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Implementing a Dual Income Tax in Germany: Effects on Investment and Welfare

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Abstract

This paper investigates the effects of implementing a dual income tax (DIT) in Germany. We follow the reform proposal of the German Council of Economic Advisors (2003) and analyze its implications on capital formation, investment and welfare using a dynamic computable general equilibrium model. The main features of the model are an intertemporal investment model and the traditional Ramsey model on the household side. Our findings suggest that the introduction of a DIT with a proportional capital income tax rate of 30% and progressive labour income tax rates up to 35% leads to higher investments, an increased capital accumulation up to 5.8% and welfare gains of about 1% of GDP.

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1 Introduction

A redesign of the German tax system is imperatively required since the present tax law is complicated, non-transparent and a major obstacle for the country to survive in the international tax competition. Double taxation and legal tax loopholes create severe distortions concerning the investment and financial decisions of firms resulting in major welfare losses. In the light of recent discussions, especially brought about by the report of the German Council of Economic Advisors (GCEA,2003), a dual income tax (DIT) has become increasingly popular as an option for reforming the German tax system. A DIT, which has been applied in several Nordic countries and practiced in Austria and Belgium in some rudimentary form, would not only reduce these distortions but also create substantial efficiency gains.

We use a computable general equilibrium growth model calibrated to the German economy and consisting of four blocks. Optimal investment behavior is derived from a neoclassical, intertemporal investment model with convex adjustment costs. Since we mainly focus on the efficiency effects of the tax reform on welfare, we model the household sector using the traditional Ramsey model of an infinitely lived household. The public sector introduces various distortions on agents' behavior through taxation. The model's fourth building block is the Rest of the World (RoW), which closes the model. While the home economy is considered in detail, the foreign economy is only roughly modelled.

Following the proposal made by the GCEA (2003), we measure the economic effects such a reform would have. Our findings suggest that the introduction of the proposed dual income tax with a proportional capital income tax rate of 30 per cent and progressive

labour income tax rates up to 35 per cent leads to higher investments and an increased capital accumulation. The calculated 5.8 per cent increase in the capital stock is mainly driven by a nine per cent reduction in the cost of capital as a result of the major reduction in statutory tax rates on the corporate and household level. Moreover, GDP and welfare in terms of life-time income also rise by 3.3 and 1.6 per cent respectively.

The next section of the paper describes the experiences of Nordic countries with the dual income tax and presents the advantages and shortcomings of such a tax. Section three introduces the baseline model and derives several important behavioral responses as well as comparative static results. Section four discusses the simulation results, which are checked with regard to their robustness by a sensitivity analysis. Finally, the conclusion highlights the most important findings.

2 The DIT - An Option for Germany

Germany, the country of the 'Wirtschaftswunder' and once the leader of European growth statistics, has now fallen behind most other European countries in terms of growth. Germany faces persistent structural problems and a weak economic climate which is among other factors also the result of the increased tax competition. Moreover, according to the GCEA (2003), the tangled mass of partly proposed, partly enforced tax reliefs and modifications in the tax system have not led to much improvement but induced a credibility loss, resulting in decreasing investments. Furthermore, the partial alteration of the tax system, has undermined the principles underlying the comprehensive income tax system and led to many distortions concerning investment behavior, financial decisions

or the organizational choice of a firm. While the German income tax system is still perceived to be a comprehensive one, it systematically deviates from this principle in reality; e.g. distributed profits are taxed differently than earnings stemming from other sources according to the half-income principle of dividend taxation. Additional anomalies arise due to the multitude of tax exemptions, including for instance returns from institutional savings or capital gains. Another incompatibility consists in the methodical difference of determining the respective tax base of labor and capital income.[1]

2.1 Reasons for a Schedular Tax System

There are several reasons for applying different tax rates for labour and capital. Thus, a lower capital income tax rate as given by the DIT could substantially reduce the intertemporal distortions related to the saving-consumption decision. These distortions are the result of a double taxation phenomenon: Savings stem from after tax earned income and returns from saving are taxed once again when they occur. To avoid this additional burden on future consumption, no capital income tax should exist. However, this is not always feasible and thus a lower capital income tax rate compared to the labour income tax rate is desirable (Boadway, 2004).

Moreover, the present tax competition presents an additional argument for taxing the internationally mobile factor capital at a lower rate. Despite the recent tax reliefs,

[1] While the capital income tax base is determined on the accrual basis (difference in wealth between the beginning and end of each tax period), the labor tax base is calculated on a cash basis (difference between revenue arising from labour supply and the expenses needed to achieve this revenue). Thus, income stemming from labour enjoys tax privileges, since expenses linked to human capital investments are immediately deductible, while those required for capital investments can only be deducted later on via depreciation (Wagner, 2000).

Germany's effective tax rates are still among the highest within Europe (EUROPEAN COMMISSION 2001). Albeit the statutory corporate tax rate amounts to only 25 per cent, adding the local trade tax and the solidarity surcharge the effective tax rate on profits adds up to 38.7 per cent, while the EU 15 average is 29.4 per cent, the OECD average is just 29 per cent and the average among the ten new EU members only 16.p per cent. Therefore, Germany will have to lower its capital income tax rates further to prevent capital from fleeing to low tax countries.

Last but not least, the production efficiency theorem[2] states that a wage tax solely distorts the consumption decision, while a source tax on capital also distorts the international capital allocation resulting in a deadweight loss.

Therefore, these arguments favour levying a lower tax rate on capital vis-a-vis labour. The empirical findings of instance by MENDOZA ET AL. (1994), DEVEREUX ET AL. (2002) or SØRENSEN (2000) also suggest a shift of the tax burden towards labour income.[3] Thus, both, theory and empirical evidence provide multiple arguments in favour of introducing a DIT.

[2] See Diamond and Mirrlees (1971).

[3] MENDOZA ET AL. construct time series of tax rates for seven OECD countries from 1965-1988 using national accounts and revenue statistics. Their findings suggest inter alia that there is a moderate shift of the tax burden towards labour. DEVEREUX ET AL. (2002) provide evidence for the international trend towards lower tax rates on capital. Similar conclusions are derived by SØRENSEN (2000) who computes average effective tax rates on labour and capital respectively for 12 countries for the periods 1981-1985 and 1991-1995. His results show that while the tax burden on labour increased, the burden on capital declined or remained constant.

2.2 The Experience of Nordic Countries

Looking for an adequate option for reforming the German tax system one may notice that similar problems were solved in the Nordic Countries by introducing a DIT a decade ago. Several papers like Sørensen (2001), Cnossen (2000), and Sørensen/Nielsen (1997) discuss the experiences these countries had with such a tax system. Starting with Denmark in 1987, followed by Sweden in 1991, and Norway and Finland in the subsequent years, all four countries changed their tax system from a comprehensive income tax to a schedular one. The modifications included a reduction in statutory capital income tax rates to 28 per cent in Norway (IBFD 2004) and Finland and 30 per cent in Denmark (European Tax Handbook 2004). Simultaneously, the existing tax base was broadened such that major losses in aggregate tax revenue were prevented. Additionally, a progressive tax schedule, ranging between 28 to 41.5 per cent in Norway, or 39.7 to 59 per cent in Denmark was levied on labour income (Mennel/Förster 2003). Regarding the double taxation of distributed profits, Norway and Finland avoided this by applying full imputation. The double taxation of retained profits was abolished only in Norway. Furthermore, withholding or source taxes were installed at the company level or at the level of interest, royalty or other types of capital income paying entities, to guarantee the single taxation of capital income.

