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FINANCIAL POLICIES AND THE COST OF CAPITAL

The purpose of the present article is to verify the two hypotheses on the effect of debt and dividend policies of a firm on its market value and cost of capital, proposed by Professors Franco Modigliani and Merton H. Miller. These two are verified within the framework of Miller-Modigliani econometric model of 1966[1]. Cost of capital estimates are also provided for the period covered.

This is a continuous cross section analysis covering the period 1960-65. 38 companies are selected from the Indian Electric Utility Industry; source of data is Bombay Stock Exchange Official Directory.

Market value of a levered firm has been expressed by Miller and Modigliani (hereafter MM) as:

$$V = S + D + P = \frac{\overline{X}(1-\tau)}{\rho} + \tau D \qquad \ldots (1)$$

where

V = is the sum of the market values of all the securities of the firm;

S = is the market value of equity;

D = is the market value of debt;

P = is the market value of preferred stock;

$\overline{X}(1-\tau)$ is the expected level of after tax average annual earnings;

$1/\rho$ is the market's capitalisation rate for the expected value of uncertain pure-equity earnings stream of the type characteristic of the class (equi-risk class); and

τ is the (constant) marginal and average rate of corporate income tax.

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1 Miller, Merton H. and Modigliani, Franco: 'Some Estimates of the cost of capital to the Electric Utility Industry, 1954-57', American Economic Review, LVI, June 1966, pp. 333-91

Equation (1) mentioned above states that the advantage from debt is only to the extent of corporation income tax rate since debt carries with it only tax advantages. With this advantage, of course, the market value of a firm (and also its cost of capital) becomes a function of its financial policy. 'To see the precise nature of the dependence, let dS° . . . . stand for the change in the market value of the shares held by the current owners of the firm ; dS^{n} the value of any new equity issued ; dP = the value of any new preferred stock issued; and dD = the value of any new tax-deductible debt issued, with $dS^{n} + dP + dD = dA$[2] and dA is the purchase cost of the assets acquired. From Equation (1) above it follows that :

$$\frac{dV}{dA} = \frac{dS^{\circ}}{dA} + \frac{dS^{n}}{dA} + \frac{dP}{dA} + \frac{dD}{dA} = \frac{dS^{\circ}}{dA} + 1$$

$$= \frac{d\bar{x}(1-\tau)}{dA} \cdot \frac{1}{\rho} + \tau \frac{dD}{dA} \quad \ldots \quad (2)$$

From Equation (2) it follows that the cost of capital on a tax-adjusted basis is

$$C = \rho \left(1 - \tau \frac{dD}{dA} \right) \quad \ldots \quad (3)$$

since $\frac{dS^{\circ}}{dD} \geq 0$ if, and only if, $\frac{d\bar{x}(1-\tau)}{dA}$ is equal to or greater than the right hand side of Equation (3).

By introducing the long-run average proportion of debt and equity capital in the firm's future programme of financing into equation (3), the average cost of capital can be obtained, which is the relevant cost for investment decision. If this proportion of debt is denoted L, then the average cost of capital can be expressed as

$$C = C(L) = \rho(1 - \tau L) \quad \ldots \quad (4)$$

Equation (4) above states that a firm's value depends on its earnings stream and its appropriate discount rate and the tax advantage from debt capital. In the matter of cost of capital MM say that ' ... while the definition of cost of capital has become a good deal complex as a result of the introduction of corporate income taxes, the problem of estimation remains essentially the same. It

2 Miller and Modigliani, ibid, p. 341.

still involves only the estimation of a single capitalisation rate—in this case $1/\rho$, the capitalisation rate for unlevered pure equity streams in the class. The difference between the cost of equity and debt capital introduces no new difficulties because the cost of debt capital does not depend on the market rate of interest on bonds but only on the above capitalisation rate and the tax.' [3]

Cost of capital expression given in Equation (4) above helps in comparing the cost according to the original proposition No. 3 of Modigliani and Miller (1958) (See reference No. 2 at the end), according to which the relevant cost for investment decisions for any company—levered and unlevered—is ρ only. Now, with the acceptance of tax advantage from debt, the relevant cost of capital becomes less than ρ, a concept useful for the entire class. Should the coefficient for the debt variable turn out to be more than the tax rate implying advantages other than the tax advantage, the relevant cost of capital then will be still lower.

Should the coefficient for the debt variable turn out to be much more than the tax rate, which result supports the traditional view on leverage as against MM's, the cost of capital expression can readily be adjusted to incorporate this. Such an expression can be given as

$$C = \rho\,(1 - aL) \qquad \ldots \quad (5)$$

where 'a' is the coefficient for the leverage variable, in a valuation equation with $a > \tau$.

