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INVESTMENT TAX INCENTIVES AND FREQUENT TAX REFORMS

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ABSTRACT

Despite the frequency of tax changes and their potential importance to investors, almost all of the analysis of tax-based investment incentives assumes investors never anticipate any tax changes. We depart from this approach by analyzing the historical pattern of U.S. corporate investment incentives over the period 1953-86, incorporating the feature of investor awareness that the tax code may change.

Our analysis incorporates a predictive equation for future tax variables into a model of optimal investment subject to adjustment costs and uncertainty. We find that expectations of future tax changes significantly affect the incentive to invest only if adjustment costs are low. In this case, the incentive to invest in 1986 was strong, as investors are estimated to have anticipated the coming reduction in investment incentives.

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In the uncertain business of planning for U.S. corporate investment, one of the few reliable forecasts one can make is that the tax law will change before any new investment outlives its usefulness. While the Tax Reform Act of 1986 mandates an unusually dramatic reform in the structure of business taxation and the incentive to invest, the simple fact that Congress chose to alter in 1986 the tax treatment of new investments is hardly surprising. Earlier in the 1980s Congress changed investment incentives with new tax legislation in 1981, 1982, 1984 and 1985, and over the period 1953-1985 made such changes in 16 different years.

The willingness, indeed eagerness, of the U.S. government to amend the rate at which it taxes new investments seems likely to have substantial consequences for investor incentives. By far the bulk of an investor's return comes in years subsequent to the year in which new plant and equipment is put in place. Tax reforms affect investor returns not only by changing the amount of money owed the government, but also by encouraging or discouraging competing future investment and thereby changing levels of before-tax future earnings. For example, the knowledge that Congress plans to introduce a large investment tax credit in two years seems likely to depress investment this year and next, since the investment wave two years hence will be expected to drive down the return to any capital already in place when it starts.

Despite the frequency of tax changes and their potential importance to investors, almost all of the analysis of tax-based investment incentives follows the seminal work of Dale Jorgenson (1963) in assuming investors never to anticipate any tax changes. Recent examples include Alan Auerbach (1983) and Mervyn King and Don Fullerton (1984). The U.S. Treasury Department in its tax reform proposal (1984) analyzed investment incentives in each year of its phased-in reform package under the assumption that investors never anticipate the sequence of tax changes that is explicitly part of the reform. In this paper, we depart from this approach by analyzing the historical pattern of U.S. corporate investment incentives over the period 1953-1986, incorporating the feature of investor awareness that next year's tax code may not be the same as this year's.

I. Anticipated Tax Reforms

In order to analyze the impact of expected future tax changes it is necessary to understand over which tax variables investors form expectations. The tax law as written contains thousands of provisions affecting corporate investment. Even restricting attention just to the statutory tax rate, the investment tax credit, and the present value of depreciation allowances leaves a problem of great complexity, since Congressional choice of the level of one variable is surely conditioned by the chosen levels of the others.

There is, furthermore, a relevant issue of the extent to which the government's "choice" of a particular tax variable is truly volitional. In roughly half of the postwar years the government did not make substantial legislative changes in any of the three variables listed. Yet even without specific Congressional action, the ex ante value of depreciation allowances available on new investments varies from year to year with movements in expected inflation and real interest rates. And while these movements automatically affect the level of investment tax incentives, they also are likely to be correlated with changes in general economic conditions, such as unemployment or GNP growth. Hence it may be the case that during periods of no tax changes Congress was actually permitting automatic features of the tax system to set investment incentives at acceptable levels. Or it could be that in the years in which no new tax laws appeared Congress would have chosen to set tax rates at different levels, but was for some reason prevented from making any changes that year.

