Chap. 9 we modify the Modigliani–Miller theory for the case of arbitrary frequency of payment of tax on profit. Combining the theoretical consideration with numerical calculations within MS Excel we show that:

1. All Modigliani–Miller theorems, statements, and all formulas change.
2. All main financial indicators, such as the weighted average cost of capital, WACC, company value, V, and equity cost, ke, depend on the frequency of tax on profit payments. This allows to company manage WACC, V, ke, etc. by choosing the number of payments of tax of profit p per year;
3. in case of income tax payments more than once per year (at $p \neq 1$), as it takes place in practice, the weighted average cost of capital, WACC, company value, V and equity cost, ke start depend on kd, while in ordinary (classical) Modigliani–Miller theory all these values **DO NOT depend on kd**;
4. the tilt angle of the curve of equity cost, ke (L), decreases with the number of payments of tax of profit p, this modifies the dividend policy of the company, because the economically justified value of dividends is equal to equity cost;
5. obtained results allow to company choose the number of payments of tax of profit per year, as many, as it is profitable to it (of course, within actual tax legislation): more frequent payments of income tax are beneficial for both parties: for the company and for the tax regulator.

Chapter 10 studies the influence of two effects (frequent payments of tax on profit and the method of its payment: at the end of periods or by advanced payments) to main financial indicators of the company, such as the weighted average cost of

capital, WACC, company value, V, and equity cost, ke, we modify the Modigliani–Miller theory for the case of arbitrary frequency of payments of tax on profit: for payments at the end of periods as well as for advanced payments. Account of these two effects leads to very important consequences.

In Chap. 11, for the first time, we have generalized the world-famous theory by Nobel Prize winners Modigliani and Miller for the case of variable profit, which significantly extends the application of the theory in practice, specifically in business valuation, ratings, corporate finance, etc. We demonstrate that all the theorems, statements, and formulae of Modigliani and Miller are changed significantly. We combine theoretical and numerical (by MS Excel) considerations. The following results are obtained:

1. Discount rate for leverage company changes from the weighted average cost of capital, WACC, to WACC–g (where g is growing rate), for a financially independent company from k0 to k0–g. This means that WACC and k0 are no longer the discount rates as it takes place in the case of classical Modigliani–Miller theory with constant profit. WACC grows with g, while real discount rates WACC–g and k_0–g decrease with g. This leads to an increase of company capitalization with g.
2. The tilt angle of the equity cost $k_e(L)$ grows with g. This should change the dividend policy of the company, because the economically justified value of dividends is equal to equity cost.
3. **A qualitatively new effect in corporate finance has been discovered:** at rate $g < g^*$ the slope of the curve $k_e(L)$ turns out to be negative, which could significantly alter the principles of the company's dividend policy.

Chapters 12–15 are devoted to the description of the innovative investment models, created by the authors and accounting for some features of real investments, such as frequent payments of tax on profit and the method of its payment: at the end of periods or by advanced payments.

The modern investment models with debt repayment at the end of the project are described in Chap. 12, while Chap. 13 is devoted to a description of the investment models with uniform debt repayment and their application. Both types of investment models are well tested in the real economy. These models are used by us for the investigation of different problems of investments, such as influence of debt financing, leverage level, taxing, project duration, method of financing, and some other parameters on efficiency of investments and other problems.

In Chaps. 14–15 we create eight innovative investment models, considering the long-term as well as arbitrary duration models with payments of interest on debt and of tax on income a few times per year (semiannually, quarterly, monthly), which could be applied in real economic practice. Their verification will lead to the creation of a comprehensive system of adequate and correct assessment of the effectiveness of the company's investment program and its investment strategy. In Chap. 14 payments of interest on debt and of tax on income are made at the ends of periods, while In Chap. 15 these payments are made in advance. Numerical calculations showed that in the case of advance payments of income tax and interest on debt, all

the results related to the effect of the number of payments of income tax and interest on debt on the effectiveness of the investment projects are opposite to the results in the case of payments at the end of the periods.

Results obtained in Chaps. 14–15 help tax regulator (Finance Ministry) to understand the influence of the number of payments of tax on income per period and credit regulator (Central Bank) to understand the influence of the number of payments of interest on debt per period on the effectiveness of investment projects. These allow both Regulators to modify and improve tax legislation and credit policy, respectively.

Chapters 16–18 are devoted to the application of the Modigliani–Miller theory in ratings of nonfinancial issues and of project ratings.

Chapter 16 describes the rating of nonfinancial issuers, while Chapter 18 describes the long-term project rating. In these chapters, the Modigliani–Miller theory has been modified for rating needs.

The key factors of a new approach are: (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 Modigliani–Miller theory. This, on the one hand, allows the use of the powerful tools of this theory in the rating, and on the other hand, it ensures the correct discount rates when discounting financial flows. We discuss also the interplay between rating ratios and leverage level which can be quite important in rating. In Chap. 17 the Modigliani–Miller theory generalized for the case of advance payments of tax on profit (which is widely used in practice) (MMM theory) (see Chap. 8) has been modified for rating needs. A serious modification of MMM theory in order to use it in rating procedure has been required. The financial "ratios" (main rating parameters) were introduced into MMM theory. The necessity of an appropriate use of financial flows discounting in rating methodologies is discussed. The dependence of the weighted average cost of capital (WACC), which plays the role of discount rate, on coverage and leverage ratios is analyzed.

All these create a new base for rating methodologies. New approach to ratings and rating methodologies allows to issue more correct ratings of issuers, makes the rating methodologies more understandable and transparent.

