Tax Capitalization in Stock Prices:
Theory and Evidence on the Interaction between Distribution Policy and Tax Rates

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Abstract: This study develops and tests a model of tax capitalization in stock prices. The key innovation of the model is consideration of how distribution policy affects the extent to which dividend and capital gains taxes are impounded into stock prices. The key innovation of the empirical analysis is the use of data aggregated to the national level to reduce measurement error and to encompass a long time series (49 years) with a wide range of tax regimes. This study finds supporting evidence for the hypotheses that both dividend and capital gains taxes reduce stock prices, as well as the hypothesis that stock repurchase intensity shifts the capitalization effect from dividend taxes to capital gains taxes.

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An important issue in the valuation of equity is the influence of shareholder taxes on both dividends and capital gains. Since taxes reduce the after-tax cash flows received by investors, one would expect stock prices (which should equal the present value of after-tax cash flows received from investment in stock) to be negatively related to both dividend and capital gains tax rates. Moreover, one would expect that actions taken by firms to avoid the adverse cash flow effects of these taxes (through stock repurchases, for example) should alter the magnitude of this tax capitalization effect.

Tax capitalization models in the literature include Auerbach (1979), Bradford (1981), Harris and Kemsley (1999), Lang and Shackelford (2000), Collins and Kemsley (2000), and Kemsley and Williams (2001a). The first three of these studies focus on dividend taxation. They explore a context in which dividend timing is irrelevant to firm value since the present value of the tax burden is the same regardless of when dividends are paid. This dividend-irrelevancy perspective is commonly referred to in the literature as the "new view."

Lang and Shackelford (2000) assume that firms and their shareholders have identical rates of return on investment and show this to imply that share prices are more sensitive to capital gains tax rates when firms defer dividend payments (by paying out only a fraction of free cash flows as dividends). Collins and Kemsley (2000) impose a different assumption regarding relative rates of return (in particular they assume that the shareholder discount rate is one minus the capital gains tax rate times the firm's discount rate), use Ohlson-type transformations of the dividend discount model and then restrict future abnormal earnings, as commonly done in Ohlson-style models, and future changes in economic goodwill, which would otherwise affect the present value of capital gains taxes. The result is a cross-sectional model that predicts that the capitalization multipliers on retained earnings and current earnings in the Ohlson-style valuation formula are decreasing functions of the dividend tax rate and the capitalization multiplier on current earnings is also a decreasing function of the capital gains tax rate. Unlike the other papers cited above, Kemsley and Williams (2001a) do not model firm distribution policy but rather treat it as exogenous. They assume the existence of multiple tax clienteles and show that a weighted-average of their tax rates are capitalized into stock prices, where the weights depend on the consumption-investment tradeoff of the clienteles.

There has been substantial recent empirical research finding evidence suggestive of a tax capitalization effect. For example, Lang and Shackelford (2000) provide event-study evidence that the 1997 reduction in capital gains tax rates led to an increase in share price for low-dividend firms, while Ayers, Cloyd, and Robinson (2000) conduct a similar event study for the 1993 increase in ordinary tax rates, showing that stocks prices of high-dividend firms were adversely affected. Collins and Kemsley (2000) provide pooled, cross-sectional evidence that investors appear to capitalize both dividend and capital gains taxes into prices. Harris and Kemsley (1999) incorporate dividend taxes into Ohlson's residual-income model and find that taxes affect the relative valuation weights on book value versus earnings in a predictable manner. Harris, Hubbard, and Kemsley (2001) find supporting cross-country evidence. However, it should be noted that some recent papers have suggested alternative explanations for the findings of these last two papers (Dhaliwal, Erickson, Myers, Banyi, 2001, and Hanlon, Myers, and Shevlin, 2001, although Kemsley, 2001, suggests that these two papers misinterpret their own evidence). Finally, two additional panel studies include Hubbard, Kemsley, and Nissim (2001) and Gentry, Kemsley, and Mayer (2001) which offer evidence of dividend tax capitalization based on differences in earnings growth rates and for Real Estate Investment Trusts, respectively.

This paper seeks to address the same basic question as these studies, whether shareholder tax rates influence the level of stock prices, but with some distinct features. Specifically, I derive a model of share price as a multiple of permanent earnings where the multiple is a function of earnings growth, distribution policy, and shareholder tax rates. I then test the predictions of the model by regressing the price-earnings ratio on the variables indicated by the model.

The primary innovation of the model is consideration of share repurchase activity and how it alters the extent to which both dividend and capital gains taxes should be capitalized. Since share repurchases are taxed more favorably than dividends, it is reasonable to expect that stock prices would be less adversely affected by high dividend tax rates when stock repurchases are used extensively (although prices should be more sensitive to capital gains taxes in that case). While there have been studies of whether share repurchases are motivated by tax considerations (*e.g.,* Lightner, 2001), no prior study has tested whether their use affects the valuation impact of tax rates.

One feature of the empirical tests in this paper distinct from the above cited studies is its use of a national aggregate-level time series. This is particularly useful in this case because firm-level expected growth is difficult to measure while firm-level reported earnings are contaminated by transitory components. Aggregation significantly mitigates these measurement problems. Moreover, the key variables of interest in the study, shareholder tax rates, do not vary across firms in the same time year, so aggregation costs nothing in terms of sample variation for these variables. Indeed, one of the main advantages of a time series approach (using 49 years of data) is more variation in shareholder tax rates than feasible in either an event study, cross-section, or panel (none of the above cited papers includes a panel with nearly as broad a time span).

The empirical findings in this paper are that the aggregate price-earnings ratio is decreasing in both the dividend and capital gains rate, and statistically significant. Further, the paper finds that share repurchase intensity significantly shifts capitalization from dividend to capital gains taxes, as predicted. An additional empirical finding is that increases in retention of earnings are associated with decreases in share value, in contrast to the traditional view that deferral of distributions should increase stock price. Overall, the evidence is consistent with the predictions of my tax capitalization model.

The remainder of the paper is organized as follows. First, I develop a model of how taxes and distribution policy affect the price-earnings ratio. I use this model to develop the empirical structure and hypotheses used in the empirical tests. Next, I discuss the advantages and limitations of an aggregated time series approach. I then discuss the data used in the paper. Finally, I conduct the empirical tests of the hypotheses developed in my tax capitalization model.

