Capital Structure, Investment Unanimity, and Public Goods: 
The Case for Social Responsibility

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I. Introduction:

Not long after the seminal paper by Modigliani and Miller, [12] which demonstrated that in a perfect capital market, the capital structure decision of a firm was a matter of indifference to its investors, M&M published a correction, [13] indicating that the corporate tax would impart value consequences to the choice of the corporate debt level. Since that time, the tax advantage of debt financing has occupied a central role among the marginal benefits associated with debt in so called ‘trade-off theories’. In a commemorative symposia published in the Journal of Economic Perspectives, several authors, including Merton Miller, commented on the tax advantage, its role in capital structure theory, and the fact that the predictions of the theory are not born out by either observed capital structures or the response of corporations to changes in the corporate tax code either enhancing or reducing the benefit of corporate debt. Recent empirical work, [7], indicates that the tax advantage to additional debt may amounts to a significant $.15 of extra value per dollar of debt.

There are at least two reasons why the role of taxes in the firm’s capital structure need to be understood. The first is that the classical theory of finance attempts to delineate policies which are in the best interests of the owners. In a well functioning competitive market, wealth and utility effects are related. Thus, the unutilized marginal benefit of debt may indicate that firms are not pursuing the objectives valued by owners and are not maximizing their utility. The second reason is more mundane. If actions which increase value do not necessarily increase utility, the fact that firm value depends upon debt usage means that there are market incentives to pursuing the value maximizing debt policy which firms should, but may not be able to, ignore.
This paper concentrates on the first question — is a value maximizing capital structure based upon tax shields associated with debt necessarily an optimal capital structure? In particular, can we link Pareto optimality to the capital structure decision as did a previous literature which found that value maximizing investment decisions by firms were the appropriate analogue to Pareto optimal profit maximization in the classical static model of competitive economics. Unlike preceding papers, the concepts of optimal capital structure and investment are investigated in an economy where government has a role — the provision of a public good. This public good is financed through current tax revenues and by the sale of government securities. The market value of these securities is not determined by the value of public good production to society, but rather is the present value of the claims to future tax revenue. If public good production is linked to this value, then actions by firms which affect those future revenues may have utility consequences apart from that measured by the market value of the firm. Hence, decisions which maximize market value of the firm may be neither unanimously supported nor socially optimal.

It is demonstrated that unanimous support for value maximizing capital structure and investment decisions requires the equilibrium to be tax neutral or tax minimizing with respect to that decision. This is because rational investors preferences for decisions would incorporate changes in public good output if (the present value of) taxes were to change. Alternatively, an ill structured tax system implies a linkage between firm’s decisions and public finance. This linkage operates as an externality which the value maximizing firm is unable to observe because of its concentration on after tax cash flows — hence, it generally will not infer the true societal consequences of its decisions. This implies that the ‘balancing’ theory of optimal capital structure can never represent a unanimously supported capital structure — unless its proponents are willing to argue that ‘leverage related costs’ also provide utility to investors.

If value maximizing decisions are to be Pareto Optimal (they will then be unanimously preferred), additional restrictions are placed upon the tax system. Essentially, taxes must be lump sum, or consumption based. If this is so, then no optimal decision will be motivated by taxes, and capital structure — in particular — cannot matter. If the tax system does not satisfy these criteria, then value maximization may be unanimously preferred, but is not optimal.

The paper proceeds as follows: Section II details the equilibrium process for the economy. Section III
examines the conditions necessary for unanimity with respect to capital structure and investment decisions. Section IV develops the conditions necessary for Pareto Optimal allocations in the economy, and compares them to the competitive equilibrium conditions associated with value maximizing firms. Section V examines various theories of capital structure in the light of the model. Section VI concludes the paper.

II. The Economy:

A. Overview

This section presents the basic details of the economy to be studied. Economic activity focuses on the production of a private and a public good. The first good — the private good — is produced by two risky firms (or technologies). The second good is a public good which is produced by government. At the outset, there is only a stock of the private good which could be consumed at time zero, or invested in the production of the private good to yield (private) consumption at time one, or invested in the production of a public good under the direction of the government to yield public benefits at time one. Ownership of the private good rests with the economy’s m consumers, and to acquire the necessary investment capital for production, government and the private firms must sell securities in the economy’s securities market. This section concludes with a qualitative summary of the economic equilibrium which in principle specifies the market values of the economy’s securities. The following section continue the discussion of the behavioral postulates (‘conjectural variations’) for the consumers, the firms, and the economy’s government which leads to a more complete characterization of the economy’s equilibrium

B. Markets

The securities issued by the risky firms and government are traded in the economy’s securities market. This market is ‘perfect’ — there are no associated transactions costs, access to the market is unrestricted, and information is costlessly available to all investors. This market is an ex-ante tatonnement market — no trades occur until all investors, firms, and government are satisfied with their actions at existing market prices. The functions of this market are to allow investors to trade securities for the purpose of establishing their desired portfolio (representing claims to future consumption), to allow firms and government access to the financing they need to acquire the resources which will be invested, and to establish values which help the decentralized firms to make production plans. The market values of total equity in the risky firms and
government are denoted by $S_1$, $S_2$, and $S_g$, respectively, and the market values of the private firms total debt claims are denoted by $D_1$, and $D_2$.

C. Firm Production and Financing

The firms of this economy convert the initial input of the private good, $I_j$, $j = 1, 2$, into end of period output, $X_j$, through a random production function

$$X_j = X_j(I_j, \theta_j),$$

(1)

where $\theta_j$ is a random variable.\(^7\) Equation (1) captures technological uncertainty in end of period output. Note that investment externalities are not allowed by equation (1) because output does not depend on the investment levels of other firms. Such externalities would, by themselves, lead to the failure of the decentralized market system.

Firms finance their investment by selling debt and equity securities. The security values reflect the consumption benefits to be derived at the end of the period from their ownership. The output of the firm is shared by stockholders, bondholders, and government (and possibly bankruptcy costs). The first claimant to end of period output is government. That claim to output is denoted by $\phi_j$ (the corporate tax). The structure of the tax will be described further in the following subsection under the topic of government financing and production. The second claimant to output is a single le class of bondholders who have been promised $K_j$ at the end of the period, $K_j$. Either the firm earns enough over the period to pay its obligations to bondholders or it defaults and faces bankruptcy. The end of period flow to bondholders is denoted either the promised payment, or whatever is left after settling the claims of government and any bankruptcy costs. Let $B_j$ denote the end of period payment; then

$$B_j = \min \{X_j - \phi_j - L_j, K_j\}.$$  

(2)

where $L_j$ represents bankruptcy costs which bondholders do not receive from their total claim on corporate cash flows, These bond claims are valued in the marketplace, raising $D_j$ units of capital. The residual claim to the firm end of period output is equity. Their end of period flow is\(^8\)

$$R_j = X_j - \phi_j - B_j - L_j.$$  

The remaining capital after debt financing, $I_j - D_j$, is raised from stockholders according to their initial
(fractional) ownership claims, $z_{ij}^0$. A secondary market exists for shareholders who wish to increase or decrease their ownership claim. The investment decision and the adjustment of ownership lead to a market value for the shares of $S_j$. The value of investor i’s initial claim is then $z_{ij}^0S_j$.

