Stockholm School of Economics
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Inflation and Taxes

A Dynamic General Equilibrium Analysis of Fiscal Drag in Germany

Abstract

This thesis analyses fiscal drag and its implications on efficiency, welfare, inequality and tax revenue in Germany. For this analysis, I construct a dynamic general equilibrium model and calibrate it to resemble central features of the German economy and tax code. I find that steady state output after three years of 1.6% inflation decreases output by 0.4% and reduces utility for all income groups considered. Net income is distributed more equally and tax revenue increases by 2.4%. Additionally, I compare fiscal drag to a proportional increase in wage taxes and an increase in consumption taxes regarding the costs of each tax reform to increase tax revenue by the same amount. Fiscal drag has less negative implications on the economy than the proportional increase in wage taxes, but more than the increase in consumption taxes. If the government does not want to relinquish higher tax revenue, then a switch from fiscal drag to higher consumption taxes is still a strict Pareto improvement for all income groups considered, despite increasing inequality in net earnings. The same amount of tax revenue is raised as under fiscal drag with output increasing by 0.3%.

Key Words: Fiscal Drag, General Equilibrium, Income Distribution, Inflation, Taxation
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1 Introduction

Taxes are central to the discussion of inflation. As Fischer (1996) states: "the costs of any given rate of inflation depend on the extent to which the institutional structure of the economy - particularly the tax system and especially the taxation of capital - has adapted to inflation." In this thesis, I analyse a specific phenomenon caused by inflation and taxes: fiscal drag.

Fiscal drag, also referred to as bracket creep, is caused by the difference between the real income that purchases goods and services and the nominal income that is taxed. If there is inflation, then the nominal income increases more quickly than does real income. As households are usually subject to increasing tax rates for higher nominal incomes, the taxable income increases more strongly than the real one. As a consequence, the tax rate for a specific real income increases over time until it possibly converges to the maximum tax rate in the limit.

Fiscal drag has multiple effects on an economy. Since it causes higher tax rates, tax revenues increase over time even without explicit tax increases. The higher the inflation and the longer the tax code remains unaltered, the higher is the increase in tax revenue. Equally, higher taxes decrease the after tax return to labour and encourage the agent to work less or, possibly, engage in illicit work. Moreover, as average tax rates converge to the highest marginal tax rate in the limit, the tax code becomes less progressive. One aspect, often seen as positive, is the fact that fiscal drag possibly reduces inflation through lower disposable income and consequently lower demand.

Being aware of the implications of fiscal drag, numerous countries including France, Canada and the USA introduced mechanisms to adapt the tax code to inflation and hence lower the effect of fiscal drag. This is done in different ways including automatic adjustments depending on the inflation experienced or regular meetings to openly discuss adjustments for price increases. An overview of such mechanisms is given by Immervoll (2005). Germany, on the other hand, has not introduced any formal mechanism to counter fiscal drag. Since inflation has been relatively low in recent years, averaging 1.6% for the years 2006 until 2010, possible effects of fiscal drag have possibly been minor in Germany, but probably still affected the German economy. Additionally, expectations of higher inflation rates are repeatedly expressed in the media (including Handelsblatt, 2011 and Wall Street Journal,

2011). Therefore, I analyse the effects of fiscal drag on steady state economic efficiency, welfare, inequality and tax revenue in Germany for the historical inflation rate, while also considering higher hypothetical ones.

To analyse fiscal drag in Germany, I construct a general equilibrium model with overlapping generations and calibrate it to mirror central characteristics of Germany's economy, demographics and tax code. I model a closed economy without international influences. The model is deterministic and formulated in real terms. I simulate inflation by scaling income with the cumulative effect of inflation when determining the taxable income. Tax credits are reduced in real terms, but not in nominal ones. Tax credits do not increase with inflation. The inflation rate in the model is exogenous. I analyse the average inflation rate of the last 5 years of 1.6% over a time span of 3 years and additionally 2% and 4% to measure the possible effect of stronger price increases. Afterwards, I analyse the relative effects of using fiscal drag to increase tax revenue. I consider two alternative tax reforms: (1) proportional increases in consumption taxes and (2) proportional increases in wage taxes to analyse whether the same amount of tax revenue as under fiscal drag can be raised at lower costs for the economy. Again, I evaluate the policies according to their relative efficiency, impacts on inequality and individual utility implications.

For an inflation rate of 1.6% over 3 years without changes in the tax code, the steady state output in Germany is reduced by 0.4%[1]. Capital declines by 0.7% and effective labour by 0.2%. Tax revenue increases by 2.4%, while contributions to the pension system decline by 0.4%. Although fiscal drag reduces utility for all types of households considered, it also reduces income inequality. The effect of fiscal drag is felt strongest by university graduates, the highest income group considered, contradicting the common notion that fiscal drag affects agents with lower incomes most. Income has to be significantly higher than that of a typical university graduate to reduce the impact of fiscal drag. It is strictly Pareto improving to index the tax code for inflation and counter fiscal drag. The negative effects of fiscal drag increase as inflation increases or the time between adaptions of the tax code gets longer.

[1] All percentages refer to the real values.

Comparing fiscal drag to alternative tax increases that raise the same tax revenue, I conclude that higher consumption taxes benefit all types of households relative to fiscal drag. Low income households prefer higher consumption taxes over the benchmark, too. A proportional increase in wage taxes benefits households with a lower income and hurts those with a higher one. The economic inefficiencies of an increase in wage taxes amount to 1.1% of output. However, while being the least efficient way analysed to raise taxes, it is also the most redistributive. Although it is most efficient to index the tax code to inflation and abolish the effect of fiscal drag, it might not be feasible, since the government is not willing or able to relinquish higher tax revenue. In this case, a switch to higher consumption taxes still increases output by 0.26%.

