Journal of Banking and Finance 5 (1981) 395–403. North-Holland Publishing Company

SHARE VALUES, INFLATION, AND ESCALATING TAX RATES

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Received March 1980, final version received October 1980

The interaction of inflation with a progressive tax system has been known to cause tax rates, and thus tax liabilities, to escalate with nominal income. Often blamed for having undesirable effects on investment and wealth, this feature of modern tax systems has not received formal treatment in the literature. The present study examines the impact of this inflation-related phenomenon upon the value of corporate equity within the framework of partial equilibrium. It is shown that the combination of moderate inflation and a mildly progressive rate structure may have a substantial adverse effect on share values, an effect sharply increasing with the firm's real growth rate. These results provide a partial explanation for the apparent conflict between the Fisherian hypothesis and the commonly observed inverse relationship between the rate of inflation and the deflated value of stock price indices. To the extent that occasional adjustment of tax schedules does not prevent taxpayers from being pushed toward higher tax brackets, these results suggest a sizable potential benefit from full indexation of tax rates in an economy suffering from chronic inflation. They also confirm the belief that failure to dò so is expecially harmful to economic growth.

1. Introduction

Sustained inflation has been blamed for having four major effects on the taxation of corporate-source income: at the corporate level — over-taxation of interest income and over-deduction of interest expense and replacement costs; at the individual level — over-taxation of realized capital gains and a periodic push to higher tax brackets. The objective of this paper is to explore the last effect and its implications for the valuation and formation of capital in the corporate sector. Recently referred to as 'the central problem of our era' [Wanniski (1980)], this is a major tax effect not yet treated formally in the literature. The partial equilibrium treatment offered here is a necessary first step toward full multi-sector analysis of this effect.[1]

The progressive rate structure of a personal tax system causes marginal tax rates to escalate arbitrarily with inflation-caused increases in nominal

[1]The effect of escalating tax rates on bond yields has been noted by Darby (1975). For an overview of various long-term distortions created by inflation see Friedman (1974) or Fellner et al. (1975). Examples of theoretical models and empirical assessments of other tax distortions may be found in Brinner (1973), Aaron (1976), Feldstein et al. (1978), Feldstein (1979), Feldstein and Summers (1979), and Yaari et al. (1980).

income. This undesirable effect can be corrected by indexing to a price deflator bracket intervals, exemptions, and deductions, all of which are defined in nominal terms.[2] The analysis here is based on the assumption that official or unofficial indexation of this sort (when present) is incomplete, allowing inflation to interact with the rate structure. Understanding of the nature of this interaction will allow *assessment* of the resulting tax impact in a system such as that of the U.S., where tax schedules are subject to mere partial adjustments through occasional legislation.[3] At the same time, to isolate effects related to the personal tax system, the analysis is conducted under the assumption that effects associated with the corporation tax have been fully removed through indexation. Further simplification in exposition is achieved by limiting the discussion to an all-equity firm and to the setting of constant growth.[4] Extension of the results to a more 'realistic' corporate environment involving additional tax effects, debt financing, and non-uniform growth rates is conceptually straightforward.

While the *direction* of the effect of escalating tax rates on share valuation is predictable, its *magnitude* is not. Surprisingly, results indicate that this effect may reach substantial proportions under a mildly progressive rate structure when allowed to interact with moderate but sustained inflation. Of no less significance is the finding that this effect sharply increases with the firm's growth rate. A hypothetical example based on the U.S. tax rate structure reveals further that this effect may exceed the often-cited adverse effect caused by taxing at fixed rates nominal capital gains as real ones [e.g., Feldstein et al. (1978)].

2. The model

Consider an all-equity constant-growth firm distributing a fixed fraction of its annual post-tax earnings as cash dividends which, due to the presence of a constant rate of inflation are subject to an escalating marginal tax rate.

[2]This form of indexation has been adopted by a number of countries, including Australia, Brazil, Canada, Israel, The Netherlands, and Switzerland (see *Hearings on the President's 1978 Tax Program*, Appendix B).

