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Tax Incentives for Corporate Leverage in the 1980s

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This paper shows that the rise in nominal interest rates boosted the income-tax related incentives for corporate leverage in the 1980s, but market-value leverage among nonfinancial corporations in the latter half of the 1980s still was higher than would be expected given the estimated tax incentives.

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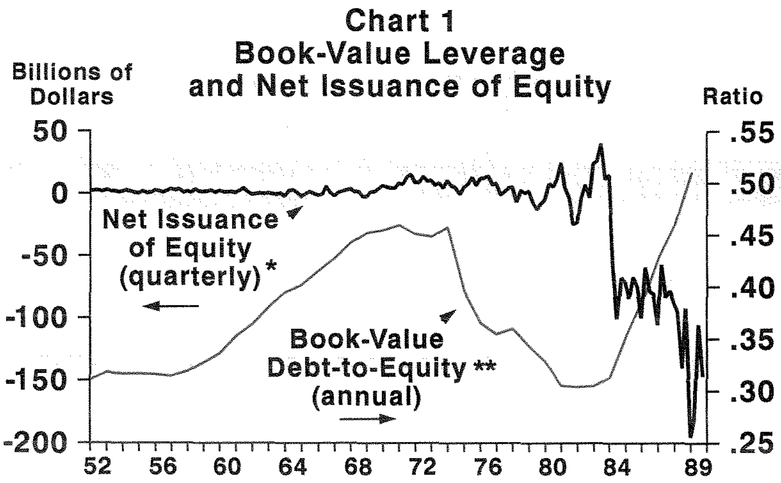
The 1980s were marked by a greater emphasis on debt financing by corporations. This shift away from equity financing is apparent in the rise in the aggregate, book-value, debt-to-equity ratio of nonfinancial corporations. As shown in Chart 1, aggregate, book-value leverage began rising in 1984, corresponding with an unprecedented surge in the net retirement of equities that many attribute to the increase in corporate restructuring in the 1980s.

The decade also was punctuated by two key tax reform laws that brought about major changes in marginal income tax rates. The 1981 tax reform act, for example, reduced the maximum marginal tax rate on ordinary, personal income from 70 percent to 50 percent. The 1986 tax reform act further reduced the maximum rate on ordinary, personal income, lowered the maximum tax rate on corporate profits, and raised the maximum marginal tax rate capital gains.[1]

With this combination of developments, it is only natural to look for a link between the income-tax rate changes and the shift away from equity and toward debt financing by nonfinancial corporations during the 1980s. This paper examines this connection. It differs from previous studies in two ways. First, it considers the effects on corporate leverage of changes in nominal interest rates working through tax incentives as well as the direct effects of changes in income-tax rates. The analysis in this paper suggests that tax-related incentives toward leverage increase with nominal interest rates, and that this interest rate link had a pronounced influence on income-tax incentives for corporate leverage in the 1980s. Moreover, changes in income-tax rates, in theory, cause the nominal interest rate to change, thereby partly offsetting the direct effects of income-tax rate changes.

This paper also differs from previous studies in that it evaluates the relationship between income-tax incentives and aggregate, market-value leverage among nonfinancial corporations. The empirical evidence indicates that market-value leverage among nonfinancial corporations in the latter part of the 1980s was greater than can be accounted for by income-tax incentives alone. This finding is consistent with the predominant view in the literature that factors such as financial innovation and deregulation,

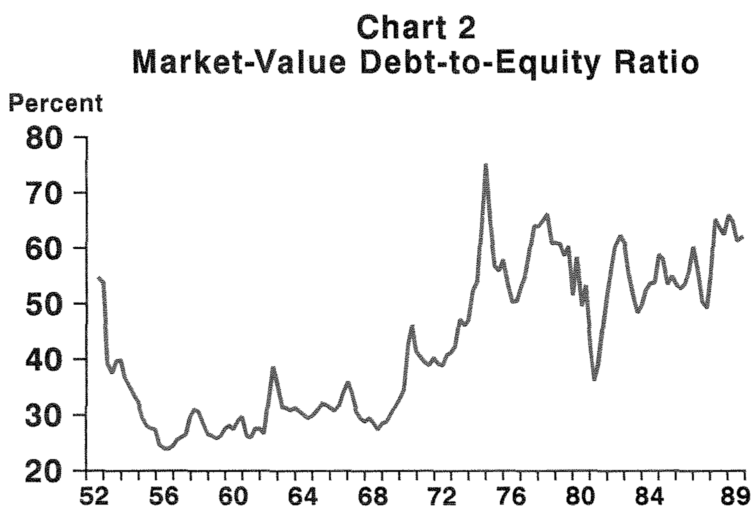


*Based on seasonally-adjusted quarterly data at annual rates for nonfinancial corporations.
**Based on annual data for nonfinancial corporations.

relaxed antitrust standards, improvements in "takeover technology," and higher levels of free cash flow, rather than income-tax incentives, contributed to higher leverage in the 1980s.[2]

This latter result is of particular interest in that the supposed boost to corporate leverage in 1980s is not apparent in the level of market-value leverage among nonfinancial corporations. This point is illustrated in Chart 2, which traces the market-value debt-to-equity ratio (D/E) for nonfinancial corporations. The estimates of leverage in the chart are based on Flow of Funds and National Income Accounts data.[3] The chart shows that market-value corporate leverage has tended to increase since the early 1950s. The most apparent run-up in leverage, however, occurred in the early 1970s, not the 1980s. In fact, the average level of market-value leverage for the 1980s was about the same as that for the second half of the 1970s.[4]

The paper presents a model relating the marginal benefit of corporate leverage to income tax rates and the nominal interest rate. The theoretical framework is used to examine how and why income-tax incentives for leverage changed over time. The estimated empirical relationship between income-tax incentives and corporate leverage then is used to determine the contribution of income-tax incentives to higher market-value, nonfinancial corporate leverage in the 1980s.



Based on seasonally-adjusted quarterly data for nonfinancial corporations.

I. The Model

Income Taxes and Leverage

To illustrate how income tax considerations can affect a firm's choice regarding market-value leverage, the value of a firm (project) financed only with equity is compared with the value of the same firm financed also with some debt. Assuming two time periods, let I be the initial investment, Y be the net nominal return from the project in the second period, and p be the inflation rate from Period 1 to Period 2. For simplicity, it is assumed that all investors have perfect foresight.

