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The Modigliani & Miller Capital Structure Theorem After 62 Years

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Abstract

The Modigliani & Miller capital structure theorem accepts irrelevance between capital structure and firm value and capital structure and cost of capital. The theorem has been being discussed for 62 years. Some writers have accepted the theorem exactly. Some other writers have criticized the theorem and rejected its assertion. Some other writers both accepted and criticized the theorem. The Modigliani and Miller replied many critiques done by the writers before they passed away, 2003. Some critiques were not replied by the Modigliani and Miller when they were living. Some critiques were done after they passed away. They were not be replied, too.

Introduction

The Modigliani and Miller in 1958 created a theorem which asserts that capital structure is irrelevant for firm value and cost of capital. It was very different than traditional capital structure theory. Especially, the concept optimal capital structure had been being seen very pragmatic method to increase the firm value.

After the M&M's capital structure theorem was built, financial theoreticians reacted the theorem differently. Some of them accepted the theorem exactly. Some of the theoreticians accepted the theorem but criticized some dimensions of the theorem negatively. The remaining group criticized the theorem and they did not acknowledge any acceptance for the theorem. Since 1958, the discussion on the M&M capital structure theory has been being continued.

In the Section II, I will explain the M&M capital structure theorem, its assumptions and the three propositions shortly because of the purpose of the study is to explain the discussion points of the theorem for 63 years. That is, the subject is the consensus points, not the M&M explanation. The finance literature covers many sources about that such as M&M itself (1958, 1963).

In the Section III, I will survey critiques about the M&M capital structure theorem. Firstly, I will survey all of the critiques. Then, I will classify the critiques as positive critiques and negative critiques and summarize the critiques in the Table I and the Table II, respectively. At the same time, two other tables will be created to classify and clarify the types of the critiques about the M&M capital structure theorem. They are the Table III and the Table IV.

In the Section IV, I will show the replies of the Modigliani and Miller for the negative critiques. The table V was prepared to show the replies in summary.

II. The Modigliani & Miller Theorem

A. The Reason to Build the M&M Theorem

The Modigliani & Miller (1958) thought that an adequate theory of the effect of financial structure on market valuation was lack.

For this reason, they showed how the theory could be used to answer the cost of capital question and how it permitted them to develop a theory of investment of the firm under conditions of uncertainty. The reason of the arising of the M&M is to contribute the finance theory about the effect of capital structure on firm value.

B. The Assumptions

The M&M determined some assumptions to build the theorem. The assumptions are (M&M (1958):

- static, partial equilibrium one focusing on the firm and industry,
- uncertainty of profits of firms,
- firms can be divided into equivalent return classes such that the return on the shares issued by any firm in any given class is proportional to and hence perfectly correlated with the return on the shares issued by any other firm in the same class,
- trading the shares concerned in perfect markets under conditions of atomistic competition (perfect competition),
- assuming all bonds yielding a constant income per unit of time, regarding this income as certain by all traders regardless of the issuer, and, trading bonds, like stocks, in a perfect market,
- rational investment and rational financial policy,
- subjective probability distribution,
- investors believe that probability distributions vary from class to class,
- profit outcome is a random variable,
- utility maximization is more frequently in a qualitative and heuristic form,
- subjective utility functions of the owners,
- individual investors are at least in agreement as to the expected return,
- no dividend,
- investors use arbitrage opportunity to eliminate the discrepancy between the market values of the firms,
- investors have the opportunity of putting the equivalent leverage into their portfolio directly by borrowing on personal account.

C. The M&M Capital Structure Propositions

C.1 The Propositions Without Tax

There are three propositions of the Modigliani & Miller (1958) about capital structure irrelevance.

The first proposition of M&M is the market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate P_k appropriate its class. This proposition can be said in terms of the firm's average cost of capital. This could be that the average cost of capital of a firm is exactly independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class.

The second proposition is derived from the first proposition. This proposition covers the determination of the rate of return on common stock in companies whose capital structure includes some debt. The proposition accepts that the expected rate of return or yield, i , on the stock of any company j belonging to the k th class is a linear function of leverage.¹ This could be explained in another sentence that the expected yield of a share of stock is equal to the appropriate capitalization rate for a pure equity stream in the class plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between p_k and r .

The third proposition is if a firm in class k is acting in the best interest of the stockholders at the time of the decision, it will exploit an investment opportunity if and only if the rate of return on the investment, say p^* , is as large as or larger than p_k . That is, the cut-off point for investment in the firm will in all cases be P_k and will be completely unaffected by the type of security used to finance the investment. This does not mean that the owners have no grounds whatever for preferring one financing plan to another or that there are no other policy or technical issues in finance at the level of the firm.

C.2. The Propositions with Tax

The M&M (1963) asserts that the tax rate and the debt level could change from year to year. So, the tax advantage of debt is not stable. Its cash flow is doubtful. There is an uncertainty.

The writers think that the net of tax approach is correct in principle because nothing in their analysis or another analyses in this matter has yet established that it is indeed legitimate to discount an uncertain stream. The writers think that the existence of a tax advantage for debt financing does not necessarily mean

¹ In here, $i_j = p_k + (P_k - r) D_j/S_j$, P_k is a constant for all firms in a risk class, and r means rate of return.

that corporations should at all times seek to use the maximum possible amount of debt in their capital structures.

Other forms of financing such as retaining earnings may in some circumstances be cheaper still when the tax status of investors under the personal income tax is taken into account. Limitations imposed by lender and, reserve need of untapped borrowing power are some issues of debt usage. So, the Modigliani and Miller do not believe that tax advantage of leverage is not very important factor to increase firm value and to decrease cost of capital. I think they have written the 1963 paper not to change their assertion about irrelevance of capital structure but to explain their propositions under tax environment. Even the cancellation of no-tax assumption, they still believe their irrelevance belief about the subject.

III.Survey of Research in the M&M Capital Structure Theory

A. *The Critiques*

Finance literature covers many studies on the M&M capital structure propositions in corporate finance.

Stiglitz (1966) says that in particular, five limitations of the M&M proof may be noted. They are:

- 1.It depended on the existence of the risk classes.
- 2.The use of risk classes seemed to imply objective rather than subjective probability distributions over the possible outcomes.
- 3.It was based on partial equilibrium rather than general equilibrium analysis.
- 4.It was not clear whether the theorem held only for competitive markets.
- 5.Except under special circumstances, it was not clear how the possibility of firm bankruptcy affected validity of the theorem. He showed some opinions about assumptions to criticize the theory.

Stiglitz (1974) asserts that debt reduces the tax liability of the firm and hence increases its value. He does not accept the irrelevance of debt.

Jensen-Meckling (1976) says that M&M (1963) asserts that the existence of tax subsidies on interest payments would cause the value of the firm to rise with the amount of debt financing by the amount of the capitalized value of the tax subsidy. But this line of argument implies that the firm should be financed almost entirely with debt. Jensen- Mecklink adds that realizing the inconsistency with observed behavior Modigliani and Miller in same article comments that it may be useful to remind readers once again that the existence of a tax advantage for debt financing does not necessarily mean that corporations should at all times seek to use the maximum amount of debt in their capital structures. Modigliani and Miller are essentially left without a theory of the determination of the optimal capital structure. They think that tax advantage of debt should provide increase in firm value. They see not being optimal capital structure in the M&M theorem as a deficiency.

Fama (1978) asserts that existence of risk classes of firms in the sense of Modigliani and Miller that is there are classes of firms wherein the net cash flows of different firms are perfectly correlated is questionable. He criticizes the existence of risk classes frankly. He does not believe that there are risk classes in this context. The risk classes should not become.

Merton (1987) says that the original MM pieces were written "tongue-in-cheek" with respect to the theory's empirical validity. But profession gave importance to it. The MM analysis established the commonplace practice of taking each corporate financial instrument as a piece that cannot be properly analyzed without reference to the whole of the firm's liability structure. Merton criticizes the empirical side of the theorem. However, he sees the theory as an important progress.

