TAX CLIENTELES AND THE MILLER MODEL WITH INCOMPLETE MARKETS

by

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(5-88)
Revision of (4-87)

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*We would like to thank Douglas Gale for discussions on this and related issues. We are grateful to the referee for many helpful suggestions. Financial support from the NSF (Grant no.: SES 8420171) for the first author is gratefully acknowledged.

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Abstract

There is some empirical evidence that high tax bracket investors hold the equity of unlevered firms while low tax bracket investors hold levered firms. It has been suggested that an extension of the Miller model can provide a theory which is consistent with this observation. However, it has been stated elsewhere that this separation arises only for some sequences of shareholder voting and trading. We show that clienteles exist irrespective of the sequence of events. However, the relationship between firm value and capital structure depends on whether a group with a tax rate equal to the corporate rate exists.

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In his presidential address to the American Financial Association [7], Merton Miller proposed a model of corporate finance integrating personal and corporate taxes. The model assumes perfect certainty, though the results also hold under either risk neutrality or complete markets.[1] Those with personal tax rates above the corporate tax rate hold equity and those with personal rates below the corporate rate hold debt. The debt-equity ratio for the economy as a whole is therefore determined by the allocation of investors across tax brackets. In equilibrium, firms must be indifferent between debt and equity for both types of securities to be issued. While marginal tax rates separate stockholders from bondholders, there are no clienteles amongst stockholders.

Because of its elegance and simplicity, the Miller model has fostered a great deal of research in corporate finance. Two works, Taggart [9] and Sarig and Scott (SS) [8], carefully analyze the Miller model in a world with risk averse investors and incomplete markets under uncertainty. Taggart argues:[2]

> . . . two distinct clienteles will emerge, one demanding that firms have no debt at all, and the other demanding that firms have as much debt as possible.
>
> If there were a number of firms in each risk class, this standoff in investor preferences could be resolved by having all firms gravitate toward one or the other of these extreme capital structures in proportion to the relative demands from the two clienteles. Any firm with an intermediate capital structure could find a market for its shares only among investors whose personal discount rates were just equal to $\underset{\sim}{R}(1 - t_c)$, so such firms would tend to disappear from the market.[3]

Sarig and Scott (SS) [8] state that Taggart's analysis cannot be used to imply the existence of financial clienteles in the real world. They reach this conclusion by rejecting Taggart's assumptions, not by finding fault with his analysis. In particular they disagree with the sequence of events he adopts concerning voting and trading. SS then argue that the received empirical results (e.g., Kim et al. [6] and Harris et al. [4]) supporting the existence of financial clienteles in capital structure are probably proxying for financial clienteles in dividend policy.

Because the two papers reach different conclusions, the existence of financial clienteles lacks firm theoretical support. In the context of a simple model, which is outlined in Section I, we first consider the case where voting precedes trading, as in Sarig and Scott. In Section II we demonstrate that clienteles of the type described in the quotation above exist.

However, we show that the relationship between the value of the firm and the amount of debt used depends on whether or not there is a group with a personal tax rate equal to the corporate tax rate. If such a group does not exist, then firm value is a V-shaped function of the amount of debt used. Those with personal tax rates above the corporate rate hold all-equity firms[4] and those with personal rates below hold firms with the maximum possible debt. Only firms with extreme capital structures exist.

On the other hand, if a group with a personal rate equal to the corporate rate does exist, then firm value is independent of capital structure as in the original Miller model. Firms with all types of capital structure may exist. Groups with tax rates above and below the corporate rate hold firms with the minimum and maximum amounts of debt respectively; firms with intermediate amounts of debt may be held by the group with a tax rate equal to the corporate rate.

In Section III we consider the case where trading precedes voting as suggested by Taggart. We show that the final holdings of investors in this case are identical to those in Section II; the equilibrium does not depend on the sequence of voting and trading.

I. The model

We posit a two-date model where financial instruments are traded at date 0 and one of n states of nature is revealed at date 1. Each state i occurs with probability π_i. All agents possess homogeneous information. There is one type of firm: each firm has profits of X_i in state i. There are a large number of these identical firms so that all are price-takers.[5]

For simplicity, firms' real investments are assumed fixed so that the only decision facing firms concerns capital structure. Following the previous literature in this area we assume that, while firms can issue any combination of equity and risk-free debt, they cannot issue risky debt. Corporate earnings at date 1 are taxed at rate τ_c and debt payments are tax deductible.

The utility function of investors can be expressed as

$$U = U(c_0, c_1) \quad \text{with } U_0, U_1 > 0 \text{ and } U_{00}, U_{11} < 0 , \tag{1}$$

where c_t denotes after-tax income or consumption at date t and subscripts denote partial derivatives in the usual way. These individuals are endowed with W_0 of the consumption good at date 0, which they use to purchase securities in the firms providing their consumption at date 1. Debt is taxed at the personal level of τ_p for those in group P whereas equity is untaxed for all groups. There are many individuals in each group so that all are price-takers.