All investors are assumed to face flat tax rates on ordinary, personal income (t_p), corporate profits (t_c), and personal, equity income (t_s). Furthermore, profits are paid both in the form of dividends and capital gains in proportions w and $(1-w)$, respectively, where $0 \leq w \leq 1$. The marginal tax rate on personal, equity income is defined as the weighted average of an individual's marginal tax rate on ordinary, personal income and the marginal tax rate on capital gains, such that $t_s = wt_p + (1-w)t_k$, where t_k is the tax rate on capital gains.[5]

With 100 percent equity financing, the value of the firm in Period 1 is the discounted value of the gross, after-tax, real return in Period 2:

$$V_E = \frac{I + \{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}-pI}{1+r}, \quad (1)$$

where r is the real after-tax required return. The required real after-tax return is exogenous and applies to all investors.

To incorporate the effects of leverage, the initial investor is assumed to issue debt to other (outside) investors in Period 1 in some proportion, a, of the initial investment, where $0 < a < 1$.[6] The nominal rate-of-return on the debt, R, is the sum of the real required rate-of-return and the rate of inflation adjusted for taxes on interest income, so that

$$R = \frac{r+p}{1-t_p} . \quad (2)$$

This expression is the Darby (1975) respecification of the Fisher equation, and it implies that an increase (decrease) in the marginal tax rate on ordinary, personal income will raise (lower) the before-tax, nominal interest rate on debt.[7]

Given these assumptions, the value of debt in Period 1 can be expressed as

$$D = aI = \frac{aI + aI[R(1-t_p) - p]}{1+r} , \quad (3)$$

where D is both market-value and book-value of debt.[8]

The value of the firm with debt financing, then, can be derived from (1) and (3). This is accomplished by adjusting the before-tax claims of the equity holder in (1) by the before-tax claims of the debtholders and adding the after-tax value of debt. The value of the firm with debt financing is:

$$V_D = \frac{I-D+(Y-DR)\{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}-p(I-D)}{1+r} + \frac{D+D[R(1-t_p)-p]}{1+r}$$

or

$$V_D = V_E + \frac{DR\{(1-t_p)-(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}}{1+r} . \quad (4)$$

From (4), it can be seen that the initial investor would have an incentive to use debt financing as long as the tax rate on interest income is less than the effective rate on equity income—that is, as long as $t_p < [t_c + t_s(1-t_c)]$. The tax rate on equity income reflects the double taxation of corporate profits—first when the corporation pays taxes on earnings and again when personal taxes are paid on dividends or capital gains. Interest on debt, on the other hand, is tax-deductible for corporations, and, thus, is taxed only once, as ordinary, personal income.

When interest income is taxed at a lower rate than equity income, then, the value of the firm is positively related to the amount of debt financing. For the case in which the initial investor issues debt to finance the project, the marginal benefit of debt *versus* equity financing is

$$g \equiv \frac{\partial V_D}{\partial D} = \frac{R\{(1-t_p)-(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}}{1+r} > 0. \quad (5)$$

For an existing corporation, (5) is the marginal tax benefit from using debt (rather than equity) to finance new investment.[9] The expression shows that the income-tax incentives for leveraging are a function of the marginal tax rates as well as the nominal interest rate.

The reason the nominal interest rate has an effect is the presence of the inflation premium.[10] From (5), the effect of inflation, and, thus, of the nominal interest rate, on the incentives for leveraging, holding taxes constant, is:

$$\frac{\partial g}{\partial p} = \frac{1 - \dfrac{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]}{1-t_p}}{1+r} > 0. \quad (6)$$

An increase in inflation (rise in the nominal rate of return) reinforces the positive effect on the value of the firm from issuing debt, assuming that the tax rate on interest income is less than the effective rate on equity income.[11] The reason for this is that the higher nominal income due to higher inflation is taxed at a lower rate when it is taken as interest income rather than as equity income.

The unambiguous sign in (6) in part stems from the absence of "bracket creep," which is assumed away by having flat tax rates. With a progressive tax rate structure and no inflation indexation, t_p would rise with inflation due to bracket creep. If the marginal tax rate on ordinary income rises due to inflation, the theoretical effects of inflation on the incentives for leveraging are ambiguous.[12] In the U.S., the 1981 tax reform act introduced inflation indexation (effective in 1985), but in prior years the marginal tax rates for individuals increased with inflation. In any case, the empirical evidence in the next section indicates that the bracket creep effect has not dominated.

The effect of a change in the tax rate on ordinary, personal income on the incentives for a firm to leverage can be shown formally by differentiating (5) with respect to t_p. This yields

$$\frac{\partial g}{\partial t_p} = \frac{\partial R}{\partial t_p} \frac{\{(1-t_p)-(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}}{1+r} + \frac{R[(1-t_c)w-1]}{1+r}$$

or

$$\frac{\partial g}{\partial t_p} = \frac{R\left\{1 - \dfrac{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]}{1-t_p}\right\}}{1+r} + \frac{R[(1-t_c)w-1]}{1+r} \cdot \left\{ \begin{array}{l} = 0 \text{ when } w = 1 \\ < 0 \text{ when } w < 1 \end{array} \right. . \quad (7)$$

As background to the discussion in the empirical section on the effects of interest rates and tax rates on income-tax incentives for leveraging, it is useful to consider the two sets of terms on the right-hand side of (7). The second set of terms on the right-hand-side of (7) represents the direct effect of a change in t_p on the marginal benefit from an increase in leverage. This term is negative for all allowable values of w—that is, $0 \leq w \leq 1$. This direct effect generally is what analysts have in mind when arguing that lower marginal tax rates on ordinary, personal income favor greater corporate leverage.[13]

When debt is issued to outside investors, the overall effect of a change in t_p on the incentives for leveraging, however, will be less negative than that suggested by the direct effect. This is true since a change in the personal tax rate alters the before-tax, nominal rate of return.[14] The effect of the change in the nominal interest rate is represented by the first set of terms on the right-hand-side of (7). This set of terms is positive for allowable values of w, and increases with w. Ignoring the feedback of tax rates on the nominal interest rate, then, would lead to an overstatement of the effect of a change in t_p.

Thus, the sign of the derivative in (7) is negative as long as some corporate profits are realized in the form of capital gains ($w<1$).[15] A higher marginal tax rate on ordinary income, then, would lead to less debt and lower leverage. Likewise, a lower tax rate would lead to more debt and higher leverage.

