

Peter Brusov · Tatiana Filatova
Natali Orekhova · Mukhadin Eskindarov

Modern Corporate Finance, Investments and Taxation

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*Dedicated to our dear granddaughter Anyuta,
who sings songs equally wonderful in Russian
and in German*

Preface

This book describes in detail the modern theory of corporate finance, investment, and taxation, created by Brusov, Filatova, and Orekhova (BFO theory), which has replaced the famous theory of capital cost and capital structure by Nobel laureates Modigliani and Miller. The authors have moved from the assumption of Modigliani–Miller concerning the perpetuity (infinite time of life) of companies and further elaborated quantitative theory of valuation of key parameters of financial activities of companies with arbitrary time of life (of arbitrary age).

Results of modern BFO theory turn out to be quite different from those of Modigliani–Miller theory. They show that the latter, via its perpetuity, underestimates the assessment of weighted average cost of capital, WACC, and the equity cost of the company and substantially overestimates the assessment of the capitalization of the company.

Such an incorrect assessment of key performance indicators of financial activities of companies has led to an underestimation of risks involved, and impossibility, or serious difficulties in adequate managerial decision-making, which was one of the implicit reasons of global financial crisis in 2008.

Within new modern theory of capital cost and capital structure (BFO theory), a lot of qualitatively new results have been obtained, among them:

1. The qualitatively new effect in corporate finance, discovered by authors: abnormal dependence of equity cost on leverage, which alters the main principles of the company's dividend policy significantly.
2. Bankruptcy of the famous trade-off theory has been proven.
3. A very important discovery has been done recently: the valuation of WACC in the Modigliani–Miller theory (perpetuity limit) is not minimal and valuation of the company capitalization is not maximal, as all financiers supposed up to now: at some age of the company (“golden age”) its WACC value turns out to be lower than in perpetuity limit and company capitalization V turns out to be greater than perpetuity limit of V .

4. Mechanism of formation of the company optimal capital structure, different from the one suggested by trade-off theory, has been suggested.
5. The inflation in both Modigliani–Miller as well as in Brusov–Filatova–Orekhova theories has been taken into account in explicit form, which has a nontrivial impact on the dependence of equity cost on leverage.
6. Study of the role of taxes and leverage has been done, which allows the Regulator to set up the tax on profits rate and allows businessmen to choose the optimal level of debt financing.
7. Investigation of the influence of tax on profit rate on the effectiveness of investment projects at different debt levels has showed that increase of tax on profit rate from one side leads to decrease of project NPV, but from other side it leads to decrease of sensitivity of NPV with respect to leverage level. At high leverage level L , the influence of tax on profit rate change on effectiveness of investment projects becomes significantly less.
8. Studying the influence of growth of tax on profit rate on the efficiency of the investment as well has led to two qualitatively new effects in investments:
 - the growth of tax on profit rate changes the nature of the NPV dependence on leverage L : at some value t^* , there is a transition from diminishing function $NPV(L)$ at $t < t^*$, to growing function $NPV(L)$ at $t > t^*$.
 - at high leverage levels, the growth of tax on profit rate leads to the growth of the efficiency of the investments.

Discovered effects in investments can be applied in a real economic practice for optimizing of the management of investments.

Established BFO theory allows us conduct a valid assessment of the core parameters of financial activities of companies, such as weighted average cost of capital, equity capital cost of the company, and company's capitalization. It allows the management of a company to make adequate decisions, which improves the effectiveness of the company management. More generally, the introduction of the new system of evaluation of the core parameters of financial activities of companies into the systems of financial reporting (IFRS, GAAP, etc.) would lead to a lower risk of global financial crisis.

The second part of this book is devoted to the assessment of effectiveness of investment projects created by the authors within the modern investment models. The determination of the optimal leverage level for investments is studied in this book from two points of view: 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.

Corporate management in the modern world is the management of financial flows. The proposed Brusov–Filatova–Orekhova theory allows to correctly identify discount rates—basic parameters for discounting of financial flows to arbitrary time moment, compare financial flows with a view to adopt literate managerial decisions. The discount rate is a key link to the existing financial system, on which the modern finance can be adequately built, and this proposed book can be of substantial assistance.