In order to eliminate the possibility of tax arbitrage it is assumed that a firm's equity is risky for all possible debt levels. Also, short sales of equity are ruled out.

The equilibrium concept used is based on that in Allen and Gale [1], which is a development of that suggested by Hart [5]. The concept allows for the pricing of both issued and unissued securities. Given that there are many firms, the securities issued by any particular firm are negligible relative to the size of the economy as a whole. Without loss of generality, we can assume that if a security is issued, it will be widely held and each individual investing in it will hold a negligible amount. In that case, a security is valued according to the marginal utilities of consumption of those investors that hold it. Taking the securities issued by other firms as given, firms rationally conjecture that the price they would receive if they issued a security is the maximum amount that any individual would be prepared to pay for it. In equilibrium, all agents maximize expected utility taking prices for issued and unissued securities as given. All markets, including those for issued and unissued securities, clear at the prevailing prices.

II. Equilibrium with voting before trading

Sarig and Scott argue that the formation of financial clienteles is crucially dependent on the sequence of events. They present a model with the following steps:

SS1) Investors receive their initial endowments.

SS2) Investors vote on the capital structures of the firms in which they own stocks.

SS3) Investors trade to their optimal portfolios.

These three steps should occur instantaneously in a world with no transaction costs, since a delay before trading (step SS3) can only reduce utility. In a model where no investor's consumption opportunity set is affected by the decisions of a single firm, the authors conclude that shareholders unanimously vote at time SS2 for the capital structure that maximizes firm value. This result[6] is a special case of De Angelo's [2] finding that, for any decision variable, stockholders unanimously select the value-maximizing policy if no investor's consumption opportunity set is affected by the decision variable. It is also closely related to Hart's [5] results concerning unanimity.

SS stop short of mentioning what the value-maximizing capital structure is. In this section we derive the relationship between firm value and capital structure. We consider two cases. Initially, all investors fall into one of two groups. Investors in group H (group L) are taxed at the rate τ_H (τ_L) on their income from debt where

$$\tau_L < \tau_C < \tau_H. \tag{2}$$

Using arguments related to those in Kim et. al. [6], we show:

<u>Proposition 1</u>

In the case where there is <u>no</u> group with $\tau_P = \tau_C$, equilibrium involves all individuals in group H holding firms with no debt and all individuals in group L holding firms with the maximum possible amount of debt. No other firm with a different type of capital structure exists. Firms are indifferent between issuing the maximum possible debt and issuing no debt. Each firm perceives that the relationship between its value and its debt level is V-shaped.

<u>Proof</u>

The proposition is demonstrated in three steps.

(i) If no firm issues the maximum possible amount of risk-free debt, it is always worthwhile for a firm to do this. Similarly, if no firm is all-equity, it is always worthwhile for a firm to become all-equity.

Thus both firms which issue the maximum amount of debt and firms which issue the minimum must exist in equilibrium.

(ii) In order for firms with different levels of debt to exist, the value of every firm must be the same. Given this, investors in group H always strictly prefer firms with the minimum amount of debt and investors in group L always strictly prefer firms with the maximum amount of debt. Thus, in equilibrium, only firms which issue the maximum amount of debt and firms which issue the minimum amount of debt will exist.

(iii) Given (ii), the two groups' willingness to pay for firms with different levels of debt are such that in equilibrium each firm correctly perceives that its total value as a function of its level of debt is V-shaped.

These are demonstrated in turn.

(i) Let the price of risk-free debt be p_D per unit of income paid at date 1. Consider a firm with debt B, less than the maximum possible debt, B_{MAX}. The payoff in state i to the equity of this firm is $X_i - B$. The fraction, α,of the firm's shares costs αp at date 0, where p is the price of the firm's equity. Since equity is untaxed at the personal level, an investor holding the fraction, α, receives an after-personal-tax payoff of $\alpha(X_i - B)(1 - \tau_C)$ at date 1.

Suppose that initially no firm issues the maximum possible debt. If a firm were now to issue this level of debt, an individual with personal tax rate, τ_L, could buy the fraction α of the equity of the firm with maximum debt and lend D on personal account. This individual would duplicate his after-personal-payoff in the first firm if:

$$\alpha(X_i - B)(1 - \tau_C) = \alpha(X_i - B_{MAX})(1 - \tau_C) + D(1 - \tau_L)$$

or equivalently

$$\alpha(B_{MAX} - B) = D\,\frac{(1 - \tau_L)}{(1 - \tau_C)}\ . \qquad (3)$$

The firm with maximum debt could attract an individual in group L if the price of its equity, p_{MAX}, were set so that

$$\alpha p = \alpha p_{MAX} + p_D D$$

or equivalently

$$\alpha(p_{MAX} - p) = -\ p_D D\ . \qquad (4)$$

Now the value, V, of the firm with debt B is

$$V = p + p_D B\ . \qquad (5)$$

The value, V_{MAX}, of the firm with maximum debt is

$$V_{MAX} = p_{MAX} + p_D B_{MAX}\ . \qquad (6)$$

It follows from (3), (4), (5) and (6) that:

$$V_{MAX} - V = \frac{p_D D}{\alpha(1 - \tau_C)}\,(\tau_C - \tau_L)\ . \qquad (7)$$

