DETERMINANTS OF CAPITAL STRUCTURE FOR CLOSELY-HELD VERSUS PUBLICLY-HELD CORPORATIONS

by

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I. Introduction and Summary

A recent paper by Irwin Friend and Joel Hasbrouck (1986) used data on holdings of their own stock by corporate insiders (officers, directors and principal stockholders) to test the hypothesis that the corporate capital structure is determined at least in part by optimization of management interests even when these conflict with stockholder interests. These data were obtained for the 1975-1983 period from the U.S. Securities and Exchange Commission. The Friend and Hasbrouck (F-H) paper pointed out that it is difficult to explain the relatively low use of debt in the U.S. on the basis of stockholder maximization and that management has a much greater incentive than other stockholders to maintain a low debt ratio to avoid non-diversifiable risk. The value of their stock held by corporate insiders and the ratio of their holdings to the total value of their stock outstanding were used in that study as measures of the greater incentive to management than to other stockholders for maintaining a low debt ratio.

The results of the F-H paper were strongly supportive of the hypothesized inverse relationship between insider holdings and debt when the value of insider holdings (MV) was used as a proxy of the risk to management associated with debt, but less so when the fraction of stock owned by management (FR) was used as a second measure of the relevant risk. As indicated in Appendix A, MV is a better measure of non-diversifiable risk than FR. However, FR is clearly a better measure of the degree of insider control.

F-H provide strong evidence that corporate management as a whole maintains a suboptimum debt ratio which is less than the stockholders' optimization would dictate. It is clear that management has an incentive to maintain lower debt than stockholders desire but it is not so clear that management has the ability to do so. For the closely-held companies there is likely to be a greater ability as well as desire of corporate insiders to implement a debt policy most consistent with their interests: however, this is less likely to be true in publicly-held companies. It is therefore desirable to analyze closely-held firms separately from publicly-held corporations in a study of debt policy, and such an analysis is carried out for the first time in this paper. Furthermore, while the earlier results were used to test whether the optimization of management as distinct from stockholder interests significantly affected the corporate capital structure, this paper (to the extent the data permit) considers which of several recent agency theories the new and earlier results are most consistent with.

The corporations whose insiders all combined hold more than 15% of the common stock outstanding are classifed as closely-held corporations (CHC) in this paper. Otherwise, corporations are treated as publicly-held (PHC). (We also experimented with cut-off points for CHC ranging from 10% to 20% for all insiders combined or from 5% to 15% for the largest insider and obtained similar results.) According to the SEC disclosure rules, an investor who now holds more than 5% (formerly 10%) of an equity issue is classified as a principal stockholder, and this information, together with all holdings by corporate officers and directors, has to be publicly disclosed. We have treated as insiders only officers and directors to ensure that investors classified as insiders are part of management; as a result, not all principal stockholders are included in this category. In our CHC group, based on a 15% cut-off point for all insiders combined, the largest insider in every company holds more than 5% of its common stock, and 95% of the largest single insiders hold more than 10% of the company's common stock. This cut-off point between the

CHC and PHC groups not only provides a reasonable distinction between corporations whose management has a major ownership interest and other corporations but also permits an adequate size of sample in each category. These two types of companies will be tested to determine whether they evidence different behavior in their debt policy. The summary statistics for PHC and CHC are presented in Table I.

The linear regression analysis presented in Table II points to a negative impact of both MV and FR of the largest insiders on the debt level in CHC. These findings are much stronger than Friend and Hasbrouck's original results for CHC and PHC combined. In the case of PHC (Table III), we still find a negative impact of MV on the debt ratio, but not uniformly significant. On the other hand, the impact of FR on the debt ratio is positive and uniformly significant. The positive impact of FR in the linear regression model for the PHC is somewhat perplexing and needs to be further examined if FR as well as MV are treated as a proxy for the manager's non-diversifiable risk.

It is found that the positive relationship between FR and the debt ratio in the linear regression analysis for PHC is primarily a consequence of a relatively small number of firms with very high debt ratios, and does not appear to characterize the entire population as shown in Table IV. Once we take these firms out of our sample, the impact of FR is no longer significant as shown in Table V. It is obvious, however, that we do not have the same strong evidence to infer a negative relationship between the debt ratio and both MV and FR for the PHC as we have for the CHC, though as noted earlier MV is likely to be a better measure than FR of risk to management. On the other hand, FR is a better measure of control by management.

Additional evidence on the relations among the debt ratio, MV and FR is given in Table VI, which presents the sample means for quartile subgroups ranked in order of descending values of the debt ratio. In CHC, the patterns of means of both MV and FR suggest a negative monotonic relationship with means of the debt ratio, though the relationship is much stronger for MV. But in PHC, the pattern of MV means is much more suggestive of a monotonic relationship than that of the FR means.

As expected, it is found that for the CHC the results are strongly supportive of the hypothesized inverse relationship between insider holdings and debt for both of the proxies. For PHC only MV is supportive of the hypothesized relationship (and only weakly supportive in the linear regression analysis), while FR, the other proxy used to measure the risk of management, is not supportive. As a consequence, while the hypothesized inverse relationship between the different measures of insider holdings and the debt ratio clearly holds for CHC, a corresponding relationship for PHC has not been firmly established. A number of recent agency theories, however, may further illuminate our empirical findings.

Grossman and Hart (1982) argue that, even in a world of no corporate taxes and no bankruptcy costs, if there is asymmetric information between management and dispersed investors about investment prospects, management has to use a certain amount of debt as the bonding commitment to signal the market about its investment intentions. In such a world of no corporate taxes and no bankruptcy costs, no optimum debt for shareholders exists in the sense that the optimum debt balances the interest tax shield against costs of bankruptcy until the value of the firm is maximized (hereafter the optimum debt). To compare the relative magnitude of the bonding committed debt and optimum debt, Lang (1986) extends the G-H model into a world of corporate taxes and bankruptcy costs. As summarized in Appendix B, Lang shows that if management loses its stake in the event of bankruptcy (in the sense of G-H), then management will prefer a level of debt which is less than optimal (hereafter suboptimum debt). This result could be interpreted as implying that even with symmetric information it is not feasible to reimburse management for its total investment in the firm (including human wealth) in the event of bankruptcy. If there is asymmetric information, then management has to use more debt as the bonding commitment. With such a bonding commitment, the equilibrium or observed debt level may be located between the suboptimum and optimum or it may exceed the optimum. In other words, management may not be able to choose its preferred debt/equity ratio if there is asymmetric information.

