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WHY IS THE CORPORATION TAX NOT NEUTRAL?

Anticipated Tax Reform, Investment spurts and Corporate Borrowing

Luis Alvarez Jr* **, Vesa Kanninen*** and Jan Södersten****

Abstract

The paper shows that a corporate tax policy which is thought to be neutral may have significant incentive effects. This result is established in a model with tax advantage to debt and expectations about a forthcoming tax reform. Investment spurt effects are established and compared to those of a firm with equity finance. A tax-cut cum base-broadening tax reform which leaves the long-run investment incentives of an all-equity firm unaffected is shown to cause a substantial short run investment hike. The findings are illustrated by numerical simulations indicating the magnitudes of the spurt effects.

Keywords: tax neutrality, tax reform, investment spurts, debt finance

JEL classification: H25, H32

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I Introduction

The extensive literature on corporate taxation, starting with Stiglitz (1973), King (1974), Sandmo (1974) and culminating in Sinn (1987) has established conditions when the corporate tax is neutral, in the sense that no tax falls on the return of the marginal investment project. Most of these results, however, are confined to and only informative about the long-run steady state interaction between tax structure and accumulation. The main point of the current paper is to claim that the corporation tax, which has been thought to be neutral, may be highly distorting. Such effects may arise in conditions of unstable fiscal policy. The corporation tax has often been viewed as a useful instrument both for short run adjustments to generate revenue and for meeting public targets on redistribution of income. Such changes typically do not come as a surprise, but are more or less anticipated. To state the argument briefly: when corporations have good reasons to anticipate changes in future tax policy, incentives may be created to revalue the existing investment programs. The same conclusion was obtained a long time ago by Sandmo (1979), but for a cash flow corporation tax. For an income tax, this result has previously been obtained by Auerbach (1989) and others.¹

Some time ago, Auerbach and Hines (1988) observed that the tax treatment of new investment in the US was altered in no less than 16 years over the period 1953-1985, providing the justification for an analysis of anticipatory effects of taxation. Revisions in tax policy have not become less frequent since then. Policy changes may, however, have a rather different profile. In the 1980's and 1990's, most western economies went through comprehensive tax reforms. Against that background, Alvarez, Kannianen and Södersten (1998; AKS hereafter) introduced a complementary approach which is appropriate for exploring the effects of dramatic turning points in policy stance, proposed to be of a once-and-for-all type. AKS proved the existence of *investment spurts*, as they called the dramatically re-assessed incentives to revise investment programs, associated with anticipated tax reform with noise about both magnitude and timing. AKS traced the reasons for such a policy uncertainty to the nature of the political and parliamentary processes with long-lasting committee work and public debate attracting escalated activity of lobby groups in society. Timing uncertainty was shown to reinforce the spurt effect resulting from uncertain expectations about the magnitude of future tax cuts or base broadening, representing the two typical policy instruments subject to uncertainty.

This paper contributes to the literature on investment spurts in several respects. The AKS work was based on the simplifying assumption of an all equity firm. However, a tax advantage to debt financing continues to be the typical distortion of the corporation tax system in most OECD countries in that equity financing is most often subject to double taxation, which is only partially mitigated. The current paper establishes and compares the magnitudes of the spurt effects in a model (i) with equity finance, (ii) with a tax advantage to debt. The precise dynamic investment path of a firm anticipating a tax reform is derived and numerical simulations presented to illustrate the findings.²

¹ An early concern about problems caused by anticipated tax policies was expressed by King (1974) and also advanced by him later, King (1985), claiming that during the transitional period between the announcement and the implementation of a reform there were significant changes in investment expenditures in the U.K. That tax reforms can be destabilizing was subsequently documented by Auerbach and Hines (1988), and by Auerbach and Hassett (1992). Robson (1989) argued that the traditional (long-run) measures of the cost of capital may significantly underestimate the extent to which investment incentives are affected by anticipated changes in the tax rates.

² Kannianen and Södersten (1995b) studied incentive effects of an anticipated tax reform with debt finance but did not derive the precise dynamic investment path of the firm.

The tax incentives for the corporation to issue debt instead of equity are not limited to finance capital accumulation, however. There are incentives to be engaged in tax-arbitrage to borrow and to pay more dividends.³ In such a situation, some mechanism is required to control excessive corporate borrowing.⁴ We have suggested earlier (Kanninen and Södersten (1995a, 1995b), KSa and KSb hereafter) that such mechanisms are typically created by civil laws which provide indirect breaks to borrowing by constraining corporate dividends. We refer to the *uniform* and *separate reporting conventions* in effect in most OECD- countries.

To analyze the interaction of expected changes in tax policy and investment dynamics with and without access to borrowing, we introduce a model which has more economic structure than that employed in the earlier work by AKS. We address the following questions:

- (i) What are the determinants of investment spurts created by sure anticipations of a tax reform with adjustments both in tax rate and tax base?
- (ii) How are investment spurts affected if one allows not only for equity finance, but also for a tax advantage to corporate debt? We compare the short and long-run implications of equity and debt finance, under the two reporting conventions mentioned above.
- (iii) In light of the results, in what way should one evaluate the standard recipes for eliminating tax distortions, i.e. deduction of economic depreciation and the cost of funds, and what is the relationship between the spurt effects and the well-known Johansson-Samuelson rule for neutral taxation?

Our analysis suggests that due to forward-looking behavior, tax reforms may easily lead to short-run incentive effects even in the presence of otherwise neutral taxation. Our results on the spurt effects under access to debt financing seem to challenge an influential view (originating by Stiglitz (1973)) on tax neutrality under debt financing. A notable additional result is the finding that a tax-cut cum base-broadening tax reform, designed to leave the long-run cost of capital of the all-equity firm unchanged, will result in a short-run investment spurt.

II Tax Policy and Tax Reforms. How Do Expectations Arise?

