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Appendix C
Technical Aspects of the Swedish Tax System

Annell Deduction

The first point we discuss is the value of the Annell deduction for new share issues. In chapter 4 we argued that the deduction must be transformed into a tax saving per dollar of investment. The problem of transformation arises simply because assets depreciate. In deriving the cost of capital for a hypothetical investment project, we implicitly assumed that the financial capital raised to pay for new investment was repaid to the investors as the asset depreciated. In the light of this, it is not reasonable to interpret the Annell rules to imply that a firm that raises one hundred crowns worth of new equity capital to finance an asset that depreciates in, say five years' time would be able to deduct $h(100)$ annually for w years notwithstanding that after five years the original one hundred crowns are already repaid to the equity investors. Consider an all-equity firm that distributes all its after-tax economic profits, including real capital gains. This firm would issue new shares at time u of an amount, $N(u)$, equal to the change in the nominal value of its capital stock,

$$N(u) = P_K\dot{K} + \dot{P}_K K, \tag{C.1}$$

where P_K denotes the price of capital goods and K the net capital stock.

Assuming geometric depreciation at the rate of δ so that $I = \dot{K} + \delta K$, we have

$$N(u) = P_K I - (\delta - \pi)P_K K, \tag{C.2}$$

where $\pi = \dot{P}_K/P_K$. The flow of new equity capital therefore equals the amount required to finance gross investment minus the amount repaid to the owners to maintain the chosen equity/capital ratio (of unity) as the capital stock depreciates and the price level rises.

In the case of pure *debt* finance, the equation corresponding to (C.2) represents the net change in debt. The two terms appearing on the right-hand side of (C.2) then have a clear interpretation as borrowing to finance new investment and amortization of previously acquired debt to maintain the debt/capital ratio. Such a distinction is obviously difficult to make in the case of new issues, since it is hard to imagine that firms in practice would simultaneously raise and pay back new equity capital. For analytical purposes, however, we may look upon the flow of new share capital to the firm as the *net* of the amount raised to finance investment and the amount repaid to the owners. It is clear from (C.2) that, except for the case $\delta = \pi$, the amount of new share capital raised by the firm $N(u)$, and on which the firm claims Annell deductions, is not equal to gross investment. Let H be the present value of tax savings per dollar of new issue, as defined by equation 4.1 in chapter 4. The equivalent present value of tax savings per dollar of *investment*, A_A, can then be defined as

$$\text{(C.3)} \qquad \int_0^\infty A_A P_K I \cdot e^{-\rho u} du = \int_0^\infty HN(u) \cdot e^{-\rho u} du .$$

Integrating by parts, and assuming $K(0) = 0$, it can then be shown that

$$\text{(C.4)} \qquad A_A = \left(\frac{\rho}{\rho - \pi + \delta} \right) H ,$$

where $\rho/(\rho - \pi + \delta)$ is interpreted as the amount of new issues that "on average" is required per dollar of gross investment. Hence the "net cost of investment," as defined in chapter 2, becomes

$$\text{(C.5)} \qquad 1 - A = 1 - f_1 A_d - f_2 \tau - f_3 g - A_A .$$

Equation (C.4) assumes that fiscal depreciation coincides with economic depreciation. As explained in chapter 4, Swedish tax laws allow firms accelerated depreciation. The deferral of corporation tax brought about by accelerated depreciation is often compared to an interest-free loan from the Treasury. The deferred corporate tax may thus be regarded as a source of finance to the firm.

Let A_E represent the present value of the tax savings from true economic depreciation, taken to be replacement cost depreciation minus the nominal capital gain that accrues on fixed assets (cf. Bergström and Södersten 1981 and King 1977, p. 243),

$$A_E = \frac{\tau(\delta - \pi)}{\rho - \pi + \delta} .$$

The value of actual depreciation allowances may be written as

$$\text{(C.6)} \qquad A = A_E + f_3 g + (f_1 A_d + f_2 \tau - A_E) ,$$

where the last term (in parentheses) may be interpreted as the presented value of the tax savings from accelerated depreciation. The equation for MRR in chapter 2 (setting $w_c = d_2 = 0$ to simplify exposition) becomes

$$\text{MRR} = \delta - \pi + \frac{\rho}{1-\tau} \left[1 - \left(\frac{\rho - \pi + \delta}{\rho}\right)(f_1 A_d + f_2 \tau - A_E)\right] - \frac{f_3 g(\rho - \pi + \delta)}{1 - \tau}. \tag{C.7}$$

To interpret (C.7), consider the case when there is no accelerated depreciation. In this case $f_2 = 0, f_1 = 1$, and $A_d = A_E$. Gross capital cost MRR then equals the rate of change in the nominal value of the asset ($\delta - \pi$) plus the required before-tax net rate of return. This net rate of return is the firm's pretax rate of discount [$\rho/(1 - \tau)$] less the imputed gross return on the investment grant.

