A Re-examination of the MM Capital Structure Irrelevance Theorem:

A Partial Payout Approach

Kouki Mondher

Faculty of Management and Economics Sciences of Tunis, Tunisia

Tel: 216-98-543-763   E-mail: koukimondher@yahoo.fr

Abstract

Contrary to *Modigliani and Miller (1958, MM hereafter)*, Capital Structure is not irrelevant when we consider a firm with a dividend payout policy. This article extends the MM capital structure theorem by relaxing the full payout assumption and introducing retention policy. The theoretical contribution shows that it is possible to verify the theorem when we suppose an investor who exchanges his initial holding for another portfolio composed of consumption and investment. The empirical analysis of this new approach is based on a data set of the USA Electric Utilities and Oil companies for the period 1990-1998. The results show that the relationships between leverage and firm value are significantly affected by the firm's payout ratio. This finding is largely inconsistent with MM's view that the division of a stream between cash dividend and retained earnings is a mere detail in dealing with the irrelevance of capital structure.

Keywords: Capital structure, Firm value, Irrelevance theorem, Arbitrage, Payout policy

1. Introduction

Miller and Modigliani's (1958) irrelevance theorem is one of the important and puzzling issues in modern corporate finance theory (note 1), which has challenged the traditional view that an optimum leverage exists. The main source of the puzzle stems from the fact that financial research don't seem to explain the firm financing behaviour as we attempt to reconcile the MM theory with the evidence(Myers 1984, Gordon and Chamberlin1994, Rajan and Zingales1995). The MM theorem(proposition I) has shown that under a perfect market hypothesis the market value of any firm is independent of its capital structure (Stulz 2006). This fundamental proposition explicitly indicates that the aptitude of investors to engage in personal or "homemade" leverage is sufficient to ensure that corporate leverage in itself cannot modify the total market value of the firm. In other words, the theorem provides conditions under which arbitrage by individuals keeps the value of the firm depending only on cash flow generated by the investment policy.

Following the seminal paper of MM (1958), most theories have been put forward in corporate finance to reconcile the shortcomings of the irrelevance theorem with variables that explain the firm's choice of capital structure. According to the previous debate, criticism against this theorem can be grouped in two types of arguments: on the one hand, there are papers which deal with the limitations of the arbitrage conditions; on the other hand, there are studies which analyze the effect of market imperfections on the firm's choice of capital structure. Despite the importance of these investigations, we note that all of the limitations deal with the explicit assumptions used by MM, but none deals with the critiques of the MM's implicit assumptions. More recently, *DeAngelo and DeAngelo (2006*, DD hereafter) have challenged MM's irrelevance dividend policy. Dealing with this alternative of earnings as fully distributed, these authors have shown the irrelevance of the MM dividend irrelevance theorem when MM's assumptions are relaxed to allow retention (note 2). According to DD(2006), the MM's irrelevance theorem forces firms to choose only among dividend policies that distribute the full present value of   free cash flow(FCF) to shareholders. Distributions below the totality of earnings are ruled out by the implicit hypothesis.

Dealing with this problem of fully-distributed earnings, MM(1958) used the same hypothesis in the development of the irrelevance of capital structure. As pointed by the authors *"....as will become clear later, as long as management is presumed to be acting in the best interests of the stockholders, retained earnings can be regarded*

as equivalent to a fully subscribed, pre-emptive issue of common stock. Hence, for present purposes, the division of the stream between cash dividends and retained earnings in any period is a mere detail." *MM, 1958* p266. However, MM(1958) failed to recognize that proposition I implies that firms distribute all their cash flow to shareholders without paying any attention to their retention policy. This paper constitutes a new extended proof of the MM theorem by not considering the hypothesis of earnings as fully distributed. We will show that it is possible to verify the theorem when we suppose an investor who exchanges his initial holding for a mix of consumption and investment. The rest of the paper is organized as follows: in the next section, we demonstrate the irrelevance of the MM's capital structure irrelevance when earnings are not fully distributed. We propose the possibility of extending of the MM theorem. Furthermore, we show that the two firms are not forced to distribute their full earnings; and the irrelevance is hold in the presence of the mix of investment and consumption. Section 3 describes the data set, introduces the methodology, examines the hypothesis of the variables and investigates whether the empirical Modigliani-Miller capital structure irrelevance is influenced by dividend payout ratio. Section 4 provides some concluding remarks.

2. The Theoretical finding

2.1 Related literature

Literature about the validity of the MM-proposition is discussed about whether investors can really accomplish the required conditions of the arbitrage method without changing the overall value of the company. In this context, many authors have shown the inadequacy of the theorem when variables that deal with the real world are introduced. Following *Stiglitz(1988), Ross(1988),* it is not easy to compare between corporate debt and personal leverage for many reasons: (i) firms can borrow for a long horizon while the investor use short debt to meet shortage of liquidity. (ii) For many individuals' investing in shares is not the only option to fructify money. Investors can use Treasury bills, saving account, and other risk free bonds.