It has been typical of recent tax reforms in the OECD countries that prolonged committee work, public debates and the democratic, parliamentary processes have largely anticipated both the direction and the principles of the forthcoming reforms. In the 1980s, both the UK and US governments proposed comprehensive tax reform packages that included significant changes in the taxation of corporate income. The 1984 Spring Budget in the UK and the November 1984 proposal by the US Treasury subsequently led to far-reaching tax reforms. The intensive debate following the first Treasury plan led to a modified plan for the celebrated tax reform in 1986 in the US. The UK and US reforms had substantial international spillovers throughout the OECD economies, creating pressures to cut (and harmonize) tax rates and to introduce the principle of "leveling the playing field" by broadening tax

³ Cf. Boadway and Bruce (1979).

⁴ The need for such constraints has been established earlier by King (1974), Boadway and Bruce (1979), Mayer (1986), Sinn (1987).

bases. In this spirit, all the Nordic countries, for example, initiated intensive preparations for highly ambitious tax reforms in the following years. Denmark introduced her reform as early as 1987 and the year before, Sweden set up a parliamentary committee to reform corporate taxation. Even though the basic committee work did not become available until June 1989 and the new rules were not operative until 1991, the general lines of the reform were publicly known almost four years in advance! It is often the case that the Nordic countries are linked together in their social policies. The Norwegian reform of 1992 was claimed to be the most revolutionary in the nation's history; its general direction was also well-understood a long time before implementation. The same holds for the Finnish tax reform which was introduced in several phases culminating in the comprehensive reform of taxation of corporate and capital income as from the beginning of 1993. Thus, in recent decades there are several examples where the nature of the forthcoming tax reform was known in advance. The current paper explores analytically the implications of anticipated tax reform plans in terms of investment spurt effects.

III Assumptions of the Model

We introduce the following assumptions:

A.1 Tax Structure. We let τ_p, τ_c and τ_d be the tax rates on debt interest, capital gains and corporate dividends, respectively. At the corporate level, profits will be taxed at rates τ_1 and τ_2 prior to and after the tax reform. We assume a tax advantage to debt over equity, measured by the difference between the total tax rates on retained profits and on debt interest, $[\tau + \tau_c(1 - \tau)] - \tau_p > 0$. In line with typical OECD tax systems (cf. Sinn (1987)), we also assume $\tau_p > \tau_c$. Moreover, corporations are allowed to accumulate tax debt, i.e. the rate of fiscal depreciation (γ) may exceed the rate of economic depreciation (δ), $\gamma \geq \delta$. We define $\theta = (1 - \tau_d)/(1 - \tau_c)$ as the degree of tax discrimination between distributed and undistributed profits. The capital market opportunity cost of shareholders, $r = i(1 - \tau_p)/(1 - \tau_c)$, with i denoting the market interest rate, then gives the relevant discount rate for the firm. Our assumptions imply that $(1 - \tau)i < r < i$.

A.2 Tax Reform. We consider a tax reform which is expected to be of the "rate cut cum base broadening variety", $\tau_1 > \tau_2$, $\gamma_1 > \gamma_2$.

A.3 Investment Financing. We consider both an all-equity firm and a corporation which has a given initial equity, but is assumed to be free to issue debt ($L_t = dB_t/dt$) in the open market at the market rate i .

A.4 Technology and Adjustment Costs. Capital, K , is assumed to be accumulated at the gross rate I with unit price q while labor, N , is rented for w , the wage rate. Output is sold at price p per unit of output and the firm is assumed to be a price-taker in all markets. The firm faces internal costs, $c(I)$, when capital is adjusted. Hence, it is the price of current output which provides the relevant opportunity [cost in the face of the output losses involved. For the cost of adjustment, it will be assumed] that $c(I)$ is monotonically increasing and strictly convex in I , $c'(I) > 0$, $c''(I) > 0$. As to the technology, we

⁵ We plan to work with the widely accepted idea of internal adjustment costs arising from the use of productive factors in planning and installing new capital, machine set-up costs, overtime costs, and the like. This view was originally formalised by Lucas (1967) and adopted by Treadway (1969). For further extensions, see Nickel (1978).

assume (i) that the production function $F(K,N)$ is linearly homogenous in K and N , and (ii) that F is concave with $F_K > 0$, $F_N > 0$, $F_{NN} < 0$, $F_{KK} < 0$ and $F_{NN}F_{KK} - F_{KN}^2 = 0$. Choosing the variable input optimally at each point in time provides a short-run profit function. Constant returns means that it can be written as $p\Gamma(w/p)K = \max_N \{pF(K,N) - wN\}$. Well-known as it is, the marginal revenue product $p\Gamma(w/p)$ is independent of the accumulated capital attributable to constant returns, and only depends on the real wage rate with $\partial\Gamma/\partial(w/p) < 0$.

We assume throughout that the revenue produced by each capital vintage exceeds the borrowing cost and the cost of depreciation, $p\Gamma(w/p) - q(i+\gamma) > 0$. This requirement is tantamount to assuming that the firm pays positive taxes from its investment projects.

A.5 Cash Flow. The equality between use of corporate funds and sources of funds requires

$$(1) \quad D + qI \equiv (1-\tau)[p\Gamma(w/p)K - iB - pc(I)] + \tau\gamma C + L$$

where D = cash dividends per unit of time and where C = tax accounting value of the firm's capital stock. The distinction between the tax accounting value of capital, C , and the real capital, K , is essential when fiscal depreciation and economic depreciation do not coincide. The rate of investment, I , and the rate of borrowing, L , are taken to be the controls and the states are subject to the motions $dK/dt = I - \delta K$, $dC/dt = qI - \gamma C$, $dB/dt = L$. By equation (1) adjustment costs reduce the firm's tax base, that is, they are written off immediately. This reflects the assumption that adjustment costs take the form of disturbances to the firm's production activities. The economic implications of this assumption will be brought up again when discussing spurt effects in section IX.

