Article

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Designing Net Asset-Based Income-Splitting Rules under Dual Income Tax

Abstract: This article revisits the income-splitting regulations within the Nordic dual income tax framework. These regulations were introduced to counteract the inclination to transfer income between labor and capital income tax bases. They involve imputing a return on equity, considered as capital income, and taxing the residual portion at rates similar to those imposed on labor income. There are primarily two methods for computing imputed capital income. One method involves imputing a return based on the shares' acquisition price (implemented in Sweden and Norway), while the other calculates a return using the net book assets of the company (utilized in Finland). This study examines the economic implications of the net asset-based splitting approach, an area not extensively explored in earlier literature. Our findings suggest that with appropriate selection of tax-parameter values, the net asset-based splitting system embodies the fundamental characteristics of a neutral corporate tax system akin to the ACE corporation tax. Consequently, our analysis indicates that the issues regarding incentive concerns in the Finnish taxation of closely held companies, highlighted in previous studies, stem more from erroneous parameter values rather than flawed underlying principles.

Keywords: Dual Income Tax; Income-splitting; Neutral Taxation; Investment; Depreciation Allowances

JEL Classification: H21; H24; H25; H32

1 Introduction

Over the past few decades, the Nordic dual income tax (DIT) has been discussed as a blueprint for tax reform in numerous European countries and beyond.[1] DIT stands out for its systematic segregation of capital income taxation from other income types. Capital income, known for its higher mobility, faces a lower flat tax rate, while other less mobile income types usually adhere to a traditional progressive tax structure. As such, this model aligns with the principles outlined in optimal tax theory.

It is widely acknowledged that a key challenge when implementing a DIT system revolves around handling the business income of entrepreneurs who are actively involved in their ventures and have significant investments there.[2] The specific issue varies based on the organizational form. For closely held companies (CHCs), the concern centers on preventing owner-managers from misrepresenting their compensation as more favorably taxed capital income. Nordic countries addressed this income-shifting dilemma by splitting entrepreneurs' income into capital and labor components. This method involves initially computing an anticipated return on the equity invested in the enterprise (normal return), designated as capital income, and subjecting the remaining compensation (excess return/dividends) to progressive labor income taxation.

The existing rules governing the splitting of income acquired from closely held companies essentially encompass two distinct approaches.[3] In Sweden, the normal return in an owner's income is computed based on the

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[1] DIT was first implemented by the three Nordic countries Sweden, Norway, and Finland in the early 1990s (Sørensen 1994). Variants of DIT have been proposed by Spengel and Wiegard (2004) for Germany, Keuschnigg and Dietz (2007) for Switzerland, Sørensen (2007) for Canada, Sørensen and Johnson (2010) for Australia, and Kleinbard (2010) for the USA. Meanwhile, dualistic aspects have become increasingly common, particularly in Europe in the form of low final withholding taxes on certain types of capital income.

[2] See, for example, Sørensen (1994), Boadway (2004), and Selin (2021).

[3] By "income splitting" we refer to the method where an imputed return on equity (normal return) is taxed effectively at the rate of capital income, and the residual of dividends at higher rates. We also use the phrase to cover the current

initial purchase price of the company's shares. Norway subsequently adopted this rule in determining the rate-of-return allowance (RRA), a pivotal component of its extensively debated shareholder model (e.g. Sørensen, 2005; Griffith et al., 2010; Mirrlees Review, 2011; Södersten, 2020). Conversely, the alternative approach calculates the normal return part by estimating the return on the *net assets* detailed in the firm's financial accounts. Finland adopted this model for its 1993 tax reform.[4] The primary *goal* of the splitting rules is to constrain attempts by entrepreneurs in CHCs to report all their remuneration as capital income. Besides this goal, the designers of the Nordic systems endeavored to find solutions that would avoid possible unintended side effects, particularly distortions to firms' investment and financing decisions. Indeed, one key question in economic research has been how the various designs fare from an efficiency point of view.

Numerous studies have argued that the purchase price approach (as adopted in Sweden and Norway) is theoretically consistent and may yield neutral taxation along several margins. For example, Södersten (2002) and Lindhe et al. (2004) argue that using the purchase-price split makes it possible to align the investment incentives of CHCs with other types of companies. Studies focusing on the Norwegian shareholder model have argued that if the RRA allowance is calculated using an appropriately chosen imputed rate of return, the present value of future allowances would mirror the initial investment (Sørensen, 2005). This implies that, similarly to the Allowance for Corporate Equity (ACE) and the cash-flow corporate tax, the shareholder model is also neutral with respect to investment and financing decisions.[5] Additionally, it is argued in the literature that certain other aspects of the RRA allowance make the tax system neutral with respect to the timing of realizations of capital gains, and therefore remove the lock-in effect associated with standard capital gains taxes (Sørensen, 2005; Lindhe and Södersten, 2012). Södersten (2020) extends the neutrality results by

illustrating that the RRA model does not affect the choice between the two primary sources of equity funds: issuance of new shares and retained earnings.

Södersten (2002) provides a theoretical argument for why the acquisition cost of shares is an appropriate choice for the capital base in a tax system, where, as in Sweden, equity returns are generally subject to double taxation. It is because the possibly high, progressive labor-tax rate on excess dividends does not affect the cost of capital of investment financed by retained profits. The so-called trapped equity effect abolishes the impact of dividend taxation. The firm's cost of capital, instead, depends on the personal tax rate on capital gains, which is in line with the double tax norm.

In contrast to splitting systems reliant on purchase-price considerations, scholars such as Lindhe et al. (2002, 2004), Hietala and Kari (2006), and Kari and Karikallio (2007) posit that the Finnish tax regulations concerning CHC owners lead to distortions in their decisions regarding investments and financing. They claim that the cost of capital varies between firms depending on the marginal tax rate on labor income, and may, in extreme cases, even be negative. Additionally, the Finnish system has been found to include possibilities enabling the artificial inflation of net assets through certain arrangements in corporate group structures. Harju and Matikka (2016) and Koivisto (2021) provide evidence of income-shifting among CHC owners in Finland.[6]

These studies seem to have led to a prevailing understanding that a purchase price-based split is the ideal way to calculate the normal return part of shareholder income, and that the net asset method practiced in Finland does not rely on similar sound principles. However, in an applied policy analysis contribution, a Finnish tax committee argued that the system could achieve approximate neutrality through relatively minor adjustments (Ministry of Finance, 2010). Similarly, Selin (2021), in evaluating the Swedish splitting rules, found merit in the Finnish approach. Selin prefers the Finnish system to the Swedish one but does not suggest such a reform due to the transition costs from the current system. Selin also highlights that the Finnish approach more accurately mirrors the actual activity of the firm compared to the Swedish one.

Norwegian approach to the taxation of dividends despite its specific features.

4 For further details of Finnish, Swedish and Norwegian income-splitting systems, see Appendix 1.

5 Observe that the neutrality norm differs between the studies. While for Sørensen (2005) (and this study) it is full neutrality with respect to investment, i.e., the independence of the cost of capital of tax parameters, in Lindhe et al. (2004) the norm is equality of investment incentives between CHCs and widely held companies.

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6 Alstadsaeter and Jacob (2012, 2016) and Thoresen and Alstadsaeter (2010) study income-shifting in the Swedish and Norwegian DIT systems, respectively.

To reconsider the issue, we set up a dynamic investment model to analyze the incentive properties of the net asset-based splitting system. We compare our results to two benchmarks: the generalized cash flow tax of Boadway and Bruce (1984) (GCFT) and the equity allowance by Devereux and Freeman (1991) (ACE). Both papers show that a corporate tax system based on an imputed-income method may have wide neutrality properties. Numerous subsequent studies have expanded on these findings, exemplified by works such as those by Fane (1987) and Bond and Devereux (1995, 2003). These studies have shown, for instance, that a tax on business profits can be designed to achieve neutrality in terms of investment decisions, wind-up considerations, and default outcomes, under uncertainty and bankruptcy risk.

Interestingly, while GCFT and ACE are corporate tax systems and the net asset-based splitting model is a shareholder-level tax system, these two approaches have clear similarities in their principles and operation. Both aim to calculate the opportunity cost of investments and either exempt it (GCFT and ACE) or subject it to a low tax rate (splitting system).

One further useful aspect of GCFT and ACE is that, besides granting neutral treatment of some key business decisions, they make the fiscal depreciation rules unimportant in tax policymaking. This is useful as it liberates tax policymakers from expending efforts on crafting depreciation rates geared toward minimizing distortions. Moreover, devising fiscal depreciation rules tends to be inherently imprecise.

The fact that DIT taxes all forms of capital income at a relatively low nominal rate does not address the potential problems caused by economic double taxation resulting from profits being subjected first to corporate tax and then to personal tax on capital income. Neutral treatment may be deemed to warrant some arrangement for reducing the excess taxation of corporate-source income. Indeed, Sørensen's (1994) streamlined version of DIT includes full relief from double taxation. In their current practices, Finland and Norway eliminate double taxation of normal dividends, while Sweden runs a minor relief (see Appendix 1).