This paper is structured in the following fashion: section 2 gives an overview of past research. Sections 3 and 4 provide a detailed explanation of the model and discuss the calibration of it. Section 5 describes the benchmark equilibrium. Section 6 discusses the results of the simulation. Section 7 concludes.

2 Literature Overview

Research about inflation and also fiscal drag has been especially intensive during the 1970s. As an example, Aaron (1976) analyses the possible benefits of indexing the US tax code to inflation.

More recent research includes Immervoll (2005) and Herr and Suessmuth (2003). Immervoll (2005) analyses the effect of bracket creep in the Netherlands, the United Kingdom and Germany using EUROMOD, a static micro-simulation model. He finds that the income tax burden rises, but social security payments fall if tax rules are not adjusted to inflation. Furthermore, the tax system becomes less progressive over time and income is distributed more equally. He also finds that tax indexation in the Netherlands and the UK successfully counter fiscal drag.

Heer and Suessmuth (2007) analyse the effect of inflation and bracket creep in the USA. After trying to analyse fiscal drag empirically, they argue that bracket creep cannot be analysed well with econometric models and hence turn their main focus to a dynamic stochastic general equilibrium model. They conclude that fiscal drag is “one of the main reasons for an income-

inequality reducing effect of (moderate) inflation." However, they also conclude that these effects are rather small, possibly being caused by the relatively low progressivity of the tax code.

Similar to the research question in this thesis, Heinemann (2001) studies the impact of fiscal drag on tax revenue growth of OECD countries between 1965 until 1998. He finds that inflation did indeed contribute to tax revenue growth as well as increases in social security contributions. Furthermore, Heinemann finds that even without official indexation, countries reduce the effect of fiscal drag via regular adjustments resulting in de-facto indexation. However, he states that this does not necessarily imply that similar adjustments will be taken in the future.

Persson et al. (1996) analyse the effect of (high) inflation on government revenue in 1994 in Sweden not restricting themselves to fiscal drag. They conclude that inflation is a possible way to reduce deficits, albeit a costly one. They argue that fiscal drag is favoured by politicians, because it is a politically inexpensive way to raise taxes. Sadka (1991), on the other hand, analyses the impact of inflation on tax revenue during the late 1970s. He concludes that inflation can even lead to lower real tax revenue, primarily caused by timing effects of the realization of the taxable event and the collection of taxes.

Finally, Immervoll (2007) analyses whether fiscal drag can work as an automatic stabilizer and in turn reduce inflation. This is one of most popular arguments against indexing taxation. He investigates the contradicting concepts that, firstly, bracket creep may lower inflation as it lowers demand and, secondly, that employees might bargain for higher wages to compensate for lower real after-tax income causing a wage-price spiral that might enhance the effect of inflation. For the Netherlands, UK and Finland, he finds indications of a cost-push effect, meaning that fiscal drag causes inflation to increase even further.

Given the common findings that fiscal drag increases tax revenue, albeit reducing economic efficiencies, I quantify the effects of fiscal drag for the relatively small historical and additionally higher inflation rates in Germany. By using a dynamic general equilibrium model compared to a static model, I can account for changes in behaviour. Similarly to Persson el al. (1996), I compare the relative distortions of using fiscal drag to raise tax revenue.

3 The Model

The model builds on the dynamic general equilibrium model developed by Auerbach and Kotlikoff (1987). Similar models have been used frequently to simulate changes in tax codes. Examples include Conesa and Krueger (2006) and Altig et al. (2001). The model contains three sectors: households, technology and the government. All three sectors interact. The economy and its agents are not exposed to risk, i.e. agents have perfect foresight. Given current demographics in Germany, the model does not consider population growth. Furthermore, the economy is closed and no interaction with another country takes place.

3.1 Households

The economy is inhabited by a continuum of households, also referred to as agents, that maximise lifetime utility subject to their individual budget constraints.

3.2 Demographics

All agents in the economy are described by their date of birth and lifetime earning profile. A new generation of agents is born each period and consists of 6 subgroups differing among each other only by the lifetime human capital profile. The size of all generations is constant. Agents of type *j* correspond to the share ω_j of the population. Birth in the model represents the beginning of an agent's working life and corresponds to an age of 21 years. The agent retires at the average German retirement age of 63 years. He lives for 80 years or 60 periods in the model. Each agent leaves a bequest to the member of his type born 25 years later.

3.3 Preferences and the Utility Function

Utility is derived from consumption, labour and bequests. Lifetime utility of agent *j* born in year *t* is determined by the following time separable utility function:

$$(1) \qquad U_t^j = \sum_{s=21}^{80} \beta^{s-21} \left(\frac{{c_{s,t}^j}^{1-\rho}}{1-\rho} - \alpha \frac{{h_{s,t}^j}^{1+\frac{1}{\gamma}}}{1+\frac{1}{\gamma}} \right) + \beta^{80-21} \mu \frac{{b_{80,s+59}^j}^{1-\sigma}}{1-\sigma}$$

Each agent's utility is determined by the series of consumption $\left\{ c_{s,t}^{j} \right\}_{s=21}^{80}$ and labour $\left\{ h_{s,t}^{j} \right\}_{s=21}^{80}$ as well as the level of bequests $b_{80,t+59}^{j}$. Bequests are included because of their importance for capital accumulation (Kotlikoff and Summers, 1981). Further determinants of utility are the discount rate β with $\beta < 1$, the relative importance of labour to consumption α and the corresponding parameter for bequests μ. The inter-temporal elasticity of substitution is given by ρ for consumption and σ for bequests. Finally, γ is the Frisch labour supply elasticity and determines how responsive agents are in their choice of hours worked to changes in the environment. The parameters β, α, μ, ρ, σ and γ are constant across agents and time.