[3]An example of evidence for less than full adjustment in the U.S. is found in Fellner et al. (1975), who compare rate reductions needed to offset the effect of 10 percent inflation between 1973 and 1974 with reductions enacted by Congress. Although the overall tax cut enacted roughly compensated for the effect of inflation, rate reductions applied to taxpayers in middle and high income brackets — those most likely to hold stock [see Blume et al. (1974)] — were far short of the needed reductions.

[4]The use of a perpetual constant-growth model simplifies the exposition, essentially without affecting the results. Despite appearance to the contrary, this model is not more restrictive than the fashionable one-period investment model which, in terms of tax consequences, can be shown to implicitly assume perpetual repetition of the one-period investment, representing a special case of perpetual growth. As shown by Yaari et al. (1980), the perpetual growth model has the advantage of avoiding certain pitfalls associated with the one-period model.

Let

P_0 = ex-dividend, current share price,
E = first-year, post-corporate-tax earnings per share, expressed in prices prevailing at the beginning of the year,
b = year-end total investment expressed as a fraction of current post-tax earnings,
ρ^* = post-corporate-tax above-normal average yield on investment increments (assumed to be in the same risk class),
g = *real* growth rate of earnings and price per share, where $g = b\rho^*$,
m = constant rate of inflation exogenous to the corporate sector,
r = *real* rate of return net of all taxes sought by shareholder, exogenous to the corporate sector,
g^{N} = *nominal* growth rate resulting from inflation at the rate m and real growth at the rate g, where $g^{\mathrm{N}} = (1+g)(1+m)-1$, assuming $\partial g/\partial m = 0$,
r^{N} = *nominal* rate of return net of all taxes sought by shareholders, fully reflecting the expected rate of inflation, such that $r^{\mathrm{N}} = (1+r)(1+m) - 1$, assuming $\partial r/\partial m = 0$,[5]
i = fixed-cycle time interval, measured in years,
$g_i, m_i, r_i, g_i^{\mathrm{N}}, r_i^{\mathrm{N}}$ = i-year equivalents of the one-year g, m, etc., respectively, where $g_i = (1+g)^i - 1$, etc.,
t_j^{D} = overall marginal tax rate of dividends at the end of year j ($j = 0, 1, 2, \ldots$), where $t^{\mathrm{D}} = t_0^{\mathrm{D}}$,
s = fraction of dividend taxed at a fixed marginal rate $t^{\mathrm{D}} = t_0^{\mathrm{D}}$, where the fraction $1-s$ is taxed at a progressing marginal rate, such that the weighted average of the two is the overall marginal rate t_j^{D},
v = constant tax-rate escalation factor subject to $0 \leqq v \leqq \infty$; determined by the system's marginal rate of progression and independent of m,[6]
w^j = $1/(1+m)^{vj}$, ratio of post-tax value to pre-tax value of the portion of progressively-taxed dividend income in year j (representing a fraction $1-s$ of the dividend in that year),
t_j^{G} = marginal tax rate of capital gains at the end of year j where, for any given j, $t_j^{\mathrm{G}} = h t_j^{\mathrm{D}}$, $0 \leqq h \leqq 1$ being constant.

[5]As the assumption of $\partial g/\partial m = 0$ made above, the assumption of $\partial r/\partial m = 0$ ignores economy-wide effects of inflation; it also ignores the interaction between uncertain m and r, which is likely to contribute to the risk premium implicit in r. Evidence supporting Fisher's (1930) claim that nominal interest rates anticipate the rate of inflation is found in numerous studies listed in Cargill and Meyer (1980). Regardless of their empirical content, these assumptions are conducive to exploring consequences of tax policy changes aimed at the corporate sector.

[6]If c ($0 \leqq c \leqq 1$) is an inter-temporal coefficient of rate escalation, considering the system's cross-sectional marginal progression and the partially offsetting adjustment of statutory tax rates, then $v = c/(1-c)$.