In closely-held corporations where the fraction of stock owned by insiders is relatively high, the gap between the information available to management and to investors may be less pervasive than in publicly-held corporations. (This is obviously true for very closely-held firms.) Moreover, for the closely-held companies there is likely to be a greater ability of corporate insiders to implement a debt policy most consistent with their interests. In contrast, the bonding commitment requirement may cloud the inverse relationship between insider holdings and preferred debt for PHC.

Grossman and Hart (1980) present a different version of monitoring from outside shareholders. G-H in that earlier paper argue that small shareholders who predominate in most companies do not have a big enough stake in the firm to absorb the costs of monitoring management. Unless there is one outside large shareholder who internalizes the costs and benefits of monitoring, as suggested by Shleifer and Vishny (1986), it might be difficult for stockholders to impose effective discipline on management; as a result, the management has more freedom to adjust its debt/equity ratio in its own interest. The F-H finding can be construed as indicating that in most companies the presence of large outside shareholders does not, as S-V suggest, discipline management and vitiate or at least greatly reduce its ability to choose its preferred debt/equity ratio. The explanation may consist of the comparative unimportance of large outside shareholders or it may reflect the fact that the large outside shareholders also prefer a low debt ratio because they too may have as undiversifiable stake in the firm which it may be difficult to dispose of without a substantial financial penalty (e.g. the payment of a capital gains tax which could otherwise be postponed indefinitely).

While data on the holdings of common stock by the largest outside shareholders are not contained in the data available to us, we can carry out an indirect test of S-V's theory about the effectiveness of monitoring by the largest outside shareholders. (We are currently collecting data from the SEC tape on large outside shareholder holdings where they are defined as holdings in excess of 10% by investors who are neither officers or directors.) We separate firms into 5 groups by the fraction of stock held by the largest insider (FR) as follows: Group 1 with $FR < 1\%$, Group 2 with $1\% < FR < 5\%$, Group 3 with $5\% < FR < 10\%$, Group 4 with $10\% < FR < 20\%$, and Group 5 with $FR > 20\%$. In Table X, we report the coefficients and t-statistics of MV and FR, and supress the other variables. If the monitoring from the largest outside shareholders is effective and directed towards different objectives from insiders, we should expect to find insignificant MV and FR coefficients, consistent with the hypothesis that outside shareholders monitor insiders to behave so as to optimize the shareholders' interests. Of course, this is not what we observe in Table X except for Group 2. But one may argue that the largest insider in Groups 4 or 5 holds a substantial amount of stock, so that he is likely to be much less subject to effective monitoring by outside shareholders than the largest insider who only holds a negligible fraction of stock, such as those in Group 2 and especially in Group 1. We should thus expect to find the least significant MV and FR in Group 1. However, as we can see from Table X, both MV and FR are insignificant only in Group 2 and FR is very positively significant in Group 1, which does not seem to provide much support for the S-V theory.

On the other hand, the evidence in Table X can support the theory by Lang in the sense that as the fraction of stock owned by insiders diminishes from Group 5 to Group 1, the gap between the information available to management and to investors may also be more pervasive. Therefore the smaller the fraction of stock owned by insiders, the stronger the requirement of a bonding commitment. As we can see from Table X, this is consistent with our results, with a consistently significant positive impact of FR on debt in Group 1, which might be expected to require the strongest bonding commitment.

The evidence in Table X as well as the earlier results on the different effects of MV and especially FR on the debt ratio of CHC and PHC is also consistent with the Jensen (1986) "control hypothesis". That hypothesis holds that debt reduces the agency costs of free cash flow by reducing the cash available for spending at the discretion of management and hence enables management to effectively bond its promise to pay out future cash flow. Such a bond is likely to be more necessary in a PHC than in a CHC.

II. Econometric Aanlysis and Evaluation of Results

The symbols, data sources and computational procedures are described below:

- DRT - Debt/asset ratio which is defined on a book value basis and excludes trade credit and short-term accruals from debt.
- RPPEAB - Ratio of net property, plant and equipment to book assets.
- ROAM - Mean of earnings (before interest payments and taxes) asset ratio defined on a book value basis. It is used as the proxy for profitability of a firm.
- ROAS - Standard deviation of earnings (before interest payments and taxes)/asset ratio used as proxy for risk since it is a better measure of an insider's non-diversifiable risk than the more customary beta coefficient. However, beta was also used instead of ROAS and gave similar results.

MV - Market value of equity in his firm held by dominant insider (millions of $).

LMV - Log of MV.

FR - Fraction of equity held by dominant insider.

LA - Log of total assets.

All the above variables except ROAM and ROAS are on a five-year average basis (1979-1983), ROAM and ROAS are on a ten-year basis (1974-1983). If there are any missing values of these variables for a firm within this period, this firm is excluded. We compute DRT, ROAM, ROAS and RPPEAB from the Compustat data base by excluding financial organizations and public utilities. The detailed descriptions of MV and FR are provided in Appendix C. In the results presented in the tables, MV and FR, which might be expected to proxy the degree to which the insider's holding is an undiversified position, are computed only for the largest single insider. (Similar results to these presented were also obtained when holdings for all insiders in each firm were combined). Absent any other information about the insider's portfolio, we examine the market value of the holding (MV) on the reasonable assumption that the larger MV the larger the undiversified concentration of holdings in a single asset. As an alternative measure, we also examine the fraction (FR) of total equity in the firm constituted by the largest insider's holdings.

Descriptive statistics of the variables for CHC and PHC are summarized in Table I. We can see from Table I that the firms in the PHC group are mainly larger firms with lower ROAS, MV and FR, but higher ROAM and RPPEAB. All these variables are associated with a lower debt ratio in PHC.

A large number of multivariate relationships for the debt ratio are estimated using ordinary least squares, and representative samples of the results are reported in Tables II and III. Because the slopes of these two sets of regressions are different, it is inappropriate to apply a PHC-CHC dummy to run the whole sample. It is also found that the regression results in Table II and III do not change significantly even when we add industry dummy variables at the 2-digit SIC level.

In Tables II and III, ROAM (profitability) and RPPEAB (fixed assets ratio) suggest relations consistent with the findings of earlier studies. Profitability measures for the firm (such as return on assets) are employed in several of the earlier cross-sectional studies (Carlton and Silberman, Toy et.al.). These measures have invariably been found to be strongly negatively related to leverage. The mechanism at work here is presumably retention; more profitable firms need to borrow less. The positive impact of RPPEAB on DRT was found by Long and Malitz (1983) and Auerbach (1984). RPPEAB bears on the collateral value of assets with an obvious link to debt capacity.

