Taxation and Corporate Use of Debt: Estimates for Behavioral Responses and Implications for Tax Policy

by

Roger H Gordon[*]
UCSD

Existing taxes on corporate and personal income in the U.S. create a wide variety of distortions to firm behavior. One such tax distortion that has received attention for many years is the distortion to a firm's choice of debt vs. equity finance.

Views about the effects of taxes on corporate use of debt have evolved over time. The modern discussion dates back to Modigliani and Miller (1958), who argued that firms should be indifferent between debt and equity finance, ignoring real costs of bankruptcy and ignoring taxes. Miller and Modigliani (1961) then emphasized that corporate tax provisions favor use of debt finance, since interest payments but not dividends are deductible expenses under the corporate tax. Firms, they argued, borrow to take advantage of the resulting tax savings, until the tax savings from further debt are just offset by extra costs resulting from a higher risk of bankruptcy. Based on this taxes-vs.-bankruptcy cost model for corporate use of debt, taxes lead to an excessive use of debt.[1] This theory is laid out in section 1.

The corporate finance literature then focused on measuring to what degree taxes changed corporate use of debt vs. equity finance. Many studies were undertaken. The basic finding was that taxes had at best modest effects on corporate financial policy.[2] For example, a common finding was that firms with tax losses if anything borrowed more than firms with taxable profits, even though their inability to make use of interest

[*] This paper has been prepared for the Forum for Analysis of Corporate Taxation, to be held at American Enterprise Institute on March 17, 2008. I would like to thank Alan Auerbach and Peter Merrill for comments on an earlier draft.
[1] Later papers took into account implications of corporate borrowing for personal as well as corporate taxes, though the basic conclusions remained in force.
[2] Some of the key studies are summarized briefly in section 1.

deductions to save on taxes should have led them to borrow less. Under the taxes-vs.-bankruptcy-costs model, taxes create larger efficiency costs the more responsive is behavior to the tax law. The small estimated behavioral response to taxes then implies small efficiency costs from this tax distortion favoring corporate use of debt.

Recent papers point out various biases that caused earlier studies to underestimate the role of taxes, however. For example, firms with tax losses (and tax loss carryforwards) may borrow more just because they have losses and therefore have greater need for supplementary funds to cover operating expenses. An indicator for the presence of tax losses captures these direct effects on use of debt, as well as the indirect effects through the implications of tax losses for tax incentives, making interpretation of the statistical evidence uncertain.

Two recent papers focus on a different means of identifying the role of taxes. The prior literature examined the behavior only of large corporations. If these firms earn a normal rate of return, they would all face the same corporate tax rate. Any cross-sectional variation in tax incentives across firms therefore needs to come from variation in taxable income, so mainly from whether the firm has profits vs. losses, leading to the biased estimates. By using data on small as well as larger corporations, though, the recent papers can identify the role of taxes through making use of the full tax schedule under the corporate tax.[3] The results suggest that taxes have statistically significant and economically important effects on corporate use of debt. This research on estimating the responsiveness of corporate debt to taxes is summarized in section 2.

The next question is estimating the resulting efficiency costs of these tax distortions, to judge whether these behavioral responses are in fact of serious policy concern. Section 3 develops a standard measure of this efficiency cost, building on the taxes-vs.-bankruptcy-cost framework. The estimated efficiency gains from eliminating the tax distortion favoring use of debt finance could be as large as 39 billion dollars per year, but still a

[3] Currently, for example, the corporate tax rate faced by firms with income below $25,000 is only 15%, while high-earning firms face a corporate rate of 35%.

very small fraction of GDP. While there are a variety of additional complications that can lead to some modifications to this estimate, all have relatively modest effects.

As a result, it is not surprising that this particular tax distortion has not been a major focus in policy discussions. The recent cuts in personal relative to corporate tax rates in 1986, for example, substantially exacerbated the tax distortion favoring use of debt vs. equity finance.[4] Even if the efficiency costs of the distortions are small, though, it still seems surprising that these distortions would have remained in place, and in fact grown during recent years, given the ease of reducing or eliminating these distortions.

How confident can we be, then, in these efficiency cost calculations based on the taxes-vs.-bankruptcy cost model? Under the taxes-vs.-bankruptcy-cost model, we expect that large corporations, who face the top corporate tax rate so have the largest tax savings from interest deductions, should borrow much more than smaller firms, who face a lower corporate tax rate and so gain little from the equivalent interest deductions. The data strongly suggest the reverse, with small firms financing a far higher fraction of their capital stock with debt than do larger firms. That some of the most successful firms, IBM when this question first arose in the literature and Microsoft now, have little or no debt even though they are the firms that can most surely save on taxes through interest deductions, raised serious questions about what factors in fact drive corporate decisions on use of debt.

Facing these puzzles in the data, Myers and Majluf (1984) argued that when corporations seek outside finance, investors learn that the firm needs funds. While this need for funds could be due to the firm having profitable investment opportunities (or opportunities to reduce tax liabilities), however, it equally well could be due to its being short of cash due to poor sales. Papers document that stock prices fall when a firm announces new borrowing, suggesting that investors take this borrowing as bad news about the firm. If

[4] See Gordon and MacKie-Mason (1991) for evidence on the effects of the 1986 tax reform on corporate use of debt finance. The cut in personal tax rates during 2001-2, in itself favoring debt finance, was offset by further cuts in the tax rates on dividends and capital gains, leaving little net change in the tax incentives on debt vs. equity finance.

firms that borrow tend to be firms with poor recent sales records, then the interest rates charged on the debt will also be high, reflecting the resulting pessimism about the status of the firm. Given this impact of borrowing on stock prices and interest rates, Myers and Majluf (1984) argue that firms with less pressing needs for cash (those who are doing well) will forego outside finance, even at the cost of foregoing some good investment projects. Only the weaker firms borrow.

This is a classic example of a lemons problem, noted first by Akerlof (1970). Akerlof sought to explain why the price of a used car is so low. He hypothesized that those with a lousy car are much more likely to choose to sell, so that the equilibrium price of used cars *should* be low. The problem is that car purchasers have incomplete information, and take the decision to sell a car as a bad signal about its quality. By analogy, investors take the decision by a firm to borrow as a bad signal about the quality of the firm. The result is too little corporate borrowing, just as there is too little trade in used cars. Companies forego good projects rather than pay too high an interest rate on new loans.