Ross (1988) thinks that the homemade leverage opinion of the M&M proposition with which the investor could duplicate the return on the leveraged firm's equity at lower cost raises questions about the ability of investors to borrow on their own accounts as cheaply as the leveraged firm. Ross also criticizes that the concept risk class is not clear enough to understand the theory. Ross thinks the original M&M analysis really only works when the unleveraged firm's value is pegged. But this is just an implication of the assumption that the economy wide pricing of cash flow streams is unaltered. Ross raises his critiques that relative values are unaffected by capitalization for only their risk class and idiosyncratic risk is not added to the total risk affecting the prices firms in same risk class because the M&M works in the assumption partial equilibrium.

He thinks that can only be eliminated in general equilibrium condition. His critiques are partial equilibrium, risk class, not containing idiosyncratic risk, homemade leverage, validity for leveraged firm.

Copeland & Weston (1988) thinks that the M&M theory is the one of the six seminal and internally consistent theories upon which modern finance is founded². The theory has important implications for the firm's choice of capital structure and dividend policy. They accept the M&M as a theory which is a starting point for finance to become a positive science, one of the founder finance theories, and important about a firm's choice of capital structure and dividend policy.

Bhattacharya (1988) thinks that, together, Miller's papers (that is MM 1963, Miller 1977, Miller and Scholes 1978) advanced the notion of firm-level indifference to debt and dividend policies for valuation, as a candidate solution for market equilibrium. He thinks that irrelevance insight has started with the M&M and have been improved with the contribution of the Miller papers.³

Harris & Raviv (1991) thinks that the modern theory of capital structure began with the paper of M&M in 1958. The M&M pointed the direction that such theories must take by showing under what conditions capital structure is irrelevant. Since then, many economists have followed the path they mapped. The capital structure is already a subtitle of the theory of corporate finance. The three propositions of the M&M explained in the article published in 1958 are about the capital structure. For this reason, the M&M propositions are very important parts of the theory of corporate finance.

Graham (2000) integrates under firm-specific benefit functions to estimate that the capitalized tax benefit of debt equals 9.7 percent of firm value or as low as 4.3 percent net of personal taxes. The research covers 6,087 sample companies. It covers data between the years 1980-1994, that is 15 years. This rate is very important to increase firm value. Every increase in firm value is a contribution for overall economy and capital markets, that is, debt and equity markets.

Myers (2001) thinks that M&M assumed perfect and frictionless capital markets, in which financial innovation would quickly extinguish any deviation from their predicted equilibrium. The logic of the Modigliani and Miller results is now widely accepted. According to Myers, financing clearly can matter. The chief reasons why it matters include taxes, differences in information and agency costs. He believes that Graham (2000)'s finding given above is not small change, a 7.5 percent deviation from Modigliani and Miller's (1958) leverage-irrelevance proposition should prompt a vigorous supply response from security issuers, and one cannot accept Modigliani and Miller and at the same time ignore many mature corporations' evident lack of interest in the tax advantages of debt. He points out that the contribution of M&M propositions to debt and equity management is about not changing the value of firm and cost of capital with the change of capital structure. He changes his opinion with tax, asymmetric information, and agency cost. He gives an example Graham's research as a tax advantage.

Rubinstein (2002) thinks that William (1937) provided the first derivation of the M&M capital structure irrelevancy theorem. He implies that the M&M capital structure theorem is not original. Its root is William

Shiller (2004) thinks that the M&M articles 1958 and 1961 about dividends, earnings, and the cost of capital have become a cornerstone of financial theory. He says about the M&M in his own sentences: "The Modigliani-Miller theory freed us from financial thinking that is tied to artificial categories of thought and led us to thinking of the firm as a whole as an entity that merely divides up its cash flow among different classes of claimants. The theory freed us from a number of fundamental confusions that had infected our thinking until then, and changed the basic units of description for empirical finance". This is very important to think about finance freely because if financial scientists think freely from their old fixed ideas, they may produce new financial opinions which societies can need to live financially comfortably.

Baral (2004) thinks that the M&M theory was theoretically very sound but was based on the assumptions of perfect capital market and no tax world, which were not valid in reality. He criticizes two assumptions that he thinks they make the theorem invalid.

² They think that the other theories upon which modern finance is founded are utility theory, state-preference theory, mean-variance theory and the capital asset pricing model, arbitrage pricing theory, and option pricing theory.

³ The one of which is together with the Scholes

Stiglitz (2005) questioned in a Proceeding⁴ that as if the M&M left out something important or something was wrong with the theorem. He criticizes especially taxes, bankruptcy, and information assumptions. He thinks that tax effect of debt, different level of information about the company of investors and corporate managers, and the effect of debt- equity ratio on decreasing probability of bankruptcy are not consistent with the M&M theorem. He also asserts that the financial structure of the firm does make a difference because capital markets are imperfect. For instance, signaling effect of equity issuance could be a reason to think for investors as if the issuing company is equity constrained. He thinks that some assumptions such as taxes, bankruptcy, and asymmetric information, and perfect capital markets make the theorem unrealistic.

Abor (2005) thinks that the seminal work by Modigliani and Miller (1958) in capital structure provided a substantial boost in the development of the theoretical framework within which various theories were about to emerge in the future. However, he also thinks that M&M theory was based on very restrictive assumptions that do not hold in the real world. These assumptions include perfect capital markets, homogenous expectations, no taxes, and no transaction costs. The presence of bankruptcy costs and favorable tax treatment of interest payments lead to the says notion of an “optimal” capital structure which maximizes the value of the firm, or respectively minimizes its total cost of capital. He means the financial theories such as Trade-off Theory and Pecking Order Theory. He believes the optimal capital structure concept and its result of maximization of firm value and minimization of cost of capital.

Pagano (2005) thinks that the entire development of corporate finance since 1958 can be seen and described essentially as the sequential relaxation of the three assumptions of the M&M theorem. They are no-tax assumption, costs of bankruptcy, and frictionless markets. The writer thinks that all of the theory of corporate finance arose from the relaxation of the three assumptions of M&M theorem. He implies the importance of the theorem asserted by the M&M.

Cozzi(2005) criticizes that the M&Mtheorem is based on highly restrictive hypotheses, and therefore cannot fully reflect what is actually happening on the markets. Nevertheless, it does still represent a precise reference point a benchmark for the purpose of comparison with reality. If, then, as indeed is often the case, a change in financial structure is seen to have a significant effect on the market value of a firm, the first question to ask is which of the M&M hypotheses have been violated. Then he explains some M&M assumptions he objects. The assumptions are perfect substitutability between individual and corporate debts, homogeneous risk classes, no tax, and perfect markets. His objection is about some assumptions that the M&M theory accepts. For this reason, he finds the M&M theory unrealistic and not suitable for the real life.

Samuelson (2005) says that the Modigliani-Miller theorem reaches the counterintuitive conclusion that any degree of debt leverage can be optimal for a firm. Two issues are firms can borrow cheaper and more safely than median investors can and some societies are more risk averse than other people. He thinks that everybody could not find credit with equal cost with businesses and risk taking must be rewarded. M&M theorem does not provide this because all debt levels bring same firm level.

Rubinstein (2006) says that the M&M (1958) extends to uncertainty the idea in Fisher (1930) that the financing and production decisions of a firm can be separated. It is also the first formal treatment of the Williams (1938) Law of the Conservation of Investment Value, showing that in a perfect market, the value of a firm is independent of its capital structure. Although this result was clearly anticipated by Williams, Modigliani and Miller argue that Williams does not really prove his Law because he has not made it clear how an arbitrage opportunity would arise if his Law were to fail. To quote Modigliani-Miller’s complete comment with regard to Williams: A number of writers have stated close equivalents of our Proposition I although by appealing to intuition rather than by attempting a proof and only to insist immediately that the results are not applicable to the actual capital markets⁵.