However, if profits are paid out only in dividends ($w=1$), then, changes in a flat marginal tax rate on ordinary, personal income would not affect the marginal benefit form leveraging. From (5), the marginal benefit from leveraging would be

$$g = \frac{R(1-t_p)t_c}{1+r}$$

or, in the more familiar form,

$$g = \frac{(r+p)t_c}{1+r} .$$

For a given after-tax rate of return, the marginal benefit of leverage depends on the corporate tax rate, but not on the other tax rates, when $w=1$.

From (5), it also follows that the incentives for issuing debt *versus* equity to finance new investment are positively related to the tax rates on corporate profits and capital gains—that is,

$$\frac{\partial g}{\partial t_c} = \frac{R\{w(1-t_p)+(1-w)(1-t_k)\}}{1+r} > 0 \quad (8)$$

and

$$\frac{\partial g}{\partial t_k} = \frac{R(1-t_c)(1-w)}{1+r} > 0. \quad (9)$$

A higher corporate tax rate or higher personal tax rate on capital gains would lead to an increase in debt and leverage.[16] The reason is the higher tax rates lower the return on equity income relative to that on interest income.

Determination of Corporate Leverage

When financing new investment an investor would choose all debt when the tax rate on equity income is higher than that on interest income, if the tax treatment of interest and equity income were the only consideration. Pure debt (or pure equity) is not the observed pattern of corporate financing, however, so other factors must affect the choice of equity financing *versus* debt financing. Corporate leverage decisions, for example, can be affected by non-debt tax shields associated with depreciation deductions and investment tax credits. DeAngelo and Masulis (1980) point out that non-debt tax shields offset the income-tax advantage of leverage and could be influential enough to determine D/E ratios for individual firms.[17]

Non-tax considerations also can affect leverage; many of these make leverage more costly, and work to offset income-tax incentives favoring debt financing. An often-cited non-tax impediment to debt financing is the cost of bankruptcy. The argument is that dead weight losses are associated with a firm becoming insolvent and not meeting its debt obligations.[18] Everything else equal, at some degree of leverage, further increases in debt financing will raise the probability of bankruptcy and the expected cost of bankruptcy. Hence, bankruptcy costs would bias a firm toward equity financing, and changes in expected bankruptcy cost would be negatively related to changes in D/E ratios.

Costs associated with information asymmetries and agency problems also can be affected by, and in turn affect, the degree of corporate leverage.[19] In the case of an owner-managed firm, the manager (agent), who has more information about the firm than do outside investors, has incentives to increase the firm's risk to the detriment of the debtholders (principals). *Ex post,* such incentives for risk-taking will increase with leverage.[20] In Jensen and Meckling (1976), the monitoring and other agency costs associated with outside financing will be borne by the owner and reduce the value of the firm relative to its value with 100 percent inside financing. To the extent that inside financing is identified with equity and outside financing with debt, information asymmetries and agency costs would serve to offset the tax shield advantages of debt, and, thus, limit D/E ratios.

For many corporations, of course, agency problems exist between managers and non-manager stockholders. For such firms, much of the equity as well as the debt can be viewed as outside financing. With agency costs associated both with outside equity and debt, such costs would not necessarily increase monotonically with leverage. Jensen and Meckling argue that, for a given volume of inside financing and firm size, total agency costs should fall and then rise as the fraction financed through outside equity rises.[21] In this context, a firm's D/E mix, in principle, could be determined uniquely without tax effects.

Even so, the income tax effects discussed above can be important influences on firms' debt and equity choices.[22] The optimal D/E ratio for a corporation should balance the marginal effects from leveraging related to income-tax factors and other tax and non-tax factors. With uncertainty, there would be an *expected* marginal benefit from leveraging associated with income tax considerations comparable to (5). Given that the expected marginal benefit from leverage is positive, in equilibrium the expected net marginal effect of all other factors on leverage must just offset that benefit.

Assuming that the expected net marginal cost of other factors is some function $f()$ of the level of leverage, represented by the D/E ratio, and a vector of other variables, X, the long-run level of leverage would satisfy the condition,

$$g - f(D/E, X) = 0, \tag{10}$$

where g in this context is the expected marginal income-tax benefit from leveraging. If this equality does not hold at a given point in time, a corporation could be expected to adjust its leverage over time to eliminate the difference between the expected marginal benefit and the marginal cost.

II. Empirical Results

In this section the theoretical constructs developed above are used to evaluate empirically how income-tax considerations for corporate leverage have behaved and how these incentives have affected aggregate leverage among nonfinancial corporations in the 1980s. The analysis proceeds first by evaluating how income-tax incentives *per se* changed over time and then by relating the changes in aggregate, corporate leverage to the estimated income-tax incentives.

Estimated Income-Tax Incentives

To evaluate quantitatively how and why income-tax incentives have changed over time, estimates of the marginal value of issuing corporate debt can be derived by using (5). Using the undiscounted value, the marginal gain from leveraging is defined as:

$$G \equiv R\{(1-t_p)-(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}. \tag{11}$$

Using (11) requires choosing an appropriate before-tax interest rate and estimating the relevant tax rates. The nominal interest rate selected is the 10-year Treasury bond rate. Using a Treasury security rate, rather than a corporate bond rate, tends to understate the tax effect since expected rates-of-returns should be positively related to risk. On the other hand, using a corporate interest rate would overstate the tax effect since it would be the promised rather than the expected rate-of-return. In any case, the empirical results are not very sensitive to the use of either an interest rate on corporate bonds or one on a longer-term Treasury instrument.