A.6 Constraining Dividends. It makes a substantial difference both for the short-run and the long-run implications of tax policy, what types of mechanisms are operative in constraining the firm's dividend and borrowing policies. The need to introduce some mechanism to prevent infinite borrowing by corporations in situations where the tax system provides incentives for issuing debt has been recognized long ago. KS (1995a) sought such constraints in company laws where such borrowing breaks can indeed be found.⁶ The question amounts to establishing the rights to reward the shareholders by distributions from corporate earnings. In a majority of the OECD countries (outside the Anglo-Saxon world) firms are not allowed to violate the strict principle of *uniform reporting*. This means that the tax balance sheet of the firm drawn up for the fiscal authorities must coincide with the commercial balance sheet drawn up for the shareholders. Along with the requirement to pay dividends out of after-tax book income, the effect of this is to limit the maximum amount of dividends payable as taxable income (net of taxes). In the Anglo-Saxon world, and in some other countries, firms are allowed to submit two distinct balance sheets, one for the tax authorities and one for the shareholders. Shareholders have access to

⁶ The social motivation for such conventions arises from the need to prevent bad business habits, erosion of the corporate equity base or the desire to limit fooling of uninformed lenders in situations where the set of feasible contracts is limited by adverse selection ex ante or where the enforcement of these contracts may be threatened by moral hazard ex post. Hence, the mere existence of these constraints has undeniable legitimacy. The institutional details may differ in different countries, cf. Cummins, Harris and Hassett (1994) which also includes detailed information on several OECD economies.

dividends that have not been fully reported as taxable income by the corporation. We denote this convention *separate reporting* (cf. Sinn (1987)).

With uniform reporting, company law requires that dividends must not exceed after-tax book profits

$$(2) \quad D^{UR} \leq (1-\tau)[p\Gamma(w/p)K - iB - pc(I) - \gamma C].$$

As to the alternative convention, separate reporting, details may differ between different countries. In Sinn's (1987) interpretation, the firm faces the constraint

$$(3) \quad D^{SR} \leq [1 - \tau][p\Gamma(w/p)K - iB - pc(I) - \delta qK],$$

which means that dividends are prevented from exceeding after-tax economic profits.

Using (1) constraint (2) translates into a constraint on corporate borrowing per unit of time:

$$(4) \quad L^{UR} \leq qI - \gamma C,$$

while constraint (4) requires that

$$(5) \quad L^{SR} \leq qI - \gamma C + [1 - \tau][\gamma C - \delta qK].$$

This difference in the scope for borrowing accounts for the difference in investment behavior between firms subject to *uniform* and *separate* reporting requirements which we will demonstrate in the following section.

IV Optimal Behavior

To examine the firm's optimal accumulation prior to and after an expected tax reform, we proceed in two steps. In the first step we derive the valuation of corporate shares in the absence of any expectation of tax reform. This is a cumbersome part of the analysis, the details of which are explained in AKS. Fortunately, it is associated with a substantial payoff: once completed, it is easy to find the optimal investment rule using techniques of standard static optimization instead of dynamic ones.

Under any future investment program, the stock market value of the shares of an *all equity* firm can be written as

$$(6) \quad V^E(K(t), C(t)) =$$

$$\frac{(1 - \tau)(p\Gamma w / p)}{\delta + r} K(t) + \frac{\tau\theta}{\gamma + r} C(t) + \int_t^\infty e^{-r(s-t)} \theta [\Psi_s^E I(s) - (1 - \tau)pc(I(s))] ds$$

with

$$(7) \quad \Psi_t^E = \int_t^\infty \left[(1 - \tau)(p\Gamma w / p) e^{\delta(s-t)} + \tau\theta e^{\gamma(s-t)} \right] e^{r(s-t)} ds - q.$$

The different terms of equation (6) all have clear economic interpretations. Each unit of capital gives rise to a marginal revenue product of $p\Gamma (w/p)$, which declines over time at rate δ . The first term of (6) is therefore the after-tax present value of all future marginal revenue products, derived from the firm's *current* capital stock, $K(t)$. The second term of (6) is the present value of the tax savings from the future depreciation allowances that may be taken at the declining balance rate γ on the *current* tax accounting value of the firm, $C(t)$. The third term, finally, is the present value of the cash flows (including the after-tax adjustment costs) from the firm's *future* investment program, where Ψ_t^E stands for the after-tax net present value of the cash flows from each new unit of capital good. The third term, therefore, captures the excess profits earned by the firm on its intramarginal capital because of its convex adjustment cost technology.

The insight provided by (6), is that the market value of the shares of a firm under constant returns to scale can be decomposed into two parts, one (to be denoted as $V^{OLD,j}(t)$ below), capturing the present value of future cash flows from the firm's *current* capital stock and *current* accounting value, and the other, the present value of cash flows deriving from *future* new investment. Importantly, this insight carries over to the case where debt is used as a source of funds. In general, we may write the market value of the firm's shares as

$$(8) \quad V^j(t) = V^{OLD,j}(t) + \int_t^\infty e^{-r(s-t)} \theta [\Psi_s^j I(s) - (1 - \tau)pc(I(s))] ds, \quad j = E, UR, SR$$

where E denotes an all equity firm, and UR and SR a firm with debt under *uniform* and *separate reporting*, respectively. The expression for Ψ_t^j differs depending on the mode of finance.

With uniform reporting, we derive

(9)

$$\begin{aligned}\Psi_t^{UR} &= \int_t^\infty \left[(1 - \tau) p \Gamma w / p e^{\delta(s-t)} + \tau q e^{\gamma(s-t)} - i(1 - \tau) q e^{\gamma(s-t)} - \gamma q e^{\gamma(s-t)} \right] e^{r(s-t)} ds + q - q \\ &= (1 - \tau) \int_t^\infty \left[p \Gamma w / p e^{\delta(s-t)} - i q e^{\gamma(s-t)} - \gamma q e^{\gamma(s-t)} \right] e^{r(s-t)} ds\end{aligned}$$

where we have made use of a result from KS (1995b), namely that a tax advantage to debt (A.1) is a sufficient condition for constraint (4) to bind all the way along the adjustment path. The first term under the integral in the first row of (9) is the after-tax marginal return to a unit of investment, while the second term is the tax savings from fiscal depreciation. The third and fourth terms capture the debt service from each unit of investment, that is, after-tax interest payments and debt amortization. Under uniform reporting, each new unit of investment is debt financed, and the new debt is the first term outside the integral. The last term in the first row is the acquisition cost of the capital good.

