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The Case of a Tax Reform Proposal

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Earlier or Later in CGE–Models: The Case of a Tax Reform Proposal

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Abstract

The German Income Tax Reform 2000 was welcomed by the public as a step towards unleashing lurking growth potentials. Nonetheless, in the course of the year 2001 a dispute arose, centering around the question, whether or not the later stages of the German Income Tax Reform should be brought forward as a means of stimulating the stuttering engine of the German economy. Abstracting from the seemingly Keynesian viewpoint, we analyze the individual and social welfare effects in order to find the answer of what to do. The paper presents the welfare analysis of the early German Income Tax Reform within a simplified CGE model of the Auerbach–Kotlikoff type.

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1 Introduction

In general, tax reform proposals are discussed thoroughly, passed into law right away, but introduced mostly with a relatively long announcement period. Nearly every income tax reform relieves future taxpayers from part of their load. It is astonishing that urgent need for a tax relief continues undiminished even after a series of former relief took place, but this is not the topic here. The focus of this paper is the question of whether or not we should bring a tax relief forward – if we have this possibility.

What is the reason for bringing forward an already pre–announced tax relief? Keynesian economics have told us that it might be seen as a step towards increasing effective demand in times of a recession which could even trigger future growth. In contrast, neoclassical theory tells us that private demand will be crowded out through lower public spending. So if at all, we should take that step only in case of increased individual and social welfare.

What would be the price of bringing forward a tax relief? Of course, it could be financed through higher deficits and/or reductions in other public spending. From the Keynesian viewpoint there is no price to pay at all since budget deficits do not matter in the medium run. But in the long run, deficits would explode forcing the policy makers either to increase taxes again or reduce other governments spending.

In this paper, we investigate the individual and social welfare effects of bringing forward a pre–announced tax reform. As a case study we consider the latest German Income Tax Reform (GITR), which was enacted in 2000 and announced a reduction of average tax rates in 2005. The paper presents the welfare analysis of the early GITR in a Computable General Equilibrium (CGE) setting.[1] The employed Auerbach–Kotlikoff model 1) encompasses 58 overlapping generations, 2) is calibrated to the macroeconomic settings currently found in Germany and 3) reflects a small open economy approach.

The remainder of the paper is organized as follows: Section 2 specifies the CGE setting. The details of the investigated GITR as well as our results are presented in Section 3. Finally, section 4 summarizes our findings and points out some topics for future research. It should be noted already from the scratch, that this paper should be seen as a start–up for an ongoing research agenda, which aims towards formulating a fully specified stochastic CGE model of the German economy.

[1]The floodings of the Elbe river in East Germany took place after this paper was finished. In the aftermath, the German government decided with agreement of the oppoitional conservative party to postpone the already announced second stage of the GITR which serves as the reference scenario in this paper. To analyse this particular policy measure, please reverse all following results.

2 The Model

2.1 Household Sector

In order to simplify the analysis, we adopt a highly stylized overlapping generations model in the tradition of Samuelson (1958), Diamond (1965) and Auerbach/Kotlikoff (1987). In each period t, there is a youngest generation $i = 1$ just entering the labor force and $I - 1$ older generations $i = 2, \cdots, I$. The population grows at a constant rate g. Let L_0 be the number of individuals entering the labor force in period $t = 0$. Thus, if we denote the number of individuals of generation i at time t by $L(i,t)$, then

$$L(i, t + 1) = (1 + g)L(i, t), \tag{1}$$

and

$$L(i, 0) = (1 + g)^{1-i} L_0. \tag{2}$$

Each generation consists of two types of individuals, that is high and low skilled individuals.[2] The two types of individuals are distinguished by the index $j \in \{H, L\}$, where $j = H$ stands for high skilled and $j = L$ respectively for low skilled. The composition of the generations is constant during time, i.e. a constant fraction λ_H (λ_L) of each generation is high (low) skilled, where the λ's sum up to one.

In every phase of their life–cycle low skilled individuals face the risk of being unemployed. For simplicity we assume that the probability of being unemployed in period t is given by the low skilled unemployment rate $\mu^L(t)$. Thus, the probability of being employed in period t is given by $1 - \mu^L(t)$, respectively. Because of this unemployment risk, the consumption and asset levels of a low skilled individual will in general depend on its past employment history. To simplify we make the assumption, that the low skilled members of each generation pool their income to insure against the individual unemployment risk. That is, we may treat the low skilled members of a generation as identical individuals, despite the fact that they will in general differ with respect to their employment histories.

Specifically we assume, that the preferences of a member of generation i in period t, are represented by a nested and time–additive utility function with constant elasticity of substitution

$$U^j(i,t) = \frac{\gamma}{\gamma - 1} \sum_{k=0}^{I-i} \Delta^k \left(c^j(i+k, t+k)\right)^{\frac{\gamma-1}{\gamma}}, \tag{3}$$

where $c^j(i,t)$ denotes the consumption of goods which a type j member of generation i enjoys in period t. γ represents the (constant) intertemporal elasticity

[2] Note that we thereby also constitute two corresponding income classes. For a similar approach of implementing diverging income groups, see Fehr (1999).

of substitution between consumption in different periods of life. Finally, agents tend to value future less than present consumption and therefore discount the former by an annual factor of pure time preference Δ. Note that the entire life–cycle utility is given by $U^j(i,t)$ for $i = 1$ (see equation (3)).

Independent of their employment status, individuals inelastically supply one unit of labor during their first I_p life–cycle phases, while their labor supply falls to zero in the last $I - I_p$ life–cycle phases, which correspond to the individuals retirement phase. Let $w^j(t)$ denote the gross wage rate of a type j worker in period t. Then, being employed, the individual receives a net wage income

$$\tilde{w}^j(t) = \left(1 - \tau_w^j(t) - \tau_s^j\right) w^j(t), \tag{4}$$

where $\tau_w^j(t)$ is the income tax rate of a type j individual in period t and τ_s^j is a type j individual's payroll tax rate to the social security system. The different tax schemes reflect the progressive nature of the comprehensive income tax, including both labor and capital income and the proportional nature of contributions to the social insurance schemes. While being unemployed, a low skilled individual receives unemployment benefits amounting to $\theta\tilde{w}^j(t)$, where θ is the constant replacement ratio. From the moment on the individual enters the retirement phase he or she does not supply labor any longer. That is, a retired individual receives neither wage income nor has she or he any claims on unemployment benefits. Instead the individual receives a pension $p^j(i,t)$ from the social security administration as of the $(I_p + 1)$th life cycle phase.

Besides wage income, unemployment benefits or pension payments, an individual receives interest income $\tilde{r}^j(t)a^j(i,t)$ on assets accumulated in the past. Thereby $a^j(i,t)$ are the asset holdings of a type j member of generation i at the beginning of period t. Because we subsequently assume a small open economy, the net interest rate $\tilde{r}^j(t)$ is given by

$$\tilde{r}^j(t) = \left(1 - \tau_w^j(t)\right) \bar{r}, \tag{5}$$

where $\bar{r}$ is the exogenously given gross interest rate of the perfectly competitive world capital market. Note that the net wage rate, the net interest rate and social security transfers differ among the different types of individuals because of different income levels, tax rates and social security contributions. Net income can be saved to accumulate further assets $(a^j(i+1,t+1))$ or spent on consumption goods $(c^j(i,t))$, where consumption expenditures are subject to a sales tax τ_c, which we assume constant over time.

