o. 155 | October 1995 | Discussion Papers

Statistics Norway
Research Department

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Some Issues About the Norwegian Capital Income Imputation Model

Discussion Papers No. 155 • Statistics Norway, October 1995

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Abstract:
This paper will focus on a particular provision in the Norwegian tax reform of 1992, the imputation of capital income for self employed and small incorporated firms with active owners. A simple user cost model is derived, and this model is used to discuss the impact on investment incentives that stems from imputation of capital income. Within this framework, we discuss potential distortions that stem from certain elements in the Norwegian tax code. The formalised approach allows us to focus more on the assumptions underlying the analysis, and we show that the user cost of capital is dependent of the discount rate. We also use our approach to calculate potential tax wedges. The calculations show that the distortions can be quite large, under realistic assumptions.

Keywords: Cost of capital, self employed, taxes, tax reform.

JEL classification: H21, H25

Acknowledgement: I am indebted to Iulie Aslaksen, Tom Kornstad, Nils Maritn Stølen, Eirik Wærness and especially Erling Holmøy, Diderik Lund and Jeffrey K. Mackie-Mason for valuable comments on a eralier draft. Any remaining errors are due to the author alone.

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1. Introduction

In the previous 10 years many of the industrialised countries reformed their tax systems radically. Norway had officially their tax reform in 1992, although the personal taxation was changed every year from 1987. In 1992 the tax reform was primarily concerned with changes in corporate taxation and the taxation of self employed.

A frequently discussed issue in the tax reform debate, was the so-called «imputation model». The imputation model is a method for dividing income from business activity into a *capital income* part and a *personal income* (or labour income) part. This income split applies for economic agents, that are officially registered as *self employed* or owners of a corporation where one or several of them work actively in the corporation. The income for these agents is a function of labour effort and capital investment. Due to the fact that the total income from this kind of economic activity cannot be easily divided into capital or labour income, and that these types of income are taxed with different tax rates, the tax authorities must find a method for *imputing* the capital income or labour income. A correct division of income must be considered important in Norway, due to the high difference in tax rates on capital and labour income. The highest marginal tax rate for personal income is 52.4 percent while the marginal rate for capital income is 28 percent.

The different aspects about the Norwegian imputation model have been discussed in a lot of articles. Hansen et.al. (1991), Andersen and Sannarnes (1993, 1994a, 1994b) have all discussed different consequences for investment incentives. Sannarnes (1995) presents a portfolio model that focuses on investment incentives and uncertainty. Fagerland (1993) presents different ways to organise the activity under the presence of the imputation model. None of these paper have, however, presented an explicit user cost model[1]. This paper will discuss different investment incentives using the user cost apparatus as a tool. This paper should therefore be considered as a more compact discussion of the different aspects around investment incentives when the capital income imputation model applies. A formal model has at least two advantages over an informal approach. First, a normalisation forces us to focus on the underlying assumptions in the analysis, compared to an informal approach. Second, a formal approach will allow us to calculate tax wedges that can prevail. This property is important because it illuminates the magnitude of distortions, which is not found with an informal approach. The user cost model is an extended variant of the models developed by Bradford (1981) and Boadway (1980). The extension is primarily that a two-rate tax system is introduced. Throughout the

[1] Hansen et.al. (1991) presents some effective tax rates but the model used is not presented.

paper we will mainly use the term self employed, although the tax system applies for both self employed and for small incorporated firms with active owners. The ownership form will in general, however, not influence our results beneath[2].

The paper is organised as follows. The main provisions of the income tax system after 1992 for self employed are described in section 2. The derivation of the model is done in section 3, and in section 4 we discuss how to achieve undistorted investment incentives. Section 5 discusses different provisions in the Norwegian tax code and their impact on investment incentives. In Section 6 we focus on the choice of the discount rate, and give examples of how this choice will change the cost of capital. Section 7 gives some tax wedge calculations based on the user cost model. Section 8 concludes.

2. The Norwegian imputation model

The Norwegian tax system divides income according to source. Income from capital is taxed with a flat tax rate. This is currently 28 percent Income from labour effort or personal income, is taxed with a progressive tax rate. The lowest tax rate for personal income is 28 percent, thus the same rate applies for personal and capital income, but the tax rate can be as high as 52.4 percent when personal income is higher than approximately 250 000 kroner.