Separate reporting yields (again assuming the firm's borrowing constraint (equation (5) to bind)

(10)

$$\begin{aligned}Y_t^{SR} &= \int_t^\infty \left[(1 - t) p G(w / p) e^{d(s-t)} + t g e^{g(s-t)} - i(1 - t) q (e^{g(s-t)} + (1 - t)(e^{d(s-t)} - e^{g(s-t)})) \right. \\ &\quad \left. - (g e^{g(s-t)} - (1 - t)(g e^{g(s-t)} - d e^{d(s-t)})) \right] e^{r(s-t)} ds + q - q.\end{aligned}$$

The difference between Ψ_t^{SR} and Ψ_t^{UR} (cf. the third and fourth terms under the integral), reflects the more extensive possibilities for borrowing under separate reporting. Evaluating (10) gives

$$(11) \quad \Psi_t^{SR} - \Psi_t^{UR} = \frac{(1 - t)(g - d)}{(d + r)(g + r)} [r - i(1 - t)] q > 0.$$

Since we assume that $r - i(1 - \tau) > 0$ (a tax advantage to debt) and $\gamma > \delta$ (accelerated depreciation), (11) means that the present discounted value of cash flows from each unit of investment will be higher under separate reporting than uniform reporting. We also find that

$$(12) \quad \Psi_t^{UR} - \Psi_t^E = \frac{[r - i(1 - t)]}{(g + r)} q > 0,$$

implying that

$$(13) \quad \Psi_t^{SR} > \Psi_t^{UR} > \Psi_t^E.$$

In equation (16) we have expressed the pre-reform Ψ_s^E as the sum of two parts; the first is the after-tax net present value of the cash flows from a new unit of capital good in the absence of expectations of tax reform. This is denoted as $\Psi_{\tau=\tau_1}^E$ and is given by equation (7) with $\tau = \tau_1$. The second part, $S^E(s)$, $s < t^*$, is the present value of tax savings per unit of new investment:

$$(17) \quad \begin{aligned} S^E(s) &= b\tau_1 - \tau_2 \int_{t^*}^{\infty} [p\Gamma e^{-\delta(v-s)} - \gamma q e^{-\gamma(v-s)}] e^{-r(v-s)} dv \\ &= b\tau_1 - \tau_2 \left[\frac{p\Gamma}{\delta+r} e^{-b\delta+r(t^*-s)} - \frac{\gamma q}{\gamma+r} e^{-b\gamma+r(t^*-s)} \right]. \end{aligned}$$

As in previous section, expression (15) may be generalized to

$$(18) \quad V_{t < t^*}^j(t) = V_{t < t^*}^{OLD,j}(t) + \int_t^{\infty} e^{-r(b_s-t)} \theta[\Psi_s^j I(s) - (1 - \tau(b_s) p c I(s))] ds, \quad j=E, UR, SR$$

where

$$(19) \quad \Psi_{s < t^*}^j(s) = \Psi_{\tau=\tau_1}^j + S^j(s).$$

The expressions for $\Psi_{\tau=\tau_1}^j$ are given by (9) and (10) above and we derive

$$(20) \quad \begin{aligned} S^{UR}(s) &= (t_1 - t_2) \int_{t^*}^{\infty} [p\Gamma e^{-d(v-s)} - g q e^{-g(v-s)} - i q e^{-g(v-s)}] e^{-r(v-s)} dv \\ &= (t_1 - t_2) \left[\frac{p\Gamma}{d+r} e^{-(d+r)(t^*-s)} - \frac{g+i}{g+r} q e^{-(g+r)(t^*-s)} \right] \end{aligned}$$

for *uniform reporting*. We find that the *spurt effect* $S^j(s)$, $j = E, UR$, is positive, provided that $\gamma \geq \delta$ and given that the firm pays positive taxes on its investment projects; positive taxes, in turn, requires that $p\Gamma > b_i + \gamma q$ for a debt financed firm, and $p\Gamma > \gamma q$ for an all-equity firm. Moreover, the spurt effect of an all-equity firm turns out to be greater in magnitude than that of an UR-firm. There is an intuitive reason for this: the difference is given precisely by the present value of interest payments and results from the fact that the reduction of the tax rate reduces the future value of interest payments.

For *separate reporting* we get:

(21)

$$\begin{aligned}
S^{SR}(s) = & (t_1 - t_2) \int_{t^*}^{\infty} \left[p\Gamma e^{-d(v-s)} - gqe^{-g(v-s)} - iqe^{-g(v-s)} \right] e^{-r(v-s)} dv \\
& - \int_{t^*}^{\infty} i \left[\left(e^{-d(v-s)} - e^{-g(v-s)} \right) \left((1-t_2)^2 - (1-t_1)^2 \right) - (t_1 - t_2)(1-t_2) \left(e^{-d(t^*-s)} - e^{-g(t^*-s)} \right) \right] e^{-r(v-s)} dv \\
& + \int_{t^*}^{\infty} (t_1 - t_2) \left(ge^{-g(v-s)} - de^{-d(v-s)} \right) e^{-r(v-s)} dv
\end{aligned}$$

Due to the complexity of this expression, it is difficult to determine analytically the sign of $S^{SR}(s)$. However, our numerical examples in section VIII and extensive experimentation with alternative parameter assumptions support the assumption of a positive spurt effect for the SR-firm as well.