**D. Government**

Government’s role in the economy is to provide for the production of a public good — such as national defense. The terms of production, though not necessary in this section, are described by the production function

$$g_1 = g_1(I_g, \theta_g),$$

where $\theta_g$ is a random variable. Thus, public good production may be subject to stochastic effects.

The government begins the analysis with no wealth, and in the absence of taxes, could not finance the production of the public good. To accomplish its production goal, government institutes a consumption tax for individuals, and drafts a tax code which defines taxable income, $Y_j$, based upon the firm’s time one production, the initial investment decision, and the promised payment to bond holders, $K_j$. Thus

$$Y_j = Y_j(X_j, I_j, K_j).$$

This code establishes the tax liability, $\phi_j(Y_j)$, for each firm. These future tax revenues are the basis for the value of the claims sold by government in the securities market. Claims against government entitle the holder to a share of government revenue

$$R_g = \sum_{j=1}^{2} \phi_j(Y_j).$$

For the purposes of this section, government attempts to follow a balanced budget such that value of its securities, $V_g$ satisfies $S_g = I_g - \sum_{i=1}^{m} \phi_i$, where $\phi_i$ is any initial consumption tax (function) collected from individual $i$.

**E. Consumers**

Each of the $m$ consumer/investors begins the analysis with an initial endowment of the private good, $I_i$, and some level of initial ownership claims on the two risky firms, $z_{ij}^0$. Given the proposed investment decision of the firms and the resulting market valuations, this establishes the initial wealth of the consumer as

$$W_{i0} = I^{(i)} + \sum_{j=1}^{2} z_{ij}^0(S_j - (I_j - D_j)).$$
\[ I^{(i)} + \sum_{j=1}^{2} z_{ij}^0 (V_j - I_j), \quad (6) \]

where the second equation has resulted from the value of the firm identity, \( V_j = S_j + D_j \). The latter equation suggests correctly suggests that the investors will want firms to maximize net market value, \( V_j - I_j \), as long as actions which maximize that value do not affect the consumption opportunities of the investor. Further discussion of this important point is the topic of the next section. The preferences of each consumer over consumption bundles, \((c_{i0}, c_{i1}, g_1)\), are characterized by a cardinal utility function, \( U^{(i)}(c_{i0}, c_{i1}, g_1) \).

The objective of consumers is to construct a portfolio of claims, subject to their wealth constraint, which maximizes their expected utility. To do this, investors purchase fractional equity claims, \((z_{i1}, z_{i2}, \text{and } z_{ig})\), and fractional debt claims, \((\gamma_{i1}, \gamma_{i2})\), at prevailing market prices in the economy’s securities market subject to their wealth constraint. Investors have homogeneous expectations and behave as if:

- The investment decision of each firm and government will not be altered from its announced value.
- Their demand will have no effect on market prices.

The first assumption allows firms to extract price information from observed market values and the second assumption is the standard competitive assumption for investors.

Formally, the consumer’s problem is to

\[
\max_{\{z_{ij}, \gamma_{ij}\}} \left\{ EU^{(i)} + \lambda_i \left[W_{i0} - c_{i0} - \sum_{j=1}^{2} z_{ij}S_j - \sum_{j=1}^{2} \gamma_{ij}D_j - \phi_i(c_{i0}) \right] \right\}, \quad (7)
\]

where \( EU^{(i)} \) (expected utility) is,

\[
EU^{(i)} = \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} U^{(i)}(c_{i0}, c_{i1}, g_1) f(\theta_1, \theta_2, \theta_g) d\theta_1 d\theta_2 d\theta_g, \]

\( f(\theta_1, \theta_2, \theta_g) \) is the joint density for the random variables determining output, and end of period consumption is

\[ c_{i1} = z_{i1}R_1 + z_{i2}R_2 + z_{ig}R_g + \gamma_{i1}B_1 + \gamma_{i2}B_2. \]

The first order conditions characterizing optimal consumption/investment by investors are:

\[
\begin{align*}
E\{U_t^{(i)}(c_{i1})\} - \lambda_i S_1 &= 0, \\
E\{U_t^{(i)}(c_{i2})\} - \lambda_i S_2 &= 0, \\
E\{U_t^{(i)}(D_1)\} - \lambda_i D_1 &= 0, \\
E\{U_t^{(i)}(D_2)\} - \lambda_i D_2 &= 0, \\
E\{U_t^{(i)}(1 + \phi_{i})\} - \lambda_i (1 + \phi_{i}) &= 0, \\
E\{U_t^{(i)}(R_g)\} - \lambda_i S_g &= 0,
\end{align*} \quad (8)
\]

where, \( U_t^{(i)} = \partial U/\partial c_{i1} \) is the marginal utility of consumption at time \( t \), \((t = 0, 1)\). In general, these equations represent the equilibration of marginal expected utility benefits from current consumption and the
end of period consumption benefits available form each of the economy’s securities.

F. Equilibrium

The equilibrium process begins with firms announcing investment plans and capital structures, and government their investment and tax code. A set of values is declared by the market maker, \( \{S_j, D_j\} \). Investors compute their demands for claims at these values by solving the previously described equations. If aggregate demand is such that the fractional ownerships of all equities and debt sum to unity (demand equals supply):

\[
\sum_{i=1}^{m} z_{ij} = 1, \quad \text{and} \quad \sum_{i=1}^{m} \gamma_{ij} = 1 \forall j,
\]

then the set of values represents a securities market equilibrium. If not, then the process is repeated until the securities market equilibrium is achieved. Firms and government (government using the balanced budget objective) now decide if they wish to change their investment or capital structure plans. If not, equilibrium has been achieved; otherwise the process begins anew.

III. Investment and Capital Structure Unanimity

A. Overview

The focus of this section is the existence of unanimously preferred investment and financing rules for the firm.\(^{12}\) In particular, what are the conditions necessary for investors to exhibit unanimous preference for value maximizing decisions by firms? Except for the imposition of taxes and the public good, the economy of this paper is that of the classical financial model, and we know that under certain restrictions competitive value maximization has the desirable property of leading to a Pareto optimal allocation.\(^{13}\) The introduction of government as an economic entity complicates the model, and it is shown that value maximization may not represent behavior in the best (expected utility) interests of owners (or society) unless certain conditions are met. Aside from all the traditional considerations, owners unanimously support value maximization (at the margin) only when it does not affect the availability of the public good. Whether this condition is met in practice is a function of the design of the tax system and simply reflects the decision of government to allow the tax system to distort economic decisions by embedding a pecuniary externality in the system.