The main change for self employed compared to the tax system before the tax reform of 1992 was the definition of the personal income tax base. Instead of allowing interest deductions in the personal tax base, the total income for the self employed is divided in two parts. One part is classified as capital return and this part is taxed at the flat tax rate for capital income. This part is estimated as a capital return rate multiplied with the tangible capital that is used in the activity. The other part, total income minus capital return, is taxed as personal income. The *capital income imputation rate* is equal for all sorts of production, and it is intended to be equal to the market interest rate plus a risk premium. In addition, if the self employed has employees, he/she can deduct a percentage of total labour cost (wages) in the firm. We will not, however, discuss the wage deduction further in this paper. It is useful to formalise a simple tax function for self employed and shareholders with similar characteristics. For simplicity we consider one agent, this allows us to treat these two organisational forms equally for tax purposes. Let $n(k,l)$ denote the income. The income is a function of both capital (k) and labour (l). Total income is taxed with a flat tax rate t^c. The part of total income that is

[2] However, corporations with limited liability can in certain cases be curbed with regard to their use of income, and these restrictions can influence on the user cost of capital. These cases are not considered in this paper. See Kanniainen and Södersten (1995) for a discussion.

classified as labour income is additionally taxed with a rate t^g. In reality t^g is a function of income but throughout the paper we will assume that t^g is flat. This is, of course, a simplification. The personal income tax rate is then equal to $t^c + t^g$ and the total income will in this system be taxed progressively. Depreciation allowances (ρk), where ρ is a depreciation rate, are deducted from $n(k,l)$, and the income after depreciation is the base for the income split. Interest costs (rk) are deductible in the capital income base, not in the personal income base. With this specification of the interest deduction we are implicitly assuming that interest on both equity and debt are deductible. This assumption will be discussed in section 6. We assume that the imputation rate α is an estimate for the normal capital return chosen by the tax authorities. Given this, and the definitions above, we can write the tax as

$$(1) \qquad T^i = t^c\,(n(k,l) - \rho k - rk) + t^g(n(k,l) - \rho k - \alpha k)$$

where T^i denotes the imputed tax.

From equation (1) we see that depreciation allowances have an impact on both the capital and the personal tax base, while the imputation has only an effect on the personal tax base. The major point is, however, that an incorrect estimate of the capital income will give an progressive or regressive taxation of capital. If such a case appears we can express this as «a not intended two rate capital income tax system».

As mentioned above, it will be difficult to actually observe the economic correct capital return. This is due to problems with measuring the economic values of k, ρ and α. If the estimated value of k is different from the economic value the average tax will be incorrect, because both tax depreciation and imputed capital return will differ from the economic value. If we look at a marginal increase in k, and assume that the marginal increase can be valued correctly, the marginal tax will be correct if the imputed marginal capital return (α) is equal to the net capital return and ρ is equal to economic depreciation. Because this paper will focus on investment incentives, the problem of measuring the economic value of k is irrelevant for our purposes as long we are able to measure a marginal increase in k correctly.

3. A discussion of investment incentives

The user cost approach is a widely used concept in analysis of capital taxation. The popularity of this concept is probably due to the fact that distorting effects of any tax system can be analysed with this tool.

The point of departure is a partial equilibrium multi-period model. We assume that the agent runs a profit-maximising price-taking corporation. The individual wants to allocate his wealth in a way that maximises his utility. We assume that the individual can borrow or lend as much as he wants, at the same interest rate, in the financial market. This means that we can concentrate on the investment decision separately, well known as the Fisher separation theorem (Fisher(1930)). The tax rates (t^c and t^g) and the definition of the tax bases are assumed to be constant over time. To keep the model simple we do not discuss the cost of finance i.e. personal taxation, we will solely focus on the cost of capital. This assumption can to a certain degree be defended, because one of the main goals in the Norwegian tax reform was to equate the cost of finance between different financing forms. In section 6 this issue will be discussed in more detail. We also assume that price changes in capital goods are zero.