The all-equity corporation can finance growth by retention of earnings or by issuing new stock. Internal financing has the advantage of avoiding round-trip taxation at t_j^D on distribution reinvested at the end of year j, but has the disadvantage of greater exposure to t_j^G due to a higher rate of share price appreciation. Since it can be shown that, given the relationship $t_j^G < t_j^D$ for any year j, there is a net advantage in internal financing, it is assumed that the firm's growth is optimally financed by retention [cf. Stiglitz (1973)].[7]

2.1. Dividend tax (*DIT*)

Analysis of the combined effects of inflation, cross-sectional progression, and incomplete adjustment in statutory tax rates is facilitated by imagining that a given fraction s of dividend income is taxed at a fixed marginal rate t^D, while the remainder $1-s$ is taxed at an escalating rate. This interpretation is consistent with a system under which marginal rates monotonically escalate over time, pushing shareholders toward a given maximum tax bracket. For example, if the current marginal tax rate of U.S. shareholders of 0.40 [Feldstein and Frisch (1977)] should eventually reach the current maximum rate of 0.70, the system may equivalently be described as imposing a fixed marginal tax rate of 0.40 on fifty percent of income, and a marginal rate which escalated over an infinite horizon from 0.40 to 1.0 on the remaining fifty percent of income. Under this scheme the overall marginal rate will progress from its present level of (0.5)(0.40)+(0.5)(0.40)=0.40 to an ultimate level of (0.5)(0.40)+(0.5)(1.00)=0.70.

Based on the definitions of s and w^j, the per-share flow of consumable dividends associated with a retention ratio b and a nominal growth rate g^N may be spelled out in terms of the following components:

End year	*Proportionally taxed*	*Progressively taxed*
1	$sE(1-b)(1+m)(1-t^D)$	$(1-s)E(1-b)(1+m)(1-t^D)w$
2	$sE(1-b)(1+m)(1+g^N)(1-t^D)$	$(1-s)E(1-b)(1+m)(1+g^N)(1-t^D)w^2$
⋮	⋮	⋮
j	$sE(1-b)(1+m)(1+g^N)^{j-1}(1-t^D)$	$(1-s)E(1-b)(1+m)(1+g^N)^{j-1}(1-t^D)w^j$,
⋮	⋮	⋮

with the first component indicating a fixed tax rate of t^D, and the second an escalating rate of $1-(1-t^D)w^j \geqq t^D$ for any year $j \geqq 1$. The escalating overall marginal *DIT* rate in year j is a weighted average of the two rates, expressed below as a difference between fixed and variable terms

$$
\begin{aligned}
t_j^D &= st^D + (1-s)[1-(1-t^D)w^j] \\
&= [1-(1-t^D)s] - [(1-t^D)(-s)w^j]. \qquad (1)
\end{aligned}
$$

[7]The model can be readily expanded to accommodate the use of a fixed fraction of external financing, at the cost of inconsistency with the relationship $t_j^G < t_j^D$.

Upon discount at $r^N=(1+r)(1+m)-1$ and substitution of $1/(1+m)^v$ for w, the flow of consumable dividends yields the following value per share (subject to $r>g$):[8]

$$PV_{\text{div}}=\frac{E(1-b)(1-t^{\text{D}})}{r-g}\left[s+(1-s)\frac{r-g}{(1+r)(1+m)^v-(1+g)}\right]. \tag{2}$$

Given $m>0$ and $v>0$, the expression in brackets is less than unity, indicating the adverse effect of inflation due to its interaction with this tax under a progressive system with incomplete indexation of statutory rates. Under the partial equilibrium assumptions of $\partial r/\partial m=0$ and $\partial g/\partial m=0$, this effect is monotone increasing in m and v, causing the value of dividends to reach a positive minimum of $E(1-b)(1-t^{\text{D}})s/(r-g)$ under $m\to\infty$ and/or $v\to\infty$. The current value of dividends is seen to be partially increasing in ρ^* (implicit in g), but less so under higher values of m and v. Consistency of (2) is confirmed by noting that under complete rate indexation ($v=0$) it is reduced to $E(1-b)(1-t^{\text{D}})/(r-g)$ regardless of the rate of inflation ($m\geqq 0$).