⁴ Stiglitz J. E, “Modigliani, the Modigliani Miller Theorem, and Macroeconomics”, Conference on Franco Modigliani and the Keynesian Legacy, New School University, April 14-15, 2005, New York City, NY, the U.S.A

⁵ Rubinstein gives these sentences from MM (1958:271) about the subject. He also gives some other sentences in the footnote 13 at the same page of the M&M. These sentences are: “None of these writers (*See, for example, J.B. Williams [21, esp. pp. 72–73]; David Durand [3]; and W.A. Morton [14].*) describe in any detail the mechanism which is supposed to keep the average cost of capital constant under changes in capital structure. They seem, however, to be visualizing the equilibrating mechanism in terms of switches by investors between stocks and bonds

Rubinstein comments that while MM's criticism, it seems to him, is questionable with respect to Williams, it does seem on the mark with respect to Walter A. Morton⁶. Rubinstein says that Morton says that the essential difference between the obligations of the same company lies in the priority of claim to earnings and assets. If only one security is issued, it bears all the risk whether it be called a bond, preferred stock, or common stock, and would have the same value provided that the security could share in all the earnings. Similarly, if one individual owned all of the various types of securities issued, his risk would be the same. Legal differences in the event of insolvency or reorganization and tax policy will modify this result. If all the securities were sold in "packages" of bonds, preferred and common, the risk to each owner would be the same as if it were all common stock. It follows accordingly that the overall cost of money would be unaffected by capital structure if individuals could not differentiate risks. He especially points out that the opinion the M&M theory asserts was already available in Fisher (1930), William (1937) and Morton (1954). He highlights not being original of the M&M theorem.

Tirole (2006) says that economists were stunned when, in two articles in 1958 and 1961, Modigliani and Miller came up with the following rather striking and somewhat counterintuitive result. He accepts the importance and originality of the M&M theory totally firm value of capital structure and dividend irrelevancies, that is totally four propositions in 1958 article and 1961 article.

Hindriks(2008) asserts that three assumptions in particular, those of the absence of taxes, bankruptcy costs, and agency costs play an important role in the explanation of several contrasts. As a consequence of its many unrealistic assumptions, it provides for a striking foil that figures in explanations that prompt new explanatory questions, which can be answered by subsequent models that are part of the same theory. All in all, it could be concluded that the MM theory is "an explanatory engine" capable of providing many potential explanations. However, Hindriks criticizes The Proposition I with tax opinion of the M&M. He thinks that although taxes per se do not influence their results, a differential tax treatment of debt versus equity does. And firms can in fact deduct interest payments before calculating taxes, whereas they cannot deduct dividend payments. Thus, debt is advantaged over equity. He thinks that Modigliani and Miller argue that, because of this, financing a firm with debt only is the optimal strategy for maximizing its value. The tax adjusted version of proposition I implies that the way to maximize the value of a firm is by relying on debt financing only. It shares with the received wisdom at the time the idea that increasing the amount of debt can increase the value of a firm, though the underlying reasoning is very different. But it takes this thought to its extreme by maintaining that the maximal value is achieved by relying on debt only, rather than an intermediate value of the debt to equity ratio being optimal, as the naive view has it. He logically implies that because of debt interest is excluded from tax and profit is taxed, debt increases firm value. Hethinks comparatively between debt and equity.

Fosberg (2010) thinks that Modigliani and Miller (1958, 1963) laid the foundation of the modern capital structure theory. He accepts M&M as the builder of modern capital structure theory. He accepts their authority about the field.

Parker (2010) says that the Modigliani-Miller theorem shows that under some conditions the decision about how much to invest is independent of the decision about how to finance that investment, since the value of the firm is the same regardless of whether the firm issues bonds or uses accumulated profit or the proceeds from issuing new equity. This independence allows macroeconomists to focus only on the firm's investment decision, leaving analysis of the decision about how to raise the required funds to specialists in finance. It could be thought that he means that investment analysis does not cover financing, it covers only project evaluation. This easiest the business of investment analysts. They focus only the evaluation. It is because of the acceptance of M&M capital structure propositions.

Caldentey&Vernengo (2010) assert that M&M theorem had important ramifications for the choice of the composition of capital structure and its relation to the asset side of firms. The function of the M&M theorem is perceived by the two writers all about a firm or company. It's a corporate finance.

as the yields get out of line with their "riskiness." This is an argument quite different from the pure arbitrage mechanism underlying our proof, and the difference is crucial".

⁶ Rubinstein says that Morton writes these opinions in [Morton (1954:442)] "The Structure of the Capital Market and the Price of Money," *American Economic Review* 44, No. 2 (May 1954), pp. 440-454:

It is about relationship between capital structure at the passive side and at the asset side of a company. It is all the theory of the corporate finance.

Tudose (2012) thinks that the validity of the M&M two statements which are irrelevance of firm value and irrelevance of cost of capital has been verified only under conditions of predefined assumptions specific to an ideal situation. They are absence of bankruptcy costs, no corporate income tax, no market imperfections, etc. Beyond any issues that may raise criticism, the two proposed and subsequently validated statements marked the starting point in founding modern finance. He thinks the propositions for an ideal situation because predetermined assumptions.

Iqbal, Muneer, Jahanzeb, & Rehman (2012) thinks that in capital structure theories, the theory of Modigliani & Miller "irrelevance theory of capital structure" presented in 1958 has significant importance and has captured interest of finance managers, practitioners and economists. It is said that Modigliani & Miller has established the basis of modern finance in 1958 because before them there was no generally accepted theory of capital structure. The writers pointed out the importance and contribution of the M&M capital structure propositions to the theory of corporate finance.

Saito, Fereira, & Fama⁷ (2013) asserts that in the beginning of 1950s, one of two mainstreams formed the foundations of modern finance is Corporate Finance which was set forth by Modigliani & Miller.⁸ They devised the concept that the value of a company is independent of its capital structure. They already accept that theory of corporate finance is one of the two mainstreams of the theory of modern finance. They also accept that, with their propositions, the M&M are the builder of the theory of corporate finance. That is, M&M propositions are not only important for the theory of corporate finance but also the propositions are the most important opinions for the theory of corporate finance. Its reason is that after the propositions, many corporate finance theories have been improved by other finance theoreticians.

Ghazouani (2013) thinks that since the theorem Modigliani & Miller (1958) came to rule in finance literature discussing all the inapplicability of the financial structure for real decisions, economists have gradually adjusted their positions. Putting themselves in the framework of neoclassical financial theories, the relaxation of the simplifying assumptions of Modigliani & Miller has allowed the development of financial theory called compromise. Indeed, consideration tax system and bankruptcy costs suggest the existence of an optimal ratio of debt. The current theory is known as the theory of the Static Trade-off Theory. He thinks that MM stimulated the improvement of some financial theories. It is an important contribution to the theory of corporate finance. He also believes the importance of the existence of optimal ratio of debt.

Adika & Nugroho (2013) thinks that Modigliani and Miller theories, held as one of the most important theoretical compasses for the world of Corporate Finance, has stated some aspects and measurements in which will determine one company's step of heading towards financial decision of its capital structure. Their opinion is that the M&M propositions are the most important compass for the theory of corporate finance. Their opinion has been a driving force for the other studies in the sub-field Corporate Finance. For this reason, the propositions are the most important study for the subfield.

Saarani & Shahadan (2013) says that M&M theory's arguments have triggered a further discussion and to deepen study on capital structure. Following the discourse on the M&M theory, two theories of capital structure emerged and often cited by researchers today, namely Trade-off Theory and Pecking Order Theory. However, they also think that empirical evidence from the real business is different from the assumptions made by M&M theory. They think that the M&M theory has been a starting point for some next theories in the theory of corporate finance.

Tilehnoiei & Shivaraj (2014) says that value-irrelevance proposition of the Modigliani & Miller (1958) is the first theory about capital structure and asserts that firm value is irrelevant to capital structure or financing decision. They are point out that the M&M is the first theory of financing decision or capital structure. That's why the propositions have contributed financing and capital structure subtitles of the theory of corporate finance.