Turning to the risk measure ROAS, the studies by Baxter (1967), Ferri and Jones (1979) and Long and Malitz (1983) all suggest the expected negative relationship. Scott (1980) finds this relationship ambiguous while Flath and Knoeber (1980) suggest that there is no relationship between the variations in a firm's earnings, measured in several ways, and its debt. Auerbach (1984) finds an ambiguous relationship between debt level and variability of a firm's value. Castanias (1983) suggests that it would be easier to find a negative relationship if more small firms are included. Though CHC contains many more smaller firms than PHC, we find the expected negative relations for both groups with insignificant difference in the effect of earnings variability on the debt ratio.

The other variables MV, FR and LA all have different interpretations (LA will be discussed in the next section). In CHC, we can see from Table II that MV and FR are always significantly negatively related to the debt ratio. If MV and FR can be treated as a proxy for the manager's non-diversifiable risk, then Table II suggests that the manager generally uses less debt to avoid the bankruptcy risk which is implicit in higher debt. These results are more satisfactory than the Friend and Hasbrouck (1985) original finding which combines PHC and CHC.

In the case of PHC, as shown by Table III, MV is significant only when combined with FR, but its explanatory power is dominated by FR. More precisely, MV becomes negatively significant while FR becomes more positively significant when both MV and FR are included in the same specification. On the other hand, FR is always positively significant in combination with any other variables in every regression. These findings are quite different from those for CHC.

As noted earlier, the positive relationship between FR and DRT for PHC is primarily a consequence of a relatively small number of firms with very high debt ratios, and does not appear to characterize the entire population. To separate these 'extreme' firms with very high debt ratios, we further group the sample in PHC into eight groups in order of descending values of DRT as shown in Table IV. As we can see from that table, for the firms in the first category with highest DRT (mean of DRT = 0.4728), FR is located far away from the other seven categories. If we exclude the first category in our sample, we get Table V which indicates that FR is no longer significant. Although as indicated in Appendix A, MV is likely to be a better measure of risk than FR, the evidence is still less conclusive for PHC than for CHC even judging from MV only. (We also group the sample in CHC into eight groups as we have done for PHC. Even though we exclude the first category, we still obtain similar results to those in Table II).

Further evidence on the relation among these variables is given in Table VI, which presents sample means for quartile subgroups ranked in order of descending values of DRT. As indicated earlier, the patterns of means of MV and FR in CHC have a negative monotonic relation with means of DRT.

In PHC, the pattern of MV means is much more suggestive of a monotonic relationship than that of the FR means. Indeed, the latter seems to exhibit something closer to a "U"-shape. But once we exclude extreme firms, this "U"-shape becomes flat.

Table I shows that DRT in PHC is significantly lower than in CHC. We conclude from Tables II and III that only ROAM could explain this difference, since the other variables, except for LA whose effect appears ambiguous, all seem to point to a higher DRT for PHC than for CHC. Even for LA when the extreme firms are eliminated, the coefficient is significantly positive for both PHC and CHC, so that only ROAM has a consistently negative effect on DRT. It is obvious that the impact of ROAM dominates the other variables in determining the average size of DRT in both PHC and CHC. The dominant role of ROAM is indicated when we omit ROAM from all the regressions, which reduces R^2 (adjusted for degrees of freedom) from 30% to values in the neighborhood of 13% for both PHC and CHC. The regression coefficients of ROAM on DRT in Tables II and III and the difference between the mean ROAM for CHC and PHC in Table I imply a substantially larger difference in DRT than that observed in Table I, reflecting the offsetting effects of the other independent variables in the regressions.

It should be noted that MV is used in these Tables II and III regressions instead of LMV because the regressions with LMV were much more affected by the inclusion of firms with extreme DRT, there was much higher multicollinearity with ROAM which was highly negatively correlated with DRT, and the multiple correlation coefficients were somewhat lower. However, the corresponding results using LMV both with and without extreme firms are also presented in Table XI. (The use of MV instead of LMV might be expected to result in a heteroscedasticity problem. However, we performed the

Bartlett test and found that the χ^2 statistics associated with the use of MV and LMV are 2.14 and 2.25 respectively; therefore we could not reject the null hypothesis that there is no significant heteroscedasticity.)

III. Further Investigation of PHC-CHC and Size Effect

As noted earlier (Table I), PHC includes more large firms than CHC. In many of our regressions, we have attempted to hold size constant by introducing a size variable. To further investigate the PHC-CHC (P-C) effect separated from the size effect, we ran the following four sets of regressions by controlling the size effect as follows:

(1). CHC with $LA < 5.233$;

(2). CHC with $LA > 5.233$;

(3). PHC with $LA < 5.233$; and

(4). PHC with $LA > 5.233$,

where $LA = 5.233$ is the median of LA for the PHC and CHC combined.

We present (1) and (3) for comparison in Table VII, and (2) and (4) in Table VIII. We first check the P-C effect on MV and FR in Tables VII and VIII by controlling for size in the manner indicated. The P-C distinction affects FR significantly in three out of four experiments (i.e. (1), (3) and (4)) in the same direction as obtained in Tables II and III when size is not controlled. In the one exception (i.e. (2)), the FR coefficients are not significant. The P-C distinction is also associated in all four cases with the sign of the MV coefficients in the same direction as in Tables II and III when size is not controlled.

Note that FR in (3) and (4) is positively significant. As we mentioned before, the positive relation between FR and the debt ratio is primarily a consequence of a relatively small number of firms with very high debt ratios included in the eighth category of Table IV. Once we take these firms out of the sample, the impact of FR is no longer significant, as shown in Table IX, and the significance of MV is also reduced, which is also true in the linear regressions in Table V when size is not controlled. (The lower panel of Table IX indicates similar results to those in Table II when the extreme firms in CHC are excluded.) The evidence suggests that the size factor still possesses an effect which is independent from but weaker than the CHC-PHC effect.

It was observed earlier that the coefficients of LA in PHC and CHC have different signs in Tables II and III. However, when we exclude extreme firms in PHC as shown in Table V, the size factor also has a positive impact on the debt ratio, the same as in CHC.