This section follows the somewhat standard practice of establishing the envelope conditions on expected utility related to investment and financing decisions, and then characterizing the conjectural variation assump-
tions sufficient for value maximization.

B. Investment Unanimity

To evaluate the preferences of consumers for the firm’s investment policy, consider the change in expected utility caused by an infinitesimal increase in the investment of firm one. In principle, the change in expected utility is determined by the perceptions of the investor regarding: changes in the investment of firm two and government, changes in the capital structure decision of firm two, changes that the investor expects to occur in the tax system as a part of government’s reaction to firm one’s investment plan, and the changes the investor believes will take place in security market prices. The general form for the total change is

\[
\frac{dEU^{(i)}}{dI_1} = E \left( U_1^{(i)} \frac{dc_{i1}}{dI_1} + U_g^{(i)} \frac{dg_1}{dI_1} \right) + \lambda_i \left[ z_{i1}^0 \left( \frac{dS_1^{(i)}}{dI_1} - 1 + \frac{dD_1^{(i)}}{dI_1} \right) \right. \\
+ z_{i2}^0 \left( \frac{dS_2^{(i)}}{dI_1} - \frac{dI_2}{dI_1} + \frac{dD_2^{(i)}}{dI_1} \right) - \sum_{j=1}^{2g} z_{ij} \frac{dS_j^{(i)}}{dI_1} \\
- \sum_{j=1}^{2} \gamma_{ij} \frac{dD_j^{(i)}}{dI_1} - \nabla \phi_i \right],
\]

where

\[
\frac{dc_{i1}}{dI_1} = \sum_{j=1}^{2g} z_{ij} \frac{dR_j}{dI_1} + \sum_{j=1}^{2} \gamma_{ij} \frac{dB_j}{dI_1},
\]

\[
\frac{dY_j}{dI_1} = \left( \frac{\partial Y_j}{\partial X_j} \frac{dX_j}{dI_1} + \frac{\partial Y_j}{\partial I_j} \frac{dI_j}{dI_1} + \frac{\partial Y_j}{\partial K_j} \frac{dK_j}{dI_1} \right),
\]

\[
\frac{dB_j}{dI_1} = \begin{cases} 
\frac{dK_j}{dI_1} - \frac{dL_j}{dI_1}, & \text{for } X_j - \phi_j \geq K_j, \\
\frac{\partial X_j}{\partial I_j} \frac{dI_j}{dI_1} - \phi_j \frac{dY_j}{dI_1} - \frac{dL_j}{dI_1} - \nabla \phi_j, & \text{for } X_j - \phi_j < K_j,
\end{cases}
\]

\[
\frac{dR_j}{dI_1} = \frac{\partial X_j}{\partial I_j} \frac{dI_j}{dI_1} - \phi_j \frac{dY_j}{dI_1} - \nabla \phi_j - \frac{dB_j}{dI_1},
\]

\[
\frac{dR_g}{dI_1} = \sum_{j=1}^{2} \left( \frac{\partial j}{\partial I_1} + \nabla \phi_j \right),
\]

terms such as \( S_j^{(i)} \) symbolize investor i’s beliefs about the valuation change, and the notation \( \nabla \phi \) indicates possible changes in the tax function as a response by government.

At issue are the related questions of whether or not equation (9) can be reduced to the value maximization criterion through appropriate assumptions, and whether or not such assumptions are consistent with equilibrium. The first step is to identify the wealth equivalent of the marginal income effects. These terms take the form

\[
E \left\{ U_1^{(i)} \frac{dR_j}{dI_1} \right\}, \quad E \left\{ U_1^{(i)} \frac{dB_j}{dI_1} \right\}
\]
in the reduced form of equation (9). Referring back to the statement of the investors portfolio problem, 8, terms such as those above were equated to the market value of the security times the investors shadow price of the wealth constraint, \( \lambda_i \). The shadow price would have the dimensions of marginal utility per unit of wealth. Authors such as Leland, [9] and Diamond, [6], were quick to note that the quantity

\[
\frac{1}{\lambda_i} E \left\{ U_1^{(i)} \right\}
\]

could be interpreted as the continuous equivalent of (personalized) Arrow-Debreu state prices. Leland termed valuations based on this approach perceived price taking. Assuming that investors behave as perceived price takers—i.e., they estimate the changes in security values resulting from the investment change, \( dS_j^{(i)}/dI_1 \) and \( dD_j^{(i)}/dI_1 \) by calculating

\[
\frac{dS_j^{(i)}}{dI_1} = \frac{1}{\lambda_i} E \left\{ U_1^{(i)} \frac{dR_j}{dI_1} \right\}, \quad \frac{dD_j^{(i)}}{dI_1} = \frac{1}{\lambda_i} E \left\{ U_1^{(i)} \frac{dB_j}{dI_1} \right\},
\]

terms such as

\[
E \left\{ U_1^{(i)} z_{ij} \frac{dR_j}{dI_1} \right\} - \lambda_i z_{ij} \frac{dS_j^{(i)}}{dI_1}
\]
disappear (the envelope conditions). Using the fact that \( V_j = S_j + D_j \), perceived price taking reduces equation (9) to

\[
\frac{d}{dI_1} E U^{(i)} = E \left\{ U_1^{(i)} \frac{d g_i}{dI_1} \right\} + \lambda_i \left[ z_{i1}^0 \left( \frac{dV_1^{(i)}}{dI_1} - 1 \right) + z_{i2}^0 \left( \frac{dV_2^{(i)}}{dI_1} - \frac{dI_2}{dI_1} \right) - \nabla \phi_i \right],
\]
indicating that changes in (perceived) utility would be related to changes in the values and investments of each firm, changes in taxation, and any changes in the investment by government towards public good production, resulting from a change in investment by firm one.\(^{17}\)

Nash assumptions are traditionally invoked at this point in the analysis to restrict the pricing impact of a firm’s actions to its own output (i.e. to preclude externalities from arising).\(^{18}\) The assumptions normally employed are that the capital structure and investment decisions of the other firm are unchanged as a result of the change in investment by firm one. Such assumptions are defensible in the traditional model because, in the absence of production externalities, the market value of other firms will experience only second order changes through the change in state prices associated with the decision of firm one. Competitive firms do not account for this; hence there is no (perceived) reason for firm two to alter either decision. More importantly, when equilibrium is reached, the assumption will be literally true because firm one will see it as unprofitable.
to change its investment level. But the economy of this section differs from that traditional one because the change in investment by firm one may occasion a change in taxes which affects the value of firm two, even in the absence of production externalities. Indeed, the main problem to be circumvented in this section is the potential for externalities imposed by the tax system.