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

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4 February 2014

Peter Brusov

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Part I
Corporate Finance

Chapter 1

Introduction

One of the main problems in corporate finance is the problem of cost of capital and the impact of capital structure on its cost and capitalization of the companies. To date, even the question of the existence of an optimal capital structure of the companies (at which the company capitalization is maximal, and weighted average cost of capital is minimal) is open. Numerous theories and models, including the first and the only one until recently quantitative theory by Nobel laureates Modigliani and Miller (MM) (Modigliani et al. 1958, 1963, 1966), not only does not solve the problem but also because of the large number of restrictions (such as, for example, theory of MM) have a weak relationship with the real economy. Herewith the qualitative theories and models, based on the empirical approach, do not allow to carry out the necessary assessment.

In the monograph, the foundation of modern corporate finance, investment, and taxation is laid. It is based on the author's work on modifying theory of capital cost and capital structure by Nobel Prize winners Modigliani and Miller, which led to the actual replacement of this theory by the modern theory by Brusov–Filatova–Orekhova (BFO theory) (Brusov and Filatova 2011; Brusov et al. 2011a, b, c, 2012a, b, 2013a, b, 2014a, b; Filatova et al. 2008, Brusova 2011). The authors have moved from the assumption of Modigliani–Miller concerning the perpetuity (infinite time of life or infinite age) of companies and further elaborated quantitative theory of valuation of core parameters of financial activities of companies with arbitrary time of life (of arbitrary age).

Results of modern BFO theory (Brusov and Filatova 2011; Brusov et al. 2011a, b, c, 2012a, b, 2013a, b, 2014a, b; Filatova et al. 2008; Brusova 2011) turn out to be quite different from that of Modigliani–Miller theory (Modigliani et al. 1958, 1963, 1966). They show that later, via its perpetuity, underestimates (often significantly) the assessment of weighted average cost of capital and the equity cost of the company and substantially overestimates (also often significantly) the assessment of the capitalization of both financially independent company as well as the company using the debt financing.

Such an incorrect assessment of key performance indicators of financial activities of companies has led to an underestimation of risks involved, and impossibility, or serious difficulties in adequate managerial decision-making, which was one of the implicit reasons of global financial crisis of the year 2008.

Within new theory of capital cost and capital structure (BFO theory), a study of the role of taxes and leverage has been done, which allows the regulator to set the tax on profit rate and businesses to choose the optimal level of debt financing. The qualitatively new effect in corporate finance, discovered by authors, is described: abnormal dependence of equity cost on leverage, which significantly alters the principles of development of the company's dividend policy (modern principles of which are formulated in monograph). Authors take into account in explicit form the inflation in both Modigliani–Miller as well as Brusov–Filatova–Orekhova theories, with which they detected its nontrivial impact on the dependence of equity cost on leverage.

The established BFO theory (Brusov and Filatova 2011; Brusov et al. 2011a, b, c, 2012a, b, 2013a, b, 2014a, b; Filatova et al. 2008) allows conduct a valid assessment of the core parameters of financial activities of companies, such as weighted average cost of capital and equity capital cost of the company, its capitalization. It allows the management of a company to make adequate decisions, which improves the effectiveness of the company management. More generally, the introduction of the new system of evaluation of the parameters of financial activities of companies into the systems of financial reporting (IFRS, GAAP, etc.) would lead to lower risk of global financial crisis, since, as is shown in the monograph, a primary cause of the crisis of 2008 was a mortgage crisis in the USA, which is associated with overvalued capitalization of mortgage companies by rating agencies, using incorrect MM theory. This reason is now understood by the US Government, which requires \$1 billion from rating agency S&P for overvalued capitalization of mortgage companies.