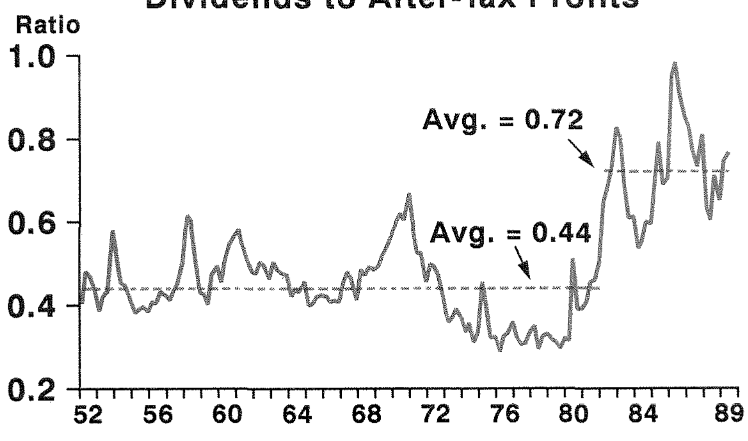
The estimated tax rates should reflect the marginal tax rates of the investors that would hold the additional debt or equity issued. With regard to the stock of outstanding securities, we observed that individual investors hold both equity and debt (apparently for diversification motives), which means that, for estimating the average value of the income-tax incentive, the appropriate tax-rates for personal income (both interest and equity) are weighted averages of the tax rates for the investors holding corporate securities. If it is further assumed that new debt and equity is acquired by investors in different tax brackets in the same proportion as the outstanding stocks, the average marginal tax rates also are appropriate for evaluating the effects of taxes on the marginal value of leverage. In this section, then, (11) is evaluated using estimates of the weighted average marginal tax rates for personal income—interest, dividends, and capital gains, along with the maximum tax rate on corporate profits.

For ordinary, personal income, separate estimates were made for tax rates on interest income and for those on dividend income.[23] This is necessary because debt and equity instruments are not held in the same proportions among investors subject to different marginal income-tax rates. Equities tend to be held by investors with higher incomes. The weighted-average marginal tax rates were derived through 1986 based on data from *Individual Income Tax Returns* for the appropriate years. The average marginal rate on interest income is based on the distribution of interest income across adjusted gross income categories. This assumes that the distribution of corporate debt holdings is proportional to the distribution of all debt. The average marginal tax rate on dividends is based on the distribution of dividend income across adjusted gross income categories.[24] The estimates after 1986 were derived by applying the weights based on 1986 income data to the marginal tax rates for the different income categories for each year.

The tax rate on capital gains is based on estimates of the average marginal rate from the Congressional Budget Office (CBO).[25] The CBO estimates represent tax rates on realized capital gains. The common assumption is that the effective tax rate is considerably lower than the rate on realized gains because of the general deferral of taxes, the selective realization of losses and gains, and the increase of basis at death. The usual convention is to set the effective capital gains tax rate equal to one-fourth the rate on realized capital gains.[26]

In estimating the average marginal personal tax rate on equity income, w usually is set equal to one-half based on the observation that, historically, corporate profits have been distributed about equally through dividends and capital gains.[27] Over the period from 1950 through 1988, for example, the ratio of dividends to after-tax profits among nonfinancial corporations averaged just about 50 percent.

Chart 3
Dividends to After-Tax Profits



Based on seasonally-adjusted quarterly data for nonfinancial corporations.

Chart 3, however, indicates that using a fixed value for w may not be appropriate. The dividend to profits ratio jumped in the 1980s, averaging 72 percent after 1981 and 44 percent from 1950 through 1981. The significance of this change depends on whether the higher ratio is permanent or temporary. The higher ratio could reflect a permanent endogenous response to the shift in tax rates in the 1980s, which narrowed the spread between the rate on ordinary income and that on capital gains.

Alternatively, the change in the ratio could be temporary. First, corporations may have increased dividends as a way of adjusting leverage in response to developments in the 1980s that are argued to have encouraged debt financing. Second, the rapid appreciation in stock prices in the 1980s are indicative of higher expected profits. If dividends are related to long-run profits, the higher ratios of dividends to current income observed in the 1980s could decline as higher levels of profits are realized in the future.

Based on these considerations, two sets of weights are considered, one with a value of w fixed at 0.44 and the second with a value of w set equal to 0.44 for the period through 1981 and equal to 0.58 after 1981. The choice of 0.58 for the more recent years assumes that the increase in the share of long-run profits paid out in dividends is equal to half of the observed rise in the aggregate, dividends-to-profits ratio.

Chart 4 shows the estimates of G, which are affected by income tax rates as well as by interest rates. The dark line traces the estimated values of G when w is allowed to change, while the light line traces the estimates when w is held constant. The chart shows that the tax advantage of debt over equity financing increased, on balance, over the last three decades. The incentives were greatest in 1982 and remained relatively high through 1984. After declining markedly through 1986, they rebounded some through 1989. The estimates of the tax incentives for leveraging in 1989 were a bit lower than at the start of the decade and about equal to the level prevailing in the mid-1970s.

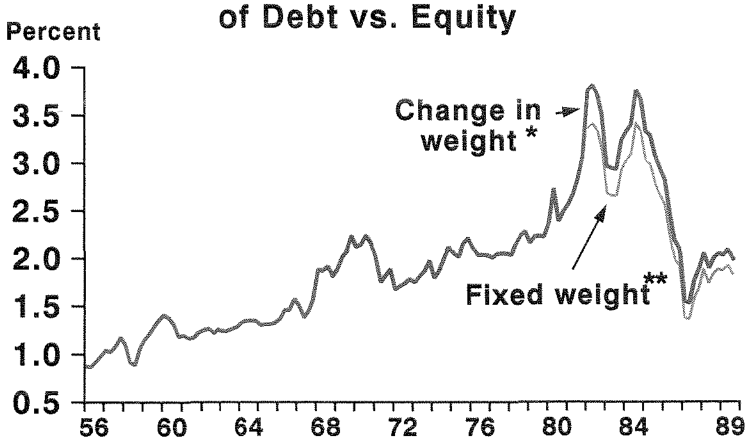
To identify the relative importance income-tax rates and the nominal interest rate in determining movements in G, it is useful to separate the two effects. To isolate the tax rate effects, the term in braces in (11) commonly is used. This approach amounts to measuring the effect of income taxes holding the before-tax nominal interest rate constant. Doing this, however, ignores the theoretical feedback from tax rates to the before-tax nominal interest rate.

The discussion in the previous section suggests that, in theory, the more appropriate approach would be to evaluate the tax rate effects holding the *after-tax* nominal interest rate constant. This says that the marginal effect of debt financing should be expressed in terms of the tax rates and the after-tax nominal interest rate.[28] Using (2) and (11), the undiscounted marginal value of leveraging can be expressed as:

$$G \equiv (r+p)\{1 - \frac{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]}{1-t_p}\} \quad (12)$$

where $(r+p)$ is the after-tax nominal interest rate on debt.[29] In this expression for G, the term in braces, in principle, captures the effects of changes in tax rates on the incentives for leveraging, including those due to changes in the before-tax nominal interest rate that are related to income-tax rate changes.

