Does Incorporation Matter? Quantifying the Welfare Loss of Non-Uniform Taxation Across Sectors*

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Abstract

According to Harberger's 1962 and 1966 seminal papers, the corporate income tax distorts the allocation of capital between the corporate and the non-corporate sector and reduces therefore aggregate output. To quantify this efficiency loss we apply a dynamic, computable, general equilibrium growth model. We compare the allocation of capital under the current, non-uniform German tax system with the allocation of capital arising from a hypothetical, sector neutral tax system where both sectors face the same effective tax burden. Our numerical results underpin the theoretical finding, that the loss in overall output is highly sensitive to the source of investment funds. Accordingly, if investments are exclusively financed via new share issues the efficiency loss amounts to nearly 2 per cent of aggregate output. However, if less than half of overall investments are financed via new equity injections the efficiency loss is almost negligible.

Keywords: Capital income taxation, Non-uniform taxation, Computable general equilibrium modeling,
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1 Introduction

Recalling HARBERGER'S seminal 1962 and 1966 papers, he was the first one who presented a comprehensive analysis concerning the incidence of the corporate income tax. Applying a general equilibrium model, featuring two sectors and two inputs, he distinguished between two distorting effects arising from corporate taxation, namely an output effect and an input substitution effect. While the output effect refers to the changes in sectoral output resulting from taxation, the input substitution effect captures the adjustment in input factors due to taxation. The corporate income tax incurs an additional tax burden on the input factor capital and thus it discriminates against capital accumulation within the corporate sector. However, Harberger demonstrated that, even if a tax is levied on capital within the labor intensive sector, the overall demand for capital in the whole economy may increase. Such an outcome is possible, if the output effect dominates the factor substitution effect, or stated differently, if the general equilibrium effect dominates the partial equilibrium effect. Even if this result is derived under rather strong assumptions, it demonstrates the importance of a general equilibrium framework when analyzing the arising effects of capital income taxation.

Since then, various extensions have been added to the Harberger analysis. A survey on these studies is provided by MCLURE (1975). The empirical work of MACKIE-MASON (1990), GORDON and MACKIE-MASON (1993, 1997) as well as the articles of GRAVELLE and KOTLIKOFF (1989, 1993) are among the most prominent contributions on this issue. While all these studies either focus on the distortion in the legal choice of firms or the welfare loss arising due to the firm specific tax structure prevailing in the U.S., none of these studies take the financial behavior of firms explicitly into account. However, the financial decision of firms is of special importance, since the different types of investment funds may or may not increase the required return on corporate equity and thus discriminate against corporate investments vis-a-vis non-corporate investments. For example, under the classical system of corporate taxation, the return of a corporate investment financed by new share issues is subject to double taxation, since the return is first subject to the corporate tax and thereafter to the dividend tax on the shareholder level. As opposed to this, the return of a non-corporate investment is taxed only once, namely when the personal income tax of the firm owner is levied.[1] Consequently, the question arises whether the resulting efficiency loss from the non-uniform tax treatment of corporate and non-corporate firms is an important issue from a quantitative point of view[2].

To quantify the efficiency loss resulting from the non-uniform taxation of sectors we apply a dynamic, computable general equilibrium growth model calibrated to the German economy. In a first simulation we model the current discriminating German tax system and control for the capital accumulation within the corporate and the non-corporate sector, respectively. Thereafter we run a second simulation and apply a hypothetical revenue neutral tax reform where both sectors face the same tax burden. The difference in the allocation of capital across sectors for the first and the second simulation provides a first measure for the distorting power of the corporate tax system. Moreover, the gain in aggregate output arising due to the improved allocation of capital induced by a sector neutral tax reform is computed. To evaluate the relevance of the firm's financial behavior on the resulting gain in aggregate output, these calculations are carried out for several combinations of investment funds, ranging from pure external equity finance to a combination of only internal equity finance and debt finance.

The paper is structured as follows: The subsequent Section two provides a short survey on the existing literature while Section three reviews the main theoretical arguments for and against taxing corporations and additionally presents the main findings of the Harberger model within a simple, stylized framework. The applied computable general equilibrium (CGE) model which is an extended version of this stylized framework is

[1] Additionally, independent of the financial structure, the design of a tax system may a priori discriminate against the accumulation of capital within one sector. This could for example happen by providing sector specific depreciation rules, imputation factors or tax exemptions, as it is the case in Germany.

[2] Limiting the decision whether to incorporate or not, only to the effective tax rate would be by far too naive. In reality there are many other non-tax advantages which countervail the disadvantage of double taxation. For example, the institution of limited liability, the lower transaction cost of collecting equity money, special rules affecting the profit and loss accounting, are important non-tax advantages which might compensate a corporate firm for the higher tax burden. However, these aspects are not accounted for in this analysis.

discussed jointly with a comparative dynamic analysis in Section four. In Section five we compute the effective tax burden on corporate and non-corporate firms inherent in the present German tax system. The simulation results as well as the sensitivity analysis are the focus of Section six, while Section seven concludes.

2 Literature Survey

Given that corporate income taxes exist in one form or the other in almost every country, several papers have dealt with the influence of taxation on the choice of legal form of firms and the deadweight loss stemming from this non-uniform taxation. On the one hand, GRAVELLE and KOTLIKOFF (1989 and 1993) find significant distortions by using a model that allows for both corporate and non-corporate firms to produce within the same sector.[3] However, their results are strongly influenced by the large elasticity of substitution assumed between the organizational forms. Using the compensating variation as a measure of the excess burden, the authors compute a deadweight loss of 123 per cent of total tax revenue by using unitary demand and production elasticities. Simiar conclusions are drawn by GOOLSBEE(1997) who studied the effects of changes in taxes between 1900-1939 and found a significant but small effect on the choice of organizational form for that period.

On the other hand, GORDON and MACKIE-MASON (1991) show only a modest response of the shift in legal form to taxation. Nevertheless, their low findings result from the fact that during the analyzed period (1957-1997), the major changes in tax rates regarded mainly personal taxes and not corporate taxes.

In their 1997 article, CARROLL and JOULFAIAN conclude that the 1986 US tax reform[4]

[3]This is the major difference to the standard Harberger model. Harberger assumed that the commodities produced in the corporate sector differ from the one produced in the non-corporate sector. However, the basic conclusions do not change if the corporate and non-corporate sectors are producing the same goods (see also SINN, 1987, p. 171).

[4]Through the 1986 Tax Reform Act the maximum corporate tax rate was reduced from 46% to 34%. Distributed dividends were taxed as ordinary income and the capital gains tax rate was 28%. Non-corporate firms were liable to a 50% tax before the reform (CARROLL and JOULFAIAN, 1997)

resulted in an increased number of firms organized as 'S-firms'[5] due to the larger difference between the corporate and non-corporate tax rates. Moreover, GORDON and MACKIE-MASON (1993) show that changes in the organizational form of a firm will mainly depend on the investor's tax bracket. Thus, non-corporate firms which record losses should be owned by investors in high tax brackets while investors in low tax brackets have an incentive to own profitable firms under the 1993 US tax law. However, the authors estimate only minor efficiency gains of abolishing this differential tax treatment. Summarizing the findings of this line of literature, we conclude that the tax differential between corporate and non-corporate firms does indeed matter and has a significant impact on firm behavior. However, the quantified distortions and especially the computed loss in aggregate output is only small and highly sensitive to the applied elasticities.

3 The Efficiency Cost of the Corporate Income Tax

The existing public finance literature presents several arguments for or against the taxation of corporations. On the one hand, corporations may earn positive pure profits and a tax on these profits is non-distorting. Moreover, in the case the corporation is seen as a separate identity with an independent ability to pay which carries certain economic and legal privileges from incorporation, like for example the possibility to issue public shares, or the legal privilege of limited liability, the existence of the corporate income tax can be justified.

On the other hand, if the corporation is just seen as a mechanism to transmit earnings to its owners, only an individual income tax should apply to corporate income. Following this view, the corporate income tax resembles a discriminatory tax on the use of capital within incorporated firms, and, according to the theory of optimal taxation, the corporate tax should be set equal to zero, to avoid any efficiency losses.[6] Moreover, if a corporate

[5]An 'S-firms' does not have to pay any corporate income tax and can directly pay its profits to shareholders. However, it can not have more than 35 shareholders, can not choose to be incorporated for 5 years and can not issue more than one class of stock (CARROLL and JOULAFAIAN,1997).

[6]If a profit tax does not allow for any deduction of the opportunity cost of equity capital the profit

tax applies, the marginal products of capital may deviate across sectors, resulting in a suboptimal allocation of capital. The herewith inherent loss in aggregate output is a strong argument against the double taxation of corporate earnings. A more detailed discussion on this type of efficiency loss is presented in the following subsection, which introduces a simple version of the Harberger model.