3.4 Budget Constraint

Agents either consume their income or invest in assets that allow the agent to smoothen consumption. The movement of capital holding is described by:

$$(2) \qquad a_{s+1,t+1}^{j} = \begin{array}{l} \left[1+\left(1-\tau^{K}\right)r_t\right]\left(a_{s,t}^{j}+g_{s,t}^{j}\right)+(1-\tau^{P})w_t\varepsilon_{s,t}^{j}h_{s,t}^{j}+p_t+Tr_t \\ -\left(\left(1+\tau^{C}\right)c_{s,t}^{j}+\tau^{W\,j}{}_{s,t}((1-\tau^{P})w_t\varepsilon_{s,t}^{j}h_{s,t}^{j}-\kappa_{s,t}^{j})+b_{s,t}^{j}\right) \end{array}$$

with

$$(2') \qquad h_{s,t}^{j} \le E$$

$$(2'') \qquad a_{81,s+60}^{j} \ge 0$$

In equation (2), $a_{s,t}^{j}$ denotes asset holdings of agent *j* aged *s* in year *t*. Consumption $c_{s,t}^{j}$, labour $h_{s,t}^{j}$ and bequests $b_{s,t}^{j}$ are the same as in the utility function. Labour must not exceed time endowment *E*, i.e. $h_{s,t}^{j} \le E$. Agents take the interest rate r_t and wages w_t as given. Inheritances are denoted by $g_{s,t}^{j}$ and equal bequests left by the member of the same group of generation *t-25*, hence $g_{55,t}^{j} = b_{80,t}^{j} \ge 0$ and $g_{s,t}^{j} = 0 \ \forall \ s \neq 55$. $\varepsilon_{s,t}^{j}$ denotes human capital and determines how efficient an agent works in a specific year. Agents older than 63 years are required to retire and stop working. Households have to pay consumption taxes τ^{C}, capital income taxes τ^{K} and wage taxes $\tau^{W\,j}{}_{s,t}$. Wage taxes depend on the size of the taxable income that in turn is given by gross wages after pension payments adjusted for tax credits $\kappa_{s,t}^{j}$. A

fixed proportion τ^P of gross wages is deducted to finance the pension system. In turn, each pensioner receives pension payments $p_{s,t}$. Agents may further receive government transfers Tr_t. Initial wealth is zero and households are required to hold no debt upon death.

3.5 Technology

The production sector consists of one representative firm. Output is produced according to a constant returns to scale Cobb-Douglas production function:

$$Y_t = K_t^{\theta} EH_t^{1-\theta} \tag{3}$$

where

$$K_t = \sum_{s=21}^{80} \sum_{j=1}^{6} \omega_j (a_{s,t}^j + g_{s,t}^j) \tag{4}$$

$$EH_t = \sum_{s=21}^{80} \sum_{j=1}^{6} \omega_j \varepsilon_{s,t}^j h_{s,t}^j \tag{5}$$

Output Y_t is a function of aggregate capital K_t and aggregate effective labour EH_t in period *t*. The capital share of production is given by the constant θ. Capital depreciates at a constant rate δ. As I do not consider fundamental tax reforms, adjustment costs are not included in the model. The aggregate resource constraint takes the following form:

$$K_t^{\theta} EH_t^{1-\theta} \geq G_t + I_t + C_t \tag{6}$$

where

$$C_t = \sum_{s=21}^{80} \sum_{j=1}^{6} \omega_j c_{s,t}^j \tag{7}$$

$$I_t = K_{t+1} - (1-\delta)K \tag{8}$$

3.6 The Government

The government levies taxes to finance government expenditures G_t and lump-sum transfers Tr_t. Government expenditures G_t have no impact on the household's utility and can be seen as necessary investments in infrastructure. Transfers Tr_t are distributed equally to all

households. All taxes are collected at the household level. Total tax revenue is denoted by T_t. The government faces the following budget constraint:

$$(9) \qquad G_t + Tr_t \leq T_t = \tau^c C_t + \tau^t r_t(K_t) + \sum_{j=1}^{6} \sum_{s=21}^{80} \omega_j \tau^{w\,j}_{s,t}$$

3.7 Social Security

The social security system only considers pensions. It is designed as a pay-as-you-go system with defined contributions. All pensioners receive equal pensions regardless of the individual contributions made during the individual working lives. Pensions p_t are given by:

$$(10) \qquad p_t = \frac{\tau^P H_t}{80 - 63}$$

3.8 Equilibrium

Since I do not consider population growth and technological progress, the conditions for steady state are relatively straight-forward. A competitive steady state equilibrium is reached if the following conditions are fulfilled:

1. Agents maximise life-time utility (1) subject to constraints (2), (2') and (2''). Equation (11) determines the development of consumption for a specific agent over time. Equations (12) gives the optimal choice of labour prior to retirement. Bequests are determined by equation (13). Equation (14) states that the agent must not leave any resources unused nor leave any debt.

$$(11) \qquad c^j_{s+1,t+1} = \left(\beta\left[1 + \left(1 - \tau^K\right)\right]r\right)^{\frac{1}{\gamma}} c^j_{s,t}$$

$$(12) \qquad h^j_{s,t} = \left(\frac{(1-\tau^P) w \varepsilon^j_{s,t} - \frac{d\tau^{w\,j}_{s,t}}{dh}}{\alpha\left(1+\tau^C\right) {c^j_{s,t}}^{\rho}} \right)^{\gamma}$$

$$(13) \qquad b^j_{80,t+59} = \left[\mu\left(1+\tau^C\right) {c^j_{80,t+59}}^{\rho}\right]^{\frac{1}{\sigma}}$$