Thus the period t budget constraint of the representative type j member of generation i reads

$$(1 + \tau_c)c^j(i,t) = \left(1 + \tilde{r}^j(t)\right) a^j(i,t) - a^j(i+1,t+1) + s^j(i,t), \tag{6}$$

where non–capital income $s^j(i,t)$ is defined as follows:

$$s^H(i,t) = \begin{cases} \tilde{w}^H(t) & \text{for } 1 \le i \le I_p \\ p^H(i,t) & \text{otherwise} \end{cases}$$

$$s^L(i,t) = \begin{cases} \left(1-\mu^L(t)\right)\tilde{w}^L(t) + \mu^L(t)\theta\tilde{w}^L(t) & \text{for } 1 \le i \le I_p \\ p^L(i,t) & \text{otherwise.} \end{cases}$$

Note that the income of a low skilled individual equals per capita income of the low skilled members of generation i as a whole. This is due to our assumption that the low skilled members of each generation pool their income.

Because we abstract from any bequest motives and since there is no uncertainty concerning the deterministic life–span, the oldest generation I being in their last life cycle phase in period t consumes their entire wealth, while the asset level of the youngest generation $i = 1$ is equal to zero, i.e.

$$a^j(I,t+1) = 0 \;\text{ or }\; (1+\tau_c)c^j(I,t) = \left(1+\tilde{r}^j(t)\right)a^j(I,t) + s^j(I,t) \tag{7}$$

$$a^j(1,t) = 0 \tag{8}$$

Given the utility function in equation (3), the budget constraint in equation (6), and the terminal and initial conditions in equations (7) and (8) individuals choose consumption and asset levels in each period such that utility over their remaining life–time will be maximized. According to the theory of dynamic programming, the utility maximization problem of a type j member of generation i may thus be written as

$$\begin{aligned} V^j(a,i,t) = \;& \max_c \;\; \left\{u(c) + \Delta V^j(a', i+1, t+1)\right\}, \\ & \text{s.t.} \quad a' = (1+\tilde{r}^j(t))a + s^j(i,t) - (1+\tau_c)c, \\ & \qquad\;\; a' = 0 \;, \text{ if } i = I, \\ & \qquad\;\; a = 0 \;, \text{ if } i = 1. \end{aligned} \tag{9}$$

Equation (9) constitutes the Bellman equation, which can be solved backwards to yield sequences of policy functions $\{c^j(i,t), a(i,t)\}_{i=1}^I$ for the endogenous and exogenous control variables for all t.

Based on individual utility maximization, we are now ready to specify the social planners viewpoint thereby entering the muddy waters of social welfare maximization. In order to simplify the analysis, we assume the social planner to act according to the Benthamite welfare function

$$SW(t) = \sum_{i=1}^{I} \sum_{j=H,L} \left[\frac{1}{\gamma'}U^j(i,t)\right]^{\gamma'} + \sum_{k=1}^{\infty} \sum_{j=H,L} (\Delta')^k \left[\frac{1}{\gamma'}U^j(1,t+k)\right]^{\gamma'}, \tag{10}$$

where the first sum represents the restricted rest–of–life welfare of all living generations, the second sum stands for the utility of future generations discounted by the social planners discount factor $\Delta' > \Delta$ and $\gamma' = \frac{\gamma}{\gamma-1}$ is a transformation factor. Note that CES–utility has to be monotonically transformed into the positive defined linear homogeneous form, which represents relative equivalent variations on the individual basis.

2.2 Public Sector

The public sector acts according to the unified budget principle, that is combined tax revenues finance total expenditures. Tax revenues $T(t)$ consist of three components: 1) a proportional tax from payroll, representing the contributions to social security, 2) a progressive comprehensive income tax on both labor and capital income, and 3) a consumption tax in line with the VAT. Thus the government's overall tax revenue in period t is given by

$$\begin{aligned} T(t) &= \sum_{j=H,L} \sum_{i=1}^{I_p} \lambda^j L(i,t) \left(1 - \mu^j(t)\right) \tau^s(t) w^j(t) \\ &+ \sum_{j=H,L} \sum_{i=1}^{I_p} \lambda^j L(i,t) \left(1 - \mu^j(t)\right) \tau_w^j(t) w^j(t) \\ &+ \sum_{j=H,L} \sum_{i=1}^{I} \lambda^j L(i,t) \tau^c c^j(i,t) \\ &+ \sum_{j=H,L} \sum_{i=1}^{I} \lambda^j L(i,t) \tau_w^j(t) \bar{r} a^j(i,t), \end{aligned} \tag{11}$$

where $\mu^H(t) = 0$.

Expenditures are composed of transfer expenditures $Tr(t)$ and other government expenditures $PG(t)$. Transfer expenditures consist of payments from the pension scheme and unemployment benefits. The latter substitute for wage income with a high tax–benefit–linkage since it is calculated to ensure a replacement ratio of θ percent. The pension system constitutes an off–budget scheme and is fully pay–as–you–go financed. Thus the replacement ratio evolves endogenously. Summing up over all individuals, the transfer expenditures in year t are given by

$$\begin{aligned} Tr(t) &= \sum_{j=H,L} \sum_{i=I_p+1}^{I} \lambda^j L(i,t) p^j(i,t) \\ &+ \sum_{i=1}^{I_p} \mu^L(t) \lambda^L L(i,t) \theta \tilde{w}^L(t), \end{aligned} \tag{12}$$

where

$$p^j(i,t) = \frac{\sum_{s=1}^{I_p} \lambda^j L(s,t) \tau_s(t) w^j(t)}{\sum_{s=I_p+1}^{I} \lambda^j L(s,t)}.$$

Besides transfer expenditures, the government also provides for public goods which reflect the real purchase of goods and services. To finance its expenditures the government collects not only taxes but also draws resources from the private sector by issuing bonds $B(t+1)$ which are annually repayed and served with the interest rate of the world‘s capital market. Taking into account both additional items, the overall budget constraint of the public sector is then given by

$$B(t+1) - B(t) = PG(t) + Tr(t) + \bar{r}B(t) - T(t). \qquad (13)$$

2.3 Production Technology, Foreign Trade and Equilibrium Condition

2.3.1 Production Technology

Competitive firms use labor and capital to produce output which can be used for both consumption and investment. Production is characterized by constant returns to scale which ensures that the present value of the firms' profits will vanish in a world of perfectly competitive good markets. Because firm size is indeterminate under constant returns to scale, we can think of production as being carried out by a single representative firm. For simplicity we assume that the production technology of this representative firm is given by a Cobb–Douglas production function

$$Y(t) = Z(t)F\left(K(t), N(t)\right) = Z(t)\left(K(t)\right)^{\alpha}\left(N(t)\right)^{1-\alpha} \qquad (14)$$

where $Y(t)$, $K(t)$, and $N(t)$ are output, capital, and labor input, all at time t. α reflects the share of capital income and $1-\alpha$ the total labor income share on GDP. The parameter $Z(t)$ is a technology parameter, which captures the impacts of stochastic technology shocks. For simplicity we consider only the deterministic case and therefore set $Z(t)$ equal to unity in the remainder of this paper.[3] Note that for this reason $Z(t)$ will be ignored in subsequent equations. Furthermore, labor input $N(t)$ is given as a Cobb–Douglas composite of high skilled labor $N^H(t)$ and low skilled labor $N^L(t)$:

$$N(t) = \left(N^H(t)\right)^{\beta}\left(N^L(t)\right)^{1-\beta}. \qquad (15)$$

Thereby β reflects the share of high skilled labor and $1-\beta$ the share of low skilled labor on total labor income. The firm's problem can be solved using a two step procedure. First, whatever the value of the composite labor input $N(t)$, firms choose high and low skilled labor such that the cost of attaining $N(t)$ is minimized. That is, firms solve the following cost–minimization problem:

$$\begin{array}{cl} \min_{\{N^H(t),N^L(t)\}} & \sum_{j=H,L} w_p^j(t)N^j(t) \\ \text{s.t.} & N(t) = \left(N^H(t)\right)^{\beta}\left(N^L(t)\right)^{1-\beta}, \end{array}$$