3.1 The Harberger Problem

While Harberger's 1962 paper mainly deals with the tax incidence of the corporate income tax, his later 1966 paper is dedicated to the efficiency cost or welfare loss arising from corporate income taxation as well as its numerical approximation. Harberger's analysis showed that if a tax levied on capital only within one sector (e.g. the corporate sector) but not on the other sector (e.g. the non-corporate sector), too much capital will be employed in the tax exempt sector and too little in the sector which is taxed. The following stylized model describes the efficiency loss induced by corporate taxation. The extended version of the model is also a core building block of the numerical CGE model discussed further below.

There are two sectors in the economy, a corporate sector and a non-corporate sector, distinguished by the superscript C and NC, respectively. The production technology, $F(\cdot)$, is linearly homogenous and the same for both sectors. Both sectors use capital, K, and labor, L, as input factors. While capital is perfectly mobile across sectors, $K = K^C + K^{NC}$, labor is immobile and ex ante optimally distributed across sectors. Both firms hire on the same competitive labor market. Capital depreciates at rate δ and thus aggregate output net of depreciation is given by:

$$F(K, L) - \delta K = F(K^C, L^C) - \delta K^C + F(K^{NC}, L^{NC}) - \delta K^{NC}. \tag{1}$$

Assuming a uniform profit tax τ levied on the output of both sectors of the economy, the

tax is a distorting tax on the production factor capital. In order to minimize the distortion concerning the choice of input factors, the profit tax should be small or even zero.

representative firm of either sector maximizes:

$$\max_{K^f} \quad F(K^f, L^f) - \delta K^f - wL^f - iK^f - \tau \left[F(K^f, L^f) - wL^f - \delta K^f\right], \qquad (2)$$

where w denotes the uniform wage rate and i the exogenously given market rate of interest. The optimal output maximizing, amount of capital used in each sector is determined by the equality of the marginal product of capital net of depreciation and net of taxes and the market rate of interest, i, according to: $(1-\tau)\left[\frac{\partial F}{\partial K^f} - \delta\right] = i$. Since the tax rate and depreciation are assumed to be equal across sectors, the optimality condition simplifies to:

$$\frac{\partial F}{\partial K^C} = i = \frac{\partial F}{\partial K^{NC}}. \qquad (3)$$

This optimality condition will be satisfied in a competitive market equilibrium without taxation, but also in the presence of a uniform tax. The size of each sector is determined by a sector specific fixed factor, which allows for a positive pure profit within each sector. For the corporate sector this fixed factor could be explained by the non-tax benefits of incorporation like the economic privilege of issuing public shares or by the legal advantage of limited liability. For the non-corporate sector, one major non-tax advantage arises from the fact that firms operating in this sector are not subject to tight bureaucratic rules and regulations.

In case only one sector, namely the corporate sector is subject of taxation, whereas the non-corporate sector is tax exempt, the optimal use of capital in the corporate sector is determined by: $(1-\tau)\left[\frac{\partial F}{\partial K^C} - \delta\right] = i$, and by $\frac{\partial F}{\partial K^{NC}} - \delta = i$ in the non-corporate sector. Accordingly, the marginal products of capital do not equate across sectors:

$$(1-\tau)\frac{\partial F}{\partial K^C} = i = \frac{\partial F}{\partial K^{NC}}. \qquad (4)$$

The intuition behind Harberger's problem is evident: Due to the non-uniform taxation of the two sectors, too little capital is installed in the more heavily taxed corporate sector, compared to the case without taxation or the case of uniform taxation. Accordingly, in a general equilibrium framework, the residual amount of capital has to be installed in the untaxed, or less heavily taxed non-corporate sector, per assumption. Therefore, the corporate tax drives a wedge between the marginal products of capital and induces a loss in aggregate output. This loss called Harberger the 'efficiency cost' of the corporate income tax.[7] Reallocating capital from the non-corporate to the corporate sector would thus represent a way to increase aggregate output.

3.2 The Harberger Triangle

Figure 1 illustrates the Harberger problem: The two downward sloping curves depict the marginal product of capital in the corporate, $\frac{\partial F}{\partial K^C}$, and the non-corporate, $\frac{\partial F}{\partial K^{NC}}$, sector, respectively. Maximal aggregate output is achieved, if, according to equation (3), the marginal products of capital are the same for each sector. This situation is depicted by point D in Figure 1.

[7] There exists some criticism to the Harberger problem, which should be briefly mentioned here: According to Stiglitz (1973), investments are always financed via debt and not equity capital at the margin. Thus, if the marginal investment is financed externally or via retianed earnings, the corporate income tax does not matter any more and the Harberger problem disappears.

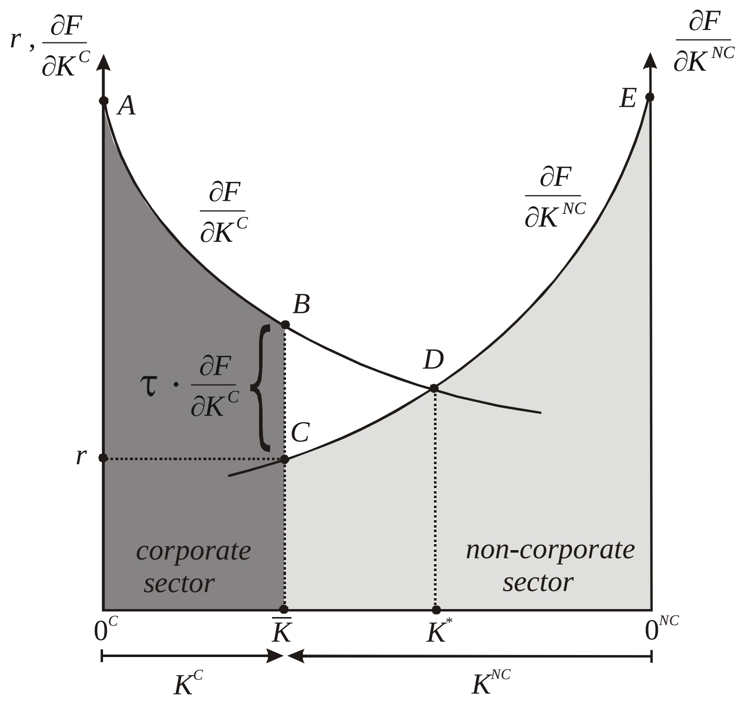

Figure 1: *The Harberger Triangle*, following Sinn (1987).

At point D, aggregate output amounts to $ADE0^{NC}0^C$, which is equivalent to the sum of corporate sector output, ADK^*0^C, and non-corporate sector output $DE0^{NC}K^*$. The optimal allocation of capital across the two sectors is represented by K^*, indicating that the amount $\overline{0^CK^*}$ is installed in the corporate sector, while the remaining amount of $\overline{K^*0^{NC}}$ is installed in the non-corporate sector.

If a corporate income tax of size τ is levied, capital is reallocated from the corporate to the non-corporate sector inducing a new allocation of capital, given by $\overline{K}$, as compared to the initial allocation depicted by K^*. Therefore, the remaining amount of capital in the corporate sector is $\overline{0^C\overline{K}}$, and capital of the amount $\overline{\overline{K}K^*}$ moves from the corporate to the non-corporate sector. The resulting stock of capital within the non-corporate sector is thus given by $\overline{\overline{K}0^{NC}}$. Accordingly, the marginal product of capital in the non-corporate sector, declines while the marginal product of capital in the corporate sector rises, as predicted by equation (4). The resulting amount of output generated within each sector amounts to the dark shaded area $AB\overline{K}0^C$ for the corporate sector and to the light shaded area $CE0^{NC}\overline{K}$ in the case of the non-corporate sector. Aggregate output equal to $ABCE0^{NC}0^{C}$ is thus reduced by the triangle BCD compared to the initial situation without taxation. This loss in aggregate output is the so-called *Harberger Triangle*. The extent to which the financial decision of firms affects the size of this loss in aggregate output is discussed in the following Section.

4 The Model

This Section introduces the theoretical underpinning of the dynamic computable general equilibrium growth model. It includes a detailed modelling of each firm sector, allowing us to measure the arising welfare loss of the corporate tax in two distinct ways: First, the Harberger loss can be computed in each period of time according to the original static framework. Moreover, we are also able to measure the change in the Harberger welfare loss during the phase of transition from the pre-reform to the post-reform steady state equilibrium. The firm's optimal investment behavior is derived from an intertemporal investment model with convex adjustment costs. Since we mainly focus on the efficiency aspects of taxation rather than on the distributional issues, the household sector is represented by the traditional Ramsey model. The public sector introduces various distortions on the behavioral margins of agents through taxation and public debt. The model's fourth building block is the rest of the world, which is linked to the domestic economy via the current account.[8] The domestic economy is modelled as a small open economy, which faces an exogenously given world market rate of interest denoted by i.