(14) $a_{81,t+60} = 0$

2. Factor prices are determined competitively and equal their marginal products:

(15) $$r = \theta \frac{EH}{K}^{1-\theta} - \delta$$

(16) $$w = (1-\theta) \frac{K}{EH}^{\theta}$$

3. The goods market clears:

(17) $$K^{\theta} EH^{1-\theta} = G + \delta K + C$$

4. The government budget is balanced, i.e. tax revenue equals government consumption and transfers:

(18) $$G + Tr = T = \tau^{c} C + \tau^{t} r(K_t) + \sum_{j=1}^{6} \sum_{s=21}^{80} \omega_j \tau^{W\,j}_{s,t}$$

5. The social security system is balanced:

(10) $$p = \frac{\tau^{P} EH}{80 - 63}$$

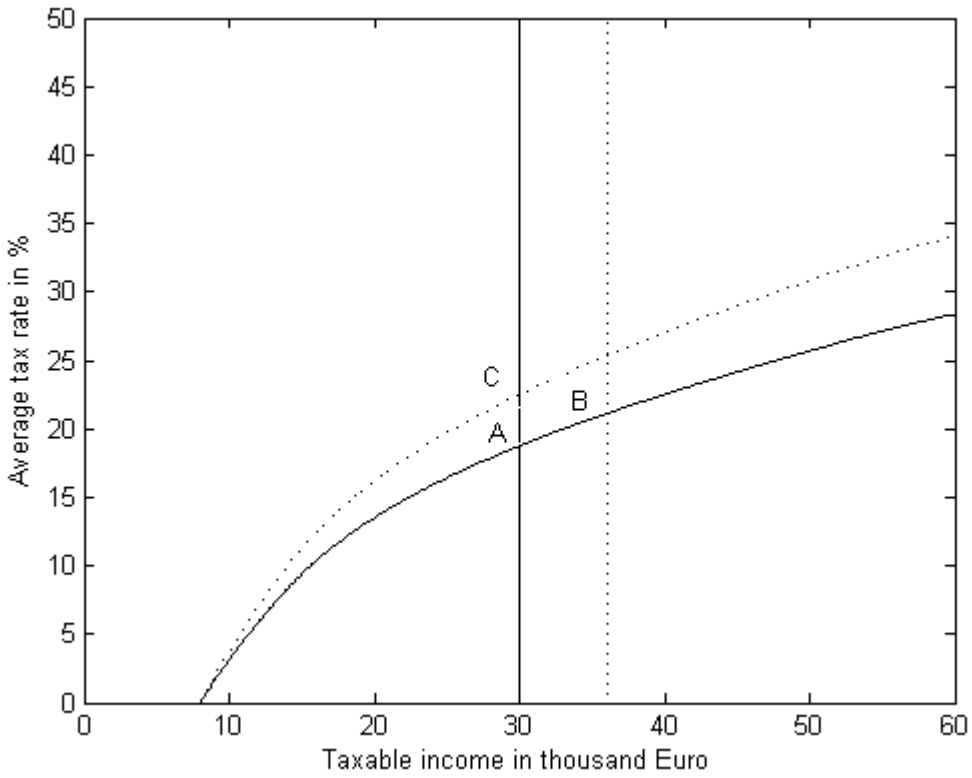
The time subscripts for variables that are not specific to the individual agents are dropped, as these variables are constant in steady state. For information about the equilibrium solving algorithm, please turn to appendix D.

3.9 Simulation of Inflation

All variables and parameters used in this model are in real terms. I do not model money and inflation explicitly. Instead, inflation is built into the model through scaling real income upwards when wage tax rates are calculated. For example, if one earns € 1,000 in year one

and there are 2% inflation with an increases in earnings of 2%, then in year two one's real income is still € 1,000, but the nominal income is 1.02 * € 1,000 = € 1,020. Hence, one gets taxed for € 1,020. Tax credits do not change in nominal terms. Please note that this approach assumes that wages increase perfectly in line with inflation and that inflation affects all agents equally. Figure 1 illustrates the difference between the effect of fiscal drag and a proportional increase in wage taxes if the government adjusts the index for inflation. Intersection *A* gives the tax rate if there is neither fiscal drag nor an increase in tax rates. If there is fiscal drag, the taxable income shifts to the right and the tax rate is given by intersection *B*. If the government adjusts for fiscal drag, but instead decides to raise tax revenue via higher tax rates, then taxable income does not change, but tax rates increase. The tax rate is then determined by intersection *C*. Since the average tax rate converges to 45% (excluding the solidarity surcharge) as taxable income goes to infinity, fiscal drag cannot increase the tax rate above 45%.

Figure 1: Fiscal drag against a proportional increase in taxes.



3.10 Evaluation of Policies

I evaluate the different tax reforms along a variety of dimensions. First, I consider efficiency, i.e. effects on total output and other impacts on aggregate variables. Second, I measure the change in utility resulting from the tax reform. Changes in utility are expressed using the consumption equivalence Δ_C. Comparing two different streams of consumption, labour and bequests, the consumption equivalence is the proportional reduction of consumption of one of those streams that makes the agent indifferent between both alternatives. Equation (19) shows the consumption equivalence for an agent with an initial stream of consumption, labour and bequests on the left-hand-side of the equation and an alternative stream of consumption, labour and bequests on the right hand side. Finally, I measure the effect of a tax reform on the distribution of net income through changes in the Gini coefficient..

$$(19) \qquad U_t^j(\{c_{s,t}^j\}_{s=21}^{80}, \{h_{s,t}^j\}_{s=21}^{80}, b_{80,t+59}^j) = U_t^j((1-\Delta_C)\{c'^j_{s,t}\}_{s=21}^{80}, \{h'^j_{s,t}\}_{s=21}^{80}, b'^j_{80,t+59})$$

I measure the tax burden of the different agents as the percentage of taxes paid in a certain period divided by spending in that period. To account for timing differences, values are discounted to the period of birth using $1/(1+r_t)$ as the discount rate. The result is used to compare the lifetime tax burden among different tax codes and different agents.

$$(20) \qquad TB_t^j = \sum_{s=21}^{80} \frac{1}{(1+r_t)^s} \frac{\tau^C c_{s,t}^j + \tau^{W\,j}_{s,t}((1-\tau^P) w_t \varepsilon_{s,t}^j h_{s,t}^j - \kappa_{s,t}^j) + \tau^K r_t \left(a_{s,t}^j + g_{s,t}^j\right)}{\left(c_{s,t}^j + b_{s,t}^j\right)}$$

4 Calibration

In this section, I present the calibration of the model. Special emphasis is laid on the tax code as well as the human capital profiles of the different agents. I capture the most important aspects of the German tax code to remodel key identities of the German economy.