Incorporating other variables influencing value like size and growth rate and appropriately deflating with the size factor (T=Total assets) to reduce heteroscedasticity, the following valuation equation can be arrived at : [4]

$$\frac{V - \tau D}{T} = a_1 \frac{\bar{X}^{\tau} - \tau \bar{R}}{T} + a_2 \cdot \frac{1}{T} + a_3 \frac{\overline{\Delta T}}{T} + u \qquad \ldots \quad (6)$$

3 Miller and Modigliani, Ibid, p. 343.

4 In order to save space the undeflated equation in non-homogeneous form (i.e. the way size variable is introduced and its explanation) is not given here as we did in our earlier papers - 'Leverage and the value of the Firm', The Journal of Finance, Vol. XXIV, No. 4, September 1969, and 'Estimates of cost of Capital to the Indian Engineering Industry, 1962-65', The Yorkshire Bulletin of Economic and Social Research, Vol. 21, No. 2, November, 1969.

where

$V - \tau D$ is the value of the firm adjusted for the tax advantage from debt;

$\bar{X}^{\tau} - \tau \bar{R}$ Is the expected level of after tax average annual earnings;

$\overline{\triangle T}$ is the 5-year linear average growth rate of total assets times total assets in the current year;

u is random disturbance term; a_2 gives the influence of size on value; and T, the deflator, is Total Assets.

HYPOTHESIS TESTING

Leverage Hypothesis :

Should the coefficient for the leverage variable of a valuation equation emerge not significantly different from the corporation income tax rate, MM's hypothesis on leverage that debt has only tax advantage gains support; if it turns out to be significantly higher than the corporation income tax rate it could be said then, that the data are consistent with the traditionalists' view that debt has non-tax advantages ALSO. Equation used to test this hypothesis is

$$\frac{V}{T} = a_1 \frac{\bar{X}^{\tau} - \tau \bar{R}}{T} + a_2 \frac{1}{T} + a_3 \frac{\overline{\triangle T}}{T} + a_4 \frac{D}{T} + a_5 \frac{P}{T} + u \quad \cdots \quad (7)$$

where all the terms are as defined earlier; D is the market value of debt; and P is the market value of preferred stock[5] Tax advantage from debt is not impounded in the dependent variable in the above equation.

Dividend Policy Hypothesis :

On the dividend policy hypothesis of MM and their argument of 'informational content' of dividends, the question is whether dividend policy has an independent effect on value; or all that dividend policy does is to provide information about expected earnings only. MM

5 Preferred stock coefficient has emerged insignificant and hence eliminated from the explanatory variable set.

propose the latter view[6] whereas the traditionalists advocate that dividend policy has an independent effect on value and hence on cost of capital. The following dividend policy variable is added to Equation (7) to test the dividend policy hypothesis. Dividend Policy variable is defined as—

$$[\ Div - \lambda\ (\bar{X}^{\tau} - \tau\ \bar{R})\ ]$$

where

Div is total dividends declared ;

λ is the sample average payout ratio in terms of $\bar{X}^{\tau} - \tau\ \bar{R}$ for the year under consideration

$$= \frac{\sum_{j=1}^{38} (Div)_j}{\sum_{j=1}^{38} (\bar{X}^{\tau} - \tau\ \bar{R})_j}$$

Equation used to test the dividend policy hypothesis is—

$$\frac{V}{T} = a_1 \frac{\bar{X}^{\tau} - \tau\ \bar{R}}{T} + a_2 \frac{1}{T} + a_3 \frac{\overline{\Delta T}}{T} + a_4 \frac{D}{T} + a_5 \frac{P}{T}$$
$$+ a_6 \frac{[\ Div - \lambda\ (\bar{X}^{\tau} - \tau\ \bar{R})\ ]}{T} + u \qquad \ldots (8)$$

Tables 1 and 2 give the results of the leverage hypothesis tests. Regression coefficients reported in Table 1 pertain to the equation in which expected earnings variable is used. Average earnings variable is used in the equation estimates of which are reported in Table 2.

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6 MM are not, it looks, emphatical on the dividend policy hypothesis. To quote MM :

> 'We hasten to add that omitting dividends is, again not a procedure we would care to recommend for general applicatton' (Miller and Modigliani Ibid, Foot Note 20, p. 347) in the same article they stated at another stage that :

> 'The picture becomes considerably more complicated, however as soon as we weaken the assumptions to allow for the present tax subsidy on capital gains and for the existence of substantial brokerage fees and flotation costs. Under these assumptions, a firm's dividend policy can, in general, be expected to have an effect on its market value though the precise amount of the effect is difficult to determine a priori (pp. 345-46).

> However, these two propositions are associated with Miller and Modigliani whose direct assertion in the case of leverage proposition and 'informational content' argument in the case of dividend policy proposition have thrown the hitherto accepted views on the defensive, current interest is, therefore, revolving round these two propositions.