Based on corporate finance literature, Gordon and Chamberlin (1994) focused on how specific market imperfections (cf. tax system, agency and bankruptcy costs) can violate the MM theorem and make significant effect of leverage on the firm value. According to *Chang (2004),* the MM's first theorem can be verified in an environment where there is no financial market for lending and borrowing, and does not require that investors and companies use the same rate of interest. *Bailey (2010)* shows how the MM-theorem can be demonstrated when capital market is perfect. If an investor is to duplicate the effects of economic behaviour taken by corporation, he must be able to borrow or lend on the same conditions as the firm. According to *Bailey*, what really matters is not that taxes are neutral but the rate of taxation is the same. Thus, the MM's irrelevance theorem does not necessarily fail when taxes differ among financial structure and income source.

In addition to these developments, it is well-known that financing decisions in a prefect market present an idealized picture of the firm behavior. We know that none of the MM's assumptions hold in the real world. However, this theorem makes a fundamental contribution to modern theory of corporate finance; it constitutes one of the earliest formulations of the law of one price. In particular, by relaxing MM's assumptions, the theorem provides conditions under which the allocation of capital between equity and debt affects the firm market value. In other words, the analysis of the relevant MM's hypothesis allows us to know which market imperfections explain the real relationship between leverage and the market value of the firm.

2.2 The failure of the MM theorem when earnings are not fully distributed

As indicated by *Rubinstein (2003),* "the law of the conservation of investment value" of MM (1958) was anticipated by many studies (*Fisher (1930), Williams (1938), Durand (1952); Morton (1954)* for examples*)* but none of these authors have used arbitrage mechanism to prove the invariance of the cost of capital under changes in leverage. The MM's theorem demonstrates that under certain hypothesis of market conditions, the value of the firm is independent of its debt-equity ratio and is given by capitalizing the expected return generated by its assets. This model can be expressed as:

$$V_j = (S_j + D_j) = \frac{X_j}{\rho_k} \quad \text{for any firm j in class k} \tag{1}$$

Where V stands for the market value of the firm, S_j for the market value of its common shares, D_j for the market value of its debts, X_j for its expected earnings before interest on its assets, ρ_k for the capitalization rate "appropriate to its class k". The analysis of the MM's arbitrage steps shows the implicit hypothesis of full payout ratio which plays a crucial role in the model. The MM's capital structure irrelevance theorem constrains

firms to distribute all of their earnings. In particular, we note that the validity of the proof developed by MM is based on this implicit assumption. MM(1958) consider (see MM(1958) pages 269-270) the return of the investor Y as a fraction α of the net income available ($X - rD$ for levered firm and X for unlevered firm) for the stockholders.

$$Y_b = \begin{cases} \alpha(X - rD) & if\ V_L \succ V_U \\ \alpha X & if\ V_U \succ V_L \end{cases} \tag{2}$$

Where: Y_b is the return of the investor before arbitrage process, L is levered firm and U is Unlevred firm and α is fraction of the total outstanding shares owned by the investor. Obviously, MM(1958) confuse artificially return of the investor(dividend return) and net income which should be distributed between dividend and retention. MM(1958 page 266) assert that "*the division of the stream between cash dividends and retained earnings in any period is a mere detail*".

When we derive the MM capital structure theorem for firms that are not distributing all their earnings as dividends, it follows a non-adequacy of the arbitrage operations, a non-proof of the irrelevance model. Table1 shows the two cases used by MM(1958) when we introduce a level of payout different from 100%. Therefore, when we use the same arbitrage as MM(1958), we must then admit that the two firms distribute all the available income to verify the leverage irrelevance proposition.

[Insert Table 1 here]

As will be shown later, this assumption can modify the validity of the MM theorem. To justify this thesis, we suppose the same steps of the MM first proposition but with a slight difference: here we suppose that firms are not constrained to distribute all of their earnings. This means that we introduce in the arbitrage reasoning the payout ratio (PR) as a new variable. Table 1 below shows that MM theorem is not verified. The difference between returns (before and after arbitrage operations) is not the same as showed by MM (1958 page 270).

2.3 How do we reconcile MM's capital structure irrelevant theorem with the firm's payout choice?

The object of this section is to show that it is possible to demonstrate MM's proposition I without the hypothesis of earnings are fully distributed. In other words, we present an extension of the MM capital structure theorem for the case in which firms are allowed to have a payout policy.

To prove this new proposition, we suppose the same hypothesis used by MM (1958), except that earnings are not fully distributed. Using the MM formulation, we consider two firms (U, L) for which the expected return is the same $X_L = X_U = X$. Company U is financed entirely by stock S_U and company L by stock S_L and debt D. The market value of each firm is then $V_U = S_U$ and $V_L = S_L + D$.

* Case 1: we suppose the value of the levered firm V_L, to be greater than that of the Unlevered firm V_U).