[3] In future work, $Z(t)$ will be modelled as a stationary Markov process with finite state-space $S_Z = \{1, 2, \ldots, z\}$ and probability transition matrix P_Z with transition probabilities $P_{ij} = Prob(Z(t) = j|Z(t-1) = i)$. This specification will allow us to incorporate a stochastic real business cycle into the framework of our model. Note that for notational ease we ignored the just mentioned possibility of stochastic shocks in our treatment of the household sector.

where $w_p^j(t)$ denotes the employer's unit costs of labor. From the Lagrangian to this problem we obtain the conditional labor demand functions:

$$N^H(t) = \beta \frac{W(t)}{w_p^H(t)} N(t) \quad (16)$$

$$N^L(t) = (1-\beta) \frac{W(t)}{w_p^L(t)} N(t) \quad (17)$$

where $W(t)$ is a cost of labor index, measuring the minimum cost of obtaining one unit of the composite labor input. This index is defined as

$$W(t) = (\beta)^{-\beta}(1-\beta)^{-(1-\beta)} \left(w_p^H(t)\right)^{\beta} \left(w_p^L(t)\right)^{1-\beta}. \quad (18)$$

In the second step, firms choose composite labor and capital such that their market value is maximized. Assuming that the amount of labor and capital employed can be adjusted costlessly, the first–order conditions for the firm's problem can be reduced to yield the familiar conditions

$$\frac{\partial F\left(K(t), N(t)\right)}{\partial N(t)} = W(t) \quad (19)$$

$$\frac{\partial F\left(K(t), N(t)\right)}{\partial K(t)} = \bar{r} + \delta. \quad (20)$$

According to equation (19) composite labor should be employed up to the point where the marginal product of labor equals the cost of labor index $W(t)$, while equation (20) demands that the expected marginal product of capital should be equal to the user cost of capital $\bar{r} + \delta$.

Rewriting equations (19) and (20) for the case of the Cobb–Douglas production function in equation (14), the capital–labor ratio $k(t)$ and the cost of labor index $W(t)$ are given by

$$(1-\alpha)\left(k(t)\right)^{\alpha} = W(t) \quad (21)$$

$$\alpha\left(k(t)\right)^{\alpha-1} = \bar{r} + \delta. \quad (22)$$

2.3.2 Labor Market Equilibrium

Since individuals inelastically supply one unit of labor during each of their first I_p life–cycle phases, the aggregate labor supply $L_s^j(t)$ in the two labor market segments at time t is given by

$$L_s^j(t) = \sum_{i=1}^{I_p} \lambda^j L(i,t). \quad (23)$$

For high skilled workers, the unit costs of labor equal the market–clearing wage rate in this labor market segment, i.e. $w_p^H(t) = w^H(t)$. This ensures that labor supply equals the firm's labor demand at any respective wage $w^H(t)$.

However, in the low skilled labor market segment a distortion exists, arising for example from efficiency–wages, union wage–bargaining, or imperfections in the matching process, which prevent market clearing and induce unemployment in this labor market segment. Following Gali (1996) we assume that this distortion is summarized by a variable ξ^L, which marks the wedge between the market clearing wage rate actually paid to low skilled workers and employer's unit costs of labor. Thus, for low skilled labor the unit costs of labor are given by

$$w_p^L(t) = \frac{w^L(t)}{\xi^L} \ , \ \xi^L < 1, \tag{24}$$

where $w^L(t)$ denotes the market clearing wage rate in absence of the distortion. ξ^L can be thought of as determining a wage curve in the low skilled labor market segment. The intersection of this wage curve with the firm's labor demand then determines the employment level, while the difference to the labor supply curve corresponds to the amount of unemployment in the low skilled labor market [See Hirte (2002:83)]. Because the size of this wedge will in general depend on the specific labor market institutions, as well as the tax system, our assumption of a constant wedge is only a short–cut to introducing unemployment in an otherwise competitive general equilibrium framework. In particular we thereby ignore possible employment effects arising from fiscal policy changes such as the tax reforms considered in section 3. In a more elaborate model, this wedge should therefore be endogenously determined, i.e. by explicitly incorporating the process of wage determination into the model.

Assuming a uniform distribution of unemployment among low skilled generations, the equilibrium in the two labor market segments may then be defined as

$$N^H(t) = L_s^H(t) \tag{25}$$

$$N^L(t) = \left(1 - \mu^L(t)\right) L_s^L(t) \tag{26}$$

Given the low skilled unemployment rate $\mu^L(t)$, the high skilled wage rate $w_p^H(t)$ and the low skilled unit costs of labor $w_p^L(t)$ can be obtained from equations (22), (21), (23), (25), (26), (16) and (17).

2.3.3 Current Account and Capital Market Equilibrium

Assuming a small open economy, the aggregate feasibility constraint for the economy as a whole is given by the current account identity

$$CA(t) = F(t+1) - F(t) = \bar{r}F(t) + Y(t) - C(t) - I(t) - PG(t), \tag{27}$$

where $F(t)$ denotes the economy's net foreign assets. $C(t)$ is aggregate consumption, given by

$$C(t) = \sum_{j=H,L} \sum_{i=1}^{I} \lambda^j L(i,t) c^j(i,t),$$

and $I(t)$ is gross investment

$$I(t) = K(t+1) - (1-\delta)K(t).$$

The aggregate feasibility constraint in (27) may also be written as

$$CA(t) = F(t+1) - F(t) = S(t) - I(t), \tag{28}$$

where $S(t)$ denotes the aggregate savings of the economy

$$S(t) = A(t+1) - A(t) - (B(t+1) - B(t)), \tag{29}$$

and $A(t)$ denotes the assets of the economy's private sector as a whole

$$A(t) = \sum_{j=H,L} \sum_{i=1}^{I} \lambda^j L(i,t) a^j(i,t).$$

Equation (28) reflects the fact that the aggregate feasibility constraint is also the capital market equilibrium condition.