Since $\tau_C > \tau_L$, $V_{MAX} - V$ is positive. Thus, a group L individual holding equity in a firm with less than maximum debt would pay a premium for the equity of the firm with maximum debt compared to any other firm. It follows from this that, if no firm is currently issuing the maximum possible amount of debt, it is always worthwhile for a firm to do so. Furthermore, it is easily shown in a similar way that, if no firm is currently all-equity, it is always worthwhile for a firm to become so.[7]

(ii) Part (i) implies that, in equilibrium, both firms issuing the maximum possible amount of debt and all-equity firms must exist. We now wish to show that only these extreme capital structures exist in equilibrium.

Suppose firms with debt levels B^j and B^k exist in equilibrium, where $B^j < B^k$. The prices of their equities are p_j and p_k, respectively. Since any firm would switch to the most valuable debt level, both types of firms can exist in equilibrium only if they have equal values. Hence,

$$p_j + p_D B^j = p_k + p_D B^k$$

or, equivalently,

$$p_j = p_k + p_D(B^k - B^j) \ . \tag{8}$$

Consider a person with personal tax rate, τ_P, buying the fraction, α, of firm j's equity. The cost of this portfolio is αp_j and the after-personal-tax payoff in state i is

$$\phi_i^j = \alpha(X_i - B^j)(1 - \tau_C). \tag{9}$$

An alternative strategy is to buy α shares of firm k and lend $\alpha(B^k - B^j)$ on personal account. It follows from (8) that the cost of this strategy is the same as buying α shares of firm j. The after-tax payoffs to this portfolio are

$$\phi_i^k = \alpha(X_i - B^k)(1 - \tau_C) + \alpha(B^k - B^j)(1 - \tau_P) \ . \tag{10}$$

Now

Hence, a high (low) tax bracket investor is always strictly better off buying the less (more) levered firm j. This argument, together with (i), implies that only all-equity firms and firms with the maximum amount of debt exist in equilibrium. Hence (ii) is demonstrated.

(iii) In this part, we find investors' willingness to pay for firms with capital structures not existing in equilibrium. This allows the value of a firm as a function of its debt level to be determined.

Let w* be the price at which an investor with tax rate, τ_P, would be willing to purchase a very small amount of the equity of a firm with debt B*, given that the equity of the firm which has his/her most preferred capital structure (firm with debt B) has price p. The investor's optimization problem is:

$$\max_{\varepsilon,\ \varepsilon^*,\ D} EU(c_0,\ c_1) \tag{12}$$

subject to

$$c_0 = W_0 - \varepsilon p - \varepsilon^* w^* - p_D D \tag{13}$$

$$c_1 = \varepsilon(X_i - B)(1 - \tau_C) + \varepsilon^*(X_i - B^*)(1 - \tau_C) + D(1 - \tau_P)\ , \tag{14}$$

where ε and ε^* (= 0 in the case of interest) are the demands for the equity of firms with debt B and B*, respectively, and D is their demand for debt. This gives first order conditions

$$- EU_1 p + EU_2(X_i - B)(1 - \tau_C) = 0 \tag{15}$$

$$- EU_1 w^* + EU_2(X_i - B^*)(1 - \tau_C) = 0 \tag{16}$$

$$- EU_1 p_D + EU_2(1 - \tau_P) = 0\ . \tag{17}$$

By subtracting (15) from (16) and using (17), one can show that

$$w^* = p + \frac{(1 - \tau_C)}{(1 - \tau_P)} p_D (B - B^*). \tag{18}$$

Consider first the case of investors in group H, who hold the all-equity firm. If the equity of this firm has price p_E, this group's willingness to pay is given by

$$w^* = p_E - \frac{(1 - \tau_C)}{(1 - \tau_H)} p_D B^* . \tag{19}$$

Similarly, for group L investors

$$w^* = p_{MAX} + \frac{(1 - \tau_C)}{(1 - \tau_L)} p_D (B_{MAX} - B^*) . \tag{20}$$