We denote respectively, PR_L and PR_U the payout ratios of the levered and unlevered firms (MM 1958 page 269 suppose $PR_L = PR_U = 100\%$ all expected return is distributed).

- ***First stage*** (initial return): Consider an investor who owns s_L dollars' worth of the stock in the company L representing a fraction α of the total outstanding shares S_L, where $s_L = \alpha S_L$. His return Y_L can be written as:

$$Y_L = \alpha\, PR_L\, (X - rD) \tag{3}$$

The return from this portfolio, denoted by Y_L, will be a fraction α of the income distributed $PR_L(X - rD)$ for the stockholders of company L, which equals the multiplication of the payout ratio PR_L by the difference between to total return X and the interest charge r D_L. Where, r is the interest rate which the firm pays on its debt.

- ***Second Stage*** (*Arbitrage* process): now suppose that an individual investor who adjusts his own personal leverage in order to increase his profits. He makes the following operations:

  - (a) Sold his worth s_L of the company L and he divided it as follows: (i) he partially invested an amount $I_U = PR_L.s_L$ (which equals: $I_U = PR_L \alpha S_L$) in acquiring shares (ii) he consumes the remainder

    $C_L = (1\text{-}PR_L) \alpha S_L$. where $s_L = I_U + C_L$.

  - (b) Borrowed an additional amount $d = \dfrac{D}{S_L} PR_L s_L = \dfrac{D}{S_L} PR_L \alpha S_L = PR_L \alpha D$.

- (c) Acquired an amount $s_U = I_U + d$ of the shares of the company U. He could so by using the

amount I_U from the sales of his initial holding and the amount d from borrowing.

- **Third Stage:** (the new return): the income of the investor ((i) who holds s_U dollars' worth of the shares of the company U (ii) and who must pay interest of personal debt d would be:

$$Y_U = \alpha \, PR_L \left[PR_U \, \frac{V_L}{V_U} X - rD \right] \tag{4}$$

- *Last Stage*: Arbitrage profit: Comparing (4) with (3) we obtain:

$$\Delta Y = Y_U - Y_L = PR_L \, \alpha \, X \left[PR_U \, \frac{V_L}{V_U} - 1 \right] \tag{5}$$

Thus, under this approach we can distinguish two situations:

- *The first situation*: If PRU= PRL = 1 then we find the same result as obtained by MM (1958 page 270).

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$$\Delta Y = Y_U - Y_L = \alpha \, X \left[\frac{V_L}{V_U} - 1 \right] \tag{6}$$

- *The Second situation:* we can also verify the same result of MM(1958 page 270) without the hypothesis of $PR_U = PR_L = 1$, we can simply assume $PR_U = 1$, while the payout ratio of the levered firm PR_L is likely to vary between 0% and 100%, we get then:

$$\Delta Y = Y_U - Y_L = PR_L \, \alpha \, X \left[\frac{V_L}{V_U} - 1 \right] \tag{7}$$

From equation (7), we conclude that as long $V_L \succ V_U$ we must verify $Y_U \succ Y_L$, so that it pays shareholders of corporation L to sell their investments, by this means decreasing S_L and hence V_L, and replace them with a mix of consumption and portfolio investment, which contains shares of the unlevered firm and personal debt, thereby growing S_U and thus V_U. This arbitrage process will be finished when equilibrium restores the stated equalities between the values of the two firms.

* *Case 2: we suppose the value of the unlevered firm V_U, to be larger than that of the Levered one V_L*.

- *First stage:* The return of the investor who holds s_U dollars of shares of company U representing a fraction β of the total outstanding stock S_U. Where $s_u = \beta \, S_U$

$$Y_U = \beta \, PR_U \, X \tag{8}$$

The return from this portfolio denoted by Y_U will be a fraction β of the income distributed $PR_U \, X$ to shareholders of the unlevered firm U.

- *Second stage:* suppose that the investor exchanges his initial holding in U by another portfolio in the levered firm L. The arbitrage process with consumption behaviour will take the following form: the investor sold his

worth of company U: $s_u = \beta S_U$ and divided it as follows: $s_u = I_L + I_B + C_u$

- (i) He invested partially $I_L = PR_U \beta S_U \frac{S_L}{V_L}$ of the shares of the company L

- (ii) He invested also $I_B = PR_U \, \beta \, S_U \frac{D}{V_L}$ of bonds of the company L

- (iii) The remainder will be consumed $C_U = (1 - PR_U) \beta S_U$.