How should policy deal with such lemons problems? If there is too little trade in these markets, then policies that increase trade can generate efficiency gains. This immediately suggests a subsidy to trade. A better answer is a subsidy to borrowing by better firms, and perhaps even a tax on borrowing by weaker firms. By increasing the fraction of new issues coming from good firms and reducing the fraction coming from poor firms, interest rates charged on these bonds will fall and more firms will choose to borrow. In theory, these subsidies and taxes should be designed to reflect the externalities each borrower imposes on other borrowers, through changing the composition of borrowers that then determines market interest rates. This pattern of subsidies and taxes corresponds in many ways to what we now have in the tax law, with firms in the highest tax brackets saving taxes on net through borrowing while firms with tax losses paying more in taxes on net once we take into account the taxes paid by those receiving the interest payments.

Existing tax policy then looks much less puzzling under the Myers-Majluf (1984) model for use of debt. This model is described in section 4, and its implications for the tax treatment of debt are analyzed in section 5.

The Myers-Majluf (1984) model is not the only alternative model for why firms borrow. Section 6 describes more briefly two other models for debt finance: an agency cost model as initially described by Easterbrook (1984) and Jensen (1986), and the signaling model developed by Ross (1977). In each case, the efficiency implications of tax distortions are described. The section then reports on the consistency of the empirical evidence with these two models, and their implications for the efficiency costs of the existing tax distortions favoring use of debt finance.

Section 7 then provides a brief summary of the weight of the evidence concerning the efficiency effects of the existing tax treatment of corporate debt.

I. Taxes vs. Bankruptcy Costs

To what degree do taxes distort a corporation's choice between debt and equity finance?

To judge this, consider the implications for tax payments by both the firm and those who invest in the firm when the firm borrows an additional dollar in debt. Assume that it uses the proceeds to pay extra dividends or to repurchase some existing equity, and will adjust future payouts to shareholders in the same proportion between dividends and repurchases so as to leave real investment unchanged.

With a dollar of extra share repurchases, the immediate effect of this change in policy is extra cash receipts by shareholders equal to $\$1(1-e)$, where e is the effective personal tax rate on these payouts, based on the fraction of the dollar used to finance extra dividends vs. share repurchases.

In each future period, the firm has reduced net-of-tax cash flow equal to $i(1-\tau)$, where i denotes the interest rate. In addition, with extra debt it faces the threat of higher bankruptcy and agency costs each period. Denote the resulting overall pre-tax certainty-equivalent cost each period by $C(d, X)K$, where the function C measures the cost per dollar of capital generated by a debt/capital ratio different from the value that minimizes real agency and bankruptcy costs,[5] $d = D/K$ is the firm's debt/capital ratio, D is the firm's overall debt, K represents the firm's capital stock, while X captures any other factors (e.g. industry) that affect the size of real costs to a firm from varying its debt levels. Assume that C is a convex function of d, with a minimum value when $d = d^*$. Taxes will then induce the firm to choose a debt/capital ratio different from the value d^* that minimizes costs.

When the firm borrows an extra dollar, the available cash flow to the firm falls by $(i + C_d)(1-\tau)$ in each future period. This reduction in the firm's cash flow reduces the funds available each period for dividends or share repurchases, leading to a fall in net of tax income to shareholders of $(1-e)(i + C_d)(1-\tau)$.[6]

In discounting all of these future reductions in payouts to shareholders to the present, we discount at the shareholders' opportunity cost of funds. Shareholders can invest in either bonds or equity, and would choose a portfolio so that they are indifferent between the two at the margin. We can therefore use either rate of return as the discount rate, and for convenience use the after-tax rate of return available on bonds. This net-of-tax rate of return equals $i(1-m)$, where m is the tax rate the investors face on interest income. Given this discount rate, the present value of the drop in future payouts to shareholders resulting from a dollar in extra debt equals $(1-e)\int_0^\infty (i + C_d)(1-\tau)e^{-i(1-m)t}dt$.

[5] See Jensen and Meckling (1976) for an extended discussion of the many factors affecting the size of the debt/capital ratio that minimizes real costs, given the conflicts of interest both between debt and equity and also between inside and outside equity holders.

[6] The effective tax rate that would have been paid on any such payouts is again assumed to equal e.

The shareholders are then indifferent to an extra dollar of debt when the initial extra cash receipts just equals the present value of the future drop in payouts, implying

(1) $$1-e=(1-e)\int_0^\infty (i+C_d)(1-\tau)e^{-i(1-m)t}dt\ .$$

Carrying out the algebra, we find that

(2) $$i\frac{\tau-m}{1-\tau}=C_d$$

The higher are nominal interest rates or the higher is the corporate tax rate relative to the personal tax rate on interest income, the stronger are the tax incentives to increase borrowing, leading to a higher value for d.[7]

What can we say about the size of this tax distortion, and how it varies across firms and over time? The corporate tax rate τ represents the marginal tax rate on future income accruing to the firm. By statute, this marginal tax rate depends on the firm's taxable income, denoted by π, so that we can express the firm's marginal tax rate by $\tau(\pi)$. Under current statutes, marginal corporate tax rates vary from 35% for firms with the high incomes to 0 % for firms with tax losses extending into the indefinite future, with several different tax brackets in between. This whole schedule has changed frequently over time, even though the top corporate rate has changed much less often.

We can then express taxable income by $\pi \equiv (\tilde{\rho}-id)K$, where $\tilde{\rho}$ represents the firm's ex post taxable rate of return. The corporate tax rate therefore varies across firms and across time due to differences in statutes, and then differences in K, d, i, and $\tilde{\rho}$. In the next section, we focus on the implications of using each of these sources of variation when trying to estimate the effects of taxes on corporate financial policy.

[7] Note that the tax rate on dividends or capital gains, e, does not enter this expression. The logic fundamentally is the same as that in Auerbach (1979). Either the firm pays out funds now or reduces borrowing and pays them out later, but regardless the funds are ultimately subject to personal taxes.

The tax rate, m, represents the personal tax rate on interest income faced by the firm's shareholders. This raises the immediate complication that shareholders are heterogeneous, and can be in very different personal tax brackets, assuming they are taxable at all. There have been various papers that explore how best to capture the personal tax incentives driving firm behavior. Miller (1977) provides a model in which investors divide into clienteles based on their personal tax rate, with those in higher tax brackets investing in stocks or municipal bonds and those in lower tax brackets buying taxable bonds. Within this model, the tax rate that drives firm behavior is that of the investor who is just indifferent between taxable and municipal bonds. Gordon and Bradford (1980) develop an alternative model in which all investors buy bonds and stocks, but in different proportions depending on their tax incentives and risk aversion. Here, the tax rate that drives firm behavior is a weighted average of the tax rates faced by all investors, with weights depending on their wealth (and degree of risk aversion). Both approaches have been used in the past literature in coming up with a plausible estimate for m.