TAX CAPITALIZATION MODEL

The purpose of this paper is to explore how tax rates and distribution policy (the choice between dividends, stock repurchases, and retentions) affect the market value of firms. Empirically, this requires that one control for "fundamentals" that influence firm value. There are two fundamentals that are commonly used, distributions to shareholders and earnings. Shareholder distributions are theoretically the most important factor in determining firm value, but lack timeliness (since firms can defer payouts for long periods of time) in empirical studies. Earnings are therefore more useful proxies for fundamental value in empirical tests. The problem with earnings is that the tax treatment of shares depends on the pattern of distributions. For these reason, most tax capitalization models focus on payouts (including Lang and Shackelford, 2000, and Kemsley and Williams, 2001). The extant tax capitalization models that are based on earnings are oriented toward cross-sectional tax effects (including Harris and Kemsley, 1999, and Collins and Kemsley, 2000) and involve restrictive assumptions that I seek to avoid (*e.g.*, on form of distribution, dividend or repurchase, and rates of return on reinvested earnings). For this reason, I develop an earnings-based tax capitalization model to motivate the choice of variables and structure that will be used in the forthcoming empirical tests.

The objective of this model is to determine the price of a company's stock as a function of its earnings, its distribution policy, and the taxes faced by its shareholders. To that end, I define the following variables:

t is the shareholder tax rate on dividends,

g is the shareholder tax rate on capital gains (accrual-equivalent rate),

r_c is the marginal after-tax rate of return earned by the company on its investment,

r_s is the after-tax rate of return required by the firm's shareholders (their discount rate),

d is the dividend payout ratio (the fraction of earnings paid out as dividends), $d \geq 0$,

s is the stock repurchase ratio (the fraction of earnings used for repurchases), $s \geq 0$,

ϕ is the retention ratio (the fraction of earnings retained) where $\phi = 1 - d - s$, $1 > \phi \geq 0$,

h is the firm's earnings growth if no earnings are retained,

E_i is the firm's earnings in year i, and

P_i is the firm's market value at the beginning of year i (so P_{i+1} is the value at year's end).

I model the firm as paying out a fixed share of its earnings each year as dividends and another fixed share as stock repurchases. Note that stock repurchases could include any capital gains taxed distribution of cash from the firm, so payments received by shareholders in an acquisition would qualify as well. Of course, firms are not acquired on a fractional basis every year, but rather are occasionally acquired in whole. Likewise, stock repurchases are not typically smooth events, but tend to occur in lumps. Thus, I interpret s as the expected amount of payments to shareholders through repurchases or acquisitions in a given year (as a fraction of earnings), recognizing that in any firm-year, the actual amount of payments could be much larger or smaller.

While the firm could completely refrain from either distribution method, it is required to distribute at least some of its earnings each year. Any retained earnings are reinvested in the firm at its marginal rate of return, r_c, which contributes to earnings growth. In addition, I allow for the possibility of exogenous earnings growth that occurs even if the firm retains none of its earnings (*e.g.*, due to technological advancements or improved economic opportunities over time). There is, consequently, a double benefit of retained earnings (the direct investment return of r_c and the indirect benefit of growth from a higher earnings base in the future). Total earnings growth is a combination of exogenous growth (h) and retention-fueled growth (ϕr_c):

$$E_{i+1} = E_i(1 + h + \phi r_c). \tag{1}$$

The smooth growth assumed in (1) clearly does not characterize reported net income of most firms. Thus, the concept of earnings used in the model is the "permanent" component of earnings, the portion of earnings that persists across time. This model's purpose is to ultimately determine a price-earnings multiplier as a function of tax attributes. Temporary components of earnings would not warrant as large a multiplier as this model predicts. This will be important for empirical tests of the model's prediction, as such tests should be based on a measure of earnings as close to permanent earnings as possible.

The market value of the firm will be set in each period such that the total after-tax return to shareholders equals the required rate of return (r_s). There are three components to the return: dividends (taxed at rate t), cash received from repurchases (taxed at rate g), and increases in firm value (taxed at rate g).[1] Thus,

[1] Technically, repurchases are taxed only to the extent of gains on the tendered shares. However, if stock repurchases occur, the non-tendered shares incur capital gains in excess of the increase in total firm value, so in effect, the sum of repurchase value plus

$$r_s = \frac{[d(1-t)+s(1-g)]E_i + (1-g)(P_{i+1} - P_i)}{P_i}.$$

$$r_s P_i = [d(1-t)+s(1-g)]E_i + (1-g)(P_{i+1} - P_i).$$

$$P_{i+1} = (1-g)^{-1}\{(1+r_s - g)P_i - [d(1-t)+s(1-g)]E_i\}. \quad (2)$$

(1) and (2) together comprise a system of two first-difference equations in two unknown sequences (E_i and P_i). To uniquely solve this system, I need assumptions regarding either the initial or terminal values of the two sequences. I assume an initial value for E_i, that is $E_0 = a$, for some $a > 0$. For the price sequence, a terminal value restriction is needed, which means a transversality condition since there is no terminal date. Specifically, I assume that

$$\lim_{i\to\infty}\left|\frac{P_i}{E_i}\right| < \infty. \quad (3)$$

This is a standard no-bubble condition, commonly assumed in asset pricing to rule out multiple equilibria. In particular, it ensures that in the long run, prices do not explode relative to the fundamental, which is earnings in this case. It is easy to show that any

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the increase in firm value is taxed as capital gains as I assume. To see this, consider as an example a firm with 100 shares priced at \$10 per share at the beginning of the year (\$1,000 market value). During the year, the price per share increases to \$20, and the firm repurchases 10 shares at that price, leaving 90 shares outstanding. The amount of capital gains on the repurchased shares is 10 shares x (\$20-\$10) = \$100. The amount of capital gains on the outstanding shares is 90 shares x (\$20-\$10) = \$900. Thus, total capital gains are \$1,000. Note that \$200 was spent on repurchases and that the market value of the firm increased by \$800 (from \$1,000 to \$1,800), which sums to \$1,000, which is the amount of total capital gains.

price sequence that solves the system {(1), (2)} is either a bubble (it violates (3)) or exhibits a constant price-earnings ratio. This is because the growth prospects of the firm never change (since growth in earnings is a constant in (1)), so price should maintain a constant multiple of earnings. Any change in the P/E ratio over time compounds and accelerates, causing price to soar to plus or minus infinity relative to earnings.