These results are illustrated in Figure 1. The two lines, (19) and (20), intersect at (p', B'). The prices of the unissued types of equity are given by the upper envelope of these two lines. Thus the value of the equity of a firm with debt $0 \leq B^* \leq B'$ is determined by the willingness to pay of group H and for $B' \leq B^* \leq B_{MAX}$ it is determined by that for group L. The value of debt as a function of the amount of debt used, $p_D B^*$ is shown by the dotted line. Hence the total value of a firm with debt $0 \leq B^* \leq B'$ is

$$V^* = p_E - \frac{(\tau_H - \tau_C)}{(1 - \tau_H)} p_D B^* . \tag{21}$$

For firms with debt $B' \leq B^* \leq B_{MAX}$,

$$V^* = p_{MAX} + \frac{(1 - \tau_C)}{(1 - \tau_L)} p_D B_{MAX} + \frac{(\tau_C - \tau_L)}{(1 - \tau_L)} p_D B^* . \tag{22}$$

Hence the value of the firm is a V-shaped function of the amount of debt used with the turning point at (p', B') as shown in Figure 2. This demonstrates part (iii).

In order to illustrate the type of equilibrium that arises in Proposition 1, consider the following example. Every individual's utility function is of the form:

$$U(c_0, c_1) = c_0 + 0.8 \ln c_1 . \tag{23}$$

The values for the tax rates are $\tau_H = 0.60$, $\tau_L = 0.40$ and $\tau_C = 0.50$. There are three equally-likely states with $X_1 = 1$, $X_2 = 2$ and $X_3 = 3$. Therefore, the maximum amount of risk free debt that can be issued is such that the payoff in each state is 1. For simplicity, the number of firms and the number of consumers in each group are normalized to unity.

It can be shown that, in equilibrium, the value of the equity of the firms with no debt is $p_E = 1.6$ and for firms with the maximum amount of debt it is $p_{MAX} = 0.697$. The price of debt is $p_D = 0.903$ (this is equivalent to a risk free rate of 10.7%). Thus, both types of firm have a total value of 1.6 and are indifferent between issuing no debt and the maximum possible amount. However, they perceive that the relationship between debt and value is as shown in Figure 2 so that they strictly prefer these levels of debt to any other possible capital structure. At these prices group H's demand for the equity of unlevered firms is 0.884. Hence, the proportion of all-equity firms is also 0.884 and these are held exclusively by group H. Group L demands the remaining 0.116 of firms which issue the maximum possible amount of debt. Group H borrows 0.679 of risk free debt and group L holds this and the 0.116 units of debt issued by the levered firms so their total holdings of debt are

So far it has been assumed that there are just two groups: one with a personal tax rate strictly above the corporate tax rate and one with a rate strictly below. However, it can be seen from the proof of Proposition 1 that none of the results depend on the existence of only two groups. In particular, (19) and (20) still hold. Provided there is no group with a tax rate equal to the corporate tax rate, all of the proof can be adapted to account for more groups.

The main difference is in Figure 1. For example, suppose that there are two groups, L_1 and L_2, with a personal tax rate below the corporate rate and two groups, H_1 and H_2, above. Then the willingness to pay for the equity of each group is shown in Figure 3. The two high tax bracket groups have the lines with the intercept p_E; the one with the steeper slope is for the group with the highest tax rate. Similarly for the lines for the low tax bracket groups, the line with the least slope represents the willingness to pay of the lowest rate group. As before, the perceived value of levered equity is determined by the upper envelope of these lines. This again implies that the relationship between firm value and the amount of debt issued is V-shaped.

What happens if there is an intermediate group, I, with a personal tax rate equal to the corporate rate? This group's willingness to pay is:

$$w^* = p_E - p_D B^* = p_{MAX} + p_D(B_{MAX} - B^*) \ , \tag{24}$$

which is illustrated in Figure 4. The group is indifferent between firms, no matter what their capital structure. The groups with tax brackets above τ_C have a willingness to pay as in (19) and groups below as in (20). Thus, as shown in Figure 4 the group with the same tax rate as the corporate rate determines the relationship between equity value and leverage since their willingness to pay lies above those of the other groups.

It follows that firm value is independent of capital structure as in the original Miller equilibrium. This is illustrated by the dotted line in Figure 4. People in low tax brackets hold firms with the maximum possible leverage and people in high tax brackets hold all-equity firms. Given that people with the same tax rate as corporations are indifferent between firms with all possible debt levels, it follows that firms with intermediate debt levels can exist. This gives:

Proposition 2

In the case where there is a group I with $\tau_P = \tau_C$, equilibrium involves all individuals in group H holding firms with no debt and all individuals in group L holding firms with the maximum possible amount of debt; individuals in group I may hold firms with any capital structure. Firms are indifferent between all levels of debt. Firms with any type of capital structure can exist.

Propositions 1 and 2 allow us to consider the existence of leverage clienteles empirically. In the case where no group has a personal tax rate equal to the corporate rate, all firms would have an extreme capital structure. They would either issue the maximum amount of debt or be all-equity. When a group with a personal tax rate equal to the corporate rate does exist, firms with any level of capital structure can exist but there will be clusters at the maximum and minimum levels.