2.2. Capital gains tax (CGT)

Given that the statutory *CGT* rate remains a fixed fraction of the escalating *DIT* rate, the former may be stated as $t_j^{\text{G}}=ht_j^{\text{D}}$ (where $0\leqq h\leqq 1$ is a constant) or, based on (1),

$$t_j^{\text{G}}=h[1-(1-t^{\text{D}})s]-h[(1-t^{\text{D}})(1-s)w^j]. \tag{3}$$

Under the assumption that the marginal investor trades his marginal holding ex-dividend[9] at fixed i-year intervals ($1\leqq i\leqq\infty$), the outflow of *CGT* payments entailed by a presently-held share is given by the sum of the following components based on the definition of t_j^{G} in (3):[10]

End year	*Fixed rate component*	*Variable rate component*
i	$P_0g^{\text{N}}h[1-(1-t^{\text{D}})s]$	$-P_0g^{\text{N}}h(1-t^{\text{D}})(1-s)w^i$
$2i$	$P_0g^{\text{N}}(1+g^{\text{N}})^ih[1-(1-t^{\text{D}})s]$	$-P_0g^{\text{N}}(1+g^{\text{N}})^ih(1-t^{\text{D}})(1-s)w^{2i}$
⋮	⋮	⋮
ji	$P_0g^{\text{N}}(1+g^{\text{N}})^{(j-1)i}h[1-(1-t^{\text{D}})s]$	$-P_0g^{\text{N}}(1+g^{\text{N}})^{(j-1)i}h(1-t^{\text{D}})(1-s)w^{ji}$
⋮	⋮	⋮

[8]The condition $r>g$ is sufficient but not necessary to ensure convergence under $t^{\text{G}}>0$. Nonetheless, the condition is set due to its appealing economic content in the context of a perpetual growth model.

[9]It can be shown that if the rate of capital loss credit is below the rate of capital gains tax, trading at other points in the dividend cycle is likely to impose an additional tax penalty on investors. The assumption in the text is non-restrictive in view of the prevailing practice of quarterly dividend.

[10]This formulation of *CGT* payments applies the escalating tax rate to capital gains realized through share price changes, rather than to funds retained. As shown by Palmon and Yaari (1981), the latter, more common approach overlooks tax payments on future distribution resulting from current reinvestment.

At the discount rate r^{N} these flows yield the negative tax value

$$PV_{CGT}=P_0h\left[g_i+\frac{m_i}{1+m_i}\right]\times\left[\frac{1-(1-t^{\mathrm{D}})s}{r_i-g_i}-\frac{(1-t^{\mathrm{D}})(1-s)}{(1+r_i)(1+m_i)^v-(1+g_i)}\right], \tag{5}$$

which is monotone decreasing in i, having a minimum of zero under $i\to\infty$ and a finite maximum under $i=1$. These relationships also hold under complete indexation of tax rates ($v=0$), in which case the maximum value is reduced to $P_0t^{\mathrm{G}}[g+m/(1+m)]/(r-g)$ since $t^{\mathrm{G}}=ht^{\mathrm{D}}$. Given $\partial r/\partial m=0$ and $\partial g/\partial m=0$, the value of CGT payments is monotone increasing in m and ρ^* whether or not tax rates are fully corrected for the effect of inflation ($v\geqq 0$). It has a minimum of zero under $m=0$ and a theoretical maximum of $P_0hg_i[1-(1-t^{\mathrm{D}})s]/(r_i-g_i)$ (if $v>0$), or $P_0t^{\mathrm{G}}g^i/(r_i-g_i)$ (if $v=0$) under $m\to\infty$.