$$\frac{P_{i+1}}{E_{i+1}} = \frac{P_i}{E_i}.$$

$$\frac{(1-g)^{-1}\{(1+r_s-g)P_i - [d(1-t)+s(1-g)]E_i\}}{E_i(1+h+\phi r_c)} = \frac{P_i}{E_i}.$$

$$\{(1+r_s-g)P_i - [d(1-t)+s(1-g)]E_i\}E_i = (1-g)E_i(1+h+\phi r_c)P_i.$$

$$[(1+r_s-g)-(1-g)(1+h+\phi r_c)]P_i = [d(1-t)+s(1-g)]E_i.$$

$$\frac{P_i}{E_i} = \frac{d(1-t)+s(1-g)}{r_s-(1-g)(h+\phi r_c)}. \qquad (4)$$

(4) is a very general price-earnings model of tax capitalization. It allows for any feasible distribution policy (choice of d and s). There are various special cases of interest. First consider the no-tax case with $r_c = r_s - h$. In this case, (4) simplifies to

$$\frac{P_i}{E_i} = \frac{d+s}{r_s-[h+(1-d-s)(r_s-h)]} = \frac{1}{r_s-h}. \qquad (4a)$$

(4a) is a standard earnings capitalization model in which earnings are multiplied by one over the difference between the shareholder discount rate and the earnings growth rate. In this case, distribution policy does not matter because it has no tax consequences and an extra dollar retained in the firm earns a rate of return equal to what that dollar would earn outside the firm.

Another variation of (4) would occur if a firm pays out all of its earnings as dividends (d = 1). In this case, (4) simplifies to

$$\frac{P_i}{E_i} = \frac{1-t}{r_s - h(1-g)}. \qquad (4b)$$

In this case, the dividend tax has a proportionate effect on price, while the capital gains tax has the effect of reducing the benefit of earnings growth. (4b) corresponds to the "new view" framework in which all distributions are assumed to be exclusively dividends and in which retention of earnings is assumed to be value-irrelevant.

A final transformation of (4) is to model distribution policy in terms of two new parameters. First let δ be the fraction of distributions that take the form of stock repurchases. Second define η as the retention-based growth rate (*i.e.*, ϕ / r_c). Then,

$$d = (1-\delta)(1-\eta / r_c).$$
$$s = \delta(1-\eta / r_c).$$

$$\frac{P_i}{E_i} = \frac{1-t+(t-g)\delta}{r_s-(1-g)(h+\eta)} \frac{r_c-\eta}{r_c}. \qquad (5)$$

Taking logs, (5) becomes:

$$\log(P_i) - \log(E_i) = \log[1-t+(t-g)\delta] - \log[r_s-(1-g)(h+\eta)] + \log(r_c-\eta) - \log(r_c). \qquad (6)$$

We can derive the following comparative statics from (6), which will form the basis for the hypotheses tested in the paper.

$$
\begin{aligned}
&\frac{\partial \log(P_i)}{\partial t} = \frac{\delta - 1}{1 - t + (t-g)\delta} \leq 0. \\
&\frac{\partial \log(P_i)}{\partial g} = \frac{-\delta}{1 - t + (t-g)\delta} - \frac{h+\eta}{r_s - (1-g)(h+\eta)} < 0. \\
&\frac{\partial \log(P_i)}{\partial h} = \frac{1-g}{r_s - (1-g)(h+\eta)} > 0. \\
&\frac{\partial \log(P_i)}{\partial r_s} = \frac{-1}{r_s - (1-g)(h+\eta)} < 0. \\
&\frac{\partial \log(P_i)}{\partial r_c} = \frac{1}{r_c - \eta} - \frac{1}{r_c} = \frac{\eta}{r_c(r_c - \eta)} \geq 0. \\
&\frac{\partial \log(P_i)}{\partial \delta} = \frac{t-g}{1 - t + (t-g)\delta} > 0. \\
&\frac{\partial \log(P_i)}{\partial \eta} = \frac{1-g}{r_s - (1-g)(h+\eta)} - \frac{1}{r_c - \eta}.
\end{aligned}
\tag{7}
$$

(7) indicates that the dividend tax's effect depends on the fraction of distributions that takes the form of stock repurchases (δ), but importantly, does not depend on the choice of retained earnings. If any dividends are paid, then price is declining in t. The capital gains tax (g) reduces stock prices, more so when firm growth is high and when stock repurchases are used. Price is increasing in exogenous earnings growth (h), is declining in the shareholder discount rate (r_s), and is increasing in the firm's marginal rate of return (r_c) when retentions are positive. If capital gains are taxed favorably relative to dividends (*i.e.*, $g < t$), then shifting from dividends to repurchases increases stock price (more so when the dividend tax rate is substantially higher than the capital gains rate).

According to (7), the retention rate (which corresponds to η) has an ambiguous effect on firm value. Depending on the model parameters, deferral of distributions could be either value increasing or decreasing. Rearranging (7),

$$\frac{\partial \log(P_i)}{\partial \eta} = \frac{(1-g)(r_c-\eta)-\left[r_s-(1-g)(h+\eta)\right]}{\left[r_s-(1-g)(h+\eta)\right](r_c-\eta)}.$$

$$\frac{\partial \log(P_i)}{\partial \eta} = \frac{(1-g)(r_c+h)-r_s}{\left[r_s-(1-g)(h+\eta)\right](r_c-\eta)}.$$

Retention policy is irrelevant if

$$(1-g)(r_c+h)=r_s. \qquad (8)$$

This equation can be interpreted as saying that the after-tax return on funds invested in the firm (after both corporate level taxes, imbedded in r_c, and shareholder capital gains taxes) equals the after-tax return on funds invested directly by the shareholder. In this case, keeping a dollar in the firm generates exactly the same return as paying it out and having the shareholders invest it themselves. (8) is essentially the condition required for the "new view" dividend timing irrelevance. Kemsley and Williams (2001b) show that a condition equivalent to (8) arises as a consequence of general equilibrium when firms, through adjustments to dividend policy to exploit violations of (8), shift their capital structures sufficiently to alter the marginal clientele between stocks and bonds. As the marginal clientele changes, both the LHS and RHS of (8) change. This continues until the LHS and RHS of (8) become equal, at which point firms stop changing their dividend policies (since there is no longer any benefit to changing them). If such a general equilibrium exists (which depends on some strong assumptions), then (8) holds, and (5) simplifies to

$$\frac{P_i}{E_i} = \frac{1 - t + (t - g)\delta}{r_s - (1 - g)h}. \tag{5a}$$

In general, (8) does not necessarily hold and so retention policy could be value relevant. If the LHS of (8) exceeds the RHS, then increases in retention (deferral of payouts) lead to higher P-E ratios, consistent with the traditional view. In contrast, if the RHS of (8) exceeds the LHS, then P-E is decreasing in the retention ratio.