Chart 4
Income-Tax Advantage of Debt vs. Equity



*Weight = 0.44 (1954–1981), weight = 0.58 (1982–1989).
**Weight = 0.44

Chart 5 shows that accounting for the effects of taxes on the nominal interest rate alters the perspective on how recent tax law changes have affected incentives for corporations to leverage. The black line is the value of the term in braces from (11), multiplied by the average value of the ten-year Treasury bond rate for 1978 and 1979. The green line is the value of the term in braces from (12), multiplied by the average of the after-tax ten-year Treasury rate for 1978 and 1979.

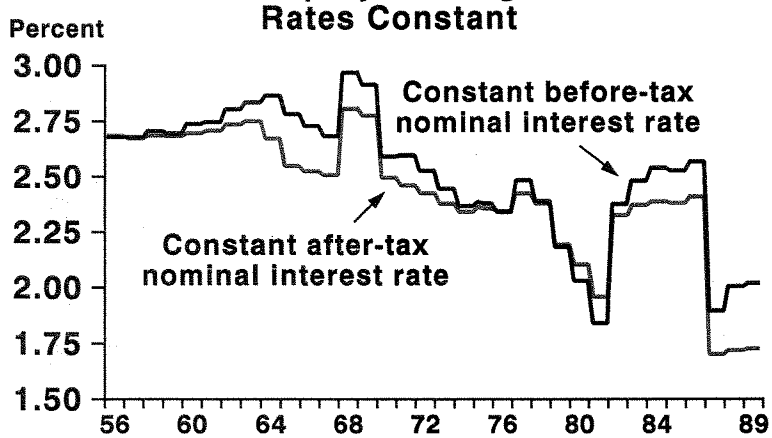
Both series in Chart 5, however, show that the bias in the income tax rates toward debt financing has declined since about the mid-1960s. The upward trend in G, shown in the previous chart, then, is due to the rise in nominal interest rates. That is, based on these estimates, higher interest rates, rather than tax policy *per se,* have increased the relative attractiveness of debt financing.

With respect to the recent tax law changes, the series in Chart 5 indicate that the changes in income-tax rates following the 1981 tax reform act boosted the incentives for leveraging. This would be expected, given that the major income-tax changes in the 1981 act lowered marginal tax rates on ordinary income, with the maximum rate reduced from 70 percent to 50 percent. The increase in the bias toward debt financing from this act, however, did not do much more than offset the decline in the bias inherent in U.S. income tax policy during the second half of the 1970s.[30]

The relatively strong incentives for leveraging in the early 1980s primarily reflect the higher nominal interest rates that prevailed in that period rather than changes in marginal tax rates. Moreover, the subsequent decline in these incentives from 1984 through 1986 was due to the drop in nominal interest rates, which essentially offset the effects of the 1981 tax act. By 1986, the tax advantage of debt *versus* equity financing was only a little above the levels prevailing in the 1970s (see Chart 4).

The income tax rate changes following the 1986 tax act reduced the bias toward debt financing, as indicated by the decline in the series plotted in Chart 5. Although the 1986 tax act lowered marginal tax rates on ordinary income and raised them on capital gains, which, according to the discussion above, should have favored debt financing, it also lowered the marginal tax rate on corporate profits, which should have reduced the tax bias toward debt financing. The estimates in Chart 5, showing a net decline after 1986, suggest that the change in the corporate tax rate simply dominated. However, the effect of the law is more complicated. The reduction in the maximum marginal tax rate on ordinary, personal income from 50 percent to 33 percent (28 percent for the highest tax brackets) lowered the average marginal tax rate for individuals earning dividend income by much more than the average marginal tax rate for individuals earning interest income. As a result, the estimated tax incentives for leveraging were not boosted much by the lower tax rates on ordinary, personal income. In fact, in the case of the green line in Chart 5, which takes into account the effects of tax rates on nominal interest rates, the net effect of the changes in personal tax rates was to reduce the incentives for leveraging, and to reinforce the effect of the lower corporate tax rate. This is not a result that would have been anticipated based on the model presented above, in which marginal tax rates on interest and dividend income are equal and move together.

Chart 5
Income-Tax Advantage of Debt vs. Equity Holding Interest Rates Constant



Tax Incentives and Leverage

The discussion in this section turns to the empirical evidence on the relationship between income-tax incentives and the aggregate, market-value, debt-to-equity ratio for nonfinancial corporations. The analysis starts with (10), and the assumption that expected values are based on lagged observations, except for the marginal tax rates.[31] For the empirical analysis, the marginal benefit from leveraging due to income taxes is represented by G. It is further assumed that $f()$ takes the form $B_1(D/E)_{t-1}^{b2}$, with the marginal cost of leveraging hypothesized to be positively related to the level of leverage. The leverage ratio (D/E) is the market-value, debt-to-equity ratio plotted in Chart 2.

When the equality in (10) does not hold, corporations are assumed to adjust (at a cost) to the difference. Using the log-linear change in leverage, the adjustment process can be expressed as:

$$\Delta\log(D/E)_t = b_0\{\log G_{t-1} - [b_1 + b_2\log(D/E)_{t-1}]\} + e_t$$

or

$$\Delta\log(D/E)_t = b_0\log G_{t-1} + c_1 + c_2\log(D/E)_{t-1} + e_t, \quad (13)$$

where G_{t-1} is based on the ten-year Treasury bond rate at $t-1$ and the tax rates prevailing at t. In the expressions, b_0 is expected to have a positive sign. That coefficient should reflect the average cost of adjusting leverage, which is assumed to be constant over time. The coefficient b_1 is equal to $\log(B_1)$, so the sign of b_1 depends on whether $0<B_1<1$, $B_1 = 1$ or $B_1<1$. This means that the sign of the constant term in (13), $c_1 = b_0b_1$, could be positive, negative or zero. The expected sign of the coefficient on lagged leverage, $c_2 = b_0b_2$, is negative. The term e_t is a random disturbance term.

One problem estimating (13) is that *ex post* changes in aggregate corporate leverage reflect not only decisions regarding debt and equity financing, but also exogenous shocks to equity prices. If corporations take their share prices to be random walks and do not react to contemporaneous changes in these prices, the change in corporate leverage in period t that would be related to income-tax incentives and the marginal cost of leverage could be expressed as:

$$\Delta\log(D/E)_t + b_3\Delta\log SP_t,$$

where SP represents aggregate stock prices, and b_3 would be expected to be equal to 1.[32] On the other hand, if changes in stock prices were exogenous and there were offsetting adjustments to the effects of changes in stock prices on leverage, b_3 could be greater than 1.