We rely on a basic neoclassical linearly homogenous production technology with capital, K and labour, L, as production factors, $Y^f = F(K^f, L^f)$. Again, the superscript $f \in \{C, NC\}$ with C = corporate and NC = non-corporate denotes the legal form of a particular firm. The price of the output good is normalized to unity. Additionally, the firm incurs adjustment costs $J^f(I^f, K^f)$ which describe decreasing returns from capital

[8] The complete model documentation can be received on request from the authors.

accumulation.[9] The steady state adjustment costs are zero such that they do not influence the steady state solution. Domestic firms hire labour and accumulate capital in order to maximize their value. Corporate profits are subject to the corporate income tax, $\tau^{P,C}$, levied on the firm level. Moreover, whenever corporate profits are distributed the dividend tax, τ^{D}, additionally applies on the shareholder level[10], constituting a double taxation of corporate profits. Even in the case corporate profits are retained, a double taxation of corporate profits applies, due to the taxation of capital gains at the rate, $\tau^{G,C}$. Profits of non-corporate firms are taxed only once, namely at the personal level. The appropriate tax rate is the personal income tax, $\tau^{P,NC}$, of the firm owner.

Capital accumulates over time whenever gross investment, I_t^f, exceeds the depreciation of the existing capital stock, δK_t^f. Therefore the equation of motion for capital is given by:

$$GK_{t+1}^f = I_t^f + (1-\delta)K_t^f. \tag{5}$$

The growth factor $G = (1+g)$, enters the model as we allow for an exogenous trend growth in labour productivity at rate g. Thus, in a balanced growth equilibrium the capital stock as well as all other variables grow at the rate g.

In the case of debt finance, each unit of debt installed incurs interest payable equal to the market rate of interest and additional agency cost of $m(b^f)$.[3] The agency cost of debt depend on the firm's debt-asset ratio, $b^f = B^f/K^f$. In the case the debt-asset ratio rises, the bank will charge higher agency cost to count for the increased risk of bankruptcy the

[9] Adjustment costs are introduced to obtain more realistic dynamics in an open economy. The adjustment cost function is assumed to be linearly homogeneous in investments, I and capital, K and convex in investment.

[10] According to the German "Halbeinkünfteverfahren", dividends, D, are first taxed on the firm level and then half of distributed profits are once again taxed on the personal level. To account for this imputation system, we take only half of the statutory tax rate applied to dividend income for the simulations.

Moreover, effectively there is no capital gains tax in Germany but the variable, $t^{G,f}$, is carried along for reasons of completeness.

[3] The agency cost of debt, $m = m(b^f)$, are increasing in the debt equity ratio, $b^f = \frac{B^f}{K^f}$, since the first, $m'(b^f)$, and the second , $m''(b^f)$, derivative are positive.

firm is facing. Debt accumulates according to:

$$GB_{t+1}^{f} = BN_t^f + B_t^f. \tag{6}$$

Accordingly, the next period's stock of debt, B_{t+1}^f, is the sum of the existing stock of debt, B_t^f, and new debt, BN_t^f.

The following equation shows net of tax profits π_t^f defined as output Y_t^f, less adjustment costs J_t^f, wage payments $w_t L_t^f$, depreciation δK_t^f, interest payments on debt $(i_t + m^f)B_t^f$ and the tax liability of the firm $T_t^{P,f}$:

$$\begin{aligned} \pi_t^f &= Y_t^f - J_t^f - w_t L_t^f - \delta K_t^f - (i_t + m^f)B_t^f - T_t^{P,f}, \\ \text{with} \quad T_t^{P,f} &= \tau^{P,f}[Y_t^f - J_t^f - w_t L_t^f - \delta K_t^f - (i_t + m^f)B_t^f - z_3(I_t^f - \delta K_t^f)]. \end{aligned} \tag{7}$$

The tax allowances for new investments is represented by z_3.[4] Since we distinguish between corporate and non-corporate firms, the different ways of financing investments have to be analyzed separately.

4.1 Corporate Firms

Firms which operate in the corporate sector can draw on three different sources to finance their investment projects[5]. They can either use retained earnings, $\left(\pi^C - D^C\right)$, which implies a reduction of current dividend payouts, D_t^C, or they could rely on new equity injections, VN_t^C, or on external debt capital, BN_t^C.

In the following, the parameter β which exogenously determines the amount new share issues, controls for these different sources of investment funds. Therefore, the amount of new equity amounts to $VN^C = \beta(1 - z_3\tau^{P,C})IN^C$. In the case β is equal to one, all investments are financed via new equity injections. However, if β is set equal to zero the

[4] If $z_3 = 0$ we have the case of true economic depreciation. If $z_3 = 1$ we allow for a full immediate write-off and $\tau^{P,f}$ can be interpreted as a cash-flow tax.

[5] Moreover, we assume that replacement investments are always financed internally via retained earnings.

corporate firm has to rely on retained earnings and debt in order to finance its investment projects. Thus, the amount of retained earnings and debt is determined endogenously within the model, but the amount of new share issues is set exogenously via the parameter β. Accounting for the three different types of investment funds, the flow of funds equation for the corporate firm states:

$$IN_t^C = \left(\pi_t^C - D_t^C\right) + VN_t^C + BN_t^C. \tag{8}$$

In equilibrium, the investor has to be indifferent between a financial market investment and the investment in corporate equity. While a financial market investment yields a net of tax return equal to $r_t = (1 - \tau^i) \cdot i_t$,[11] the return on corporate equity includes net of tax dividend income and net of tax capital gains:

$$r_t V_t^C = (1 - \tau^D) D_t^C + (1 - \tau^{G,C}) \left[G V_{t+1}^C - V_t^C - VN_t^C \right]. \tag{9}$$

This is the so-called no-arbitrage condition.Written as a differential equation of the firm value, V_t, and solving this equation forward, the present value of the corporate firm is defined as

$$V_t^C = \sum_{S=t}^{\infty} \frac{\overline{D}_S^C}{1 + r_S^{equ,C}} \prod_{z=t}^{S+1} \frac{1+g}{1 + r_Z^{equ,C}}, \tag{10}$$

where $\overline{D}_t^C$ determines tax adjusted dividend payouts net of new equity injections. Accordingly, the present value of the corporate firm in any period t is given by the discounted sum of all future tax adjusted net distributions to shareholders, $\overline{D}^C$. The appropriate discount rate is given by the tax adjusted return on corporate equity according to: $r^{equ,C} = r/(1 - \tau^{G,C})$.

From the maximization problem of the corporate firm (compare the appendix), one can

[11] τ^i denotes the tax on interest income and i_t the gross interest rate.

derive the cost of capital formula defining the required return of a corporate investment:

$$
\begin{aligned}
F_K^C - \delta \quad = \quad & \underbrace{\frac{r}{(1-\tau^{G,C})(1-\tau^{P,C})}\left[1-b^C\right]}_{\text{cost of equity}} \qquad + \quad \underbrace{\left[i+m^C\right]b^C}_{\text{cost of debt}} \\
+ \quad & \underbrace{\frac{r}{(1-\tau^{G,C})(1-\tau^{P,C})}\beta\left[\frac{(1-\tau^{G,C})}{(1-\tau^{D,C})}-1\right]}_{\text{cost of new equity injections}} \\
- \quad & \underbrace{\frac{r}{(1-\tau^{G,C})(1-\tau^{P,C})}z_3\tau^{P,C}\left[1+\beta\left(1-\frac{(1-\tau^{G,C})}{(1-\tau^{D,C})}\right)\right]}_{\text{advantage of accelerated depreciation}}
\end{aligned}
\tag{11}
$$

According to equation (11) the required return of a corporate investment before taxation is determined by the weighted average of the arising cost of equity finance under retained earnings (first term) and new share issues (second term) as well as the arising cost of debt finance (third term). In the case the tax system allows for a tax credit for new investments or accelerated depreciation, the cost of capital is reduced by this particular tax benefit (fourth term).

If we disregard from accelerated depreciation ($z_3 = 0$) and assume a firm which finances investments just via retained earnings ($b^C = 0$ and $\beta = 0$) the cost of capital formula changes to:

$$F_K^C - \delta = \frac{r}{(1-\tau^{P,C})(1-\tau^{G,C})}. \tag{12}$$

This is the same expression which applies under the 'New View' of dividend taxation. Accordingly, only the corporate and the capital gains tax distort the investment decision of the corporate firm. However, in the case, the firm finances its investment exclusively by new share issues ($b^C = 0$ and $\beta = 1$) the cost of capital states:

$$F_K^C - \delta = \frac{r}{(1-\tau^{P,C})(1-\tau^{D,C})}. \tag{13}$$

This time, the formula corresponds to the one derived under the 'Old View' of dividend taxation. In this case, the corporate tax and the dividend tax play a significant role.

Finally, for a firm that just employs debt as a source of finance ($b^C = 1$ and $\beta = 0$) and again abstracting from accelerated depreciation ($z_3 = 0$) the cost of capital equals the gross interest rate i plus the agency cost of debt m^C according to: $F_K^C - \delta = i + m^C$.