In order to model anticipations of future tax reforms, we assume investors to expect tax changes based on a model of government choice in which the government reveals its desired tax levels only in those years that it enacts new tax laws. Thus, the 16 years in which the corporate tax law changed over the period 1953-1985 afford us 16 glimpses of the outcome of the government's desired tax function. We take the probability that a new tax law will be enacted to be exogenous. (This is a very simple and perhaps inadequate specification; we are currently pursuing work based on alternative assumptions.) If no new law appears then of course the pre-existing tax law applies to new investments, with possibly new incentives due to changes in inflation and interest rates.

There still remains the issue of specifying the particular future tax variable investors predict when making their decisions. Following Jorgenson (1963) and subsequent authors, we assume that a firm expecting no future tax changes will set its marginal product of capital equal to

$$q(\rho+\delta)\cdot\frac{(1-k-\tau z)}{1-\tau}$$

where q is the relative price of capital goods, ρ is the real discount rate, δ is the geometric rate of economic depreciation, k is the investment tax credit, τ is the corporate tax rate and z is the present value of depreciation allowances per dollar invested. The cost of capital, then, is directly affected by the ratio $(1-k-\tau z)/(1-\tau)$, and it is this ratio which we assume Congress to peg in making its tax choices.

This choice of tax specification raises an issue that bears on the appropriateness of different sample periods for estimating the government's choice function. This model embodies the assumption that changes in the statutory tax rate, τ, apply only to new investments. Of course this is not the case, but in defense of our procedure, the statutory corporate tax rate changed infrequently over the period 1953-1985, and moved very little when it moved at all: it ranged from a high of 52.8% to a low of 46%. The Tax Reform Act of 1986 departed widely from this pattern by introducing a phased reduction of the statutory rate to 34%, and for that reason we leave 1986 out of our estimating sample.

Denoting the ratio $(1-k-\tau z)/(1-\tau)$ for aggregate corporate investment in year t by Tax_t, (with z calculated using an assumed real interest rate of 4 percent and static inflation expectations) we estimated several equations with explanatory variables suggested by our view of the factors likely to affect policy choices. The best fit was obtained with the following equation:

$$(1)\quad Tax_t = \underset{(0.16)}{1.90} - \underset{(.006)}{0.045}\, UNEM_t - \underset{(.004)}{0.021}\, YGRO_t - \underset{(.004)}{0.017}\, REALR_t - \underset{(.89)}{1.94}\, IGNP_{t-1}$$

$n=16$, $\bar{R}^2=.88$, $SEE=0.036$

where UNEM is the unemployment rate, YGRO is the real growth rate of GNP from the previous year, REALR is the real interest rate on short-term commercial paper (using the GNP deflator to measure inflation), and IGNP is the ratio of real investment to GNP. Standard errors are in parentheses.

Even allowing for the small number of degrees of freedom all the variables except the last are significant at a 95% confidence level, and $IGNP_{t-1}$ fails the 95% text only just barely. Equation (1) is characterized by a surprisingly good fit for a time series regression with a nontrending dependent variable, and in fact (1) predicts, out of sample, a tax reform in 1986 very similar to the change Congress enacted (see below). Coefficients on the unemployment and real interest rates indicate that investment incentives are set in a countercyclical manner. Neither current nor lagged inflation entered significantly in (1), indicating that Congress set tax rules with a view toward undoing the effects of changing inflation rates. However, the remaining coefficients have the "wrong" sign for that interpretation - and the whole notion of "countercyclical" tax policy using investment incentives has been questioned by Robert Lucas (1976), and by Finn Kydland and Edward Prescott (1977), who specifically discussed the impact on private behavior of government attempts to use the investment tax credit as a stabilization tool.

II. Model

In order to analyze the impact of current tax changes and anticipated future tax reforms on investment incentives, it is necessary to construct a model of dynamic firm behavior. In particular, one must pay close attention to the specification of the costs firms face as they vary their investment levels. It seems quite reasonable empirically to employ a model in which rapid adjustment is costly, but the introduction of adjustment costs introduces a number of complications.