2.4 Calibration

To add realism to the numerical simulations, we employ empirically significant parameter estimates from the literature. Where these are not available, indirect methods and ad hoc assumptions have to be made. Although our simulation approach yields numerical insights into real world policy making, the illustrative character of the results should be borne in mind. The model's starting–point for the different tax reform proposals is calibrated to macroeconomic conditions, the legal system, and institutional settings presently found in Germany. Estimates are required for the parameters I, g, λ^j, γ, Δ, Δ', θ, τ_w^j, τ_s^j, τ_c, PG, α, β, ξ^L, $\bar{r}$, δ. They are described in the remainder of this section.[4]
Individual Life–Cycle (I, I_p): The span of the (rest–of) life–cycle of the individuals after entering the labor force amounts to 58 years and our model will thus constitute 58 overlapping generations. Of these $I_p = 45$ years will be spent while being employed.
Population Growth Rate (g): The population growth rate g is assumed to represent both quantitative and qualitative population growth. The latter represents labor augmenting technical progress. In line with the demographics in Germany, we assume a shrinking population with an annual decline of -0.3 percent *per annum*, while technical progress is assumed to increase the effective supply of labor by 1.5 percent *per annum*. We therefore set the overall growth rate of the labor force g on a value of 1.2 percent *per annum*.

[4]If not otherwise stated, data is taken from the Statistical Yearbook of the years 1999 and 2000.

Population Shares (λ^j): Distributing the population into two fractions, we assume 44 percent of all agents to represent the high skilled or above average people while the remainder share is assumed to be low skilled workers. This number roughly corresponds to the share of high qualifier workers with special training and education in 1998.

Intertemporal Elasticity of Substitution (γ): Following Hirte (2002:91) we set γ $(= 0.3)$.

Individual Time Preference Factor (Δ): We set Δ $(= 1/1.01)$ which corresponds to an annual rate of pure time preference of 1 percent. This relatively low level is in accordance to many other simulation studies and produces a realistic consumption profile.

Social Discount Factor (Δ'): Standard welfare theory indicates that the discount factor of the social planner for the utility of future generations is rather low – if not zero. Additionally, the discount rate of the immortal social planner should be lower as compared to the discount rate of mortal individuals. In the light of this 'common sense', we set Δ' $(= 1/1.005)$ which corresponds to an annual rate of 0.5 percent.

Replacement Rate (θ): We use the overall net replacement ratio of unemployment insurance in Germany which depends on family status and earnings history. Thus, we set the replacement rate to 67 percent of previous net wage earnings.

Income Tax Rates (τ_w^j): The income tax rates are calibrated to generate a ratio of government debt to GDP of approximately 59 percent in the initial steady state, which corresponds to the value found in Germany in 2000. In the initial steady state which corresponds to the period until year 2002, we set the average tax rates τ_w^j on a value of approximately 23.5 percent for high skilled individuals, while those being low skilled have a significant lower rate of 13.6 percent.[5] Both rates reflect averages of the respective percentiles of high and low skilled workers. The tax reform will lower these rates to approximately 21.2 percent for high skilled individuals and 12.3 percent for low skilled individuals, respectively.

Social Security Contributions (τ_s^j): While in reality the payroll contribution to social security is presently 19.1 percent of gross wages, the contribution rates in the simulations are calibrated to generate a replacement rate of pension benefits of approximately 70 percent for the two skill groups, which corresponds to the actual average replacement rate in 2000. This is ensured by setting the payroll contributions τ_S^j for low skilled workers on a value of 12.5 percent, while for high skilled workers it is set on a value of 9.5 percent. The different contribution rates are in accordance with the fact that there exist specific ceilings in

[5] Note that earlier stages of the German tax reform, that is, those tax reliefs prior to the 2003 reductions are thereby neglected.

the respective social security plans representing roughly double average income. As a result, contributions are restricted to a maximum value. We therefore employ a reduced average payroll tax rate for high skilled workers.

Consumption Tax Rate (τ_c): As in the legal system of Germany, we assume a VAT–type of consumption tax. At present, rents and some other sales revenues are exempt from VAT and only a few subsistence goods are taxed at a reduced rate of 7 percent. The remaining goods face a rate of 16 percent or are due to special excise taxes. However, to generate a realistic ratio of consumption tax revenues to GDP, which was approximately 7 percent in 2000, we set the consumption tax rate to a value of 13.5 percent.

Public Good Supply (PG:) This parameter is set to reproduce the public sector activity of 19 percent of the GDP in the initial steady state. Of course, this ratio reflects exclusively the purchase of goods and services and does not take into account transfers to the private sector.

Production Elasticity of Capital (α): We use a capital income share of $\alpha = 0.28$. This value reflects year 2000 NIPA figures and represents also a good approximation of the long–run average over the last decades. It sets total labor income to 72 percent of GDP.

Production Elasticity of High Skilled Labor (β): We use a share of high skilled labor income of $\beta = 0.66$. This value is found in the latest SOEP survey of the income distribution in Germany.

Low Skilled Labor Market Distortion (ξ^L): The value of the wedge between the market clearing wage paid to low skilled workers and the unit costs of low skilled labor is calibrated to fix the low skilled unemployment rate μ^L at a level of approximately 16 percent.

Real Interest rate and Depreciation Rate of Capital ($\bar{r}$, δ): The real interest rate and the depreciation rate of the overall Capital Stock are calibrated to generate a capital coefficient of approximately 2.84 and a ratio of gross investment to GDP of approximately 22 percent in the initial steady state. This is ensured by setting the real interest rate $\bar{r}$ to a value of 3.23 percent, while the depreciation rate δ is set to 6.6 percent. The latter is slightly larger than the actual ratio of depreciation to GDP, which was 5.1 percent in 1999.

3 The German Income Tax Reform

3.1 Issues and Instruments

With the adoption of the Tax Reduction Act by the German *Bundestag*, on July 6, 2000 and its approval by the *Bundesrat*, which represents the German states (*Bundesländer*), the German Tax Reform was passed into law by January 2001. Among other, one central element of the latest German Tax Reform is the reduction of income tax rates. It is this element – henceforth called the GITR – which is in the very focus of this paper.

In the first stage of the GITR, started on January 1, 2001, the basic income tax rate has fallen to 19.9 percent, the top rate was cut from 51 to 48.5 percent while the basic personal allowance was increased by €494 to approximately €7,206.[6] During the second stage, starting on January 1, 2003 the basic personal allowance will be increased to €7,426. The basic tax rate will be cut to 17 percent while the top rate will fall to 47 percent. Finally, as from January 1, 2005 the third stage will increase the basic personal allowance to €7,664. The basic tax rate will be reduced to 15 percent, while the top rate will be brought down to 42 percent.

3.2 The Key Issue: Earlier or Later

While the adoption of the German Tax Reform was welcomed by the public as a step towards unleashing lurking growth potentials, in the course of the year 2001 a public dispute arose out of the fear of a recession. This dispute centered around the question, whether or not the later stages of the GITR should be brought forward as a means of stimulating the stuttering engine of the German economy.

Although leading economic research institutes and the political opposition voted in favor of bringing the tax reform forward, the German government – a coalition of the Social Democrats and the Greens – resisted increasing pressure from the public. On the one hand the government argued that the expansionary effect of a early tax reform is too small and thus will fizzle out. On the other hand, the early tax reform would *ceteris paribus* imply a higher budget deficit, which conflicts with another government's mid–term goal of presenting a balanced budget in the year 2006. Thus government's resistance to bring forward the tax reform may be seen as a means to build up their reputation as a consolidator of the national budget.