IV. Conclusion

The traditional view of debt policy suggests a model of shareholders' wealth maximization. This paper provides evidence that management in CHC not only owns larger shares of their firms, but also have a much larger dollar investment than management in PHC, so that they have both greater ability and incentive to maintain a low debt ratio. This is reflected in the negative impact of MV and FR on the debt ratio in CHC while this relation is much less conclusive for PHC. In PHC, where management is more separated from ownership of the firm, a smaller incentive and less control plus the greater need for bonding, and perhaps the monitoring from large outside shareholders, might cloud the hypothesized inverse relationship of insider holdings and debt.

APPENDIX A

As indicated in the text of this paper, the market value of insider holdings (MV) is the primary measure used to represent the risk of undiversified concentrations of holdings in a single asset. However, the fraction (FR) of total equity constituted by insider holdings is also used and, though we state that it is not likely to be as satisfactory a measure as MV of the risk associated with an insider's position, it is necessary to point out the analytical basis for this conclusion.

It is clear that MV is much more closely related than FR to the absolute risk entailed in an insider's holdings. However, since investors' behavior seems to be much better characterized by constant relative risk aversion than by absolute risk aversion (Friend and Blume, 1975), the relevant question to raise is whether MV or FR is a better proxy for MV/W, where W is the insider's wealth. In other words, is MV or FR more highly correlated with MV/W? It will be recalled that FR = MV/M, where M is the market value of outstanding shares of the stock including shares owned by the public as well as by insiders. For the sake of convenience, we shall deal with the logs of the relevant variables, i.e. v = log MV, w = log W and m = log M, so that log (MV/W) = v-w and log (MV/M) = v-m. Then

$$\rho(v,v-m) = \frac{\left(\sigma_v^2 - \sigma_{vm}\right)}{\left(\sigma_v \bullet \sigma_{v-m}\right)}$$

$$\rho(v-m,v-w) = \frac{\left(\sigma_v^2 - \sigma_{vw} - \sigma_{vm} + \sigma_{mw}\right)}{\left(\sigma_{v-m} \bullet \sigma_{v-w}\right)} ,$$

where ρ is the correlation coefficient and σ is the standard deviation. The circumstances under which MV is a better proxy than FR for MV/W can be written as $\rho(v,v-m) > \rho(v-m,v-w)$ or

$$\frac{\sigma_v^2 - \sigma_{vw}}{\sigma_v} > \frac{\sigma_v^2 - \sigma_{vw} - \sigma_{vm} + \sigma_{mw}}{\sigma_{v-m}} .$$

All of these statistics, with the exception of those involving w, can be estimated from our sample results for the 1468 corporations covered. Then $\sigma_v = 1.7526$, $\sigma_m = 1.7200$, $\sigma_{v-m} = 1.4913$, $\sigma_{vm} = 1.5153$, $\rho_{vm} = 0.5027$. To determine whether this inequality holds, it is necessary to estimate $\sigma_{vw} = \sigma_v\sigma_w\rho_{vw}$ and $\sigma_{mw} = \sigma_m\sigma_w\rho_{mw}$. We know σ_v and σ_m and we can estimate σ_w (i.e. the standard deviation of the log of wealth) or at least put plausible bounds on its value from the data on wealth and related information compiled from the Federal Reserve Board's 1983 Survey of Consumer Finance, covering a sample of 3824 families, 282 of whom indicated that they owned stock of corporations for which they worked. For the subsample of 282 families, $\sigma_w = 1.35$. Since this subsample includes both corporate insiders and other employees who are stockholders in the corporation for which they work, in an attempt to separate those families who are more likely to be corporate insiders or to resemble corporate insiders in their wealth characteristics, σ_w was also computed for the 61 families in this subsample with annual income over \$50,000, for the 11 families with income over \$100,000, for the 124 families with net worth over \$100,000 and for 13 families with net worth over \$500,000. For these groups, σ_w is 0.86, 0.91, 0.63 and 0.40 respectively. Of the entire sample of 3824 families, for the 26 with wealth in excess of \$1 million, $\sigma_w = 0.30$; for the 90 families with wealth in excess of \$500,000, $\sigma_w = 0.44$. Thus, while to ensure that we do not bias the results in favor of our hypothesis we shall use $\sigma_w = 1.35$ as our estimates of the standard deviation of the log of wealth for corporate insiders, the evidence suggests this is an overstatement.

Information on ρ_{vw} and ρ_{mw} is not available, but so long as $\rho_{mw} < 0.46 + 0.15\rho_{vw}$, $\rho(v,v-w) > \rho(v-m,v-w)$. Since there is no necessary relationship between m and w, though MV would be expected to be fairly highly correlated with W of which it is a part, ρ_{mw} would be expected to be lower than ρ_{vw} and well below the critical value of 0.54 for $\rho_{mw} = \rho_{vw}$. For the more realistic assumption $\rho_{mw} < \rho_{vw}$, the critical level for ρ_{mw} would be even higher. It might be noted that if ρ_{vw} and ρ_{mw} were both 0.5, $\rho(v,v-w) > \rho(v-m,v-w)$ so long as $\sigma_w < 1.45$, which is higher than the upper bound of 1.35 suggested above as the critical level for σ_w. With a more plausible relation between ρ_{vw} and ρ_{mw}, with correlation of 0.75 and 0.25 respectively, $\rho_{(v,v-w)} > \rho_{(v-m,v-w)}$ so long as $\sigma_w < 4.42$.

For closely-held corporations, the evidence in favor of the superiority of MV over FR as a proxy for MV/W is even more striking. MV would be a superior proxy so long as $\rho_{mw} < 0.530 + 0.360\rho_{vw}$. This result is obtained from data for a sample of 723 closely-held corporations for which $\sigma_v = 1.4645$, $\sigma_m = 1.6446$, $\sigma_{v-m} = 0.8723$, $\sigma_{vm} = 2.0443$ and $\rho_{vm} = 0.8488$. As a result, for the extreme assumption that $\rho_{mw} = \rho_{vw}$, MV is a better proxy than FR for MV/W so long as $\rho_{mw} < 0.83$. For the more realistic assumption $\rho_{mw} < \rho_{vw}$, the critical level for σ_{mw} would again be even higher.

For publicly-held corporations, the results are closer to those obtained for all corporations combined. From data for a sample of 747 corporations, it is estimated that $\sigma_v = 1.6292$, $\sigma_m = 1.7457$, $\sigma_{vm} = 1.6425$, $\sigma_{v-m} = 1.5546$, $\rho_{vm} = 0.5775$, so that the condition for the superiority of MV over FR as a proxy for MV/W becomes $\rho_{mw} < 0.65 + 0.043\rho_{vw}$. If $\rho_{mw} = \rho_{vw}$, MV is a better proxy so long as $\rho_{mv} < 0.68$. For $\rho_{mw} < \rho_{vw}$, the critical level ρ_{mw} would be increased.