Since under both views[12] a double taxation of corporate profits occurs, one could assert that they lead to similar distortion in the investment decision of corporate firms. However, such a conclusion is misleading for two reasons: First, even if the statutory tax rates on capital gains and dividends were the same, the effective tax burden on capital gains is much lower than the one on dividends, since capital gains are taxed on realization rather than on an accrual basis. Therefore, the tax deferral during the holding period of capital gains leads to significant tax advantages. Consequently, the arising double taxation of corporate profits as predicted by the 'New View' is less severe compared to the one predicted by the 'Old View'. Second, most tax system of industrialized countries leave capital gains tax free. Therefore, if the capital gains tax equals zero, a double taxation of corporate profits arises only if investments are financed by new share issues. [13]

To what extent does the financial decision of corporate firms interfere with the welfare loss predicted by Harberger? As discussed above, the arising suboptimal allocation of capital across sectors depends on the difference in the tax burden levied on each sector. Therefore, in the case new share issues are chosen as the exclusive source of investment funds, corporate profits are subject to double taxation. However, as we have seen, non-corporate profits are taxed only once, namely at the personal income tax of the firm owner. This additional burden on corporate profits induces a suboptimal allocation of capital across sectors. However, if retained earnings are chosen as the marginal source of investment funds, corporate profits as well as non-corporate profits are taxed only once. Additionally, if the rate of corporate tax and the personal income tax of the firm owner are equal, both sectors will face a rather similar tax burden. Consequently, the arising

[12] For a detailed discussion on the Old and New View of dividend taxation see AUERBACH (2002), SINN (1991) or ZODROW (1991), for example.

[13] The empirical literature does not provide any particular support for the Old or 'New View' of dividend taxation, but suggests that both views are valid. For example, POTERBA and SUMMERS (1983) conclude in their often cited paper, that the 'Old View' is the correct one, but a more recent study of AUERBACH and HASSET (2003) claims that both views are valid, depending on the growth stage of a corporation.

distortion in the allocation of capital across sectors will be only small.

4.2 Non-Corporate Firms

As opposed to corporate firms, non-corporate firms, can only choose between new debt BN_t^{NC} or new equity injections VN_t^{NC} as a source of investment funds. Retained earnings are not available as a source of finance, since all profits are immediately distributed to the firm owner, such that $\pi^{NC} = D^{NC}$ holds. Hence, the flow of funds equation for the non-corporate firm is reduced to:

$$IN_t^{NC} = VN_t^{NC} + BN_t^{NC}. \tag{14}$$

Moreover, non-corporate firms do not pay any dividends and therefore are not liable to the dividend tax. However, the distributed profits are subject to the personal income tax of the firm owner $\tau^{P,NC}$. The same arbitrage calculus applied to the corporate firm holds for the non-corporate firm as well:

$$r_t V_t^{NC} = \pi_t^{NC} + (1 - \tau^{G,NC}) \left[GV_{t+1}^{NC} - V_t^{NC} - VN_t^{NC} \right]. \tag{15}$$

Thus, an investor has to be indifferent between investing into the financial market, yielding a net of tax return of r_t, or investing into non-corporate equity, yielding net of tax profits and net of tax capital gains. Again, the value of the non-corporate firm is calculated by applying the same procedure as used for corporate firms:

$$V_t^{NC} = \sum_{S=t}^{\infty} \frac{\overline{\pi}_t^{NC}}{r_t^{equ,NC}} \prod_{z=t}^{S+1} \frac{1+g}{r_t^{equ,NC}}. \tag{16}$$

The variable $\overline{\pi}_t^{NC}$ denotes the net cash distributions of the non-corporate firm to the firm owner. These distributions are net of tax and net of new equity injections. According to equation (16), the value of the non-corporate firm is given by the discounted sum of all future net cash distributions.

Once again, by solving the maximization problem of the firm we can derive the following cost of capital formula for non-corporate firms:

$$F_K^{NC} - \delta \quad = \quad \underbrace{\frac{i(1-\tau^i)}{1-\tau^{P,NC}}\left[1-b^{NC}\right]}_{\text{cost of new equity}} \quad + \quad \underbrace{\left[i+m^{NC}\right]b^{NC}}_{\text{cost of debt}} \quad - \quad \underbrace{z_3\frac{\tau^{P,NC}\cdot i(1-\tau^i)}{1-\tau^{P,NC}}}_{\text{adv. of acc. depreciation}} \tag{17}$$

While the cost of capital formula for the corporate firm included four terms, the cost of capital formula of non-corporate firms is made up of only three terms since the latter can not rely on retained earnings as a possible source of investment funds. The first term of equation (17) determines the cost of new equity, while the second term represents the occurring cost of debt finance. The third term shows the tax advantage stemming from an investment subsidy or accelerated depreciation. In the case the non-corporate firm relies only on new equity as investment funds ($b^{NC} = 0$) and abstracting from accelerated depreciation ($z_3 = 0$), the above cost of capital formula changes to:

$$F_K^{NC} - \delta = \frac{r}{1-\tau^{P,NC}}. \tag{18}$$

Thus, only the personal income tax rate of the firm owner drives a wedge between the return on non-corporate equity and the net of tax rate of interest and there is no double taxation of non-corporate profits. In the case of debt finance, the arising cost of capital amounts to the interest rate plus the agency cost of debt, according to: $F_K^{NC} - \delta = \left[i + m^{NC}\right]$.[14]

4.3 Comparative Dynamics

The comparative dynamic analysis allows us to derive basic insights about the economic effects arising as a result of taxation. This section focuses on the investment and financial behavior of the firms when the different tax rates are either increased or decreased. There-

[14]The remaining buildings blocks of a CGE model, in particular the household and the government sector as well as the rest of the world are not regarded here since they are only of minor importance for the theoretical underpinning and the interpretation of the simulation results.

fore, we compute the impact on the marginal product of capital and the cost of equity, respectively, arising from a marginal change in one of the tax rates under consideration. To start with, the financial behavior of the firm is evaluated.

Financial Behavior

The expression determining the optimal debt-asset ratio, derived from the firm's optimality and envelope conditions (equation (A.9) and (A.10) in the appendix), requires that the marginal cost of equity finance which is represented by the left hand side of equation (19) is equal to the marginal cost of debt finance:

$$\underbrace{\frac{(1-\tau^{i})i}{1-\tau^{G,f}}}_{r^{equ,f}} = \frac{\gamma^{D,f}}{\Omega^{f}}\left[i + m_{f} + m'_{f}b_{f}\right]. \tag{19}$$

The marginal cost of equity finance consist of the net return earned at the capital market adjusted by the capital gains tax. Accordingly, an investor is only willing to invest in equity capital, if the net of tax return on this investment is at least as high as the return he or she could earn on the alternative net of tax capital market investment.

The marginal cost of debt finance, represented by the r.h.s. of equation (19), consist of the market rate of interest and the agency cost of debt. Moreover, since each additional unit of debt increases the debt-asset ratio and thus raises the firm's risk of bankruptcy, additional agency cost of the size $m'b$ incur, which reduce the advantage of debt finance. The tax factor $\gamma^{D,f}/\Omega^{f}$ represents the advantage of interest deductibility inducing a preference for debt finance.

The optimal debt level is achieved, if the marginal tax preference for debt is fully offset by the marginal increase in the agency cost.

To evaluate the effects of a marginal change in the tax rates on the financial decision of a firm, we analyze the change in the cost of equity stemming from a marginal change in the tax rate under consideration. Similar to Dietz/Keuschnigg (2004) or Keuschnigg

(1991), we compute the percentage change in the cost of equity analogous to: $\widehat{r^{equ}} \equiv dr^{equ}/r^{equ}$, where dr^{equ} denotes the deviation from the initial value of the cost of equity. The relative change in the particular tax rate is then defined as $\widehat{\tau} \equiv d\tau/\left(1-\tau\right)$ to avoid division by zero. Therefore, we obtain:

$$r^{equ,f} = \frac{(1-\tau^i)i}{1-\tau^{G,f}} \qquad \longrightarrow \qquad \widehat{r^{equ,f}} = \widehat{\tau^{G,f}} - \widehat{\tau^i}. \tag{20}$$

According to equation (20), an increase in the interest tax rate lowers the cost of equity and stimulates equity finance, implying a decline in the debt-asset ratio since a capital market investment becomes less attractive - compared to a real investment in firm equity. As an implication of arbitrage, the equity financed investment becomes more attractive, and thus the firm's debt-asset ratio improves.

$$\frac{db}{d\tau^i} = -\frac{i/\left[(1-\tau^{G,f})(1-\tau^{P,f})\right]}{[2m' + m''b]} < 0.$$

As opposed to this, a rise in the capital gains tax rate increases the cost of equity and enhances therefore the attractiveness of debt finance.

$$\frac{db}{d\tau^{G,f}} = \frac{i(1-\tau^i)/\left[(1-\tau^{G,f})^2(1-\tau^{P,f})\right]}{[2m' + m''b]} > 0.$$

As shown in Figure 2, under the present tax constellation, the initial debt-asset ratio, b^*, is determined by the point of intersection between the horizontal line, depicting the cost of equity, r^{equ}, and the upward sloping curve, representing the marginal cost of debt finance. If the tax on interest income is raised, $d\tau^i > 0$, the cost of equity finance decreases, since a financial market investment yields a lower return for savers. This effect lowers the debt asset ratio because retained earnings are increasingly used as a source of finance, inducing a lower debt asset ratio as depicted by b'.