AGGREGATION APPROACH

To test the tax capitalization predictions of equations (5) and (6), I develop a single time series of data for the entire non-farm non-financial corporate sector in the U.S.[2] There are significant advantages to using aggregate data as opposed to firm-level data to test for tax capitalization.

First, as mentioned in the introduction, some of the variables in the model, particularly permanent earnings[3] and long-term growth[4] are difficult if not impossible to

[2] This sector is chosen to correspond to the sector classifications used in the Flow of Funds Accounts of the United States (Board of Governors, 2000). The Flow of Funds does not distinguish between corporate and noncorporate farms and does not provide the necessary data (market value and profit) for financial companies.
[3] Lev (1989) reviews a number of studies and concludes that firm-level earnings have much less value relevance than they should if they reflect permanent earnings well. More recent work by Liu and Thomas (2000) suggests than even the “clean” earnings numbers provided by IBES possess less value relevance than permanent earnings theoretically

measure at the firm-level, but easier to measure at the national level due to canceling of idiosyncratic measurement error. Indeed, Beaver, Lambert, and Morse (1980) show that aggregation significantly improves the value relevance of earnings. Another variable that is more accurately measured in the aggregate is stock repurchase intensity. The relevant measure of stock repurchases is the expected amount of stock repurchases (including acquisition payments). But actual stock repurchases and acquisitions are extremely lumpy for individual firms. Aggregation reduces that lumpiness.

The second advantage of aggregation is that it allows for a longer time period. Data are available from the Flow of Funds Accounts for 1952 to 2000. A firm-level study would require a much shorter sample (for example, Collins and Kemsley use 20 years of data). This is important because the primary variables of interest are tax rates that have no cross-sectional variation. Without a long enough time series, it would be impossible to identify a tax rate effect regardless of the number of firms used in each year. By utilizing 49 years of data, I have a dataset that spans a large array of tax regimes, increasing the prospect of detecting a statistically significant effect of tax rate changes.

Despite these advantages of an aggregated approach, there are limitations that should also be noted. Aggregation reduces observational mass and thereby potentially sacrifices information. A time series has one data point per year, while a pooled sample has as many observations in a year as firms. In this case, that is unlikely to be a problem

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should. Thus, the financial accounting literature suggests that measurement error in firm-level earnings is significant and not entirely correctable.

[4] Bulkley and Harris (1997) suggest that analyst growth forecasts are very poor predictors of actual growth. Liu and Thomas (2000) and Liu, Nissim, and Thomas (2000) both suggest that analyst growth forecasts provide little value relevance.

given minimal cross-sectional variation in tax rates. In any event, it is merely an issue of statistical power. As I show later, even with the small sample, there is sufficient power to derive statistical significance on most variables.

Another limitation of the aggregated approach is the inability to distinguish cross-sectional effects of tax rates within years. The tax capitalization model suggests some ways in which the tax effect could vary cross-sectionally (based on earnings growth and stock repurchase intensity), but the aggregation approach is limited in its ability to detect these variations.

Finally, a limitation of a purely time series approach is the potential bias caused by omitted time-varying economic phenomena that directly influence the price-earnings relation. The primary concerns in the context of this paper are inflation (correlated with capital gains tax rates) and industry composition trends (i.e., the rise in importance of the high tech sector, which is time trended and thus potentially correlated with dividend tax rates). I address the inflation concern by doing robustness tests using nominal capital gains tax rates, and I address the high-tech concern by including growth as a control variable (and growth is presumably the reason for higher average PEs of high tech firms).

DATA AND STATISTICAL ANALYSIS

I test the valuation formula (6) by acquiring data on P, E, h, t, g, r_s, r_c, δ, and ϕ. P is the market value of U.S. non-farm non-financial corporate businesses taken from the Flow of Funds Accounts of the U.S. provided by the Federal Reserve Board. For E, aggregate permanent earnings, I take after-tax profit for U.S. non-farm non-financial corporate businesses from the Flow of Funds[5] and adjust it for the effect of the business cycle.[6] In particular, I adjust (in logs) for the difference between full employment GDP for the U.S., provided by the Congressional Budget Office, and actual GDP, provided by the U.S. Department of Commerce. Hence, I increase corporate profits in recessions and decrease corporate profits in boom years in constructing my measure of permanent earnings.[7] The log of the price-earnings ratio, as well as the other variables discussed below, is displayed in Figures 1 and 2.

Insert Figure 1 Here

In the tax capitalization model, earnings growth is the sum of two parts, exogenous growth, *h*, and retention-driven growth η. Empirically, these cannot be

[5] The original source for corporate profits in the Flow of Funds is the U.S. Commerce Department's National Income and Product Accounts (NIPA). NIPA bases its measure of corporate profits on tax return data from the IRS. Taxable income is adjusted to remove the arbitrary components of the tax system. *E.g.,* accelerated depreciation is replaced with straight line based on a uniform set of service lives and current replacement cost, a measure that is arguably superior to GAAP depreciation, which is based on historical cost and arbitrary service lives. In addition, NIPA removes gains and losses and other non-current revenues and expenses. The NIPA measure is probably a better measure of permanent earnings than GAAP net income (or even income before extraordinary items or operating income) due to its lack of gains/losses and most non-recurring accruals. Details of the NIPA profits construct can be found in Bureau of Economic Analysis (1985).

[6] This is an important adjustment since Johnson (1999) identifies a significant business cycle effect in the price-earnings relationship.

[7] Congressional Budget Office (1995) discusses the construction of full employment GDP. The actual method is extremely sophisticated and takes into account business cycle effects beyond employment. However, to an approximation, the method is equivalent to regressing changes in real non-farm business sector GDP (roughly 80 percent of total GDP) on changes in unemployment. The estimated slope from this regression is then multiplied by the difference between unemployment in any given year and the average unemployment level (*i.e.,* "full employment") and subtracted from real GDP.

disentangled, so I use a single measure that combines both, which for brevity I call *h*. I estimate *h* by calculating the 5-year forward growth rate of real full employment GDP. For example, the measure of *h* in 1960 would be the growth rate of real full employment GDP from 1960 to 1965. This measure has the benefit of filtering out business cycle effects, so only productivity and capital and labor pool increases are factored into *h*. Also, by using full employment GDP, I can estimate *h* for 1996-2000 because the Congressional Budget Office provides forecasts of full employment GDP for all quarters up to 10 years in the future. In Figure 1, *h* is multiplied by 10 so that it conforms more closely to the scale of the other variables and its time series variation will be visible.