For our purpose in this paper we employ a discrete-time variant of the model analyzed in Auerbach (1986). We assume the firm to maximize the expected present value of its after-tax cash flows:

$$(2)\quad V_t = E_t\left[\sum_{s=t}^{\infty}(1+r)^{-(s-t)}\left\{\frac{(1-\tau_s)p_{s+1}F(K_s)}{1+r} - p_s(1+\tfrac{1}{2}\phi I_s)I_s(1-k_s-\Gamma_s)\right\}+A_t\right]$$

where E_t is the expectations operator at time t, r is the nominal discount rate, τ_s is the statutory tax rate at time s, p_s is the price level for output at time s, and $F(\cdot)$ is the firm's production function which exhibits decreasing returns with respect to capital, K. (One can also interpret $F(\cdot)$ as a reduced form of a constant returns production function with levels of other factors chosen optimally.) The parameter ϕ reflects investment adjustment costs, which are assumed to be capitalized and depreciated for tax purposes. k_s is the investment tax credit available in period s, while Γ_s is the present value of future depreciation allowances times future statutory tax rates (hence $\Gamma=\tau z$ if τ is expected to be constant). A_t is predetermined (though perhaps uncertain) in year t; it is the value of financial attributes (such as future depreciation allowances on old investments) the firm cannot affect.

Maximization of (2) over the choice of investment (and hence the capital stock) in each year yields a first order condition that (assuming that r, δ, and the inflation rate $\dot{p}/p$ are small), can be approximated by:

$$\frac{F'(K_t)(1-\tau_t)}{1-k_t-\Gamma_t} = q_t(\rho+\delta) + \frac{E_t\ \Delta[q_t(1-k_t-\Gamma_t)]}{1-k_t-\Gamma_t} \tag{3}$$

in which $\rho=r-\dot{p}/p$ is the real discount rate, q_t is the pre-tax marginal cost of an additional piece of capital (inclusive of adjustment costs) relative to the price of output, and the operator Δ denotes changes from one year to the next. If the second term on the right side of (3) were zero, so that investors expect no changes in the after-tax relative price of new capital between this year and next, then the formula implies that the after-tax cost of capital is exactly the same as that cost which emerges in the standard Jorgenson (1963)-type framework.

But in general investors will not expect the change in $[q_t(1-k_t-\Gamma_t)]$ to be zero from year to year. The after-tax marginal cost of capital will be expected to change either through tax changes, or through changes in investment levels which affect marginal adjustment costs. And naturally the level of investment is itself a function of current and expected future tax policy. Hence a consistent analysis of forward-looking investment tax incentives should incorporate not only the tax treatment of current investments, but also the effect of the tax law on the current level of marginal adjustment costs and expected changes in marginal adjustment costs.

Following Auerbach (1986), it is possible to derive a fairly simple expression for the combined effect of taxes on marginal investment incentives. (Details are available from the authors on request.) Doing so requires some approximations, such as linearizing the model around steady-state values of investment and the capital stock, and it also requires a specification of the nature of anticipated tax changes. For the purposes of this solution we assume investors to anticipate that the government will introduce (potentially) new values of $(k+\Gamma)$ at some date, but are uncertain about the timing of their adoption. That is, investors at time t observe current tax parameters and also form expectations of the values the parameters would take in a tax reform package, and investors anticipate the probability of passage of a reform measure to be constant at a rate π per year. Investors expect the tax reform, once adopted, to be the true final resting spot for the tax system, with no further tax changes to follow.

Given this specification of the model, the cost of capital that determines the capital stock takes the form (suppressing subscripts):

$$q \left[\frac{(\rho+\delta)(1-k-\Gamma)}{1-\tau} + \frac{\Delta(k+\Gamma)}{1-\tau} \cdot \frac{[\lambda-(\rho+\delta)]\pi}{\lambda+\pi}\right] \tag{4}$$

where $(1+\lambda)$ is the unstable root of the second-order difference equation describing the evolution of the capital stock in response to tax changes. λ lies in the interval $[(\rho+\delta), \infty)$ and approaches infinity as adjustment costs vanish. Use of (4) permits changes in the cost of capital to be decomposed neatly into two pieces: the first term, which is standard (see expression (1) above) and the second term, which is the effect of future tax changes through π and the <u>average</u> value that tax variables are expected to take.