Assume now that the individual wants to undertake a marginal real investment. In equilibrium we know that the marginal investment cost must equal the present value of the income stream from the investment. The marginal real investment gives a gross return of $n_k\ (k,l)$. If we assume that the marginal capital return can be found given the optimal input of labour, we can denote this return as c. This means that we treat the marginal capital return separately, given the optimal use of labour. The price on the marginal investment is set to q, thus treated as exogenous and assumed constant over time. We assume that capital services from the marginal investment decay exponentially at a rate δ. This means that a unit of age s capital is equal to $e^{-\delta s}$ new units of capital. The nominal capital return at time s is then equal to $ce^{-\delta s}$.

In a world without taxes, which is our reference case, the equilibrium condition will be equal to

$$(2) \qquad q = \int_0^\infty c\, e^{-(r+\delta)s} ds$$

where r is the discount rate. As shown in Auerbach (1983) a direct formulation of the optimisation problem as in equation (2), can also be solved by a more comprehensive dynamic programming problem. Integration of (2) gives our familiar first order condition for optimal investment

$$(3) \qquad c = (r+\delta)q$$

The agent should invest until the marginal return to capital is equal to the interest plus depreciation. An ever easier explanation of equation (3) is that the investor should invest until the net return per krone invested ($c/q - \delta$) is equal to r. If all corporations in an economy followed this investment rule, production efficiency will be achieved, also called a Pareto-optimum in the production. If we believe in such a rule, the goal for a tax system should be to not change this rule.

Let us consider the case where the imputation model applies. If we take the derivative of equation (1) with respect to k we get:

$$(4) \qquad \frac{\partial T^i}{\partial k} = t^c\,(c - \rho - r) + t^g(c - \rho - \alpha)$$

where c is the marginal capital return, i.e. $c = n_k(k,l)$. Equation (4) is the tax on a marginal investment. To get the required return after tax for a marginal investment project we take the present value of the marginal tax and subtract this from equation (2). This gives us the following equilibrium condition

$$(5) \qquad \begin{aligned} q = &\int_0^\infty ce^{-(r+\delta)t}dt - t^c \int_0^\infty ce^{-(r+\delta)t}dt - t^g \int_0^\infty ce^{-(r+\delta)t}dt + q[t^c \int_0^\infty \rho e^{-(r+\rho)t}dt + t^c \int_0^\infty re^{-(r+\beta)t}dt \\ &+ t^g \int_0^\infty \rho e^{-(r+\rho)t}dt + t^g \int_0^\infty \alpha e^{-(r+\lambda)t}dt] \end{aligned}$$

where β is the payment path for interest deductions, and λ is the path for the deduction of the imputed capital income.

The first three integrals on the right hand side represent the present value of the marginal return (c) after tax. The fourth and the sixth integral is the present value of tax saving due to tax depreciation. The fifth integral is the tax saving from interest deductibility and the seventh integral is the tax saving from the imputed capital return. We have in general assumed that interest deductions and deductions for imputed capital return follows different paths than tax depreciation deductions. We will discuss possible paths for these deductions below.

Calculating the integrals gives us the following first order condition for the marginal investment.

$$(6)\qquad \frac{c}{q}=\frac{1}{1-t^{c}-t^{g}}[r+\delta(1-t^{c}-t^{g})-t^{c}r(\frac{r+\delta}{r+\beta}+\frac{\rho-\delta}{r+\rho})-t^{g}r\frac{\rho-\delta}{r+\rho}-t^{g}\alpha\frac{r+\delta}{r+\lambda}]$$

From equation (6) we find that the potential distortions stem from four sources, accelerated depreciation, the payment path of interest, imputation of capital income and the path for the capital income imputation. Equation (6) allows us therefore to discuss several possibilities for undistorted investment incentives when the Norwegian imputation model applies. The parameter values for β, λ and ρ can all be given important economic interpretations; their impact on the user cost of capital will therefore be explored below.

4. Requirements for undistorted investment incentives

Result 1.

When $\beta=\lambda=\rho$ and $\alpha=r$ we do not have any distortions from the tax system on the marginal investment.

The result is easily proved when we substitute α for r and λ and β for ρ in equation (5). Interest deductions that declines with ρ means that the interest deduction is given on the tax depreciated value of the marginal investment.