From I_L and I_B, we can write respectively: $I_L = PR_U \beta \frac{V_U}{V_L} S_L$ and $I_B = PR_U \, \beta \, \frac{V_U}{V_L} D$

- *Third stage:* The return of the investor (i) who holds I_L dollars worth of the shares of the company L (ii) and who holds I_B dollars worth of bonds of the company L.

$$Y_L = PR_L \, PR_U \, \beta \frac{V_U}{V_L}(X - rD) + r \, PR_U \, \beta \frac{V_U}{V_L} D \tag{9}$$

- **Last stage**: Arbitrage profit: comparing Y_L (from 9) with Y_U (from 8) we obtain:

$$\Delta Y = Y_L - Y_U = PR_U \, \beta \, X \left[PR_L \frac{V_U}{V_L} - 1 \right] + PR_U (1 - PR_L) \beta \frac{V_U}{V_L} r \, D \tag{10}$$

In order to get a profitable arbitrage opportunity for the investor, we must consider a positive difference of returns. Analysing equation (10), we can easily formulate two possibility of payout ratio:

-   In the first, if we suppose a full earning model for the two firms ($PR_L = PR_U = 1$), therefore we will obtain the same results as showed by MM(1958) (page 270). According to this situation, equation (10) can be written as:

$$\Delta Y = Y_L - Y_U = \beta \, X \left[\frac{V_U}{V_L} - 1 \right] \tag{11}$$

-   In the second, the MM's results can also be obtained if we just assume a full earnings for levered firm $PR_L = 1$ while the payout ratio of the unleveled firm PR_U is likely to vary between 0% and 100% implying that the firm can use a payout policy, which is not restricted to full earnings. Such a representation is written as:

$$\Delta Y = Y_L - Y_U = PR_U \, \beta \, X \left[\frac{V_U}{V_L} - 1 \right] \tag{12}$$

In this context, it is also important to show that as $V_U \succ V_L$ we must obtain $Y_L \succ Y_U$, hence it pays the shareholders of company U to sell their holdings and substitute them with a mix of consumption and portfolio investment, which contains shares and bonds. If $V_U \succ V_L$, all investors in firm U will accomplish the three stages below, decrease the value of the unlevered firm U and increase the price of the levered firm L. This switching process will be over when equilibrium restores the stated equalities between the values of the two firms.

From these demonstrations (case 1 and case 2) we can conclude that we are not compelled to suppose that the two firms distribute all of their returns. In other words we can make arbitrage process merely by considering that the overpriced firm (levered firm L in the first case and unlevered firm U in the second case) has a payout ratio PR which is not restricted to be 100% of the earnings.

3. The Empirical Analysis

The previous part of this paper provides a new extension of the relationship between firm value and capital structure when the firm has a payout policy. In this section, we attempt some possible empirical tests. The central issue is, whether or not the leverage ratio affects firm value when earnings are not fully distributed?.

Modigliani and Miller (1958) have taken two samples of 43 electric utilities during 1947-1948 and 42 oil companies during 1953. The data are provided respectively by two studies conducted by *Allen (1954) and Smith (1955)*; and they estimated the weighted average cost of capital (wacc) according to the financial leverage of the firm. The regression form of the model was:

$$WACC = a_0 + a_1 Leverage + \varepsilon \tag{13}$$

Where wacc is the weight cost of capital approximated by X/V, here X is the expected return net of taxes, V is the market value of all securities and the financial leverage of the firm measured by the ratio D/V, where D is the market value of Bonds and preferred stock. The results of the tests (as shown MM (1958page 282) are favourable to *Modigliani and Miller (1958)'s* hypothesis. The values of the correlations coefficients are small and not statistically significant. *Weston (1963)* criticizes *Modigliani-Miller* empirical result. In particular, he assumes that the lack of effect of capital structure on the overall value of the firm is due to deficiency of the approach to take account of other factors that may be influencing the firm's cost of capital. Contrary to MM, the author shows in the empirical tests that leverage is correlated negatively with firm value in the presence of the hypothesis of earnings growth.

3.1 Data and Methodology

In order to conduct an empirical analysis similar to MM's, we have collected data on the same sectors from the same country as done by *Modigliani and Miller 1958*. The data we use are annual standardized financial information of US firms observed in the period 1990-1998. Our sample is formed by two sub samples: from the Electric sector we use 256 companies, and from the oil sector we take 223 companies. These data were obtained from the Worldscope Database (SIC Code 13 and 49). Contrary to Weston (1963), we consider the hypothesis of risk-class can be verified in the oil industry and the electric sector (as supposed by MM 1958).

According to MM (1958), a linear model was constructed to explain the relationship between leverage and the firm value. The variables used in our regressions are constructed (see Table 2) as the same way as presented by these authors. The corresponding models used by MM(1958) are: For Model 1 :see MM(1958) page284 (note 38), for model 2,see MM(1958) page282;   For Model 3,see MM(1958) page284 (note 39). With regard to the basic capital structure irrelevance theorem to be estimated; we propose three regressions models as follows:

$$Model\ 1:\ Value_{ij} = f + g\ ER_{ij} + h\ DR_{ij} + v_{ij} \tag{14}$$

$$Model\ 2:\ WACC_{ij} = a + b\ Leverage1_{ij} + \varepsilon_{ij} \tag{15}$$

$$Model\ 3:\ WACC_{ij} = c + d\ Leverage1_{ij} + e\ ML1_{ij} + u_{ij} \tag{16}$$

Where wacc is the weighted average cost of capital; Leverage 1: first measure of leverage; ML1: modified leverage 1; Value: the ratio of the firm value; ER: earnings ratio; DR debt ratio.