4.1 Tax and Social Security

There are three different types of taxes that are all collected at the household level: consumption taxes, capital taxes and wage taxes. The tax code is modelled according to OECD (2009).

4.1.1 Consumption and Capital Taxes

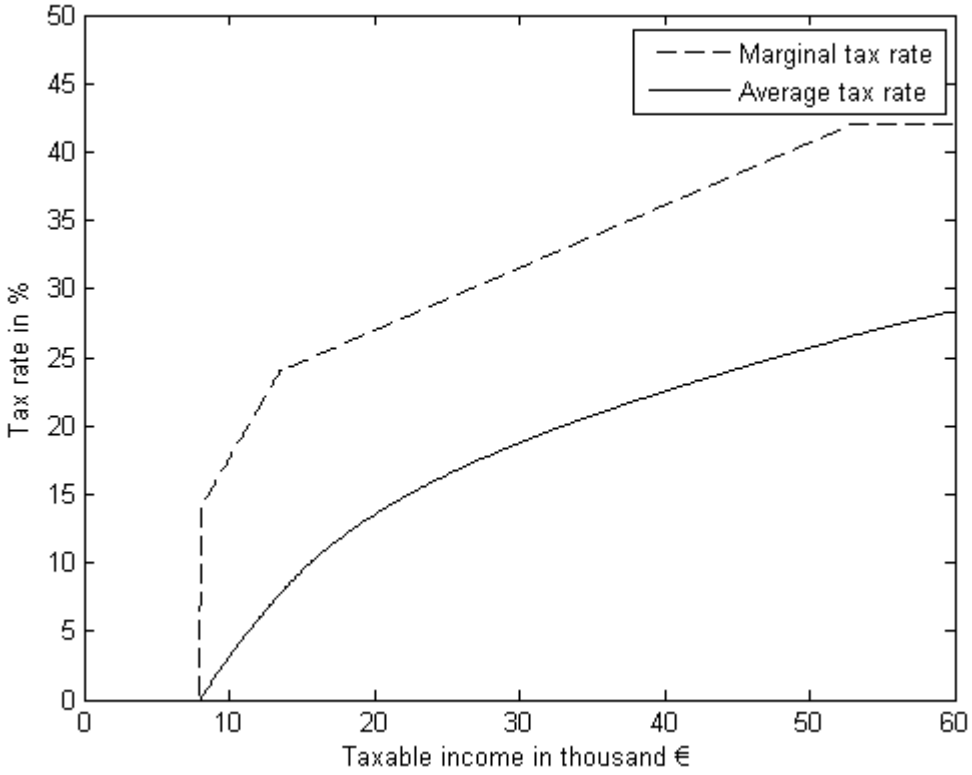
Consumption taxes in Germany depend on the good taxed. Normally, consumption taxes are 19% while some goods are subject to a reduced rate of 7% or 0%. In 2010, Germany collected consumption taxes of € 180 billion which equals 12.5% of total consumption expenditures. Hence, I set τ^C to 0.125.

Since 2009, capital income is generally taxed at 25% in Germany. In addition to this 25%, church taxes and a solidarity surcharge are levied. Since one can evade church taxes by not being a member of a church, I do not treat church taxes as a tax, but as consumption of religious services and hence do not include it as a tax. The solidarity surcharge equals 5.5% of regular capital taxes. I set τ^K to 0.25*1.055 = 0.26375.

4.1.2 Wage Taxes

Wages in Germany are subject to progressive tax code. There are five brackets with different marginal taxes. Any taxable income below € 8,005 per year is tax exempt, while a taxable income above € 250,731 is subject to the highest marginal tax rate of 45% (excluding the solidarity surcharge). Figure 2 gives an overview of average and marginal tax rates for taxable incomes below € 60,000. For the mathematics of the tax code consult appendix C.

Figure 2: Average and marginal tax rate



Like capital taxes, wage taxes are subject to the solidarity surcharge of 5.5% of the tax liability with an exemption limit of € 972 for singles and € 1,944 for couples. In 2000, 50% of all households consisted of a married couple. I hence take the average of € 1,458 as a deduction level for the solidarity surcharge. I summarize all effects on taxable income in the parameter κ, including e.g. income splitting, child assistance and donations. I choose tax credits κ so that the economy resembles the actual German government spending. In the benchmark equilibrium, kappa is calculated as a proportion of income. To match the German economy, I set κ to 0.4. For an alternative treatment of tax credits, consult the sensitivity analysis in section 6.3.

To determine the wage taxes in the simulation that correspond to the real tax code, I translate the German tax code in percentages of the mean income similar to Ventura (1999). The average gross income in 2009 was € 40,929 (OECD, 2009). So the € 8,004 which correspond to an exemption of wage taxes correspond to 28% of the average income. An overview of the tax code translated into percentages of mean income ξ is given in table 1.