My estimate of *t* is the tax rate for the top marginal individual income tax bracket for the U.S. It ranges from 28 percent from 1988 to 1990 to 91 percent (prior to 1964). My estimate of *g* is more complicated. It is the top long-term capital gains tax rate plus the potential effects of add-on minimum and maximum taxes (prior to 1979).[8] *g* is further modified to include the effect of inflation on the real capital gains tax rate. Specifically, the real tax rate is the tax rate that would produce an identical tax burden if the tax only applied to real gains as opposed to nominal gains (i.e. as if the tax basis of a capital asset was indexed for inflation). This is an important adjustment since investors do not care about the nominal returns that they receive from investment, but rather the purchasing power benefits provided by investment.[9]

[8] Tax rate data for years prior to the Tax Reform Act of 1986 come from U.S. Department of the Treasury (1985) which calculates the effect of the add-on minimum and maximum taxes in the years when they applied.

[9] For example, if you earn a 10 percent pre-tax nominal return, but pay 50 percent capital gains tax, then you make 5 percent. But if prices are 5 percent higher at the end of the investment period than at the beginning, then you have really gained nothing, so in effect, the capital gains tax has consumed your entire return.

The particular formula that I use for g is

$$g = 1 - \frac{[(1+m+\pi)^n - 1](1-g_n)}{(1+m)^n - 1} \tag{9}$$

where m is the real rate of return, π is the inflation rate, g_n is the statutory capital gains tax rate, and n is the holding period.[10]

To estimate the effect of inflation on g, I employ (9), assuming a 5 percent real return, a three year holding period, and an inflation rate equal to the inflation rate during the current year (based on the GDP deflator). The real capital gains tax rate varies from 24.3 percent in 1998 to 141.2 percent in 1974 (a year with a very high statutory tax rate as well as a very high inflation rate).[11]

Insert Figure 2 Here

There are two rates of return in (6), r_s and r_c. The former is the after-tax return required by shareholders (*i.e.*, their discount rate), and the latter is the marginal after-tax return earned by firms. Neither variable is directly observable, but both are clearly related. For this reason, I choose to include a single interest rate variable, r, to proxy for both; specifically, I use the real 3-month Treasury Bill interest rate (adjusted for the inflation rate calculated from the GDP deflator). While this measure is especially likely

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[10] This method of inflation adjusting capital gains tax rates is suggested by U.S. Department of the Treasury (1985).

to be much lower than the stock valuation discount rate,[12] the time series patterns of all three rates should be similar. The real interest rate varies from –2.3 percent in 1976 to 5.4 percent in 1985.

Stock repurchases are measured as the additive inverse of net new equity issues by non-farm non-financial corporations in the U.S. (from the Flow of Funds). The Flow of Funds measure includes any transaction in which a non-financial corporation buys/sells shares (of any corporation) to/from anyone other than another non-financial corporation. Thus, the measure includes new equity issues, share repurchases, and cash acquisition payments. As mentioned earlier, cash acquisitions serve an equivalent function to repurchases (distribution of funds to shareholders not taxed as dividends). Likewise, equity issues are mechanically just negative share repurchases, so the Flow of Funds measure is a reasonable representation of stock repurchases, for my purposes. I construct δ as share repurchases divided by the sum of share repurchases and dividends (also for non-financial non-farm corporations, taken from the Flow of Funds). δ ranges from –1.15 in 1972 to 0.71 in 1988.

While not directly included in (6), the retention ratio, ϕ, is indirectly represented by η. While not included in the main regression analysis, ϕ will be considered in a supplemental analysis. I measure ϕ as the one minus the ratio of (dividends minus net new equity issues) to earnings (all variables taken from the Flow of Funds for the non-farm non-financial sector). ϕ ranges from –1.21 in 1986 to 0.81 in 1971.

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[11] I have conducted all tests using the nominal capital gains tax rate instead of the real rate. These unreported results are very similar to the reported results, although with larger coefficients (and larger standard errors) on the capital gains rate.

[12] This is due to the large equity premium that has been studied in numerous papers in economics and finance (e.g. Mehra and Prescott 1985).

Table 1 displays univariate statistics for the price / permanent earnings ratio, growth rate, real interest rate, tax rates, stock repurchase intensity, and earnings retention ratio. The sample offers considerable variation in each variable with the possible exception of *h* for which the coefficient of variation is 0.136. Table 2 displays the correlation matrix for the variables. In Table 2, unlike Table 1, I use both the price / earnings ratio and its logarithm (which are the dependant variables in the forthcoming regressions). *P/E* is strongly negatively correlated with the tax rates and moderately positively correlated with stock repurchase intensity, as predicted by the model.

Insert Tables 1 and 2 Here

Primary Regressions

The initial multivariate analysis conducted in this study involves the following two regressions, motivated by (6).[13]

$$\log(P_i / E_i) = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \varepsilon_i. \tag{10}$$

$$P_i / E_i = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \varepsilon_i. \tag{11}$$

[13] I could also include variables shown in prior studies to influence the time series relationship between stock prices and earnings. In particular, Johnson (1999) suggests that both business cycle and interest rate variables should be included. My specification includes the interest rate, *r*, and I adjust earnings to account for business cycle effects. In unreported regressions, I also include an additional regressor, the difference in logs of GDP and full employment GDP (roughly equivalent to a measure of unemployment), to further account for business cycle effects. The business cycle variable is insignificant in each regression, and its inclusion has no material effect on the coefficient estimates of the other variables.

(10) is very closely related to (6).[14] (11) involves a greater departure from (6), however, the estimation of (11), in concert with estimation of (10), allows me to test for tax capitalization without being tied to a specific structure, offering more robustness to the study.

For both regressions, I can derive coefficient sign predictions from the comparative statics in (7). Given that my growth measure is a composite of h and η, there is no definitive sign for its coefficient. However, as discussed earlier, if the "new view" condition (8) holds, then η has no effect on price, in which case, the prediction is that $\beta_1 > 0$ (growth enhances value). A similar problem exists for the interest rate. It proxies for two rates, r_c and r_s. Both interest rates have opposite effects on price according to (7). Thus, there is no general prediction for β_5. However, if (8) holds, then there is a prediction that $\beta_5 < 0$ (the real interest rate reduces value). The model suggests that higher tax rates lead to lower prices, so I expect that $\beta_2 < 0$ (dividend taxes reduce value) and $\beta_3 < 0$ (capital gains taxes reduce value).