As mentioned earlier, events SS1-SS3 occur instantaneously at the beginning of the period. Time passes before uncertainty is resolved at the end of the period. Given this timing of events, one would expect an "empirical researcher" in our model to measure clienteles after SS3. Thus, unanimity at the voting date is consistent with an empirical observation of financial clienteles.

Provided there are no transaction costs, the results of our one-period model carry over to a multiperiod setting. Voting occurs whenever the wealth or tax brackets of individuals are altered, implying a change in the size of the clientele groups. At each vote, all concerned unanimously support the value-maximizing capital structure. The subsequent trading of individuals should immediately result in the formation of new clienteles. However, if there are costs of trading, shareholders may not immediately adjust their portfolios. Here, although there are still clienteles, there may no longer be unanimity.

III. Equilibrium with trading before voting

We have the following sequence of events in the Taggart model:

T1) Investors receive their initial endowments.

T2) Firms make nonbinding announcements of their intended capital structures.

T3) Investors trade to their optimal portfolios.

T4) Investors vote on the capital structure of the firms in which they own stock.

As Sarig and Scott point out, the last two steps of Taggart's sequence are the reverse of their sequence. SS conclude that this reversal leads to a different equilibrium. However, we argue below that investors' holdings in the equilibrium in the SS model are the same as those in the equilibrium in the Taggart model.

In order to know how much to pay, investors at T3 must have expectations about how firms' shareholders will vote at T4. In a rational expectations condition their beliefs on the announcements firms make at T2. Then the analysis of Section II holds as before. If there is no group with a personal rate equal to the corporate rate, firms offer either the most amount of debt or the least amount of debt, being indifferent between the two alternatives. If a firm were to announce an intermediate debt level, individuals expect this plan to be carried out. They value the firm at an accordingly low level as in Figure 2.

In equilibrium, the holdings of investors and the relationship between firm value and debt level are as before. At T3 the investors in group H choose the firms which announce they will have the least amount of debt. They vote at stage T4 to confirm the announcement. Similarly, the investors in group L choose firms with the most amount of debt at T3 and then vote to confirm at T4. The equilibrium is such that everybody's expectations are fulfilled and the allocations are the same as in Proposition 1. Similarly, if there is a group whose personal tax rate is equal to the corporate rate, the equilibrium is the same as in Proposition 2. This gives:

Proposition 3

The equilibrium prices and final holdings of investors are independent of the sequence of voting and trading.

As in the previous section, it can be argued that events T1-T4 occur in quick succession so that one would expect an "empirical researcher" to measure clienteles after T4. Again unanimity at the voting date is consistent with an empirical observation of financial clienteles. Also the results extend to a multiperiod setting provided there are no transaction costs.

IV. Concluding Remarks

We argue above that an equilibrium with clienteles exists when voting precedes trading. The precise form of the equilibrium and, in particular, the relationship between firm value and capital structure depends on the existence of a group with the same tax rate as the corporate rate. If no such group exists, all firms perceive a V-shaped relationship between firm value and the amount of risk-free debt that is issued. Firms either issue no debt or the maximum amount. If a group with a tax rate equal to the corporate rate does exist, each firm perceives its value to be independent of its capital structure. Firms with all levels of debt can exist. Nevertheless, there will be clusters of firms at the all-equity and maximum level of debt since high (low) tax bracket individuals strictly prefer all-equity (maximum debt) firms.

We argue that the sequencing of trading and voting does not affect these results. As far as the empirical existence of financial clienteles is concerned, what is important is the stage at which observations are made. In SS's model there are no clienteles until stage SS3. In Taggart's model there are no clienteles until stage T4. It is likely that observations will be made after these stages.

Finally, it should be pointed out that the models have important simplifications. In particular, the assumption of risk-free debt is severely restrictive. This limits the empirical implications that can be drawn from the model. An important question for future research concerns the effect of risky debt on clienteles.

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FOOTNOTES

[1] See De Angelo and Masulis [3] for a discussion of the complete markets case.

[2] P. 654.

[3] Here, R is the taxable bond rate and t_c is the corporate tax rate.

[4] We assume that firms do not issue stock in order to invest in the riskless asset. If they did, one could view these firms as having "negative" debt. Our analysis can straightforwardly be extended to the case where the minimum amount of debt, B_{MIN}, differs from zero.

[5] The assumptions that there are only two dates and one type of firm are for ease of exposition. The results obtained below can readily be shown to hold in the case where there are many periods and many types of firms.

[6] SS's Proposition 2, p. 1463.

[7] This proof is omitted in the paper to save space.