Table 1: Tax brackets in the model economy

Income relative to mean income	Marginal tax rate
$0\,\xi$ – $0.20\,\xi$	0
$0.20\,\xi$ – $0.33\,\xi$	0.14 – 0.25
$0.33\,\xi$ – $1.29\,\xi$	0.25 – 0.42
$1.29\,\xi$ – $6.16\,\xi$	0.42
$6.13\,\xi$	0.45

4.1.3 Social Security System

In Germany, there is a wide range of social security taxes payable by employers and employees. I restrict the social security system to the public pension system. In Germany, both employers and employees have to pay 9.95% of gross wages as contributions to pensions. Yearly gross incomes above € 66,000 and € 57,600 in the west and east of Germany are not subject to pension contributions. Pension taxes τ^P are calibrated to match the ratio of pensions to GDP in Germany[2]. τ^P takes the value 0.16.

4.2 Human Capital

I base the human capital profiles $\varepsilon_{t,s}^{j}$ on Dustmann and van Soest (1998). They estimate different models to determine differences in pay for male employees between the private and public sector. I use their estimates for the wage equation obtained by model 5 of their study and take the weighted average of the estimates for the public and private sector. I assume that the level of experience increases each year, i.e. that agents are not unemployed. The obtained values are normalised relative to the least efficient agent. The distribution of the different education levels (EL) in the population of German men is taken from Ammermueller and Weber (2005) and presented in table 2.

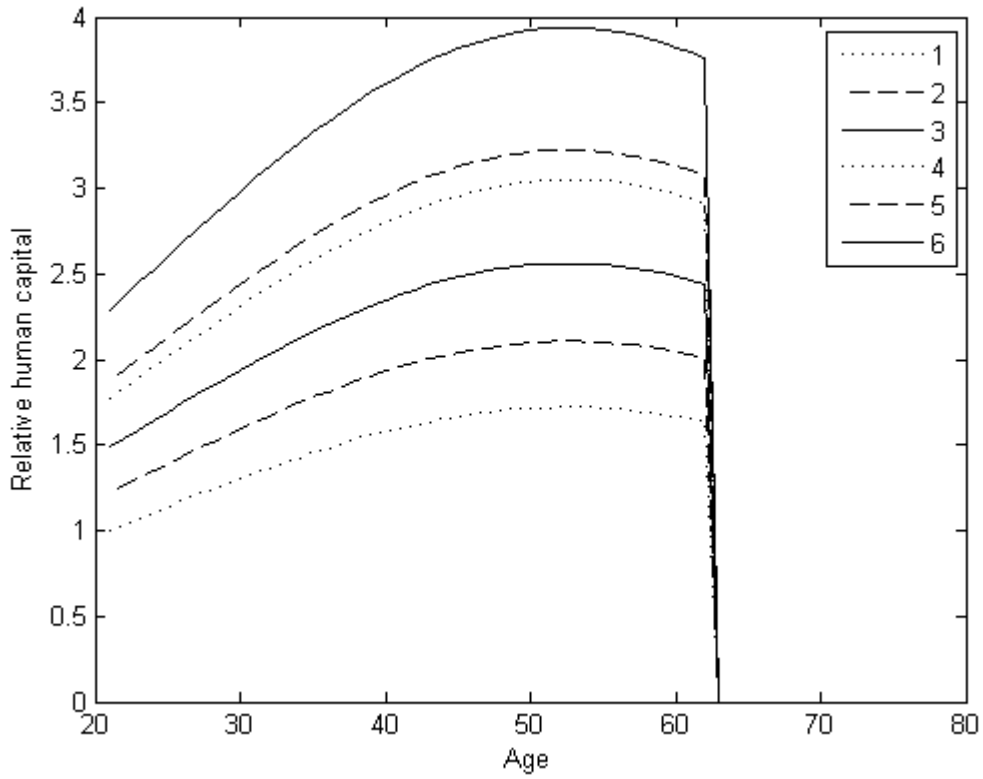
[2] See Appendix A: Data.

Table 2: Distribution of agents

Education level	Description	Share of population
1	Basic or intermediate schooling	9.06%
2	Basic schooling and apprenticeship	27.6%
3	Intermediate schooling and apprenticeship	18.31%
4	High school/high school and apprenticeship	20.46%
5	Engineering school or higher specific school	8.78%
6	University	15.8%

Human capital is inversely U-shaped for all agents. It is highest when the agent is 53 years old and becomes zero upon retirement. There is a vast difference in human capital between agents. An university graduate with 53 years of age possesses about 4 times more human capital than an 21 year old agent with only basic schooling. Figure 3 shows the development of the human capital profile. Further information about the human capital derivation can be found in appendix B.