Within Brusov–Filatova–Orekhova theory, the analysis of wide-known trade-off theory has been made (Brusov et al. 2013a). It is shown that suggestion of risky debt financing (and growing credit rate near the bankruptcy) in opposite to waiting result does not lead to growth of weighted average cost of capital, WACC, which still decreases with leverage. This means the absence of minimum in the dependence of WACC on leverage as well as the absence of maximum in the dependence of company capitalization on leverage. This means that the optimal capital structure is absent in famous trade-off theory, and this fact proves the insolvency of famous trade-off theory.

Under condition, proved by authors, of insolvency of well-known classical trade-off theory, the question of finding a new mechanism of the formation of the company's optimal capital structure, different from one suggested by trade-off theory, becomes very important. A new such mechanism has been developed by the authors in this monograph. It is based on the decrease of debt cost with leverage, which is determined by growth of debt volume. This mechanism is absent in perpetuity Modigliani–Miller theory (Modigliani et al. 1958, 1963, 1966), even in modified version, developed by us, and exists within more general BFO theory.

The second part of this monograph is devoted to assess effectiveness of the investment projects (IP). The authors created the modern investment models of evaluation of the efficiency of IP index, using as a discount rate, the correct values of weighted average cost of capital as well as the equity cost of the company, obtained in the BFO theory and in its perpetuity limit (MM theory).

Since virtually every investment project uses debt financing, one of the most important problems is the determination of the optimal leverage level for investments. The monograph studies this problem from two points of view: 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. The study has been conducted without division of cash flows as well as with division of cash flows on the financial and operating plus investment flows (Brusov et al. 2011c, 2012a).

Within the framework of the established models, the evaluation of the effectiveness of investment from the point of view of their optimal capital structure has been made on the example of one of the largest telecommunication companies in Russia. It has been shown that there is an optimum structure of investment capital. But company has lost from \$98 million up to \$645 million because the company has worked at leverage levels, which were far from optimal values. The procedure proposed by authors for evaluation of the efficiency of investment projects will avoid such losses in the future.

In this monograph, the significant attention has been given to the study of taxes and taxation in manufacture as well as in investments. Some recommendations for regulator concerning taxation (value of tax on profit rates, etc.) have been done.

Investigation of the influence of tax on profit rate on effectiveness of investment projects at different debt levels showed that increase of tax on profit rate from one side leads to decrease of project NPV, but from other side, it leads to decrease of sensitivity of NPV with respect to leverage level. At high leverage level L , the influence of changes of tax on profit rate on effectiveness of investment projects becomes significantly less.

Studying the influence of growth of tax on profit rate on the efficiency of the investment as well has led to two qualitatively new effects in investments:

1. The growth of tax on profit rate changes the nature of the NPV dependence on leverage at some value t^* : there is a transition from diminishing function NPV (L) when $t < t^*$ to growing function NPV(L).
2. At high leverage levels, the growth of tax on profit rate leads to the growth of the efficiency of the investments.

Discovered effects in investments can be applied in a real economic practice for optimizing the management of investments.

A very important discovery has been done recently by the authors within BFO theory. It is shown for the first time that valuation of WACC in the Modigliani–Miller theory (perpetuity limit) (Modigliani et al. 1958, 1963, 1966) is not minimal, and valuation of the company capitalization is not maximal, as all financiers

supposed up to now: at some age of the company (“golden age”), its WACC value turns out to be lower, than in Modigliani–Miller theory and company capitalization V turns out to be greater, than V in Modigliani–Miller theory (see Chap. 18).

A distinctive feature of the book is the extensive and adequate use of mathematics that allows the reader to count various financial and economic parameters, including investment and taxation ones, up to the quantitative result.

Corporate management in the modern world is the management of financial flows. The proposed Brusov–Filatova–Orekhova theory (Brusov and Filatova 2011; Brusov et al. 2011a, b, c, 2012a, b, 2013a, b, 2014a, b; Filatova et al. 2008) allows the reader to correctly identify discount rates—basic parameters for discounting financial flows to arbitrary time moment—and to compare financial flows with a view to adopt literate managerial decisions. The discount rate is a key link of the existing financial system, by pulling on which modern finance can be adequately built, and the proposed monograph can be of substantial assistance in this.

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

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Chapter 2

Capital Structure: Modigliani–Miller 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 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 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.