2.3. Price determination

The current share price is obtained by summing up the post-*DIT* value of dividends [eq. (2)] and the negative value of *CGT* payments [eq. (4)], and solving for P_0

$$P_0=\frac{\dfrac{E(1-b)(1-t^{\mathrm{D}})}{r-g}\left[s+(1-s)\dfrac{r-g}{(1+r)(1+m)^v-(1+g)}\right]}{1+h\left[g_i+\dfrac{m_i}{1+m_i}\right]\left[\dfrac{1-(1-t^{\mathrm{D}})s}{r_i-g_i}-\dfrac{(1-t^{\mathrm{D}})(1-s)}{(1+r_i)(1+m_i)^v-(1+g_i)}\right]}. \tag{5}$$

Interpretation of this formula is straightforward. The first term in the numerator, recognized from (2), is the price that would exist in the absence of inflation ($m=0$), or under a tax system of complete indexation. The second term in the numerator, also appearing in (2), shows the interaction of inflation with *DIT* under a system of incomplete rate indexation. It follows that the numerator as a whole represents the price that would exist under inflation if only real capital gains were subject to tax. The denominator reflects the interaction of inflation with *CGT* under a system which taxes nominal capital gains as real ones, with full indexation of tax rates ($v=0$) or with only partial adjustment of this sort ($v>0$). Based on (4), its main term may be economically interpreted as the present value of *CGT* payments per dollar of current price. In view of the analysis of (2) and (4), the price indicated by (5) is partially decreasing in t^{D}, t^{G}, $m\,(v\geqq 0)$ and $v\,(m>0)$, and increasing in i. Surprisingly, its relationship to ρ^* (implicit in g) is ambiguous due to effects in the same direction on both the numerator and the denominator.[11]

3. Valuation under the U.S. rate structure: A hypothetical example

Assuming an annual inflation rate of $m=0.10$ with no future adjustment of nominal tax provisions as they exist in 1979, it was first determined that a rate-escalation function with $v=0.55$ best approximates the marginal rate schedule of a model taxpayer between the currently estimated $t^D=0.40$ and the maximum $t^D_\infty=0.70$. Share prices displayed in table 1 were calculated from (5) utilizing the statutory provision $h=0.4$ (implying $t^G=0.16$), the parameter $s=0.5$ (implied by t^D and t^D_∞), and the assumption $r=0.10$ (implying $r^N=0.10$ under $m=0$, or $r^N=0.21$ under $m=0.10$). The importance of rate escalation in the determination of share prices is reflected in the following comparisons which ignore potential indirect effects of m on r and g. *First*, an increase in the rate of inflation in the presence of $i<\infty$ may cause a substantial price decrease. With no growth ($g=0$) and annual trading ($i=1$), an increase from $m=0$ to $m=0.10$ causes a price decrease from \$6.00 to \$5.24 when tax rates are fully indexed, compared to a decrease to \$4.12 when rates are allowed to escalate at a current annual rate $(t^D_1-t^D)/t^D=(t^G_1-t^G)/t^G$ of 3.83 percent ($v=0.55$) [panel (A)]. The first decrease, due to the taxation of purely nominal capital gains, is supplemented by an even greater decrease due to the escalation of *DIT* and *CGT* rates. *Second*, an increase in the marginal holding period causes the adverse price effect associated with incomplete rate indexation to diminish but not disappear. If the holding period in the above example were $i=10$ instead of $i=1$, the same increase in the rate of inflation would cause smaller respective price decreases from \$6.00 to \$5.65 and \$4.50 [panel (A)]. At the extreme, an infinite holding period ($i\to\infty$) would eliminate the adverse effect of taxing purely nominal gains, but not that of incomplete rate indexation [note that the numerator of (5) is not affected by i]. *Third*, the price effect of inflation due to its interaction with a progressive rate structure is enhanced by growth. Given $i=1$ and $v=0.55$, the share price associated with $m=0.10$ decreases by 30 percent (from \$4.98 to \$3.48) due to the lack of rate indexation when $g=0.036$ [panel (C)], as opposed to a decrease by 47 percent (from \$7.77 to \$4.12) when $g=0.072$ [panel (E)].[12] *Fourth*, the adverse price effect of inflation may be substantial

[11] It can be shown that although the partial derivative $\partial P_0/\partial \rho^*$ may assume negative values, there is always a sufficiently low b under which this derivative becomes positive.