Figure 3: Life-time human capital profiles for different education levels



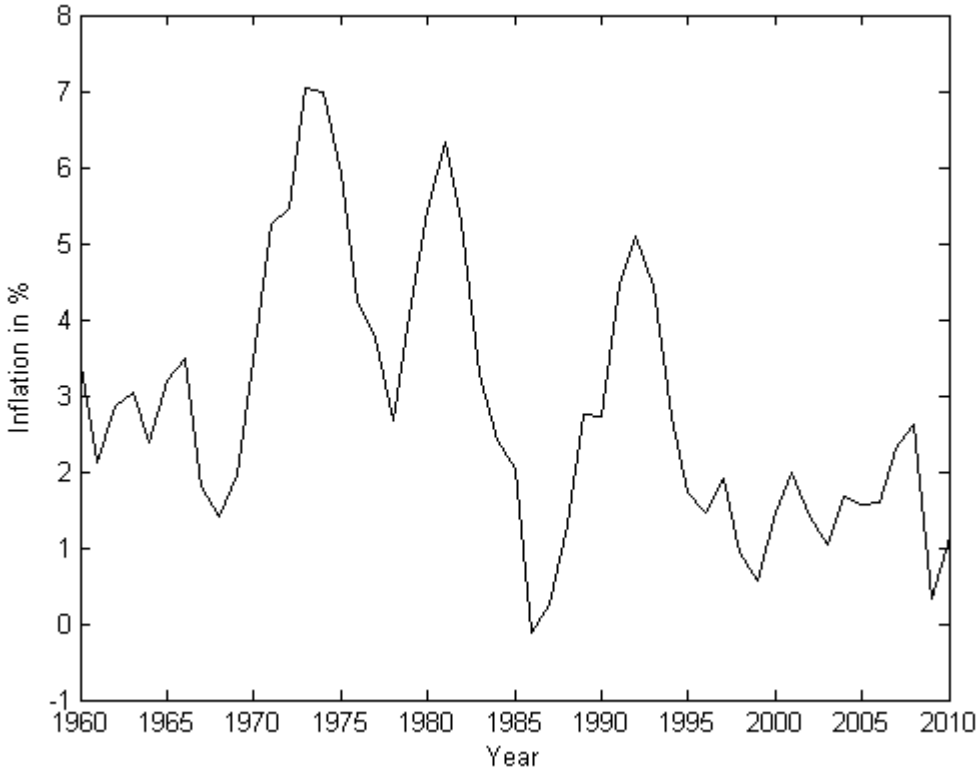
4.3 Preferences and Technology

Schwarz (2008) estimates the GDP share of labour income to be 67.1% in 2007. Hence, I set θ to 0.33. The depreciation rate of capital δ is set to resemble the ratio of investment to GDP in 2010 of 0.18. I set δ to 0.07. The relative weight on disutility of labour α is set to 50. It is chosen that agents spend about one third of their time (before retirement) on labour. The utility weight on bequests is 3. The inter-temporal elasticity of substitution for consumption ρ and bequests σ are both chosen to be 2 in line with Domeij and Klein (2010). The Frisch labour supply elasticity is set to 0.5 as estimated by Domeij and Flodén (2006). The discount rate β is set to 0.985. The discount rate β and the weight on leaving bequests μ are set to match the German ratio of capital to GDP. An overview of all parameters is given in table 3.

4.4 Assumed Inflation Rates

In Germany, inflation was the highest in the 1970s and early 1980s with yearly increases in prices of as high as 7%. Later, inflation declined and except for a short return in the early 1990s, rates were generally very low. Recently inflation rates have again increased and amount to 2.6% in the first quarter of 2011.

Figure 4: Inflation in Germany[2]



I base the main focus of my analysis on the average inflation rate[3] for the last 5 years being 1.6%. Additionally, I report the effect of 2% and 4% inflation. I include 2%, because it is the target inflation rate of the European Central Bank and 4% to illustrate of a higher inflation rate.

I analyse fiscal drag over a time span of 3 years similar to Herr and Suessmuth (2007). It is also expected in the popular media that taxes will not be lowered in the years to come, as politics seek to reduce the government deficit (Spiegel-Online, 2011). Taxpayers in Germany are therefore likely to be exposed to fiscal drag.

[3] Source: German Federal Statistical Office through Datastream

Table 3: Overview of parameters

Parameter	Definition	Value
α	Utility weight on labour	50
μ	Utility weight on bequests	3
β	Discount rate	0.985
γ	Frisch labour supply elasticity	0.5
ρ	Inter-temporal elasticity of substitution: consumption	2
σ	Inter-temporal elasticity of substitution: bequests	2
ε	Human capital / productivity	[ ]*
ω	Distribution of agents0	[ ]*
θ	Capital share	0.33
δ	Depreciation	0.07
τ^C	Proportional consumption tax	0.125
τ^K	Proportional capital-income tax	0.26375
τ^W	Progressive wage tax	[ ]*
κ	Deductions from income	[ ]*
τ^P	Proportional pension payments	0.16
	Inflation (in %)	1.6 (2, 4)
	Years of inflation	3

***** indicates a matrix of values.

5 Benchmark Economy

In this section, I present the results for the benchmark economy (BE). The benchmark economy is calibrated to match core characteristics of the real German economy.

5.1 Aggregate Characteristics

Core parameters of the initial steady state are presented in table 4. The benchmark economy exhibits a slightly higher capital to output ratio K/Y with 2.85 compared to 2.84. The relative size of the government of 21% in the model equals the 21% of the actual German economy. In contrast, consumption is lower in the benchmark economy with 60% of output compared to 61%. In the benchmark economy, 20% of output is invested compared to 18% in Germany. Pension payments are 11% in the benchmark economy relative to 10% in Germany. The interest rate in the benchmark economy is 4.6%.

Table 4: Core indicators for Germany and the Benchmark Economy

	Germany	Benchmark economy
K/Y	2.84	2.85
I/Y	0.18	0.20
G/Y	0.21	0.21
C/Y	0.61	0.59
P/Y	0.10	0.11