The public economics literature suggests that double tax relief has much to recommend it in a closed economy, but, as argued by Boadway and Bruce (1992) and Fuest and Huber (2000), much less in a small open economy context, where the marginal shareholder may be a foreign investor. In a Nordic debate, Lindhe and Södersten (2012) have claimed that Norway's RRA allowance mostly affects the savings patterns of individual Norwegian investors and has little, or even negative, impact on corporate investment. Sørensen (2014, 2022) is more optimistic and argues that in cases where investors who do not have well diversified portfolios and invest in shares that are not publicly traded, domestic shareholder-level tax rules affect the investment and financing of such firms. NOU (2022) adopts this view and proposes keeping the RRA allowance and making it even more generous by allowing a slightly higher imputed rate of return. In this paper we study the effects and design of the net asset-based splitting system in a closed economy context and leave questions related to its optimality in an open economy setting for future research. One such question might be whether the current coverage of the Finnish splitting system (all shareholders of all non-listed firms) is too broad for a small open economy.

Our analysis shows that under rather mild assumptions concerning the tax parameters, the model satisfies many of the neutrality properties of GCFT and ACE. One noteworthy property is that, in contrast to the Norwegian RRA but like ACE and GCFT,[7] the net asset-based imputed income method does not require aligning fiscal depreciation with economic depreciation. Therefore, distortions in the allocation of capital caused by inappropriately set depreciation rates should not be a worry in this system. We conclude that the shortcomings observed in the past and current Finnish net asset-based system do not stem from their underlying principles but rather from an inadequate choice of parameter values, particularly concerning the imputed rate of return.

Our primary focus is on how a net asset-based splitting system should be designed to achieve neutrality with respect to investment decisions. The key issue is how to calculate the normal return part of the owner's remuneration subject to the relatively low tax rate. Therefore, questions about how excess remuneration is taxed, and in what form it is withdrawn, are of secondary importance. We simply assume that excess income is subject to taxation at a rate that is higher than or equal to the uniform capital income tax rate and may be proportional to or in the top MTR of a progressive schedule. Setting the focus this way implies that we abstract from some but not all forms of income-shifting. However, as will be debated

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[7] Sørensen (2005) refers to this limitation of the RRA allowance (pp. 793-4). His statement is informal, but it is straightforward to show that it is correct.

later in the discussion section, our results also have important implications for some forms of profit-shifting, particularly for those related to the allocation of the entrepreneur's remuneration into normal return and excess income parts.

The subsequent sections of this paper are structured as follows: Section 2 presents the analysis of the incentive properties associated with the net asset-based imputed income method. Section 3 provides a comprehensive discussion, and section 4 is the conclusion.

2 Net asset-based splitting system in a dynamic model

This section is composed as follows: After introducing our model in section 2.1 we show the neutrality properties of a net asset-based splitting system assuming a combination of tax rates, which allows us to use the straightforward approach by Boadway and Bruce (1984) (simple case, section 2.2). Section 2.3 extends the analysis by providing the conditions for neutrality for a more general tax system. Section 2.4 considers these properties in selected special cases with links to real-life applications and section 2.5 discusses the implications of the results for reforming the Finnish tax system.

2.1 Model

Consider a model where an all-equity CHC maximizes the present value of the revenue flow to its shareholders net of taxes and issues of new equity, while taking into account both firm-level taxation and individual-level taxation. The CHC has no access to international equity markets and is therefore dependent on financing provided by domestic investors.

The firm produces using capital as the only input and finances from retained profits and new equity Q. Its operating profit is denoted by $\pi(K)$ and it spends the accruing resources on dividends D, investment I, and corporate taxes T_f. The firm's budget constraint is

$$\pi(K) + Q = D + I + T_f \qquad (1)$$

The profit function is strictly concave ($\pi'(K) > 0$ and $\pi''(K) < 0$). Debt financing is ruled out and all prices are normalized to one in our calculations.[8] D and

Q are both chosen to be non-negative. The lower boundary for Q implies that the CHC cannot distribute profits through repurchases of shares. This constraint is not grounded in current regulations, rather it is an assumption chosen to simplify the analysis. However, the actual practice among Nordic CHCs supports it. Such firms rarely buy back shares. They usually have a small stock of initial equity, collected at the time the firm was set up, and a larger stock of accumulated profits.

Observe that the model contains one single means to remunerate the owner, profit distributions, D, paid out from after-tax profits. This is in contrast with some previous papers on the Nordic DIT, which have carefully modelled the differences in the tax treatment of wages and dividends and allowed the firm to choose the tax-optimal way to remunerate the owner (Lindhe et al., 2002; Hietala and Kari, 2006; Koivisto, 2021). In our model, D can be interpreted to represent the tax-optimal remuneration channel with its personal-level tax rate, defined below, summarizing all relevant tax consequences arising from that choice.

We allow for the firm's fiscal depreciation to differ from its economic depreciation. The firm's capital stock, K, depreciates at an exponential rate δ, while the accounting stock of capital, A, depreciates at an exponential rate α (fiscal depreciation), which may differ from δ. The equations of motion for capital and the accounting stock of capital read as follows:

$$\dot{K} = I - \delta K \qquad (2)$$

$$\dot{A} = I - \alpha A \qquad (3)$$

Corporate taxes are paid on profits after fiscal depreciation. By denoting the corporate tax rate by τ_f, the corporate tax reads as follows:

$$T_f = \tau_f [\pi(K) - \alpha A]. \qquad (4)$$

We do not rule out the CIT tax liability from being negative, which can be interpreted to imply that a full loss offset is available in one way or another. This assumption departs from practices in most actual tax systems, which commonly allow losses to be carried forward but still falls short of full loss-offset. Hence, our model is quite stylized in this respect.

To model owner-level taxation in a simple form, let us assume that tax is paid on dividends at the rate

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8 Debt financing might provide additional interesting insights, but in this paper our focus is on the effects of income-splitting

on investment incentives, not on the choice between debt and equity.

τ_d and on all other forms of capital income at the proportional effective rate τ_c.[9] The tax rates generally satisfy $\tau_d = \tau_c \geq \tau_f$.[10] In our model there is another difference between the tax treatment of dividends and other types of capital income. An equity allowance, iA, is deducted from dividend income.[11] Here, i is called the imputed rate of return (or normal rate of return) and A is the accounting stock of capital. Thus, the tax on dividends reads as follows:[12]

$$T_D = \tau_d \left(D - iA \right). \qquad (5)$$

We allow the base of the dividend tax to be positive or negative.[13] Again, this means that full loss offset is provided either by crediting the negative tax liability or, more conveniently, by allowing carry-forward of unutilized allowances with interest. This assumption implies that taxation is symmetric with respect to profits and losses. Observe that while both Sweden and Norway have carry-forward rules in their dividend tax systems, Finland does not allow any unutilized dividend allowances to be carried forward. Hence, our model draws a very stylized picture of the Finnish splitting rules in this respect.

We will return to this topic in the discussion section and deal with several issues such as: Why is symmetric tax treatment of income important for neutrality? How does this aspect tend to affect the design of other

aspects of a neutral tax system? And what are the likely implications of the Finnish practice of not allowing carry-forward?

Dividend income net of taxes is hence:

$$D_{Net} = D - T_D = (1 - \tau_d) D + \tau_d iA. \qquad (6)$$

The value of the firm, V, is determined by the following no-arbitrage condition

$$(1 - \tau_c) rV = D_{Net} + (1 - \tau_g)(\dot{V} - Q),$$

where r is the market rate of interest, which is determined in the world capital markets and its level is therefore given in the domestic economy. τ_g is the accrual-equivalent tax rate on capital gains satisfying $\tau_g < \tau_c$, and $\dot{V}$ is the rate of change of V with respect to time. The condition requires that in equilibrium the shareholder is indifferent between holding shares or exchanging them for bonds yielding the after-tax return $(1 - \tau_c)r$. We can now write the objective of the value-maximizing firm as follows:

$$\max_{\{D, Q\}} V_0 = \int\limits_0^\infty [\gamma D_{Net} - Q] e^{-\rho t} dt \qquad (7)$$

where $\gamma = \frac{1}{1-\tau_g}$, and $\rho = \frac{1-\tau_c}{1-\tau_g} r$ is the firm's after-tax discount rate. Hence, the firm maximizes the revenue flow from the firm to the owner net of taxes and new equity issues.

2.2 Simple case ($\tau_d = \tau_c = \tau_f$)

We start the analysis by considering a streamlined version of DIT, where:

- the personal tax rate on capital income is proportional and aligned with the corporate tax rate, $\tau_c = \tau_f$
- the excess-return part of dividends is taxed at the proportional rate (τ_d) that equals the common capital and corporate income tax rates, $\tau_d = \tau_c = \tau_f = \tau$
- the normal return part of dividends is calculated using net assets as the asset base, and this income is tax-exempt at the shareholder level

These properties mostly satisfy the characteristic features of the prototype DIT system outlined in Sørensen (1994) and discussed in Appendix 1. The only deviation is that τ_d is proportional instead of being determined by the progressive tax schedule for labor

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9 This means that the effective tax rate on capital gains is the same as the standard rate on capital income. Even if many related studies have chosen the effective tax rate on capital gains to be lower, we choose these to be the same since this choice provides simpler calculations and is still capable of illustrating our main conclusion.