VI Investment Spurts and the Cost of Capital

Our results above demonstrate clearly that expectations of future tax reform interact with the valuation of capital and consequently with the optimal investment behavior in the short run. Although the valuation expression (18) is rather involved, it is most helpful to notice that the current investment $I(s)$ only enters one term. Therefore, one can see directly that to follow the optimal pre-reform investment policy, the firm has to choose the path satisfying

$$(22) \quad I(s) = \arg \max_{I(s)} [\Psi_{s < t^*}^j I(s) - (1 - t_1) pc(I(s))], \quad s < t^*,$$

We find it illuminating to utilize equation (19) and decompose equation (22) into two sets of incentives, one generated by the current tax rate τ_1 and the other generated by the anticipated reduction in the tax rate $\tau_1 - \tau_2$,

$$(23) \quad I(t) = [c']^{-1} \left[\Psi_{\tau=\tau_1}^j + \frac{S^j(s)}{p} \right]$$

where $S^j(s)$, which is given by eqs. (17), (20) and (21) above, captures what we have denoted as the spurt effect.

An alternative way to characterize the firm's response to an expected future tax cut is to derive the cost of capital. Inserting $I^* = \delta K^*$ as the steady-state relation, equation (14) can be used to derive the long-run gross cost of capital. In the absence of any expectation of tax reform, it reads with $\tau = \tau_1$ as

$$(24) \quad \rho_E^* / q = b_p / q [\rho \Gamma - b\delta + r] c'[\delta K_E^*] = \delta + \frac{r}{1-\tau} \left[1 - \frac{\tau b \gamma - \delta q}{\gamma + r} \right]$$

for the all-equity firm⁷ and

$$(25) \quad \rho_{UR}^* / q = b_p / q [\rho \Gamma - b\delta + r] c'[\delta K_{UR}^*] = \delta + i \left[1 - \frac{\tau_p - \tau_c}{1 - \tau_c} \right] \left[\frac{\gamma - \delta}{\gamma + r} \right]$$

for the UR-firm and

$$(26) \quad \rho_{SR}^* / q = b_p / q [\rho \Gamma - b\delta + r] c'[\delta K_{SR}^*] = \delta + i \left[1 - \tau \right] \left[\frac{\gamma - \delta}{\gamma + r} \right]$$

for the SR-firm. We note that $\partial \rho_E^* / \partial \tau > 0$, $\partial \rho_{UR}^* / \partial \tau = 0$ and $\partial \rho_{SR}^* / \partial \tau < 0$. As is well-known, the corporate tax raises the long-run cost of capital for the all-equity firm when the cost of equity funds is not deductible. For the SR-firm, the combination of interest deductibility and accelerated depreciation ($g > d$) makes the long-run cost of capital a negative function of the corporate tax rate (this is known as the “taxation paradox”). For the UR-firm, the long-run cost of capital is immune to changes in the tax rate since the binding dividend constraint turns the corporate tax into a semi cash-flow tax.⁸ In all cases, the long-run cost of capital is a negative function of the rate of fiscal depreciation, $\partial \rho_j^* / \partial \gamma < 0, \forall j$.

With an expected future cut in the tax rate, we get the short-run costs of capital as

$$(27) \quad \rho_j^s / q = b_p / q [\rho \Gamma - b\delta + r] c'[\delta I_j] = \rho_j^* - b\delta + r [S^j], j=E,UR,SR$$

where $S^j > 0$ is defined by equations (17), (20) and (21) above. The expectation of a future tax cut therefore creates a negative wedge between the short-run (pre-reform) cost of capital and the long-run (pre-reform) cost of capital. It is interesting to note that these effects occur despite the fact that with uniform reporting, the long-run investment incentive is unrelated to the seize of the corporate tax rate, and with separate reporting, the long-run cost of capital is a negative function of the corporate tax rate.

⁷ For later use, note that the cost of capital for the all-equity firm also can be written as $\left[1 - \frac{\tau_1 \gamma}{\gamma + r} \right] b\delta + r$.

⁸ See Sinn (1987) for an explanation of the taxation paradox and Kanninen and Södersten (1995a) for further discussion of long-run tax effects under uniform reporting.

VII Spurt Effects Arising from Future Tax Base Adjustment and Tax-Cut cum Base-broadening Tax Reform

We next turn to the case where the firm anticipates a cut in the rate of fiscal depreciation from γ_1 to γ_2 at the future date t^* . With declining balance fiscal depreciation, the new rate γ_2 is applied both to new investment and to the firm's remaining tax accounting value⁹ at time t^* . We first present an analysis of anticipation effects with $\gamma_1 > \gamma_2$, assuming that the tax rate τ is left unchanged. We then proceed to examine a *tax-cut-cum-base-broadening* tax reform, where both the tax rate and the rate of depreciation is expected to change. Throughout this section we ignore the SR-case because of its complexity.

At time $t < t^*$, that is before the change in γ , the value of the firm's shares is given by

$$(28) \quad V_{t < t^*}^j = V_{t < t^*}^{OLD,j} + \int_t^{\infty} e^{-r(s-t)} \theta [\Psi_s^j I(s) - (1 - \tau) I(s) p c I(s)] ds, \quad j = E, UR,$$

After the cut in the rate of fiscal depreciation, that is for $s \geq t^*$, Ψ_s^j is defined as in (7) and (9) with $\gamma = \gamma_2$, whereas for $s < t^*$

$$(29) \quad \Psi_{s < t^*}^j = \Psi_{\gamma=\gamma_1}^j + S^j I(s).$$

In equation (29) we have expressed the pre-reform Ψ_s^j as the sum of two parts; the first is the after-tax net present value of the cash flows from a new unit of capital good in the absence of expectations of tax reform. This is denoted as $\Psi_{\gamma=\gamma_1}^j$ and is given by equations (7) and (9) with $\gamma = \gamma_1$. The second part, $S^j I(s)$, $s < t^*$, is the present value of tax savings per unit of new investment:

$$(30) \quad S_{s < t^*}^E = -r \frac{\tau(\gamma_1 - \gamma_2)}{\gamma_1 + r \gamma_2 + r} e^{-[\gamma_1 + r](t^* - s)} < 0$$

for the all equity firm, while for the firm using debt and adhering to uniform reporting, we derive

$$(31) \quad S_{s < t^*}^{UR} = -i \left[1 - \tau \frac{\tau_p - \tau_c}{1 - \tau_c} \frac{\gamma_1 - \gamma_2}{\gamma_1 + r \gamma_2 + r} \right] e^{-[\gamma_1 + r](t^* - s)} < 0.$$

Hence, the expectation of a future cut in the rate of fiscal depreciation ($\gamma_2 < \gamma_1$), results in a *negative* spurt effect for both modes of finance. However, when debt is used by the firm, and the firm's

⁹ In Anglo-Saxon public finance jargon, we assume that there is no *grand-fathering*. Conversely, grand-fathering would mean that investments already put in place when the tax reform is implemented would continue to be written off at the old, pre-reform, rate of depreciation.

borrowing is constrained by uniform reporting, the existence of a spurt effect is contingent upon a non-harmonized personal taxation of interest and capital gains, that is $\tau_p \neq \tau_c$.