2.3 The Concept of a Dual Income Tax

The dual income tax can be ascribed to the theoretical model of the Johansson-Samuelson tax, which taxes only the true economic profit. Such a tax is levied uniformly on all types

of income that have been determined in an identical way in the country of residence. Since income cannot always be computed in the same way, different tax rates may be necessary to adjust the differences in the computation of the tax base. Accordingly, a pure DIT distinguishes between capital and labour income. Capital income – including business profits, dividends, capital gains, interest and rental income – is taxed at a low proportional tax rate, whereas progressive tax rates are levied on labour income (Cnossen 2000, Sørensen 1994). Moreover, a full imputation system should be installed to prevent the double taxation of distributed profits. The separation between capital and labour income taxation has several advantages. On the one hand, the proportional tax on capital income mostly assures the aspired neutrality concerning the investment and financial decisions, as well as the choice of the legal form of the firm.

On the other hand, the uncoupled proportional taxation of capital income allows for sufficient flexibility to react and survive under conditions of tax competition without changing the whole tax system. Furthermore, the progressive taxation of labour income including wages (as well as the employer's calculatory salary), pension income, governmental transfers, and social security benefits, offers a solid base for redistribution, if desired.[4] However, one has to consider that the difference between the low, proportional tax rate on capital income and the higher top marginal tax rate on labour income is not too large in order to prevent tax arbitrage. Without any functional mechanism to counteract income shifting, especially managers of non-corporate firms are tempted to declare their fruits of labour as capital income to avoid the higher progressive tax that is levied on labour

[4]See Sørensen (1994) and Cnossen (2000) for a detailed description of the features of a DIT.

income. Additionally, by lending to the firm, it would be possible to accumulate the returns to debt-financed assets within a corporation subject to the lower capital income tax and, on the other hand, deduct the interest payment against the higher personal tax rate.

An often cited criticism regarding the dual income tax, according to WAGNER (2000), relates to the fact that it is a schedular tax. Nevertheless, such an allegation would only be meaningful if all types of income, irrespective of their source, were determined in the same way but taxed at different tax rates. In Germany, however, capital and labour income are computed in different ways under the present tax law. Another concern related to the DIT applies to small enterprises, such as partnerships and proprietorships. They may suffer a severe disadvantage if returns on business investments are taxed at the higher tax rate applying to labour income. This is what SØRENSEN (1994) calls the Achilles' heel of the DIT. To avoid this discrimination of small enterprises, one may impute a rate of return on equity and tax this calculated return as capital income at the lower capital income tax rate. Norway for instance solved this problem using a special method: Returns from capital are computed using a statutory interest factor, which is equal to the return on three-month Treasury Bills. Labour income is then determined residually as the difference between the owner's share of corporate profits and capital income (CNOSSEN 2000). Finnish tax law requires dividends paid by unlisted companies to be divided into two components. One is treated as capital income and subjected to the capital income tax rate and the other one is treated as earned income taxed at the progressive labour income tax (SØRENSEN 2001, 1994). An additional shortcoming of such a tax system seems to be the fact that non-residents do not have to pay any taxes on withholding interest and

royalties and thus several tax loopholes are created, but this mainly worries the foreign tax authorities.

3 The Model

Evaluating and quantifying the effects of a comprehensive tax reform is a difficult task. Beside the more obvious first order effects economy-wide repercussions and second-order effects have to be considered, too. Hence, it is advisable to use a general equilibrium model to capture all kinds of effects. The model is in line with neoclassical growth theory. Savings and investment decisions are forward looking and thus permit a consideration of important tax capitalization effects. Furthermore, the model mimics several important behavioral margins at the firm level that are strongly sensitive to the effects of capital income taxation like the investment behavior and the financial decision.

The applied computable general equilibrium (CGE) model, *IFOmod,* is a modification of the Swiss CGE model developed by KEUSCHNIGG (2002). Compared to other well known CGE models - like *Multimode Mark III* developed by the IMF (LAXTON ET AL. 1998), *OECDTAX*, developed by SØRENSEN (2001), or the model developed by FEHR (1999) - our model contains a detailed modelling of the firm sector as well as the traditional Ramsey model instead of an overlapping generation model on the household side, which allows us to estimate how the reform affects the welfare of the representative individual.

3.1 Business Sector

This section presents an inter-temporal investment model with convex adjustment costs to highlight the main transmission channels: We rely on a linear homogenous production technology with capital and labour as production factors. The price of the output good is normalized to unity. Additionally, the firm incurs adjustment costs which result from disruptions due to the firm's internal reorganization. The adjustment cost function is assumed to be linearly homogeneous in investment and capital and convex in investment. The steady state adjustment costs are zero such that they do not influence the steady state solution.

Domestic firms hire labour and accumulate capital and debt to maximize their firm value. However, optimal investment and financial decisions are distorted through taxation. We consider a profit tax which is levied on firm level as well as a dividend and a capital gains tax on household level. Moreover, interest income is also subject to taxation. According to the present German tax system, distributed earnings are first taxed on the firm level and then half of these are once again taxed on the personal level. Although there is effectively no capital gains tax in Germany, the variable is carried along for reasons of completeness. In addition, a tax on labour income as well as a value added tax (VAT) are considered.

3.1.1 Financial Identities and Arbitrage

Capital expands over time whenever gross investment, I_t, exceeds the depreciation of the existing capital stock, δK_t. Therefore capital accumulation is given by

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

where G is a growth factor determined by productivity growth[5]. Concerning debt policy, we assume that interest payments on debt include an additional premium $m(b)$ which denotes the agency cost of debt depending on the debt asset ratio $b_t = B_t/K_t$ of a firm. The agency costs are increasing in b_t,[6] reflecting that a firm's risk of bankruptcy increases with rising indebtedness as the real cost of default increase. Debt accumulates

[5]IFOMOD includes a fixed exogenous trend growth, X_t, of labour productivity. Accordingly, the linearly homogeneous production technology is defined as:

$$\tilde{Y}_t = F(\tilde{K}_t, X_t L_t). \tag{2}$$

Since L_t is assumed to remain constant in the long run, manpower becomes increasingly productive with labour saving technological progress. Therefore, labour input $X_t L_t$ will grow with the productivity growth rate g,

$$X_{t+1} = G \cdot X_t; \qquad G = 1 + g. \tag{3}$$

We analyze a long-run growth equilibrium where the capital output ratio remains constant. This requires capital and output to grow at the same rate g. Variables such as capital, consumption, etc. can be divided into a trend and a stationary component:

$$\tilde{K}_t = X_t \cdot K_t \qquad \Rightarrow \qquad K_t = \tilde{K}_t / X_t. \tag{4}$$

In the stationary case, these variables have to be detrended.