10 The case $\tau_f > \tau_c$ is excluded as it is contrary to the principles of the Nordic DIT. One of the original ideas of DIT was to set $\tau_c = \tau_f$ to establish neutral taxation different forms of capital income. Later Sweden and Finland departed from this principle by reducing τ_f below τ_c, justifying this change broadly by the relatively high mobility of investment and firms.

11 In the net asset-based splitting system the normal return on equity is calculated as a return on the firm's net book assets (total assets minus debt). As we are considering an equity-financed firm, debt-financing is not included in our model, which implies that the value of the firm's equity capital equals its accounting stock of capital (A).

12 This means that the tax rate for the dividends under the equity allowance is zero. We relax this assumption in section 2.3 below.

13 Note that even if we allow for the tax bases to be negative, the steady-state solution to our deterministic model implies that neither the corporate nor the dividend tax base is negative. This results from the concavity of the profit function.

income.[14] In this section we insert this simple tax rate constellation in the previous section's model and use the approach of the influential article by Boadway and Bruce (1984) to derive the conditions under which this tax system shows neutrality with respect to various decisions of the firm.

There are at least two innovations to be highlighted in the Boadway and Bruce (1984) study. First, they assume that the opportunity cost of investment that they propose is deducted from corporate profit and is calculated based on the value of the assets in the fiscal accounts. Using the asset values after fiscal depreciation reported in financial accounting makes the results applicable to the real world. Another innovative and interesting aspect they show is that with an appropriately chosen imputed rate of return the system satisfies neutrality and also removes the distortions arising from differences between fiscal depreciation and economic depreciation.

One convenient aspect of the analytical approach of Boadway and Bruce (1984), which we utilize in this section, is its simplicity. The conditions for neutrality are obtained by first writing an expression for the value of the firm and then considering under what conditions the expression is reduced to equal the corresponding condition in an environment with no taxation. We show, using the streamlined tax rate constellation defined above, that this approach is pertinent and gives a condition for the size of the imputed rate of return (splitting rate) that realizes the desired neutrality properties.

While this subsection derives the conditions for investment neutrality following the (simple) approach by Boadway and Bruce (1984), the result is extended to more general cases in the next section. Regarding the simple case, our result is captured in Proposition 1.

Proposition 1 (Simple Case). The (Finnish) income-splitting tax system described in section 2.1 has the same investment neutrality property as the business tax plan introduced in the Boadway and Bruce (1984) model in cases where the investment is made from retained earnings and the tax rates on dividends, capital income and corporate income are the same ($\tau_d = \tau_c = \tau_f = \tau$), and the imputed rate of return is i $= (1-\tau)\rho$.

Proof: see Appendix 2

Hence, under certain conditions concerning the tax rates and the imputed rate of return, the net asset-based splitting system becomes neutral with respect to the firm's investment decision. In this simple model the system is in fact equivalent to the ACE corporation tax. Therefore, it also exhibits ACE's well-known property that fiscal depreciation rates have no effect on investment (Boadway and Bruce, 1984, and Devereux and Freeman, 1991).

Observe that in our model ρ depends on tax rates, $\rho = \frac{1-\tau_c}{1-\tau_g}r$, implying that the cost of capital is not entirely independent of tax rates. However, if capital gains were taxed on an accrual basis either generally or in the margin, then $\tau_g = \tau_c => \rho = $ r. Therefore, the possible non-neutralities are linked to the tax treatment of capital gains, not to corporate taxation or the splitting system. If $\tau_g = \tau_c$ is achieved using accrual taxation or some other means, the tax system of Proposition 1 can be shown to be neutral also with respect to the choice between new share issues and retained earnings.

In the following sections we will develop the results further and give interpretations for the results.

2.3 General case ($\tau_d \geq \tau_c \geq \tau_f$)

Above we employed a methodology similar to Boadway and Bruce (1984). Even if this allows us to derive the optimal conditions in a convenient way, it still has its own restrictions, and while the neutrality conditions become more complicated, it is better to use other tools. In what follows we generalize the above result, derive an additional result regarding the effects of fiscal depreciation allowances and provide the intuition and reasoning behind the results. For this we need to augment the model and employ dynamic optimization.

One important aspect of the tax system in the previous section was that the corporate tax rate (τ_f) coincided with the general tax rate on capital income (τ_c). At the same time, the normal return part of dividends was tax-exempt in the hands of the shareholder. These features were also key aspects of the prototype model of DIT defined in Sørensen (1994) and they are still retained by Norway in its DIT application.

The key novelty of the tax system in this section is that the corporate tax rate is allowed to be lower than the capital income tax rate. In more detail and more generally, we study the following setting: $\tau_d \geq \tau_c \geq \tau_f$. In order to be able to maintain the principle of Sørensen's (1994) prototype model that the normal return part of dividends is taxed effectively at the rate of τ_c, we

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14 This constellation, however, allows a situation where the combined tax rate on excess dividends ($\tau_f + (1 - \tau_f)\tau_d$) aligns with the top tax rate on labor income (τ_w).

augment the tax system with a new element: a share $s \geq 0$ of normal return on equity is included in the owner's taxable income. Dividend income net of taxes now becomes:

$$D_{\text{Net}} = D - [\tau_c s i A + \tau_d (D - iA)] = (1 - \tau_d)D + (\tau_d - \tau_c s)iA. \quad (8)$$

To achieve the outcome that normal return is taxed effectively at rate τ_c, s should be chosen as follows:

$$\tau_f + \left(1 - \tau_f\right) s \tau_c = \tau_c \iff s = \frac{\tau_c - \tau_f}{\left(1 - \tau_f\right) \tau_c}. \quad (9)$$

Observe that when chosen this way $s = 0$ when $\tau_c = \tau_f$ and $s > 0$ when $\tau_c > \tau_f$.

In sum, by introducing the parameter s we may have a tax system that satisfies most aspects of the tax rate constellation of the prototype DIT even if $\tau_f < \tau_c$.

The Lagrangian for our optimization problem reads as follows:

$$L = \frac{1 - \tau_d}{1 - \tau_g}D + \frac{\tau_d - \tau_c s}{1 - \tau_g}iA - Q$$

$$+ q_1 \left[(1 - \tau_f)\pi(K) + \tau_f \alpha A + Q - D - \delta K\right]$$

$$+ q_2 \left[(1 - \tau_f)\pi(K) + Q - D - (1 - \tau_f)\alpha A\right]$$

$$+ \lambda_1 D + \lambda_2 Q \quad (10)$$

The marginal condition corresponding to equation (A8) for the augmented model can be written as follows (see Appendix 2 for the derivation):

$$F'(K) = \pi'(K) - \delta = \frac{\rho}{1 - \tau_f}\left[1 - \tau_f \frac{\alpha - \delta}{\rho + \alpha}\right]$$

$$- \frac{\tau_d - s \tau_c}{(1 - \tau_f)(1 - \tau_d)}i\left[1 - \frac{\alpha - \delta}{\rho + \alpha}\right] \quad (11)$$

where $F'(K)$ is the marginal rate of return after true economic depreciation. The interpretation of the condition goes as follows: The first of the two terms on the right-hand side stands for the effective cost of equity financing, where $\frac{\rho}{1 - \tau_f}$ is the unit cost of equity, and the bracketed term is the share of marginal investment that is financed with equity. The term $\tau_f \frac{\alpha - \delta}{\rho + \alpha}$ reflects the deferral of corporate taxes due to accelerated depreciation and is interpreted as the (average) share of investment financed by deferred taxes. Thus, we may consider that that part of the investment is financed with equity and the rest from deferred taxes. The latter element has a zero unit cost, and therefore does not show up.[15]

The second term on the right-hand side is the effect of the equity allowance on the cost of capital. The bracketed term can be rewritten $1 - \frac{\alpha - \delta}{\rho + \alpha} = \frac{\rho + \delta}{\rho + \alpha}$. The expression gives the average share of the firm's capital stock which in effect qualifies for the equity allowance. The higher the rate of fiscal depreciation, α, the smaller the average value qualifying for the allowance and the smaller the value of the allowance. Hence, since the capital base is net assets of the firm, high accelerated depreciation reduces the capital base and therefore reduces the effects of the equity allowance on the incentive to invest.

To move on to considering the neutrality properties of the general model, let us rewrite equation 11 in the following way:

$$F'(K) = \frac{\rho}{1 - \tau_f} - \frac{\tau_d - s \tau_c}{(1 - \tau_f)(1 - \tau_d)}i$$

$$+ \left[\frac{\alpha - \delta}{\rho + \alpha} \frac{\tau_d - s \tau_c}{(1 - \tau_f)(1 - \tau_d)}i - \frac{\alpha - \delta}{\rho + \alpha} \frac{\rho \tau_f}{1 - \tau_f}\right]. \quad (12)$$

The bracketed term on the right-hand side collects the two terms which reflect the channels through which accelerated fiscal depreciation affects the cost of capital. The latter term within the brackets describes the saving in corporate tax due to accelerated depreciation, and the first term gives the effect of depreciation allowances on the size of the effect of the equity allowance. We observe that the two elements are of opposite signs: accelerated depreciation decreases the cost of capital via corporate income tax but increases it via personal-level taxation of dividends.