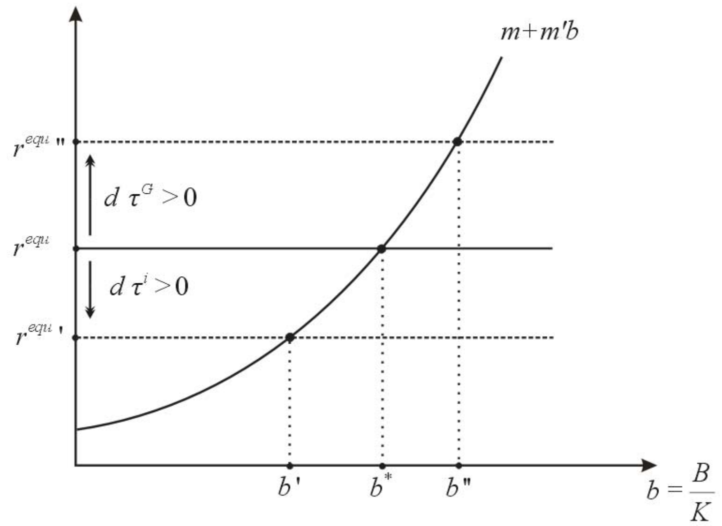

Figure 2: *Optimal Debt Asset Ratio*

On the contrary, an increase in the capital gains tax rate, $d\tau^G > 0$ shifts the cost of equity upwards, resulting in a higher debt-asset ratio of b''.

Moreover, if the interest expenditures are tax deductible, an increase in the corporate tax rate - or in the personal income tax of the firm owner will boost the tax advantage of debt finance compared to equity finance. The formal derivatives states:

$$\frac{db^C}{d\tau^{P,C}} = \frac{i(1-\tau^i)/\left[(1-\tau^{G,C})(1-\tau^{P,C})^2\right]}{[2m'(b)+m''(b)]} > 0$$

$$\frac{db^N}{d\tau^{P,N}} = \frac{i(1-\tau^i)/(1-\tau^{P,N})^2}{[2m'(b)+m''(b)]} > 0.$$

Investment Behavior

In Sections 4.1 and 4.2 we have derived the cost of capital formulae for corporate and non-corporate firms.

(a) Corporate Firms: Thus, differentiating equation (11) with respect to the tax rate under consideration, we find that an increase in the corporate as well as in the capital gains tax rate has a negative impact on investment, since in each case the cost of capital rises[15]:

$$\begin{aligned}
\frac{d(F_K^C-\delta)}{d\tau^{P,C}} &= \frac{i(1-\tau^i)}{(1-\tau^{G,C})(1-\tau^{P,C})^2}(1-b_C) > 0,\\
\frac{d(F_K^C-\delta)}{d\tau^{G,C}} &= \frac{i(1-\tau^i)}{(1-\tau^{G,C})^2(1-\tau^{P,C})} > 0.
\end{aligned}$$

If the corporate tax rate increases, returns stemming from real investments are more heavily taxed compared to those from a financial investment which is not subject to the corporate tax rate. Hence, the cost of capital will increase if $d\tau^{P,C} > 0$, resulting in less real investments. The size of this effect will be larger for firms endowed with much equity and smaller for highly indebted firms. Therefore, it is particularly important to model the debt equity ratio carefully. Concerning an increase in the capital gains tax, the cost of capital increases to the extent that profit retentions are used as a marginal source of investment funds. As a consequence, the investment activity will slow down.

In contrast, an increase in the interest tax rate reduces the cost of capital and stimulates therefore real investments:

$$\frac{d(F_K-\delta)}{d\tau^i} = -\frac{i_t}{(1-\tau^{P,C})\,(1-\tau^{G,C})} < 0.$$

In the case the interest tax rate is raised, an alternative investment in the financial market becomes less attractive and accordingly real investments are favoured relative to financial capital market investments.

Differentiating (11) with respect to β the parameter indicating the amount of new share issues used to finance investments we get:

$$\frac{dF_K^C}{d\beta} = \frac{i(1-\tau^i)}{1-\tau^{P,C}}\frac{\tau^D-\tau^{G,C}}{(1-\tau^D)(1-\tau^{G,C})}.$$

[15] Since we also assume that the debt asset ratio is optimally chosen, a marginal change in a tax rate has no influence on the optimal debt asset ratio which enters the cost of capital formula.

This expression is either larger or smaller than zero, depending on the difference between the dividend and capital gains tax, $\tau^D - \tau^{G,C}$. Since in nearly all countries $\tau^D > \tau^{G,C}$ holds, the whole expression is positive. Thus, an increase in the amount of new share issues used as investment funds will increase the cost of capital of a corporate firm. The rationale for this result is based on the 'subsidizing' effect of the dividend tax. If investments are financed via retentions - implying a reduction of dividends - the corporation avoids paying the dividend tax for each unit of capital not distributed to the shareholder. Each net of tax Euro sacrificed on the shareholder level leads to an increase in retentions of $\left(1 + \tau^D\right)$ on corporate level. If new share issues are the marginal source of investments, each Euro injected into the corporation increases corporate funds by exactly this single Euro and there are no additional benefits in terms of tax savings.

(b) Non-Corporate Firms: The cost of capital formula for an investment in the non-corporate sector was derives in equation (17). The striking difference to the cost of capital of corporate firms is the fact that the capital gains tax rate does not enter the formula of non-corporate firms because non-corporate firms can not draw on retained earnings as a marginal source of investment funds. Accordingly, the capital gains tax rate does not influence the investment decision of non-corporate firms.

Differentiating equation (17) with respect to the personal income tax of the firm owner shows that an increase in this tax rate has a negative impact on investment, since the cost of capital rises:

$$\frac{d(F_K^N - \delta)}{d\tau^{P,NC}} = \frac{i(1-\tau^i)}{(1-\tau^{P,NC})^2}(1 - b_{NC}) > 0.$$

As in the case of corporate firms, if the interest tax is increased, the investor might choose to switch to investing in non-corporate capital because an alternative investment in the financial market becomes less attractive.

5 German Tax Law and the Legal Form of Firms

5.1 The Significance of Corporate and Non-Corporate Firms

The German tax system systematically differentiates between the taxation of corporate and non-corporate firms. On the one hand ,these differences have evolved as a result of the double taxation which applies to German corporate firms. On the other hand, these differences also originate in the one-sided support of small and medium sized enterprises (SMEs)[16] by the German government. Since these SMEs are to a large extent organized as non-corporate firms it was a stated goal to have special benefits for unincorporated companies. These firms were to benefit from the significant cuts in income tax rates and from the possibility to credit the trade tax against their income tax liability in a standardized form (German Ministry of Finance 2004 a and b). Accordingly, the Supplementary Tax Reduction Act which entered into force in 2001 was especially designed to add tax relief to SMEs. This preferential treatment of the non-corporate sector advocated by the reformers was based on the argument that 82.7 per cent of all German enterprises are organized as sole proprietorships or partnerships, while only 15.8 per cent belong to the corporate sector.[17] However, looking at turnover data the picture changes: in 2000, for instance, non-corporate firms generated only 40.8 per cent of total turnover vis-à-vis 55.1 per cent by the corporate sector (own calculations based on Guenterberg and Wolter 2002). The importance of the corporate sector becomes even more striking, if one looks at the employment data. Firms in the corporate sector employ about 65 per cent of all employees, while only 35 per cent of all employees work in the non corporate sector (Destatis 2002 and BMF 2004, IAB own calculations). [18]

[16] Small and medium sized enterprises are interpreted as those having less than 500 employees and an annual turnover not exceeding 500.000 euros for small firms and 50 Million euro for medium -sized enterprises.

[17] The residual 1.5 per cent belong to various other legal forms.

[18] This measure of employment is applied to calibrate the size of each sector in the model.

5.2 The Tax Burden on Corporate and Non-Corporate Firms

As mentioned above, the effective tax burden on corporate and non-corporate firms differs considerably. Specifically, profits of a German corporate firm are subject to the local trade tax as well as to the corporate income tax and the solidarity surcharge. If profits are distributed, then, according to the half income principle, half of distributed profits are once again subject to the personal income tax as well as to the solidarity surcharge.

The actual marginal tax rate on retained profits of a corporate firm in Germany is:

$$\tau_{retained}^{C,\ actual} = \tau^{GC} \cdot (1 + soli) \cdot (1 - \tau^{GT}) + \tau^{GT}, \tag{21}$$

where τ^{GC} denotes the corporate tax rate, which currently amounts to 25 per cent. *Soli* denotes the solidarity surcharge of 5.5 per cent and τ^{GT} stands for the local trade tax, which is somewhere around 16.7 per cent.[19] For 2005 we compute an actual corporate tax burden of $\tau_{retained}^{C,\ actual} = 38.7$ per cent for retentions. [20]

The tax burden on distributed profits includes in addition the tax levied on personal level:

$$\tau_{distribution}^{C,\ effective} = \tau_{retained}^{C,\ actual} + \frac{\tau^{L}(1 + soli)}{2}\left[1 - \tau_{retained}^{C,\ actual}\right], \tag{22}$$

where τ^L represents the personal income tax rate. If we assume the top personal income tax rate of $\tau^L = 42$ per cent applies, the effective marginal tax rate for distributed profits of a corporation is $\tau_{distribution}^{C,\ effective} = 52.3$ per cent.