Result (1) can at first glance seem surprising because it is valid for any tax depreciation i.e. it is valid in the presence of accelerated depreciation ($\rho\neq\delta$). The intuition behind this result is that the interest deduction declines with the tax depreciation rate. The gain from accelerated depreciation is therefore outweighed of the «loss» in the present value of interest deductions due to the fact that they decline with the tax depreciation rate. A similar explanation can be given on the neutrality result that stems from the equality between the imputation rate (α) and the interest rate (r). An imputation rate equal to the interest rate means that the tax base for personal tax and the capital income coincide. Given that the tax bases declines along the same path, the tax system turns effectively into a one base tax system with undistorted investment incentives as a result. This is actually a restatement of arguments given in for instance, Sandmo (1974). If interest deductions are given for the full value of the marginal investment, independent of the financing form, we will achieve undistorted investment incentives.

In some cases one can imagine that interest deductions decline with the economic depreciation rate (δ), because this will be more in accordance with the development of gross return and hence « the ability to pay the interest cost». If this is true we will get the following expression for the optimal investment

$$(7) \qquad \frac{c}{q} = r + \delta - \frac{t^c r}{1 - t^c - t^g}\left[\frac{\rho - \delta}{r + \rho}\right]$$

where we have assumed that $\alpha = r$. This result tells us that accelerated depreciation will lower the user cost of capital, and hence stimulate investment if the interest deduction declines with a rate lower than the tax depreciation rate. The user cost will, on the other hand, be higher than the neutral value if interest cost declines faster than tax depreciation.

Assume that $\beta = \lambda = \rho$, which means that both interest deductions and capital income imputation deductions follows the path of tax depreciation. Equation (5) can then be rewritten as

$$(8) \qquad \frac{c}{q} = \frac{1}{1 - t^c - t^g}\left[(r + \delta)(1 - t^c) - t^g(\alpha + r) - t^g \frac{\rho - \delta}{r + \rho}(r - \alpha)\right]$$

We can use equation (8) to explore the connection between accelerated depreciation and the capital imputation rate. If accelerated depreciation exists and $\alpha \neq r$ we find that an increase in α can be divided into two gross effects. First, a marginal increase in α will reduce the tax and the cost of capital with t^g , because α of the marginal income is evaded from the high tax rate, t^g . On the other hand we find that for given accelerated depreciation an increase in α will reduce the value of accelerated depreciation with t^g (ρ-δ). The reason for this second effect is that the deduction of imputed capital income reduces the tax burden on personal income, that also indirectly reduce the gain from accelerated depreciation, through the tax rate, t^g.

5. A discussion of some provisions in the Norwegian tax code

The model presented can be used to discuss some issues about the capital income imputation model that have been debated in the previous years. When the imputation model was implemented the government allowed corporations to use different types of value assessment of the tangible capital that is used as the base for the capital income imputation. A corporation could in general choose between tax value, book value, a certain percentage of insurance value and several other alternatives. After 1995 a corporation can only choose between tax value and book value. In our setting , λ can be interpreted as the value assessment parameter. If λ is equal to ρ we know from result 1 that the capital income imputation gives neutrality. This gives us result two;

Result 2.

Allowing corporations only to use the tax depreciated value as the base for capital income imputation and interest cost payment entails neutral investment incentives.

The result is intuitive. When $\alpha = r$ and the deduction for the imputed capital return follows the same path as tax depreciation (ρ), there will be no difference between the tax bases in any period. This means that the tax system turns into a one base tax system with no distortions from the imputation as a consequence. It is, however, important to understand the implications of interest deductibility. This result will only hold if interest on both equity and debt are deductible, see for instance Sandmo (1974). However, interest deductions are only given on the face value of debt which implies non-neutrality if some of the marginal investment is financed by equity.