Even if we observe complex effects of accelerated depreciation on the cost of capital, with a suitable choice for the normal rate of return, i, we can make the cost of capital independent of accelerated depreciation. Choosing the normal rate of return as follows:

$$i = \frac{\tau_f}{\tau_d - s \tau_c}(1 - \tau_d)\rho, \quad (13)$$

causes the bracketed term in equation 12 to take the value of zero, and the two first terms to merge into ρ. Hence, the marginal condition for investment becomes:

$$F'(K) = \rho, \quad (14)$$

which is effectively the same as condition (A8), where there was no corporate or dividend taxation at all ($\tau_d = \tau_f = 0$), and it is also independent of the accelerated depreciation. Let us formulate our neutrality result as our Proposition 2.

Proposition 2 (General Case). The income-splitting tax system described in equations (10) and

15 See e.g. Södersten (1982) and Kanniainen and Södersten (1995).

(A10)–(A15) and with a condition $\tau_d \geq \tau_c \geq \tau_f$ is neutral with respect to investment decisions when the normal rate of return is chosen to be i $= \frac{\tau_f}{\tau_d - s\tau_c}(1-\tau_d)\rho$, where $s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$.

In addition to the result in Proposition 2, the described tax system and its choices imply neutral tax treatment with respect to depreciation of capital. With the optimal imputed rate of return, i, the possible differences between fiscal and economic depreciations do not play any role in the tax treatment between different assets. Furthermore, to achieve the outcome that normal return is taxed effectively at rate τ_c, the share of normal return on equity to be included in the owner's taxable income should be set: $s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$.

Observe again that $\rho = \frac{1-\tau_c}{1-\tau_g}r$ depends on the tax rates on interest income and capital gains and, therefore, (14) does not display full neutrality. However, with $\tau_g = \tau_c$ we have full neutrality.

2.4 Selected special cases

Now let us concentrate on some interesting special cases of the above general model. Table 1 describes three of these cases.[16] These cases relate to the Finnish tax system. The simple case collects some aspects of the original Finnish income-splitting system applied in years 1993–2004.[17] Case 2A refers to a tax reform proposal launched by a tax committee in 2010. Case 3A roughly corresponds to the current Finnish income-splitting system.

The first row of the table describes the simple case with equal tax rates, studied in section 2.2. In this case $s = 0$. Neutrality is achieved by choosing the normal rate of return to be the after-tax interest rate, i $= (1-\tau)\rho$.

The second row of the table (Case 2A) describes the case where the corporate tax rate is lower than the personal-level tax rate on capital income. It assumes that the lower tax rate at the firm level is compensated by taxing a share of normal dividends distributed to the owner. This share depends on both firm-level and personal-level tax rates: $s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$. In this case,

the optimal imputed rate of return is $i = (1-\tau_f)\rho$. This case closely corresponds to the reform proposal of a tax committee in Finland (Ministry of Finance, 2010; Eerola and Kari, 2010). The committee proposed keeping the net asset-based splitting method but reforming the prevailing parametrization of the system. It proposed taxing excess dividends as capital income at the standard rate (instead of as labor income), including a compensating share of normal dividends in taxable capital income, and reducing the imputed rate of return to close to the after-corporate-tax interest rate.

The third row of Table 1 (Case 3A) considers the case where excess dividends are taxed at a higher rate than other forms of capital income, $\tau_d > \tau_c$. Assume first that the rate is proportional. In this case a neutrality-yielding i is i $= \frac{\tau_f}{\tau_d - s\tau_c}(1-\tau_d)\rho$, where $s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$ and $\rho = \frac{1-\tau_c}{1-\tau_g}r$.

If the tax rate on excess dividends is progressive, with τ_d representing the marginal tax rate, and if CHC owners are spread across the tax brackets of the tax schedule, the system cannot be made to satisfy the same neutrality properties as the cases above. The cost of capital varies across different owners depending on the marginal tax rate on excess dividends. The current Finnish and Swedish splitting systems tax excess dividends as labor income at progressive rates and therefore face this challenge.

Cases 2A and 3A in Table 1 show how particular choices of nominal rates of return imply neutrality properties of a tax system under the condition that some share of normal dividends distributed to the owner are included in owner-level taxation ($s > 0$). In Appendix 2 we show that the neutrality properties are also achieved when this share is zero ($s = 0$). These results show an intriguing relation between the choices of the share of normal distributed dividends included in owner-level taxation (s) and the normal rate of return (i).

Next, we provide calculations for the selected special cases illustrated in Table 1. These calculations use Finnish tax parameters.

According to Tables A1 and A2, the parameter values for the Finnish tax system are $\tau_f = 20\%$, $\tau_c = 30\%$, $\tau_d = 0.75 * \tau_w = 0.75 * 55\% = 41.25\%$ (thus $\tau_d > \tau_c > \tau_f$). For the calculations we use two different pre-tax interest rates: a risk-free interest rate of $r = 4\%$ and a risky interest rate of $r = 9.4\%$.[18] The

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16 In Appendix 2 we provide two more cases which allow the combination of $s = 0$ and $\tau_c > \tau_f$ which is not in conformity with condition (9). We do this to highlight the implications of different ways of taxing the normal return.

17 The main difference between the simple case and the original Finnish DIT is that τ_d was the progressive tax rate on labor income in the latter, while the former assumes that τ_d corresponds to the flat rate on capital income.

18 We use the average interest rate on corporate bonds of Finnish companies in Q2/2023, 9.4 %, as our risky interest rate, available at: https://www.suomenpankki.fi/fi/tilastot2/tilastotie

Table 1: Optimal imputed rates of return in selected special cases.

Tax Rates	Parameter s	Optimal Normal Rate of Return	
Simple Case: ($\tau_d = \tau_c = \tau_f = \tau$)	$s = 0$	$i = (1-\tau)\rho$	Finland 1993-2004 (original)
Case 2A: $\tau_d = \tau_c > \tau_f$	$s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$	$i = (1-\tau_f)\rho$	Ministry of Finance Proposal in 2010
Case 3A: $\tau_d > \tau_c > \tau_f$	$s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$	$i = \frac{\tau_f}{\tau_d^*}(1-\tau_d)\rho$; $\tau_d^* = \tau_d - \frac{\tau_c - \tau_f}{1-\tau_f}$	Current Finnish System (applied from 2005 on)

accrual-equivalent tax rate on capital gains is calculated by using Devereux–Griffith methodology (which yields $\tau_g = 23.4\%$).[19]

The upper panel of Table 2 provides the firm's after-tax discount rate (ρ), the parameter s[20] and the optimal imputed rate of return for selected special cases with the risk-free interest rate $r = 4\%$. In the simple case, in which all relevant tax rates are equal to the tax rate on capital income (30 %), the discount rate remains at 3.7% and the normal rate of return is $i = 2.6\%$.

In Case 2A the tax rate on excess dividend (τ_d) is aligned with the tax rate on capital income ($\tau_d = \tau_c = 30\%$), but the corporate tax rate differs from these two ($\tau_f = 20\%$). Following this change the optimal imputed rate of return becomes slightly larger than in the simple case. Also, the parameter s becomes non-zero ($s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c} = 0.417$).

Case 3A roughly corresponds to the current Finnish practice. Excess dividends are taxed at rates higher than the tax rate on capital income. The calculations in Table 2 assume that the owner's MTR on earned income corresponds to the top rate of the progressive tax schedule, in which case the marginal tax rate on excess dividends is 41.25%. For this tax-rate structure the

optimal imputed rate of return is 1.5%, much lower than in the two cases discussed above. Hence, the optimal level of the imputed rate of return is quite sensitive to the MTR of excess dividends.

The lower panel of Table 2 studies the optimal choice for the normal rate of return when the risky interest rate is used. The results show that the normal rate of return should be chosen to be 3.3%-6.4%, depending on the case. These are larger than the corresponding numbers with a risk-free interest rate.

2.5 Implications for Finland's tax system

To sum up, the calculations provided in Table 2 suggest that the optimal normal rate of return (i) should be roughly either at the level of 2 or 3 percent, or at the level of 3 to 6 percent, depending on the choice of pre-tax interest rate. The two reference interest rates should be interpreted to give the lower and upper boundaries for the optimal normal rate of return.

The results following from using a risk-free interest rate are quite far from the Finnish time-invariant splitting rate of 8 percent, which is stipulated in Finnish tax law. The results that are based on the risky interest rate are closer to the current choice, but still below it, even in current environment of relatively high interest rates. Another issue is that the share (s) of normal dividends that should be included in the owner's taxable income, currently 25% (or 85%) in Finland, is also far from the neutrality-yielding level of 41.7%.

In sum, the optimal parameter values differ from those in the current Finnish tax system. Both the normal rate of return i (8% in the Finnish system) and the share s of normal return on equity to be included in the owner's taxable income (25% or 85% in the Finnish system; see Appendix 1) differ between the Finnish system and the neutral design. Moreover, the current Finnish system has a euro-limit for non-listed company dividends (EUR 150,000) that partially determines the

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dotteet_fi/muut-rahoituslaitokset-lainat-ja-korot/2023/muiden-r ahoituslaitosten-myontamien-uusien-yrityslainojen-keskikorko-yli -9-/

19 In determining the accrual-equivalent tax rate on capital gains, τ_g, we follow the procedure provided in the Devereux–Griffith methodology (see e.g. Final Report 2012 of Project for the EU Commission TAXUD/2008/CC/099; ZEW, Mannheim, 2012). τ_g is chosen in this methodology to be $\frac{\lambda \tau_g^*}{\lambda + (1-m^i)i}$, where $\lambda = 0.1$, τ_g^* is the personal tax rate on capital gains realization (30% in our calculations), m^i is the personal tax rate on interest income (30% in our calculations) and the nominal interest rate is $i = (1+r)(1+\pi) - 1$, where r is the real interest rate and π is the inflation rate. We consider inflation to be zero in our calculations (and thus $i = r$).