⁷ Fama is not the Eugene Fama.

⁸ The other mainstream was introduced by Markowitz (1952), and has followers in authors such as Tobin (1958) and Sharpe (1964). It focuses on portfolio and risk and return studies. However, its importance was not recognized until the 1970s (Saito, Fereira, & Fama, 2013:6).

Abeywardhana (2017) thinks that capital structure irrelevance theory of Modigliani and Miller (1958) is considered as the starting point of modern theory of capital structure. They argue that value of levered firm is same as the value of unlevered firm. Therefore, they propose that managers should not concern the capital structure and they can freely select the composition of debt to equity. In addition, he thinks drawbacks in M&M theory stimulated series of research devoted on proving irrelevance as theoretical and empirical matter. So may other theories that contribute to capital structure theorem have developed based on the MM theorem and it is much hard to validate any of them. However, Abeywardhana also thinks that capital structure irrelevance theory was theoretically very sound but was based on unrealistic set of assumptions. These assumptions are securities are traded in perfect capital market, all relevant information are available for insiders and outsiders to take the decision, transaction cost, bankruptcy cost, and taxation do not exist, borrowing and lending is possible for firms and individual investors at the same interest rate which permits for homemade leverage, firms operating in a similar risk classes and have similar operating leverage, interest payable on debt do not save any taxes, and firms follow 100% dividend payout. He accepts that M&M asserts that corporate value does not change with the leverage level. This is important determining for the theory of corporate finance because of financial managers' concentrations on asset side management of financial management functions. The investment and management of funds are more important than that of selecting financing sources. He also thinks that M&M stimulates theoretical and empirical studies in capital structure theory of corporate finance. However, he criticizes all of the assumptions of the M&M.

Kumar (2017) thinks that Modigliani and Miller's proposition is built on the assumption of a perfect market where there is no tax and bankruptcy disasters. As a response to this statement, the trade-off theory and pecking order theory were introduced. These theories were developed in opposition to the unrealistic assumption of Modigliani and Miller's proposition of perfect capital markets. Kumar thinks that trade-off and pecking order theories were introduced because of some M&M assumptions. He implies some missing points of the MM. He criticizes the assumptions.

Charness & Neugebauer (2019) thinks that due to its assumptions of perfect capital markets and the no-limits-to-arbitrage condition which requires the perfect positive correlation of asset returns, no fees on the use of leverage etc. The MM theorem has not been satisfactorily tested on real-world market data. Its empirical significance has thus been unclear. They criticize empirical side of the M&M theory. They think that empirical side of the theory is not enough to be sure of the theory.

B. Summary of Critiques

The summary sub-section of the section will be carried out in two table. The positive critiques are summarized at the Table 1 below.

Table 1 Summary of Positive Critiques

Writer	Positive Critique
Copeland & Weston (1988)	-the M&M theory is the one of the six seminal and internally consistent theories upon which modern finance is founded
Bhattacharya (1988)	-together Miller's papers (that is MM 1963, Miller 1977, Miller and Scholes 1978) advanced the notion of firm-level indifference to debt and dividend policies for valuation
Harris & Raviv (1991)	-the modern theory of capital structure began with the paper of M&M in 1958
Shiller (2004)	-the M&M articles 1958 and 1961 about dividends, earnings, and the cost of capital have become a cornerstone of financial theory
Pagano (2005)	-the entire development of corporate finance since 1958 can be seen and described essentially as the sequential relaxation of the three assumptions of the M&M theorem. They are no-tax assumption, costs of bankruptcy, and frictionless markets
Tirole (2006)	-economists were stunned when, in two articles in 1958 and 1961, Modigliani and Miller came up with the following rather striking and somewhat counterintuitive result
Fosberg (2010)	-M&M (1958, 1963) laid the foundation of the modern capital structure theory
Parker (2010)	-the independence between capital structure and firm value allows macroeconomists to focus only on the firm's investment decision, leaving analysis of the decision about how to raise the required funds to specialists in

	finance
Caldentey&Vernengo (2010)	-the M&M theorem had important ramifications for the choice of the composition of capital structure and its relation to the asset side of firms
Iqbal,Muneer,Jahanzeb, &Rehman (2012)	-Modigliani &Miller has established the basis of modern finance in 1958 because before them there was no generally accepted theory of capital structure
Saito, Fereira, &Fama (2013)	-in the beginning of 1950s, one of two mainstreams formed the foundations of modern finance is Corporate Finance which was set forth by Modigliani a&Miller.
Ghazouani (2013)	-since the theorem Modigliani &Miller (1958) came to rule in finance literature discussing all the inapplicability of the financial structure for real decisions, economists have gradually adjusted their positions
Adika & Nugroho (2013)	-held as one of the most important theoretical compasses for the world of Corporate Finance, has stated some aspects and measurements in which will determine one company's step of heading towards financial decision of its capital structure
Tilehnoiei&Shivaraj (2014)	-value-irrelevance proposition of the Modigliani &Miller (1958) is the first theory about capital structure
Merton (1987) ⁹	-the M&M analysis established the commonplace practice of taking each corporate financial instrument as a piece that cannot be properly analyzed without reference to the whole of the firm's liability structure
Abor (2005)	-the seminal work by Modigliani and Miller (1958) in capital structure provided a substantial boost in the development of the theoretical framework within which various theories were about to emerge in the future
Hindriks (2008)	-as a consequence of its many unrealistic assumptions, it provides for a striking foil that figures in explanations that prompt new explanatory questions, which can be answered by subsequent models that are part of the same theory
Saarani &Shahadan (2013)	-the M&M theory's arguments have triggered a further discussion and to deepen study on capital structure
Abeywardhana (2017)	-capital structure irrelevance theory of Modigliani and Miller (1958) is considered as the starting point of modern theory of capital structure

The positive critiques are being the first theory of capital structure, being striking, starting macroeconomics focusing only investment decision, having ramifications in the choice of capital structure, being first theorem in firm level indifferent or irrelevance, resulting the sequential relaxation of the three assumptions- no-tax, costs of bankruptcy, and frictionless markets-with the entire development of corporate finance, bringing some aspects and measurements to financial decision of capital structure, teaching that financial instruments could not properly analyzed without firm's all liability structure, being a boost in the development of the theoretical framework in capital structure, being striking foil bringing explanation questions which causes producing models in the finance theory, and triggering a further discussion on capital structure.

The negative critiques are summarized at the Table II below.

Table II Summary of Negative Critiques

Writer	Critique Negative
Stiglitz (1966)	- dependence on the existence of risk classes -subjective probability distributions over the possible outcomes -partial equilibrium, not general equilibrium -competitive markets are necessary -bankruptcy is not considered
Stiglitz (1974)	-debt reduces the tax liability of the firm and hence increases its value
Jensen-Meckling (1976)	- the firm should be financed almost entirely with debt to increase firm value via debt with tax - the M&M left a theory without determination of the optimal capital structure

⁹ The writers after this line have also negative critiques. Their negative critiques are seen at the Table 1.