APPENDIX B

Consider a corporation in which the manager collects funds H by issuing stocks S and bonds B to implement investment project at Date 0. It is assumed that this firm will be dissolved after Date 1. The firm's pre-tax cash flow X is normally distributed with mean g and variance σ^2. g is assumed to be a concave function on investment I with $g' > 0$, $g'' < 0$.

To simplify the model, the manager is assumed to invest I out of H and to consume H-I. The equilibrium condition requires that H must be equal to the firm's value V(I,B), the amount of money the risk-neutral investors expect to earn back at Date 1 if the risk free rate is assumed to be zero. The firm's value is measured as follows:

$$V(I,B) = \int_{-\infty}^{B^*} \left[\sigma z + g(I) - K\right] f(z)dz + \int_{B^*}^{\infty} \left[B + (1 - t)\left(\sigma z + g(I) - B\right)\right] f(z)dz \tag{B.1}$$

where $B^* = (B-g)/\sigma$, B is the principal and interest payments of debt, K is lump-sum bankruptcy cost, t is the income tax rate, and z is the standardized cash flow.

Let the manager have a concave von Neumann-Morgenstern utility function U(H-I) in which $U' > 0$, $U'' < 0$. It is assumed that this utility is only realized if the firm does not go bankrupt. The manager maximizes his expected utility function as follows before X is known:

$$U = E\left[U(I,B)\right] = U(H - I)\left(1 - F(B^*)\right) \quad . \tag{B.2}$$

It is shown in Lang (1986) that the equilibrium conditions are as follows:

$$V_B = T + G \gtrless 0 \tag{B.3}$$

$$g' > 1 \quad , \tag{B.4}$$

where V_B is the partial derivative of V on B, $T = rU/sU' > 0$, $G = I'(B)(1-g')/(1-I'(B)g') < 0$ if $g' > 1$ ($I'(B) = dI/dB$, $1-I'(B)g' > 0$), $r = f/(1-F)$ which is the "hazard rate". I' is the information asymmetry effect. The relationship is depicted in Figure A. The vertical axis is firm value V, the left part of the horizontal axis is investment I and the right part is debt B. In quadrant (a), $g' > 1$ corresponds to I_0 which is associated with a unique concave $V(I_0,B)$ in quadrant (b). The sign of $V_B = T + G$ is indeterminate; therefore we do not know the exact location of B_0 suggested by $V_B = T + G$ relative to an optimum debt B_p.

If we do not consider the asymmetric information, setting $I'(B)$ in (B.3) equal to zero yields $V_B = T > 0$ which corresponds to $g' = 1$. We can get the same solution by maximizing $U(V-I)(1-F)$ w.r.t. I and B. The relationship $V_B = T$ and $g' = 1$ can be also depicted in figure A. $g' = 1$ suggests a higher investment I_1 which is associated with a unique concave value function $V(I_1,B)$. $V_B = T > 0$ suggests a suboptimum debt B_1 which is less than optimum B_n.

We have the following empirical implications:

(1) If we do not consider an information asymmetry effect, the suboptimum debt B_1 suggested by $V_B = T > 0$ is always less than optimum suggested by $V_B = 0$.

(2) If we incorporate the information asymmetry effect into the model, the investment will decrease. With this lesser investment the equilibrium debt B_0 suggested by $V_B = T + G$ will exceed the supposed suboptimum debt B^* suggested by $V_B = T$ (because $T + G < T$), but may be less or greater than optimum B_p suggested by $V_B = 0$. $B_0 > B^*$ indicates that management has to use more debt to signal the market about its investment intentions.

(3) We do not know the relative magnitudes of B_0 and B_1.

APPENDIX C

The measure of insider holdings in this paper were derived from records filed with the U.S. SEC. (National Archives and Record Service, General Services Administration, Washington, D.C. 20408). In accordance with the Securities Act of 1934, officers, directors, trustees and principal stockholders (i.e. those holding over 5% of the shares recently and over 10% formerly) are required to report holdings, acquisitions and dispositions of securities of corporations in which they are insiders and have had transactions during the month. Specifically, the insiders included in this paper are: chairman of board, other officers, directors, controlling person (but with only few entries) and principal stockholders who are either officers or directors, so that the group of insiders covered consisted of the firms' management. The excluded categories include beneficial owners of more than 10% of the shares who are not officers or directors, investment advisors and trustees. We just consider the direct holdings of common stock by the aforementioned insiders. The indirect holdings reflecting holdings in trusts and other similar vehicles are ignored. The SEC places on the transaction records an inconsistency code when holdings can not be reconciled with acquisition and disposition data. Records so marked were dropped.

The records in the tape were sorted by CUSIP number, insider identification and time. An end-of-month holding for a particular insider was taken to constitute a balance that persisted until the date of the next filing, or until December 1983 (the last date considered in this study) if no later filings were encountered. For each firm, we pick the holdings of the dominant insider at the end of each year. We multiply these holdings by the closing stock price of the year to get MV. We divide these shares of the dominant insider by the total shares outstanding to get FR. We also compute MV and FR for all insiders combined. A final limitation of the data concerns investors who leave the insider population by virtue of retirement or other separation. Since the investor loses insider status, the disposition will not be reported. This may lead to a systematic upward bais in our insider holding counts, but we can conceive of no plausible reasons why this error might be related to capital structure.

TABLE I

Summary Statistics
1974 - 1983

	PHC		CHC		t-statistics
	Mean (a)	Standard Deviation	Mean (b)	Standard Deviation	of (a) minus (b)
DRT	0.234	0.129	0.260	0.160	3.6
ROAM	0.124	0.065	0.114	0.064	3.5
ROAS	0.045	0.030	0.057	0.037	6.9
RPPEAB	0.368	0.174	0.330	0.179	3.5
MV	17.497	66.436	47.650	115.197	4.9
LMV	1.375	1.746	2.248	1.645	9.87
FR	0.030	0.030	0.204	0.140	33.10
LA	6.067	1.642	4.624	1.395	17.60

* The sample size of PHC (Publicly-Held Companies) = 747; the sample size of CHC (Closely-Held Companies) = 723.