We demonstrated in the previous section that a future cut in the corporate tax rate creates incentives for an investment spurt, and we conclude from equations (30) and (31) above that this destabilizing effect is reduced under simultaneous base broadening measures. As to the net effects, the outcome depends on the precise nature of the tax reform.

Using the same technique as above, we derive the spurt effect at time $s < t^*$ when the tax rate is cut and the rate of depreciation reduced (from τ_1 to τ_2 and from γ_1 to γ_2) at date t^* :

$$(32) \quad S_{\gamma, \tau}^E(s) = (\tau_1 - \tau_2) \frac{p\Gamma}{\delta + r} e^{-[\delta + r](t^* - s)} - \left[\frac{\tau_1 \gamma_1}{\gamma_1 + r} - \frac{\tau_2 \gamma_2}{\gamma_2 + r} \right] q e^{-[\gamma_1 + r](t^* - s)},$$

$$(33) \quad S_{g,t}^{UR}(s) = (t_1 - t_2) \frac{p\Gamma}{d + r} e^{-(d+r)(t^* - s)} - \left[\frac{t_1(g_1 + i)}{g_1 + r} - \frac{t_2(g_2 + i)}{g_2 + r} \right] q e^{-(g_1 + r)(t^* - s)}.$$

While the present value of tax savings from depreciation allowances will fall clearly (the last bracketed term of (32) and (33) including the preceding sign is negative), the present value of after-tax gross returns (first term) will rise. The net impact on the present value of tax payments, as captured by the spurt effect $S_{g,t}^j(s)$, $j = E, UR$, is therefore, as expected, ambiguous.

To determine the direction of the spurt effect we, therefore, need to make further assumptions about the precise nature of the tax-cut cum base-broadening tax reform. For the all-equity firm, an interesting case is where the *feasible combinations* of tax cuts and base-broadening measures are constrained by the requirement that long-term investment incentives be unchanged. The long-term cost of capital for the all-equity firm was given by (24) above; using the alternative formulation of the cost of capital given in footnote 7, we find that

$$(34) \quad \frac{\tau_1 \gamma_1}{\gamma_1 + r} - \frac{\tau_2 \gamma_2}{\gamma_2 + r} \equiv (\tau_1 - \tau_2) \frac{\rho_E^*}{\delta + r}$$

when the reform leaves the long-run cost of capital unchanged. Since $\rho_E^* = p\Gamma - (\delta + r)(c'I^*)$ in long-term equilibrium (I^* is steady-state investment, which is unchanged by the reform), we then derive

$$(34') \quad S_{\gamma, \tau}^E(s) = (\tau_1 - \tau_2) \frac{p\Gamma}{\delta + r} [e^{-[\delta + r](t^* - s)} - e^{-[\gamma_1 + r](t^* - s)}] + c'I^* [e^{-[\gamma_1 + r](t^* - s)}] > 0.$$

A tax-cut cum base-broadening tax reform designed to leave the long-run investment incentives of the all-equity firm unchanged will therefore still cause the firm to increase its investment in the short run.

VIII Numerical Illustrations of Spurt Effects

To give the reader some feeling for the quantitative importance of the spurt incentives analyzed in previous sections, we next turn to reporting of the results from a few numerical simulations. We study the investment response to a tax reform which is announced at date $t=2$, to be fully implemented at date $t^*=7$. The investment response to a given reform obviously depends on the firms' adjustment cost technology. We have normalized pre-reform long-run investment (for $j=E, UR$ and SR) to be 100, and the adjustment cost parameters assumed for our simulations imply that the firm's long-run elasticity of demand for investment with respect to the cost of capital is 0.3. Further details about the simulation technique are given in Appendix 1. Even though the parameters have been chosen with care, we emphasize that the results should be regarded as just an illustration as we have not carried out any full-scale sensitivity analysis.

Figure 1 shows the investment response when the corporate tax rate is expected to be cut from 50 to 30 percent. (Note that year 7 in the figure gives post-reform long term investment.) For the all equity firm, the effect of this is an increase in long-term investment, while with debt constrained by separate reporting, long-term investment will fall (cf. equations (24)-(26) above). With uniform reporting (UR), the firm's long-run investment incentive is unchanged. Irrespective of mode of finance, however, we find a substantial pre-reform hike in investment.

The remaining figures 2 and 3 are confined to the all-equity firm. In Figure 2, we illustrate the investment response to an expected future cut in the rate of fiscal depreciation, from 30 to 10.0 percent, while Figure 3 reports the effects of a tax-cut cum base-broadening tax reform. The corporate tax rate is cut from 50 to 30 percent, and simultaneously, the rate of fiscal depreciation is reduced from 30 to 10 percent (equal to the assumed rate of economic depreciation, δ). The combined effect of these changes is to leave the long-run cost of capital unchanged. The remarkable result is that the seemingly neutral tax reform will cause a substantial short-run instability in investment spending.

IX Neutral Taxation

We have demonstrated that with uniform reporting as an indirect constraint on corporate borrowing, the long run cost of capital is insensitive to the corporate tax rate. The corporation income tax is turned into a semi-cash flow tax, which differs from a neutral tax only to the extent that non-harmonization of tax rates on debt and capital gains makes the cost of capital sensitive to fiscal depreciation (cf. equation (25)). However, we have also demonstrated that even though manipulation of the corporate tax rate may have no role to play in the long run, it creates volatility in the short run. Investment spurts do exist as a response to expectations of future policy changes (cf. equation (20)).