Finally, the model suggests that stock repurchases shift the tax burden from dividend to capital gains, so they should increase price in proportion to the difference between t and g. Thus, the model predicts that $\beta_4 > 0$. While the model does not suggest that δ should have any effect on price by itself (and thus there is no separate δ term in (10) or (11)), it should be noted that inclusion of δ as an additional regressor has no

[14] In principle, I could use an identical specification to (6). However, the effects of the individual variables on prices would be entangled. (10) allows me to isolate the individual tax effects. Moreover, given my measures of the variables in the study, some of the terms in brackets in (6) are negative (so their logs do not exist) in some years, making that approach infeasible.

substantial effect on the coefficient estimates. The principal effect of including δ in the regressions is that the estimate of β_4 becomes more significant.

One final coefficient prediction based on (7) is $\beta_4 = -\beta_2$. This follows from the fact that a complete shift from dividends ($\delta = 0$) to repurchases ($\delta = 1$) would fully offset the dividend tax capitalization effect.

Insert Table 3 Here

Table 3 displays the regression results for both (10) and (11). All of the coefficient estimates have the predicted signs and are statistically significant (the largest p-value is 0.013) in both regressions. Moreover, β_4 and $-\beta_2$ are insignificantly different (p-values of 0.18 and 0.24), consistent with the prediction of their equality. The R^2s in the regressions are 73.1 percent (log) and 69.2 percent (level). The Durbin-Watson statistics are 0.96 in the log regression and 1.02 in the level regression, which suggest autocorrelation in the residuals.

To correct for the autocorrelation in the regressions, I use the Cochrane-Orcutt regression variant. I model the error terms as

$$\varepsilon_i = \gamma\varepsilon_{i-1} + \nu_i. \quad (12)$$

Substituting in (12), (10) becomes

$$\log(P_i / E_i) - \gamma \log(P_{i-1} / E_{i-1}) = \alpha(1-\gamma) + \beta_1(h_i - \gamma h_{i-1}) + \beta_2(t_i - \gamma t_{i-1}) + \beta_3(g_i - \gamma g_{i-1}) + \beta_4[(t_i - g_i)\delta_i - \gamma(t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5(r_i - \gamma r_{i-1}) + \nu_i. \quad (10a)$$

Likewise, (11) becomes

$$P_i / E_i - \gamma P_{i-1} / E_{i-1} = \alpha(1-\gamma) + \beta_1(h_i - \gamma h_{i-1}) + \beta_2(t_i - \gamma t_{i-1}) + \beta_3(g_i - \gamma g_{i-1}) + \beta_4[(t_i - g_i)\delta_i - \gamma(t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5(r_i - \gamma r_{i-1}) + \nu_i. \quad (11a)$$

The estimation procedure iteratively estimates the main equation (10a or 11a) and the autocorrelation equation (12), using OLS, repeating the process until the estimates converge. The results of the Cochrane-Orcutt regressions are displayed in Table 4. The autocorrelation coefficient estimates, γ, are 64.1 percent in the log regression and 55.3 percent in the level regression, and highly significant in both cases. The autocorrelation correction significantly increases the standard error estimates for the most autocorrelated regressors (growth and dividend tax rate), reducing statistical power for those coefficients. As a consequence, β_1 is no longer significant, although it retains a positive sign in both the log and level specifications. However, all the tax-based variables remain highly significant (at the one percent level except the dividend tax in the log specification, with a p-value of 1.4 percent). Moreover, β_4 and -β_2 are even closer to each other with the autocorrelation correction than without, consistent with the prediction of their equality.

Insert Table 4 Here

Overall, the regressions indicate the presence of both dividend and capital gains tax capitalization, with the magnitudes of each dependant upon the intensity of stock repurchases. Dividend taxes appear to be more heavily capitalized when repurchases are low, and capital gains taxes more heavily capitalized when repurchases are high. This conforms to the theoretical predicts of the valuation model developed in this paper. It is consistent with evidence in other empirical studies (discussed earlier), but adds a finding, absent from prior studies, that tax capitalization magnitude depends on the use of stock repurchases.

Supplemental Analysis

To confirm the robustness of the regression findings, I conduct some additional tests. First, I conduct some non-parametric tests, beginning with Spearman rank-correlation tests (for an association between *P/E* and each of h, t, g, $(t\text{-}g)\delta$, and r). Table 5 provides the results of this test. The rank correlations all have the predicted signs, except for r, which has an insignificant relationship to *P/E*. The rank correlations are statistically significant for both tax rates, t and g (at the 1 percent level). The stock repurchase variable is much less significant (0.089 p-value), but note that it should be an offset effect (it reduces the effect that the dividend tax has on price), so it is unsurprising that by itself, it would be only weakly associated with *P/E*. In addition, in untabulated results, I estimate rank regressions (using ranks of the same variables in (10)). With autocorrelation correction, all variables are significant except the growth rate and the dividend tax, both of which are highly significant if no autocorrelation correction is made.

Insert Table 5 Here

A potential concern about the dividend tax rate is that it is nearly monotonic decreasing during the sample (see Figure 1). Thus, the regressions could attribute a secular time trend in *P/E* to *t*. This would be problematic if there is an omitted variable with a time trend (although it is unclear what that omitted variable could be). To check that, I add a time trend to the regressions performed in this study (these regressions are not reported in the paper). Not surprisingly, given the near monotonicity in *t*, doing so eliminates the significance of the dividend tax rate in every regression except one (OLS using log(*P/E*)), while the other coefficient estimates are not materially affected. While this does not prove that *t* is loading spuriously in the reported results (indeed it could simply be due to multicolinearity in a small sample given the correlation between *t* and year of –94%), it raises the possibility that *t* is picking up the effect of a time trending omitted variable.

A final analysis considers whether the earnings retention ratio, ϕ, affects the price-earnings ratio. While ϕ is not directly included in (6), it determines η, which is included. Based on the comparative statics in (7), ϕ has an ambiguous effect on *P/E* which depends on whether or not the firm's marginal rate of return (net of the capital gains tax) exceeds the shareholder discount rate. To estimate the retention ratio's effect, I modify (10) and (11) to include ϕ. Thus, I estimate

$$\log(P_i / E_i) = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \beta_6 \phi_i + \varepsilon_i. \tag{13}$$

$$P_i / E_i = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \beta_6 \phi_i + \varepsilon_i. \tag{14}$$

In both cases, there is no predicted sign on β_6, so I use two-tailed p-values for this coefficient estimate. Table 6 includes the results of estimating (13) and (14) both with and without autcorrelation correction. The inclusion of ϕ has minimal effect on the estimated coefficients for the other variables. The estimate of β_6 is negative in each case, but significant at the 5 percent level, two-tailed, in only one case (levels regression without autocorrelation correction). ϕ is significant at the 10 percent level, two-tailed, in both Cochrane-Orcutt regressions. Thus, there is modest evidence that deferral of payouts to shareholders decreases firm value. This contrasts with both the new view, which predicts no relation, and the traditional view, which predicts a positive relation. In the context of my model, this finding suggests that the rate of return inside the firm is less than the shareholder rate of return, which is plausible if corporate tax rates are sufficiently high relative to individual tax rates (that is, if the corporate tax rate exceeds the difference between the shareholder tax rates on dividends and capital gains).