** DRT is the debt/asset ratio; ROAM is the average of earnings/asset ratios; ROAS is the standard deviation of earnings/asset ratios; RPPEAB is the ratio of property, plant and equipment to assets; MV is the market value of equity in firms held by dominant insiders; LMV is the log of MV; FR is the fraction of equity held by dominant insiders; and LA is the log of total assets. The unit of MV is one million dollars, the unit of LMV is the logarithm of MV, and the unit of LA is the logarithm of one million dollars. See the text for more detailed definitions of the symbols used.

*** Some of the variables cover the period 1974-1983, others 1979-1983. See text.

TABLE II

Regressions for CHC

ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
-.916 (-11.3)*	-.264 (-1.811)*	.218 (7.18)*	-.0003 (-4.78)*	-.065 (-1.7)*	.026 (5.2)*	.284
-.915 (-11.1)*	-.480 (-3.36)*	.269 (9.22)*	-.0001 (-2.27)*	-.103 (-2.7)*		.256
-.897 (-10.9)*	-.526 (-3.69)*	.271 (9.23)*	-.0001 (-3.06)*			.252
-.956 (-11.8)*	-.441 (-3.10)*	.260 (8.97)*		-.125 (-3.39)*		.254
-.980 (-12.0)*	-.345 (-2.32)*	.226 (7.32)*			.013 (3.09)*	.252
-.905 (-11.2)*	-.279 (-1.91)*	.215 (7.11)*	-.0003 (-5.61)*		.027 (5.62)*	.282
-.987 (-12.2)*	-.305 (-2.06)*	.228 (7.44)*		-.123 (-3.35)*	.013 (3.04)*	.262

1. The dependent variable in all specifications is DRT.
2. The t-statistics are given in parentheses. The significance at the .05 level is denoted by * (one-tail test).
3. R^2 is adjusted for degrees of freedom.
4. See Table I for definitions of symbols.

TABLE III

Regressions for PHC

ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
-.872 (-13.9)*	-.329 (-2.29)*	.192 (7.76)*	-.0002 (-2.27)*	.526 (3.43)*	-.003 (-.99)	.291
-.872 (-13.9)*	-.279 (-2.07)*	.184 (7.91)*	-.0002 (-2.78)*	.580 (4.04)*		.291
-.895 (-14.2)*	-.203 (-1.50)	.175 (7.51)*	-.0001 (-1.54)			.276
-.892 (-14.3)*	-.240 (-1.78)*	.177 (7.61)*		.451 (3.31)*		.285
-.900 (-14.3)*	-.334 (-2.38)*	.196 (7.87)*			-.008 (-2.63)*	.281
-.890 (-14.1)*	-.330 (-2.27)*	.196 (7.87)*	-.0001 (-.96)		-.007 (-2.34)*	.281
-.887 (-14.2)*	-.339 (-2.34)*	.194 (7.79)*		.386 (2.74)*	-.006 (-1.88)*	.287

* The footnotes are the same as in Table II.

TABLE IV

Summary Statistics of PHC and CHC
Grouped Into 8 Classes by Debt Ratios

	DRT	MV	LMV	FR	LA
PHC					
1.	0.4728	9.888	1.1007	0.0452	5.638
2.	0.3386	12.091	1.0081	0.0272	6.229
3.	0.2793	10.504	1.3005	0.0282	6.095
4.	0.2402	17.273	1.4961	0.0262	6.467
5.	0.2077	29.000	1.6280	0.0284	6.299
6.	0.1692	14.820	1.4126	0.0250	6.225
7.	0.1222	26.280	1.4682	0.0254	6.211
8.	0.0410	21.880	1.6022	0.0331	5.396
CHC					
1.	0.5532	30.45	2.1210	0.2033	5.0740
2.	0.3991	15.28	1.9390	0.1607	4.8260
3.	0.3271	28.15	1.8370	0.1887	4.5180
4.	0.2689	35.99	1.9130	0.1979	4.4810
5.	0.2221	42.41	2.5030	0.1973	4.8950
6.	0.1736	62.98	2.6788	0.1968	4.7574
7.	0.1058	71.46	2.5520	0.2277	4.4380
8.	0.0305	56.33	2.4180	0.2563	4.0050

* See Table II for definitions of the symbols.

TABLE V

Regressions for PHC Excluding the Extreme Firms

ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
-.593 (-11.9)*	-.284 (-2.48)*	.091 (4.25)*	-.0001 (-1.35)	.044 (.35)	.004 (1.62)	.230
-.595 (-12.0)*	-.349 (-3.25)*	.104 (5.19)*	-.00004 (-.85)	-.021 (-.17)		.228
-.595 (-12.0)*	-.352 (-3.33)*	.104 (5.26)*	-.00004 (-.98)			.230
-.60 (-12.1)*	-.338 (-3.17)*	.101 (5.12)*		-.057 (-.51)		.229
-.599 (-12.1)*	-.287 (-2.52)*	.091 (4.25)*			.003 (1.31)	.230
-.594 (-12.0)*	-.282 (-2.47)*	.091 (4.25)*	-.0001 (-1.33)		.004 (1.59)	.231
-.599 (-12.1)*	-.286 (-2.50)*	.091 (4.25)*		-.028 (-.25)	.003 (1.23)	.229

1. The footnotes are the same as in Table II.
2. The first category of Table IV is excluded; the sample size equals 639.

TABLE VI

The Debt Ratio and Insider Holdings
Results Grouped by Debt Ratio Quartiles

DRT Quartile	DRT Mean	MV Mean	LMV Mean	FR Mean	LA Mean
CHC					
1.	0.4757	22.83	2.029	0.1819	4.949
2.	0.2985	32.48	1.908	0.1945	4.528
3.	0.1974	55.81	2.600	0.1986	4.820
4.	0.0683	63.94	2.485	0.2419	4.222
PHC					
1.	0.4053	11.00	1.054	0.0362	5.935
2.	0.2601	13.82	1.3970	0.0275	6.266
3.	0.1882	20.79	1.4875	0.0262	6.251
4.	0.0815	24.03	1.5173	0.0294	5.785

* See Table I for definitions of symbols.