With equity finance and non-deductibility of the cost of funds, the cost of capital is sensitive to the corporate tax rate also in the long run. A standard recipe for eliminating tax distortions in the case of equity finance is to allow the firm to deduct the cost of funds, r , and abandon accelerated depreciation, that is putting $\gamma = \delta$. While this would turn the long-run cost of capital into

$$(35) \quad \rho_E^* / q = \frac{p}{q} \left(\frac{p}{\delta + r} - \frac{p}{q} \right) = \delta + r,$$

expectations of future changes in the corporate tax rate will still result in short run investment spurts. We derive the spurt effect as

$$(36) \quad S_{t < t^*, \gamma = \delta}^E = \frac{p}{q} \left(\frac{p}{\delta + r} - \frac{p}{q} \right) e^{-\frac{p}{q}(\delta + r)(t^* - t)},$$

which is positive for $\tau_1 > \tau_2$.

There is a simple way to explain this result. The first order condition for optimal investment [cf. eq. (14) above] before the tax reform (which occurs at date $t^* > t$) is

$$(37) \quad \Psi_{t < t^*}^E = \frac{p}{q} (1 - \tau_1) - \tau_1 \left(\frac{p}{q} \right) \left(\frac{p}{\delta + r} - \frac{p}{q} \right)$$

where, as explained above, the left-hand side is the net present value of the cash flows from a new unit of investment (ignoring adjustment costs), and the right-hand side is the after-tax marginal adjustment cost. Evaluating equation (37) with $\gamma = \delta$ and allowing for the deductibility of the cost of equity funds, yields

$$(37') \quad \frac{p}{\delta + r} (1 - \tau_1) + \frac{p}{q} (\tau_1 - \tau_2) e^{-\frac{p}{q}(\delta + r)(t^* - t)} = \frac{p}{q} (1 - \tau_1) + \frac{p}{q} (\tau_1 - \tau_2) e^{-\frac{p}{q}(\delta + r)(t^* - t)} + \frac{p}{q} (1 - \tau_1) \left(\frac{p}{\delta + r} - \frac{p}{q} \right).$$

Hence, both the present value of the quasi-rents from the new investment and the acquisition cost, q , are reduced in the proportion $\tau_1 - \tau_2$, while the adjustment cost gets a tax rebate in proportion to the old tax rate τ_1 . The (assumed) tax treatment of the firm's adjustment costs, therefore, appears to be the key to the spurt effect.

It is intuitively clear from (37') that had the tax code disallowed the immediate deduction of adjustment costs, and instead required the firm (*i*) to write off both the acquisition costs of capital goods and the adjustment costs at the rate δ , and (*ii*) to base the deduction of the cost of funds on the written-down balance of acquisition costs and adjustment costs, the spurt incentives would disappear. We then derive

$$(38) \quad \frac{p\Gamma}{\delta + r} [1 - \tau_1 + b\tau_1 - \tau_2] e^{-b\delta + r} [1 - \tau_1 + b\tau_1 - \tau_2] = [q + pc' bI] [1 - \tau_1 + b\tau_1 - \tau_2] e^{-b\delta + r} [1 - \tau_1 + b\tau_1 - \tau_2]$$

which means that the quasi-rents and the "total" cost of the marginal investment are reduced at the same rate, making the investment decision invariant to taxation and to expectations of tax reform. The problem here is of course that there is no way for the tax authorities to make the firm reveal the true adjustment costs, as these often take the form of disturbances to the firm's production activities.¹⁰ Clearly, this will effectively allow adjustment costs to be written off immediately, as we have explicitly assumed in this paper [and for equation (37')]. As a result, expectations about tax reform matter.

The early contributions by Johansson (1961, 1969) and Samuelson (1964) provide a further insight into the mechanism behind (37) and (38). The Johansson-Samuelson theorem¹¹ says that tax neutrality prevails if investment projects are taxed on their cash flows, and tax depreciation is based on true economic depreciation. True economic depreciation is measured from the *income* side, as the change in the discounted value of the cash flow streams generated by the projects. The theorem further requires that the discount rate is reduced in proportion to the tax rate, reflecting the assumption that all capital incomes are taxed at the same rate. Without adjustment costs, the discounted value of the cash flow stream generated by a marginal investment project equals the acquisition cost of the project. Writing off the acquisition cost at the same rate as the rate of decline over time in the project's quasi-rents (that is δ in this case), therefore achieves the equivalent of true economic depreciation. In the presence of adjustment costs, the present value of the cash flows from the marginal investment will be higher, and equal the acquisition cost *plus* the (marginal) adjustment cost. Hence, for the tax system not to affect the investment decision, the tax code cannot adhere to the accounting principle that depreciation be based on the purchase price of assets.¹²

Implementing Johansson-Samuelson taxation at the firm level still turns out to be a straight-forward matter. In particular, there is no need to separate the firm's adjustment costs from other disturbances to the production activities. The following steps are required: First, tax the firm on the basis of its cash flow less true economic depreciation. Depreciation is then measured from the income side as the change in the market value of the shares, $-\dot{V}$ ($\dot{V} \equiv \partial V / \partial t$, which may be positive or negative). The firm's taxable income is therefore $p\Gamma K - qI - pc'bI - iB + L - [-\dot{V}]$. For firms noted on the stock exchange, this income concept is easy to use; the required measure of depreciation is readily provided by the stock market. The budget constraint is then

$$(39) \quad D = [p\Gamma K - iB + L - qI - pc'bI - \tau] + \tau[-\dot{V}].$$

¹⁰ Cf. however, the US tax code which requires the firm to depreciate (rather than expense) adjustment costs.

¹¹ This name was suggested by Sinn (1987), who also offers a penetrating discussion of tax neutrality.

¹² The problems posed by inflation are ignored here.