To highlight the potential tax externalities, the analysis proceeds by first making the traditional (private) Nash assumptions that investment and capital structure decisions by other firms are unchanged in response to a change in the investment decision of firm one. With these (private) Nash assumptions, equation (9) becomes

$$\frac{d E U^{(i)}}{d I_1} = E \left\{ U^{(i)} \frac{d g_1}{d I_1} \right\} + \lambda_i \left[ z_{i1} \left( \frac{d V^{(i)}_1}{d I_1} - 1 \right) + \left( z^0_{i2} \frac{d V^{(i)}_2}{d I_1} \right) - \nabla \phi_i \right], \quad (10)$$

where the notation $d V^{(i)}_2 / d I_1$ indicates that the only source of change in value for firm two is the potential change in its tax function. It is evident from (10) that the sources of change in expected utility are more than the change in market value for firm one ($z_{i0}(dV_1 / dI_1 - 1)$). Additional elements are associated with any change in public good production and externalities associated with the tax system — i.e. investors believe that firm one’s actions may alter their personal consumption tax or the tax levied on firm two. In the latter case, the existence of such an effect would give firm two a reason for altering its investment and capital structure decisions in response to firm one’s investment change. In equilibrium, then, it may not be appropriate to assume that an infinitesimal change in investment by firm one does not occasion a response by other firms.

In the present model, traditional Nash assumptions need to be supplemented by assumptions concerning the response of government in terms of tax policy and investment policy. The next set of assumptions will prevent tax externalities from undermining the correspondence between (Private) Value Maximization and Expected Utility Maximization. These assumptions can take one of two forms:

**T1:** $\phi_i = 0 \; \forall \; i, \quad \nabla \phi_j = 0, \; \forall \; j,$

This first form assumes there is no initial consumption tax and rules out any changes in the functional nature of the corporate tax code. Before proceeding, it should be noted that **T1** does not eliminate the externality between the firms decision and the value of the government security — only the externalities for firm two and consumers.
The second tax characterization, T2, effectively implies no marginal tax on the investment, and is operationally equivalent to a lump sum tax on corporate income.

Utilizing either assumption reduces (10) to

\[
\frac{dE U^{(i)}}{dI_1} = E \left\{ U_{g}^{(i)} \frac{d\theta}{dI_1} + \lambda_i \varepsilon_1^{(i)} \left( \frac{dV^{(i)}}{dI_1} - 1 \right) \right\},
\]

where, T1) implies

\[
\frac{dV^{(i)}}{dI_1} = \frac{1}{\lambda_i} E \left\{ U_1^{(i)} \frac{\partial X_1}{\partial I_1} \left( 1 - \phi_1 \frac{\partial Y_1}{\partial X_1} \right) - U_1^{(i)} \phi_1 \frac{\partial Y_1}{\partial I_1} + U_1^{(i)} \frac{\partial L_1}{\partial I_1} \right\},
\]

while T2) leads to

\[
\frac{dV^{(i)}}{dI_1} = \frac{1}{\lambda_i} E \left\{ U_1^{(i)} \left( \frac{\partial X_1}{\partial I_1} - \frac{\partial L_1}{\partial I_1} \right) \right\}.
\]

Equation (11) indicates that private and social values may differ if investors believe that investment changes by either firm lead to changes in public good production. As mentioned previously, T1 implies some possible change in the value of government securities as a result of the marginal investment decision. If this is not offset by changes in taxes somewhere else in the system, rationality requires that investors infer some linkage. Hence, value maximizing investment decisions by the firm do not maximize expected utility of owners. In general, however, there will exist no unanimously supported level of investment because consumer’s marginal utilities of public good consumption have no mechanism by which they may be equated. If the tax effects are offset (or non-existent — as in T2), then perceived value maximization is preferred by each investor (for whom \( z_{ij}^0 > 0 \)).

Given the assumptions detailed, and that investors believe that government production is unaffected by the investment decisions of the private firms, (Perceived) Value Maximization is unanimously supported. However, this will not provide a viable criterion for the firm unless perceived values are identical. This condition will occur if markets are complete, or (minimally) if all marginal cash flows are spanned. It is a simple corollary that there is no unanimously supported investment equilibrium unless investors form homogeneous perceived values. The previous discussion can be summarized as follows:

**Theorem 1**  *Sufficient conditions for the unanimous support of private value maximization by the owners of the firm with respect to investment decisions are:*
A1: In making investment decisions, investors believe that the investment decision of each firm and government will not be altered from the announced value.

A2: Investors believe that changes in their demand will have no effect on market prices.

A3: Investors are perceived price takers.

A4: Investors believe that changes in investment by any firm do not affect the investment decisions of the other firm.

A5: Investors believe that changes in investment by any firm do not affect the capital structure decisions of the other firm.

A6: One of the two following marginal tax characterizations holds:

A6a: The government will not change tax functions as a result of the investment activity of the firm.

A6b: Investors perceive no marginal taxes.

A7: Investors believe that changes in investment by any firm do not affect the investment decisions of government.

A8: Markets are complete, or all marginal investment cash flows are spanned by existing securities.

In essence, the conditions sufficient for the unanimous preference for Value Maximization represent a generalization of Nash assumptions to incorporate government investment and tax decisions. A potential inconsistency, however, has arisen because, unlike the traditional Nash assumptions (A3–A5; A7), A7: may not be defensible if tax revenues were to change as a result of a change in investment by firm one. To adopt the above A7: in the presence of a revenue effect is equivalent to assuming that (all) investors beliefs are that of a 'free rider'. Yet, it must be emphasized that this observation is related to the externality imparted to the economy by the government’s choice of a tax code, and not a natural externality in the system.