Allowing for stock price shocks, the leverage adjustment equation can be rewritten as:

$$\Delta\log(D/E)_t = b_0\log G_{t-1} + c_1 + c_2\log(D/E)_{t-1} + b_4\Delta\log SP_t + u_t, \quad (14)$$

where the change in stock prices is the log difference of the *S&P500* index.[33] The coefficient, b_4, is expected to be negative and of the same magnitude as b_3.

To allow for more flexibility in the short-run dynamics of the adjustment in corporate leverage, lagged values for the log changes in G and in D/E were included in (14). Lagged changes in leverage were significant, but lagged values of the change in tax incentives were not. The regression results in the table were derived by including the first and second lagged values for the change in leverage.

The results in the first column of that table show that the coefficients have the expected signs. The coefficient for G is positive and statistically significant, while the one for lagged leverage is negative and significant. The positive sign on the constant term indicates that B_1 is estimated to be less than one. The coefficient on the change in stock

Regression Results

Sample period: 1956:1 to 1989:2

Dependent Variable: $\Delta\log(D/E)_t$

Independent Var.	(1)	(2)	(3)	(4)
Constant	.170	.201	.026	.283
	(2.19)	(2.63)	(4.45)	(2.39)
$\log G_{t-1}$	.046	.062	—	.102
	(1.97)	(2.66)		(2.84)
$\log(D/E)_{t-1}$	−.048	−.080	—	−.145
	(1.86)	(2.90)		(3.52)
$\Delta\log(D/E)_{t-1}$	−.308	−.304	−.339	—
	(4.94)	(4.99)	(5.57)	
$\Delta\log(D/E)_{t-2}$	−.120	−.109	−.138	—
	(2.13)	(2.80)	(2.50)	
$\Delta\log SP_t$	−1.263	−1.277	−1.319	—
	(12.97)	(13.45)	(13.70)	
d85	—	.051	.031	.039
		(2.80)	(1.82)	(1.41)
$\bar{R}_2$	.60	.63	.60	.07
SEE	.061	.060	.061	.093

Figures in parentheses are the absolute values of the t-statistics.

prices is significantly different from zero, and its absolute value is greater than one, which suggests that corporations may attempt to offset some of the the effect of stock price changes that occur during a quarter.[34] The empirical results are very similar whether G is defined using the fixed value of w or allowing w to change after 1981. The statistics in the table are derived assuming the weight, w, changes.

These results, then, are consistent with the hypothesis that market-value leverage among non-financial corporations is affected by the difference between the leverage gains related to income taxes and the net cost of other factors. Of central interest to this paper is whether that relationship shifted during the 1980s. Such a shift should be reflected in the values of the coefficients in (14). For example, a larger estimated constant term for more recent years would be consistent with developments not directly related to income-tax factors in the 1980s, on balance, favoring more debt financing relative to equity financing than was the case in earlier years.

Data on the net issuance of equity by nonfinancial corporations in Chart 1 suggests that a shift in the relationship might have occurred around 1984. The Quandt (1958) likelihood method also was employed to help identify the most likely date for a shift in the leverage relationship. The test indicates that a likely break in the 1980s occurred in the latter part of 1985.

To evaluate the statistical significance of the break in the relationship, the results from the Quandt test were used. Accordingly, a bivariate dummy variable was used to test for a change in the constant term after the third quarter of 1985. The coefficient on the dummy variable, *d85*, in Column 2 of the table is statistically significant. The estimated increase in the constant term indicates that, even on a market-value basis, changes in corporate leverage have been larger in recent years than would be expected given stock price movements and income tax incentives for leveraging.

To evaluate the extent to which controlling for the effects of income-tax incentives for leveraging makes a difference to this results, the leverage equation was estimated without G and lagged leverage. A comparison of the statistics for the dummy variable in Columns 2 and 3 shows that the estimated shift is smaller and only marginally significant when only changes in stock prices are taken into account. At the same time, the results in Column 4 indicate that controlling for the effects of changes in stock prices is important. When the change in stock prices is not included, the estimated coefficient for *d85* is not statistically significant.[35] As also can be seen from the results in Column 4, income-tax incentives explain a fairly small portion of the quarterly change in aggregated, market-value leverage among nonfinancial corporations.

The regression results, then, suggest that changes in market-value corporate leverage did increase significantly in the latter part of the 1980s, and that influences beyond income-tax incentives contributed to the increase. This result combined with the data on the estimated income-tax advantage of debt shown in Chart 4 suggest that changes in income-tax incentives for leveraging were not the impetus for the rise in corporate restructuring in the second half of the 1980s. As shown in Chart 4, in the latter part of the 1980s the estimated income-tax incentives for corporate leveraging were low relative to the first part of the decade and a bit lower on average than in the latter part of the 1970s. The other influences that contributed to the higher leverage could be those discussed in the introduction and identified in other studies as contributing to the surge in corporate restructuring in the second part of the 1980s.

While changes in income-tax incentives may not have spurred the much discussed rise in corporate restructuring in the second part of the 1980s, the relatively high estimated income-tax advantage of debt over equity financing in the first half of the 1980s may have contributed to a higher average level of leverage over the decade. The strong tax-incentives in the first part of the decade should have resulted in higher leverage than if the incentives had remained at the levels prevailing in 1978 and 1979.

To estimate how much the tax incentives might have affected corporate leverage during the 1980s, two dynamic simulations were conducted using the historical relationship of the change in aggregate, market-value, nonfinancial corporate leverage to income-tax incentives and lagged leverage. The simulations were run beginning in 1980. For one simulation G took on its historical values and in the other G was set equal to its average value over the 1978-79 period. The simulation results show an average level of market-value leverage for the 1980s that is about five percentage points higher with the historical movement in income-tax incentives than is the case when the income-tax incentives are held at the levels prevailing in the latter part of the 1970s.

III. Conclusion

Income-tax incentives for corporate leverage are a function of nominal interest rates as well as income-tax rates. The estimates of income-tax incentives for leveraging indicate that nominal interest rates have been important. Over the past 25 years, the rise in interest rates has accounted for the estimated net increase in the income-tax bias favoring debt over equity financing.