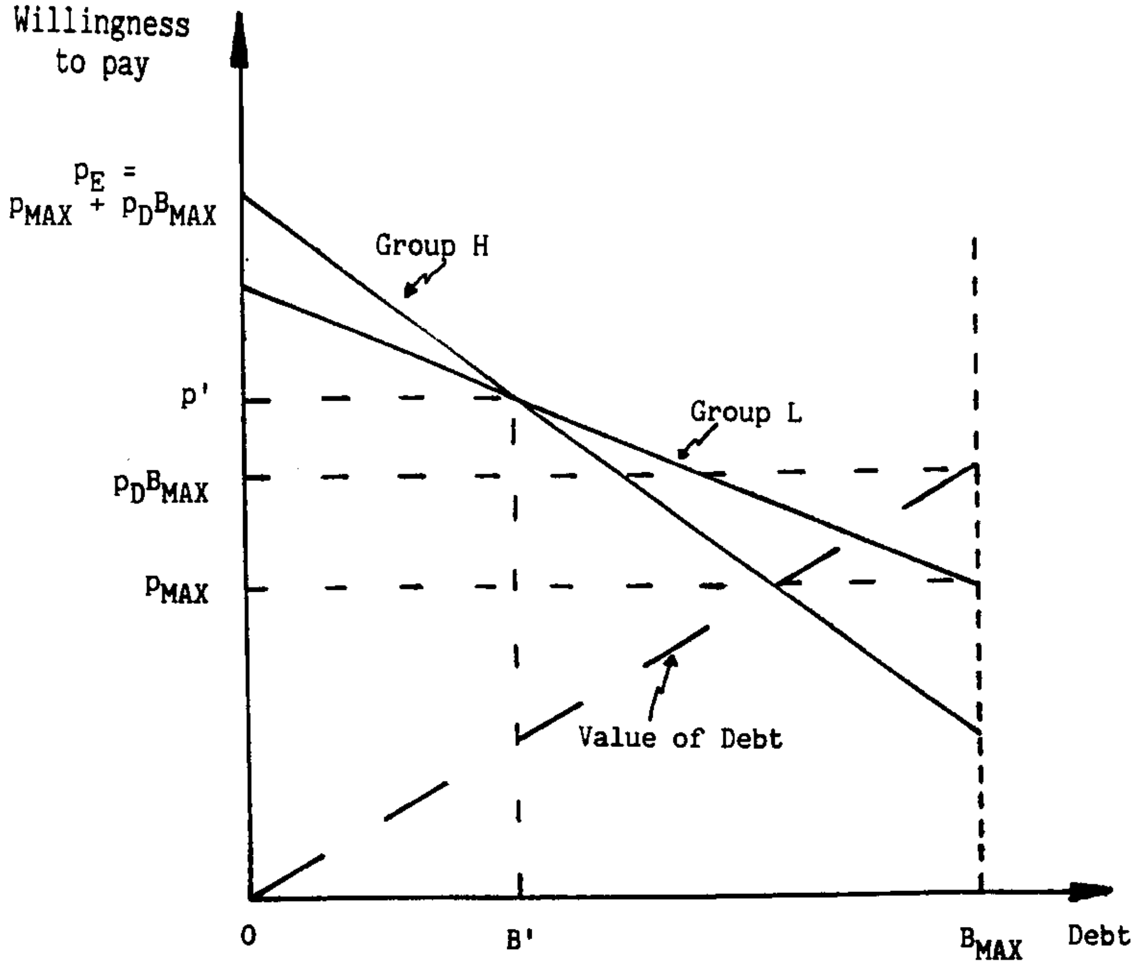

Figure 1

Willingness of Groups L and H to Pay for Equity as a Function of Debt Level

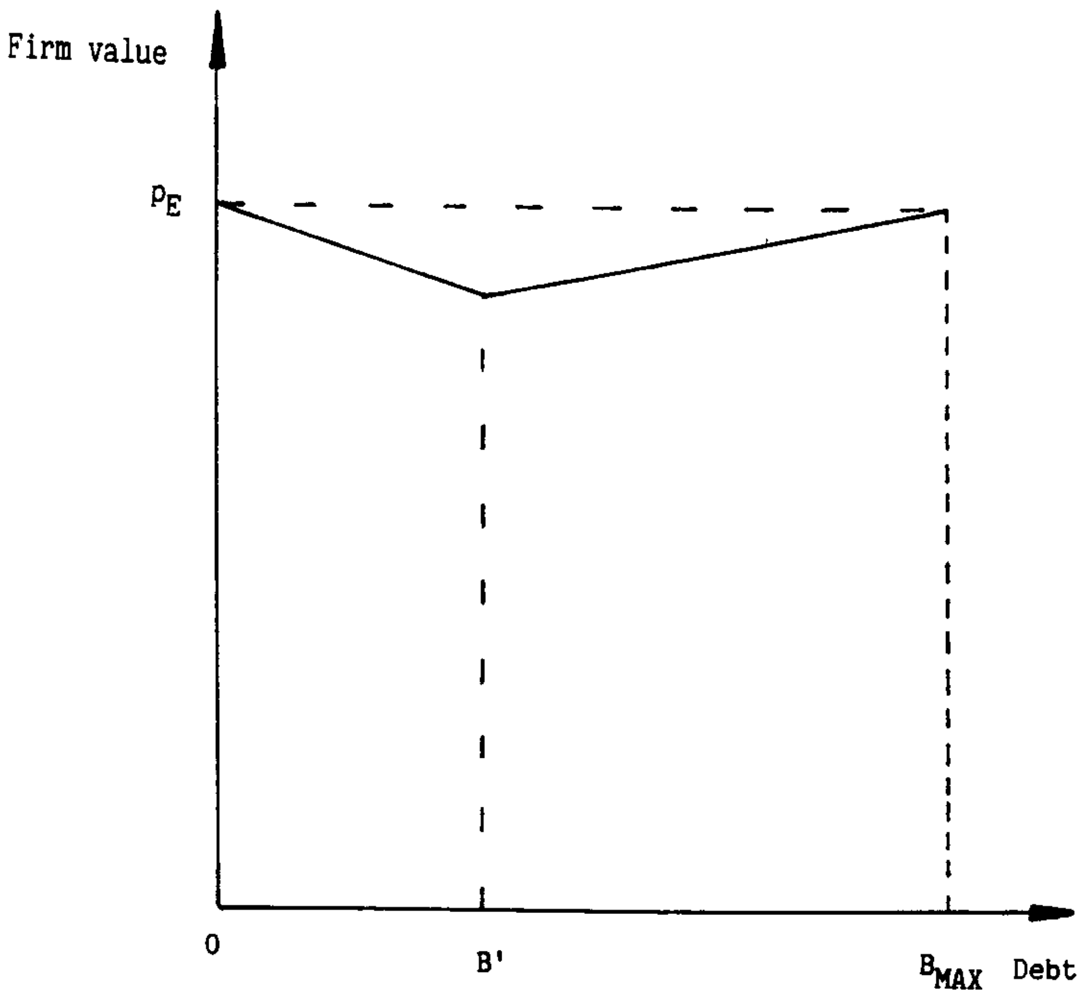