C. Capital Structure Unanimity:

The issue of capital structure unanimity can be treated in a manner analogous to the investment decision of the prior paragraphs. The general expression for the change in expected utility associated with a change in the promised payment to bondholders of firm one, \( K_1 \), is

\[
\frac{dE(U^{(i)})}{dK_1} = E \left\{ U_1^{(i)} \frac{dc_1}{dK_1} + U_g \frac{dg}{dK_1} \right\} + \lambda_1 \left[ z_{11} \left( \frac{dS_1^{(i)}}{dK_1} - \frac{dI_1}{dK_1} + \frac{dD_1^{(i)}}{dK_1} \right) \right]
\]

\[
+ z_{12} \left( \frac{dS_2^{(i)}}{dK_1} - \frac{dI_2}{dK_1} + \frac{dD_2^{(i)}}{dK_1} \right) - \sum_{j=1}^{2g} z_{ij} \frac{dS_j^{(i)}}{dK_1} \]

\[
- \sum_{j=1}^{2g} \gamma_{ij} \frac{dD_j^{(i)}}{dK_1} - \nabla \phi_i \right], \quad (12)
\]
where

\[
\frac{dc_{i1}}{dK_1} = 2g \sum_{j=1}^{2} \frac{z_{ij}}{dK_1} + 2 \sum_{j=1}^{2} \gamma_{ij} \frac{dB_j}{dK_1},
\]

\[
\frac{dY_j}{dK_1} = \left( \frac{\partial Y_j}{\partial X_j dK_1} + \frac{\partial Y_j}{\partial I_j dK_1} + \frac{\partial Y_j}{\partial K_j dK_1} \right),
\]

\[
\frac{dB_j}{dK_1} = \begin{cases} \frac{dK_j}{dK_1} - \frac{dL_j}{dK_1}, & \text{for } X_j - \phi_j \geq K_j, \\ \frac{\partial X_j}{\partial I_j dK_1} - \psi_j \frac{dY_j}{dK_1} - \frac{dL_j}{dK_1} - \nabla \phi_j, & \text{for } X_j - \phi_j < K_j, \end{cases}
\]

\[
\frac{dR_j}{dI_1} = \frac{\partial X_j}{\partial I_j dI_1} - \psi_j \frac{dY_j}{dI_1} - \nabla \phi_j - \frac{dB_j}{dI_1},
\]

\[
\frac{dR_{g1}}{dI_1} = 2 \sum_{j=1}^{2} \left( \phi_j \frac{dY_j}{dI_1} + \nabla \phi_j \right).
\]

Perceived price taking, along with the Nash assumptions on the response of firm two, leads to

\[
\frac{dE U^{(i)}}{dK_1} = E \left\{ U_g \frac{dg_1}{dK_1} + \lambda_i \left[ z_{i1} \left( \frac{dV_1^{(i)}}{dK_1} \right) + \left( z_{i2} \frac{dV_2^{(i)}}{dK_1} (\nabla \phi_2) \right) - \nabla \phi_i \right] \right\},
\]

where

\[
\frac{dV_1^{(i)}}{dK_1} = \frac{1}{\lambda_i} E \left\{ U_1^{(i)} \left( \phi_1 \frac{dY_1}{dK_1} - \frac{\partial L_1}{\partial K_1} - \nabla \phi_1 \right) \right\}.
\]

Again, the notation \( dV_2^{(i)} (\nabla \phi_2)/dK_1 \) indicates that the only source of change in value for firm two is the potential change in its tax function, while the only sources of change in value for firm one are the tax and bankruptcy cost effects associated with its capital structure change.

Assumptions regarding the tax response of government are again necessary. Making assumption T1 reduces the change in expected utility to

\[
\frac{dE U^{(i)}}{dK_1} = E \left\{ U_g \frac{dg_1}{dK_1} + \lambda_i \left[ z_{i1} \left( \frac{dV_1^{(i)}}{dK_1} \right) \right] \right\}.
\]

Equation (14) indicates that investors will unanimously prefer a capital structure which maximizes firm’s value only if they believe that the firm’s pursuit of that capital structure will not alter production by government.20

Assumption T2 leads directly to

\[
\frac{dE U^{(i)}}{dK_1} = E \left\{ U_g \frac{dg_1}{dK_1} \right\} + \lambda_i \left[ z_{i1} \left( \frac{dV_1^{(i)}}{dK_1} \right) \right] = 0,
\]

with the change in firm value based solely on the marginal effects of bankruptcy costs, implying that capital structure is irrelevant unless it incurs bankruptcy costs and/or affects public good production — which it cannot do within the confines of a lump-sum tax.

**Theorem 2** Sufficient conditions for the unanimous support of private value maximization by the owners of the firm with respect to capital structure decisions are:
A1: In making investment decisions, investors believe that the investment decision of each firm and government will not be affected from the announced value.

A2: Investors believe that changes in their demand will have no effect on market prices.

A3: Investors are perceived price takers.

A4: Investors believe that changes in capital structure by any firm do not affect the investment decisions of the other firm.

A5: Investors believe that changes in capital structure by any firm do not affect the capital structure decisions of the other firm.

A6: The government will not change the tax function as a result of the investment/capital structure activity of any firm.

A7: Investors believe that changes in capital structure by any firm do not affect the investment decisions of government.

A8: Markets are complete, or all marginal investment cash flows are spanned by existing securities.

Again, required for the unanimous support of value maximization are the assumptions that all other decisions are unchanged — including government’s. Because the only trade-off here appears to be taxes and bankruptcy costs, the institution of a lump sum tax allows capital structure to be relevant only in a negative sense, and is not included in the above conditions. It should be clear that there is an inconsistency in the ‘balancing theory’ with regard to equation (14) in that if firms arrive at a value maximizing optimal capital structure which trades off tax savings against bankruptcy costs, the marginal capital structure decision implies some sacrifice of public good production and its associated utility benefits. Hence investors whose perceptions are not those of a ‘free rider’ do not unanimously support such a decision.

D. Summary and Concluding Comments:

Traditional capital structure theory assumes value maximization is the appropriate goal of the firm and that taxes are deadweight losses to investors. It follows from these two assumptions that increases in debt levels are beneficial to investors because they reduce taxes. Those models, in contrast to this one, do not recognize that government may provide utility in the form of a public good. As demonstrated in this section, if investors obtain utility from public goods, then they will not unanimously prefer that the firm maximize private value through investment and capital structure decisions — unless they believe that government production is unaffected by firm’s decisions. Without these conditions, the optimality of capital structure from a value maximization standpoint may have little to do with maximizing the expected utility of owners. The next section attempts to resolve this issue by investigating the optimality of value maximizing decisions in
terms of social welfare

IV. Pareto Optimality

A. Overview

This section examines the conditions necessary for the Pareto optimal allocation of resources in the economy introduced in section II, and compares them to those arising from the value maximizing activity of the economy’s firms. Briefly, the condition necessary for (Private) Value Maximization to be Pareto optimal is simply that the tax system must not distort resource allocations. If it does, then (Private) value maximization is relegated to the role of a rule of thumb with no societal justification — even though its pursuit might lead to ‘perceived’ expected utility maximization. This follows from the observation that the capital structure decision of the firm is generally without welfare consequences in the analysis of this, and other, papers.

The problem in this section is that of a social planner who must allocate the economy’s supply of scarce resource, $I$, to individual current consumption, investment in the two risky processes, and investment in the production of the public good. The social planner also allocates consumption at time one through the available securities — including the government security and bankruptcy costs. Formally, the model falls into the class of constrained Pareto optimality because the social planner is not free to distribute time one consumption outside the linear patterns offered by (combinations of) the available securities. The problem of incompleteness is minimized by the assumption that the number of securities does not pose an allocational problem.