Dividing the equation of capital accumulation, $\tilde{K}_{t+1} = \tilde{I}_t + (1-\delta)\tilde{K}_t$, by X_t and noting equation (3), we get:

$$\frac{\tilde{K}_{t+1}}{X_{t+1}}\frac{X_{t+1}}{X_t} = \frac{\tilde{I}_t}{X_t} + (1-\delta)\frac{\tilde{K}_t}{X_t} \qquad \Rightarrow \qquad GK_{t+1} = I_t + (1-\delta)K_t. \tag{5}$$

[6]Thus, for the convex adjustment costs both the first, $m'(b)$, and the second , $m''(b)$, derivative are positive.

according to:

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

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

Net of tax profits consist of output less adjustment costs, J_t, wage payments, $w_t L_t$, depreciation, δK_t, interest payments plus agency cost on debt, $(i_t + m)B_t$, and the tax liability, T_t, according to:

$$\begin{aligned} \pi_t &= Y_t - J_t - w_t L_t - \delta K_t - (i_t + m)B_t - T_t, \\ \text{with} \qquad T_t &= t^U[Y_t - J_t - w_t L_t - \delta K_t - (i_t + m)B_t - e(I_t - \delta K_t)] \ , \end{aligned} \tag{7}$$

where e represents the tax allowances for investments.[7]

We consider a small open economy and thus the world interest rate, i_t, is fixed. Net of tax interest rates, $r_t = (1-t^i)i_t$, equate across countries since we assume capital mobility and apply the source principle of taxation.[8]

Following a basic no-arbitrage condition:

$$r_t V_t = (1 - t^D)D_t + (1 - t^G)\left[GV_{t+1} - V_t - VN_t\right] \ , \tag{8}$$

in equilibrium an investor needs to be indifferent between a financial market investment, yielding a net of tax return of $r_t V_t$ where V_t denotes the value of firm equity, and a real investment, yielding net of tax dividends $(1 - t^D)D_t$ and net of tax capital gains $(1 - t^G)\left[GV_{t+1} - V_t - VN_t\right]$.

[7] If $e = 0$ we have the case of true economic depreciation. If $e = 1$ we allow for a full immediate write-off and and t^U can be interpreted as a cash-flow tax.

[8] According to the source principle a change in the domestic interest tax rate affects also foreign savings.

According to the cash flow identity:

$$IN_t = (\pi_t - D_t) + VN_t + BN_t \ , \tag{9}$$

net investments[9] , $IN_t = I_t - \delta K_t$, can either be financed via a reduction in payouts (dividends) and therefore through retained earnings $(\pi_t - D_t)$, by issuing new equity, VN_t, or externally via new debt, BN_t.

Since we refer to a mature economy, characterized by mature firms[10], we follow the "New View" of dividend taxation, and thus dividends are determined residually (Sinn, 1987). Keeping in mind the empirical evidence provided by Auerbach and Hasset (2003), who state that both views on the effects of dividend taxation are valid, we determine new share issues exogenously by $VN_t = \beta(1 - et^u)IN_t$. This approach is similar to Fehr (1999). New investments are largely financed by retained earnings or by new debt and only a fixed fraction, β, of five per cent is financed via new share issues.

Solving the cash flow identity (9) for dividends and inserting the expression for net of tax profits, (7), we can derive an explicit formula determining dividends:

$$D_t = [Y_t - J_t - wL_t - \delta K_t - (i_t + m_t)B_t] - T_t + VN_t + BN_t - IN_t. \tag{10}$$

[9] We assume that replacement investments are always financed internally.

[10] According to the nucleus theory the nucleus is incorporated in the first step and then a phase of internal growth sets in. During this phase, no dividends are paid, nor are any new shares issued, but all profits are retained to finance all profitable investments. After the nucleus has reached its stage of maturity, all profits are distributed as dividends. The dividend tax discriminates against the initial size of the nucleus; thus in the set-up phase, the 'Old View' applies, but the dividend tax is neutral in the stage of maturity according to the 'New View' (Sinn 1991).

3.1.2 Intertemporal Optimization

Firms want to maximize their value by choosing optimal investment and financial policies. To derive an expression determining the firm value, we rearrange the no-arbitrage condition and solve it forward to get:

$$V_t^e = \sum_{s=t}^{\infty} \underbrace{\frac{1-t^D}{1-t^G} D_s - VN_s}_{\chi_s} \prod_{u=t+1}^{s} \frac{1+g}{1+\frac{r_u}{1-t^G}}, \quad \lim_{T\to\infty} V_T^e \prod_{u=t+1}^{T} \frac{G}{1+\frac{r_u}{1-t^G}} = 0. \tag{11}$$

where V_t^e denotes the end of period firm value according to $V_t^e = (1+\frac{r_t}{1-t^G})V_t$. The last condition excludes bubbles and restricts the solution to the fundamental value of the firm.

Thus, the end of period market value of a firm is determined by the present value of all future net of tax dividend payments less new equity injections. The net dividend flow is discounted using the cost of equity which is the required gross return on firm level, $r_t^{equ} = \frac{(1-t^i)i}{1-t^G}$. Using the two tax factors $\gamma^D \equiv \frac{(1-t^D)(1-t^U)}{1-t^G}$ and $\gamma^I \equiv \left[\frac{1-t^D}{1-t^G}(1-\beta)+\beta\right](1-et^U)$ and substituting the dividends from (10) into (11) the maximization problem becomes:

$$V^e(K_t, B_t) = \max_{L_t,\, I_t,\, BN_t} \left[\chi_t + \frac{G\; V^e(K_{t+1}, B_{t+1})}{1+r_t^{equ}}\right] \qquad \text{s.t. (1) and (6)} \tag{12}$$

with

$$\chi_t = \gamma^D \left[Y_t - J_t - w_t L_t - \delta K_t - (i_t+m)B_t\right] + \frac{1-t^D}{1-t^G} BN_t - \gamma^I IN_t.$$

Thus, the value function $V(K_t, B_t)$ is a function of the historically accumulated stocks capital and debt. We use the *Bellman's Principle of Optimality* to derive optimal labor demand, optimal investment and optimal financial behavior.

Defining the shadow prices of capital: $q_t \equiv \frac{\partial V(K_t)}{\partial K_t}$ and debt: $\lambda_t \equiv -\frac{\partial V(B_t)}{\partial B_t}$, respectively,[11] the optimality conditions concerning the control variables labour, investment and

[11] The shadow prices determine the increase in the value of the objective function resulting from a marginal increase in the stock variables capital or debt.

new debt are:

$$\begin{aligned} &\text{(a)} \quad L: \qquad w_t &&= F'_{L,t}\ , \\ &\text{(b)} \quad I: \qquad q_{t+1} &&= (1+r^{equ}_{t+1})\left(\gamma^D J_I + \gamma^I\right)\ , \\ &\text{(c)} \quad BN: \quad \lambda_{t+1} &&= -(1+r^{equ}_{t+1})\tfrac{1-t^D}{1-t^G}. \end{aligned} \tag{13}$$

According to (13b): $q_{t+1} = (1+r^{equ}_{t+1})\left\{\frac{(1-t^D)(1-t^U)}{1-t^G}J_I + \left[\frac{1-t^D}{1-t^G}(1-\beta)+\beta\right](1-et^U)\right\}$, the optimal investment decision incorporates the advantage of decreasing marginal adjustment cost and the marginal advantage of accelerated depreciation, if $e > 0$. In the case that depreciation conforms to true economic depreciation, $e = 0$ holds and thus the share of marginal investment financed by new share issues (here, fraction β) incur a cost of one. The fraction $(1-\beta)$, financed through other sources, will then primarily be subject to the capital gains tax.