Fama (1978)	-existence of risk classes of firms are questionable
Ross (1988)	-homemade leverage -risk class - idiosyncratic risk is not added to the total risk
Graham (2000)	-tax benefits of debt affect firm value
Myers (2001)	-financing can matter because of tax, asymmetric information and agency cost
Baral (2004)	-the assumptions of perfect capital market and no tax world were not valid in reality
Rubinstein (2002)	-William (1937) provided the first derivation of the M&M capital structure irrelevancy theorem
Stiglitz (2005)	-bankruptcy is not considered - tax, asymmetric information is not considered
Cozzy (2005)	- the M&M theorem is based on highly restrictive hypotheses, and therefore cannot fully reflect what is actually happening on the markets
Samuelson (2005)	- any degree of debt leverage can be optimal for a firm is a counterintuitive conclusion -no reward for risk increase
Rubinstein (2006)	-m&m extends to uncertainty the idea in Fisher (1930) - It is the first formal treatment of the Williams (1938) Law of the Conservation of Investment Value - Morton (1954) says that the essential difference between the obligations of the same company lies in the priority of claim to earnings and assets
Tudose (2012)	-its validity is verified only under conditions of predefined assumptions specific to an ideal situation (absence of bankruptcy costs, no corporate income tax, no market imperfections, etc.)
Kumar (2017)	- the assumption perfect capital markets where there is no tax and bankruptcy disasters are unrealistic and as a response to this statement, the trade-off theory and pecking order theory were introduced
Charness & Neugebauer (2019)	-Its empirical significance has been unclear because of its assumptions of perfect capital markets and the no-limits-to-arbitrage condition the MM theorem has not been satisfactorily tested on real-world market data
Merton (1987) ¹⁰	-not enough empirical study during the theorems are asserted
Abor (2005)	the assumptions perfect capital markets, homogenous expectations, no taxes, and no transaction costs, and no bankruptcy cost do not fit real world -the optimal capital structure concept and its result of maximization of firm value and minimization of cost is valid
Hindriks (2008)	- although taxes per se do not influence their results, a differential tax treatment of debt versus equity does, and firm value increases with tax deduction of debt
Saarani & Shahadan (2013)	- empirical evidence from the real business is different from the assumptions
Abeywardhana (2017)	- all assumptions are unrealistic

The negative critiques are risk class existence and dependency, subjective probability distribution over possible outcome, accepting, partial equilibrium, necessity of competitive markets, not being considered bankruptcy cost, requiring %100 debt finance to increase firm value, not being optimal capital structure and accepting that any degree of debt is optimal, homemade leverage, idiosyncratic risk is not added to total risk, not affecting firm value the tax benefit of debt, not being considering asymmetric information and agency cost, and signaling affect, substitutability between individual and corporate debt, no reward for risk increase, looking like the theorem to Fisher (1930), William (1937), and Morton (1954), validity only under all the assumption, not being tax, bankruptcy cost and transaction cost, and being more logical that differential tax treatment for debt and equity should bring tax advantage and firm value increase.

¹⁰ The writers after this line have also positive critiques. Their positive critiques are seen at the Table 1.

A separation about positive and negative critiques by the writer in chronological order is given at the Table III below.

Table III Critiques by Their Direction and Year

Writer	Direction of the Critique
Stiglitz (1966)	negative
Stiglitz (1974)	negative
Jensen-Meckling (1976)	negative
Fama (1978)	negative
Merton (1987)	both positive and negative
Ross (1988)	negative
Copeland & Weston (1988)	positive
Bhattacharya (1988)	positive
Harris & Raviv (1991)	positive
Graham (2000)	negative
Myers (2001)	negative
Rubinstein (2002)	Negative
Shiller (2004)	positive
Baral (2004)	negative
Stiglitz (2005)	negative
Abor (2005)	both positive and negative
Pagano (2005)	positive
Cozzy (2005)	negative
Samuelson (2005)	negative
Rubinstein (2006)	negative
Tirole (2006)	positive
Hindriks (2008)	both positive and negative
Fosberg (2010)	positive
Parker (2010)	positive
Caldentey & Vernengo (2010)	positive
Tudose (2012)	negative
Iqbal, Muneer, Jahanzeb, & Rehman (2012)	positive
Saito, Fereira, & Fama (2013)	positive
Ghazouani (2013)	positive
Adika & Nugroho (2013)	positive
Saarani & Shahadan (2013)	both positive and negative
Tilehnoiei & Shivaraj (2014)	positive
Abeywardhana (2017)	both positive and negative
Kumar (2017)	negative
Charness & Neugebauer (2019)	negative

As you see from the Table III, Copeland and Weston (1988), Bhattacharya (1988), Harris & Raviv (1991), Shiller (2004), Pagano (2005), Tirole (2006), Fosberg (2010), Parker (2010), Caldentey & Vernengo (2010), Iqbal, Muneer, Jahanzeb, & Rehman (2012), Saito, Fereira, & Fama (2013), Ghazouani (2013), Adika & Nugroho (2013), and Tilehnoiei & Shivaraj (2014) have positive critiques.

The Table III shows that Stiglitz (1966), Stiglitz (1974), Jensen-Meckling (1976), Fama (1978), Ross (1988), Graham (2000), Myers (2001), Rubinstein (2002), Baral (2004), Stiglitz (2005), Cozzy (2005), Samuelson (2005), Rubinstein (2006), Tudose (2012), Kumar (2017), and Charness & Neugebauer (2019) have negative critiques.

You can see from the Table III that Merton (1987), Abor (2005), Hindriks (2008), Saarani & Shahadan (2013), and Abeywardhana (2017) have both positive and negative critiques.

A summary of the directions of the critiques is shown at the Table IV below.

Table IV Summary of the Directions of the Critiques

Direction of the Critique	Number of the Writer	% of total critiques
Positive critique	14	40.00
Negative critique	16	45.71
Both	5	14.29
Total	35	100.00

If we only consider the writers who have only positive and only negative critiques, the two sides are 16 and 14, respectively. The total is 30. If we add the 5 writers who have both positive and negative critiques, the total number of articles are 35. When their critiques are separated as positive and negative critiques and added to the positive and the negative critiques, the positive side will be 19 article, and the negative side will be 21 articles. That is, there are 19 positive criticizing articles and 21 negative criticizing articles in this survey about the M&M theorem. However, 5 of the writers will be in every two sides because of having both positive and negative critiques.

IV. Replies to the Critiques by the Modigliani and Miller

A. Replies of the Modigliani and Miller

Stiglitz (1966) critiques that the theorem accepts partial equilibrium, not general equilibrium. Modigliani & Miller (1958) thinks that their approach has been that of static, partial equilibrium analysis. These and other drastic simplifications have been necessary in order to come to grips with the problem at all. Having served their purpose they can now be relaxed in the direction of greater realism and relevance, a task in which they hope others interested in this area will wish to share. They already expect from other financial scientists to complete the theorem by canceling some assumptions and adding some other necessary things such as different data etc. Hence, the M&M theorem is a productive study field of finance. They offered some propositions, not rules. Of course, the propositions would be discussed. All offerings are discussed in the life. Financial propositions are not excluded from this reality.

Stiglitz (1966), Fama (1978), Ross (1988), and Cozzy (2005) criticize the concept risk class. M&M (1958) says that from their definition of homogeneous classes of stock it follows that in equilibrium in a perfect capital market the price per dollars' worth of expected return must be same for all shares of any given class. That is, in any given class, the price of every share must be proportional to its expected return. The concept risk class is not identical to industry but closely related to it. Appropriate class boundaries will depend on the particular problem being studied. An economist concerned with general tendencies in the market might be prepared to work with far wider classes than would be appropriate for an investor planning his portfolio or a firm planning its financial strategy. The Modigliani and Miller has replied to the writers in 1958. Miller (1988) replies about the risk class, too. Miller says that this concept was offered with several objectives in mind. It could be called spanning set which means the uncertain, underlying future cash flow streams of the individual firms within each class could be assumed perfectly correlated, and hence perfect substitutes. But the characteristics of those correlated streams could be allowed to differ from class to class. Hence, at the more practical level, the risk class could be identified with Marshallian industries- groupings around which so much academic and Wall Street research had always been organized. Then he gives example oil or electricity generation for the risk class and offers reading M&M (1966) for empirical studies for the risk class. The M&M (1966) covers electricity generation companies which are in the same risk class. They are shown at the Appendix 1

Stiglitz (1966), Baral (2004), Abor (2005) Cozzy (2005), Tudose (2012), Kumar (2017), and Charness and Neugebauer (2019) think that the M&M is valid for only for competitive markets. They perceive it as a deficiency. The M&M (1958) accepts atomistic competition as an assumption. The concept means competitive markets. Hence, I think, the theorem is valid only for competitive markets. Actually, the M&M answers the critiques about competitive markets critiques. To me, competitive markets assumption is a limitation. Modigliani and Miller accept it in advance during the theory is built in 1958.