The optimality problem for this economy may be written as:

$$\max \sum_{i=1}^{m} \delta_i E\{U^{(i)}\} + \psi_i \left( I - \sum_{i=1}^{m} G_{i0} - \sum_{j=1}^{2} L_j \right) - \sum_{j=1}^{2} \psi_j \left( 1 - \sum_{i=1}^{m} z_{ij} \right) - \sum_{j=1}^{2} \Gamma_j \left( 1 - \sum_{i=1}^{m} \gamma_{ij} \right),$$

(15)

where $\delta_i$ represents the central planner’s weighting of individual $i$, and the various $\psi$ and $\Gamma$ are the undetermined multipliers associated with the constraints on capital and claims. The instruments at the central planner’s disposal are claims to the five securities, investment levels in the two risky processes and public good production, capital structures for the two risky firms, and the current consumption level for each consumer. In principal, the central planner also has control over the tax functions, but these functions matter for
Pareto optimality only in terms of their distributional implications.

B. Pareto Optimal Claims and Capital Structure

The first order conditions associated with a Pareto optimum for the claims structure 

\((z_{i1}, z_{i2}, z_{ig}, \gamma_{i1}, \gamma_{i2})\) are given by:

\[
\begin{align*}
\delta_i & E\{U_1^{(i)} R_1\} - \psi_1 = 0, \text{ } \forall \ i, \\
\delta_i & E\{U_1^{(i)} R_2\} - \psi_2 = 0, \text{ } \forall \ i, \\
\delta_i & E\{U_1^{(i)} R_g\} - \psi_g = 0, \text{ } \forall \ i, \\
\end{align*}
\]

Comparing the above equations with those characterizing investor utility maximization, (8), it can be seen that the market economy exhibits a claims structure which is Pareto optimal for the weights \(\delta_i = \lambda_i^{-1}\) and the multipliers \((\psi_1, \psi_2, \psi_g, \Gamma_1, \Gamma_2) = (S_1, S_2, S_g, D_1, D_2)\).

In the absence of a true societal effect on cash flow, it seems evident that capital structure has no optimality consequences aside from the issue of security market incompleteness. This intuition can be verified by examining the change in societal welfare associated with a change in capital structure of either firm. That change is

\[
\sum_{i=1}^{m} \delta_i E\left\{ U_1^{(i)} \left( z_i \frac{\partial R_j}{\partial K_j} + z_{ig} \frac{\partial R_g}{\partial K_j} + \gamma_{ij} \frac{\partial B_j}{\partial K_j} \right) \right\} + \delta_m E\left\{ U_1^{(m)} \frac{\partial L_j}{\partial K_j} \right\}, \quad (16)
\]

where consumer \(m\) is the recipient of the bankruptcy costs. Noting that

\[
\frac{\partial R_j}{\partial K_j} + \frac{\partial R_g}{\partial K_j} + \frac{\partial B_j}{\partial K_j} = -\frac{\partial L_j}{\partial K_j}, \quad \forall \ (\theta_1, \theta_2, \theta_g), \quad (17)
\]

and utilizing homogeneous perceived prices (market completeness), it follows that the expression in (16) is identically zero. Hence, capital structure is irrelevant to the social planner — because it cannot affect productive efficiency, and is not necessary for distributional efficiency! Note that this result stems from our assumption that bankruptcy costs are not deadweight losses — but merely a wealth transfer — and the fact that the social planner evaluates contributions to government securities and transfer payment when determining the social desirability of a decision. It seems evident that if bankruptcy costs are deadweight losses, then the (Pareto) optimal capital structure decision would entail no such possibility.24

C. Pareto Optimal Investment and Consumption

The optimal allocation of investment capital is determined through the conditions:25

\[
\sum_{i=1}^{m} \delta_i E\left\{ U_1^{(i)} \left( \sum_{k=1}^{2} \left[ z_{ik} \frac{\partial R_k}{\partial I_j} + \gamma_{ik} \frac{\partial B_k}{\partial I_j} \right] + z_{ig} \frac{\partial R_g}{\partial I_j} \right) \right\}
\]
\[
+\delta_m E \left\{ U^{(m)}_1 \frac{\partial L_j}{\partial I_j} \right\} - \psi_I = 0, \quad j \in \{1, 2\}. \tag{18}
\]

The social planner, by definition, obeys the Nash assumptions with respect to other firm’s (and government’s) investment and capital structures. That is, when considering the impact of a change in investment for firm one:

\[
\frac{\partial I_2}{\partial I_1} = \frac{\partial I_g}{\partial I_1} = \frac{\partial K_2}{\partial I_1} = 0.
\]

Utilizing the definition of perceived prices from the prior section, and the fact that \(\delta_i = \lambda_i^{-1}\), equation (18) may be written as

\[
\sum_{i=1}^{m} \left\{ \sum_{k=1}^{2} \left( z_{ik} \frac{\partial S^{(i)}_k}{\partial I_j} + \gamma_{ik} \frac{\partial D^{(i)}_k}{\partial I_j} \right) + z_{ig} \frac{\partial S^{(i)}_g}{\partial I_j} \right\} + \delta_m E \left\{ U^{(m)}_1 \frac{\partial L_j}{\partial I_j} \right\} = \psi_I, \quad j \in \{1, 2\}, \tag{19}
\]

where the last term on the left hand side represents the marginal value of bankruptcy costs to our lawyer (consumer \(m\)). The assumption of homogeneous perceived values (market completeness) reduces equation (19) to:

\[
\sum_{k=1}^{2} \frac{\partial V_k}{\partial I_j} + \frac{\partial S_g}{\partial I_j} + \frac{\partial PV(L_j)}{\partial I_j} - \psi_I = 0, \tag{20}
\]

where the \(PV(L_j)\) denotes the present value of bankruptcy costs. The absence of a need to restructure the tax system in combination with the lack of production externalities or probability effects associated with firm’s investments leads to the final form of this equation:

\[
\frac{\partial V_j}{\partial I_j} + \frac{\partial S_g}{\partial I_j} + \frac{\partial PV(L_j)}{\partial I_j} = \psi_I. \tag{21}
\]

Hence, the central planner — unlike firms — incorporates all the effects — both the tax component, and the contribution to bankruptcy costs, into the evaluation of the desirability of investment in each firm.