TABLE VII

LA < 5.233 for PHC and CHC

	ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
PHC[2]							
	-.883 (-8.29)*	-.107 (-.46)	.097 (1.73)*	-.003 (-1.68)*	.723 (2.33)*	.035 (2.91)*	.287
	-.878 (-8.11)*	-.391 (-1.81)*	.132 (2.38)*	-.001 (-.56)	.510 (1.67)*		.263
	-.905 (-8.4)*	-.383 (-1.77)*	.132 (2.36)*	.0003 (.20)			.257
	-.893 (-8.52)*	-.401 (-1.87)*	.128 (2.33)*		.435 (1.59)		.265
	-.929 (-8.86)*	-.184 (-.81)	.101 (1.79)*			0.026 (2.33)*	.275
	-.917 (-8.60)*	-.151 (-6.4)	.103 (1.82)*	-.001 (-.62)		.028 (2.40)*	.272
	-.923 (-8.83)*	-.201 (-.88)	.094 (1.68)*		.469 (1.73)*	.027 (2.42)*	.281
CHC[3]							
	-.958 (-9.72)*	-.233 (-1.44)	.178 (4.67)*	-.00004 (-1.71)*	-.094 (-2.03)*	.047 (6.11)*	.268
	-.929 (-9.11)*	-.487 (-3.01)*	.226 (5.87)*	-.00004 (-.18)	-.144 (-3.06)*		.216
	-.889 (-8.72)*	-.515 (-3.16)*	.220 (5.91)*	-.0002 (-1.09)			.203
	-.935 (-9.75)*	-.489 (-3.03)*	.225 (5.9)*		-.146 (-3.25)*		.218
	-1.01 (-10.7)*	-.292 (-1.81)*	.170 (4.45)*			.046 (6.14)*	.257
	-.934 (-9.52)*	-.236 (-1.45)	.177 (4.64)*	-.0005 (-2.48)*		.050 (6.52)*	.264
	-1.01 (-10.8)*	-.269 (-1.68)*	.173 (4.56)*		-.119 (-2.71)*	.044 (5.86)*	.266

1. The footnotes are the same as in Table II.

2. The sample size equals 224.

3. The sample size equals 515.

TABLE VIII

LA > 5.233 for PHC and CHC

	ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
PHC[2]							
	-.887 (-10.8)*	-.233 (-1.15)	.222 (8.32)*	-.0001 (-1.74)*	.485 (2.62)*	-.012 (-2.56)*	.312
	-.849 (-10.4)*	-.155 (-.77)	.207 (7.91)*	-.0002 (-2.94)*	.650 (3.72)*		.305
	-.874 (-10.6)*	-.110 (-.54)	.202 (7.62)*	-.0001 (-1.5)			.287
	-.880 (-10.8)*	-.109 (-.54)	.200 (7.62)*		.435 (2.72)*		.294
	-.923 (-11.4)*	-.229 (-1.13)	.224 (8.35)*			-.016 (-3.95)*	.305
	-.917 (-11.2)*	-.230 (-1.14)	.224 (8.35)*	-.00003 (-.50)		-.016 (-3.68)*	.304
	-.914 (-11.3)*	-.228 (-1.13)	.222 (8.32)*		.326 (2.02)*	-.015 (-3.50)*	.309
CHC[3]							
	-.807 (-4.82)*	-.335 (-.93)	.306 (6.25)*	-.0002 (-3.05)*	.039 (.54)	.016 (1.10)	.355
	-.868 (-5.49)*	-.370 (-1.03)	.316 (6.57)*	-.0002 (-3.19)*	.014 (.20)		.354
	-.872 (-5.59)*	-.355 (-1.02)	.316 (6.58)*	-.0002 (-3.44)*			.357
	-1.01 (-6.56)*	-.147 (-.41)	.310 (6.31)*		-.082 (-1.27)		.325
	-1.02 (-6.61)*	-.319 (-.88)	.321 (6.47)*			-.016 (-1.51)	.327
	-.828 (-5.1)*	-.301 (-.85)	.307 (6.29)*	-.0002 (-3.23)*		.014 (.99)	.357
	-1.02 (-6.64)*	-.251 (-.69)	.321 (6.47)*		-.075 (-1.16)	-.015 (-1.42)	.328

1. The footnotes are the same as in Table II.

2. The sample size is 523.

3. The sample size is 208.

TABLE IX

Significance of Regression Coefficients for PHC and CHC with LA < 5.233 and LA > 5.233 Excluding Extreme Firms

ROAM	ROAS	RPPEAB	MV	FR	LA	R^2
			PHC			
LA < 5.233[2]						
-7.14*	-1.28	.38	-.99	.25	3.36*	.255
-6.85*	-2.77*	.95	.37	-.52		.212
-6.85*	-2.81*	.96	1.44			.215
-6.94*	-.275*	.99		-.40		.215
-7.45*	-1.61	.36			3.25*	.259
-7.21*	-.13	.39	-1.0		3.4*	.259
-7.43*	-1.58	.37		-.29	3.23*	.255
LA > 5.233[3]						
-9.63*	-.76	4.78*	-.90	.28	-.26	.231
-9.78*	-.73	4.89*	-1.08	.38		.232
-9.84*	-.70	4.88*	-1.02			.234
-9.96*	-.63	4.79*		-.11		.232
-9.95*	-.75	4.78*			-.62	.232
-9.75*	-.75	4.78*	-.88		-.37	.232
-9.94*	-.74	4.77*		-.21	-.65	.231
			CHC			
LA < 5.233[4]						
-8.17*	-1.08	2.13*	-1.34	-2.97*	5.08*	.202
-7.58*	-2.35*	3.06*	-.073	-3.81*		.158
-7.82*	-1.13	2.07*	-2.41*		5.63*	.188
-8.99*	-1.26	2.04*		-3.59*	4.89*	.201
-7.05*	-2.56*	3.08*	-1.23			.133
-8.08*	-2.36*	3.07*		-4.01*		.160
-8.82*	-1.46	1.87*			5.21*	.180
LA > 5.233[5]						
-4.68*	-2.37*	4.57*	-2.29*	-1.35	.12	.321
-4.95*	-2.41*	4.69*	-3.14*	-1.47		.325
-4.51*	-2.61*	4.48*	-3.44*		.59	.318
-5.92*	-2.22*	4.79*		-2.87*	-2.11*	.304
-4.84*	-2.76*	4.66*	-4.12*			.320
-5.78*	-1.78*	4.48*		-2.99*		.290
-5.91*	-2.63*	4.66*			-2.26*	.275

1. The footnotes are the same as in Table II.
2. The sample size equals 182.
3. The sample size equals 456.
4. The sample size equals 455.
5. The sample size equals 177.