The cost of decomposing investor incentives in this way is that the model we use is somewhat stylized. Investors expect the statutory tax rate not to change, and anticipate any future changes in k and Γ to be permanent. This permanent change is adopted at a constant hazard rate π. While none of these assumptions is required in order to solve this model, their use greatly simplifies the problem at little likely cost of changing the results. The same evaluation appears to apply to the specification of the adjustment cost function in (2). Here a central issue is whether the cost of adjusting the capital stock is properly specified as a function of the rate of investment, or as a function of the rate of investment relative to the size of the capital stock. Since a growing economy exhibits secular growth in the former, it may be more reasonable to use the latter specification. Unfortunately, the phenomenon of ratio adjustment costs requires a different measure of economic depreciation from that commonly used (see Andrew Abel (1983) and Auerbach (1986)). Auerbach (1986) and Auerbach and James Hines (1987) analyze investment tax incentives with ratio adjustment costs. This complication would make our calculations difficult to compare with other studies that ignore adjustment costs altogether. Therefore, we present results which emerge from the model in (2) with level adjustment costs. Calculations performed with ratio adjustment costs did not differ qualitatively from those reported in this paper, and are available from the authors.

III. Results

It is convenient to summarize investment tax incentives with effective tax rates, which measure marginal wedges between the gross and net of tax returns to capital. In the case that the tax system is expected to change, this rate may be interpreted as that constant tax rate on true economic income which would yield the current level of investment (see Auerbach (1986)).

We measure effective tax rates for aggregate nonresidential corporate investment using expression (4), with the expected tax change set to zero for the case of myopic expectations. The calculations also require specification of several parameters. We set δ=.0704 (based on calculations in Auerbach and Hines (1987)), and ρ=.04. For "high-adjustment-cost" simulations, we choose a value of ϕ that, when multiplied by the steady-state capital stock around which the approximation is taken yields a marginal adjustment cost equal to that imposed by a proportional adjustment cost model with a corresponding quadratic parameter of 20. This choice implies extremely slow adjustment, but is nonetheless somewhat lower than many empirical estimates (e.g. Lawrence Summers (1981)). For "low-adjustment-cost" simulations, we set ϕ to correspond to a ratio adjustment cost parameter of .5. The root λ depends on ρ, δ, ϕ and the local elasticity of the marginal product of capital with respect to the capital stock (details available on request). For this parameter, we use a value of .65, which is reasonable given its interpretation in the Cobb-Douglas production function as the labor share of gross output. This yields values for λ of .128 in the high-adjustment-cost case and .409 in the low-adjustment-cost case.

Finally, we must specify the probability of change perceived by investors and that tax system expected to be adopted if a change occurs. We consider two specifications of probability. The "variable reform probability" sets each year's probability to the fraction of the previous five years in which a tax change occurred, while the "constant reform probability" specification sets each year's probability to .5, the approximate fraction of sample years in which taxes changed. In all simulations, the potential tax reform expected in each year is that which equation (1) predicts given that year's economic variables.

Table 1 summarizes our findings. The far left column presents effective tax rates as conventionally measured, that is, under the assumptions of no adjustment costs and no future changes in any relevant variables, including tax variables. The next two columns present effective tax rates in the presence of large adjustment costs, and while these rates are not identical to standard measures of effective tax rates, the difference is quite small. This similarity arises because future investment tax incentives are of little importance to firms that feel locked into today's investments by steep costs of varying their investment rates. Hence adjustment costs at the levels estimated by some authors make anticipated tax policy unimportant to contemporary investment decisions.