Jensen-Meckling (1976) asserts that the M&M left a theory without determination of the optimal capital structure. M&M (1958) accepts that general rule of capital structure irrelevance is that there is no optimal capital structure and all capital structures are equal from the point of view of the cost of capital. It means the capital structure does not affect cost of capital in every mix of capital structure.

The M&M did not leave the optimal capital structure without determination, but the M&M theorem did not accept the concept of optimal capital structure at all.

Jensen-Meckling (1976) also says that M&M (1963) implies that the firm should be financed almost entirely with debt to increase firm value. Modigliani and Miller in same article comments that it may be useful to remind readers once again that the existence of a tax advantage for debt financing does not necessarily mean that corporations should at all times seek to use the maximum amount of debt in their capital structures. M&M (1963) actually says that the existence of a tax advantage for debt financing, even the larger advantage of the corrected version, does not necessarily mean that corporations should at all times seek to use the maximum possible amount of debt in their capital structure. They explain their opinion with some other forms of financing such as retained earnings. They think retained earnings may be still cheaper in some circumstance when the tax status of investors under the personal income tax is taken into account. More important, there are limitations imposed by lenders as well as many other dimensions and kinds of costs in real world problems of financial strategy which are not fully comprehended within the framework of static equilibrium models such as M&M and the traditional models. This consideration could be thought a substantial reserve of untapped borrowing power. M&M thinks that the tax advantage of debt may well tend to lower the optimal size of that reserve, but it is hard to believe that advantages of the size contemplated under their model could justify any substantial reduction, let alone their complete elimination. It seems from the article M&M (1963) that they believe cheaper financing methods such as retained earnings. They also think that debt has some drawbacks. So, it could be understood that they necessarily believe % percent debt to increase firm value. Actually, they do not believe the relevance.

Stiglitz (1974), Jensen-Meckling (1976), Graham (2000), Myers (2001), Baral (2004), Stiglitz (2005), Abor (2005), Cozzy (2005), Hindriks (2008), Tudose (2012), and Kumar (2017) think that tax could affect the irrelevance. That is, it could add to the firm value. Miller (1977) says some others object that the invariance proposition was derived for a world with no taxes, and that world is not ours. They point out that in our world, the value of the firm can be increased by the use of debt since interest payments can be deducted from taxable corporate income. To reap more of these gains, however, the stockholders must incur increasing risks of bankruptcy and the costs, direct and indirect, of falling into that unhappy state. They conclude that the balancing of these bankruptcy costs against the tax gains of debt finance gives rise to an optimal capital structure, just as the traditional view has always maintained, though for somewhat different reasons. Miller says that even in a world in which interest payments are fully deductible in computing corporate income taxes, the value of the firm will still be independent of its capital structure. Miller points out that bankruptcy balances tax advantage of debt and for this reason, the debt does not increase firm value. Miller (1988) says that there is one sense, albeit a somewhat strained one, in which the basic value-invariance does go through even with corporate taxes. Miller still believes in 1977 and in 1988 that tax advantage does not affect the firm value. The irrelevance is still valid even debt has tax advantage. Modigliani in an interview (2005)¹¹ says that about tax effect to the firm value, there is a disagreement between Miller and himself (Modigliani). Modigliani believes that taxes can introduce a differential advantage between different kinds of instruments, while Miller thinks not (according to Modigliani). But Modigliani says that even though, in principle, taxation could affect the comparative advantage of different instruments, Miller and himself agree that with the current system of taxation, the differences are unlikely to be appreciable. He says current tax system of the USA does not allow to appreciate the taxes for firm value. He thinks this after 41 years from the M&M (1958) and after 36 years from the M&M (1963). So, the two of the M&M writers did not give up their irrelevance opinions even with tax.

Merton (1987), Charness and Neugebauer (2019) think that there is not enough empirical study. Miller (1999) says there is not any direct calibration test of the M&M propositions and their implications. The reason of difficulty of testing is the initial M&M paper itself. The capital proposition says that if you could

¹¹Interviewed by William A. Barnett and Robert Solow, November 5–6, 1999. It was also published in Barnett William A. and Robert Solow, *Macroeconomic Dynamics*, volume 4, Issue 2, June 2000, pp.222-256

find two firms whose underlying earnings are identical, then so would be their market values regardless of how much of capital structure takes the form of equity as opposed the debt. Because of hardship of two identical firms, change in capital structure of same firm is used to determine firm value.

If a firm borrows and uses the proceeds to pay its shareholders a huge dividend or to buy back shares, does the value of the firm increase? Many studies have suggested that it does. But the interpretation of such results faces a hopeless identification problem.

Rubinstein (2002 and 2006) asserts that M&M extends to uncertainty from the idea in Fisher (1930), it is the first formal treatment of the Williams (1938) Law of the Conservation of Investment Value, and it looks like the opinion that Morton (1954) who says that the essential difference between the obligations of the same company lies in the priority of claim to earnings and assets. He implies that the M&M is not original. M&M (1958) says that a number of writers have stated close equivalents of the Proposition I although by appealing to intuition rather than by attempting a proof and only to insist immediately that the results were not applicable to the actual capital markets. The M&M continues their explanation in the same page at the footnotes 13. They say that none of these writers such as J.B. Williams [21, esp. pp. 72–73]; David Durand [3]; and W.A. Morton [14].) describe in any detail the mechanism which is supposed to keep the average cost of capital constant under changes in capital structure. They seem, however, to be visualizing the equilibrating mechanism in terms of switches by investors between stocks and bonds as the yields get out of line with their “riskiness.” This is an argument quite different from the pure arbitrage mechanism underlying our proof, and the difference is crucial”. Regarding Proposition I as resting on investors’ attitudes toward risk leads inevitably to a misunderstanding of many factors influencing relative yields such as limitations on the portfolio composition of financial institutions. These sentences from the M&M (1958) are like the answer to Rubinstein (2002 and 2006).

Modigliani (1988) replied the question if he and Miller used to produce the M&M theory from another person or people’s opinion. Modigliani says that “I had been intrigued by the subject ever since attending a National Bureau conference on Business Finance at which I gave a fairly conventional paper (Modigliani and Ziman, 1952). But mostly I listened to a paper by David Durand (1952) in which the possibility that financial structure would not affect the market valuation or the cost of capital was suggested, only to be rejected as not relevant to the actual capital markets” (Modigliani, 1988:149). It could be seen frankly that he has been affected from Durand’s proceeding. He does not hide it. But it is not Fisher (1930), Williams (1937) or Morton (1954). It is Durand (1952). The Modigliani’s Conference story implies that during the M&M theorem is being creating, Fisher (1930), William (1937), and, Morton (1954) have not been considered.

Miller (1988) says that though departing substantially from the conventional views about capital structure, their propositions were certainly not without links to what had gone before. He says their distinction between the real value of the firm and its financial packaging raised many issues long familiar to economists in discussions of the money illusion and money neutrality. Even some of the particular financial illusions to which they were directing attention had themselves already been noted by others as they duly cited in their paper. These earlier statements from which they were aware of were not followed by finance writers. He points out that the only prior treatment similar in spirit to their own was by David Durand (1952). Miller acknowledges that their first formal critic was by David Durand (1959), too. Miller says about Fisher effect assertion that they opted for a Fisherian rather than the standard Marshallian representation of the firm. Fisher’s view of firm focuses on the underlying net cash flow. The firm for Fisher was just an abstract engine transforming current consumable resources, obtaining by issuing securities, into future consumable resources payable to the owners of the securities. Even so, what did it mean to speak of firms or cash flow streams being different, but still similar enough to allow for arbitrage or anything close to it. He finds their (Modigliani and himself) irrelevance opinions closer to Fisher’s opinions than that of Marshall’s. Especially the opinion to allow for arbitrage.