For a non-corporate firm one euro of profit is subject to the personal income tax augmented by the solidarity surcharge (first term in equation (23)) and a reduced local trade tax (terms two through four in equation (23)). The tax base of the local trade tax is reduced by the amount of the personal income tax liability as given by the second term.

[19] Assuming a an average value of the German multiplier ("Hebesatz") of $h = 400$, and a uniform base rate ("Gewerbesteuermesszahl") of $m = 0.05$ and accounting for the deductibility of the local trade tax from its own tax base, we compute according to the formula: $\tau^{GT} = \frac{h \cdot m}{1 + h \cdot m}$, an effective local trade tax of 16.7%. The local trade tax is deductible from the tax base of the corporate income tax.

[20] This rate enters equation (7) as $\tau^{P,C}$.

The last term provides an additional reduction of the local trade tax liability which was introduced to improve the tax position of non-corporate firms.

$$\begin{aligned}\tau^{NC,\ actual} &= \tau^{L}(1+\text{soli})+\tau^{GT}-\tau^{L}(1+\text{soli})\cdot\tau^{GT} \\ &\quad -1.8\cdot m\cdot(1-\tau^{GT})(1+\text{soli}),\end{aligned} \tag{23}$$

where m denotes a special measure of the local trade tax, the so called uniform base rate ('Gewerbesteuermesszahl'), which amounts to approximately 5 per cent. The effective tax levied on profits distributed by a non-corporate firm amounts to $\tau^{NC,\ actual} = 45.7$ per cent.[21] These examples show that, if an investor draws one euro from a non-corporate firm the tax liability amounts to 45.7 cent vis-à-vis 52.3 cent from a corporate firm. Thus, for an individual in a high income tax bracket, the advantage of investing in a non-corporate firm is 6.6 cent per euro invested. [22]

[21] Applying the relevant German tax parameters: $\tau^{L} = 0.42$; $soli = 0.05$; $\tau^{GT} = 0.167$; $m = 0.05$, the effective tax rate for a non corporate firm is according to equation (23): $\tau^{NC,\ eff} = 0.457$. Here we also allow for the special credit for standardized amount of local business tax in the size of 1.8.

[22] The German 2000 tax reform was aimed at improving the situation of non-corporate firms but also to achieve a more neutral tax system regarding the organizational choice of firms (BT 2000). However, according to Herzig (2001) and the German Council of Economic Advisors (GCEA, 2001) this tax reform has even increased the difference in the taxation of corporate and non-corporate firms. According to the calculation of the GCEA, the effective marginal tax rates for non-corporate firms decreased by 13.0 percentage points from 66.3 to 53.3 per cent and by only 11.2 percentage points, from 69.9 to 58.7 per cent, for corporate firms. The disparity is even larger, if one considers a tax exempt investor (zero tax bracket). The effective marginal tax rate for this type of investor increases by 12.3 percentage points for an investment in the corporate sector and by only 1 percentage point for an investment in the non-corporate sector. Similar results are obtained in a large number of studies. The paper by Jacobs et al (2003) highlights that non-corporate firms are favoured relative to corporate firms regarding their tax treatment. Blaufus (2001) emphasizes the tax advantage of a sole proprietorship or a partnership relative to a corporate firm. In case a firm records losses, non-corporate firms present an advantage since the owner can immediately credit these losses against other positive income, whereas losses can only be deducted in the future by a corporate firm. Thus, a non-corporate enterprise presents a liquidity and an interest advantage relative to a corporate firm. Jacobs (2001) shows that mostly enterprises in low or medium tax brackets benefit from having the legal status of a sole proprietorship or partnership.

6 Simulation Results

6.1 The Efficiency Cost of the German Corporate Income Tax

To quantify the efficiency loss resulting from the non-uniform taxation of corporate and non-corporate firms in Germany we perform two simulations. In the first simulation we calibrate the model according to the prevailing German tax system. Therefore, the actual corporate tax rate is set at a level of 38.7 per cent (which adds up to 52.3 per cent if one accounts for the personal taxes[23]) and the actual tax rate for non-corporate firms is set at 45.7 per cent. While running this first simulation we control for the amount of tax revenue collected as well as for the allocation of the capital stock between the two sectors. The second simulation is a revenue neutral tax reform under which both sectors are taxed in an equal way. Thus, not only similar rates apply to each sector, but also the dividend tax has to be abolished to assure that there is no double taxation of corporate returns. After running the two simulations we compare the allocation of the capital stock across sectors and the change in output under each of the two simulations.

Keeping in mind that the efficiency loss resulting from the non-uniform taxation of the corporate and non-corporate sectors is highly sensitive to the financial source of investments, we perform a number of simulations, each applying a different value for β, the parameter which determines the share of investments financed via new share issues. Tables one, two and three display the results for each scenario where $\beta \in \{1, 0.75, 0.5, 0.25\}$ is chosen.

In scenario one β is set equal to one, implying that all investments are financed via new share issues. Simulating the arising allocation of capital across sectors under the present German tax system, 63.5 per cent of the overall capital stock is allocated to the corporate sector while the residual amount of 36.5 per cent is employed in the non-corporate sector. The second simulation represents a 'sector neutral' tax reform for which

[23] Accounting for personal taxes, half of dividend payouts are again subject to the personal income tax of 44.3%. However, the effective capital gains tax is zero in Germany.

a uniform tax rate of 50.2 per cent is applied for both sectors, to ensure a revenue neutral reform scenario. Under this sector neutral tax system, 73.5 per cent of overall capital is used in the corporate sector and the remaining 26.5 per cent in the non-corporate sector. Thus, the current German tax system distorts the allocation of capital across sectors, since less capital than optimal is employed in the corporate sector. The capital stock in the corporate sector should be approximately 20 per cent higher, while the capital stock in the noncorporate sector should be about 24 per cent lower. This suboptimal allocation of capital leads to a loss in aggregate output of about 2 per cent. Table one summarizes the results of Scenario one:

Table 1: Simulation Results Scenario 1, $\beta = 1$

Simulation 1:	C- Sector	N-Sector
Profit tax rate	38.7	45.7
Effective tax burden	52.3	45.7
Capital allocation (in %)	**63.5**	**36.5**
Simulation 2:		
Uniform tax rate	50.2	50.2
Capital allocation (in %)	**73.4**	**26.6**
Change in sectoral capital stock	+ 20.2	- 24.0
Change in overall capital stock	+ 4.0	
Change in output	+ 2.0	

Source: Own Calculations

The reason why the uniform tax rate does not lie between the initial corporate tax rate of 38.7 per cent and the tax rate on profits of non-corporate firms of 45.7 per cent is the elimination of the dividend tax. Since the tax reform is meant to be revenue neutral, higher tax revenues have to be generated by the taxation of corporate and non-corporate firms to counter the revenue loss arising from the abolition of the dividend tax. Table two summarizes the applied tax rates for Scenarios two and three. In Scenario two 75 per cent of new investments are financed via external equity and only half of all investments in scenario three.

Table 2: Simulation Results Scenario 2 and 3

	Scenario 2, $\beta = 0.75$		*Scenario 3, $\beta = 0.5$*	
Simulation 1:	C- Sector	NC-Sector	C- Sector	NC-Sector
Profit tax rate	38.7	45.7	38.7	45.7
Effective tax burden	52.3	45.7	52.3	45.7
Capital allocation (in %)	**64.0**	**36.0**	**64.5**	**35.5**
Simulation 2:				
Uniform tax rate	49.8	49.8	49.5	49.5
Capital allocation (in %)	**70.7**	**29.3**	**67.7**	**32.3**
Change in sectoral capital stock	12.7	– 16.8	5.4	- 9.0
Change in overall capital stock	+ 2.1		+ 0.3	
Change in output	+ 1.0		+ 0.15	

Source: Own Calculations

Again, the first simulation represents the allocation of capital under the current German tax system while the second simulation shows the arising allocation of capital under the sector neutral tax reform. The size of β has a crucial implication for the uniform profit tax rate applied to corporate and non-corporate firms in the second simulation. A high value of β implies that a large fraction of investments is financed via new share issues. Thus, corporate firms do not retain profits, but they distribute them to shareholders and thereafter they raise funds through new share issues for investment purposes. Clearly, such a policy is not advantageous for corporations since each distribution is penalized by the dividend tax. However, the government benefits from such a firm behavior since it can collect an increased amount of dividend taxes compared to a situation where β is small. A low value of β implies that firms finance a large fraction of new investments by retained earnings and do not pay any dividends. As a result, the government will only raise little revenue from dividend taxation. Accordingly, the larger β, the higher the applied uniform profit tax rate has to be to ensure that a given amount of tax revenue is achieved.