The purpose of model 1 is to test the effect of leverage (as measured by Debt ratio DR) on firm value, while the Model 2 and model 3 test the effect of leverage (measured by Leverage1) on the cost of capital (measured by WACC). The variable ML1 (modified leverage 1) is included in model3 to test the U-shaped hypothesis that the coefficient e of this variable should be significant and positive to confirm the traditional view, and not significantly different from zero to confirm the irrelevance theorem. Note also that according to our approach the correlation between these variables should be different from zero.

To test the validity of the MM's proposition when earnings are not fully distributed, we alternatively estimate all the above regressions in the absence (model *MM58* and the model *MM58supp*) and the presence of the payout ratio. We validate this last alternative in two steps: In the first step, we test the models for all firms (model *MMExt)*. In the second step, we test the models for subsamples: First Quartile sample (Firm's Payout ratio is less than 25%), Second Quartile sample (firm's payout ratio is between 25% and 50%), Third Quartile sample (firm's payout ratio is between 50% and 75%), and Fourth Quartile sample (firm's payout ratio is more than 75%). The Table 2 below reports the different measures of variables and their predicted effects.

[Insert Table 2 here]

3.2 Descriptive statistics

As indicated in Table 3, the descriptive statistics shows that the average value of cost of capital is 5.92% for electric utilities and 4.48% for oil companies (note 2). On average, we have a leverage ratio of 51.79% (37.85%), this measure is 62% (50.2%) when we use total assets as deflator. The average firm has a value ratio of 1,38 for electric utilities which is much weaker than those of oil companies (1,99). For these firms, earnings ratio ranges from 0% to 2.7% for electric utilities (0% to 66% for oil companies). In terms of net income, the average value of payout is more important for electric utilities (45%) ranging from 0% to 99,9%, than those of oil companies (16%). These results show that the division of the stream between cash dividend and retained earnings in any period is not a mere detail as supposed by Modigliani and Miller (1958 page 266). None of firms in the two samples and during the whole period (1990-1998) has distributed the totality of its income. For the normal distribution of the series around the mean (see table 3), all of the distributions of the variables are not symmetric since their skewness values are different from zero. This conclusion is also verified by the values of the Kurtosis which are quite different from 3.

[Insert Table 3 here]

3.3 Test of the effect of Leverage on the firm value (model 1)

The MM (1958)'s theorem is confronted with our hypothesis in order to know the crucial effect of payout ratio on the sensitivity of firm value to leverage. If our prediction is true, we should find a significant coefficient of leverage ratio, otherwise the MM's view should be confirmed. As indicated in Table 4, estimates result shows that coefficients of earning ratio (ER) and debt ratio (DR) are significantly different from zero, which fails to support the MM's view. Since our results, as presented below, demonstrate that the coefficient of debt ratio is significantly negative and contrary to the traditional view. We prefer to give more clarifications of this

relationship based on the presence of the payout policy. The latter has a negative influence on the two samples (see Model MMExt, Table 4) which is in the opposite direction as obtained by the cost of capital regressions (see table5). There are two main explanations for this result: (1) According to Brigham and Gordon (1968), the relationship between stock price and leverage depends on the association between R (return on assets and investment) and i (the rate of interest which the firm pays on its debt), not on the level of Leverage L. when R is less than i, the leverage effect on stock price P will be negative. Furthermore, the negative influence of the dividend ratio on the firm value confirms the leverage impact when the return on investment is less than the cost of debt. This means that firms experiencing lower rate of investment tend to use funds from internal and external resources to display higher payout ratio. (2) The leverage measure is not the same: in Wacc regression, this variable is measured by debt on firm value (D/V), while in firm value regression (Value), the debt ratio is measured by debt on total Assets (D/A). The fact that both variables are divided by differents deflators may be affected by a random disturbances of the market value of the firm. This bias correlation is not observed in the firm value regression.

According to Modigliani and Miller (1958), the constant term in the previous regression should give more information on the value of the unlevered firm. As shown in Table 4 below, the estimated coefficient of this variable is not only significantly different from zero, but is quite positive and greatly relative to the coefficient of the debt ratio. This conclusion is confirmed for the two samples with large values for the oil companies.