To relate equation (21) to the investment activity of the economy’s firms, it will be necessary to evaluate \(\psi_I\). This is accomplished by noting that the condition for the optimal allocation of current consumption is:

\[
\delta_i EU^{(i)}_0 - \psi_I = 0 \quad \forall i. \tag{22}
\]

Combining the last two equations, Pareto Optimal investment levels satisfy

\[
\frac{\partial V_j}{\partial I_j} + \frac{\partial S_g}{\partial I_j} + \frac{\partial PV(L_j)}{\partial I_j} = \delta_i EU^{(i)}_0, \quad \forall i \quad \forall j, t \tag{23}
\]

Finally, utilizing the equilibrium condition for optimal consumption (section 2.6)

\[
\frac{\partial V_j}{\partial I_j} + \frac{\partial S_g}{\partial I_j} + \frac{\partial PV(L_j)}{\partial I_j} = 1 + \phi_i', \quad \forall i \quad \forall j. \tag{24}
\]
Equation (24) indicates that several conditions are necessary for the attainment of a Pareto optimal allocation of resources. First, all consumers must face the same marginal tax rate, and, second, all firms must generate an equivalent (certainty equivalent) marginal product of investment when measured by contribution to private value, government value, and bankruptcy costs.

D. Optimal Taxation

To explore the optimality issue under the two tax systems consistent with value maximization, consider first the simplest case — the lump sum tax \text{A6b}. With a lump sum tax, \( \phi'_i = 0 \) and equation (24) reduces to

\[
\frac{\partial V_j}{\partial I_j} + \frac{\partial PV(L_j)}{\partial I_j} = 1. \tag{25}
\]

The competitive firm will set \( dV_j/dI_j = 1 \). If there are no (wealth transfer) bankruptcy costs (at the margin), then, (Private) Value Maximization through the investment decision is Pareto optimal. This, of course, defeats government’s attempt to transfer wealth to the lawyer. If bankruptcy costs are deadweight, then private value maximization through investment is also Pareto Optimal because the optimal capital structure will entail a zero probability of bankruptcy costs.

The analysis is also straightforward for the functional tax system \text{A6a}. As mentioned previously, all consumers must face the same marginal tax rate for consumption. Assuming this, Private Value Maximization requires

\[
\frac{\partial V_j}{\partial I_j} = 1 \tag{26}
\]

while Pareto Optimality is characterized by equation (24). Hence,

\[
\frac{\partial S_g}{\partial I_j} + \frac{\partial PV(L_i)}{\partial I_j} = \phi'_i, \tag{27}
\]

implying that the certainty equivalent tax rate for each firm be identical, and equal to the (homogeneous) personal consumption tax rate (\( \phi'_i \)).

E. Summary

This section has demonstrated that the attainment of Pareto optimality imposes strict conditions on the tax system. In particular, marginal certainty equivalent taxes must be the same for all individuals and firms — or taxes must be lump sum. While these conclusions are by no means new, the message has typically been ignored in the finance literature. Pareto optimal tax systems have no marginal consequences (in the absence
of production externalities). If taxes are determining decisions, then the resulting allocation is not Pareto optimal. In what sense then does Financial Theory consider ‘optimal’ capital structures? A Short Critique of (Some) Capital Structure Theories

F. Overview

Section III established that value maximization would be unanimously supported by investors whose beliefs could be characterized by the Nash assumptions (which must include government). Section IV demonstrated that the resulting equilibrium would not be Pareto optimal unless the tax system exhibited certain properties. In particular, at the margin the tax system can’t seem to matter. These two aspects are related through the rationality of consumer’s beliefs. If taxes matter at the margin, the tax system has created an externality between government security value and firm decisions which must be accounted for by rational investors. This will, in turn, affect government production. Hence it is wrong for investors to make Nash assumptions, and value maximization is not unanimously supported (by rational investors).

G. The Balancing Theory

The Balancing Theory describes the ‘optimal’ capital structure as a trade-off between the tax advantage of debt and various costs related to bankruptcy or the possibility of bankruptcy. The optimal capital structure is characterized by the marginal equating of the tax benefits with the marginal leverage related costs. If, in fact, leverage related costs represent deadweight losses to society, then this trade-off cannot be Pareto optimal. In this case the fault lies with government for establishing a tax system which forces competitive firms to make productively inefficient decisions. Even if leverage related costs are not deadweight losses, it is easy to see that the tax system is encouraging wealth transfers away from government and to the benefit of the agents of the leverage related costs. This theory, while it provides a normative description of the behavior of competitive firms facing an ill structured tax system, bears no relationship to the objective of maximizing stockholder utility, and clearly leads to an inferior social solution.

H. Miller’s Debt and Taxes

The essential feature of Miller’s 1977 view of optimal capital structure, [10], is the existence of tax neutrality with respect to the capital structure decision in equilibrium. Miller observed that (depending upon the levels and forms of taxation) while the increased use of debt lowers corporate taxes, it tends to raise
personal taxes because the lower taxed equity is being replaced by more highly taxed corporate debt. In his theory, an optimal (societal) capital structure is attained when any further shifts in that structure would cause the total (market value) of corporate and personal income taxes to increase.

Miller’s theory meets most of the requirements of an optimal capital structure outlined in this paper. With taxes not mattering at the margin (only at the optimal capital structure), investors would be behaving rationally by making the Nash assumptions. Thus they will unanimously support firm’s value maximizing decisions. The only source of non-optimality now would be an ill structured tax system which distorts the consumption/savings decision.

One final caveat on the Miller theory: Miller describes his equilibrium in terms of the ‘marginal’ investor, but this generally is not sufficient to imply optimality nor equilibrium. As indicated in section IV the tax neutrality must hold for every investor at the margin, or there is no Pareto optimality. Furthermore, as shown in [3], in the presence of pre-tax perfect substitutes (a homogeneous risk class), all certainty equivalent tax rates must equalize across investors or there is no equilibrium. This is easy to accomplish with linear tax rates, but, if the desire is nonlinear taxation (progressivity, for example), tax functions must be personalized to accomplish these ends.

V. Summary

An explicit theme of the traditional capital structure and investment literature is that taxes (corporate and personal) represent deadweight losses to investors. From this assumption it follows that the appropriate objective of the firm is to maximize the market value of the firm’s securities, where value is based on after tax cash flow. Given sufficient flexibility, the optimal capital structure is viewed as one which minimizes the present value of (all) taxes to investors, or, in the balancing theory, optimally trades off the present value of the tax shield against other ‘leverage related costs’. The optimal taxation literature, on the other hand, has developed along the lines that in the absence of market imperfections, optimal tax systems should not create distortions in the marketplace, and, in the simplest setting, only matter when they are distortionary. Generally, only lump-sum taxes, or very complicated marginal tax schemes, satisfy the requirement of being non-distortionary.