Interest rates can also vary by firm, depending on the risks of default. Plausibly, they then depend on both d and $\tilde{\rho}$, raising endogeneity problems. Interest rates also vary over time, though, providing a useful supplementary source of identification.

2. Evidence on behavioral responses to tax incentives

How responsive are actual corporate financial choices to taxes?

Empirical tests have focused on both cross-sectional and time-series evidence. Time-series evidence alone proved to be insufficient, since tax incentives at least for large firms have been very stable over time, providing too little variation to identify effects of taxes on use of debt. Too many other factors change over time, obscuring any tax effects.[8]

The cross-sectional evidence made use of variation in tax incentives across firms at a particular date. Most of the past empirical work used COMPUSTAT data, which provides income and balance sheet information for publicly traded firms in the U.S. Within this data set, all firms are large enough that they would face the top corporate tax rate unless their profit rate is unusually low. Therefore, variation in K did not provide a useful source of identification.

The empirical work therefore focused on the implications of variation in π for tax incentives, and then the effects of this variation in tax incentives on corporate financial policy. Effects of variation in π for tax incentives was captured in many ways, including indicators for tax loss carryforwards and measures of the size of "nondebt tax shields," which represent key deductions (mainly depreciation) other than interest payments.[9] A more ambitious approach involved simulating the future distribution of values of π, and then calculating the effective tax rate taking account of tax-loss carryforwards and carrybacks.[10]

Using these identification procedures, little evidence was found for any important tax effects on corporate use of debt finance. Often the estimated coefficients had the "wrong" sign, since firms with tax losses commonly borrowed more than firms with profits.

---

[8] For example, Taggart (1985) studied how use of debt varied over much of the twentieth century, including periods before as well as after the introduction of the corporate income tax. Contrary to the forecasts from a model focusing just on taxes, corporate use of debt was quite high prior to the introduction of the corporate tax, presumably because equity finance was much less easily available than has been true in more recent years. This simultaneous variation over time in the sophistication of financial markets is hard to control for, making it difficult to extract information from time-series evidence about the effects of taxes.

[9] Among the many references that can be included here are: Auerbach (1985), Bradley et al (1984), Graham (1996), Graham et al (1998), Graham (1999), Gropp (1997), and MacKie-Mason (1990).

[10] The key reference here is Graham (1996).

That firms with tax losses borrow heavily is not surprising, of course, since these firms face financial pressures to seek outside funding to help cover essential current expenses. Firms needing extra funds can borrow from banks or issue commercial paper or corporate bonds much more easily than they can issue new equity.

Formally, the problem is that π can have direct effects on a firm's use of debt, and not simply serve as a proxy for the firm's effective corporate tax rate. This source of variation in tax incentives therefore does not provide a convincing source of identification.

Two recent studies have shifted to a different source of data, the Statistics of Income, which provides income and balance sheet information for all corporations filing tax returns in each year.[11] The data are subdivided into roughly fifteen size categories, based on each firm's total assets. This data set therefore provides much more variation in firm size than is available in the COMPUSTAT data. It also covers a longer time period, providing more of a chance to make use of time-series evidence.

With this data set, identification can be based on variation in K across size categories of firms combined with variation in statutory tax schedules over time. Note, though, that variation in K alone is not sufficient for identification: small firms can have very different financial policies because they have less access to the equity market. To identify tax effects therefore requires controlling flexibly for any direct effects of K on firm behavior. These papers then estimate tax effects by examining the degree to which borrowing by firms of a particular size changes over time as their tax incentives change.[12] While tax incentives for firms with high profits were relatively stable over the sample period, tax incentives for firms with low profits varied substantially, providing sufficient information to identify tax effects.

[11] See Gordon and Lee (2001, 2007)

[12] These studies also include time dummies, so in fact estimate the relative change in the borrowing by firms of different sizes compared to the differential changes in their tax incentives.

Results suggested nontrivial effects of taxes on behavior. For example, the coefficient estimates in Gordon and Lee (2007) reported in column 3 of their Table 2, suggest that shifting from the average tax distortion to no tax distortion would reduce debt/capital ratios by .022, implying that an additional 2.2% of capital would be financed with equity rather than debt.[13] The estimates in Gordon and Lee (2001), using a somewhat different specification, suggest over twice as large a response, with a reduction in debt-capital ratios by .047 if tax distortions were eliminated.[14]

The theory also forecasts that behavioral responses should be proportional to nominal interest rates. Gordon and Lee (2007) do in fact find clear support for tax effects being larger in years with higher nominal interest rates, with very large effects in the years with the highest nominal rates and essentially no effect in years with the lowest nominal rates.

3. Estimates of efficiency costs: taxes-vs.-bankruptcy-cost model

If we accept that the taxes-vs.-bankruptcy-cost model explains observed corporate choices for debt/equity ratios, then it is straight-forward to make use of the above estimates to calculate the efficiency gains from eliminating existing tax distortions to corporate financial policies. The key assumption is that corporate financial policies would be efficient if there were no tax distortions affecting these choices.

For any small change in tax policy, the resulting excess burden can be measured based on the resulting change in government tax revenue caused by any behavioral changes.[15] If tax policies change so as to induce firms to increase their use of debt finance by a dollar,

---

[13] These results are based on a year with average interest rates.
[14] This estimate is based on the coefficient estimates in column 3 of Table 5.
[15] Ignoring behavioral changes, any change in tax payments by individuals or firms just equals the extra tax payments received by the government. These effects of a tax change involve redistribution, but no efficiency costs. In addition, though, firms and individuals can change behavior in response to the tax change. While individuals and firms should be virtually indifferent at the margin when they change behavior in response to a small tax change, since otherwise they wouldn't have waited for the tax change to alter their behavior, the government experiences a change in its tax revenue. This change in tax revenue then measures the net cost to individuals and the government together resulting from the change in tax policy.

then the individuals pay additional taxes now on the dollar of extra payouts in dividends and capital gains generated by share repurchases. In addition, in each future period, corporate tax payments fall due to the extra deductions for interest expense and extra possible bankruptcy costs, while individuals receive interest income instead of dividends or capital gains. The present value of the resulting changes in government revenue equal

(3) $$e - \int_0^{\infty} (i + C_d)(\tau + e(1-\tau))e^{-i(1-m)t} dt + \int_0^{\infty} ime^{-i(1-m)t} dt$$

Making use of equation (2), it is easy to show that this expression simplifies to

(4) $$\int_0^{\infty} i\frac{\tau - m}{1-\tau}e^{-i(1-m)t} dt ,$$

or equivalently to a loss of $i(\tau - m)/(1-\tau) \equiv T^*$ in each future period. This, of course, is just what we should have expected. The real loss from a dollar of extra debt in a period equals C_d. As seen from equation (2), in equilibrium $C_d = T^*$.