[12] Vertical comparison indicates that in some cases a higher b with a given ρ^* (imply a higher g) result in a lower price. In those cases ρ^* is below the threshold average reinvestment rate. Table 1 was constructed under the assumption of a given investment policy that would be optimal under $t^G=0$.

Table 1

Escalating tax rates and the share price of a firm with a preset investment policy, given $E=\$1$, $t^{\mathrm{D}}=0.40$, $t^{\mathrm{G}}=0.16$ $(h=0.4)$, $s=0.5$, and $r=0.10$.[a, b]

Panel	Reten-tion rate b	Rate of return ρ^*	Growth rate g	$i=10$					$i=1$				
				$m=0$[c] $r^{\mathrm{N}}=0.10$	$m=0.10$ $r^{\mathrm{N}}=0.21$				$m=0$[c] $r^{\mathrm{N}}=0.10$	$m=0.10$ $r^{\mathrm{N}}=0.21$			
				Current rate of tax increase $(t_1^{\mathrm{D}}-t^{\mathrm{D}})/t^{\mathrm{D}}=(t_1^{\mathrm{G}}-t^{\mathrm{G}})/t^{\mathrm{G}}$									
				0% $(v\geqq 0)$	0%[d] (0)	1% (0.266)	3.83% (0.550)	5% (1.401)	0% $(v\geqq 0)$	0%[d] (0)	1% (0.266)	3.83% (0.550)	5% (1.401)
(A)	0	0.10	0	\$6.00	\$5.65 (0.94)	\$4.96 (0.83)	\$4.50 (0.75)	\$3.79 (0.63)	\$6.00	\$5.24 (0.87)	\$4.57 (0.76)	\$4.12 (0.69)	\$3.44 (0.57)
(B)	0.15	0.12	0.018	6.08	5.69 (0.94)	4.86 (0.80)	4.34 (0.71)	3.63 (0.60)	6.01	5.13 (0.85)	4.33 (0.72)	3.84 (0.64)	3.17 (0.53)
(C)	0.30	0.12	0.036	6.20	5.75 (0.93)	4.70 (0.76)	4.13 (0.67)	3.43 (0.55)	6.02	4.98 (0.83)	4.00 (0.66)	3.48 (0.58)	2.85 (0.47)
(D)	0.15	0.24	0.036	7.53	6.98 (0.93)	5.70 (0.76)	5.02 (0.67)	4.16 (0.55)	7.31	6.05 (0.83)	4.86 (0.66)	4.23 (0.58)	3.46 (0.47)
(E)	0.30	0.24	0.072	11.79	10.42 (0.88)	6.92 (0.59	5.87 (0.50)	4.95 (0.42)	10.63	7.77 (0.73)	4.93 (0.46)	4.12 (0.39)	3.42 (0.32)

[a] Comparability of price entries requires the assumptions of $\partial r/\partial m=0$ and $\partial g/\partial m=0$.
[b] Entries in parentheses give the actual price as a fraction of the respective complete-indexation price.
[c] Analogous to complete indexation.
[d] Implying full adjustment of statutory rates with no indexation of capital gains.

even with slowly escalating tax rates. Given $g=0.072$, a current annual escalation rate of 1 percent ($v=0.266$) causes the price fraction to decrease from 0.73 to 0.46 of the inflation-free price under $i=1$ and, still more significantly, from 0.88 to 0.59 under $i=10$ [panel (E)].

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