Even during the 1980s, which were punctuated by major changes in income-tax rates, the swings in nominal interest rates had a significant impact on the estimated income-tax advantage of debt financing. In the first half of the 1980s, high nominal interest rates raised the income-tax advantage of debt *versus* equity financing for corporations relative to the levels prevailing in the second part of the 1970s. The subsequent net drop in interest rates reduced the income-tax advantage in the second half of the 1980s to levels that generally were not much different from those in the latter part of the 1970s. This pattern suggests that income-tax incentives *per se* were not the catalysts for the sizeable net reductions in equity associated with corporate restructuring beginning in 1984. Nevertheless, the relatively high income-tax incentives for leveraging in the first part of the decade should have encouraged more debt financing relative to equity financing and should have contributed to a measurably higher average level of leverage over the decade than would have been the case if those incentives had remained at their lower pre-1980s level.

While income-tax incentives may not have provided the impetus for corporate restructuring in the second part of the 1980s, accounting for their effect does help to reconcile to some extent the difference between the pictures presented by the data on book-value and market-value leverage. It is somewhat surprising that a marked shift toward debt financing in the 1980s is not obvious when looking at aggregate, market-value leverage for nonfinancial corporations. However, evidence for such a shift is found when the change in market-value corporate leverage is weighed against the changes in the benefits and costs of leverage. When the effects of income-tax incentives are taken into account, along with the effects of changes in stock prices, changes in market-value corporate leverage are significantly larger in the second half of the 1980s. This result is consistent with a shift to debt financing that is related to developments other than changes in income-tax incentives. While the regression analysis does not identify the factors that have boosted leverage, other studies suggest that financial innovation and deregulation, an easing of antitrust standards, as well as an increase in free cash flow may have been important influences.

NOTES

1. The 1986 act provided for a reduction in the maximum marginal tax rate on ordinary, personal income from 50 percent to 33 percent, a reduction in the maximum corporate tax rate from 46 percent to 34 percent, and an increase in the maximum tax rate on capital gains from 20 percent to 33 percent.

Provisions of the 1981 and 1986 tax acts also affected non-debt tax shields. For example, the 1981 act increased investment incentives like accelerated depreciation and tax credits on equipment, while the 1986 act reduced and even eliminated certain non-debt tax shields. These provisions of the 1981 act tended to reduce incentives for leveraging and those of the 1986 act tended to make debt financing more attractive.

2. Gertler and Hubbard (1989) and Summers (1989), for example, argue that financial innovations like the rise in junk bonds, which facilitated corporate restructuring, probably were more important than tax rate changes to the rise in corporate debt. Auerbach (1989a,b) also discounts the importance of changes in tax rates to the rise in corporate borrowing. Jensen (1987) discusses the other factors mentioned in the text, with an emphasis on the role of free cash flow. Also see Jensen (1988). Free cash flow is defined as that portion of cash flow (profits plus depreciation) that cannot be reinvested in the firm profitably.

3. The estimate of the market value of nonfinancial corporate equity is taken from the Flow of Funds Accounts. Market-value corporate debt is the sum of the face value of short-term debt from the Flow of Funds and an estimate of the market value of long-term debt. The market value of long-term debt is estimated by capitalizing the difference between gross nonfinancial corporate interest expenses and interest expenses on short-term debt by the average corporate bond rate. The estimates of leverage represent end-of-quarter figures.

4. Bernanke and Campbell (1988) and Strong (1988), using different measures of aggregated corporate leverage, also find that market-value leverage among nonfinancial corporations did not increase much on balance in the 1980s.

5. In a two period model, distinguishing between dividends and capital gains is somewhat contrived. Also, unless $t_p = t_k$, other considerations not explicitly in the model are needed to explain why profits would not be paid out in the form subject to the lower tax rate.

6. With $V_E > I$, it is possible for the initial investor to issue debt such that $a > 1$. In that case, the initial investor presumably would have to pay taxes on the proceeds in excess of the book-value of equity in Period 1.

7. This differs from the assumption in Hochman and Palmon (1985) in which the interest rate on debt is fixed for a given expected interest rate.

8. This would not necessarily be the case if the initial investors financed the entire project and merely designated a portion of I as debt since it must be the case that $(Y/I) \geq R$ for all equity financing to be feasible. If the original investor designated all of the initial investment as debt, the market-value of the debt (as well as that of the firm) in Period 1 would be

$$D' = \frac{I + Y(1-t_p) - pI}{1+r} \geq D$$

The nominal before-tax rate-of-return on D' also would be R. The measured rate-of-return on I, which would represent the book-value of debt, would be $(Y/I) \geq R$.

The assumption that the debt is held by individuals other than the original investor also alters the tax effects of debt financing and the comparative statics involving changes in the inflation rate and the marginal tax rates. The differences arise because, with outside debt holders, a portion of the gross income from the project cannot be sheltered from double taxation and because the rate-of-return on the debt varies.

9. The expression for the marginal tax effect when debt is used to replace existing equity is somewhat different. In that case, the initial investor can be assumed to invest I in the project before issuing debt. If $V_E > I$, then, replacing the initial funds (the equity) with debt will involve capital gains realized in Period 1. The tax on the capital gains would reduce the marginal benefit from using debt when replacing existing equity relative to the effect in (5). Using E_B to represent the book-value of equity, which is equal to I with all equity financing, and E_M to represent the market-value of equity, which is equal to V_E with all equity financing, the marginal effect from replacing equity with debt is

$$g' = \frac{R\{(1-t_p)-(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]\}}{1+r} - \frac{(E_M - E_B)t_k}{E_M} < g. \qquad (5')$$

Strictly speaking, (5′) represents the marginal effect from leveraging on the value of the firm plus the wealth of the initial investor. The last term in (5′) represents the effect on the wealth of the initial investor from the taxation of capital gains in Period 1.

A similar complication arises in Hochman and Palmon (1985). In a model with more than two periods and no growth in real assets, a firm would have to issue additional debt and pay the proceeds to equity holders in order to maintain a constant capital structure. In that case, these payments to equity holders would be taxed at the personal tax rate on equity income. A higher tax rate on personal equity income would work to discourage such restructuring.

10. In the two-period model, with inflation equal to zero, the marginal value of leveraging is:

$$g = \frac{r}{1+r}\left\{1 - \frac{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]}{1-t_p}\right\}.$$

However, when the analysis is extended to an infinite period model with perpetual debt the interest rate terms no longer enter the expression for g. In that case, the expression is:

$$g = 1 - \frac{(1-t_c)[w(1-t_p)+(1-w)(1-t_k)]}{1-t_p},$$

which is the Miller (1977) expression for the gains from leverage per dollar of debt. With an inflation premium in the nominal interest rate, the interest rate terms remain in the expression for g.