The envelope conditions concerning the stock variables are:

$$\begin{aligned} &\text{(a)} \quad K: \quad q_t &&= \gamma^D[F_K - J_K + m'b^2] - \left(\gamma^D - \gamma^I\right)\delta + \tfrac{q_{t+1}}{1+r^{equ}_{t+1}}(1-\delta), \\ &\text{(b)} \quad B: \quad \lambda_t &&= -\gamma^D[i+m+m'b] + \tfrac{\lambda_{t+1}}{1+r^{equ}_{t+1}}. \end{aligned} \tag{14}$$

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.

3.1.3 Financing Behavior

The optimal level of indebtedness of a firm is reached if the cost of equity finance equals the cost of debt finance. Substituting (13c) into the envelope condition for the co-state

variable debt (14b) the expression determining the optimal debt asset ratio is derived:

$$\frac{r^{equ} - (1 - t^U)i}{(1 - t^U)} = m(b) + m'b. \tag{15}$$

If debt and equity are treated equally on the personal level, then both have to yield the same pretax return, namely $r^{equ} = i$. However, debt financing incorporates the advantage of interest deductibility on corporate level, inducing a preference for debt finance in the size of: $\frac{t^U i}{1-t^U}$. Since the increasing indebtedness leverages the debt asset ratio, b, additional agency cost of $m + m'b$ occur, reducing the advantage of debt finance. The optimal debt level is achieved, if the marginal tax preference for debt is offset by the marginal increase in the agency cost.

To evaluate the effects of a marginal change in the tax rates on the financing 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: $\widehat{r^{equ}} \equiv \frac{d\, r^{equ}}{r^{equ}}$, where $d\, r^{equ}$ denotes the deviation from the initial value of r^{equ}. The relative change in the particular tax rate is then defined as $\hat{t} \equiv \frac{d\, t}{(1-t)}$ to avoid division by zero. Therefore we have:

$$r^{equ} = \frac{(1 - t^i)i}{1 - t^G} \qquad \Rightarrow \qquad \widehat{r^{equ}} = \widehat{t^G} - \widehat{t^i}\,. \tag{16}$$

According to equation (16), we can see that, on the one hand, an increase in the interest tax rate lowers the cost of equity, $\frac{d\, r^{equ}}{d\, t^i} < 0$, and stimulates therefore equity finance. Thus, the debt asset ratio decreases.

Figure 1 here

In Figure 1, the initial debt asset ratio denoted by b^*, is determined by the intersection between the agency cost curve $m(b)+m'(b)b$ and the line showing the cost of equity $\frac{(1-t^i)i}{1-t^G}$. Now, if the interest tax rate increases, $t_i^1 > t_i$, the cost of equity finance decrease. The reasoning is as follows: Due to an increase in the interest tax rate, a financial market investment yields a lower return for savers. As an implication of arbitrage, equity finance becomes more attractive compared to external finance since investors will also require a lower return on equity. This effect lowers the debt asset ratio such that retained earnings are increasingly used as a source of finance inducing a lower debt asset ratio of b^{*2}. The formal derivation states: $\frac{d\,b}{d\,t^i} = -\frac{i/\left[(1-t^G)(1-t^U)\right]}{[2m'(b)+m''(b)]} < 0$.

On the other hand, an increase in the capital gains tax rate increases the cost of equity, $\frac{d\,r^{equ}}{d\,t^G} > 0$, and enhances the attractiveness of debt finance. The debt asset ratio will rise. Starting from the equilibrium, b^*, an increase in the capital gains tax, $t_g^1 > t_g$, shifts the cost of equity, leading to a higher debt asset ratio of b^{*1}. This reflects the advantage of debt finance under taxation. If the interest expenditures are tax deductible, then an increase in the corporate tax rate will boost the tax advantage of debt finance. Here, $\frac{d\,b}{d\,t^U} = \frac{i(1-t^i)/\left[(1-t^G)(1-t^U)^2\right]}{[2m'(b)+m''(b)]} > 0$ and $\frac{d\,b}{d\,t^G} = +\frac{i(1-t^i)/\left[(1-t^G)^2(1-t^U)\right]}{[2m'(b)+m''(b)]} > 0$ apply.

3.1.4 Investment Behavior

The shadow price of capital as given in (14a) represents the value of an induced marginal profit. Adding one more unit of capital creates a marginal profit stream consisting of three different components: first, profits increase by the marginal product of capital; second, due to lower adjustment costs future revenues increase; and third, the interest burden on

debt is reduced, as the debt asset ratio improves.

Combining equations (14a) and (13b) with (15) we get an expression for the cost of capital as an average of the tax adjusted costs of equity and debt weighted by the debt asset ratio b. For further simplification we set β, the share of new share issues, equal to zero, implying that equity finance solely relies on retained earnings[12]:

$$F_K - \delta = \left[\frac{(1-t^i)i}{(1-t^G)(1-t^U)}\right](1-b) + [i+m]\,b - \frac{r^{equ}\cdot et^U}{(1-t^U)}\ . \tag{17}$$

The first term on the right hand side indicates the cost of equity finance which are equal to the cost of capital. The second term, the cost of debt finance consists of interest payments plus the agency cost. The last term indicates the advantage of accelerated depreciation, in the case $e > 0$. If depreciation conforms to true economic depreciation, $e = 0$ holds and the last term cancels out (as assumed in the further calculations).

By performing a comparative static analysis, basic insights about the economic effects arising from different reform scenarios are derived. To see how changes in the tax rates affect the investment and financial behavior of a representative firm, we compute the effect of a marginal change in one tax rate on the marginal product of capital and the cost of equity, respectively.

Differentiating (17) with respect to the tax rate under consideration, we find that reducing the corporate income tax as well as the capital gains rate has a positive impact

[12]For the simulation we apply of course the complete formula, which includes the share of new equity finance. This is omitted here just to make the basic insights conveyed by this formula more clear. The comparative static results do not change as a result of this simplification.

on investment since in each case the cost of capital declines[13]:

$$\frac{d\ (F_K - \delta)}{d\ t^U} = \frac{(1-t^i)i_t}{(1-t^G)(1-t^U)^2}(1-b) > 0,$$

$$\frac{d(F_K - \delta)}{dt^G} = \frac{(1-t^i)i_t}{(1-t^G)^2(1-t^U)}(1-b) > 0.$$

The economic intuition concerning an increase in the corporate tax rate is obvious. If the corporate tax rate increases, returns stemming from real investments are more heavily taxed compared to a financial investment which is not subject to the corporate tax rate. Hence, the cost of capital increases resulting in less real investments. Concerning an increase in the capital gains tax we know that profit retentions are less favoured relative to debt financed investments. Thus, the cost of capital increase to the extent that profit retentions are used as a marginal source of finance. Therefore, 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:

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

If the interest tax rate is raised, an alternative investment in the financial market becomes less attractive and thus real investments are favoured relative to financial capital market investments. Hence, the tax wedge between the marginal product of capital and the market rate of interest becomes larger if the interest tax rate rises.

To complete the analysis concerning the long-run investment incentives induced by the proposed reform scenarios, we also derive the King and Fullerton (1984) type formulae:

[13]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.

The marginal effective tax rate is defined as the difference between the pre-tax return of the corporation, denoted by u (= cost of capital as given in (17)), and the after-tax return to the investor, denoted by $s = (1 - t^i)i$. This marginal effective tax rate measures the overall distortion of taxation with respect to investment incentives. It is straightforward that taxes at the corporate and personal level drive a wedge between the required pre-tax return u and the net of tax return s to households. Using once again equation (17) we can define the cost of capital as:

$$\begin{aligned} u &= Marginal\ \text{Rate of Return} - \delta, \\ &= F_K - \delta + m'b^2. \end{aligned}$$

The marginal effective tax rate is defined as the difference between the cost of capital and the net of tax return to the private investor divided by the cost of capital, $t^{eff} = \frac{u-s}{u}$. Under the present German tax system, the cost of capital amount to about 4.7 per cent and the after tax return for a representative investor is approximately 3.0 per cent, implying an effective marginal tax rate of about 36.4 per cent.