As pointed out above, corporations are allowed to use other valuation principles. If we assume that a corporation uses book value assessment, the parameter λ is equal to δ (given that book value equals economic value). Assuming that α is set equal to r we get two different expressions for the required pre tax rate of return (user cost of capital).

a) $\beta = \delta$

$$(9) \qquad \frac{c}{q} = r + \delta - \frac{(t^c + t^g)r}{1 - t^c - t^g}\left[\frac{\rho - \delta}{r + \rho}\right]$$

b) $\beta = \rho$

$$(10) \qquad \frac{c}{q} = r + \delta - \frac{t^g r}{1 - t^c - t^g}\left[\frac{\rho - \delta}{r + \rho}\right]$$

In case a) we find that the user cost of capital is reduced due to two effects. First, payment of interest following the economic depreciation increases the present value of interest deductions compared to the case where interest deductions follow the tax depreciation path. Second, using book value as the base for the capital imputation gives a similar increase in the present value of the capital income deduction. Both effects reduces the effective taxation of capital income and distorts investment. In case b) only the second effect will prevail because interest deductions follows the tax depreciation path. Case b) will therefore distort investment incentives only through the capital imputation and give smaller distortions than case a).

A way to achieve neutral investment incentives even when corporations are allowed to use different paths to impute capital income is to connect different capital income imputation rates to the different paths. If a corporation uses book value assessment, the tax authorities can connect a capital income imputation rate equal to $\alpha^{BOOK} = \alpha((\delta+r)/(\rho+r))$. Using a adjusted rate will give neutral investment incentives even in the presence of different assessment of the capital return base.

6. The choice of the discount rate

Will the choice of the discount rate give different expressions for the user cost of capital? In the above analysis r is chosen as the discount rate, and at the same time we deduct r from the base for capital taxation. In some papers, however, it is common to use interest after tax as a discount rate and at the same time not allow for deductions of interest costs in the tax base. Sandmo (1974), Boadway (1980) uses the first approach while Bradford (1981) uses the other approach. As Biørn (1988) points out, these approaches are not equivalent. He does not, however, discuss this issue further. In this section we will do an attempt to clarify the differences and the similarities between these two approaches, and connect it to the above presented model.

The choice of the discount rate is in reality a function of finance structure of investments, the pay-out policy and the personal and corporate tax rates. A starting point in deciding the correct discount rate is to use the fundamental arbitrage condition for equilibrium in the capital market, see for instance Goulder and Summers (1989).

$$(11) \qquad r(1-m) = \frac{c(1-\tau)(1-m) + (1-z)dV}{V}$$

where V is the value of the corporation, c is the gross pay out or dividends, m is the personal tax rate, z is the capital gains tax rate and dV is the increase in the value of the corporation. For simplicity we have neglected risk. Equation (11) tells us that the gain after tax from investing a krone in a corporation should be equal to the gain after tax from bank saving. To compare our approach above with this arbitrage approach we need to redefine some of the parameters in (11). Let the value of the corporation (V) be equal to q. This means that we can consider the value of the corporation equal to the value of the marginal investment. Assume further that we have no double taxation of the pay out from the corporation ($\tau = 0$) and a zero capital gains tax ($z = 0$). For easy comparison we will set m equal to t^c, which is true in the Norwegian tax system after 1992. Under these assumptions we get the following arbitrage condition

$$(12) \qquad r(1-t^c) = \frac{c(1-t^c)+dq}{q}$$

In this setting we can interpret c as the cost of capital i.e. the required rate of return from a marginal investment. Let us assume, for simplicity, that the increase in the price of capital goods is zero ($dq = 0$) and the investment price q is equal to 1. In addition we assume that the marginal investment has an economic depreciation at a constant rate δ in every period. This gives us the following condition

$$(13) \qquad r(1-t^c) = c(1-t^c) - \delta$$

From equation (13) it is easy to see that if depreciation is deductible in the tax base, equation (12) reduces to equation (3) for $q = 1$. Equation (13) is therefore a suitable starting point for a discussion of the discount rate in our analysis. Assume that the investment is financed by debt and that economic depreciation and interest cost is deductible in the tax base. The net return after cost and taxes from the marginal investment is $c - \delta - r - t^c (c - \delta - r)$. In equilibrium we have

$$(14) \qquad c - \delta - t^c(c - \delta - r) = r$$

The left hand side is the net return after tax and this return must be high enough to cover the interest expenses. It is also possible to interpret the left hand side in (13) as what you at least must require from a marginal investment after tax to earn the gross interest rate. The left hand side is a required income stream and this should therefore be discounted with r, the required return. The assumption in this analysis that defends the use of r as a discount rate is that the marginal investment is fully financed by debt, or that interest cost can be deducted for the full value of the marginal investment. This means that the corporation can deduct interest from both debt and equity capital. The above analysis rests therefore on the rather strong assumption that the marginal investment is fully debt financed or that the tax system does not discriminate against equity capital.