Abeywardhana (2017) thinks that all assumptions are unrealistic. Miller (1999) says that, at the micro level, tendency of many was to dismiss the assumptions underlying M&M’s and then- novel arbitrage proof as unrealistic. Profession didn’t seem to accept Friedman’s “the assumptions don’t matter” position for the M&M though it seemed the same position to accept the CAPM assumptions. The likely reason is that the Friedman’s what does count is the destructive power of the model itself was not followed up.

Charness and Neugebauer (2019) says that the no-limits-to-arbitrage condition is a block for an empirical test. Miller (1977) thinks that the arbitrage proof of this proposition can now be found in virtually

every textbook in finance, followed almost invariably, however, by a warning to the student against taking it seriously. Some dismiss it with the statement that firms and investors can't or don't behave that way. He implies their arbitrage opinion has been accepted commonly in the finance science society.

Miller (1999)¹² explains the reason of pretty much dissatisfaction about the M&M theorem. He says that the M&M analysis provided answers, but ones that left both wings of profession¹³ dissatisfied. At the macro normative level, the M&M measure of the cost of capital for aggregate investment functions never really caught on and the very notion of estimating aggregatedemand functions for investment has long since been abandoned by macro economists. At the micro level, the M&M propositions imply that the choice of financing instrument is irrelevant for the optimal cutoff. Such a cutoff is seen to depend solely on the risk or risk class of the investment, regardless of how it is financed, hardly a happy position for professors of finance to explain to their students being trained, presumably, in the art of selecting optimal capital structures. Miller thinks that the reason of not being understood of the M&M theory is the profession who see finance as essentially a branch of management science. For this reason, the profession does not understand that the M&M propositions are about equilibrium in the capital markets-what equilibrium looks like, and what forces are set in motion once it is disturbed. And this is why the M&M propositions have ever set well with those in the profession. He explains the separation of the profession as a reason for the dissatisfaction. Every wing has different insights and has different scientific expectations from the theory. For this reason, satisfaction could not be fulfilled for everybody for the theorem in this field.

B. Summary of the Replies of the Modigliani and Miller

The replies about the critiques of the M&M theorem is summarized at the Table V below.

Table V Summary of Replies by the Modigliani and Miller

Writer who Criticized and the Critique	Writer who Replied and the Reply
Stiglitz (1966), Baral (2004), Abor (2005) Cozzy (2005), Tudose (2012), Kumar (2017), Charness and Neugebauer (2019) -competitive markets are necessary	<u>M&M (1958)</u> -yes, the theorem is valid only for competitive markets, it's an important assumption
Stiglitz (1966) -partial equilibrium, not general equilibrium,	<u>M&M (1958)</u> -these and other drastic simplifications have been necessary in order to come to grips with the problem at all. Having served their purpose they can now be relaxed in the direction of greater realism and relevance, a task in which they hope others interested in this area will wish to share.
Stiglitz (1966), Fama (1978), Ross (1988), Cozzy (2005) -the concept risk class	<u>M&M (1958)</u> -in any given class, the price of every share must be proportional to its expected return - The concept risk class not identical to industry but closely related to it. <u>M&M (1966)</u> -Appendix A. covers electricity generation companies which are in the same risk class. It is a sample for the concept risk class. <u>Miller (1988)</u> -risk class could be called "spanning set"; the uncertain, underlying future cash flow streams of the individual firms within each class could be assumed perfectly correlated, and hence perfect substitutes. But the characteristics of those correlated streams could

¹²This paper is actually a proceeding presented by the Miller at the Fifth Annual Meeting of the German Finance Association in Hamburg on September 25, 1998

¹³According to Miller (1999), this wings are micro normative wing and macro normative wing. The micro normative wing was concerned with finding the cost of capital in sense of the optimal cutoff rate for investment when the firm can finance the Project either with debt or equity or some combination of both. The macro normative or economics wing sought to express the aggregate demand for investment by corporations as a function of the cost of capital that firms are actually using as their optimal cutoffs, rather than just the rate of interest on long term government bonds

	be allowed to differ from class to class
Jensen-Meckling (1976) - the M&M (1963) implies that the firm should be financed almost entirely with debt to increase firm value	<u>M&M (1963)</u> -the existence of a tax advantage for debt financing, even the larger advantage of the corrected version, does not necessarily mean that corporations should at all times seek to use the maximum possible amount of debt in their capital structure. They explain their opinion with some other forms of financing such as retained earnings. They think retained earnings may be still cheaper in some circumstance when the tax status of investors under the personal income tax is taken into account.
Abeywardhana (2017) -all assumptions are unrealistic	<u>M&M (1958)</u> -having served their purpose they can now be relaxed in the direction of greater realism and relevance, a task in which they hope others interested in this area will wish to share. <u>Miller (1999)</u> -tendency of many was to dismiss the assumptions underlying M&M's and then- novel arbitrage proof as unrealistic. Profession didn't seem to accept Friedman's "the assumptions don't matter" position for the M&M though it seemed the same position to accept the CAPM assumptions
Rubinstein (2002, 2006) -m&m extends to uncertainty the idea in Fisher (1930) - It is the first formal treatment of the Williams (1938) Law of the Conservation of Investment Value - Morton (1954) says that the essential difference between the obligations of the same company lies in the priority of claim to earnings and assets	<u>M&M (1958)</u> -none of these writers (J.B. Williams, David Durand, and W.A. Morton describe in any detail the mechanism which is supposed to keep the average cost of capital constant under changes in capital structure. They seem, however, to be visualizing the equilibrating mechanism in terms of switches by investors between stocks and bonds as the yields get out of line with their "riskiness." This is an argument quite different from the pure arbitrage mechanism underlying our proof, and the difference is crucial". <u>Miller (1988)</u> -says about Fisher effect assertion that they opted for a Fisherian rather than the standard Marshallian representation of the firm Fisher's view of firm focuses on the underlying net cash flow - the M&M propositions were certainly not without links to what had gone before - the only prior treatment similar in spirit to their own was by David Durand (1952) <u>Modigliani (1988)</u> -Modigliani listened to a proceeding by David Durand (1952) in which the possibility that financial structure would not affect the market valuation or the cost of capital was suggested, only to be rejected as not relevant to the actual capital markets. He implies he was only affected from Duran's (1952) opinions about the subject
Stiglitz (1974), Jensen-Meckling (1976), Graham (2000), Myers (2001), Baral (2004), Stiglitz (2005), Abor (2005), Cozzy (2005), Hindriks (2008), Tudose (2012), Kumar (2017) -tax could affect the irrelevance	<u>Miller (1977)</u> To reap more of these (tax) gains, however, the stockholders must incur increasing risks of bankruptcy and the costs, direct and indirect, of falling into that unhappy state. <u>Miller (1988)</u>

	- albeit a somewhat strained one, in which the basic value-invariance does go through even with corporate taxes <u>Modigliani (2005)</u> - taxes can introduce a differential advantage between different kinds of instruments, while Miller thinks not (according to Modigliani). But he says that even though, in principle, taxation could affect the comparative advantage of different instruments, Miller and himself agree (according to Modigliani) that, with the current system of taxation, the differences are unlikely to be appreciable
Charness and Neugebauer (2019) - the no limitsto arbitrage condition is a block for an empirical test	<u>Miller (1977)</u> - the arbitrage proof of this proposition can now be found in virtually every textbook in finance, followed almost invariably, however, by a warning to the student against taking it seriously
Merton (1987), Charness and Neugebauer (2019) -not enough empirical study	<u>Miller (1999)</u> -there is not any direct calibration test of the M&M propositions and their implications. The reason of difficulty of testing is the initial M&M paper itself. The capital proposition says that if you could find two firms whose underlying earnings are identical, then so would be their market values regardless of how much of capital structure takes the form of equity as opposed the debt. Because of hardship of two identical firms, change in capital structure of same firm is used to determine firm value.
Jensen-Meckling (1976) - the M&M left a theory without determination of the optimal capital structure	<u>M&M (1958)</u> - general rule of capital structure irrelevance is that there is no optimal capital structure and all capital structures are equal from the point of view of the cost of capital <u>Miller (1977)</u> Miller says that some writers conclude that the balancing of these bankruptcy costs against the tax gains of debt finance gives rise to an optimal capital structure, just as the traditional view has always maintained, though for somewhat different reasons