The output loss resulting from the non-uniform taxation of sectors declines with β as we can see from Tables one and two. In Scenario three, only half of all investments are financed via new share issues while the other half is financed via retained earnings or debt. The resulting loss in output amounts to 0.15 per cent, which is equivalent to 3.2

billion Euro.

Table 3: Simulation Results Scenario 4, $\beta = 0.25$

Simulation 1:	C- Sector	N-Sector
Profit tax rate	38.7	45.7
Effective tax burden	52.3	45.7
Capital allocation (in %)	**64.9**	**35.1**
Simulation 2:		
Uniform tax rate	49.0	49.0
Capital allocation (in %)	**64.7**	**35.3**
Change in sectoral capital stock	- 1.9	- 0.9
Change in overall capital stock	- 1.5	
Change in output	- 0.7	

Source: Own Calculations

In Scenario four the capital stock decumulates in the corporate sector and accumulates in the non-corporate sector. In this scenario, the dividend tax does not affect the cost of capital to a large extent. According to the 'New View' of dividend taxation where all investments are financed at the margin via retained earnings or debt, the dividend tax is neutral in the sense that it does not distort the investment decision of a firm (cf. Sinn 1991). Therefore, in Scenario 4 where $\beta = 0.25$, the 'New View' almost applies. Therefore, under the 'New View' the dividend tax is a useful instrument to raise extra tax revenue in a non-distorting manner. Since the second simulation has to ensure a given amount of tax revenue, the uniform tax on corporate and non-corporate firm profits has to be higher. A higher profit tax increases the cost of capital for both types of firms and therefore less capital will be accumulated. The overall capital stock declines by 1.5 per cent leading to a reduction in aggregate output by 0.7 per cent.

To conclude, for low values of β it would be meaningful to maintain the double taxation of corporate profits - since it is a non-distorting way of raising revenues - and reduce therefore the uniform tax rate for corporate and non-corporate firms. This would lower the cost of capital and therefore stimulate investments and capital accumulation. If the current German 'Halbeinkünfteverfahren' prevails, the uniform tax rate levied on both sectors can be reduced to 41.5 percentage points. However, such a conclusion is only valid if one assumes that the 'New View' of dividend taxation applies.

6.2 Sensitivity Analysis

By performing a sensitivity analysis we check the robustness of our results with respect to the elasticity of factor substitution σ^Y. For the already presented simulations, we applied an elasticity of factor substitution between capital and labor of 0.8.

Table 4: Sensitivity Analysis: $\beta = 1.0$

	$\sigma^Y = 1.2$		$\sigma^Y = 0.8$		$\sigma^Y = 0.6$	
Simulation 1:	C-Sector	N-Sector	C-Sector	N-Sector	C-Sector	N-Sector
Profit tax rate	38.7	45.7	38.7	45.7	38.7	45.7
Effective tax burden	52.3	45.7	52.3	45.7	52.3	45.7
Capital allocation (in %)	**63.5**	**36.5**	**63.5**	**36.5**	**63.5**	**36.5**
Simulation 2:						
Uniform tax rate	0.472	0.472	50.2	50.2	50.7	50.7
Capital allocation (in %)	**77.8**	**22.2**	**73.4**	**26.6**	**71.0**	**29.0**
Change sectoral cap. stock	+ 33.8	- 33.5	+ 20.2	- 24.0	+ 15,0	- 18.5
Change overall cap. stock	+ 9.2		+ 4.0		+ 2.8	
Change in output	+ 4.3		+ 2.0		+ 1.5	

Source: Own Calculations

In the following we analyze how the estimated gain in aggregate output changes if the elasticity of factor substitution is set to a value of 1.2 or 0.6, respectively. Tables four to six present the simulation results of the sensitivity analysis for three different values of σ^Y. The parameter β is kept constant within each table. Table four presents the sensitivity analysis for the case where all investments are financed via new share issues ($\beta = 1$). An increase in the elasticity of factor substitution implies that the two production factors capital and labor can be more easily exchanged against each other. Setting the value for the elasticity of factor substitution equal to 1.2 the production in the corporate sector becomes even more capital intense. Introducing a sector neutral tax system under this parameter constellation, the capital stock in the corporate sector increases by almost 34 per cent. In comparison, under the base scenario ($\sigma^Y = 0.8$) the capital stock in the corporate sector increases by just 20 per cent. Thus, a higher elasticity of factor substitution implies an even stronger capital accumulation within the corporate sector[24].

The increased capital accumulation within the corporate sector leads to a rise in the economy wide capital stock. Assuming a high elasticity of factor substitution ($\sigma^Y = 1.2$) the economy wide capital stock rises by 9.2 per cent whereas it increases by only 4 per cent if a moderate elasticity of factor substitution ($\sigma^Y = 0.8$) is assumed. On the contrary, if the elasticity of factor substitution is reduced to a value of $\sigma^Y = 0.6$, the economy wide capital stock increase only slightly by 2.8 per cent under the sector neutral tax reform. Moreover, since aggregate output is highly sensitive to the size of the economy wide capital stock, it also increases by 4.3 per cent, 2.0 per cent or 1.6 per cent if a high, medium or low elasticity of factor substitution is applied.

Table 5 displays the results of the sensitivity analysis in the case $\beta = 0.75$. Assuming still such a high value for β the results presented in table five follow the same pattern as in table four.

[24]Vis-a-vis, the decumulation of capital in the non-corporate sector will also be intensified if the elasticity of factor substitution is increased.

Table 5: Sensitivity Analysis: $\beta = 0.75$

	$\sigma^Y = 1.2$		$\sigma^Y = 0.8$		$\sigma^Y = 0.6$	
Simulation 1:	C-Sector	N-Sector	C-Sector	N-Sector	C-Sector	N-Sector
Profit tax rate	38.7	45.7	38.7	45.7	38.7	45.7
Effective tax burden	52.3	45.7	52.3	45.7	52.3	45.7
Capital allocation (in %)	**64.0**	**36.0**	**64.0**	**36.0**	**64.0**	**36.0**
Simulation 2:						
Uniform tax rate	48.5	48.5	49.8	49.8	50.3	50.3
Capital allocation (in %)	**73.8**	**26.2**	**70.7**	**29.3**	**69.0**	**31.0**
Change sectoral cap. stock	+ 20.7	- 23.9	+ 12.7	− 16.8	+ 9.5	- 12.8
Change overall cap. stock	+ 4.6		+ 2.1		+ 1.44	
Change in output	+2.2		+ 1.0		+ 0.75	

Source: Own Calculations

A higher elasticity of substitution increases the capital accumulation within the corporate sector and thus raises the economy-wide capital stock. For $\sigma^Y = 1.2$, the economy-wide capital stock increases by 4.6 per cent instead of only 2.1 per cent in case $\sigma^Y = 0.8$. Accordingly, the gain in aggregate outputdue to the equalization of the tax burden on corporate and non-corporate firms rises by 2.2 per cent compared to 1.0 per cent.

Again, if a relatively small elasticity of factor substitution is considered, the capital accumulation slows down and the advantage from a sector neutral tax reform is reduced to a 1.4 per cent increase in the overall capital stock which corresponds to a 0.75 per cent increase in aggregate output.

Last but not least, as shown in Table 6, if one assumes $\beta = 0.5$, the gain in aggregate output from a sector neutral tax system in Germany is rather small.

Table 6: Sensitivity Analysis: $\beta = 0.5$

	$\sigma^Y = 1.2$		$\sigma^Y = 0.8$		$\sigma^Y = 0.6$	
Simulation 1:	C-Sector	N-Sector	C-Sector	N-Sector	C-Sector	N-Sector
Profit tax rate	38.7	45.7	38.7	45.7	38.7	45.7
Effective tax burden	52.3	45.7	52.3	45.7	52.3	45.7
Capital allocation (in %)	**64.5**	**35.5**	**64.5**	**35.5**	**64.5**	**35.5**
Simulation 2:						
Uniform tax rate	49.5	49.5	49.5	49.5	49.8	49.8
Capital allocation (in %)	**69.3**	**30.7**	**67.7**	**32.3**	67.0	33.0
Change sectoral cap. stock	+ 8.1	- 13.2	5.4	- 9.0	+ 3.9	- 6.1
Change overall cap. stock	+ 0.5		+ 0.3		+ 0.1	
Change in output	+ 0.25		+ 0.15		+ 0.05	

Source: Own Calculations

Nevertheless, the chosen elasticity of factor substitution has still a significant impact on the results. The higher the assumed elasticity of factor substitution, the higher the increase in the economy-wide capital stock will be and thus the larger is the anticipated gain in aggregated output.