20 This parameter is either chosen to be zero or that yielding neutrality ($s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$).

Table 2: Optimal normal rates of return in selected special cases.

	ρ	s	i	Tax rates	s	Optimal normal rate of return, i	Note
				Risk-Free Interest Rate, r = 4 %			
Simple Case	0,037	0	0,026	$\tau_d = \tau_c = \tau_f = \tau$	s=0	$i = (1-\tau)\rho$	
Case 2A	0,037	0,417	0,029	$\tau_d = \tau_c > \tau_f$	s>0	$i = (1-\tau_f)\rho$	
Case 3A	0,037	0,417	0,015	$\tau_d > \tau_c > \tau_f$	s>0	$i = \frac{\tau_f}{\tau_d^*}(1-\tau_d)\rho$	$\tau_d^* = \tau_d - \frac{\tau_c - \tau_f}{(1-\tau_f)}$
				Risky Interest Rate, r = 9.4 %			
Simple Case	0,080	0	0,056	$\tau_d = \tau_c = \tau_f = \tau$	s=0	$i = (1-\tau)\rho$	
Case 2A	0,080	0,417	0,064	$\tau_d = \tau_c > \tau_f$	s>0	$i = (1-\tau_f)\rho$	
Case 3A	0,080	0,417	0,033	$\tau_d > \tau_c > \tau_f$	s>0	$i = \frac{\tau_f}{\tau_d^*}(1-\tau_d)\rho$	$\tau_d^* = \tau_d - \frac{\tau_c - \tau_f}{(1-\tau_f)}$

tax treatment of dividends exceeding this limit. That euro-limit does not have any role in a neutral tax system. It just makes another undesired distortion in the tax system.

3 Discussion

In this section we return to some important issues that were dealt with in passing only in the analysis above. They are connected to two assumptions in our model: the assumption of full loss offset, discussed briefly after equations (4) and (5) in Section 2.1, and the assumption of having only one means of withdrawing excess income from the firm, discussed briefly below equation (1) in Section 2.1.

3.1 Treatment of losses and the choice of the normal rate of return

When policymakers determine the normal rate of return, they must decide whether to include a risk premium in the rate of return. According to the economic literature, this decision depends critically on the tax treatment of losses. In the following, we explain why this connection exists and then ponder its implications for the design of Finland's splitting system.

From an efficiency point of view, the imputation rate should be set to equal the discount rate the firm uses to discount the flow of tax benefits from equity allowances. If this principle is followed, the present value of tax savings equals the savings of full expensing, i.e. of a cash flow tax, which is known to be neutral with respect to investment decisions (Boadway and Bruce, 1984; Devereux and Freeman, 1991). Whether the discount rate should include a risk premium and how

large it should be, depends on the riskiness of the flow of tax benefits. This, on the other hand, critically depends on how the tax system treats profits and losses. If full loss offset is provided, e.g., by crediting the negative tax liability or by allowing carry forward of unutilized allowances with interest, the firm can be certain of the tax consequences of tax allowances. Therefore, in such a fully symmetric tax system the flow of benefits from an equity allowance should be discounted using a risk-free interest rate (Fane, 1987; Bond and Devereux, 1995, 2003), and this interest rate should be chosen as the imputed rate of return. If the tax system is not perfectly symmetric, e.g. due to constraints in loss-offset rules or missing interest compounding, equity allowances are risky and a risk premium should be included in the discount rate. In this case, the imputation rate should also include a risk premium.

In Norway's RRA model and in the ACE proposal in the Mirrlees Review (2011), considerable effort has been put into making systems as symmetric as possible. Both systems allow unutilized allowances to be carried forward with interest. The systems are not perfectly symmetric, however, and therefore the proposals have deemed it appropriate to include a small risk premium in the imputation rate.[21] Norway's policymakers (Sorensen, 2005) and the Mirrlees Review (2011) considered the interest rate on short-term government debt to be the appropriate reference rate. Recently, a tax committee in Norway (NOU, 2022) assessed that the appropriate rate might rather be the interest rate

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21 One source of such asymmetries is that policymakers commonly impose limitations on loss offsets in order to prevent abuse.

on 10-year government bonds.[22] Giffith et al. (2010), on the other hand, proposed using the average interest rate on corporate bonds as the imputation rate of the ACE allowance.

While Sweden and Norway have improved the symmetry of their dividend tax systems by allowing carry forward of unutilized allowances, Finland has not included that element in its splitting system. One consequence of this is that the taxation of dividends is less symmetric than in Finland's Nordic counterparts. Therefore, the imputation rate in Finland should include a higher risk premium compared to e.g., in Norway. How large this risk premium should be is not easily determined. This is because, in the case of a large deviation from symmetry, there seems not to be any readily available reference interest rate. In Section 2.4 we assumed that the appropriate reference interest rate might be in a range between the risk-free rate and the average interest rate on corporate bonds. We leave this issue to be developed further in future discussions.

Besides yielding neutrality with respect to investment, symmetric taxation of dividend income may improve neutrality in other ways as well. In the literature, Norway's carry forward system is seen to lead to neutrality in the tax treatment between dividends and sales of shares, and also to remove the lock-in effect associated with standard capital gains taxes (Sorensen, 2005; Lindhe and Södersten, 2012). One related but less discussed issue is neutrality with respect to the timing of dividend distributions. Kari and Laitila (2016) show that without a carry forward system, a graduated dividend tax schedule may lead to tax-motivated dividend distributions. Several studies have indeed observed that a substantial share of CHCs in Finland distribute exactly the maximum amount of leniently taxed normal dividends (Kari and Karikallio, 2007; Ministry of Finance, 2010). Kari and Laitila (2016) argue that such behavior, apparently induced by the lacking carry forward of unutilized allowances, may reduce the funds available for financing investment in CHCs that are not able to finance from external sources and may thus cause efficiency losses. Therefore, adopting carry forward rules should improve the efficiency of Finland's splitting system and could be a source of other benefits as well.

Regarding the implementation of the optimal splitting system, a few additional aspects remain. We have shown that the optimal normal rate of return (i) is a function of tax parameters and the pre-tax interest rate (r). Therefore, to be optimal at each point in time, the optimal normal rate of return should change as a response to changes in any of these parameters. The current Finnish system does not respond to parameter changes, while the established practice is that the normal rate of return is adjusted annually with interest rate changes, the prime examples being Norway's and Sweden's dividend tax systems and the applications and proposals of the ACE allowance (see Sorensen, 2005; Selin, 2021; Zangari, 2014; Mirrlees Review, 2011). The desirability of not allowing the parameters to change may arise from stability considerations in the tax system. These changes may also increase administrative costs for governments and compliance costs for the firms. However, if the normal rate of return is not aligned with the opportunity cost of equity, the tax system will begin to distort investment decisions. Therefore, adopting the practice of annual adjustments of the key tax parameters should improve the efficiency of Finland's splitting system.

3.2 Alternative means for withdrawing funds from the firm and income-shifting

The optimal parameter values were derived in Section 2 by keeping neutral taxation of investment as the goal. We were more or less silent on income-shifting, which is nevertheless the key motivation behind the splitting rules.

Here, it may be useful to differentiate between two dimensions of income-shifting. One is between wage income and excess dividends and the other is between excess income and normal dividends. This paper is about how the normal-dividend part should be calculated in a net asset-based splitting system. Therefore, the second form of income-shifting is particularly relevant for our analysis.

One situation where the second form of income-shifting may occur is when the splitting rate is set too high. In that case, the system automatically treats income that ought to be subject to a progressive tax schedule as normal dividends subject to the relatively low tax rate (static income-shifting). A splitting rate that is too high also increases incentives to invest in the firm's equity and therefore helps to increase the

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22 See Sorensen (2005) and NOU (2022) for discussions of asymmetries in Norway's shareholder taxation that are seen to justify the risk premia.

future share of normal dividends even further (dynamic income-shifting).

We argue here that a properly specified splitting rule as outlined above could be used as a tool to deter both static and dynamic income-shifting of the second type. Therefore, reforming the currently constant normal rate of return parameter in Finland to better align with the optimal rule outlined above should reduce opportunities for income shifting. [23] There are a few other aspects that we would like to discuss related to income-shifting. Our discussion has so far assumed that the concept of net assets can be clearly defined so that it cannot be easily manipulated to achieve tax savings. Since the calculations of net assets are based on information (financial accounts of firms and asset values applied in other areas of taxation) that is subject to external auditing and tax supervision, the assumption should not be too strong.[24] However, the debate in Finland has paid attention to two types of tax planning which can be considered as income shifting between excess income and normal dividends. One such means is to inflate the asset base by collecting low-yielding non-business assets such as financial assets, apartments, real estates, and art works. Such a tax-planning strategy may be profitable, particularly when the normal rate of return is inappropriately high. In this case, for example, investments in fixed-income funds can bring a high after-tax return at low exposure to risk. One way to solve this problem could be to exclude non-business assets from the asset base. However, since the problem mostly stems from an overly high imputed rate of return, implementing an optimal splitting rule following the ideas in our proposal should be the primary solution.