Figure 2 here

Given decreasing returns to capital, the marginal rate of return curve will slope downward as shown in Figure 2. In a world without taxation, the cost of capital, u, equals the after-tax return to private investors, s. Thus, the intersection of both curves denotes the long-run capital stock in the absence of taxation. However, the corporate income tax at the firm level and the dividend and capital gains taxes at the personal level increase the

cost of capital and thus have a negative effect on capital accumulation. For example, the proposed DIT reform diminishes the tax wedge by eliminating the dividend and the capital gains tax and by reducing the profit tax rate. In turn the cost of capital, u, declines to u' and thus the distance to the after tax return to savers, s, dwindles and stimulates therefore the capital accumulation in the economy.

3.2 Households and General Equilibrium

Since we mainly focus on the welfare implications rather than on the distributional issues we model the household sector using the Ramsey model of an infinitely lived household. This representative agent takes the discounted utility of all future generations into account, where the subjective discount factor is denoted by $\rho < 1$. Accordingly, households maximize life time utility:

$$U_t = u\left\{C_t - \varphi(L_t^S)\right\} + \rho \cdot U_{t+1} = \sum_{s=t}^{\infty} \rho^{s-t} \cdot u\left\{C_t - \varphi(L_t^S)\right\} \ , \tag{18}$$

subject to their budget constraint:

$$GA_{t+1} = (1 + r_t)A_t + (1 - t^L)w_t L_t^s + t^L \cdot LTA + T_t^H - (1 + t^C)C_t \ . \tag{19}$$

Utility depends on individual consumption C_t less the disutility of work, $\varphi(L_t^S)$, where L_t^S expresses labour supply.[14] Households face a trade-off between the utility stemming from consumption and the disutility of work, implying an endogenous labour supply in the model. Household's budget consists of interest bearing financial assets, $(1 + r_t)A_t$, net of tax labor income, $(1-t^L)w_t L_t^S + t^L \cdot LTA$, where LTA stands for a labour tax allowance on

[14] This special form is chosen since we are only interested in the substitution effect and not the income effect.

houseold level, and governmental lump sum transfers T_t^H. Wealth accumulates according to income inflow, net of consumption expenditures, $(1 + t^C)C_t$.

Solving the maximization problem of the household, optimal individual labor supply is determined by the current real wage:

$$\varphi\prime(L_t^S) = \frac{(1 - t^L)}{(1 + t^C)} w_t \ . \tag{20}$$

As one can easily see, an increase in the labour tax, t^L, as well as an increase in the VAT, t^C, will lead to a decrease in labour supply: $\frac{\partial \varphi\prime(L_t^S)}{\partial t^L} < 0$ and $\frac{\partial \varphi\prime(L_t^S)}{\partial t^C} < 0$. According to the reform proposal, the labour tax will be decreased, while the VAT tax is raised in order to finance the DIT reform to assure a balanced governmental budget.

Deriving the Euler equation of consumption:

$$\frac{u'\left[C_t - \varphi(L_t^S)\right]}{u'\left[C_{t+1} - \varphi(L_{t+1}^S)\right]} = \frac{1 + t_t^C}{1 + t_{t+1}^C} \frac{\rho(1 + r_{t+1})}{G} \ . \tag{21}$$

we can analyze how a change in the VAT rate affects future consumption and therefore the savings behavior of domestic households. A rise in the VAT rate leads to a decline in expected future income and thus current consumption is reduced and savings increase. Moreover, the decline in the net interest rate which results from the increase in the interest tax also encourages savings through the income effect, since people save more given the lower return on savings, to attain a given level of savings in the future. However, there is only a temporary change in the net interest rate since in the long run the interest rate is bound to fulfill $1 + r = \rho/G$ due to the assumptions underlying the Ramsey model.

As a measure of welfare, we apply the equivalent variation, which specifies the differences in expenditures with respect to the before and after tax reform utility levels U^0 and

U^1, using the pre reform price structure p^0:

$$EV = TW(U^1, p^0) - TW(U^0, p^0) \ . \tag{22}$$

Summing up all single differences in expenditures for each period and comparing the present value of this stream to GDP or life-time income, we can compute the change in welfare in per cent of GDP, or life-time income, respectively.

The Rest of the World (ROW) is assumed to be a representative foreign agent who closes the model. ROW is endowed with an exogenous income stream and chooses an optimal consumption stream to maximize life time utility. Moreover, ROW can only save in terms of the internationally traded bonds. However, domestic investment does not stem solely from domestic sources but also from foreign savings, resulting in a current account deficit or surplus depending on the policy experiment. The current account is given by:

$$GD^F_{t+1} - D^F_t = r_t D^F_t + TB_t \ , \tag{23}$$

where D^F_t denotes foreign government debt and TB_t the domestic trade balance. Since we applied the source principle of interest taxation, a decrease in the domestic net interest rate also affects foreign savings, however, since the the net interest rate is fixed due to the assumptions underlying the Ramsey model, there is almost no change in the amount of foreign government bonds held by domestic individuals.

4 Policy Scenarios & Simulation Results

Starting from the prevailing German tax system in 2003, the statutory corporate tax rate amounts to 25 per cent but adding the local trade tax and the solidarity surcharge

the effective corporate tax rate adds up to 38.6 per cent. On the household level, the progressive labour tax rate reaches a top marginal tax rate of 48.5 per cent, including the solidarity surcharge it amounts to 51.2 per cent. Taking an average annual income of about 20,814 per year as given, the representative agent, according to the prevailing tax bracket, is liable to a marginal income tax of 28 per cent, which if we add the solidarity surcharge, reaches 29.5 per cent . This tax rate also applies to interest income. According to the German half income principle, income stemming from dividends (distributed profits) is subject to half of the personal income tax rate, while capital gains are untaxed.

In the following we consider three different policy scenarios: *Scenario 1* takes the reform proposal made by the GCEA in their 2003 report. All tax rates applying to any kind of capital income are set at a flat rate of 30 per cent while labour income is taxed progressively with a top marginal tax rate of 35 per cent.[15] Again, we do not use the top marginal labour tax rate but compute the marginal income tax rate of an average individual which would amount to approximately 24 per cent. To avoid any double taxation of distributed profits the full imputation system is installed, implying a dividend tax rate of zero. Since no capital losses should be regarded, capital gains also need to be tax exempt, implying a capital gains tax rate of zero.

Scenario 2 takes advantage of the 'New View' setting. As discussed above, the dividend tax is supposed to be neutral along the "New View" and therefore the dividend tax has no impact on the investment decision of firms. Accordingly, Scenario 2 is identical to Scenario 1, but the dividend tax is set at a flat rate of 30 per cent. In this model, the

[15]The current local trade tax, the German 'Gewerbesteuer'has been abolished in its existing form as an additional charge, and is embedded in the capital and labour income tax rate, respectively.

dividend tax is a well-suited, non-distorting instrument to raise additional tax revenue.