[Insert Table 4 here]

3.4 Test of the effect of leverage on the cost of capital (model 2 and Model 3)

According to Modigliani and Miller's proposition I: "the average cost of capital Wacc (X^t/V) should tend to have the same value independently of the degree of leverage" MM (1958, page281). In other words, the leverage's coefficient parameter in the Wacc regression should be insignificant and statistically equal to zero. The results of the MM model tests are shown in table 5 (models: MM58 and MM58supp). According to this table, the MM hypothesis is only verified in the oil sample, while leverage in the electric utilities has a negative and significant effect (coefficient is equal -0, 1162) on the cost of capital. In accordance with MM model, the fact of adding another measure in the WACC regression (ML1 in MM58supp)) is clearly favourable to MM hypothesis. The coefficients of leverage 1 in the two samples are close to zero and not significant(-0.056 for electric sample and 0.021 for oil firms). While, the modified leverage ML1 is significant and negatively correlated with the cost of capital (respectively -0.013 and -0.009 for electric and oil firms). This result is the same as obtained by Modigliani and Miller (1958 page 284 note 39) where they interpret it as the reverse of the traditional view.

When we introduce the hypothesis of payout as not fully distributed in the previous analysis, the correlation between leverage 1 and the cost of capital is significantly negative and quite different from zero (The results of these tests are shown in table5, see Model *MMExt,*). This result is consistent with our hypothesis (we expect a significant influence of leverage on the cost of capital) and contradicts the validity of the irrelevance theorem. Furthermore, this result is confirmed in six out of eight tests conducted on the sub-samples: First Quartile, Second Quartile, Third Quartile and FourthQuartile.

Unlike *Modigliani and Miller (1958)*, dividend policy is an important factor that explains the relationship between leverage and the firm's cost of capital. The estimations provide evidence for a decreasing cost of capital as the leverage ratio increases. It is significant to note also that according to Modigliani and Miller (1958), the constant terms of the regressions equations are measures of the cost of capital of Unlevered firms in the same risk-class. The estimates for the electric utilities and oil companies show that these costs are close to an accepted critical rate.

Additional tests were also conducted to assess the relevance of the variable ML1, which is supposed to take into account the curvilinear effect of the leverage on the cost of capital. Our results suggest (table 5) that the U-shaped relationship between these variables is not observed and the data provide no evidence of the traditional view. Although the variable ML1 has the same sign as indicated by MM(1958 page 284), the tests show that for both industries the coefficients are significantly different from zero.

[Insert Table 5 here]

According to our results (see table 5), when dividend payout ratio is different from 100%, the cost of capital (wacc) should vary significantly with the ratio of financial structure as measured by D/V. This relationship tends to be linear and with negative (or positive) slope. The analysis of the evolution of the debt ratio coefficient for each level of payout shows that the company should not remain indifferent to the choice of financial structure (Table 5). Based on the firm's payout policy, it is possible to minimize the cost of capital through a judicious

adjustment of capital structure. The results of the estimations of these variables show that the company can borrow (both sectors) when the payout is low (PYR <0.25) or High (PYR> 0.75), while a moderate policy of dividend (0.5 <PYR <0.75) leads us to analyze the risk of the firm. In fact, when firm's risk is low (like electric utilities), financing projects with debt is advantageous for shareholder wealth. However, if the level of risk is higher (like oil companies), borrowing is not beneficial and the firm should seek another cheaper financial instrument than debt.

In addition to the previous theoretical and empirical results, it is possible to summarize our findings as showed by Table 6. This Table also compares our approach (partial payout model) with the MM's capital structure irrelevance model (full payout model).

[Insert Table 6 here]

4. Concluding Remarks

This paper has provided theoretical and empirical evidence of the importance of payout policy in explaining the relationship between leverage and the firm value. MM's capital structure irrelevance theorem implicitly and artificially uses the assumption 100% FCF payout, thereby forcing firms to consider only among payout ratios which distribute all the income available for the stockholders in every period. This constraint means that shareholders are indifferent towards dividends and retained earnings and leads to the absurd conclusion that common stock must always sell at book value.

The theoretical part of the paper constitutes a new extended proof of the MM theorem by relaxing the hypothesis of earnings as fully distributed. We have shown that it is possible to verify the theorem when we suppose an investor who exchanges his initial holding by a mix of consumption and investment in another portfolio. The proof shows that we are not compelled to suppose that the two firms distribute all of their returns. As a consequence, we can make an arbitrage process merely by considering that unlevered (or levered) firm has such payout ratio.

In the empirical analysis, the paper tested the MM theorem after allowing earnings as not fully distributed. Estimates results show a correlation coefficient between firm value and leverage statistically significant, different from zero and fails to support the MM's view. The downward sloping part of the linear relationship between the cost of capital and leverage depends on the level of the payout ratio adopted by the firm.

The limitations of this study should again be emphasised. In the empirical analysis, we did not rely on variables related to market imperfections to test the robustness of our results, but simply proposed a model to test the validity of the MM's view and to show the importance of the payout policy in resolving the capital structure puzzle. Still, we believe that our approach may give some useful ideas for further research. As MM(1958 page 296) conclude *" having served their purpose they can now be relaxed in the direction of greater realism and relevance, a task in which we hope others interested in this area will wish to share"*.