How would we then calculate the overall efficiency gains if we were to eliminate this tax distortion entirely?[16] The overall gain in efficiency from entirely eliminating the tax distortion to corporate financial policy, assuming all firms face the same changes in incentives, equals[17]

(5) $$-\int_0^{T^*} T\frac{\partial D}{\partial T} dT = -.5(T^*)^2 \frac{\partial D}{\partial T} \quad .$$

[16] One approach for eliminating this tax distortion would be to eliminate both the deductibility of interest payments and the taxation of interest receipts.
[17] We ignore at this point behavioral responses in other markets, an issue we return to below.

Note that the second expression follows if the size of the behavioral response does not depend on *T*.[18]

Calculating this expression is straight-forward. We report above, for example, estimates ranging from .022 to .047 for the size of the reduction in the debt/capital ratio resulting from reducing the average tax distortion to zero. This figure corresponds to $\Delta \equiv T^* \partial(D/K)/\partial T$. Expression (5) then equals $.5T^* K\Delta$. The average value of T^* reported in Gordon and Lee (2007) is .46. According to the Economic Report of the President (2007), the value of shareholders' equity as of the third quarter of 2006 was 2.7 trillion dollars. With an average debt/capital ratio reported in Gordon and Lee of .26, this leads to an estimate of the corporate capital stock (evaluated at market prices) of 2.7/(1-.26) = 3.6 trillion dollars. Given these figures, the value of expression (5) is 18.7 billion dollars, assuming $\Delta = .022$, and 39.1 billion dollars assuming $\Delta = .046$. To put this figure in context, overall revenue from the corporate tax in 2006 was 353.9 billion. The efficiency loss is therefore roughly five to ten percent of corporate tax revenue.

This figure alone suggests that the tax distortions to corporate financial policy are not a dominant consideration when setting tax policy. To what degree, though, might these figures underestimate the costs of these distortions? One omission is that tax incentives vary by firm, creating misallocations as well as an average distortion. According to the figures in Gordon and Lee (2007), the average tax distortion was .46, but this tax distortion ranged from .01 to .92 across firms of different sizes and dates. If we assume that this tax distortion has a uniform distribution over this interval, then the average value of $(T^*)^2$ turns out to be a third larger than the value of $(T^*)^2$ evaluated at the average T^*.

Another omission is that the size of the tax distortion depends on the value of nominal interest rates. The above calculations were calculated assuming interest rates equal their

---

[18] The estimates in Gordon and Lee (2001) suggest comparable responsiveness among firms of different sizes. This expression also ignores general equilibrium feedbacks onto the market interest rate. To take these effects into account, a computational general equilibrium model would be needed.

average value during the sample period of 1954 - 2000. The maximum values for nominal interest rates during this period were roughly 2.5 times as high. In those years, the estimated efficiency losses from existing taxes would then be 2.5 times as large in dollar terms, and probably a yet higher fraction of corporate tax revenue given the loss in revenue from the higher interest deductions. Currently, however, nominal interest rates are roughly 40% of their average value during the sample period, reducing tax distortions proportionately.

The above figures also ignore any effects of a tax reform on behavior other than corporate financial policies. Other behavioral responses also have efficiency consequences to the degree that taxes distort these other decisions. The obvious place to focus here is corporate investment. The implications for corporate investment would depend on precisely how the tax distortions to corporate financial policy were eliminated. If these tax distortions were eliminated by eliminating both the deductibility of interest payments and the taxation of interest income under the personal and corporate tax while holding statutory tax rates unchanged, this would lead to an increase in the effective tax rate on corporate investment. Assuming that the existing tax structure discourages corporate investment, this implies an offsetting efficiency loss from eliminating the tax distortion favoring use of debt finance. The quantitative importance of this offsetting effect can be debated,[19] but its presence certainly undermines further any case for focusing on reducing existing distortions to corporate financial policy.

4. Alternative determinants of corporate financial policies

These calculations are not the end of the story, though. They are correct only if corporate use of debt would be efficient if there were no tax distortions. This assumption has been

[19] Gordon, Kalambokidis, and Slemrod (2004) find for example that tax payments under existing taxes are virtually identical overall to what would occur if we shifted to expensing of business investment and eliminated any taxation of financial income from capital (and any interest deductions), thereby eliminating all marginal distortions to savings and business investment. Gordon, Kalambokidis, and Slemrod (2004a) then argue that these small revenue effects imply a small effective tax rate on business investment.

questioned in the more recent literature on corporate finance. The questioning initially focused on a variety of inconsistencies between the forecasts from the theory and observed corporate use of debt.

According to the theory, debt is favored to the extent that $\tau > m$ for a firm, and conversely. As a result, we should expect to see less use of debt by firms facing lower effective corporate tax rates. Given the progressive rate structure under the corporate tax, and the lack of full loss offset, small firms and larger firms with tax losses face much lower effective corporate tax rates than do larger profitable firms. By the theory, these firms should then borrow less.

The data very much show the reverse. According to the figures reported in Gordon and Lee (2001), firms with assets larger than $25 million dollars financed only 17 percent of their assets with debt, whereas remaining firms financed roughly 30% of their assets with debt. The earlier empirical work found if anything that firms with tax losses had the same or slightly more use of debt than did profitable firms. Graham (2000) finds among publicly traded firms (those in the Compustat data set) that they and their investors could have saved additional taxes equal on average to at least 7.3% of firm value through expanding the use of debt finance. The firms that most forego these opportunities to save on taxes tend to be large, profitable, liquid, and in stable industries, making their behavior particularly puzzling.

In addition, while the taxes-vs.-bankruptcy-cost model implies that bankruptcy costs should be high enough at the margin to offset any tax savings from extra debt, it is hard to find potential bankruptcy costs anywhere near this large in the data. Warner (1977) for example could document ex-post bankruptcy costs in a sample of large railroad bankruptcies equal to only 1% of the market value of the firms seven years prior to bankruptcy. This figure is virtually an order of magnitude less than the foregone tax savings from extra use of debt finance, even assuming that the subsequent bankruptcy becomes certain.

A further puzzling observation is that share prices fall when a firm unexpectedly announces new borrowing.[20] Under the taxes-vs.-bankruptcy-cost model, firms choose their debt levels to maximize the utility of shareholders, so that shareholders should be indifferent to any marginal changes in debt levels.