TABLE 1

TWO STAGE ESTIMATES

Dependent Variable : V/T

Independent Variables	Regression coefficients and their standard errors (in parentheses)					
	1965	1964	1963	1962	1961	1960
$(\bar{X}^{\tau}-\tau\bar{R})/T$	7.690 (1.669)	6.599 (2.934)	10.470 (1.418)	9.377 (1.718)	6.864 (1.971)	9.136 (1.859)
$1/T.10^7$	—0.106 (0.089)	-0 811 (0.173)	—0.058 (0.102)	0.124 (0.047)	0.141 (0.050)	0.064 (0.056)
$\overline{\Delta T}/T$	—1.751 (0.388)	—0.059 (0.232)	—0.006 (0.010)	—0.138 (0.251)	—0.347 (0.324)	—0.194 (0.468)
D/T	0.736 (0.056)	0 810 (0.307)	0.848 (0.130)	1.138 (0.143)	0 968 (0.148)	1.118 (0.052)
R^2	0.9805	0.5580	0.9523	0.6710	0.6240	0.9418

TABLE 2

DIRECT LEAST—SQUARES ESTIMATES

Dependent Variable : V/T

Independent Variables	Regression coefficients and their standard errors (in parentheses)					
	1965	1964	1963	1962	1961	1960
$(\bar{X}^{\tau}-\tau\bar{R})/T$	7.818 (2.848)	8.406 (1.502)	7.783 (1.050)	7.258 (0.778)	6.820 (0.782)	6.999 (0.824)
$1/T.10^7$	0.074 (0.146)	0.084 (0.129)	0.103 (0.088)	0.127 (0.059)	0.166 (0.063)	0.120 (0.071)
$\overline{\Delta T}/T$	—0.027 (0.527)	0.012 (0.365)	—0.002 (0.010)	—0.100 (0.308)	—0.491 (0.349)	—0 023 (0.480)
D/T	0 947 (0.077)	0.923 (0.217)	0.981 (0.130)	1.022 (0.122)	0.948 (0.119)	1.083 (0.057)
R^2	0.9754	0.6527	0.6015	0.4481	0.5490	0.9015

Regression estimates reported in Tables 1 and 2 reveal that the debt coefficients are significantly higher than the corporation income tax rates of the respective years[7].

The average debt coefficient for the six years (in Table 1) is 0.936 with an average standard error of 0.139. The average corporation income tex rate is 38 per cent (i.e. $\tau = 0.380$).

Results on the Dividend Policy Hypothesis test are given in Table 3. The coefficients of the computed earnings as well as dividend policy variables reported in Table 3 can not be relied upon, since these two variables are extremely collinear[8] (correlation matrices revealed this). In economic investigations complete independence between the explanatory variables cannot be expected; but problem arises when they are extremely collinear. Debt and earnings variables, for example, are also related with each other since fixed commitments depend on the size of earnings. But this can be construed 'less harmful' and the size of the standard errors of the respective coefficients (in Table 1) may be taken as an indication of this.

TABLE 3

TWO STAGES ESTIMATES
Dependent Variable : V/T

Independent Variables	Regression coefficients and their standard errors (in parentheses)					
	1965	1964	1963	1962	1961	1960
$(\bar{X}^{\tau} - \tau\bar{R})/T$	28.270 (5.768)	33.250 (10.200)	−79.320 (31.180)	9.784 (2.143)	6.941 (2.368)	8.118 (2.346)
$1/T \cdot 10^7$	−0.110 (0.888)	−0.825 (0.177)	1.150 (0.426)	0.132 (0 048)	0.141 (0 052)	0.059 (0.056)
$\overline{\Delta T}/T$	−1.687 (0.371)	−0.053 (0.235)	0.012 (0.012)	−0.092 (0.254)	−0.347 (0.338)	−0.230 (4.047)
D/T	0.460 (0.177)	1.782 (0.284)	− 2 900 (1.328)	1.166 (0 146)	0.971 (0.153)	1.125 (0.052)
P/T	− 0.541 (0.543)	0.130 (0 412)	5.115 (2.026)	−0.241 (0.247)	0.019 (0.254)	0.310 (0.246)
$[Div - \lambda(\bar{X} - \bar{R})]/T$	1.429 (2 350)	2.424 (2.203)	0.873 (2.734)	0.407 (1.758)	0.113 (1.974)	−1.034 (2.252)
R^2	0.9918	0.5774	0.6937	0.6885	0.6252	0.9452

7 Effective corporation income tax rates are 25 per cent, 32 per cent, 39 per cent, 44 per cent, 48 per cent and 45 per cent for the years 1960, 1961, 1962, 1963, 1964 and 1965, respectively.