The replies of the Modigliani and Miller are about the validity of competitive market assumption, being a simplification of partial equilibrium, being the risk class is closely related to industry but not identical to industry, being an example of electricity generation companies to the risk class, being should be valid the Friedman's "assumption do not matter" position for the M&M theorem like the CAPM, not being the M&M without links to what had gone before, being affected from Durand's irrelevance without tax opinion in the Net Operating Income (NOI) and the Fisher's view of firm focuses on the underlying net cash flow during the M&M's establishment, debt's providing tax advantage but increasing risk of bankruptcy, being still valid firm value invariance with tax, affecting of tax's comparative advantages of different instruments but not firm value, being accepted of arbitrage proof even many textbook coverages, not being any direct calibration test because of hardship to find two firms whose underlying earnings are identical and its solution could be change in capital structure of same firm to determine firm value, being general rule of capital structure irrelevance is that there is no optimal capital structure and all capital structures are equal from the point of view of the cost of capital, and suitability of being relaxed of all assumptions in the direction of greater realism and relevance by other financial scientists.

V.Conclusion

The M&M capital structure theorem is a cornerstone of the modern finance theory. It brought a new point of view to the theory of finance. Until that time, finance theoreticians and business managers would believe that debt decreases cost of capital and increases firm value. The Modigliani and Miller asserted the opposite of this belief. Of course, they met very important opposition from other theoreticians of finance. They are Stiglitz (1966), Stiglitz (1974), Jensen-Meckling (1976), Fama (1978), Ross (1988), Graham (2000), Myers (2001), Rubinstein (2002), Baral (2004), Stiglitz (2005), Cozzy (2005), Samuelson (2005), Rubinstein (2006), Tudose (2012), Kumar (2017), and Charness&Neugebauer (2019). Some theoreticians accepted the M&M theorem, but had some critiques about the theorem. They are Merton (1987), Abor (2005), Hindriks (2008), Saarani & Shahadan (2013), and Abeywardhana (2017). The Modigliani and Miller replied many negative critiques. The negative critiques of Stiglitz (1966), Baral (2004), Abor (2005) Cozzy (2005), Tudose (2012), Kumar (2017), and Charness and Neugebauer (2019) about competitive market necessity, the critique of Stiglitz (1966) about partial equilibrium, the critiques of Stiglitz (1966), Fama (1978), Ross (1988), and Cozzy (2005) about the concept risk class, the critique of Jensen-Meckling (1976) about the M&M's imply of financing almost entirely with debt to increase firm value, the critique of Abeywardhana (2017) about unrealistic assumptions, the critiques of Rubinstein (2002, 2006) about his belief that the M&M is the extension to uncertainty of the idea in Fisher (1930), the first formal treatment of the Williams (1938) Law of the Conservation of Investment Value, and Morton's (1954) opinion that the essential difference between the obligations of the same company lies in the priority of claim to earnings and assets, the critiques of Stiglitz (1974), Jensen-Meckling (1976), Graham (2000), Myers (2001), Baral (2004), Stiglitz (2005), Abor (2005), Cozzy (2005), Hindriks (2008), Tudose (2012), and Kumar (2017) about tax could affect the irrelevance, the critique of Charness and Neugebauer (2019) about not being limits to arbitrage condition a block for an empirical test, the critiques of Merton (1987), and Charness and Neugebauer (2019) about not being enough empirical study, and the critique of Jensen-Meckling (1976) about the M&M's leaving a theory without determination of the optimal capital structure have been replied by Modigliani and Miller. Their replies are seen in the Section IV in detail and as a summary at the table V in the Section.

Not answered critiques by the Modigliani and Miller while they were living were fulfilled by Stiglitz (1966) and Ross (1988). The critiques which are not answered are shown below: Stiglitz (1966) says that except under special circumstances, it was not clear how the possibility of firm bankruptcy affected validity of the theorem. Ross (1988) thinks that the homemade leverage opinion of the M&M proposition with which the investor could duplicate the return on the leveraged firm's equity at lower cost raises questions about the ability of investors to borrow on their own accounts as cheaply as the leveraged firm.

-Ross (1988) raises another critique that relative values are unaffected by capitalization for only their risk class and idiosyncratic risk is not added to the total risk affecting the prices of firms in same risk class because the M&M works in the assumption partial equilibrium. He thinks that it can only be eliminated in general equilibrium condition

Critiques which were fulfilled after the Modigliani and Miller passed away are Stiglitz (2005), Cozzy (2005), Samuelson (2005), and (Abor, 2005).

-Stiglitz (2005) asserts that the effect of debt- equity ratio on decreasing probability of bankruptcy are not consistent with the M&M theorem.

-Cozzi (2005) objects some M&M assumptions. The assumptions are perfect substitutability between individual and corporate debts, homogeneous risk classes, no tax, and perfect markets

-Samuelson (2005) asserts that two issues are firms can borrow cheaper and more safely than median investors can and some societies are more risk averse than other people

-Abor (2005) thinks that transaction cost assumption is not realistic

The unanswered questions show that the M&M capital structure theorem will be continued to have being discussed in the future.

Appendix I

Sample Companies in Same Risk Class¹⁴

Row Number	Sample Companies in the same risk class	Row Number	Sample Companies in the same risk class
1	Atlantic City Electric Co.	33	Maine Public Service
2	Baltimore Gas&Electric Co.	34	Minnesota Power &Light
3	Boston Edison Co.	35	Missouri Public Service
4	Caroline Power and Light	36	Montana- Dakota Utilities Co.
5	Central Illinois Light	37	New York State Electric &Gas Corp
6	Central Illinois Public Service	38	Niagara Mohawk Power Corp.
7	Cincinnati Gas & Electric Co.	39	Ohio Edison
8	Cleveland Electric Illuminating	40	Oklahoma Gas& Electric
9	Columbus &Southern Ohio Electric Co.	41	Pacific Gas&Electric
10	Commonwealth Edison	42	Pennsylvania Power &Light
11	Community Public Service	43	Public Service Co. Of Colorado
12	Consolidated Edison of N. Y	44	Puget Sound Power&Light
13	Consumers Power	45	Rochester Gas and Electric Co.
14	Dayton Power &Light	46	Saint Joseph Light&Power Co.
15	Delaware Power&Light	47	San Diego Gas& Electric
16	Duke Power	48	South Carolina Electric &Gas Co
17	Duquesne Light	49	Southern Indiana Gas&Electric
18	Florida Power Corp.	50	Toledo Edison
19	Florida Power and Light Co.	51	United Gas Improvement Co.
20	Gulf States Utilities	52	Utah Power&Light
21	Public Service Electric &Gas Co.	53	Virginia Electric&Power Co.
22	Idaho Power Co.	54	Washington Water Power Co.
23	Illinois Power Co.	55	Wisconsin Electric Power Co.
24	Indianapolis Power &Light	56	Central Hudson Gas &Electric
25	Interstate Power Co.	57	Detroit Edison
26	Iowa Illinois Gas&Electric	58	Empire District Electric Co.
27	Iowa Power&Light	59	Houston Lighting&Power Co.
28	Kansas City Power&Light Co.	60	Potomac Electric Power Co.
29	Kansas Gas&Electric Co.	61	Public Service Co. (Indiana)
30	Kansas Power& Light	62	Southern California Edison Co.
31	Long Island Lighting	63	Philadelphia Electric Co.
32	Louisville Gas&Electric		

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¹⁴ This Table was cited from the Modigliani and Merton Miller (1966), "Some estimates of the Cost of Capital to the Utility Industry, 1954-1957", *The American Economic Review*, Vol. 56, No. 3, (June, 1966), pp. 333-391

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