TABLE X

Regression Coefficients for MV and FR for Five Groups of Firms Classified by FR

	Group 1 FR < 1%		Group 2 1% < FR < 5%		Group 3 5% < FR < 10%		Group 4 10% < FR < 20%		Group 5 FR > 20%	
	MV	FR	MV	FR	MV	FR	MV	FR	MV	FR
1.	-.001 (-.30)	6.5 (2.6)*	-.0002 (-1.5)	.60 (1.2)	-.001 (-2.7)*	.97 (1.7)*	-.0003 (-3.3)*	-.11 (-.39)	-.0002 (-2.8)*	-.06 (-.9)
2.	-.00002 (-.02)	5.0 (2.4)*	-.0002 (-1.4)	.52 (1.0)	-.0004 (-1.5)	.84 (1.45)	-.0002 (-3.1)*	-.15 (-.55)	-.0001 (-.83)	-.10 (-1.5)
3.	.0003 (.28)		-.0002 (-1.3)		-.001 (-1.5)		-.0002 (-3.1)*		-.0001 (-1.1)	
4.		5.9 (2.6)*		.38 (.76)		.80 (1.38)		-.22 (-.80)		-1.1 (-1.6)
5.	.0004 (.36)		-.0001 (-1.3)		-.001 (-2.6)*		-.0003 (-3.4)*		-.0002 (-3.1)*	
6.		5.0 (2.4)*		.40 (.81)		.79 (1.36)		-.21 (-.77)		-.11 (-1.4)

1. The dependent variable in all specifications is DRT.
2. We do not report the coefficients and t-statistics of the other variables (ROAM, ROAS, RPPEAB and LA). However, the combinations of MV and FR with other variables are the same as in Table II.
3. The R^2 adjusted for degrees of freedom corresponding to the above six rows and five groups are as follows:

	1.	2.	3.	4.	5.
1.	.251	.368	.238	.275	.247
2.	.250	.369	.223	.272	.214
3.	.236	.369	.220	.274	.211
4.	.253	.365	.218	.252	.227
5.	.233	.367	.232	.277	.247
6.	.254	.367	.219	.254	.215

TABLE XI

Regression Coefficients for LMV and FR

	PHC		PHC (excluding extreme firms)		CHC		CHC (excluding extreme firms)	
	LMV	FR	LMV	FR	LMV	FR	LMV	FR
1.	-.008 (-1.92)*	.669 (3.29)*	-.002 (-.49)	.032 (.189)	-.068 (-9.25)*	.175 (3.68)*	-.047 (-7.30)*	.063 (1.51)
2.	-.008 (-2.70)*	.669 (4.24)*	.001 (.516)	-.094 (-.70)	-.006 (-1.63)	-.099 (-2.46)*	-.003 (-.85)	-.144 (-4.23)*
3.	-.002 (-.61)		.0003 (.165)		-.01 (-2.84)*		-.008 (-2.71)*	
4.		.451 (3.31)*		-.057 (-.51)		-.125 (-3.39)*		-.155 (-4.97)*
5.	.002 (.66)		-.001 (-.513)		-.05 (-9.12)*		-.041 (-8.77)*	
6.		.386 (2.74)*		-.028 (-.25)		-.123 (-3.35)*		-.152 (-4.90)*

1. The footnotes are the same as Footnotes 1 and 2 in Table X.

2. The R^2 adjusted for degrees of freedom corresponding to the above six rows and four groups are as follows:

	1.	2.	3.	4.
1.	.291	.228	.340	.266
2.	.291	.228	.256	.197
3.	.274	.228	.250	.175
4.	.285	.229	.252	.197
5.	.280	.230	.329	.265
6.	.287	.229	.262	.205

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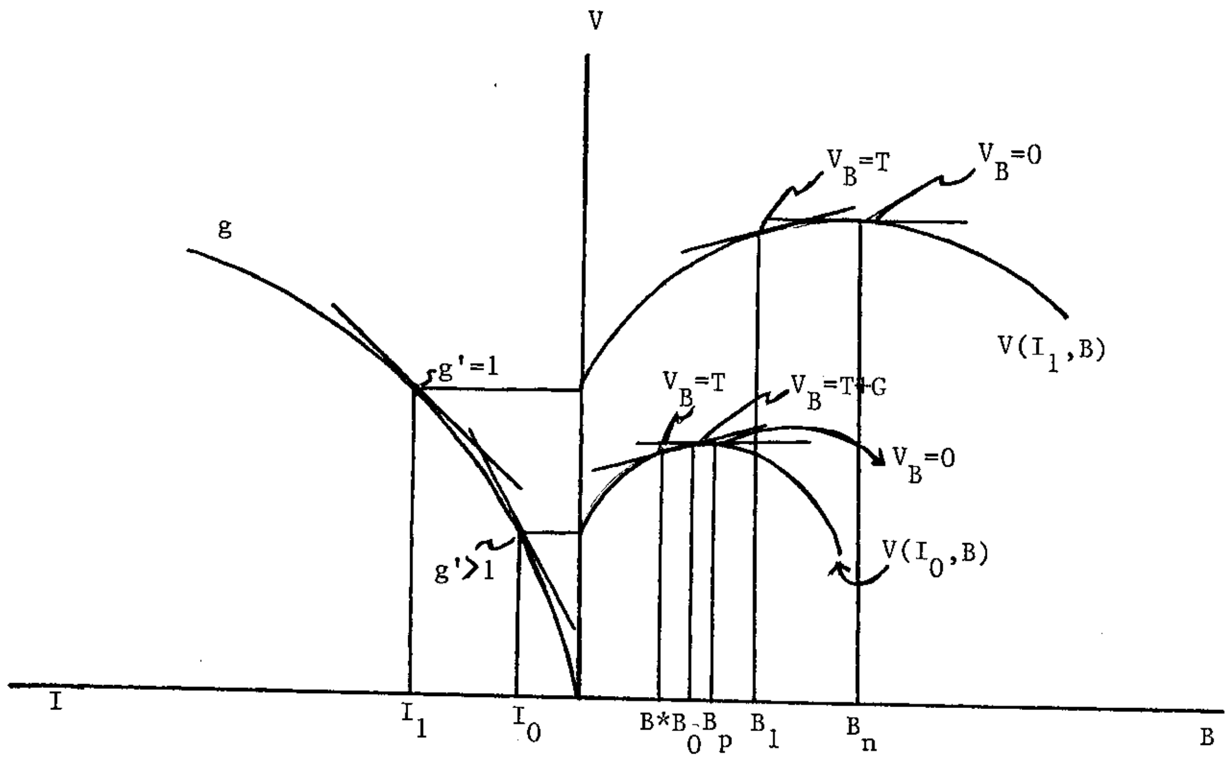

FIGURE A