This paper has argued that if investors believe that taxes savings are to be effected through the capital
structure decision of the firm, then they must believe that government revenues are affected by this also. If they believe that public good production is tied to government revenues, then they must recognize that capital structure decisions which alter government revenue cause changes in the provision of the public good. As a consequence of this, they will not unanimously prefer value maximizing decisions. Remembering that shareholder wealth maximization is only an acquired goal resulting from expected utility maximization in competitive markets, it is apparent that the concept of an optimal capital structure cannot be connected with value maximization. The explanation is simple enough — anyone who considers this problem seriously would recognize that externalities would destroy the welfare implications of value maximization under otherwise classical conditions. The imposition of a non Pareto optimal tax will, by its very nature, impart externalities to the system. We are left in a situation where if taxes matter, we no longer have a simple objective function to maximize, and if they don’t, we no longer have a problem to study.
VI. Endnotes:

1. The author would like to thank participants of the Public Economics Session (23) chaired by Robert J. Lemke at the March 29th meetings of the MEA for many useful comments.

2. The interested reader is referred to the discussion in [4], chapter 18.

3. See [11], [15], [14], and [1].


5. Unless the tax system is globally tax neutral with respect to these decisions, it is not clear that a value maximizing equilibrium would be reached by firms which make decisions in the best interests of their owners.

6. This restriction serves to insure that no wealth transfers take place in interim trades.

7. In terms of the existence of equilibrium, the production function is assumed to satisfy $\frac{\partial X_j}{\partial I} > 0$, $\frac{\partial^2 X_j}{\partial I^2} \leq 0$.

8. Bankruptcy costs, $L_j$, are zero if $X_j - \phi_j \geq K_j$.

9. In effect, this government offers only equity claims to its future revenues. This simplifies the task of investors and firms who must form expectations regarding tax policy (including transfer payments). If, for instance, the government only marketed debt claims, the debt would need to viewed as risky, and there would be outcomes for which the government would run an end of period surplus. Within this model, such a surplus could be wasted — entailing sub-optimality — or distributional schemes would be necessary to effect the ultimate provision of these surpluses to consumers. If investors are to form optimal plans under these conditions, they would need to understand the rules for these redistributions, and the effective tax policy would not be completely specified by the tax rates $\phi_1$, $\phi_j$.

10. This assumption is similar in spirit to the previous footnote. If government securities had significantly higher value than the proposed government investment level, government would have an current budget surplus which would be wasted (since there are no further time periods or generations). If $S_g < I_g$, the plan is not feasible. The role of government extracing and injecting its ‘own’ wealth into the economy is outside the scope of the present analysis.

11. $z^0_{ij} \geq 0$, $\sum_{i=1}^{m} z^0_{ij} = 1$, for $j = 1,2$.

12. Of course, unanimity here applies only to those investors who are not the recipients of bankruptcy costs (if any) for which they do not pay.

13. See Diamond [6].

14. These assumptions essentially constitute the equivalent of “conjectural variations” in industry structure theory.

15. The following symbolism needs to be interpreted literally. For example, the investment decision of firm two is (at least) a function of the investment and capital structure decisions of firm one, and the tax and investment decisions of government. Thus, $I_2 = I_2(I_1, K_1, \phi_2, I_g, \ldots )$.

Firm two’s investment change will be in response to changes in all these variables resulting from the change by firm one —

$$dI_2 = \frac{\partial I_2}{\partial I_1} dI_1 + \frac{\partial I_2}{\partial \phi_2} d\phi_2 + \frac{\partial I_2}{\partial I_g} dI_g + \ldots$$

The change in the value of firm two will result from its change in investment, capital structure, and tax.

16. In the above equation, terms involving instruments have been ignored as an implication of the envelope
condition.

17 Note that the utility term related to the public good cannot be reduced this way because there is no marketed equivalent. This would be true even if its output pattern were spanned.

18 See DeAngelo, [5].

19 Grossman and Hart, [8], demonstrate that managers with the ability to make sidepayments among shareholders can function according to a value maximization criterion even when perceived values are different. In their model, value is the initial claims weighted sum of the perceived values. Managers must then know each such perceived value to structure the sidepayments.

20 Rationality would suggest that this would occur only if capital structure does not affect aggregate taxes. This issue — and its implications for the ‘balancing theory’ will be pursued in section 5. Alternatively, if they expect the capital structure decision to affect the availability of capital to government, then value maximizing capital structures are not unanimously supported!

21 . . . that is, expected utility may be maximized according to behavioral assumptions which are incorrect within the system at hand.

22 This observation originated in Diamond, [6].

23 . . . requiring that markets be complete, or restrictions on distributions and/or preferences as in Wilson, [16], or Bosshardt, [2]. The condition of completeness implies that claims can, and will be adjusted until \( \delta_i U_1^{(i)} = b_iU_1^{(i)} \forall i \) in every possible present and future state. If markets were not complete, then one needs to explain why capital structure decisions are an economically efficient way to complete markets as opposed to (say) derivative securities.

24 ... as long as risky debt in not required to complete markets.

25 The condition for optimal investment in the public good process is of no direct interest, and is omitted.

26 The social planner does not need to worry about the consumption tax as individuals did in section II. This is because the societal investment consumption constraint automatically accounts for all assets not consumed at time zero.

27 Note that the rates must be identical as a proportion of value — not just an equivalent income tax. The certainty equivalent tax rate would be defined by the relationship:

\[
\phi'_{CE} E \left\{ U_1 \left( \frac{\partial Y_j}{\partial X_j} \frac{\partial X_j}{\partial I_j} + \frac{\partial Y_j}{\partial I_j} \right) \right\} = E \left\{ U_1 \phi'_j \left( \frac{\partial Y_j}{\partial X_j} \frac{\partial X_j}{\partial I_j} + \frac{\partial Y_j}{\partial I_j} \right) \right\}.
\]

Its relation to the expected marginal tax rate is:

\[
\phi'_{CE} = (1 + \eta) E \phi'_j
\]

where,

\[
\eta = \frac{1}{E \phi'_j} \frac{\text{Cov} \left( \phi'_j, U_1 \frac{\partial Y_j}{\partial X_j} \frac{\partial X_j}{\partial I_j} \right) + \text{Cov} \left( \phi'_j, U_1 \frac{\partial Y_j}{\partial I_j} \right)}{\text{Cov} \left( \phi'_j, U_1 \frac{\partial Y_j}{\partial X_j} \right)}.
\]

The last expression depends upon the pattern of output (through its associated valuation) and indicates that the equality of expected tax rates is not sufficient for Pareto Optimality. See [3] for a further discussion.

28 Furthermore, it not sufficient that the capital structure decision implies no certainty equivalent marginal tax because the pattern of the marginal output must be accounted for.

29 As was ably pointed out by Modigliani and Miller, [1958].
References