2.1 The Traditional Approach

The traditional (empirical) approach told that weighted average cost of capital, WACC, and the associated company capitalization, $V = CF/WACC$, depend on the capital structure, the level of leverage, L . Debt cost always turns out to be lower than equity cost because 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 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 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).

2.2 Modigliani–Miller Theory

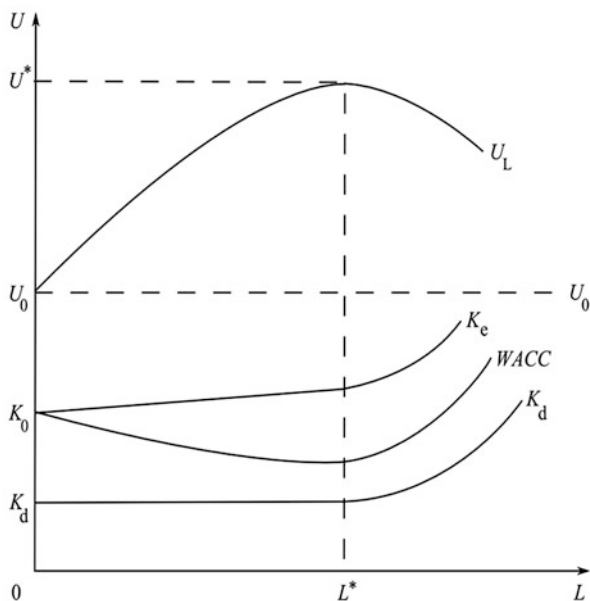
2.2.1 Modigliani–Miller Theory Without Taxes

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 traditional approach. Under assumptions (see Sect. 2.2.3 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 showed that choosing of the ratio between the debt and equity capital does not affect company value as well as capital costs (Fig. 2.1).

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 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:

Fig. 2.1 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



$$V_L = V_U = \frac{\text{EBIT}}{k_0}. \quad (2.1)$$

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

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

Because, as it follows from the formula (Eq. 2.1), value of the company does not depend on the value of debt, than according to Modigliani–Miller theorem (Modigliani and Miller 1958), in the absence of taxes, 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.

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

Note that 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

$$\text{WACC} = k_0 = k_e w_e + k_d w_d. \quad (2.2)$$

Finding from here k_e , one gets

$$k_e = \frac{k_0}{w_e} - k_d \frac{w_d}{w_e} = \frac{k_0(S+D)}{S} - k_d \frac{D}{S} = k_0 + (k_0 - k_d) \frac{D}{S} = k_0 + (k_0 - k_d)L \quad (2.3)$$

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 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 which is equal to production of difference $(k_0 - k_d)$ on leverage level L :

$$k_e = k_0 + (k_0 - k_d)L. \quad (2.4)$$

Formula (Eq. 2.4) shows that equity cost of the company increases linearly with leverage level (Fig. 2.1).

The combination of these two Modigliani–Miller statements implies that the increasing of level of debt in the capital structure of the company does not lead to increased value of firms, because the benefits gained from the use of more low-cost debt capital markets will be exactly offset by an increase in risk (we are speaking about the financial risk, the risk of bankruptcy) and, therefore, by an increase in cost of equity capital of firms: investors will increase the required level of profitability under increased risk, by which a higher level of debt in the capital structure is accompanied.

In this way, the Modigliani–Miller theorem argues that in the absence of the taxes, the capital structure of the company does not affect the value of the company and its weighted average cost of capital, WACC, and equity cost increases linearly with the increase of financial leverage.