Another puzzle, given the taxes-vs.-bankruptcy model was the sizeable use of debt finance in the early twentieth century, before tax distortions should have played any role. Taggart (1985) documents that debt/equity ratios were higher then than they were during many of the intervening years.

Myers and Majluf (1984) provide an intriguing explanation for these various observations, based on a "lemons" model for corporate borrowing. The "lemons" model dates back to Akerlof (1970), who used it to explain the low prices and small volume of trade in the market for used cars. Akerlof's hypothesis is that people are much more likely to try to sell their car if it is a "lemon," so performing poorly. Buyers may not be able to determine the quality of a car by visual inspection, so instead infer from the fact that the current owner wants to sell it that the car is likely to have problems.

Similarly, Myers and Majluf (1984) argue that lenders cannot easily judge the likelihood that a firm is doing well so will repay its debts.[21] Facing then the same interest rate, firms that are doing badly may be more inclined to borrow since it is less likely that they will end up repaying this debt, and also because they are more pressed for funds to cover current day-to-day expenses. If true, this implies that the set of firms who borrow tends to be lower quality firms. Not knowing the true quality of any particular firm, lenders need to charge a higher interest rate in order to protect themselves against the possibility that the firm borrowing money is in fact a "lemon." Firms that are doing well can then

[20] For evidence on the immediate impact of an unexpected debt issue on stock prices, see e.g. Chaplinsky and Hansen (1993) and Howton, Howton, and Perfect (1996). Spiess and Aftleck-Graves (1999) and Datta, Iskandar-Datta, and Raman (2000) provide evidence that the longer run drop in stock prices in response to a new debt issue is even larger than the observed short-run response.

[21] Formally, their model deals with any source of outside finance. In applying their model to debt finance, I reinterpret some of their expressions so as to reflect the particular trade-offs faced with debt.

find the high interest rates unattractive to the point that they may forego borrowing even at the cost of foregoing good projects or foregoing sizeable tax benefits.

This model immediately provides an explanation for why firms doing badly, who turn out to have tax losses, are the ones more likely to borrow. Myers and Majluf (1984) also use their model to explain the greater use of debt by smaller firms. They argued that these potential "lemons" problems are far more serious when firms use equity rather than debt finance, since then outside investors need to worry not just about the possibility of default but also about the entire distribution of possible returns. Outside investors will know much less about the situation of small firms than of large firms, given the economies to scale in collecting information on a firm. With greater asymmetric information for small firms, small firms will primarily use debt finance, if they raise outside finance at all.

This model also implies that share prices will fall in response to an unexpected use of debt finance, as seen in the data. In addition, real bankruptcy costs play no role in the model. Therefore, the lack of important such costs in the data can be entirely consistent with the model. The model also helps make sense of the sizeable use of debt in the early twentieth century, since this was a period when lemons problems were undoubtedly more important than they are now, given more recent improvements in the quality of the information transmitted through financial markets. As a result, the model is much more consistent with the data than is the taxes-vs.-bankruptcy-cost model.

Within this lemons model for use of debt finance, taxes can still affect choices. As in the earlier model, firms with $\tau > m$ are encouraged to borrow in order to take advantage of the resulting tax savings, while firms with $\tau < m$ will be discouraged from borrowing, everything else equal. The empirical work that finds such behavioral responses can then be consistent as well with this lemons model, as long as it controls adequately for the other factors affecting borrowing decisions. The key additional control needed under the lemons model is an indicator of the severity of asymmetric information problems. The natural control here is firm size, a control which is already used in the prior studies.

The main difference between the lemons model and the taxes-vs.-bankruptcy-cost model is in the calculation of efficiency effects. In order to demonstrate the possible efficiency effects of existing tax distortions favoring use of debt finance, consider the following variant of a "lemons" model.

5. Lemons model of corporate use of debt finance

Consider the borrowing decisions made by a set of firms all of whom look identical to outside investors but that differ in their true value and in the marginal product of any additional investment, given whatever investment is feasible out of internal funds. Following Myers and Majluf (1984), assume that any outside finance will take the form of debt rather than equity.

Firms must decide whether or not to borrow from outside investors, and if they borrow how much to borrow. Shareholders require an expected rate of return of $r(1-m)$ on any bonds they buy. The interest rate charged on such loans equals i, which is set so that lenders break even in expectation, i.e. $r = i\rho$, where ρ is the equilibrium fraction of the contractual interest that in fact is repaid and r is the risk-free market interest rate. To simplify the derivations, assume that i does not depend on the amount borrowed.

Funds, B, that are borrowed are in part used to finance extra capital, but can also in part be paid out directly to shareholders. Assume that αB equals the amount paid out directly to shareholders, while the rest of the amount borrowed is invested.[22] The amount received by shareholders earns a rate of return of $r(1-m)$ when invested in the financial markets.

[22] Equivalently, firms would have invested αB of their own funds if they chose not to borrow, but instead pay out these funds to shareholders if they do borrow.

Each firm is run by a manager who has inside information about $\tilde{\nu}$, which represents one component of the firm's cash flow. The objective of the manager is to maximize net profits. The ex-post profits accruing to the firm's shareholders equal

$$(6) \qquad (1-\tau)[\pi(K+(1-\alpha)B)+\tilde{\nu}+\tilde{\varepsilon}]+\alpha Br(1-m)-\min(iB,\pi+\tilde{\nu}+\tilde{\varepsilon})(1-\tau)$$

Here, $\tilde{\varepsilon}$ is a second random component to profits not known by the manager when she makes decisions. The firm repays the promised amount *iB* as long as it has the funds. Otherwise, it pays out all of its cash flow to lenders. Outside lenders know *K* and can monitor that $(1-\alpha)B$ was in fact invested.

The manager chooses *B* so as to maximize expression (6), subject to the constraint that the amount borrowed must be non-negative.[23] Let $P(B\,|\,\tilde{\nu})$ denote the probability that the loan is fully repaid, e.g. $P(\tilde{\varepsilon} > iB-\pi-\tilde{\nu})$, based on the information available to the manager.

The first-order conditions for *B* can be expressed as:

$$(7) \qquad \pi'(K+(1-\alpha)B) \le i - \frac{\alpha r}{1-\alpha}\left[\left(\frac{1}{P}-\frac{1}{\rho}\right)+\frac{\tau-m}{P(1-\tau)}\right],$$

where the equation is satisfied with equality whenever $B>0$. The first term on the right-hand side of equation (7) simply equals the interest rate charged on corporate debt, i. The term inside the parentheses measures the degree to which any given firm has a probability of repaying in full that differs from the average repayment rate on the loan market as a whole.[24] The higher is its default rate, the stronger its incentives to borrow.