Figure 2

Firm Value as a Function of Debt Level

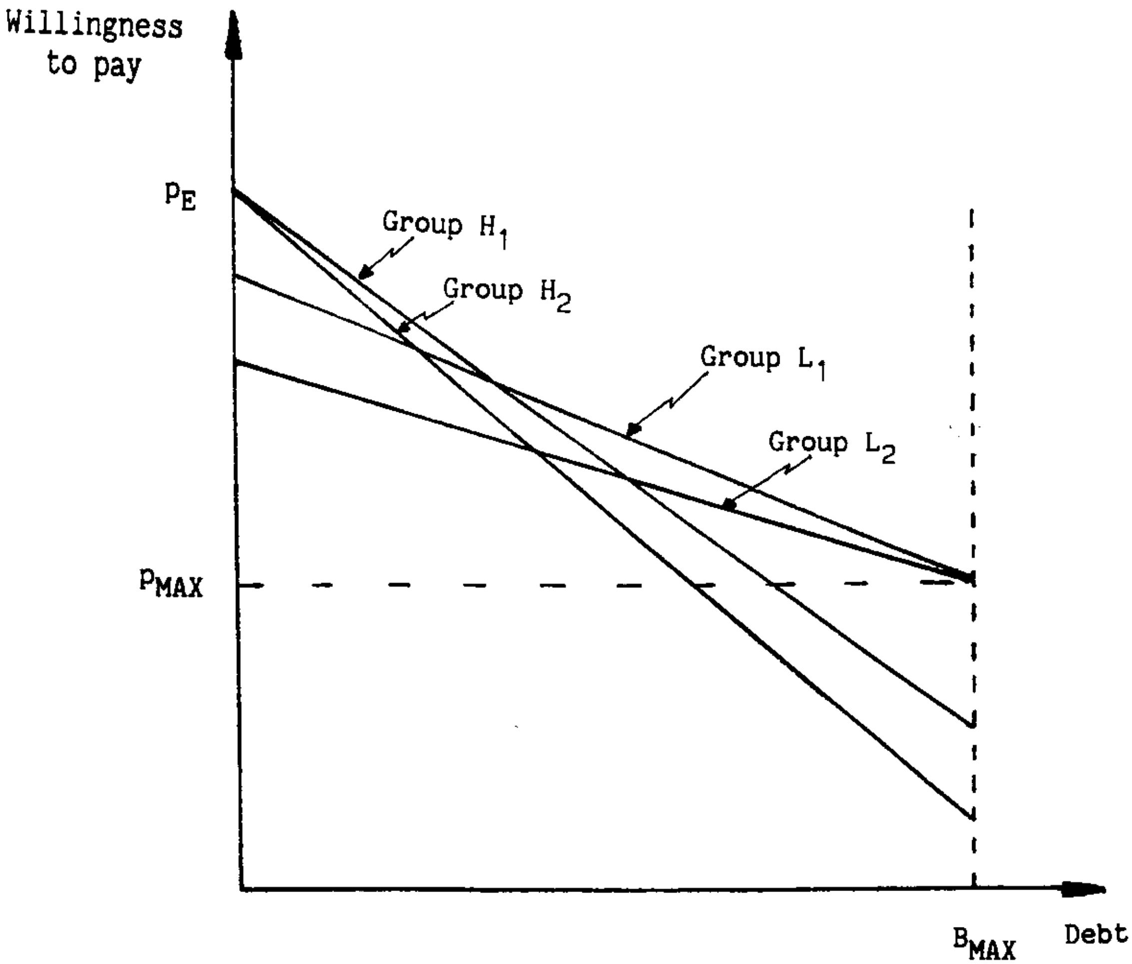

Figure 3

Willingness of Groups L_1, L_2, H_1 and H_2 to Pay for Equity