8 See for instance, J. Johnston, 'Econometric Methods', McGraw-Hill Inc., 1963 and A.S. Goldberger, 'Topics in Regression Analysis', Macmillan Co., 1968.

Earnings and dividend policy variables are extremely collinear. Five more measures, other than the one mentioned above, for the dividend policy variable were also experimented with; the same problem of collinearity was faced. Methodology[9] for the determination of the extent and location of multi-collinearity has provided testimony to this. Presence, location and severity of collinearity are identified through this methodology. These are reported in the Appendix for the year 1960 only to conserve space. Similar pattern was observed for other years also.

It could be concluded, therefore, that a satisfactory preception of the dividend policy effect, per se, on valuation demands (1) a satisfactory procedure for culling out the 'information content' of dividends without, in effect, substituting dividends with earnings; and (2) a satisfactory solution to the multi-collinearity problem.

In view of the uncertainty of the coefficient for the dividend policy variable as well as the crucial earnings variable whenever dividend policy variable is simultaneously introduced with earnings, the approach adopted in this article for the purpose of estimating cost of capital is to omit the dividend policy variable from the valuation equation. Estimates of cost of capitel so derived are reported in Table 4; these can be interpreted as applicable to companies following an average payout ratio prevalent in the industry.

TABLE 4

COST OF EQUITY CAPITAL

Year	Cost of Equity Capital (ρ) Derived From Table 1	Derived From Table 2
1960	10.945	14.257
1961	14.568	14.662
1962	10.664	13.777
1963	9.551	12.848
1964	15.153	11.896
1965	13.003	12.790

9 Methodology used for this purpose is that of Professors, Farrar and Glauber (Donald R. Farrar and Robert R. Glauber, Multicollinearity in Regression Analysis: the Problem Revisited', The Review of Economics and Statistics, February 1967, pp. 92-107).

Estimates of cost of equity capital reported in Table 4 are derived both from the coefficients of the computed earnings variable of Table 1 as well as those of the average earnings variable of Table 2.

TABLE 5

AVERAGE COST OF CAPITAL

Year	ρ (1—aL) Table 2	ρ (1—aL) Table 2
1960	9.452	10.619
1961	10.707	11.990
1962	9.752	11.252
1963	7.321	9.848
1964	11.718	9.199
1965	8.804	8.660

Since the coefficients for the debt variable are significantly higher than the corporation income tax rates of the respective years, average cost of capital (reported in Table 5) relevant for investment decisions, is derived through Equation (5) above.

CONCLUSION

Working of the supposition that more empirical evidence is better than less, which is more relevant in the Indian context, the present article verifies the two 'independence' hypotheses of Professors Modigliani and Miller on the data of the Indian Electric Utility Industry. Verification of these two hypotheses is carried out within the framework of Miller-Modigliani 1966 econometric model, since replication of a model has an important advantage in that it yields results that are readily amenable for comparison.

In the case of the leverage hypothesis the data analysed are consistent with the traditionalists' view as against MM's. The existence of an optimum capital structure—optimum resulting from deliberate management planning—is indicated. In the case of dividend policy hypothesis results obtained through the replication of

MM's 1966 model are inconclusive because of economic and econometric issues involved. Yield form equations, it is felt, have a definite advantage in this respect.

Cost of capital estimates provided in this article are not to be construed 'the' estimates since such is the nature of the problem. However, estimates derived through the valuation equation incorporating all the relevant variables affecting market value are quite likely to be lying within a narrow range of error from the 'true' estimates when compared to those derived through the simple yield measures.

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APPENDIX

Test on the Presence, severity and location of Multicollinearity

(Equation on Dividend Policy Hypothesis)

Year : 1960

MEASURES OF INTERDEPENDENCE

$X^2_{|x \cdot x|}$ [1/2 n (n−1)] = 75.5326

	X_1	X_2	X_3	X_4	X_5	X_6
F_{xi} (n−1, N−n) =	43.85	2.30	4.58	7.54	1.51	23.87

PATTERN OF INTERDEPENDENCE

Multiple R^2_{xi} on *diagonal*-Partial t_{ij} (N−n) below diagonal

	X_1	X_2	X_3	X_4	X_5	X_6
X_1	0.87					
X_2	—2.07	0.26				
X_3	—3.59	0.64	0.42			
X_4	3.92	0.32	—1.90	0.54		
X_5	1.55	0.54	1.24	—0 36	0.19	
X_6	—8.42	0.75	—1.31	1.31	0 87	0.79

N = Sample size = 38

n = Number of explanatory variables = 6

Table values : Chi-Square (0.05) = 24.99

$F_{(0.05)}$ = 2.51

$t_{(0.05)}$ = 2.04