Last but not least, *Scenario 3* represents the "pure" dual income tax system, suggesting that all kinds of capital income are taxed at a flat rate. Thus, dividends will also be subject to taxation at a flat rate of 30 per cent. Since capital gains are only taxable upon realization and not on the accrual basis we take half of the proposed statutory tax (that is 15 per cent) rate as a rule of thumb in the simulation exercise.

Table 1 here

The column "Status Quo" depicts the effective tax rates for Germany in the year 2003, while the other three columns show the effective tax rates referring to the simulation exercises of scenario one to three. Regarding the major loss in tax revenue – which will arise due to the large reduction in several tax rates, there are only very few feasible ways to finance the reform. The GCEA report proposes a comprehensive reduction of nearly all legal tax reliefs but it is arguable whether this counteracting measure is sufficient. Since the tax revenue is determined endogenously in our model, we allow for an increase in the VAT rate to finance the proposed reform scenarios. Moreover, the increase in the VAT rate is the preferred alternative by political analysts in finding ways to finance different tax reforms (Fehr and Wiegard, 2004).

4.1 Behavioral Parameters

Relying on the comparative static analysis performed in chapter 3.1.4., we anticipate that the first two proposed reform scenarios will have a stimulating effect on capital

accumulation and therefore on economic growth. However, this kind of examination only gives qualitative insights of the policy proposals. To achieve quantitative results, we apply a CGE model calibrated to a stationary equilibrium along a balanced growth path of the German economy. The real growth rate of the German economy is approximated to be 1 per cent, which is a quite fair estimation for Germany after re-unification. Economic depreciation is assumed to be 10 per cent and the adjustment speed towards the new steady state is determined by the half life of investments. Following the study of CUMMINS ET AL. (1996) we take a value of 8.0, implying that during the following 8 years after the policy shock half of the long run increase in the capital stock is accumulated. Accordingly, 99.9 per cent of the new steady state capital stock will be built up within 80 years.

Since the simulation results of any CGE model are strongly sensitive towards the behavioral parameters applied, special diligence is needed when calibrating the model. All behavioral parameters used in this model are standard results confirmed by the empirical literature. The most important ones are summarized here in Table 2:

Table 2 here

The elasticity of capital demand can be interpreted as follows: A one percent increase in the cost of capital leads to a decline in the long-run capital stock by one percent.

Concerning the elasticity of the debt-asset ratio, a decrease in the profit tax rate by 8.3 percentage points (so from the present 38.3 per cent to the suggested 30 per cent), will lead to an increase in the debt asset ratio of 0.36*8.6 = 3.96 percentage points.

The labour supply elasticity, representing an average over empirical estimates for different age and sex groups, is actually a compensated supply elasticity, thus showing just

the substitution effect between labour and leisure since this is the only effect we are interested in.

4.2 Quantitative Results

The reform proposal is characterized by a large reduction of corporate and personal tax rates. Due to the reduction in the corporate tax rate, as well as the nonexistence of a dividend and capital gains tax, the cost of capital decreases by about nine per cent from 4.7 to 4.3 per cent in Scenario 1, as shown in Table 3. In Scenario 2, the cost of capital declines only by seven per cent since in this case a dividend tax is also levied. This considerable decline in the cost of capital goes hand in hand with a reduction of the marginal effective tax rates thus boosting investments and enhancing economic growth. The marginal effective tax rate[16] declines by 17 per cent from 36.4 to 30.2 per cent in Scenario 1 and by 13 per cent in Scenario 2. The capital stock increases from its initial value by about 5.8 per cent in Scenario 1 and by 5.4 per cent in Scenario 2 leading in turn to an increase in GDP by 3.3 and 3.5 per cent, respectively. Similar results are also produced by the simulation model of FEHR and WIEGARD (2004). Concerning Scenario 3, the increase in the interest tax rate decreases the cost of equity finance on the one hand. However, on the other hand, the introduction of the capital gains tax of 15 per cent works in the opposite direction and raises the cost of equity finance. This result derives from the fact that we model the new view of dividend taxation and consider marginal investments to be financed via retained earnings. Thus, the increase in the capital gains tax leads to

[16] The marginal effective tax rate is defined as the difference between the pre-tax return of the corporation and the investor's after tax return divided by the cost of capital.

a rise in the cost of capital by around two per cent .

Table 3 here

We start each simulation scenario from a calibrated equilibrium, where 55 per cent of net investments are financed via retained earnings and 40 per cent via debt. New share issues are fixed at a rate of 5 per cent and do not vary over time. In Scenarios 1 and 2, the effect caused by the slight increase in the interest tax rate as well as by the lowering of the corporate tax rate, leads to a rise in the relevance of retained earnings as a source of finance. In the new long run equilibrium 58 instead of 55 per cent of net investments are financed via retained earnings. Concerning debt as a source of finance, only 37 per cent of overall (net) investments are financed via debt as compared to 40 per cent before the reform. Summarizing, in Scenarios 1 and 2 equity is more intensively used as a source of finance thus leading to a strengthening of the equity position of the representative firm and lowering the indebtedness in the new steady state. The debt asset ratio decreases by 7.6 per cent in both cases. In Scenario 3 we observe a slight increase in the debt asset ratio of 0.9 per cent. This effect arises, since the introduction of the capital gains tax increases the price of equity compared to debt as a source of finance.

Table 3 provides a rough overview of further important long-run, key economic figures on the household side. Until now, the simulation results of Scenarios 1 and 2 did not differ noticeably, thus the results concerning the change in domestic assets may surprise at first glance. The explanation is intuitive: While there is no dividend tax in Scenario 1, firm values – which represent a major share (ca. 38 per cent) of the financial wealth of households – increase due to reform Scenario 1 by 27 per cent. In contrast, in Scenario 2,

where a dividend tax of 30 per cent is levied, the firm value decreases by eight per cent from its initial value. Thus, the change in firm values influences the change in the asset position significantly.

On the household level the reform is characterized by a major reduction in the personal income tax rates. For an average individual the marginal labour income tax rate drops from 29.4 to 24 per cent. This tax relief has a major impact on the labour-leisure decision and households are willing to supply a larger amount of labour to the firm sector. The increased investment and capital accumulation lead also to a rise in wages of 1.4 and 1.1 per cent in Scenario 1 and 2 respectively. This result derives from the fact that capital and labour are complementary production factors and accordingly an increased capital stock increases the demand for labour. In turn, households increase their labour supply by 2.2 and 2.6 per cent in Scenarios 1 and 2. The larger increase in labour supply in the second case must be astonishing at first glance. Even though gross wages increase more in the first Scenario, it is current real wages, which also depend on consumption taxes, that affect the supply of labour by households. Since the VAT rate increases by only two percentage points in the second Scenario (compared to 3.7 percentage points in Scenario1), it is clear that labour supply will be higher as a result of this second alternative reform proposal.

However, this is not the only effect that determines labour supply. Due to the augmented capital accumulation, the marginal product of labor – the complementary production factor – rises, also implying an increase in labour supply . Thus, disposable income of households increases by seven per cent in Scenario 1 and by 7.6 per cent in Scenario 2 leading to a rise in consumption of 2.8 and 3.3 per cent, respectively.