Recently, the Finnish system has also been found to include possibilities that enable the artificial inflation of net assets by adopting a multilayer corporate group structure.[25] Using this possibility may step up the future share of normal dividends even further (dynamic income-shifting).

value of net assets, leading to an increase in the share of income taxed as more leniently taxed capital income. While this tax-planning means is linked to the splitting system, it does not warrant changes to the current splitting rules; rather, the focus should be on how net assets is calculated for corporate groups. Tax rules should, of course, be neutral with respect to different ways of organizing business activities.

A further related question is the relevant base for the allowance - net assets or total assets? As our model does not include debt, it implies that the book value of net assets is equal to the book value of total assets. The starting point for this question comes back to the original purpose of the splitting system. This aims to separate two types of compensations, that for own equity invested in the firm and the other for labor input (or the residual). Thus, if the tax base were total assets, it would raise the possibility of increasing the share of compensation considered as remuneration on capital by including debt, even if debt does not relate to own equity. With net assets as the base, the system targets own equity invested more accurately, not equity and debt. Furthermore, from the tax neutrality perspective, the optimal splitting rule outlined above should lead to approximately neutral treatment between debt and equity financing.

4 Conclusions

In this paper we have studied the neutrality properties of a dual income tax system, where the income received from a CHC is split into capital and labor income parts according to the net assets of the company. We initiate our analysis by considering equal tax rates on capital income and corporate profits, revealing that with a suitable choice of parameters such a system can be made approximately neutral with respect to investment. We also show that this set of parameters renders irrelevant the choice of the rate of fiscal depreciation, a well-known property of a different tax system, the ACE corporation tax.

We also investigate whether neutrality can be achieved when tax rates differ. We again report neutrality-yielding combinations of parameters for a broad selection of combinations of proportional tax rates. The results imply that the key parameters provide tax system designers with (surprisingly) powerful tools to implement neutrality.

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23 We recognize the potential conceptual problems that may arise when the optimal rule derived using investment theory is applied to solve problems related to income-shifting. However, we find this approach useful since it seems to be able to tackle problems related to both efficiency and tax-planning, at least approximately.

24 Observe that the ACE allowance is also calculated on net assets. The robustness of the concept should have undergone intense scrutiny in countries that have adopted the system and also by the European Commission, which has proposed its adoption in the EU.

25 Finnwatch: Sometähdet hyödyntävät verotuksen porsaanreikää yhtiöjärjestelyillä – näin vastaavat Natalia Salmela ja Auri Kananen https://yle.fi/a/74-20048530

Furthermore, our findings indicate that a net asset-based splitting system can have neutrality properties that are broadly as favorable as those involving share purchase price-based splits within DIT systems. However, trade-offs exist. While the purchase-price method can be designed to eliminate the incentive to defer capital gains realizations (Sørensen, 2005), the net asset-based models studied in this paper do not feature this property. On the other hand, the irrelevance of fiscal depreciations is a property of the net asset-based split but not of the alternative model.

Our analysis challenges the perception of net assets-based splitting as inferior to purchase price-based systems. Both models can be tailored to exhibit advantageous characteristics. Contrary to the prior literature, our study highlights that the structure of the net-assets based system is not inherently flawed; rather, it is the parameter values that need correction.

While our results show how the key parameters of the net asset-based income-splitting system ought to be chosen so as to render the system neutral, even more complete neutrality seems to require the carry-forward of unutilized normal dividends. Another interesting question relates to how costly it is to deviate from the optimal choices. These are important topics for future research.

Acknowledgments

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Appendix 1. Income-splitting under Nordic dual income tax (DIT)

According to the most streamlined version of DIT defined in Sørensen (1994), the DIT aligns the flat personal tax rate on capital income with the corporate income tax rate and with the marginal tax rate of the lowest labor income tax bracket. The tax base of capital income includes all forms of capital income and allows all expenses to be deducted, including interest expenses on debt. In this pure version of DIT, the double taxation of corporate-source income is fully alleviated. In this design, DIT can be seen as a flat tax on all net income plus a progressive surtax on high labor incomes.

Norway adopted a DIT (1992) that was very close to this pure version. However, the reforms of Sweden (1991) and Finland (1993) also included most of the features of the pure DIT (see Sørensen, 1994).

Over the years the income tax systems of these countries have been subject to several adjustments, but key aspects of the tax systems still follow the principles underlying dual income taxation. Table A1 summarizes the main features of the Nordic income tax systems in force in 2021.

However, Sweden and Finland have deviated from the original principle that personal capital income and corporate profits are taxed at the same rate ($\tau_c = \tau_f$).[26] Similarly, Norway and Finland have dropped their full imputation systems and run partial double taxation of corporate-source income. Finland has moved from a flat tax on capital income to a progressive system with two tax brackets (30% up to 30,000 euros and 34% for income exceeding that threshold).

Table A2 summarizes key aspects of the Nordic dividend tax systems, in particular the split of income into imputed normal return and excess return, and the tax treatment of these two components.

In 2006, Norway introduced its current system, where an imputed normal return is separated from the sum of dividends and realized capital gains (shareholder income) and is treated as being tax-exempt in personal taxation (rate-of-return allowance, RRA). Any amount exceeding the RRA is first factored by a factor (2021: 1.44) and then the calculated amount is taxed as capital income at a flat rate of 22%.

The Norwegian shareholder tax applies to all dividends and realized gains received by individual shareholders. The RRA allowance is calculated as an imputed rate of return times the purchase price of the shares stepped up by any unutilized RRA allowances. The imputed rate of return is set at the three-month government bond rate after tax. The step-up procedure effectively implies that unused allowances can be carried

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26 The gap between the corporate and the capital income tax rates has widened remarkably since then. It was 2 percentage points in 2012 and is currently 8 percentage points in Sweden. The corresponding figures for Finland are 2 and 10 or 14 percent, depending on the amount of capital income.

Table A1: Main aspects of the dual income tax systems of Norway, Sweden, and Finland in 2021.

	Norway	**Sweden**	**Finland**
Corporate tax rate (τ_f)	22%	20.6%	20%
Personal tax rate on capital income (τ_c)	22%	30%	30% up to 30,000 euros, 34% above that
Highest MTR on earned income (τ_e)	53% (includes ssc)	66% (employer's ssc included)	55%
Does net capital income form a separate tax base?	No, capital income from all sources is included in "alminnelig inntekt", which also includes labor income. It is subject to the flat tax rate of 22%.	Yes, net capital income from all sources forms a separate tax base	Yes, net capital income from nearly all sources is a separate tax base (interest income excluded)
Taxation of interest income	Included in taxable capital income	Included in taxable capital income	Final withholding tax, 30%
Integration of corporation and personal income tax, main rule	Partial double taxation: dividends and capital gains in excess of imputed normal return included in taxable capital income	Double taxation: dividends are included in taxable capital income	Partial double taxation: 85% of dividends (from listed corporations) are included in taxable capital income

Sources: Selin (2021), OECD: Taxing Wages, https://www.oecd-ilibrary.org/taxation/taxing-wages-2022_f7f1e68a-en

forward with interest. This mechanism is shown to have a number of benefits from a neutrality point of view, see e.g. Sørensen (2005) and Södersten (2020).

In Sweden, the splitting rules are targeted at owners of CHCs working in the firm ('active owners'). Imputed capital income is calculated broadly as in Norway, by factoring the adjusted purchase price of shares by the imputed rate of return. The adjustments include stepping up by unutilized allowances, as in Norway. This imputed part of dividend income is taxed as capital income but at a concessional rate of 20%. Any amount in excess of this imputed income is fully included in taxable labor income.

While the goals of the Finnish splitting system for closely held companies are the same as in Norway and Sweden, there are two important differences in the design. First, the rules apply to dividends received by all shareholders of non-listed companies. Hence the coverage of the rules is much broader than in Sweden but somewhat narrower than in Norway, where the RRA allowance is part of the general dividend tax system. A second important difference is that while imputed capital income is calculated similarly by factoring the capital base by an imputed rate of return, the capital base is the firm's net assets (gross assets minus debt). In 2021, imputed normal dividends are not tax-exempt as in Norway but rather 25% of that income is included

in taxable capital income. This rule applies to normal dividends up to 150,000 euros. 85% of normal dividends exceeding this threshold are included in capital income.

As in Sweden, the imputed rate of return is well above the current market interest rates and can therefore be interpreted as including a risk premium reflecting the dominant views of this design issue at the time the systems were designed. In 2021, the normal rate of return was set at 8% in Finland.