As the second step, introduce full mitigation of corporate double taxation at the shareholder level by abolishing the personal taxes on dividends and capital gains, $\tau_d = \tau_c = 0$. The non-arbitrage condition for valuing the firm's shares then becomes

$$(40) \quad D + \dot{V} = i(1 - \tau_p)V.$$

Using the budget constraint in (39), the non-arbitrage condition (40) changes to

$$(40') \quad (p\Gamma K - iB + L - qI - pc\dot{I})(1 - \tau) + \dot{V}(1 - \tau) = i(1 - \tau_p)V.$$

As the third and final step, equate the personal tax on interest and the corporate tax rate, $\tau = \tau_p$. This makes the tax terms vanish from (40') and we then get the value of the firm's shares as

$$(41) \quad V = \int_0^{\infty} [p\Gamma K - qI - c\dot{I} - iB + L]e^{-it} dt$$

that is, independent of tax! Taxation according to the Johansson-Samuelson theorem hence turns out to offer a simple way of accomplishing both long run and short run neutrality in the presence of costs of adjustment. Importantly, neither the sources of funds used by the firm, nor the character of the adjustment costs (issues which earlier have been discussed by Hartman (1978) and Abel (1983), within the framework of complicated models) matter for the neutrality result.¹³¹⁴

X Final remarks

The main lesson from the current paper can be summarized as follows: a corporation tax system which is thought to be neutral may result in significant incentive effects. The earlier work has pointed out that reforms which are anticipated may give rise to undesirable fluctuations. The current paper has formalized this concern in terms of an optimizing model and explored the effects of an anticipated tax reform of the type implemented in the OECD countries. We have not only been able to explicate the existence of investment spurt effects and state their dependency on the financial alternatives available to the firm but we have also derived the whole optimal dynamic path of a corporation.

We have also shown that the types of tax reforms introduced give rise to simultaneous spurt effects which tend to partially offset each other with the net effect depending both on the relative magnitudes of rate-cut cum base-adjustment and the structure of the tax system. A new result is that a tax-cut cum

¹³ We note that our proposal is problematic if stock prices do not sufficiently reflect economic fundamentals, as in cases or periods with substantial informational asymmetries. However, this would be less of a problem if mis-pricing does not change over time, as would be the case if mis-pricing is stochastic and on the average thus cancels out.

¹⁴ Our model has introduced partial irreversibility in terms of costly adjustment and indicated in which way one may arrive at neutral taxation in the sense of Johansson-Samuelson. Elsewhere, Alvarez and Kanninen (1997) have suggested that under uncertainty and full irreversibility, the Johansson-Samuelson theorem is unlikely to hold. See however, Niemann (1999) who proves the neutrality property of the Johansson-Samuelson theorem when implemented completely, that is when all value-adding components of the investor's portfolio are subject to taxation.

base-broadening tax reform which leaves the long-run investment incentives of an all-equity firm unchanged will cause a substantial short run investment hike. When such a reform is initiated, the democratic mechanism which creates expectations seems especially problematic from the point of view of the stability of capital accumulation. Taxation according to the Johansson-Samuelson theorem and measuring economic depreciation as the change in the firm's stock market value, turns out to offer a simple way of accomplishing both long run and short run neutrality in the presence of costs of adjustment.

Appendix 1 Simulating investment spurts

Let the adjustment cost function be

$$c(I) = \frac{1}{2} \beta [I - I_0]^2 \quad (i)$$

where I is current investment and I_0 is a constant. Hence $c'(I) = \beta [I - I_0]$ and $c''(I) = \beta$, with $\beta > 0$ and $I > I_0$. Equations (24) - (26) in section VI then yield

$$pc'(I_j^*) = \frac{p\Gamma - \rho_j^*}{\delta + r} = \beta [I_j^* - I_0] \quad (ii)$$

where $j = E, UR, SR$, I^* is the firm's pre-reform long-run investment and ρ_j^* is the pre-reform long-run cost of capital. From equation (27) we derive

$$pc'(I_j) = \frac{p\Gamma - \rho_j^*}{\delta + r} + S_j = \beta [I_j - I_0] \quad (iii)$$

where S_j is the spurt-effect, as defined in sections V and VII above. Combining (ii) and (iii) gives

$$I_j = I_j^* + \frac{S_j}{\beta} \quad (iv)$$

We next define the elasticity of long-run investment with respect to the cost of capital

$$e \equiv - \frac{dI^*}{d\rho_j^*} \frac{\rho_j^*}{I^*}. \quad (v)$$

From equations (24)-(26), we find that

$$\frac{dI^*}{d\rho_j^*} = - \frac{1}{c''(\delta + r)} = - \frac{1}{\beta(\delta + r)} \quad (vi)$$

Thus

$$e \equiv \frac{\rho_j^*}{\beta(\delta + r_j)^*} \quad (\text{vii})$$

Using (vii) we may rewrite (iv) as

$$I_j = I_j^* \left[1 + \frac{e(\mathbf{d} + r)S_j}{\mathbf{r}_j^*} \right] \quad (\text{iv})$$

which is the equation used for the numerical simulations in section VIII. We have set $e = 0.3$, the pre-reform investment $I_j^* = 100$, the rate of economic depreciation $\delta = 0.1$, the market interest rate $i = 0.06$, the personal tax on interest $\tau_p = 0.3$, and the accruals tax on capital gains $\tau_c = 0.15$. Table A1 summarises the implications of these assumptions for the long-run costs of capital when the corporate tax rate (as in Figure 1) is cut from 50 to 30 percent and the rate of fiscal depreciation is unchanged, $\gamma = 0.3$.

Table A1 *The Long-run Costs of Capital Before and after a Cut in the Corporate Tax Rate \mathbf{t} from 50 to 30 percent*

Parameter	Before tax reform	After cut in τ
τ	0.5	0.3
γ	0.3	0.3
ρ_E^*	0.171	0.159
ρ_{UR}^*	0.159	0.159
ρ_{SR}^*	0.143	0.150

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