[23] If the firm instead lends money, then it would earn the interest rate *r* rather than i. For simplicity, we ignore the possibility that firms choose to lend money at this lower interest rate.

[24] This term inside the parentheses on average is positive across firms for two separate reasons. For one, $\rho > P$ to the extent that firms make *any* repayments in the event of default. In addition, the variation in *P* across firms implies that $avg(1/P) > 1/\overline{P}$.

Finally, the last term measures the effects of taxes on corporate use of debt. Taxes again encourage debt to the extent that $\tau > m$.

The cost of capital varies across firms simply due to variation in *P*. The more likely the firm will default, the lower is *P* and the smaller is the cost of capital. Among firms that borrow, therefore, firms with a lower $\tilde{\nu}$ borrow more, and end up with a lower equilibrium value for π'. Firms with a high enough value for $\tilde{\nu}$ may find the cost of capital too high to justify any borrowing.

We therefore find a misallocation of capital, with good (high $\tilde{\nu}$) firms ending up with too little capital relative to bad (low $\tilde{\nu}$) firms. Bad firms borrow more since the cost is low, given that they are unlikely to repay the debt. On efficiency grounds, in contrast, firms should invest until $\pi' = r$. For plausible parameter values, the worst firms can easily end up investing in value-reducing projects, where $\pi' < r$.

In principle, tax policy can then be used to reduce the misallocation of capital among firms. Allocations among firms would be efficient if the expression on the right-hand side of equation (7) equals *r*, regardless of *P*, where $r = i\rho$. Solving for the value of T^* that generates such an efficient allocation, we find that:

(8) $$T^* = P\frac{1-\rho}{\rho\alpha} - (1-P)$$

Assume, for example, that $\rho \approx .75$, so that the interest rate on corporate borrowing is a third higher than the risk-free rate. With less link to the data, assume that $\alpha \approx .2$, so that shareholders can immediately remove 20% of the amount borrowed from the assets available as implicit collateral for the lenders. Then the value of T^* that induces an efficient level of investment is 0.67 for the safest firms (when $P = 1$), but equals 0.067 for a firm with a sixty percent change of not repaying the debt in full (when $P = .4$).

This compares with a mean value for T^* in the Gordon and Lee (2007) data set of 0.46, ranging across firms from 0.01 to 0.92.

To what degree can the tax law approximate such a tax schedule, imposing a much higher marginal tax rate on good firms than on bad firms? One crude way to do this is through no-loss-offset provisions. Firms with a worse value of P are more likely to face binding no-loss-offset provisions, so face a lower effective value of τ and therefore a lower T^*.

Asymmetric information is likely to be a much more severe problem for smaller firms than for larger firms. Note that firms with profits below $75,000 face a lower marginal corporate tax rate than do firms with higher profits. If the small firms likely to have access to outside credit have expected profits around $75,000, then those firms that are in fact better than average will face a much higher value of τ than those that are worse than average. Good firms are then encouraged to borrow by the tax law, whereas weak firms are perhaps even discouraged from borrowing. Larger firms in contrast face a constant value of τ over a much wider range of their possible incomes, leading to less of a differential impact on the borrowing of good vs. bad firms, as would be appropriate if there is less asymmetric information for these firms.

This lemons model therefore forecasts that a number of existing provisions in the tax law might have some beneficial effects. In particular, no-loss-offset provisions and the progressive rate schedule under the corporate tax may both help to discourage borrowing by firms expecting to do badly, while to encourage borrowing by firms expecting to do well. In both cases, this helps alleviate the allocation problems arising from asymmetric information.

6. Additional models of corporate capital structures

While the taxes-vs.-bankruptcy-cost and the "lemons" models have both received substantial attention within the corporate finance literature, they are by no means the only models of the determinants of corporate leverage that have been explored. The aim in this section is to describe more briefly two other models that have been taken seriously in the academic literature, to assess their consistency with the evidence, and then to sketch their implications for the measurement of the excess burden generated by the existing tax treatment of interest income and interest payments.

To anticipate the discussion, both models generate a number of counterfactual forecasts, and seem dominated by the "lemons" model given the available evidence.

6.1 Agency-cost models of debt finance

One alternative model, first proposed by Easterbrook (1984) and Jensen (1986), focuses on an agency problem within the firm. Managers, they argue, want to build an empire, so choose to invest more than is in the interests of shareholders. Specifically, if the firm has "free cash flow, managers will choose to invest more of these funds than is in the interests of shareholders. Shareholders, acting perhaps through the Board of Directors, should respond by reducing the firm's free cash flow. They can do this for one through dividend payments.[25] They can also do it through inducing the firm to borrow more heavily, and then to use the borrowed funds to repurchase equity. By saddling the firm with future interest payments, managers are left with less free cash flow, reducing wasteful investment.

Under this model, we should expect to see more use of debt in:

a) publicly-traded (large) firms, where shareholders have a harder time monitoring managers so where agency problems are worse,

b) more profitable firms, with greater cash flow that can potentially be wasted, and

c) firms with lower amounts of profitable investment, implying less need to leave any cash within the firm.

[25] See Gordon and Dietz (2007) for a formal examination of this explanation for dividends.

These forecasts are all contradicted by the data. As noted above, small firms rely far more on debt finance than do large firms. As reported in more detail in Graham (2000) and Fama and French (2002), more profitable firms are less leveraged, everything else equal, rather than more leveraged. Firms that investment more are more levered, as documented for example in many of the empirical studies cited above, where leverage ratios are found to be higher in firms with more depreciable capital. Note that all three of these patterns in the data are consistent with the Myers-Majluf (1984) model.[26]

Nonetheless, if the agency-cost model were the appropriate description of the determinants of corporate financial policy, how should the efficiency costs of the existing tax treatment of corporate interest payments be measured? Under the agency-cost model, shareholders choose a level of debt finance that maximizing firm values. This would also be the efficient level of debt from an efficiency perspective. As a first pass, then, the efficiency costs arising from the current tax treatment of debt would be measured in the same way as in the taxes-vs.-bankruptcy-cost model, where debt levels were also chosen efficiently ignoring taxes.