In many analysis about taxation it is common to assume that the marginal investment is financed by equity (rententions), and no explicit treatment of interest deductions in the tax base. If t^c is the tax rate on bank returns, it will in this case be proper to use $r(1-t^c)$ as a discount rate. Using $r(1-t^c)$ instead of r as a discount rate will, however, not give the same cost of capital. To understand this we can substitute $r(1-t^c)$ for r in equation (5) and not deduct the interest cost in the base for the corporate tax. Explicit integration and some calculations gives

$$(15) \qquad \frac{c}{q}=\frac{1}{1-t^c-t^g}\{(r+\delta)(1-t^c)+t^g(\alpha+r)-\frac{\rho-\delta}{r(1-t^c)+\rho}[(t^c+t^g)r(1-t^c)-t^g\alpha]\}$$

Equation (15) should be compared with equation (8). The difference between these equations is small but significant. Especially the impact from the accelerated depreciation is different. From equation (15) we find that accelerated depreciation will exist whenever the capital imputation rate α is different from the discount rate $r(1-t^c)$, even when the personal tax rate t^g is zero. From equation (8) we find that we will not have any impact from accelerated depreciation through the capital income tax rate t^c, when interest costs are deductible and the payment follows the tax depreciation path. The reason for the difference is that interest costs, following a tax depreciation path, cancels the increase in the present value due to accelerated depreciation. This effect cannot be found in equation (15) because we do not have any explicit treatment of interest expenses, i.e. that the cost of equity capital is not deductible in the tax base. The implicit assumption in equation (15) is that payment of interest cost declines with the economic depreciation rate, this increases the present value of interest deductions that will give the self employed a gain from accelerated depreciation even when the capital imputation rate is equal to the interest rate.

7. The imputation model and tax wedges. Some examples

A tax wedge is the difference between the required return before tax and the required return after tax. If the wedge differs from zero, the tax system can be characterised as non-neutral. The size of the tax wedge can give us an exact measure of the potential distortions and such calculations can therefore be helpful, especially in political decision processes[3].

[3]For more about the tax wedge literature, see King and Fullerton (1984) and Jorgensen and Yun (1989). Hagen (1988), has made tax wedge calculations for the Norwegian tax system.

Equation (6) in section 3 is the point of departure. We present two graphical illustrations where t^g varies from zero up to 24 percent, which is equal to the highest marginal tax rate on personal income in Norway. In the first illustration (figure 1) tax depreciation rate is also varied. We assume that the market interest rate and depreciation rate both are equal to 8 percent. The capital income tax rate (t^c) is set to 28 percent, equal to the actual capital income tax rate in Norway. We assume further that the imputation rate is 8 percent. With these assumptions we find that the investment neutral required rate of return is equal to 16 percent.

Figure 1 shows clearly that when tax depreciation equals economic depreciation the tax wedge will be zero, for all tax rates. However, we will have distortions when the payment path of interest expenses not follows the tax depreciation path, even when the personal tax rate (t^g) is zero. For the highest personal tax rate we find that distortions due to accelerated depreciation can raise or lower the required rate of return with around +-5 percentage points.

Figure 1. **Distortions due to accelerated depreciation under variable personal tax rate. Figures in percent/100.**