Since the reform scenarios have to be financed somehow, we allow for the VAT to adapt in order to balance the governmental budget without cutting lump-sum transfers to households. Simulating Scenario 1, the VAT increases from initially 16 per cent by 3.7 percentage points to 19.7 per cent assuring that the reform is revenue neutral. Since the government can draw on an additional tax revenue from the dividend taxation in Scenario 2, the required increase in the VAT rate amounts to only 2 percentage points, thus nearly 2 percentage points less than in Scenario 1. In Scenario 3, the VAT rate also rises to a level of about 18 per cent. The increase in revenue from capital gains taxation is not large enough to balance the governmental budget such that the VAT has to adjust accordingly to make the reform revenue neutral.

To be able to evaluate the welfare implications[17] of the three reform scenarios we rely on the equivalent variation to measure welfare. Therefore, we compute pre and post reform utility levels of a representative individual and calculate how much money the agent would need before the reform to reach the same utility level that is achieved after the reform. The present value of this cash flow is then expressed in terms of total life-time income of the representative agent and GDP. Scenario 2 yields not only the largest increase in GDP but also the largest increase in welfare. While welfare in terms of life-time income increases by 1.7 per cent – which is equivalent to a 0.9 per cent increase in terms of GDP – in Scenario 2, in Scenario 1, welfare only amounts to 0.8 per cent of GDP . The lowest increase in welfare in Scenario 3 is basically the result of the high capital gains taxation, which leads to a weaker increase in disposable income and consumption.

[17] Welfare is measured without public services.

4.3 Sensitivity Analysis

The large number of empirical papers that estimate different values for important behavioral parameters used in the model suggests to check the robustness of our results if different values for the key behavioral parameters are assumed. There are basically four different elasticities which are of interest in our context: The labour supply elasticity ε, the intertemporal elasticity of substitution σ^C, the elasticity of factor substitution σ^K , and the elasticity concerning the debt asset ratio σ^B .

Table 4 here

Tables 4, 5 and 6 show the results of the simulation exercise of Scenarios 1, 2 and 3, respectively, with different values for the underlying elasticities. The basic scenario applies a labour supply elasticity of $\varepsilon = 0.37$ which is a weighted average of compensated wage elasticities of labour supply for Germany estimated by FENGE ET AL. (2002).[18] If we set this elasticity close to zero, i.e. to $\varepsilon = 0.01$, we model an almost fixed labour supply. [19] Simulating scenario 1 (2, 3), the labour supply increases by only 0.05 per cent (0.06 per cent, 0.05 per cent) and thus also capital accumulation is impeded. In the long run the capital stock increases by only 3.58 per cent (2.81 per cent) instead of the 5.76 per cent (5.43 per cent) calculated in the base Scenario 1 (2). Accordingly, private consumption increases only to a smaller extent of 0.28 (0.27) per cent.

[18]The authors compute four different elasticities for men and women aged 20-39 and 40-39, using data from the German Socio-Economic Panel We then compute a weighted average of 0.37, using these elasticities and the share of employed in each of these categories.

[19]Such an assumption is plausible for Germany, as shown by the last tax reform : Although the German Tax Reform 2000 lead to a significant decrease in personal income tax rates employment did not increase, but decreased due to labor market rigidities and various other structural problems (Sinn 2004).

Table 5 here

Next, the values of the intertemporal elasticity of substitution, σ^C, reflect the change in the pattern of consumption and saving over time. We start with a value of 0.4 in the base scenario and then run the simulation with a higher value of 0.6. The model is to a large degree robust to the change in the intertemporal elasticity of substitution. The results change only slightly as depicted in the fourth column of tables 4 through 6. The reason why the results do change only so little is due to the fact that the long-run interest rate is bound to equal the rate of time preference in the long-run in the Ramsey model and the difference in tax rates on interest income before and after the reform is negligible. [20]

Table 6 here

Another important parameter is the elasticity of substitution between capital and labour. This elasticity is like a capital demand elasticity in our model. The more elastic capital demand is, the higher is the reaction to a change in the tax rates. Accordingly, even a slight lowering of the pre-tax rate of return will stimulate capital creation. A higher elasticity means that in Figure 2 the MRR curve becomes flatter such that at a given pre-tax rate of return **s** the same decrease in the required pre-tax rate of return

[20] Still, the following effects can arise as a result of a change in the taxation of interest income. According to theory, a higher intertemporal elasticity will have a stronger effect on the savings behavior of households. If the net interest rate decreases, savings will increase, since the income effect will dominate the substitution effect. The substitution effect arises since a lower interest rate increases the price of future periods consumption and thus we have a substitution of present consumption for future consumption. However, a lower interest rate leads to a positive income effect since the amount of savings needed to attain a given consumption level tomorrow, is increased.

u is followed by a higher adjustment of the capital stock. The basic scenario employs a factor substitution elasticity of the CES production function of 0.8. There are several estimates for this measure in the empirical literature, thus we simulate the proposed scenarios with a higher elasticity of 1.3. The higher elasticity leads to an even larger increase in the change of the long run capital stock compared to the base case. The long run capital stock increases by 8.15 (7.31) per cent in Scenario 1 (2) and only by 0.9 per cent in Scenario 3. Accordingly, the increased capital intensity leads to a change in labour supply, which increases by 2.21 per cent and 2.66 per cent in Scenarios 1 and 2. In turn, the consumption level of households rises by about three and 3.5 per cent, respectively.

Regarding the debt elasticity, this measure shows how elastic the firm's debt ratio reacts to different tax reform scenarios. In the baseline model the elasticity concerning the debt asset ratio is set to 0.36, while column six and seven of Tables 4 through 6 show the simulation results using a debt asset elasticity of 0.16 and 0.56, respectively. Firms choose the optimal debt level such that the costs of internal financing and external financing are equalized. If internal financing becomes cheaper, i.e. the required rate of return declines, enterprises will start financing more of their investments via retained earnings until the costs of external financing also decline due to the shrinking debt ratio. A reduced elasticity of e.g. 0.16 leads to a less elastic reaction of firms to cheaper internal financing.

5 Conclusion

Following the ongoing discussion of reforming the German tax system, the paper takes up the reform proposal made by the German Council of Economic Advisors in 2003. This reform proposal suggests a dual income tax for Germany similar to the one already practiced in the Nordic Countries. To analyze the economic effects of such a dual tax system, we apply a dynamic computable general equilibrium model and simulate three different reform scenarios. With standard assumptions on behavioral parameters and marginal tax rates, the reform leads to an increase in investments and therefore in capital accumulation of about 5.8 per cent. Comparing steady state values, GDP rises by 3.3 per cent and household consumption by 2.8 per cent. This complete restructuring of the tax system leads in the long run to a welfare gain of approximately 0.8 per cent of GDP which is mainly based on the increase in life-time wealth as a result of the lower tax burden. These results are to a large extent robust concerning the choice of the behavioral elasticities. The only important exemption is the labor supply elasticity. If we assume a labor supply elasticity close to zero, which is quite plausible for Germany due to the current frictions on the German labor market, the growth impact of this comprehensive tax reform diminishes. For example, the capital stock increases by only 3.9 per cent instead of the initial 5.8 per cent and GDP rises by only 1.2 per cent instead of the former 3.3 per cent. Thus, the labour supply is an important determinant of growth in two respects: First, if a tax reform stimulates capital accumulation a lack of labour supply will impede the accumulation of the complementary production factor capital. Second, if labour supply does not respond to tax incentives, households can not earn any additional

income and thus there is no demand side driven growth.

Thus, the change from the prevailing comprehensive income tax system to a dual income tax system will have a significant impact on capital accumulation and growth as well as on households' welfare, particularly if the economy has a well functioning labor market.