As can be seen from (C.7), the effect of accelerated depreciation is to reduce the weight attached to the firm's pretax rate of discount, and this effect has a clear economic interpretation. Consider a hypothetical situation where the Treasury, rather than providing accelerated depreciation allowances, offers to finance a fraction E of the acquisition cost of the investment by an interest-free loan, to be repaid at the rate of true economic depreciation $\delta - \pi$. In order for the firm to be indifferent between this arrangement and accelerated depreciation, E must be chosen such that the present value of the imputed interest on this loan equals the reduction in the present value of tax payments obtained by accelerating depreciation allowances. This condition means that:

$$\int_0^\infty \rho E e^{-(\delta - \pi + \rho)u} du = f_1 A_d + f_2 \tau - A_E. \tag{C.8}$$

Solving (C.8), we obtain

$$E = \left(\frac{\rho - \pi + \delta}{\rho}\right)(f_1 A_d + f_2 \tau - A_E). \tag{C.9}$$

This is exactly the term that appears in our expression for capital cost. E may be regarded as the proportion (in present value terms) of the investment that on average is financed by deferred taxes, and therefore $1 - E$ can be seen as the proportion financed by new equity (or debt or retained earnings).

We may now express the effects of the Annell deduction as

$$A_A = \left[\frac{\rho}{\rho - \pi + \delta}\right] H(1 - E) = \frac{\tau h[1 - e^{-\rho\omega}]}{\rho - \pi + \delta} \left[1 - \left(\frac{\rho - \pi + \delta}{\rho}\right)(f_1 A_d + f_2 \tau - A_E)\right]. \tag{C.10}$$

There is, finally, an empirical problem to take into account when analyzing the effects of the Annell deduction. In practice, few Swedish firms pay dividends on new share capital of as much as 10 percent, which is the maximum rate of Annell deduction. Available data suggest an average dividend yield of 6 percent for firms issuing new shares at the end of the 1970s, implying an Annell deduction of 6 percent after the new issues. It is reasonable to assume, however, that a successively higher rate of deduction—relative to the amount raised by the new issue—can be claimed for later years, since the amount of dividends paid by firms typically increases over time. Our numerical calculations actually assume that, starting at 6 percent, the rate of Annell deduction increases over time at the rate of inflation. A 10 percent rate of inflation means, therefore, that the maximum Annell deduction (10 percent) can be claimed on the sixth year after the new issue (assuming the initial deduction to be 6 percent). The firm then deducts 10 percent annually for an additional six years, after which time the sum of deductions taken equals the amount raised by the new issue. In the case of stable prices the annual deduction of 6 percent is taken for 16.7 years.

The Effects of Abolishing Corporate Income Tax

We examine here the relationship between the corporate tax rate and the tax wedge between savings and investment. Equation (2.17) of chapter 2 may be written as

$$p = \frac{\rho}{1 - \tau}[1 - X] - \pi, \tag{C.11}$$

where

$$X = \left[\frac{\rho - \pi + \delta}{\rho}\right][f_2\tau + f_1 A_d + f_3 g + A_A - A_E]. \tag{C.12}$$

When the sum of the investment grant (f_3g) and the present value of the tax savings from depreciation allowances and so on exceed the tax savings from true economic depreciation (A_E) $X > 0$. If the tax system allows immediate expensing of investment and no further deductions or grants ($f_2 = 1, f_1 = f_3 = A_A = 0$), equation (C.12) simplifies to $X = \tau$. We note also that the abolition of the corporate income tax implies $X = 0$.

For debt finance, the firm's after-tax rate of discount ρ is related to the nominal market interest rate i by equation (2.24) of chapter 2, which is

$$\rho = i(1 - \tau). \tag{C.13}$$

Substituting into (C.11) yields

$$i = \frac{p + \pi}{1 - X_D}, \tag{C.14}$$

where the subscript D signifies that the discount rate ρ takes the value $i(1 - \tau)$. Equation (C.14) defines (in implicit form, since i appears as an argument of X_D) the maximum nominal interest i the firm can afford to pay on a loan acquired to finance an investment project with a pretax rate of return p (say 10 percent).

It is clear from equation (C.14) that if the tax laws provide for accelerated write-off ($X_D > 0$), the abolition of the corporation income tax (making $X_D = 0$) would reduce i. Through the fall in the nominal interest rate i, the posttax return to savings is reduced, increasing the wedge between the pre- and posttax rates of return p and s and therefore the effective tax rate.

In the case of an equity-financed investment project, equation (C.13) is replaced by $\rho = i/\theta$ for new share issues and $\rho = i(1 - m)/1 - z)$ for retained earnings. Since the corporate tax rate τ does not appear in these equations, the effect of abolishing the corporation tax can be inferred directly from equation (C.11). Inverting this equation yields

(C.15) $$\rho = (p + \pi)\left[\frac{1 - \tau}{1 - X}\right].$$

It is immediately clear that only if $X > \tau$ at the outset will ρ, and therefore i, fall as the corporation tax is abolished. Thus only if tax laws allow firms deductions (or grants) that reduce tax payments by more than would immediate expensing will the wedge between the pre- and posttax rates of return p and s (and therefore the effective tax rate) increase upon abolishing the corporation income tax.