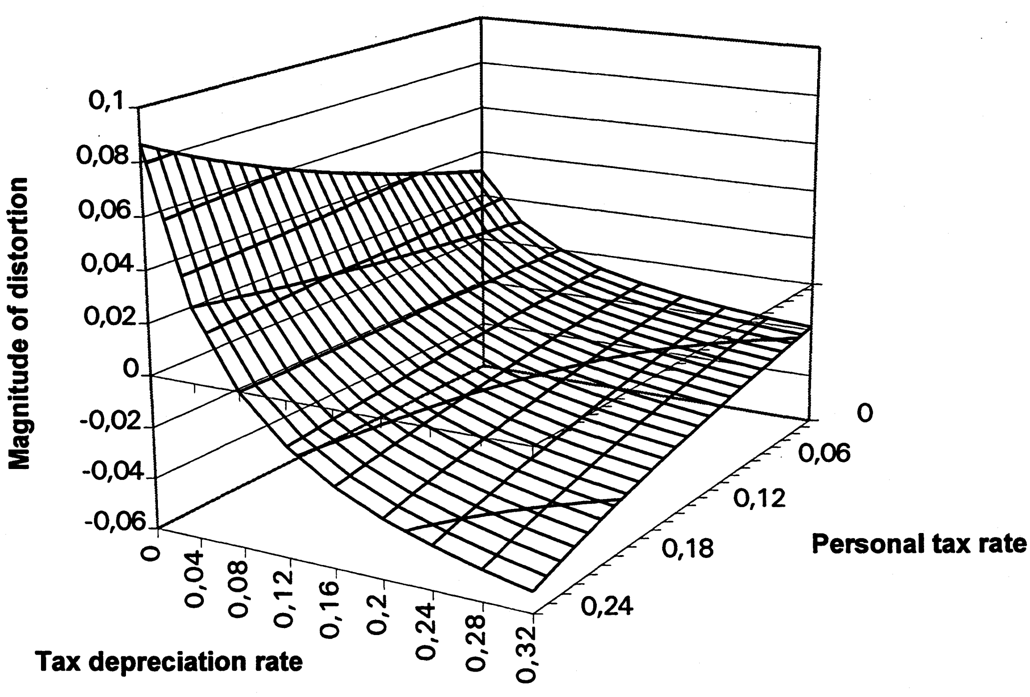
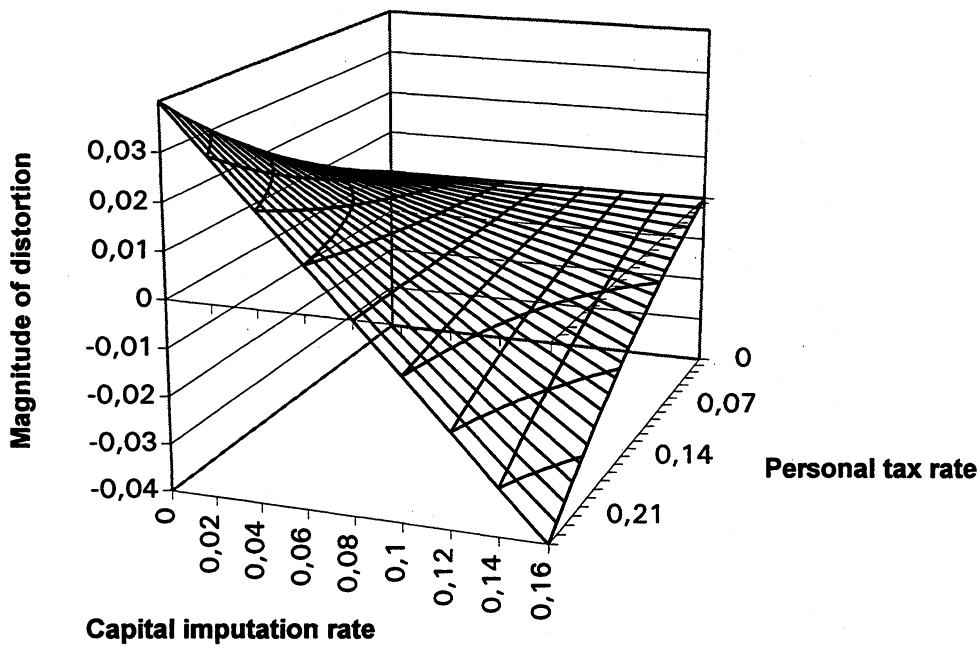


Figure 2. **Distortions due to difference between the capital imputation rate and the discount rate. Figures in percent/100.**