However, while a balanced budget *per se* may be seen as a desirable goal, it must nonetheless be judged against the welfare gains or losses which its achievement might involve for the individuals. In the framework of our model we therefore want to address the question, whether or not bringing the tax reform forward is the superior strategy if judged by their sole welfare implications. Because of individual heterogeneity, arising from the overlapping generations structure of the population and its different skill groups, there will be winners and losers of fiscal policy changes. Thus welfare judgements based on the Pareto criterion are impossible. In order to perform welfare comparisons be-

[6]The first stage of the German Tax Reform was in fact the third stage of the Tax Relief Act 1999/2000/2002, with the 2002 stage brought forward by one year to January 1, 2001.

tween different fiscal policies, we therefore have to rely on the concept of the social welfare function as specified above in equation (10). If the government acts as a benevolent social planner it should opt for the fiscal policy which maximizes social welfare. That is in our case for the fiscal policy which yields the higher social welfare level.

In line with the posed question, we consider two different scenarios. The first scenario sets up the tax reform as scheduled: Assuming that the economy is initially in a steady state, we study the effects of a pre–announced tax rate cut three years after the initial date, corresponding to the third stage of the GITR, starting on January 1, 2005. Presently this is the legal status quo. In the second scenario the tax reform is brought forward, i.e. the third stage of the GITR starts in the beginning of year 2003. Assuming again that the economy is initially in a steady state, we thus study the effect of a tax cut *cum* deficit increase in the medium run.[7]

Assuming that the government's intertemporal budget was balanced in the initial steady state, the initial tax cut in both scenarios has to be followed by a future increase in tax rates or a cut in government spending, because the induced increase in overall tax revenues will not be sufficient to close the budget in the long run. That is, the second round effects following the initial shock do not ensure that the government's intertemporal budget will be balanced eventually. This would prevent the economy from converging to a new steady state. In order to restore a balanced intertemporal budget we decided to consider the case of a cut in government spending in the long run. In particular, we designed the cut in government spending to generate a constant ratio of government debt to GDP ten years after the initial tax cut has been put in place.

Figure 1 displays the trajectories of the budget deficit under the two scenarios. As can be seen from the figure, there are only small differences with respect to the evolution of the budget deficit under the two scenarios, except that the budget deficit in scenario 1 initially decreases due to announcement effects, while it increases with a delay of 2 years, corresponding to the delayed implementation of the tax reform in this scenario [see figure 2]. The reason for this has simply to be seen in higher consumption tax revenues due to the rise in consumption induced by the announcement. In both scenarios the budget deficit continually rises after the increase following the initial tax cut, which is due to the decline in tax revenues and the corresponding rise in government debt and debt services.

[7] See Persson (1985) for a formal analysis of the tax cut *cum* deficit increase in a small open economy and Raffelhüschen and Steigum (1994) for an empirical OLG analysis in a two region model. For a tax switch CGE analysis in a closed economy, see Fehr and Wiegard (2001).

The sharp decline of the budget deficit ten years after the implementation of the tax reform corresponds to the cut in government spending which is necessary to balance the government's intertemporal budget. Afterwards the budget deficit as well as the government debt remain constant, while the necessary adjustments are reflected in the trajectory of government spending, as can be seen from figure 3, which displays the share of government spending on GDP. As is apparent from the figure, government spending initially undershoots the level consistent with a balanced intertemporal budget in the final steady state. Then it continually begins to rise to reach its new steady state level.

In the final steady state, the budget deficit is slightly smaller in scenario 1 than in scenario 2, while government spending is somewhat larger (not obvious in the graphs because of the scaling). As can be seen from figure 2, this difference is due to the rise in tax revenues following the announcement of the tax reform in scenario 1, thereby leading to an initial decline in government debt. Hence government debt and debt services in the final steady state are somewhat smaller in scenario 1 compared to scenario 2, thereby permitting a somewhat higher level of government spending. However, tax revenues in the final steady state are the same in both scenarios and reflect a tax relief amounting to approximately 4.1 percent of the entire public revenues compared to the initial steady state.

The described evolution of the budget deficit and government spending is also reflected in the trajectory of government debt under the two scenarios, which is displayed in figure 4. As can be seen from the figure, government debt continually rises after the implementation of the tax reform in both scenarios. As in the case of the budget deficit, differences arise only due to the lagged implementation of the tax reform under scenario 1. Hence, government debt initially declines due to the mentioned announcement effects, while it rises with a lag of 2 years, corresponding to the latter implementation of the tax reform. Also, as in the case of the budget deficit the rise of the government debt is abruptly stopped by the cut in government spending 10 years after the implementation of the tax reform. Afterwards government debt remains constant on its final steady state level, which is slightly smaller in scenario 1 compared to scenario 2.

The reason for the described undershooting behavior of government spending can be read off from figures 5 and 6, which display the behavior of the government's tax revenues from the taxation of consumption spending and capital income. As a consequence of the initial cut in income tax rates individuals spend more resources on consumption goods, inducing continually rising revenues from consumption taxation. In the case of capital income taxation, tax revenues initially decline, reflecting the cut in tax rates. Thereafter, as in the case of consumption spending, individuals adjust to the rise in life–time resources by increasing their savings. Thus, while the tax rate is lower, the tax base expands, causing continually rising revenues from capital taxation.

Nonetheless, the expanding tax base can only partially compensate for the lower tax rate, which is reflected by the fact that the revenue from capital income taxation is below its initial level in the final steady state. Note that as a consequence of the announcement in scenario 1 individuals increase present consumption, giving rise to an increase in revenues from consumption taxation, while on the other hand the revenue from capital income taxation declines somewhat with an adjustment lag of one period. The latter effect is due to a decline in savings to finance higher present consumption. Thereby the rise in revenues from consumption taxation outweighs the decline in revenues from capital income taxation. This is the reason for the initial decline of the government budget deficit and debt in scenario 1.

Finally, because we considered a small open economy and assumed an inelastic labor supply, the evolution of the other components of the public sector, that is tax revenues from the taxation of wage income and social security contributions, as well as transfer expenditures arising from the pension scheme and unemployment benefits, is rather unspectacular and fits the intuition. Nevertheless, they shall be briefly described for the sake of completeness. The steady state capital intensity is completely determined by the exogenously given real interest and depreciation rates and the production technology. Thus, it remains constant over the course of our simulations. Gross wages remain also constant and are not affected by the implementation of the tax reform, while the gross wage income is not affected due to inelastic labor supply. Thus, revenues from the taxation of wage income decline directly after the implementation of the tax reform and remain constant thereafter, while the revenues from social security contributions stay constant over the whole course of our simulations, which is due to the constant contributions rate.

The same holds for the social security component of transfer expenditures. Pension payments remain constant, because they are financed by the constant revenues from social security contributions. On the other hand, transfers arising from unemployment benefits increase directly after the implementation of the tax reform and remain constant thereafter. This is due to the fact that unemployment benefits are linked to net wages through a constant replacement rate. Hence expenditures from unemployment benefits increase as a result of increasing net wages, while the unemployment rate itself remains constant as a consequence of the constancy of the unit costs of low skilled labor.