This isn't the end of the story, though. At the margin, shareholders face a cost from reducing free cash flow yet further, due to the added potential costs of bankruptcy. Free cash flow may be reduced without these offsetting real costs, though, through an added tax on corporate cash flow, so a corporate surtax. Tax payments then go up when cash flow is high, and waste would be high, and may even fall (due to tax loss carrybacks) when cash flow is low and the firm might face a risk of default. The tax therefore not only reduces excess investment but can even potentially reduce the chance of default. This corporate surtax should be confined to firms with important agency problems, so publicly traded firms. The existing tax code may approximate this, through the use of a higher corporate tax rate on more profitable firms.

[26] Of course, there are some other forecasts that are consistent with the data. One is that firms may use debt finance even without tax distortions favoring debt, so that the model is consistent with the observed use of debt in the early twentieth century. The agency model, unlike the lemons model, does not help explain why debt levels should have been unusually high during this earlier time period.

6.2 Signaling model of debt finance

Yet another alternative model, proposed originally by Ross (1977), argues that a firm agrees to saddle itself with debt in order to signal to outside investors that the firm is confident that it will have sufficient cash flow in order to service this debt. When firms engage in more borrowing, they trade-off the gain from convincing investors that the firm is doing better, leading to a jump in share prices, with the cost from being left with less internal cash-flow, forcing a cut-back in desired projects.

The signaling model then forecasts that firms with greater cash flow and less investment needs will find it easier to signal and so take on extra debt. In addition, firms where outside investors are less well informed would have a stronger incentive to signal. When a firm does signal, share prices should rise.

How do these forecasts match up with the data? The first two forecasts are both counterfactual. Contrary to these models, firms with greater cash flow do not have higher leverage ratios, while firms that invest less have lower rather than higher leverage ratios.

Which firms face less well-informed outside investors, creating more of a price response to signaling? Presumably, outside investors are less well informed about the profitability of smaller firms, given the economies to scale in the collection of information. Smaller firms should then use more debt finance, consistent with the data.

The heart of the signaling model, though, is that the signal should generate a jump in share prices. As noted above, the evidence here contradicts this forecast. Unexpected increases in the use of debt have been found to lead to a drop in share prices.[27]

[27] The reported tests, though, have not been directed specifically at the forecasts from the signaling model. Under the signaling model, borrowing and using the funds to repurchase equity should lead to a jump in share prices, but borrowing to add to the firm's available cash should lead to a fall in share prices. This distinction was not made in the tests reported above.

Nonetheless, if the signaling model were correct, what can we say about the efficiency effects of the current tax treatment of interest payments/income? Under the signaling model, the firm accepts real costs through reduced investment in order to signal its profitability to the market. As argued by Spence (1973) in the context of education as a signal, efficiency would then improve if the overall costs of signaling could be reduced, holding fixed the information conveyed, so in his context if people in equilibrium "waste" fewer years acquiring education as a signal. In our context, the overall costs would be reduced if in equilibrium firms use less debt, while still successfully signaling their profitability to outside investors.

Starting from a setting with no tax distortions, the use of debt as a signal would be reduced if investors are taxed on their interest income. Additional debt then implies not only foregone investment but also extra tax costs to investors. These combined costs are again traded off with the benefits resulting from the associated increase in the firm's share price arising from the signal. By adding a tax cost, the equilibrium signal will be smaller, the overall marginal cost of the signal will be higher, but the marginal cost from foregone investment will be smaller. As a result, the efficiency loss arising from the foregone investment is smaller, so that overall efficiency increases.

In contrast, if firms receive a tax savings as a result of their interest payments, equilibrium use of debt increases to the point that equilibrium investment falls, in spite of the reduced corporate tax payments: equilibrium marginal benefits from debt are higher so that equilibrium marginal costs resulting from foregone investment should be higher.

The benefits from reducing the current tax subsidy to debt are then larger than in the taxes-vs.-bankruptcy-cost model, and there would even be efficiency benefits from replacing these subsidies with some net tax on the use of debt. As a result, though, the current tax treatment of debt seems particularly puzzling if the signaling model were true, providing further evidence against this model.

7. Summary

There is a huge academic literature investigating how taxes affect corporate use of debt. When companies borrow, their corporate tax liabilities fall due to the resulting interest deductions. Those financing the firm, though, may well face personal taxes on the resulting interest income. The tax law subsidizes debt finance to the extent that the resulting fall in corporate tax liabilities exceeds the resulting extra taxes paid on this interest income under the personal tax.

How important have these tax incentives been in practice, and how responsive have investors been to these incentives? What have been the resulting efficiency costs from these distortions to market incentives?

The most recent empirical evidence suggests that the tax incentives to borrow are often large. Graham (2000) reports that large U.S. corporations could save on average at least 11.6% of firm value in the combined tax liabilities of the firm and shareholders through use of debt.

These large tax distortions encouraging more debt have had modest but statistically significant effects on use of debt finance. The estimates suggest that the tax incentives observed over time in the U.S. have been sufficient to induce firms to increase the fraction of capital financed with debt by up to 4.6 percentage points, relative to a mean of 25%.

The remaining debate revolves around how to infer the efficiency effects of such changes to corporate financial choices. The standard presumption has been that corporations would choose the efficient use of debt, ignoring taxes, so that any tax distortion results in efficiency costs. Based on this starting point, the overall excess burden from the tax distortion to financial choices is around 5% to 10% of overall corporate tax revenue.

This standard presumption that corporations would choose the efficient use of debt, ignoring taxes, has often been questioned in the recent academic literature, however.

While Graham argues that large U.S. firms could have saved at least 11.6% of firm value in taxes, he finds that they in fact saved only 4.3% of firm value in taxes. Why do some of the most profitable firms borrow so little, given the large foregone tax savings that would result from any interest deductions? Why do firms with tax losses, where taxes discourage borrowing, nonetheless borrow as much as they do?

A commonly proposed answer in the academic literature is that firms borrow relatively little on average because of lemons problems in the loan market. Lenders cannot easily distinguish between good and bad firms, so must set one interest rate for both. At this interest rate, bad firms can easily find it attractive to borrow, since they often don't end up repaying the debt. Good firms, in contrast, may well find the interest rate too high to justify borrowing. Consistent with this hypothesis, the evidence shows that a firm's share prices fall when it unexpectedly chooses to borrow.

With such a lemons problem, good firms face a cost of capital in the bond market above that faced by bad firms. Investment is then misallocated, with too little investment in the good firms.

The tax law can, and to some degree has, been designed to alleviate the resulting misallocations. To do so, it should encourage borrowing by good firms, who borrow too little on efficiency grounds, and perhaps even discourage borrowing by bad firms. The current law does this in part through no-loss-offset provisions, which prevent a firm with tax losses from saving on taxes through additional interest deductions. The progressive corporate tax schedule also encourages profitable firms to borrow, while potentially discouraging unprofitable firms from borrowing. In both cases, these differential incentives on good vs. bad firms help alleviate the misallocations that result from lemons problems in the loan market.