The three countries have different practices in the tax treatment of excess dividends. While Sweden and Finland include such dividends in the recipient's taxable labor income, subject to a progressive tax schedule with high top marginal tax rates, Norway taxes them as capital income at the standard proportional tax rate. To avoid incentives to shift income between the two tax bases, countries that apply a dual income tax should aim at maintaining the combined effective rate on excess dividends broadly at the level of the top marginal rates on labor income. Hence, the tax rates should satisfy the following equality (Sørensen, 2005; Mirrlees Review, 2011):

$$\tau_f + (1-\tau_f)\,\tau_d = \tau_w, \qquad (A1)$$

where τ_f denotes the corporate tax rate, τ_d the (possibly progressive) tax rate on excess dividends, and τ_w the top marginal tax rate on labor income.

Table A2: Splitting of income from closely held companies under DIT in 2021.

	Norway	Sweden	Finland
Which dividends are subject to split/imputed income method?	Dividends (and realized gains) received by individuals from all companies	Dividends received by active owners of CHCs (1)	Dividends of all owners of non-listed companies
What income is subject to split/imputed income method	Dividends and capital gains	Dividends	Dividends
How is the imputed rate of return determined?	After-tax interest on 3-month gov. bonds; 2021	Government bond rate plus 9 percentage points; 2021	Fixed, 8%
What is the asset base?	Adjusted purchase price of shares	Adjusted purchase price of shares	Net assets of the non-listed company
Other elements	-	The imputed income includes a "wage addendum". The owner may choose a "simplification rule" instead of dividend split. (2)	-
Tax treatment of the imputed normal return on shares (normal dividend)	Tax-exempt	Taxed as capital income at reduced rate of 20%	Up to 150,000 euros, 25% of normal dividend is included in taxable capital income and of the amount exceeding this threshold 85% is included in taxable capital income
Tax treatment of dividend that exceeds the normal return (excess dividend)	Excess dividend factored by 1.44 and the amount is included in taxable capital income (alminnelig inntekt). The effective marginal tax rate is 31.68%	Full inclusion as labor income (progressive schedule)	75% included in taxable labor income (progressive schedule)
Highest tax rate on excess dividend	31.68% (flat rate)	52% (progressive schedule)	42% (progressive schedule)
Carry-forward rules	Yes	Yes	No

Sources: Selin (2021), Sørensen (2007), OECD Tax Data Base, year 2012

1. A corporation is considered closely held if 1-4 persons own more than 50% of the votes. An owner of a CHC is considered active if his or her work contribution is important for the firm's income generation.
2. Wage addendum: a share of wages paid by the firm is included on top of the imputed capital return . As an alternative to the imputed income consisting of imputed capital income and the wage addendum, the shareholder can choose an allowance with a fixed ceiling (simplification rule; 2012: SEK 143,275). In 2009 around 80% of active owners of CHCs chose the simplification rule. See Alstadsaeter and Jacob (2012) for details.

Appendix 2. Proofs and Extensions

The first term in the objective function in equation (7) can be written as follows:

$$\gamma D_{\text{Net}} = \gamma \left[(1-\tau_d) D + \tau_d iA \right] =$$
$$= \gamma (1-\tau_d) \left[\pi (K) + Q - I - T_f \right] + \gamma \tau_d iA =$$

$$= \gamma (1-\tau_d) \left[\pi (K) + Q - I - \tau_f \left[\pi (K) - \alpha A \right] \right] + \gamma \tau_d iA =$$
$$= \gamma (1-\tau_d) \left[(1-\tau_f) \pi (K) + Q - I + \tau_f \alpha A \right] + \gamma \tau_d iA =$$
$$= \gamma (1-\tau_d) \left[(1-\tau_f) \pi (K) + Q - I + \tau_f (I - \dot{A}) \right] + \gamma \tau_d iA =$$
$$= \gamma (1-\tau_d) \left[(1-\tau_f) \left[\pi (K) - I \right] + Q - \tau_f \dot{A} \right] + \gamma \tau_d iA =$$
$$= \gamma (1-\tau_d) \left[(1-\tau_f) \left[\pi (K) - I \right] \right] + \gamma (1-\tau_d) Q$$
$$- \gamma (1-\tau_d) \tau_f \left[\dot{A} - \frac{\tau_d}{(1-\tau_d)\tau_f} iA \right] \qquad (A2)$$

Simple case

We assume that the firm relies on retained profits to finance investment, $Q = 0$, and that the tax rates are set as follows: $\tau_d = \tau_c = \tau_f = \tau$ (simple case). The term $\gamma D_{Net} - Q$ in the objective function is equivalent to the following expression in this case:

$$\gamma D_{Net} - Q = \gamma[(1-\tau)^2 [\pi(K) - I] - \gamma(1-\tau)\tau \left[\dot{A} - \frac{1}{(1-\tau)}iA\right]$$

(A3)

Thus, we have

$$\max V_0 = \int_0^\infty (\gamma D_{Net} - Q) e^{-\rho t} dt$$

$$= \gamma[1-\tau]\left[(1-\tau)\int_0^\infty [\pi(K) - I] e^{-\rho t} dt\right.$$

$$\left. - \tau \int_0^\infty [\dot{A} - \frac{1}{(1-\tau)}iA] e^{-\rho t} dt\right].$$

(A4)

With a suitable choice of the imputed rate of return, i, the latter integral becomes a constant and the optimization problem reduces to that which would be obtained in the absence of taxation. By choosing

$$i = (1-\tau)\rho$$

(A5)

this is the case. The latter integral in the square brackets of equation (A4) can then be written as follows:[27]

$$-\tau \int_0^\infty [\dot{A} - \frac{1}{(1-\tau)}iA] e^{-\rho t} dt$$

$$= -\tau \int_0^\infty [\dot{A} - \rho A] e^{-\rho t} dt$$

$$= -\tau \int_0^\infty \frac{d}{dt}[A e^{-\rho t}] dt = \tau A_0$$

(A6)

Therefore, with this choice the original maximization problem becomes equivalent to the following:

$$\max V_0 = \gamma[(1-\tau)^2 \int_0^\infty [\pi(K) - I] e^{-\rho t} dt$$

(A7)

Since the tax term $\gamma[(1-\tau)^2$ is factored out, the problem is equivalent to the original problem in the absence of corporate and dividend taxes, and has the following solution:

$$\pi'(K) = \rho + \delta.$$

(A8)

The solution to the original problem, but without any taxes, is $\pi'(K) = \rho + \delta$, because

$$\max \int_0^\infty [\pi(K) - I] e^{-\rho t} dt =$$

$$= \max \int_0^\infty [\pi(K) - \dot{K} - \delta K] e^{-\rho t} dt =$$

$$= \max \int_0^\infty [\pi(K) - \delta K] e^{-\rho t} dt - \max \int_0^\infty \dot{K} e^{-\rho t} dt =$$

$$= \max \int_0^\infty [\pi(K) - \delta K] e^{-\rho t} dt - K_0 - \max \int_0^\infty \rho K e^{-\rho t} dt =$$

$$= \max \int_0^\infty [\pi(K) - (\delta + \rho) K] e^{-\rho t} dt - K_0,$$

(A9)

which solves as (just taking a derivative with respect to K) $\pi'(K) = \rho + \delta$.[28]

General case

Let us next derive equation 11. Let us first set up the following constrained optimization problem, where D_{Net} is given in equation 8:

$$D_{Net} = (1 - \tau_d)D + (\tau_d - \tau_c s)iA.$$

$$\max V_0 = \int_0^\infty (\gamma D_{Net} - Q) e^{-\rho t} dt$$

$$= \int_0^\infty (\frac{1 - \tau_d}{1 - \tau_g} D + \frac{\tau_d - \tau_c s}{1 - \tau_g} iA - Q) e^{-\rho t} dt$$

s.t.

$$\pi(K) + Q = D + I + T_f$$

(A10)

$$\dot{K} = I - \delta K$$

(A11)

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[27] The last equality follows from the fact that the upper bound vanishes when t goes to infinity.

[28] First, use equation (2), second, manipulate the terms, third, integrate by parts, and fourth, manipulate the terms again.

$$\dot{A} = I - \alpha A \tag{A12}$$

$$T_f = \tau_f[\pi(K) - \alpha A] \tag{A13}$$

$$D \geq 0 \tag{A14}$$

$$Q \geq 0 \tag{A15}$$

By using (A10) and (A13) for solving I and then plugging this solution into either (A11) or (A12) each time, we can write the following Lagrangian:

$$L = \frac{1-\tau_d}{1-\tau_g}D + \frac{\tau_d - \tau_c s}{1-\tau_g}iA - Q$$
$$+ q_1\left[(1-\tau_f)\pi(K) + \tau_f\alpha A + Q - D - \delta K\right] +$$
$$+ q_2\left[(1-\tau_f)\pi(K) + Q - D - (1-\tau_f)\alpha A\right]$$
$$+ \lambda_1 D + \lambda_2 Q \tag{A16}$$

Here, as above, D stands for dividends, A is the accounting stock, Q is new equity and K is the capital stock. q_1, q_2, λ_1 and λ_2 are the Lagrangian multipliers that can be considered as the shadow prices for K, A and the lower bound restrictions for D and Q, respectively.