Obtained results show that the properties of the generalized Modigliani–Miller theory are quite different from ones of the classical Modigliani–Miller theory. This leads to the fact that the generalized Modigliani–Miller theory, as well as modern investment models modified for real investment conditions, created in monograph, are much more applicable in real economy, finance and practice. Since the Modigliani–Miller theory is still widely used in practice, its generalized modification will allow increasing the quality of the company's financial management, the efficiency of corporate finance management, improving the quality of assessing the effectiveness of investments, improve the taxation and tax control system, to develop an adequate system of business assessment, and increase the objectivity of rating issues.

References

Brusov P, Filatova T (2021) The Modigliani–miller theory with arbitrary frequency of payment of tax on profit. Mathematics 9(11):1198

Brusov PN, Filatova TV, Orekhova NP, Kulik VL, Chang S-I, Lin YCG (2020a) Application of the Modigliani–miller theory, modified for the case of advance payments of tax on profit, in rating methodologies. Journal of Reviews on Global Economics 9:282–292

Brusov PN, Filatova TV, Orekhova NP, Kulik VL, Chang S-I, Lin YCG (2020b) Modification of the Modigliani–miller theory for the case of advance payments of tax on profit. Journal of Reviews on Global Economics 9:257–267

Brusov P, Filatova T, Chang S-I, Lin G (2021a) Innovative investment models with frequent payments of tax on income and of interest on debt. Mathematics 9(13):1491

Brusov P, Filatova T, Orekhova N, Kulik V, Chang S-I, Lin G (2021b) Generalization of the Modigliani–miller theory for the case of variable profit. Mathematics 9(11):1286

Filatova T, Brusov P, Orekhova N (2022) Impact of advance payments of tax on profit on effectiveness of investments. Mathematics 10(4):666. https://doi.org/10.3390/math10040666

Part I
Modigliani–Miller Theory in Corporate Finance

Chapter 2
Capital Structure: Modigliani–Miller Theory

2.1 Introduction

One of the two main theories of capital cost and capital structure is the theory of Nobel Prize winners Modigliani and Miller (1958, 1963, 1966). In this chapter, we describe the main results of this theory. Under the capital structure, one understands 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 a 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 lifted out by Brusov–Filatova–Orekhova in 2008 (Filatova et al. 2008), 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 an arbitrary lifetime (BFO–2 theory) (Brusov et al. 2015). In Fig. 2.1 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.

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

P. Brusov et al., *Generalized Modigliani–Miller Theory*, Contributions to Finance and Accounting, https://doi.org/10.1007/978-3-030-93893-2_2

Fig. 2.1 Historical development of capital structure theory (here *TA* traditional (empirical) approach, *MM* Modigliani–Miller approach, *BFO* Brusov–Filatova–Orekhova theory)

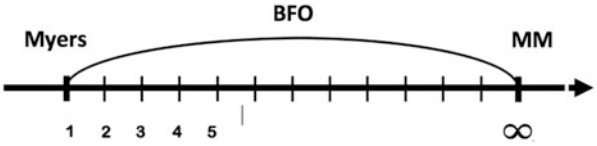


Fig. 2.2 MM theory describes perpetuity limit, Myers paper describes one-year company while BFO theory fills the whole numeric axis (from $n = 1$ up to perpetuity limit $n = \infty$)

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. 2.2). BFO theory has filled out the whole interval between t = 1 and t=∞. It gives the possibility to calculate 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.

2.2 The Traditional Approach

The traditional (empirical) approach told that weighted average cost of capital, WACC, and the associated company capitalization, $V = \mathrm{CF/WACC}$, depend on the capital structure, the level of leverage, L. Debt cost always turns out to be lower than equity cost because the first one has lower risk, via the fact that 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 a 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 the appearance of the first quantitative theory by Modigliani and Miller (1958).

2.3 Modigliani–Miller Theory

2.3.1 Modigliani–Miller Theory Without Taxes

Modigliani and Miller (MM) in their first paper (Modigliani and Miller 1958) have come to the conclusions which were fundamentally different from the conclusions of the traditional approach. Under assumptions (see Sect. 2.3.3 for details) that there are no taxes, no transaction costs, no bankruptcy costs, perfect financial markets exist with symmetry information, equivalence in borrowing costs for both companies and investors, etc., they have shown that choosing of the ratio between the debt and equity capital does not affect company value as well as capital costs (Fig. 2.3).

Under the 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 two following 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 group of business risk of this company.

$$V_{\mathrm{L}} = V_{\mathrm{U}} = \frac{\mathrm{EBIT}}{k_0}. \tag{2.1}$$

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

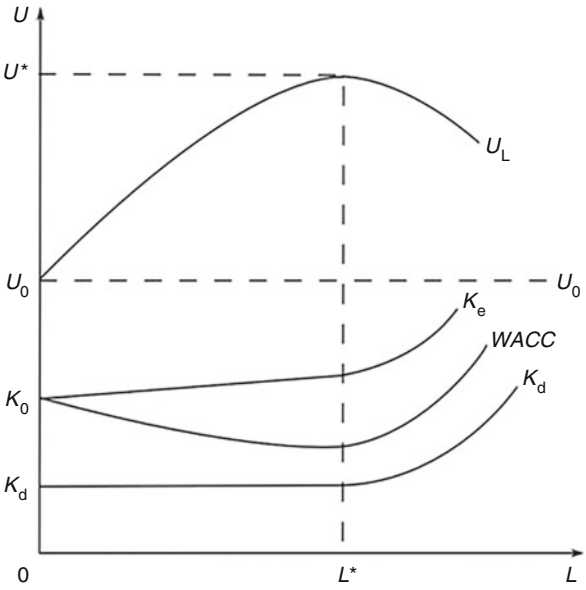


Fig. 2.3 Dependence of company capitalization, U_{L}, equity cost, k_{e}, debt cost, k_{d}, and weighted average cost of capital, WACC, in traditional (empirical) approach