Last but not least, we consider the evolution of the economy's net foreign asset position. While in reality Germany is a net creditor on the world capital market, the economy in our model is a net debtor, as can be seen from figure 7, which depicts the ratio of the economy's stock of net foreign asset to GDP.

Thus the following findings should also be regarded as indicating the qualitative direction concerning Germany's net foreign asset position. As is evident from figure 7 the economy's net foreign position worsens immediately after the announcement respectively the implementation of the tax reform in the two scenarios. Because individuals increase consumption of goods as a consequence of the anticipated increase in life–cycle resources the trade balance worsens, thereby inducing a decline in net foreign assets [see equation (27)]. For the same reason, the economy's net foreign asset position continually worsens in the periods following the announcement and implementation of the tax reform. Besides the increase in consumption, this decline in net foreign assets is also triggered by rising interest payments on outstanding net foreign debt.

When the public sector adjusts its spending to guarantee a balanced intertemporal budget, the net foreign asset position recovers. This recovering occurs with a lag of 2 yeas in scenario 1, thereby reflecting the later implementation of the tax reform and hence, due to our assumption, the delayed cut in government spending. Contrary to the initial decline in net foreign assets, this rise can best be understood by refereing to equations (28) and (29). As can be read off from these equations, the evolution of the net foreign asset position is governed by the evolution of the economy's aggregate savings rate, composed of the government's savings rate, i.e. the change in government debt, and the private sector's savings rate, i.e. the change in the private sector's stock of assets. As of the moment when the public sector cuts its spending the ratio of government debt to GDP stays constant. However, the private sector's savings rate still rises during the transition to the new steady state. The latter effect induces the continually recovering of the net foreign asset position until the final steady state is reached. Nonetheless, the increase in the private sector's savings rate cannot compensate for the larger ratio of government debt to GDP. This is reflected in the fact, that the economy's net foreign asset position has worsened in the final steady state, compared to the initial steady state.

The welfare implications can be read from figure 8. In both scenarios, there are positive welfare implications amounting to approximately three percent of the social welfare indicator in the long run. This result is straightforward since we model a tax cut cum deficit increase only in the medium term. In the long run, we relief the economy from tax burdens and reduce the governments purchase of good and services which are not included in the individuals utility function. In contrast to the long run implications, the welfare effects during transition are different in the two scenarios. In both cases, the first round welfare effects dominate significantly. However, the increase in social welfare following after the announcement in scenario 1 is somewhat smaller as compared to the respective increase following the implementation of the tax reform in scenario 2. There are two reasons for this fact. First, in scenario 2 all living generations benefit from the immediate cut in tax rates, while in scenario 1 only those living generations aged up to 76 benefit, while the generations aged 77 and 78 simply die before the tax reform is implemented. Second, all living generations benefit over a longer span of their life cycle from the tax reform in scenario 2. Thus, social welfare is somewhat larger when the tax relief comes immediate. The policy implication of this result is straightforward: Judged by its welfare implications, the tax reform should be brought forward.

Because government spending reflects at least partially the provision of public goods, which benefit the individuals, the cut in government spending may be treated as an imperfect measure of the true costs of the tax reform. Thus one should ask if the individuals are inclined to pay this price. Therefore we computed the present value of the equivalent variations for living and future generations, i.e. the amount of money the individuals are willing to pay for the implementation of the tax reform, as well as the present value of the cuts in government spending to get a feeling for the involved trade–off. Furthermore, the difference between these two numbers may well be interpreted as a measure of the social benefit or loss created by the tax reform. Thus, a benevolent social planner should opt for the policy, which is accompanied by the largest increase in social benefit.

The result of our computations is displayed in figure 9. The first two bars depict the present value of equivalent variations of living and future generations in both scenarios, while the following two bars reflect the present value of the cuts in government spending necessary in the two scenarios. The last two bars represent the corresponding differences, which may be interpreted as the rise in social benefit in the two scenarios. For comparison with the initial steady state, all bars are expressed as percent of the present value of the aggregate life–cycle earnings of living and future generations, if the economy would have stayed in the initial steady state for infinity. Furthermore, the social discount factor was used for computing the present values. As can be seen from the figure, the present value of the equivalent variations of present and future generations outweighs the present value of the cut in government spending in both scenarios. Thus there is a long–run gain in any case, since the benefits of the tax reform outweigh the costs. The difference between the two numbers amounts to 0.619 percent in scenario 2 and is thus slightly larger than in scenario, where it amounts to 0.615 percent. This result indicates, that bringing the tax reform forward is the preferable policy and confirms our previous judgment which was solely based on the increase in social welfare. In other words, the differential effects when comparing the necessary cuts in government spending in both scenarios do not offset the individual utility effects.

4 Summary

If a tax reform which will relief future taxpayers from part of their burden in the near future has been passed into law and all of a sudden the fear of a recession becomes reality, what might be a right policy choice? Is it better to stick to the original plans or can it be a superior strategy to implement the reform immediate in order to increase effective demand? If financed at least for a transitional period by increasing public debt, wouldn't that make things even better? Or is it true that the trigger effect of a tax relief which might increase private purchase of goods and services in the short run eventually ends up with a crowding out through decreased government spending?

These questions, which are in the very focus of Keynesian theory, are not the focus of this paper. We model the tax reform as a tax decrease cum tax cut in the medium term substituted by a cut in government spending in the long run. And this tax reform might or might not be brought forward by the policy makers. While we discuss whether or not the third stage of the German Income Tax Reform should be brought forward we do not enter the muddy waters of the never–ending crowding out discussion. Instead, we model individual and social welfare effects of such a policy within a simplified CGE model of the Auerbach–Kotlikoff type.

This paper finds a clear answer: We should bring the reform forward even if we finance the arising deficits through public debt. This answer holds, even if we neglect any effect on the real business cycle effects, whether it might be positive or not. Of course, the welfare gains depend on the magnitude of the tax relief and the originally planned announcement period. In our reference case the tax relief amounts to approximately 4.1 percent of the entire public revenues and the reform is brought forward by two fiscal years. In the status quo scenario in which the relief will be effective in year 2005, the dynamic welfare gains add up to 0.615 percent of aggregate life–cycle earnings. They are calculated by simply adding up equivalent variations of all presently living and future generations in monetary units discounted by the social discount rate and subtracting the present value of the cut in all future government consumption necessary to balance the budget in the long run. Doing the same calculation for introducing the tax relief two years earlier, we find a social welfare gain of 0.619 percent of aggregate life–cycle earnings.

In general, a numerical analysis within a CGE setting is incomplete without an extended sensitivity test of variations in the crucial parameters. In our case, this is not true. Our findings depend much more on the structure of the model than on the parameters as long as we ensure dynamic efficient growth and avoid the possibility of Ponzi–games. But all the results might be questionable if, for example, a bequest motive is taken into account. Moreover, government spending could have an impact via individual utility or through making the private investment more productive. And finally, a stochastic real business cycle should be added to the analysis in order to capture the positive, neglegible or negative impacts of influencing effective demand in the Keynesian way. All these questions – and many more – will be left for future research.