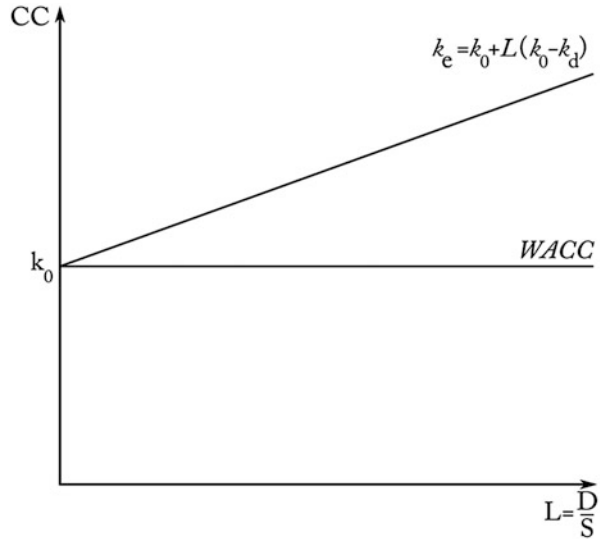
Explanations, given by Modigliani and Miller under receiving of their conclusions, are the following (Modigliani and Miller 1958). Value of the company depends on profitability and risk only and does not depend on the capital structure. Based on the principle of preservation of the value, they postulated that the value of the company, which is equal to the sum of the equity and debt funds, is not changed when the ratio between its parts is changed. An important role in justification of Modigliani–Miller statements an existence of an arbitral awards opportunities for the committed markets plays. Two identical companies, differing only by the leverage level, must have the same value. If this is not the case, the arbitration aligns business cost: investors of less cost company can invest capital in a company of more value. Selling of shares of the first company and buying of stock of the second company will continue until the values of both companies are not equalized.

Most of Modigliani and Miller assumptions (Modigliani and Miller 1958), of course, are unrealistic. Some assumptions can be removed without changing the conclusions of the model. However, assuming no costs of bankruptcy and the absence of taxes (or the presence of corporate taxes only) are crucial—the change of these assumptions alters conclusions. The last two assumptions rule out the possibility of signaling theory and agency costs theory and, thus, also constitute a critical prerequisite (Fig. 2.2).

2.2.2 Modigliani–Miller Theory with Taxes

In the real situation, taxes on profit of companies always exist. Since the interest paid on debt are excluded from the tax base—it leads to the so-called effect of “tax shield”: value of the company that used the borrowed capital (leverage company) is higher than the value of the company that financed entirely by the equity

Fig. 2.2 Dependence of equity cost k_e and WACC on leverage level L within Modigliani–Miller theory without taxes



(non-leverage company). The value of the “tax shield” for 1 year is equal to k_dDT , where D —the value of debt, T —the income tax rate, and k_d —the interest on the debt (or debt capital cost) (Modigliani and Miller 1963). The value of the “tax shield” for perpetuity company for all time of its existence is equal to (we used the formula for the sum of terms of an infinitely decreasing geometric progression)

$$(PV)_{TS} = k_dDT \sum_{t=1}^{\infty} (1 + k_d)^{-t} = DT \tag{2.5}$$

and the cost of leverage company is equal to

$$V = V_0 + DT, \tag{2.6}$$

where V_0 is the value of financially independent company.

Thus, we obtain the following result obtained by Modigliani and Miller (1963):

The value of financially dependent company is equal to the value of the company of the same risk group used no leverage, increased by the value of tax shield arising from financial leverage, and equal to the product of rate of corporate income tax T and the value of debt D .

Let us now get the expression for the equity capital cost of the company under the existence of corporate taxes.

Accounting that $V_0 = CF/k_0$ and that the ratio of debt capital $w_d = D/V$, one gets

$$V = CF/k_0 + w_d VT. \quad (2.7)$$

Because the value of leverage company is $V = CF/WACC$, for weighted average cost of capital, WACC, we get

$$WACC = k_0(1 - w_d T). \quad (2.8)$$

From here the dependence of WACC on leverage $L = D/S$ becomes the following:

$$WACC = k_0(1 - LT/(1 + L)). \quad (2.9)$$

On the other hand, on definition of the weighted average cost of capital with “tax shield” accounting, we have

$$WACC = k_0 w_e + k_d w_d (1 - T). \quad (2.10)$$

Equating Eqs. (2.9) and (2.11), one gets

$$k_0(1 - w_d T) = k_0 w_e + k_d w_d (1 - T) \quad (2.11)$$

and from here, for equity cost, we get the following expression:

$$\begin{aligned} k_e &= k_0 \frac{(1 - w_d T)}{w_e} - k_d \frac{w_d}{w_e} (1 - T) = k_0 \frac{1}{w_e} - k_0 \frac{w_d}{w_e} T - k_d \frac{D}{S} (1 - T) \\ &= k_0 \frac{D + S}{S} - k_0 \frac{D}{S} T - k_d \frac{D}{S} (1 - T) = k_0 + L(1 - T)(k_0 - k_d). \end{aligned} \quad (2.12)$$