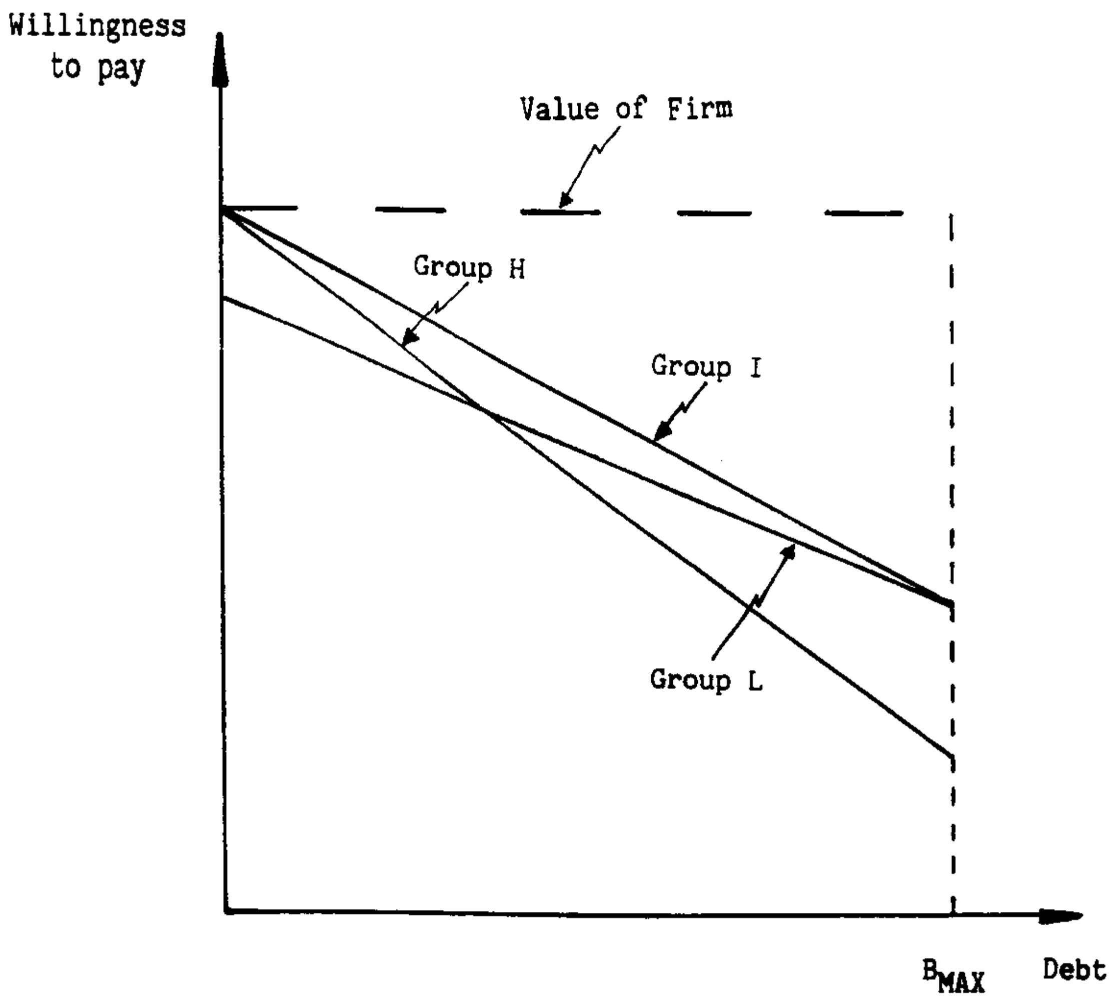

Figure 4

Willingness of Group H, Group L and Group I (with $\tau_P = \tau_C$) to Pay for Equity