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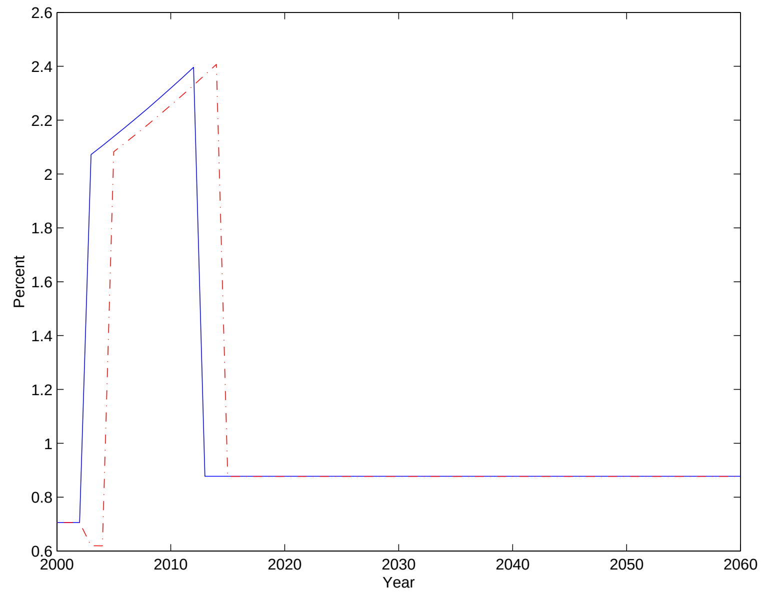

Figure 1: Government budget deficit as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

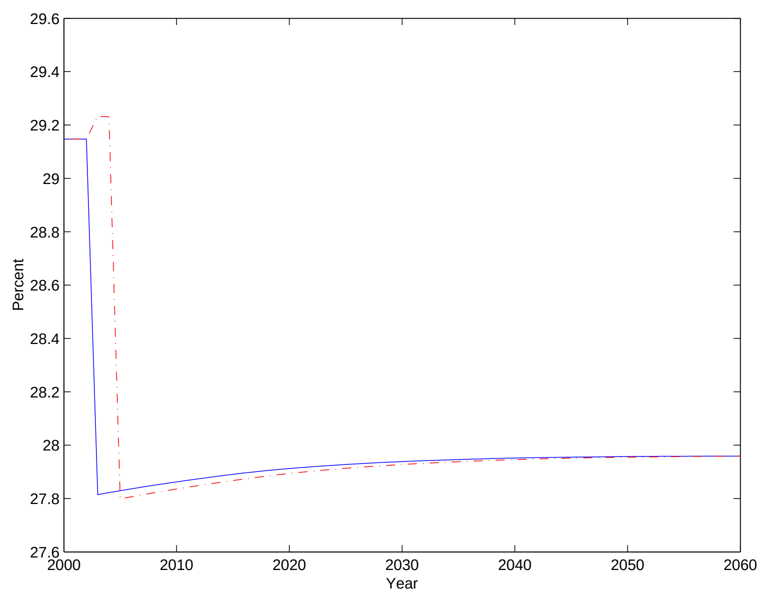

Figure 2: Tax revenue as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

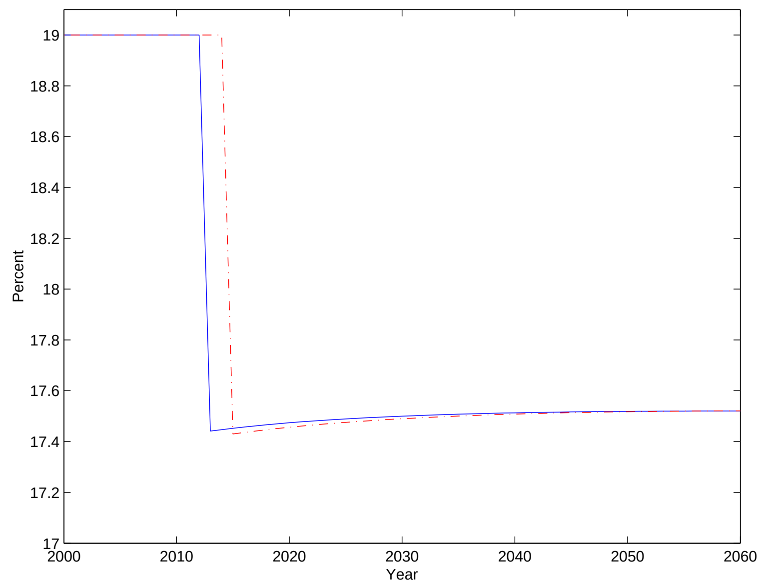

Figure 3: Government spending as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

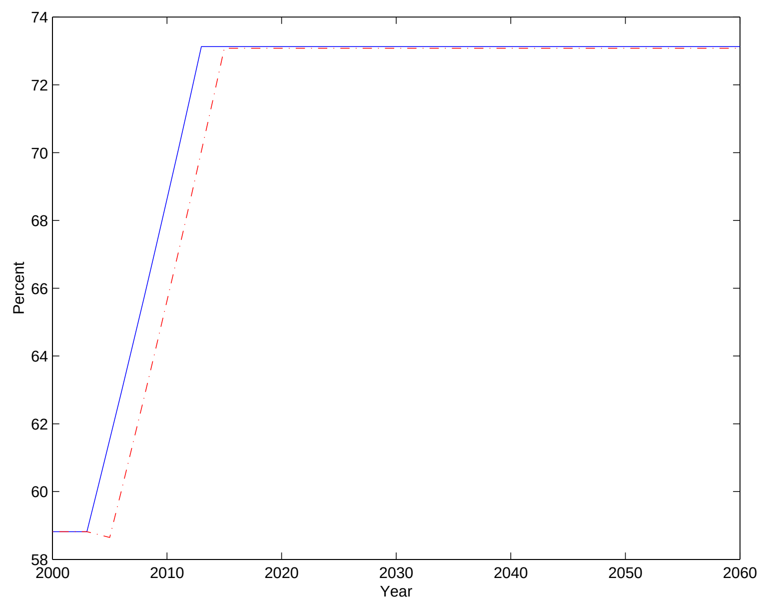

Figure 4: Government debt as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

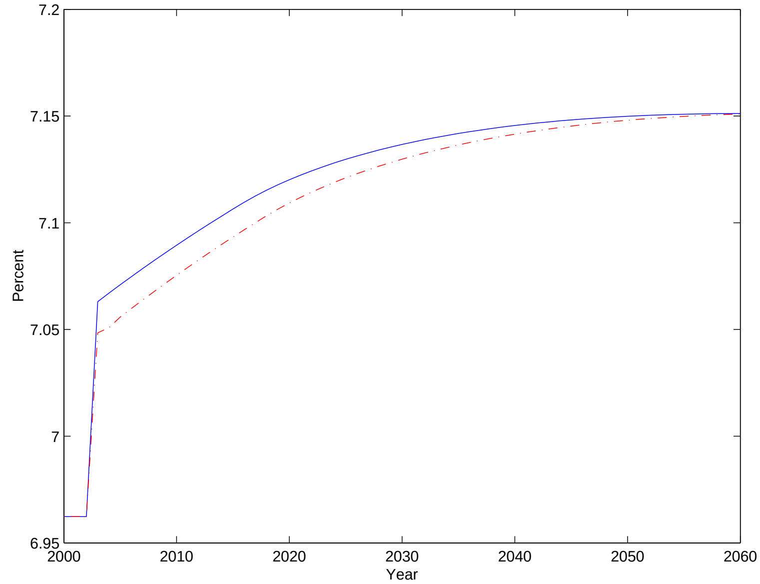

Figure 5: Consumption tax revenue as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