So, we get the following statement obtained by Modigliani and Miller (1963):

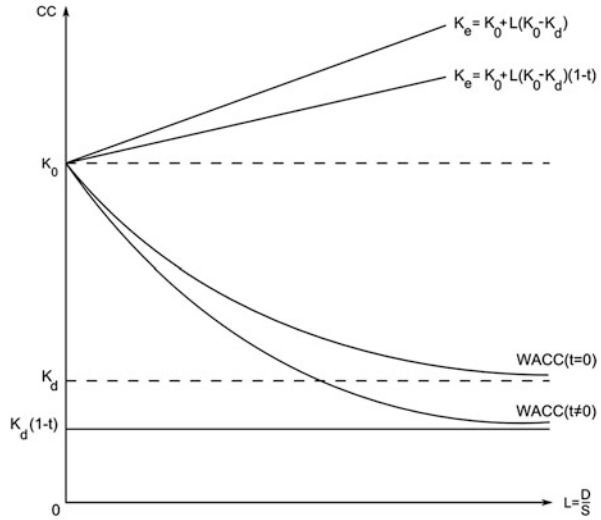
Equity cost of leverage company k_e paying tax on profit could be found as equity cost of financially independent company k_0 of the same group of risk, plus premium for risk, the value which is equal to production of difference $(k_0 - k_d)$ on leverage level L and on tax shield $(1 - T)$.

It should be noted that the formula (Eq. 2.12) is different from the formula (Eq. 2.4) without tax only by the multiplier $(1 - T)$ in term, indicating a premium for risk. As the multiplier is less than unit, the corporate tax on profits leads to the fact that capital is growing with the increasing of financial leverage, slower than it would have been without them.

Analysis of formulas (Eqs. 2.4, 2.9, and 2.12) leads to following conclusions. When leverage grows:

1. Value of company increases.
2. Weighted average cost of capital WACC decreases from k_0 (at $L = 0$) up to $k_0(1 - T)$ (at $L = \infty$) (when the company is funded solely by borrowed funds).
3. Equity cost increases linearly from k_0 (at $L = 0$) up to ∞ (at $L = \infty$).

Fig. 2.3 Dependence of equity capital cost, debt cost, and WACC on leverage in Modigliani–Miller theory without taxes ($t = 0$) and with taxes ($t \neq 0$)



Within their theory, Modigliani and Miller (1963) had come to the following conclusions. With the growth of financial leverage (Fig. 2.3):

1. The company value increases.
2. The weighted average cost of capital decreases from k_0 (for $L = 0$) up to $k_0(1 - T)$ (for $L = \infty$, when the company is financed entirely with borrowed funds).
3. The cost of equity capital increases linearly from k_0 (for $L = 0$) up to ∞ (for $L = \infty$).

2.2.3 Main Assumptions of Modigliani–Miller Theory

The most important assumptions of the Modigliani–Miller theory are as following:

1. Investors are behaving rationally and instantaneously, see profit opportunity, inadequate investment risk. Therefore, the possibility of a stable situation of the arbitrage, i.e., obtain the risk-free profit on the difference in prices for the same asset cannot be kept any length of time—reasonable investors quickly take advantage of it for their own purposes and equalize conditions in the market. This means that in a developed financial market capital, the same risk should be rewarded by the same rate of return.
2. Investment and financial market opportunities should be equally accessible to all categories of investors—whether institutional or individual investors, large or small, rapidly growing or stable, or experienced or relatively inexperienced.
3. Transaction costs associated with funding are very small. In practice, the magnitude of transaction costs is inversely proportional to the amount of