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Notes

Note 1. As Modigliani (1989) notes « The MM paper is unquestionably the most popular of my writings, primarily because it has been, and continues to be, required reading for many graduate business schools. » Modigliani.F (1989) p149-158.

Note 2. As DeAngelo and DeAngelo(2006, page 294) wrote **"** When MM's assumptions are modified to allow retention with the NPV of Investment policy fixed, a firm can reduce its value by paying out less than the full present value of FCF, and so Payout policy matters and Investment policy is not the sole determinant of value ".

Note 3. The extreme values (very low or very high) obtained from descriptive statistics are due to the proxy used in the study. According to MM (1958), we have measured the cost of capital by dividing earnings on the firm value.

Table 1. The irrelevance of the MM capital structure irrelevance when payout ratio is different from 100%

	First possibility : $V_L > V_U$	Second possibility : $V_U > V_L$
First stage the initial return of the investor Y_L	$Y_L = aPR_L (X - rD)$	$Y_U = aPR_U \, X$
Second Stage: Arbitrage process	- Sold his initial worth of the firm L - Borrows an additional amount d_L with the same interest rate r - Acquired new shares of the firm u	sold his initial worth of the firm U Acquired new shares of the firm L Acquired new bonds b of the firm L
Third stage: the return of the investor Y_U	$Y_U = \dfrac{(s_L + d_L)}{S_U} PR_U X - r\, d_L$ $= \dfrac{a V_L}{V_U} PR_U X - raD$	$Y_L = \dfrac{s_L}{S_L} PR_L (X - r\,D) + b$ $= a \dfrac{V_U}{V_L} PR_L (X - r\,D) + a \dfrac{V_U}{V_L} rD$
Final stage: Difference of earnings $\Delta Y = Y_U - Y_L$	$Y_U - Y_L = a\,X \left[PR_U \dfrac{V_L}{V_U} - PR_L \right]$ $+ raD \left[PR_L - 1 \right]$	$Y_L - Y_U = a\,X \left[PR_L \dfrac{V_U}{V_L} - PR_U \right]$ $+ a \dfrac{V_U}{V_L} r\,D \left[PR_L - 1 \right]$
Interpretations	\multicolumn{2}{c}{It is not possible to verify the MM results when we introduce the hypothesis of payout ratio different from 100%, the difference of returns will depend on the all components of the equation. When we pose $PR_L = PR_U = 1$, it is easy to obtain the same difference of returns as MM(1958): $Y_U - Y_L = a\,X \left[\dfrac{V_L}{V_U} - 1 \right]$ or $Y_L - Y_U = a\,X \left[\dfrac{V_U}{V_L} - 1 \right]$ }

Using the MM formulation, we consider two firms L and U, for which the expected return is the same $X_L = X_U = X$. Company U is financed entirely by stock S_U and company L by stock S_L and debt D. The market value of each firm is then $V_U = S_U$ and $V_L = S_L + D$, We denote PR_L and PR_U the payout ratios of the levered and unlevered firms (MM 1958 suppose $PR_L = PR_U = 100\%$ all expected return is distributed). $s_L = \alpha\, S_L$, $s_U = \alpha\, S_U$ denote the value of shares owned respectively by an investor in the levered and unlevered firm with a fraction α

Table 2. Measures of variables and predicted signs

Variables	Symbol	Measure	MM Hypothesis	Our Hypothesis
Dependants variables				
- Weighted average cost of capital	WACC	X/V		
- Firm value ratio	Value	V/A		
The explanatory variables				
First measure of leverage	Leverage 1	D/V	Zero effect	Significant effect
Modified Leverage 1 measure	ML1	D.D/V.S	Zero effect	Significant effect
Earnings ratio	ER	X/A		
Debt ratio	DR	D/A	Zero effect	Significant effect
Payout ratio	Payout	Div/NI	Not tested	Significant effect

The table reports the different measures of variables where V: firm value= market value of equity S +market value of debt D, X: Earnings before interest and Taxes (EBIT), A: is the value of the total assets, NI net income. ML1 modified leverage 1 measure = $(D/V)^2/(1-D/V)$. We measure the value of the Debt D by the amount of total liabilities.

Table 3. Descriptive Statistics of Variables (256 Electric Utilities and 223 Oil Companies)