7 Conclusion

The simulation results have shown that a non-uniform taxation of corporate and non-corporate firms does lead to efficiency losses. In particular, the corporate income tax which is exclusively levied on corporate firms introduces a disparity in the taxation of sectors resulting in a loss of aggregate output. We showed for the case of Germany that this efficiency loss can amount to 4.3% of aggregate output. However, this result is strongly influenced by the assumed marginal source of investment funds as well as the applied elasticity of factor substitution. If the marginal investment is financed via new share issues, the efficiency gain resulting from a more similar taxation of the corporate and non-corporate sector is relatively large. In case only half of all investments of corporate firms are financed via new share issues the resulting efficiency gain from a sector neutral tax reform is comparatively small, almost negligible. Moreover, the estimated efficiency gain is also highly sensitive to the applied elasticity of factor substitution. A high elasticity of factor substitution stimulates the capital accumulation within the economy and therefore the resulting change in aggregate output due to a sector neutral tax reform is large. In case only a low value of the elasticity of factor substitution is assumed, less capital will be accumulated during the transition phase and thus the gain in aggregate output will be only small. Assuming that just one half of investments is financed by new share issues and the other half via retained earnings or debt and applying a moderate elasticity of factor substitution, the introduction of a sector neutral tax reform in Germany results in only a minor increase in aggregate output. Specifically, aggregate output would increase by 0.15 per cent which corresponds to a rise in GDP of 3.2 billion Euro.

Appendix - Intertemporal Optimization of Firms

Solving the intertemporal optimization problem of the representative firm of either sector, we start with substituting $T^{P,f}$ into the expression for profits, (7), and get:

$$\begin{aligned} \pi^f &= (1-\tau^{P,f})\left[Y^f - J^f - w^f L^f - m^f B^f - \delta K^f - iB^f\right] \\ &- z_3\delta\tau^{P,f}K^f + \tau^{P,f}z_3 I^f. \end{aligned} \tag{A.1}$$

Recalling the flow of funds equation for corporate firms (8) as well as the expression for new share issues, $VN^C = \beta(1 - z_3 t^{P,C})IN^C$, and combining it with the above profit equation (A.1), we derive an explicit expression denoting dividends of corporate firms:

$$\begin{aligned} D^C &= (1-\tau^{P,f})\left[Y^C - J^C - m^C B^C - w^C L^C - \delta K^C - iB^C\right] \\ &+ BN^C - \left[(1-\beta)(1-z_3\tau^{P,C})\right] IN^C. \end{aligned} \tag{A.2}$$

Substituting this expression into the no-arbitrage condition for corporate firms (9), this equation becomes:

$$\begin{aligned} r_t^C V_t^C &= (1-\tau^D)D_t^C + (1-\tau^{G,C})\left[GV_{t+1}^C - V_t^C - VN_t^C\right] \\ [\underbrace{1 + \frac{r_t^C}{(1-\tau^{G,C})}}_{r_t^{equ,C}}]V_t^C &= \underbrace{\frac{(1-\tau^D)}{(1-\tau^{G,C})}D_t^C - VN^C}_{\chi_t^C} + GV_{t+1}^C\ , \end{aligned} \tag{A.3}$$

where χ_t^C is given by:

$$\begin{aligned} \chi_t^C &= \gamma^{D,C}\left[Y^C - J^C - m^C B^C - w^C L^C - \delta K^C - iB^C\right] \\ &+ \Omega^C BN^C - \gamma^{I,C} IN^C \ , \end{aligned} \tag{A.4}$$

using the following tax factors for corporate firms:

$$\begin{aligned} \gamma^{D,C} &= \tfrac{(1-\tau^D)(1-\tau^{P,C})}{(1-\tau^{G,C})} \ , \\ \gamma^{I,C} &= \left[\tfrac{(1-\tau^D)}{(1-\tau^{G,C})}(1-\beta)+\beta\right](1-z_3\tau^{P,C}) \ , \\ \Omega^C &= \tfrac{(1-\tau^D)}{(1-\tau^{G,C})} \ . \end{aligned}$$

Combining the no-arbitrage condition of the non-corporate firm (15) with the profit equation from above (A.1) and with the flow of fund equation for non-corporate firms (14), we get the following no-arbitrage condition for non-corporate firms:

$$\begin{aligned} r_t^N V_t^N &= \pi_t^N + (1-\tau^{G,N})\left[GV_{t+1}^N - V_t^N - VN_t^N\right] \\ [1 + \underbrace{\frac{r_t^N}{(1-\tau^{G,N})}}_{r_t^{equ,N}}]V_t^N &= \underbrace{\frac{1}{(1-\tau^{G,N})}\pi_t^N - VN_t^N}_{\chi_t^N} + GV_{t+1}^N. \end{aligned} \tag{A.5}$$

where χ_t^N is given by:

$$\begin{aligned} \chi_t^N &= \gamma^{D,N}\left[Y^N - J^N - m^N B^N - w^N L^N - \delta K^N - iB^N\right] \\ &+ \Omega^N BN^N - \gamma^{I,N} IN^N. \end{aligned} \tag{A.6}$$

using the following tax factors for noncorporate firms:

$$\begin{aligned} \gamma^{D,N} &= \tfrac{(1-\tau^{P,N})}{(1-\tau^{G,N})} \ , \\ \gamma^{I,N} &= 1 - \tfrac{\tau^{P,N} z_3}{(1-\tau^{G,N})} \ , \\ \Omega^N &= 1 \ . \end{aligned}$$

Noting that V_t^f is a beginning of period firm value, $V_t^{e,f} = \left[1 + r_t^{equ,f}\right] V_t^f$ denotes the corresponding end of period firm value. A firm can only maximize the end of period value which satisfies:

$$V_t^{e,f} = \chi_t^f + \frac{GV_{t+1}^{e,f}}{1 + r_{t+1}^{equ,f}}. \tag{A.7}$$

Applying the principle of dynamic programming, the Bellmann problem of the representative firm states:

$$
\begin{array}{llll}
V^{e,f}(K_t^f, B_t^f) = & \max\limits_{L^f,\, I^f,\, BN^f} & \left[\chi_t^f + \frac{G}{1+r_{t+1}^{equ,f}} V^{e,f}(K_{t+1}^f, B_{t+1}^f)\right] & \\
 & s.t. \;\; GK_{t+1}^f & = \; I_t^f + (1-\delta)K_t^f \;, & \\
 & s.t. \;\; GB_{t+1}^f & = \; BN_t^f + B_t^f \;. &
\end{array} \qquad (A.8)
$$

Defining the shadow prices for capital and debt according to:

$$
q_t^f \equiv \frac{dV_t^{e,f}}{dK_t^f} \qquad \text{and} \qquad \lambda_t^f \equiv \frac{dV_t^{e,f}}{dB_t^f} \;.
$$

The **optimality conditions** concerning the control variables labour, L_t^f, investment, I_t^f, and new debt, BN_t^f, are:

$$
\begin{array}{llcl}
(a) \;\; L_t^f : & w_t^f & = & F_{L,t}^f, \\
(b) \;\; I_t^f : & q_{t+1}^f & = & \left(1 + r_{t+1}^{equ,f}\right)\left[\gamma^{D,f} J_I^f + \gamma^{I,f}\right], \\
(c) \;\; BN_t^f : & \lambda_{t+1}^f & = & -(1 + r_{t+1}^{equ,f})\Omega^f.
\end{array} \qquad (A.9)
$$

The **envelope conditions** concerning the stock variables are:

$$
\begin{array}{llcl}
(a) & q_t^f & = & \gamma^{D,f}\left[F_K^f - J_K^f + m_f' b_f^2\right] - \left(\gamma^{D,f} - \gamma^{I,f}\right)\delta + \frac{q_{t+1}^f}{1+r_{t+1}^{equ,f}}(1-\delta) \\
(b) & \lambda_t^f & = & \gamma^{D,f}[-m_f' b_f - m^f - i] + \frac{\lambda_{t+1}^f}{1+r_{t+1}^{equ,f}}
\end{array} \qquad (A.10)
$$

The marginal product of capital can be derived by combining equations (A.10a) and (A.9b):

$$
F_K^f - \delta = r_t^{equ,f} \frac{\gamma^{I,f}}{\gamma^{D,f}} - (m_f' b_f) b_f \qquad (A.11)
$$

To obtain an equation representing optimal debt policy, equations (A.10b) and (A.9c) need to be combined, resulting in:

$$
\frac{\rho_{t+1}^f}{(1-\tau^{G,f})} = \frac{\gamma^{D,f}}{\Omega^f}\left[m_f' b_f + m_f + i\right], \qquad (A.12)
$$

The required post tax return on firm equity, ρ, can be replaced according to the capital market arbitrage condition by the after tax return of a capital market investment which is $i\,(1-\tau^i)$. The left hand side represents the cost of equity while the right hand side denotes the cost of debt financing. The optimal debt level is achieved if the cost of internal financing are equal to the cost of external financing.

Combining the last two equations (A.11) and (A.12) the marginal product of capital can be expressed as the weighted sum of the cost of equity capital and external capital, where the debt asset ratio, b_f, serves as weighting factor:

$$F_K^f - \delta = \frac{r^{equ,f}}{\gamma^{D,f}} \left[\gamma^{I,f} - \Omega^f b_f\right] + \left[i + m^f\right] b^f. \tag{A.13}$$

These equations enable us to determine the cost of capital which influences the investment decision of the firm as well as the cost of equity and debt finance which determine a firm's financing behavior.

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