The solution for the optimization problem reads as follows:

$$\frac{\partial L}{\partial D} = \frac{1-\tau_d}{1-\tau_g} - q_1 - q_2 + \lambda_1 = 0 \iff q_1 + q_2 = \frac{1-\tau_d}{1-\tau_g} + \lambda_1 \tag{A17}$$

$$\frac{\partial L}{\partial Q} = -1 + q_1 + q_2 + \lambda_2 = 0 \iff q_1 + q_2 = 1 - \lambda_2 \tag{A18}$$

$$\dot{q_1} = \rho q_1 - (1-\tau_f)\pi'(K)(q_1 + q_2) + \delta q_1 \tag{A19}$$

$$\dot{q_2} = \rho q_2 - \left(\frac{\tau_d - \tau_c s}{1-\tau_g}\right)i - \tau_f\alpha q_1 + (1-\tau_f)\alpha q_2 \tag{A20}$$

Now we consider a steady solution, where the firm distributes dividends. In this case $D > 0$ and therefore $\lambda_1 = 0$. Equation A17 then reduces to

$$q_1 + q_2 = \frac{1-\tau_d}{1-\tau_g} \tag{A21}$$

and equation (A19) to

$$\dot{q_1} = \rho q_1 - (1-\tau_f)\pi'(K)(q_1 + q_2) + \delta q_1. \tag{A22}$$

In a steady state $\dot{q_1} = \dot{q_2} = 0$. Thus, in this case we may solve the shadow price q_2 for the accounting stock, A, from equation (A20) straightforwardly (and using (A21)).

$$q_2 = \frac{(\tau_d - \tau_c s)i}{(\rho + \alpha)(1-\tau_g)} + \frac{\tau_f\alpha(1-\tau_d)}{(\rho + \alpha)(1-\tau_g)}. \tag{A23}$$

The terms have intuitive interpretations. The first term describes the present value of increasing the normal rate of return in dividend taxation, which takes place at the individual level. The second term describes the present value of increasing deductibility.

By summing up equations (A20) and (A22) and using the steady-state conditions $\dot{q_1} = \dot{q_2} = 0$ we get

$$\pi'(K) = \frac{\delta + \rho}{(1-\tau_f)} + \frac{(\alpha - \delta)q_2}{(1-\tau_f)(q_1 + q_2)}$$
$$- \frac{(\tau_d - \tau_c s)i}{(1-\tau_g)(1-\tau_f)(q_1 + q_2)} - \frac{\tau_f\alpha}{(1-\tau_f)} =$$
$$= \frac{\delta + \rho}{(1-\tau_f)} - \frac{(\alpha - \delta)(\tau_d - \tau_c s)i}{(1-\tau_f)(\rho + \alpha)(1-\tau_d)}$$
$$+ \frac{\tau_f\alpha(\alpha - \delta)}{(1-\tau_f)(\rho + \alpha)} - \frac{(\tau_d - \tau_c s)i}{(1-\tau_f)(1-\tau_d)} - \frac{\tau_f\alpha}{(1-\tau_f)} =$$
$$= \delta + \frac{\rho}{(1-\tau_f)} + \frac{\tau_f\delta}{(1-\tau_f)} - \frac{\tau_f\alpha}{(1-\tau_f)}\left[1 - \frac{\alpha - \delta}{\rho + \alpha}\right]$$
$$- \frac{(\tau_d - \tau_c s)i}{(1-\tau_f)(1-\tau_d)}\left[1 - \frac{\alpha - \delta}{\rho + \alpha}\right] =$$
$$= \delta + \frac{\rho}{(1-\tau_f)} + \frac{\tau_f}{(1-\tau_f)}\left[\delta - \frac{\alpha(\rho + \delta)}{\rho + \alpha}\right]$$
$$- \frac{(\tau_d - \tau_c s)i}{(1-\tau_f)(1-\tau_d)}\left[1 - \frac{\alpha - \delta}{\rho + \alpha}\right] =$$
$$= \delta + \frac{\rho}{(1-\tau_f)}\left[1 - \tau_f\frac{\alpha - \delta}{\rho + \alpha}\right]$$
$$- \frac{(\tau_d - \tau_c s)i}{(1-\tau_f)(1-\tau_d)}\left[1 - \frac{\alpha - \delta}{\rho + \alpha}\right]. \tag{A24}$$

Interpretation of Cases 2A and 2B (where $\tau_f < \tau_c$)

Table A3 adds two rows to Table 1 (Case 2B and Case 3B) with the share of normal distributed dividends included in the owner's taxation being zero ($s = 0$). Case 2B stands for the case where the corporate tax rate is lower than the personal-level tax rate on capital income. It interestingly shows that neutral treatment of investment and irrelevance of depreciation allowances do not require $s > 0$. A suitable choice of i with $s = 0$ yields similar properties.

Observe that now the rate required to yield neutrality is lower than in case 2A. This result is intuitive: the normal return is taxed more leniently, but the return is calculated using a lower rate. As a result, the value of the dividend allowance is unchanged.[29] However,

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[29] As is shown below, in both cases the allowance's after-tax value for the owner is $\frac{1-\tau_c}{1-\tau_g}\tau_f\rho$. Interestingly, assuming $\tau_g = \tau_c$

Table A3: Optimal imputed rates of return in selected special cases.

Tax Rates	Parameter s	Optimal Normal Rate of Return	
Simple Case: $\tau_d = \tau_c = \tau_f = \tau$	$s = 0$	$i = (1-\tau)\rho$	Finland 1993-2004 (original)
Case 2A: $\tau_d = \tau_c > \tau_f$	$s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$	$i = (1-\tau_f)\rho$	Ministry of Finance Proposal in 2010
Case 2B: $\tau_d = \tau_c > \tau_f$	$s = 0$	$i = \frac{\tau_f}{\tau_c}(1-\tau_c)\rho$	
Case 3A: $\tau_d > \tau_c > \tau_f$	$s = \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c}$	$i = \frac{\tau_f}{\tau_d^*}(1-\tau_d)\rho; \; \tau_d^* = \tau_d - \frac{\tau_c - \tau_f}{1-\tau_f}$	Current Finnish System (applied from 2005 on)
Case 3B: $\tau_d > \tau_c > \tau_f$	$s = 0$	$i = \frac{\tau_f}{\tau_d}(1-\tau_d)\rho$	

it is worth noting that whenever we have $\tau_c > \tau_f$ but $s = 0$ we cannot have equal treatment between a firm's investment in low-yielding assets (bonds or savings accounts) and direct investment by owners in such assets. Rather, the relatively low rate of corporate tax favors financial investment channeled through the firm. The debate on the design of dual income taxation has considered this constellation to be problematic.[30]

More enlightenment on this issue can be reached by calculating the owner value of the dividend allowance ω for a one unit investment ($A = 1$). The instant value of the allowance after both corporate and personal taxes at any time point is given by the second term on the right-hand side of equation (A16): $\omega = \gamma(\tau_d - \tau_c s)i$. Using the parameter values for i and τ_d in Table 1 and s in equation (9) we obtain the following value for the dividend allowance in Case 2A:

$$\omega^{2A} = \gamma(\tau_c - \tau_c \frac{\tau_c - \tau_f}{(1-\tau_f)\tau_c})(1-\tau_f)\rho$$

$$= \frac{\tau_c(1-\tau_f) - (\tau_c - \tau_f)}{1-\tau_g}\rho = \frac{1-\tau_c}{1-\tau_g}\tau_f\rho. \quad (A25)$$

The corresponding calculation for Case 2B in Table A3 gives:

$$\omega^{2B} = \frac{1-\tau_c}{1-\tau_g}\tau_f\rho. \quad (A26)$$

Hence, the value of the allowance is the same in both cases. This explains the trade-off between the level of the effective tax rate on the normal return and the size of i used to calculate the normal return.

It may be useful to recall that under the ACE corporate tax the firm may deduct an allowance calculated as an imputed return on the book equity of the firm. According to the literature on ACE, the corporate tax system is neutral with respect to investment if the rate of the allowance, denote a, is set to equal the market rate of interest, $a = r$ (e.g. Devereux and Freeman, 1991). Modeling the ACE allowance in our framework and using this value for the ACE rate gives the following owner value for the ACE allowance:

$$\omega^{ACE} = \frac{1-\tau_c}{1-\tau_g}\tau_f r. \quad (A27)$$

The result concerning ACE's neutrality can be interpreted as being derived from a model that assumes non-distortionary owner-level taxation, in particular $\tau_g = \tau_c$.[31] When comparing the results of the net asset-based splitting system to those of the standard ACE system, it therefore seems fair to assume this special case. Making this assumption gives:

$$\omega^{2A} = \omega^{2B} = \omega^{ACE} = \tau_f r. \quad (A28)$$

The value of the allowance is exactly equal across the tax systems. This reaffirms the notion that there is a close link between the net asset-based splitting system and the ACE corporation tax.

Case 3B in Table A3 considers a case where excess dividends are taxed at a higher rate than other forms of capital income, $\tau_d > \tau_c$. A neutrality-yielding i can also be found when $s = 0$. Again, compared to Case 3A, a relatively lower rate is required to yield neutrality. The intuition with these results is similar as above.

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this exactly corresponds to the value of the ACE allowance under ACE corporate tax.

30 As discussed in Appendix 1, the equality of the tax rates was a key element in Sørensen's (1994) prototype DIT. A Norwegian tax committee revisited this issue recently (NOU, 2014). The committee considered it important to maintain the equality even if the corporate tax rate were cut due to pressures by international tax competition.

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31 Or no owner-level taxation at all.