While there is suggestive empirical evidence in support of this lemons model, direct evidence on the implied misallocation of capital is limited. Fazzari, Hubbard, and Peterson (1988) do find evidence that at least small firms with high market values relative to their book values rely primarily on retained earnings for additional investment, consistent with the hypothesis that good firms find the interest rate on corporate loans too high to be attractive. The observed variation in market to book values for the firms in their sample is substantial. If the marginal return on additional investment is linked to the average value of the firm's existing capital, then their evidence implies substantial variation in the marginal products of capital as well. This type of evidence provides the best suggestive support for the importance of the corrective measures under the tax law laid out in this paper.

REFERENCES

Akerlof, George A. 1970. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84, pp. 488-500.

Auerbach, Alan J. 1979. "Wealth Maximization and the Cost of Capital," *Quarterly Journal of Economics* 93, pp. 433-446.

------------------. 1985. "Real Determinants of Corporate Leverage." In Benjamin M. Friedman, ed., *Corporate Capital Structure in the United States*. Chicago: University of Chicago Press.

Bradley, M., G. Jarrell and E.H. Kim. 1984. "On the Existence of an Optimal Capital Structure: Theory and Evidence," *Journal of Finance* 39, pp. 857-878.

Chaplinsky, Susan and Robert S. Hansen. 1993. "Partial Anticipation, the Flow of Information, and the Economic Impact of Corporate Debt Sales," *Review of Financial Studies* 6, pp. 709-32.

Datta, Sudip, Mai Iskandar-Datta, and Karthik Raman. 2000. "Debt Structure Adjustments and Long-Run Stock Performance," *Journal of Financial Intermediation* 9, pp. 427-53.

Easterbrook, F. H., 1984, "Two agency-cost explanations of dividends," *American Economic Review* 74, 650-659

Economic Report of the President. 2007. Washington, D.C.: Government Printing Office.

Fama, Eugene and Kenneth R. French. 2002. "Testing Trade-Off and Pecking-Order Predictions about Dividends and Debt, " *Review of Financial Studies* 15, pp. 1-33.

Fazzari, Steven M., Robert Glenn Hubbard, and Bruce C. Peterson. 1988. "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, pp. 141-95.

Gordon, Roger H. and David F. Bradford. 1980. "Taxation and the Stock Market Valuation of Capital Gains and Dividends: Theory and Empirical Results," *Journal of Public Economics* 14, pp. 109-36.

Gordon, Roger H. and Martin Dietz. 2007. "An Agency-Cost Model of Firm Financial Policies: Dividends, Share Repurchases, and Implications for Tax Policy," mimeo.

Gordon, Roger H., Laura Kalambokidis, and Joel Slemrod. 2004. "Do We Now Collect Any Revenue From Taxing Capital Income?, *Journal of Public Economics* 88, pp. 981-1009.

--------------------------------. 2004a. "A New Summary Measure of the Effective Tax Rate on Investment." In Peter Birch Sorensen, ed., *Measuring the Tax Burden on Capital and Labor*. Cambridge: MIT Press, pp. 99-128.

Gordon, Roger H. and Young Lee. 2001. "Do Taxes Affect Corporate Debt Policy? Evidence from U.S. Corporate Tax Return Data," *Journal of Public Economics* 82, pp. 195-224.

Gordon, Roger H. and Young Lee. 2007. "Interest Rates, Taxes and Corporate Financial Policies," *National Tax Journal* 60, pp. 65-84.

Gordon, Roger H. and Jeffrey MacKie-Mason. 1991. "Effects of the Tax Reform Act of 1986 on Corporate Financial Policy and Organizational Form." In Joel Slemrod, ed., *Do Taxes Matter?: The Impact of the Tax Reform Act of 1986.* Cambridge: MIT Press.

Graham, John R. 1996. "Debt and the Marginal Tax Rate," *Journal of Financial Economics* 41, pp. 41-73.

Graham, John R., Lemmon, M.L. and Schallheim, J.S. 1998. "Debt, leases, taxes, and the endogeneity of corporate tax status," *Journal of Finance* **53**, pp. 131–162.

Graham, John R. 1999. "Do personal taxes affect corporate financing decisions?," *Journal of Public Economics* **73**, pp. 147–185.

Graham, John R. 2000. "How Big are the Tax Benefits of Debt?" *Journal of Finance* 55, pp. 1901-41.

Gropp, R.E. 1997. "The Effect of Expected Effective Corporate Tax Rates on Incremental Financing Decisions," IMF Working Paper, No. 46.

Howton, Shawn D., Shellely W. Howton, and Steven B. Perfect. 1996. "The Market Reaction to Straight Debt Issues: The Effects of Free Cash Flow," *Journal of Financial Research* 21, pp. 219-27.

Jensen, Michael C. 1986. "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review* 76, 323-329.

Jensen, Michael and William H. Meckling. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* 3, pp. 305-360.

MacKie-Mason, Jeffrey K. 1990. "Do taxes affect corporate financing decisions?," *Journal of Finance* **45**, pp. 1471–1493.

Miller, Merton. 1977. "Debt and Taxes," *Journal of Finance* 32, pp. 261-75.

Miller, Merton and Franco Modigliani. 1961. "Dividend Policy, Growth, and the Valuation of Shares," *Journal of Business* 34, pp. 411-33.

Modigliani, Franco and Merton Miller. 1958. "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review* 48, pp. 261-97.

Myers, Stewart C. and Nicholas S. Majluf. 1984. "Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have," *Journal of Financial Economics* 13, pp. 187-221.

Ross, Stephen A. 1977. "The Determinants of Financial Structure: The Incentive-Signalling Approach," *Bell Journal of Economics* 8, pp. 23-40.

Spence, A. Michael. 1973. "Job Market Signaling," *Quarterly Journal of Economics* 87, pp. 355-74.

Spiess, D. Katherine and John Aftleck-Graves. 1999. "The Long-Run Performance of Stock Returns following Debt Offerings," *Journal of Financial Economics* 54, pp. 45-73.

Taggart, Robert A., Jr. 1985. "Secular Patterns in the Financing of U.S. Corporations." In Benjamin Friedman, ed., *Corporate Capital Structures in the United States*. Chicago: University of Chicago Press, pp. 13-75.

Warner, Jerold B. 1977. "Bankruptcy, Absolute Priority, and the Pricing of Risky Debt Claims," *Journal of Financial Economics* 4, pp. 239-76.