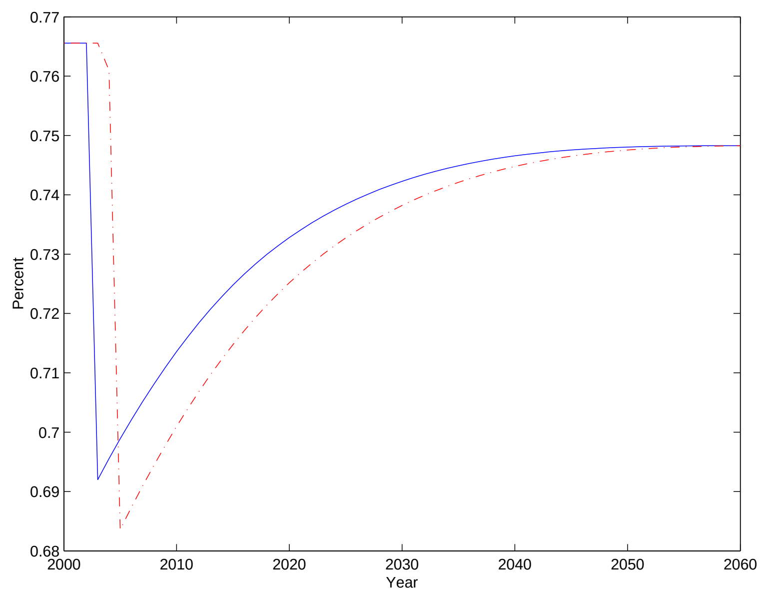

Figure 6: Capital income tax revenue as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

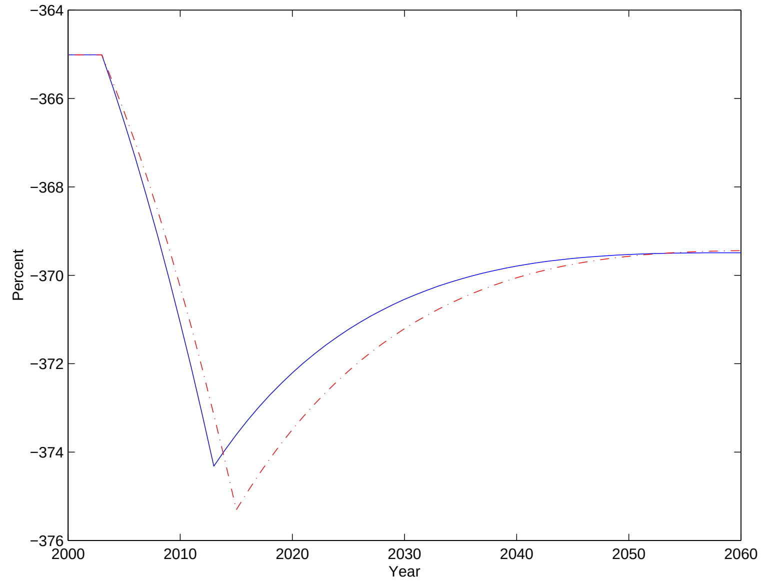

Figure 7: Stock of net foreign assets as percent of GDP: With (dotted line) or without (solid line) announcement (three years)

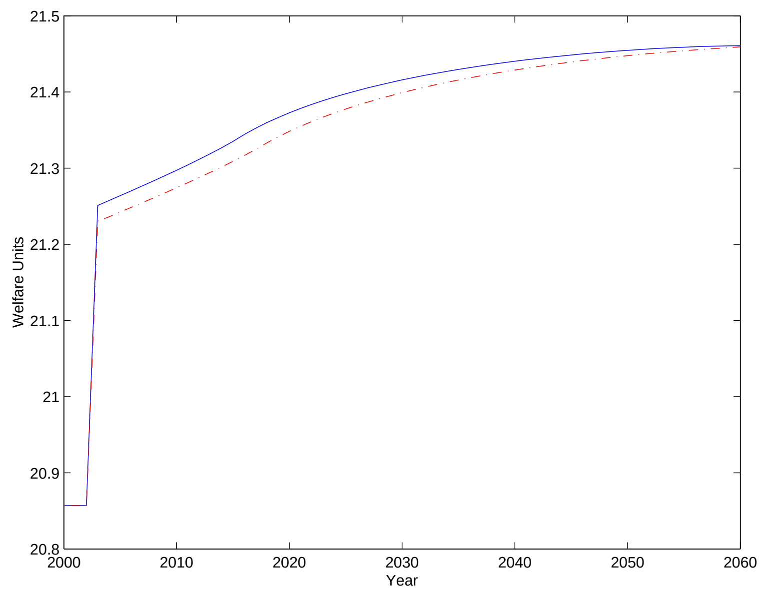

Figure 8: Social welfare: With (dotted line) or without (solid line) announcement (three years)

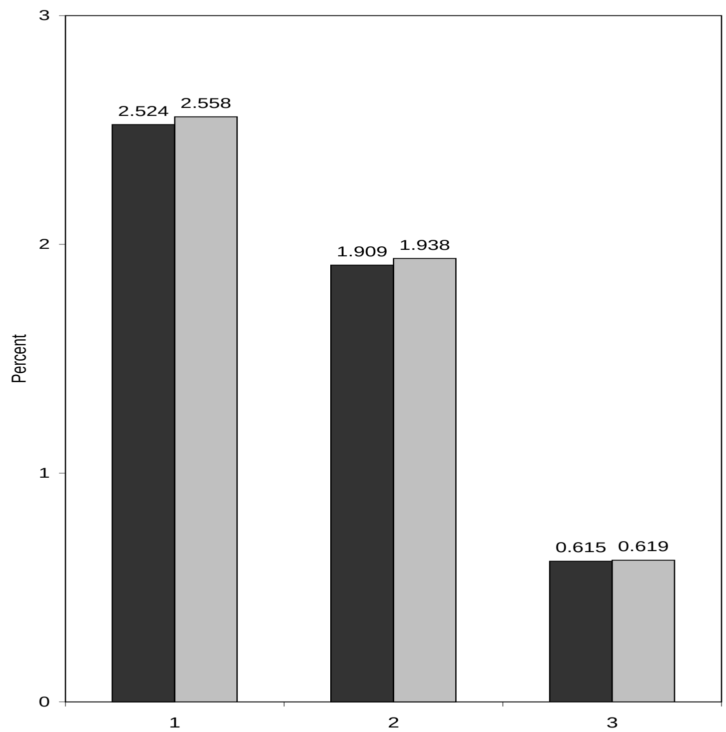

Figure 9: The cost of the German Income Tax Reform: With (black) or without (grey) announcement (three years). 1) Present values of the equivalent variations of living and future generations as percent of aggregate life-cycle earnings in the initial steady state, 2) present value of government spending cuts as percent of aggregate life-cycle earnings in the initial steady state, 3) increase in social benefit as percent of aggregate life-cycle earnings in the initial steady state [= 1)-2)] .

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