Insert Table 6 Here

CONCLUSION

This study has developed a model of the price-earnings ratio as a function of shareholder tax rates and distribution policy (payout rates for dividends and stock repurchases). Next, I have estimated the actual time series relationship between the P/E ratio and the variables predicted by the model to be relevant (including growth and interest rates in addition to tax-relevant characteristics) using aggregate data for the U.S. Using a variety of specifications and robustness tests, the results suggest that:

1) stock prices are negatively associated with the tax rate on dividends,
2) stock prices are negatively associated with the tax rate on capital gains,
3) stock repurchase activity increases the capitalization of capital gains taxes and decreases the capitalization of dividend taxes, and
4) retention of earnings decreases stock prices.

The evidence on the capitalization of dividend and capital gains taxes is consistent with similar findings in other papers that use different methodologies (*e.g.*, Collins and Kemsley, 2001 and Lang and Shackford, 2000). However, the finding that tax capitalization appears to be affected by the use of stock repurchases, is unique to this paper. The evidence on earnings retention is marginal, but it contradicts both the traditional and new views of dividend tax capitalization, while being consistent with the model developed in this paper.

Given the growing evidence of a tax capitalization effect in the literature, future research in this area should focus on additional implications and refinements of tax capitalization theory. For example, the tests in this paper and others assume the existence of a single tax clientele (individuals) that determines stock prices. Kemsley and Williams (2001a) extend the capitalization model to consider the effect of multiple clienteles operating in the stock market (such as tax-exempt institutions). Multiple clienteles induce a more complex relationship between stock prices and the variables considered in this study (growth, the two tax rates, and stock repurchase activity) than occurs in the single clientele model. Clientele effects, if they exist, are suppressed in the aggregation performed in this paper. Therefore, it remains for empirical methodologies to be developed that can test for the cross-sectional effects of multiple clienteles on stock prices.

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Table 1
Univariate Statistics

	Mean	Std. Dev.	Median	Minimum	Maximum
P / E	17.92	7.49	17.09	7.28	40.94
h	3.39%	0.46%	3.41%	2.61%	4.30%
t	63.8%	21.5%	70%	28%	91%
g	50.5%	28.6%	39.1%	24.2%	141.2%
r	1.50%	1.95%	1.84%	-2.32%	5.45%
δ	-10.1%	49.5%	-6.6%	-115.2%	70.6%
ϕ	36.5%	46.3%	58.5%	-120.6%	81.3%

Time period of the study: 1952-2000 (49 observations)

P / E is the ratio of market value to profits for all non-farm non-financial corporations. Profits are adjusted for business cycle fluctuations (to measure permanent earnings).

h is the 5-year growth rate in real full employment GDP.

t is the top tax bracket rate on ordinary income for individuals.

g is the top real capital gains tax rate, adjusted for inflation. g constitutes the fraction of real gains that is paid as tax and exceeds 100% for some years due to very high inflation.

r is the real 3-month T-bill rate. r is less than 0 in some years due to high inflation.

δ is $s/(d+s)$ where s is the negative of net new equity issues for non-financial corporations and d is dividends paid by non-financial corporations.

ϕ is the earnings retention ratio, $(e-d-s)/e$, where d and s are defined above and e is earnings of non-financial corporations.

Table 2
Correlation Matrix

	Log(*P/E*)	*P/E*	*h*	*t*	*g*	*r*	δ	ϕ
Log(*P/E*)	1							
P/E	97.0%	1						
h	14.2%	7.2%	1					
t	-54.4%	-56.9%	59.1%	1				
g	-47.9%	-42.0%	-33.4%	10.4%	1			
r	17.9%	14.3%	-11.3%	-38.2%	-45.0%	1		
δ	30.4%	32.5%	-8.8%	-47.8%	-51.6%	54.0%	1	
ϕ	-56.8%	-59.0%	37.3%	70.5%	41.3%	-47.8%	-74.4%	1

P / E is the ratio of market value to profits for all non-farm non-financial corporations. Profits are adjusted for business cycle fluctuations (to measure permanent earnings).

h is the 5-year growth rate in real full employment GDP.

t is the top tax bracket rate on ordinary income for individuals.

g is the top real capital gains tax rate, adjusted for inflation. *g* constitutes the fraction of real gains that is paid as tax and exceeds 100% for some years due to very high inflation.

r is the real 3-month T-bill rate. *r* is less than 0 in some years due to high inflation.

δ is $s/(d+s)$ where *s* is the negative of net new equity issues for non-financial corporations and *d* is dividends paid by non-financial corporations.

ϕ is the earnings retention ratio, $(e-d-s)/e$, where *d* and *s* are defined above and *e* is earnings of non-financial corporations.

Table 3
Regression Results

Models:

$$\log(P_i / E_i) = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \varepsilon_i. \qquad (10)$$

$$P_i / E_i = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \varepsilon_i. \qquad (11)$$

	Predicted sign	(10): log(P/E)	(11): P/E
β_1	+	37.0 (3.05)**	542 (2.35)*
β_2	-	-1.51 (-5.86)**	-26.7 (-5.44)**
β_3	-	-0.82 (-3.77)**	-14.4 (-3.46)**
β_4	+	0.80 (2.35)*	14.8 (2.30)*
β_5	-	-6.30 (-3.00)**	-136 (-3.15)**
R^2		73.1%	69.2%

t-statistics in parentheses.

Variables are defined in Table 1.

* represents statistical significance at the 5 percent level.
** represents statistical significance at the 1 percent level.