Variables	Sample	Mean	Minimum	Maximum	Std. Dev	Skewness	Kurtosis	Obs
WACC	Elect	0.05924	0.00000	0.29090	0.03188	0.292328	6.376099	2304
	Oil	0.04481	0.00000	0.69582	0.05448	4.75993	42.0526	2007
Leverage1	Elect	0.51796	0.01573	0.99416	0.17873	-0.46925	3.36365	2304
	Oil	0.37857	0.0000	0.98237	0.21714	0.20952	2.36431	2007
Value	Elect	1.38155	0.09087	9.77112	0.82268	5.51989	45.7871	2304
	Oil	1.99172	0.14447	138.56	5.40308	18.7716	397.615	2006
ER	Elect	0.07353	0.0000	0.027612	0.04158	0.77790	7.94274	2304
	Oil	0.06418	0.0000	0.664303	0.06683	2.104262	11.546	2007
DR	Elect	0.62322	0.02761	0.995066	0.14891	-0.9991	4.78983	2304
	Oil	0.50220	0.0000	0.9978	0.22065	-0.2593	2.4847	2006
ML1	Elect	1.34913	0.000252	169.346	6.6480	17.3645	344.950	2304
	Oil	0.61298	0.0000	23.2454	1.5346	8.6309	103.96	2006
Payout	Elect	0.45169	0.00000	0.99980	0.35978	-0.15569	1.40417	2304
	Oil	0.16381	0.0000	0.9991	0.27721	1.50967	3.90646	2006

Table 4. Directs Pooled Least-Squares Estimates of the effects of leverage on the firm value

$$Value_{ij} = f + g\,ER_{ij} + h\,DR_{ij} + v_{ij}$$

Regressions	Sample	Constant	ER	DR	Payout	AdR²	Obs
			Coefficients of				
MM 58	Elect	1.893[a]	-0.158[a]	-0.805[a]	-	0.025	2304
	Oil	2.464[a]	-6.730[a]	-0.668	-	0.048	2007
MM Ext	Elect	1.963[a]	-0.131[a]	-0.466[a]	-0.625[a]	0.095	2304
	Oil	2.465[a]	-6.703[a]	-0.642	-0.086	0.048	2007
First Quartile	Elect	1.969[a]	-0.133[b]	-0.412[c]	-	0.005	801
	Oil	2.342[a]	-7.490[a]	-0.286	-	0.052	1440
Second Quartile	Elect	1.465[a]	2.650[a]	-0.554[a]	-	0.187	216
	Oil	1.659[a]	-0.197	-0.501[a]	-	0.033	279
Third Quartile	Elect	1.206[a]	1.823[a]	-0.249[a]	-	0.096	738
	Oil	1.224[a]	3.229[a]	-0.055	-	0.113	207
Fourth Quartile	Elect	1.080[a]	1.809[a]	-0.105	-	0.102	549
	Oil	7.197[a]	0.983	-9.064[a]	-	0.676	72
a, b and c indicate significance at the 1%, 5%, and 10% levels respectively.							

Table 5. Directs Pooled Least-Squares Estimates of the effects of leverage on the cost of capital

$$w\,a\,c\,c_{ij} = c + d\ L\,e\,v\,e\,r\,a\,g\,e1_{ij} + e\ M\,L1_{ij} + u_{ij}$$

Regressions	Sample	Constant	Leverage1	ML1	Payout	Adj.R²	Obs
MM 58(model1)	Elect	0.117[a]	-0.116[a]	-	-	0.006	2304
	Oil	0.020[a]	-0.018	-	-	0.0003	2007
MM 58 Supp(model 2)	Elect	0.098[a]	-0.056	-0.013[b]	-	0.007	2304
	Oil	0.011	0.021	-0.009[a]	-	0.007	2007
MM Ext (model 1with dividend payout ratio)	Elect	0.111[a]	-0.156[a]	-	0.059[a]	0.012	2304
	Oil	0.014[a]	-0.050[a]	-	0.107[a]	0.042	2007
First Quartile	Elect	0.142[a]	-0.236[a]	-	-	0.014	801
	Oil	0.019[a]	-0.064[a]	-	-	0.008	1440
Second Quartile	Elect	0.053[a]	0.006	-	-	0.001	216
	Oil	0.003	0.110[a]	-	-	0.033	279
Third Quartile	Elect	0.083[a]	-0.026[a]	-	-	0.012	738
	Oil	0.045[a]	0.018	-	-	0.002	207
Fourth Quartile	Elect	0.093[a]	-0.038[a]	-	-	0.031	549
	Oil	0.136[a]	-0.196[b]	-	-	0.052	72

a, b, and c indicate significance at the 1%, 5%, and 10% levels respectively.

Table 6. Capital structure irrelevance theorem: Full versus Partial payout Models

	Irrelevance Model MM(1958) : *(Full Payout Model)*	Our Extension of MM's Model: *(Partial Payout Model)*
Main conclusion	Capital structure is irrelevant only with a full payout ratio condition.	Pay-out ratio plays a crucial effect in explaining the relationship between capital structure and firm value.
Key Assumption for capital structure Analysis	Arbitrage model with perfect market conditions.	Arbitrage model with perfect market conditions.
Implied restrictions	Firm is restricted to choose among payout policies that which distributes all feasible earning.	Firm is not compelled to distribute all earnings as dividends.
Characteristics of capital structure Analysis	- Investment in shares and Bonds. - Borrowing	- Investment in shares and Bonds. - Borrowing - Consumption
Empirical tests and results	Correlation between firm value and leverage is not significantly different from zero	Correlation coefficient between firm value and leverage is statistically significant