11. In a Miller (1977) type world, tax rates on interest and equity income for the marginal investor are equal and inflation does not affect leverage for an individual firm. On the other hand, Modigliani (1982), allows for benefits from diversification, and argues that the incentive for leveraging are positively related to inflation. Rangazas and Abdullah (1987) also show that tax incentives for leveraging are positively related to nominal interest rates under the assumption that firms minimize costs. That study, however, assumes that the before-tax nominal interest rate is constant for a given expected rate of inflation.

12. Hochman and Palmon (1985) also argue that the theoretical effects of inflation on leverage are ambiguous. However, they assume a Miller (1977) type world, so to get this result they have to introduce into their model other leverage-related costs. Without such costs in their model, the effects of inflation (without inflation indexation) are unambiguously *negative* because only the bracket creep effect comes into play.

13. See, for example, Auerbach (1989b) and Gertler and Hubbard (1989).

14. From (2) in the text,

$$\frac{\partial R}{\partial t_p} = \frac{r+p}{(1-t_p)^2} = \frac{R}{1-t_p} > 0.$$

15. Another complication in assessing the sign of (7) is that the proportions of profits distributed as dividends and capital gains likely are related to the tax rates on the two types of incomes. In practice, a decrease in t_p, for example, should lead to a larger portion of profits distributed as dividends—that is, the weight on t_p should be negatively related to t_p. In this case, as long as the marginal tax rate on capital gains, t_k, is less than the marginal tax rate on ordinary income, t_p, an increase in the weight on t_p increases the marginal gain from issuing debt. Thus, even if the proportion of profits paid out as dividends changes with t_p, (7) remains negative for values of w less than one.

16. In the case where debt is used to retire existing equity, it can be seen from the expression in Note 9 that the effect of a change in t_k on the marginal benefit from leveraging will involve another term.

17. DeAngelo and Masulis (1980) are responding to Miller (1977), who argues that tax considerations can determine leverage at the aggregate level, without doing so at the firm level. DeAngelo and Masulis argue that, as leverage increases, the earnings that can be sheltered by non-debt shields decline. As leverage increases, then, the marginal tax advantage of issuing debt (net of the loss in value of the non-debt shields) should eventually decrease and can go to zero. This means that factors affecting the value of non-debt shields can affect the marginal tax benefit of debt financing.

DeAngelo and Masulis also point out that inflation can reduce the value of certain non-debt shields. They note that for depletion and depreciation allowances the deductions are fixed at the time of the relevant investment. Therefore a rise in inflation and the nominal income of a firm would diminish the effects of non-debt shields and enhance the effect of the debt shield. This effect would reinforce the positive effects that inflation has on the incentives for leveraging in (7).

18. Bernanke and Campbell (1988) argue that "near-bankruptcy" costs, such as curtailment of projects due to a lack of funding, also can serve to reduce the attractiveness of debt financing.

19. Information asymmetries exist because a firm insider, like an owner-manager, knows more about the *ex ante* investment opportunities, as in Meyer and Mujlud (1984), or about the *ex post* returns, as in Williamson (1986). These information asymmetries affect the cost of outside funds because the interests of the insider (agent) often do not coincide with those of the outsiders (principals).

20. See Furlong and Keeley (1989).

21. Financing by insiders still would be preferred, all else equal. The amount of internal funds presumably would be related to the net worth of insiders.

22. The tax effects relate strictly to the firms choice between debt and equity and not necessarily to the choice between inside and outside financing.

23. The expression for the tax incentive for debt financing becomes:

$$G \equiv R\{(1-t_{pi})-(1-t_c)[w(1-t_{pe})+(1-w)(1-t_k)]\},$$

where t_{pi} is the personal tax rate on interest income and t_{pe} is the personal tax rate on dividends.

24. This approach is used in Wright (1969) and Rangazas and Abdullah (1987), though the latter use the average rate based on dividend income for both interest and dividend income.

By using gross adjusted income categories, rather than income actually taxed, this approach should overstate the marginal tax rates. Also, using only data on personal income tax rates could overstate the average rate given that certain holders of debt and equity are argued to face very low or even zero marginal tax rates (see, for example, Summers (1989), Auerbach (1989b), King and Fullerton (1984)). Nevertheless, the estimates of tax rates on interest and dividend income should be useful for examining the movements in the income-tax incentive for leveraging over time.

25. See *How Capital Gains Tax Rates Affect Revenues: The Historical Evidence*.

26. See King and Fullerton (1984), page 222.

27. See, for example, Rangazas and Abdullah (1987).

28. Gandolfi (1982) and Rose (1986) show that, with taxes on capital gains (and $t_k < t_p$) and depreciation allowances based on historical costs, the tax-amended Fisher equation is more complicated than the Darby (1975) respecification.

29. As a reminder, the average tax rates on interest and dividends are estimated separately. Following the notation in Note 23, (12) is

$$G \equiv (r+p)\{1 - \frac{(1-t_c)[w(1-t_{pe})+(1-w)(1-t_k)]}{1-t_{pi}}\}.$$

30. This decline for the most part reflects the impact of bracket creep on income tax rates and some rise in the average marginal tax rate on capital gains.

31. Changes in the statutory tax rates are known ahead of time, though exact income distributions are not.

32. In this case, firms would make decisions regarding debt and equity based on the level of stock prices at the beginning of the period. The change in leverage can be rewritten as

$$\log[\frac{(D/E)_t}{(D/E)_{t-1}}] = \log(\frac{D_t}{D_{t-1}}) - \log(\frac{N_t SP_{t-1}}{N_{t-1} SP_{t-1}}) - \log(\frac{SP_t}{SP_{t-1}}),$$

where N is the number of shares. In a given period, the first two right-hand-side terms are the ones that would reflect the decisions of firms.

33. The specification in (14) raises the issue of simultaneity bias, since changes in leverage can affect stock prices. However, it seems reasonable that the dominant channel of causation is from exogenous shocks to prices affecting the market value of equity, and, thus, market-value leverage.

34. The magnitude of the coefficient also could be due to the use of the *S&P500* index to measure the change in stock prices for all nonfinancial corporations.

35. Lagged values of the change in leverage were not significant, so the regression for Column 4 was estimated without those variables.

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