Table 4
Regression Results

Models:

$$\log(P_i/E_i) - \gamma\log(P_{i-1}/E_{i-1}) = \alpha(1-\gamma) + \beta_1(h_i - \gamma h_{i-1}) + \beta_2(t_i - \gamma t_{i-1}) + \beta_3(g_i - \gamma g_{i-1}) + \beta_4[(t_i - g_i)\delta_i - \gamma(t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5(r_i - \gamma r_{i-1}) + \nu_i. \quad (10a)$$

$$P_i/E_i - \gamma P_{i-1}/E_{i-1} = \alpha(1-\gamma) + \beta_1(h_i - \gamma h_{i-1}) + \beta_2(t_i - \gamma t_{i-1}) + \beta_3(g_i - \gamma g_{i-1}) + \beta_4[(t_i - g_i)\delta_i - \gamma(t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5(r_i - \gamma r_{i-1}) + \nu_i. \quad (11a)$$

	Predicted sign	(10a): log(P/E)	(11a): P/E
β_1	+	18.1 (0.96)	325 (0.98)
β_2	-	-0.95 (-2.28)*	-20.3 (-2.80)**
β_3	-	-0.93 (-3.99)**	-15.1 (-3.41)**
β_4	+	0.71 (2.48)**	14.0 (2.43)**
β_5	-	-3.91 (-1.91)*	-103 (-2.51)**
Autocorrelation coefficient	?	0.64 (5.76)**	0.55 (4.49)**
R^2		43.3%	42.8%

t-statistics in parentheses.
R^2 excludes the predictive effects of the autocorrelation coefficient estimate.

Variables are defined in Table 1.

* represents statistical significance at the 5 percent level.
** represents statistical significance at the 1 percent level.

Table 5
Spearman Rank Correlation Tests

Test of association between *P/E* and each of following variables:

	Predicted sign	Spearman ρ	p-value
h	+	13.7%	0.173
t	-	-50.8%	0.000
g	-	-36.4%	0.005
r	-	13.0%	0.713
$(t\text{-}g)\delta$	+	19.6%	0.089

Variables are defined in Table 1.

Table 6
Regressions including the Retention Ratio

Models:

$$\log(P_i / E_i) = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \beta_6 \phi_i + \varepsilon_i. \quad (13)$$

$$P_i / E_i = \alpha + \beta_1 h_i + \beta_2 t_i + \beta_3 g_i + \beta_4 (t_i - g_i)\delta_i + \beta_5 r_i + \beta_6 \phi_i + \varepsilon_i. \quad (14)$$

$$\begin{aligned}\log(P_i / E_i) - \gamma \log(P_{i-1} / E_{i-1}) &= \alpha(1-\gamma) + \beta_1 (h_i - \gamma h_{i-1}) + \beta_2 (t_i - \gamma t_{i-1}) + \beta_3 (g_i - \gamma g_{i-1}) \\ &+ \beta_4 [(t_i - g_i)\delta_i - \gamma (t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5 (r_i - \gamma r_{i-1}) + \beta_6 (\phi_i - \gamma \phi_{i-1}) + \nu_i. \end{aligned} \quad (13a)$$

$$\begin{aligned}P_i / E_i - \gamma P_{i-1} / E_{i-1} &= \alpha(1-\gamma) + \beta_1 (h_i - \gamma h_{i-1}) + \beta_2 (t_i - \gamma t_{i-1}) + \beta_3 (g_i - \gamma g_{i-1}) \\ &+ \beta_4 [(t_i - g_i)\delta_i - \gamma (t_{i-1} - g_{i-1})\delta_{i-1}] + \beta_5 (r_i - \gamma r_{i-1}) + \beta_6 (\phi_i - \gamma \phi_{i-1}) + \nu_i. \end{aligned} \quad (14a)$$

	Predicted sign	(13): log(P/E)	(14): P/E	(13a): log(P/E)	(14a): P/E
β_1	+	44.1 (3.51)**	701 (2.97)**	23.7 (1.27)	467 (1.42)
β_2	-	-1.35 (-5.01)**	-23.1 (-4.56)**	-0.90 (-2.19)*	-17.3 (-2.42)**
β_3	-	-0.61 (-2.47)**	-9.59 (-2.07)*	-0.82 (-3.33)**	-11.6 (-2.50)**
β_4	+	0.62 (1.78)*	10.8 (1.66)	0.64 (2.18)*	11.5 (2.00)*
β_5	-	-6.55 (-3.18)**	-132 (-3.40)**	-3.86 (-1.89)*	-101 (-2.55)**
β_6	?	-0.21 (-1.71)	-4.70 (-2.04)*	-0.14 (-1.19)	-4.44 (-1.92)
γ	?			0.62 (5.49)**	0.55 (4.42)**
R^2		74.8%	71.9%	46.3%	48.0%

t-statistics in parentheses.
R^2 excludes the predictive effects of the autocorrelation coefficient estimate for (13a) and (14a).
Variables are defined in Table 1.
* represents statistical significance at the 5 percent level.
** represents statistical significance at the 1 percent level.

Figure 1
Time Series of P/E, Growth, and Tax Rates

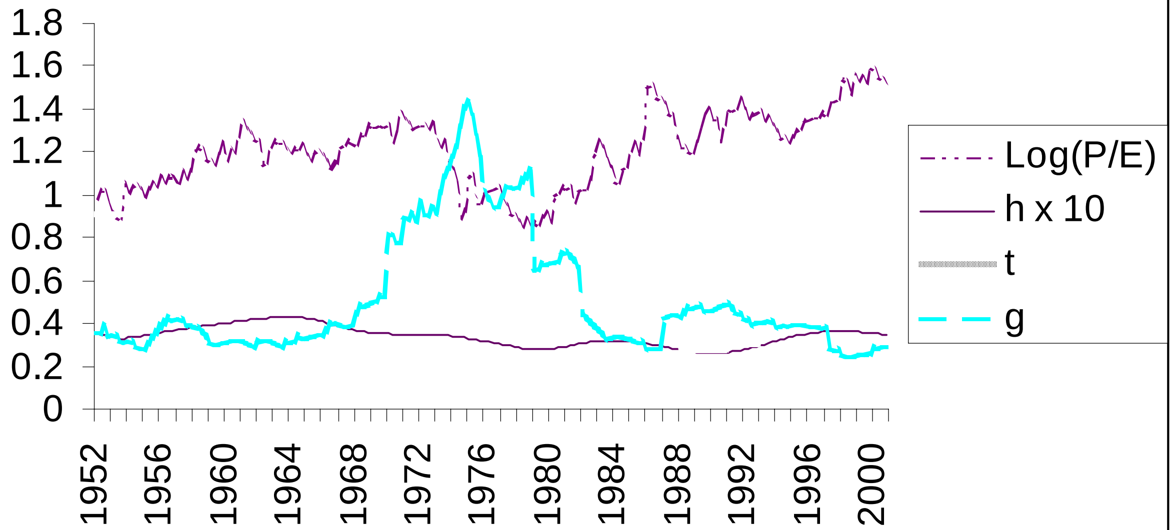

Figure 2
Time Series of Interest Rates and Distribution Policy