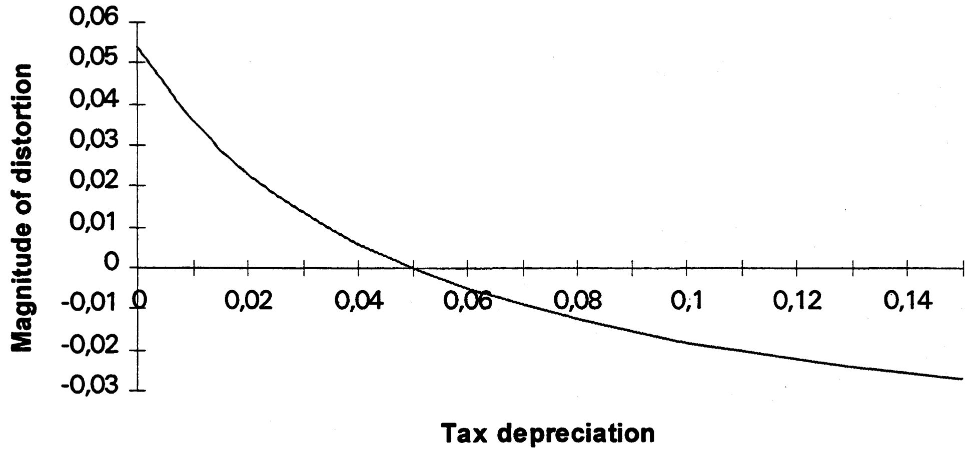


It may also be interesting to see how the required rate of return changes under variable imputation rates. Figure 2 depicts the departure from neutrality when the imputation rate and the personal tax rate are varied. To ease the interpretation of figure 2 we keep accelerated depreciation to zero. Other assumptions are as before.

When t^g is equal to zero, we have, of course, no distortion of the investment incentives. Figure 2 shows further that an imputation rate equal to the market interest also give investment neutrality, or more correctly, an imputation rate equal to the discount rate gives no distortion. If the imputation rate is lower than the market interest rate the required rate of return is higher compared to the investment neutral case, and lower when the opposite prevails. The distortion is symmetric around the neutrality path and increasing in t^g. The maximum size of the tax wedge is in figure 2 equal to about 4 percentage points or about 25 percent of the neutral required rate of return.

It is also interesting to take a closer look at the potential distortions that can prevail when book value is used as the base for the capital imputation deduction. As pointed out above, a capital income imputation deduction following the tax depreciation path will not give any distortions. Figure 3 presents an example on the magnitude of distortions given that both economic depreciation and the interest rate are set to 5 percent. We further assume that the personal tax rate (t^g) is 24 percent, the

Figure 3. **Distortions due to different paths between tax depreciation and capital imputation deductions. Figures in percent/100.**



payment path for interest follows economic depreciation. Under these assumptions we will have undistorted investment incentives when tax depreciation is 5 percent. This neutral case appears in figure 3 when the «distortion» line crosses the x-axis.

The magnitude of the distortions can be quite substantial if the book depreciation rate differ much from the tax depreciation rate. The cost of capital will be higher than the «neutral» level when tax depreciation is less than economic depreciation and lower when the opposite prevails. When tax depreciation is lower than economic depreciation, the present value of the capital imputation deduction is lower when the economic depreciation path is used, compared to a case when tax depreciation path is used. This raises the cost of capital above the «neutral» level. The opposite case prevails when tax depreciation is higher than the economic depreciation. For instance, when tax depreciation is 10 percent, the required rate of return is two percentage points lower when book value is used compared to a case where tax value is used.

8. Concluding remarks

This paper have presented a simple user cost model that discusses some of the potential distortions that can prevail when the Norwegian capital imputation model applies. The distortions are in general due to two characteristics in the tax system. These are the definition of the deductions in every period and the «payment path» of the deductions. The definition, or the assessment of the different tax parameters, decides the magnitude of the «within period distortion». In our case the magnitude of the distortions are the difference between capital imputation rate (α) and the discount rate (r) and the difference between the tax depreciation rate and the economic depreciation. The payment path distorts investment because they have an impact on the present value of the deductions. Tax wedge calculations show that the distortions can be quite large if the personal tax rate is high. However, compared to some of Hagen's (1988) tax wedge calculations the potential distortions found in this paper must be considered as small.

This analysis rests, however, on a lot of more or less restrictive assumptions. First, risk is not considered. Second, the financing of investment is taken as exogenous in the analysis. Third, the model is only of partial equilibrium character. We have to consider these assumptions as restricting, but it is more interesting to ask if the results in this paper will change significantly if these assumptions had not been made. It is, however, outside the scope of this paper to discuss these issues further.

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ISSN 0803-074X

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