Columns four and five contain estimated effective tax rates in the presence of low but nonzero adjustment costs. These estimates exhibit considerably more variability than conventional effective tax rates, as investors typically anticipate actual movements in investment incentives and understand when changes come that the legislature often overshoots its mark. Examples of these anticipations include the periods 1971-1973, 1980-1982, and 1984-1986. The scenario with variable reform probabilities shows this effect dramatically during periods such as the early 1970 and mid-1980s, when rapid-fire tax reforms make investors very sensitive to the government's desired policy since it is likely to be enacted soon. By 1986 investors we so certain that a tax change was coming, and that the change would rob the tax system of many of its investment incentives, that contemporaneous investment incentives looked extremely attractive by comparison. (Although in the event the investment tax credit was repealed retroactive to January 1, 1986.)

Much more research is necessary in order to identify the full impact of anticipated tax reforms on investment incentives. Anticipations of future economic conditions and government policy responses can be modelled in a richer environment that incorporates nonstatic expectations, rational updating of investors' anticipation function, and the endogeneity of future economic variables to tax changes. Anticipated tax policy would be likely to assume more importance in a model that disaggregated investment by sector or by asset type, since these breakdowns would capture the very large historical differences and movements in the taxation of equipment and structures investments. But even without a more detailed model, it is clear that anticipated policy is important as long as investment is relatively flexible.

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Table 1: Effective Tax Rates on Corporate Investment, 1953-1986

Year	Conventional Myopic ETR	High Adjustment Costs: Constant reform probability	High Adjustment Costs: Variable reform probability	Low Adjustment Costs: Constant reform probability	Low Adjustment Costs: Variable reform probability
1953	55.3%	55.8%	55.3%	60.7%	55.3%
1954	49.5%	49.2%	49.5%	45.4%	49.5%
1955	52.1%	52.7%	52.6%	58.8%	56.3%
1956	54.4%	55.1%	54.9%	61.2%	58.7%
1957	54.8%	55.5%	55.3%	61.7%	59.2%
1958	50.9%	51.5%	51.3%	56.7%	54.5%
1959	52.6%	53.9%	53.6%	64.5%	60.5%
1960	50.6%	51.7%	50.6%	60.6%	50.6%
1961	48.4%	49.6%	48.4%	59.4%	48.4%
1962	37.7%	37.6%	37.7%	36.0%	37.7%
1963	36.4%	36.2%	36.3%	34.5%	35.2%
1964	34.3%	34.2%	34.2%	32.5%	33.3%
1965	34.5%	33.9%	34.0%	27.5%	28.3%
1966	37.7%	37.5%	37.5%	35.4%	35.2%
1967	44.5%	44.6%	44.6%	45.4%	45.4%
1968	46.0%	45.9%	45.9%	44.8%	44.7%
1969	47.5%	47.5%	47.5%	46.9%	46.8%
1970	50.8%	51.2%	51.3%	55.5%	56.3%
1971	49.0%	49.6%	49.7%	55.2%	56.3%
1972	33.7%	33.2%	33.1%	27.4%	25.3%
1973	37.5%	37.7%	37.8%	40.6%	41.5%
1974	42.6%	42.5%	42.5%	41.0%	40.6%
1975	43.3%	43.3%	43.3%	43.8%	43.8%
1976	33.2%	33.0%	33.0%	30.4%	30.2%
1977	34.7%	34.6%	34.6%	34.1%	34.1%
1978	37.8%	38.6%	38.5%	46.0%	43.0%
1979	37.4%	37.7%	37.6%	41.3%	39.8%
1980	38.2%	38.7%	38.7%	44.1%	43.6%
1981	26.1%	26.2%	26.2%	27.3%	26.9%
1982	17.6%	17.0%	17.0%	9.5%	10.4%
1983	10.3%	10.5%	10.5%	12.8%	13.0%
1984	12.7%	13.6%	13.6%	21.9%	22.6%
1985	12.7%	12.0%	12.0%	4.3%	3.6%
1986	9.2%	6.7%	6.5%	-31.7%	-45.0%