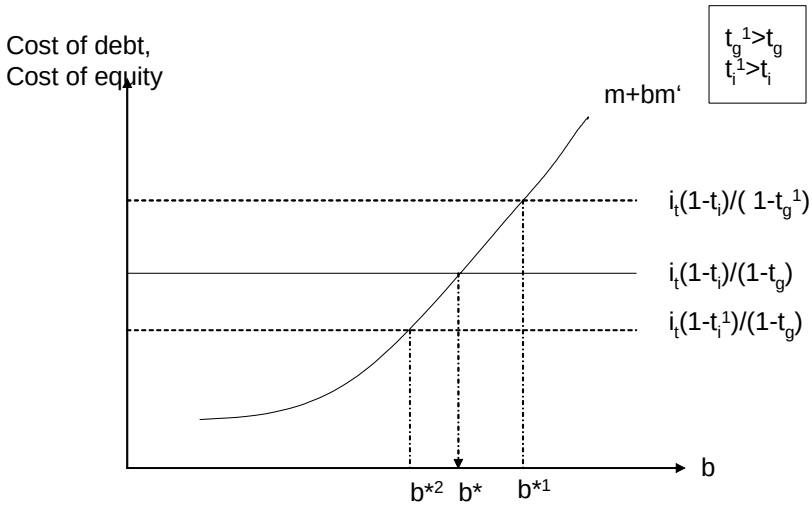

Figure 1: The Optimal Debt/Asset Ratio

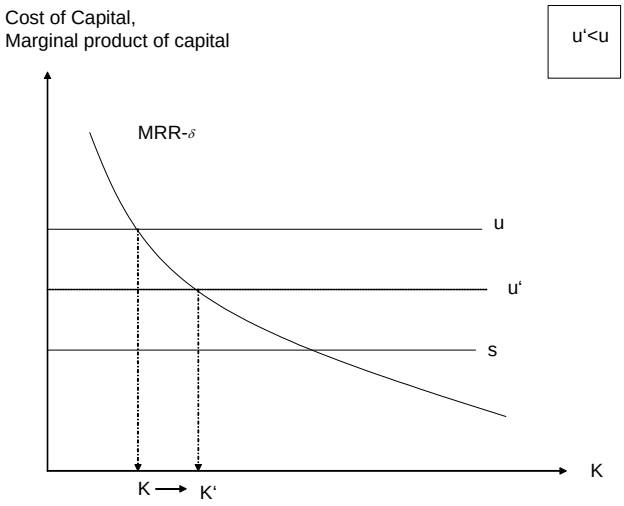

Figure 2: The Marginal Effective Tax Rate

Table 1: Tax Rates Before and After the Reform

	Status Quo (2003)	Scenario 1	Scenario 2	Scenario 3
Profit Tax, t^U	0.386	0.30	0.30	0.30
Labour Tax, t^L	0.295	0.24	0.24	0.24
Tax on Interest Income, t^i	0.295	0.30	0.30	0.30
Dividend Tax, t^D	0.148	0.00	0.30	0.30
Capital Gains Tax, t^G	0.00	0.00	0.00	0.15
VAT, t^C	0.16	endogenous	endogenous	endogenous

Source: Ministry of Finance, (BMF, 2004), (GCEA, 2003)

Table 2: Behavioral Parameter Values

Elasticity of Capital Demand*)	(CHIRINKO 2002)	- 1.0
Half Life of Capital Accumulation (in years)	(CUMMINS et al. 1996)	8.0
Elasticity of Debt-Asset Ratio^)	(GRAHAM et al. 1998)	0.36
Intertemporal Elasticity of Substitution	(FLAIG 1988)	0.4
Elasticity of Factor Substitution	(GERMAN BUNDESBANK 1995)	0.8
Labour supply elasticity	(weighted average of FENGE et al. 2002)	0.37

Elasticity with respect to: *) cost of capital; ^) profit tax

Table 3: Key Economic Figures (Long Run Change in %)

	Scenario 1	*Scenario 2*	*Scenario 3*
Capital stock	5.8	5.4	1.4
Cost of Capital	- 8.9	- 6.9	1.9
Marginal Effective Tax Rate	- 17.1	- 13.0	3.2
Gross Domestic Product	3.3	3.5	1.9
Equity as Source of Finance	5.5	5.5	- 0.6
Debt Asset Ratio	- 7.6	- 7.6	0.9
Domestic Assets	4.8	- 8.5	-1.8
Gross Wage	1.4	1.1	-0.3
Labour Supply	2.2	2.6	2.1
Disposable Income	7	7.6	5.6
Domestic Consumption	2.8	3.3	2.5
VAT Rate (Change in %-points)	3.7	2	1.9
Welfare in % of Life Time Income	1.4	1.7	1.2
Welfare in % of GDP	0.8	0.9	0.6

Source: own calculations

Table 4: Sensitivity Analysis (Long Run Changes in %)

Scenario 1$^{*)}$		$\varepsilon = 0.01$	$\sigma^C = 0.6$	$\sigma^K = 1.3$	$\sigma^B = 0.16$	$\sigma^B = 0.56$
Change in capital stock	**5.75**	3.58	5.76	8.15	5.70	5.80
Change in stock of debt	**- 2.34**	- 4.31	- 2.29	- 0.08	2.11	- 6.70
Change in labour supply	**2.15**	0.05	2.15	2.21	2.14	2.16
Change in onsumption	**2.80**	0.28	2.80	2.95	2.75	2.83

$^{*)}$applied parameters: $\varepsilon = 0.37$; $\sigma^C = 0.4$; $\sigma^K = 0.8$; $\sigma^B = 0.36$;

Source: own calculations.

Table 5: Sensitivity Analysis (Long Run Changes in %)

Scenario 2$^{*)}$		$\varepsilon = 0.01$	$\sigma^C = 0.6$	$\sigma^K = 1.3$	$\sigma^B = 0.16$	$\sigma^B = 0.56$
Change in capital stock	**5.43**	2.81	5.43	7.31	5.35	5.51
Change in stock of debt	**- 2.59**	- 5.02	- 2.59	- 0.86	1.79	- 6.99
Change in labour supply	**2.61**	0.06	2.61	2.66	2.58	2.64
Change in onsumption	**3.31**	0.27	3.34	3.46	3.25	3.38

$^{*)}$applied parameters: $\varepsilon = 0.37$; $\sigma^C = 0.4$; $\sigma^K = 0.8$; $\sigma^B = 0.36$;

Source: own calculations.

Table 6: Sensitivity Analysis (Long Run Changes in %)

Scenario 3$^{*)}$		$\varepsilon = 0.01$	$\sigma^C = 0.6$	$\sigma^K = 1.3$	$\sigma^B = 0.16$	$\sigma^B = 0.56$
Change in capital stock	**1.36**	- 0.67	1.36	0.90	1.37	1.36
Change in stock of debt	**2.23**	0.18	2.23	1.76	1.75	2.71
Change in labour supply	**2.09**	0.05	2.09	2.08	2.09	2.09
Change in onsumption	**2.48**	0.00	2.48	2.44	2.49	2.47

$^{*)}$applied parameters: $\varepsilon = 0.37$; $\sigma^C = 0.4$; $\sigma^K = 0.8$; $\sigma^B = 0.36$; $\sigma^B = 0.36$

Source: own calculations.

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