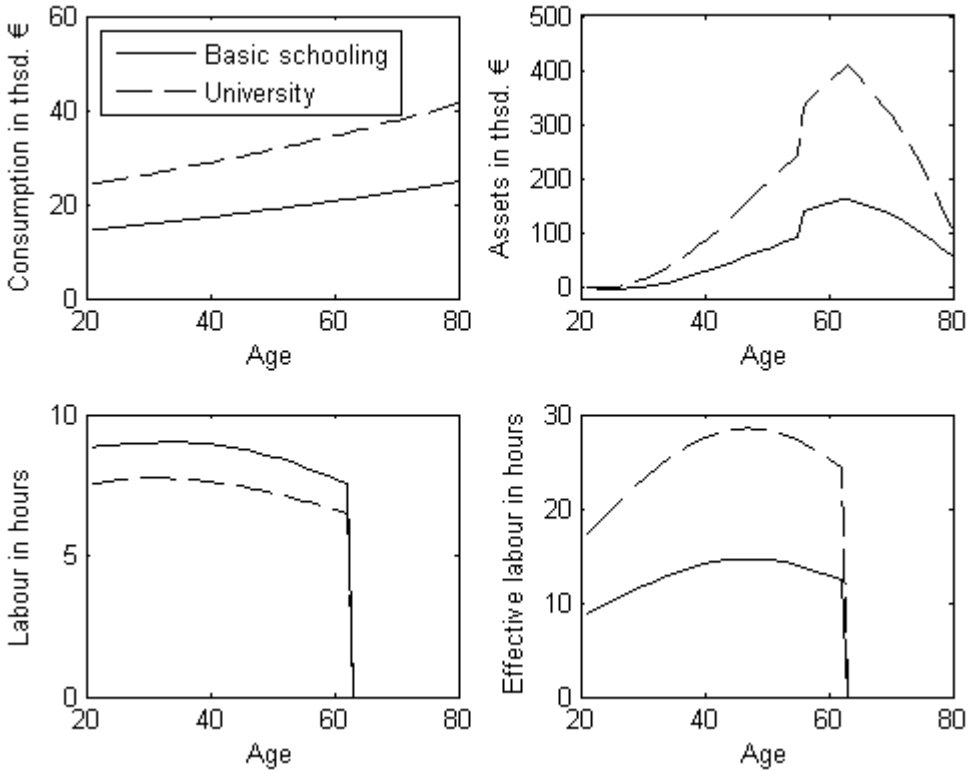
Calculation and references are given in Appendix A.

5.2 Micro-level Characteristics

Although the life-time behaviour of the different education groups is different because of different human capital endowments, it follows the same patterns. First of all, agents increase consumption throughout life. Yearly consumption of a university graduate increases from ca. € 20,000 at age 21 to more than € 40,000 at the age of 80. To be able to do so agents indebt themselves at the beginning of their life, but afterwards build up a stock of assets to finance retirement. At the age of 45 the capital stock exhibits a jump upwards due to the agent receiving bequests. Agents spend around 8 hours a day on labour. In the beginning of their working life, agents increase labour, but reduce it beginning in their 30s.. This has two reasons: first, if consumption increases agents also want to consume more leisure and, second, higher efficiency later in life causes higher income and higher tax rates, reducing labour.

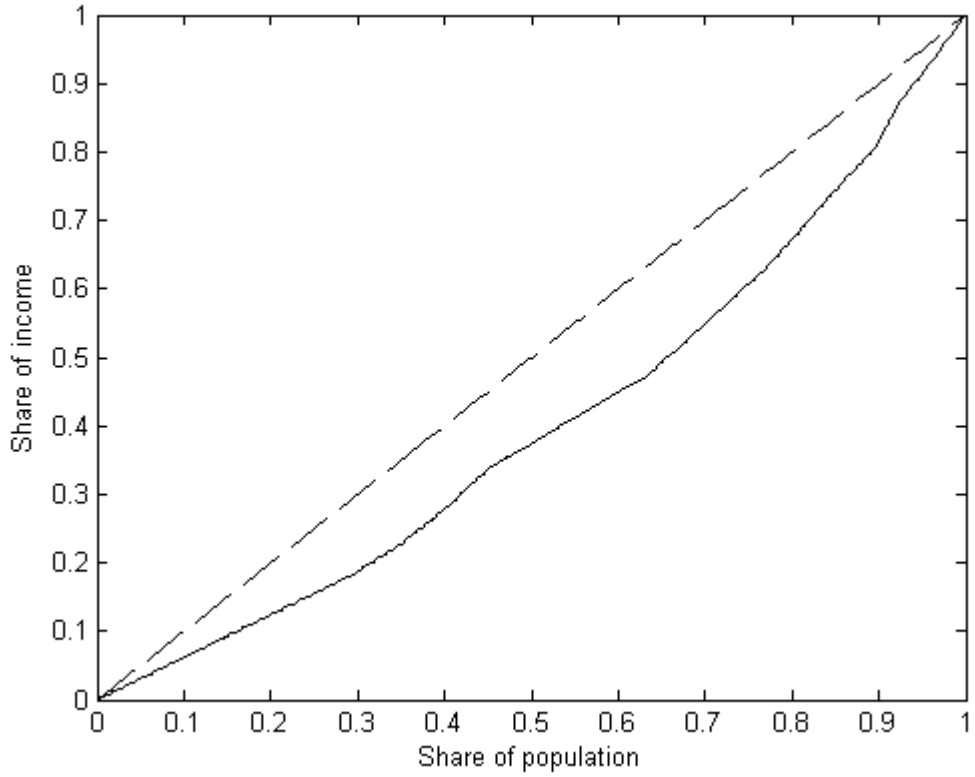
Effective labour increases in the beginning of an agent's life and decreases slightly after the age of 55. The behaviour of agents of education level 1 (basic schooling) and 6 (university graduates) is describes in figure 5.

Figure 5: Life-time profiles for agents with basic schooling and university graduates



The Gini index for net income after taxes and transfers of the benchmark economy equals 0.1976. It is lower than the OECD estimate of 0.3 for Germany in the 2000s. One should, however, be aware that the two values not directly comparable. Most importantly, the benchmark economy is constructed with 6 different lifetime earning profiles and there is therefore less variation in earnings. Furthermore, there are only 6 (types of agents) * 60 (periods lived) = 360 living agents at a time in the model. The low number of living agents compared to the actual German population is also likely to be a major cause of a lower Gini index. The index is hence of importance not to calibrate the economy, but to compare the effect of the different tax reforms on income equality. The Lorenz curve of the benchmark economy is given in figure 6.

Figure 6: Lorenz curve for the benchmark economy, income after taxes and transfers



6 Results

First, I present the impact of fiscal drag on the economy relative to the benchmark equilibrium. Then, I show how fiscal drag compares to explicit tax increases. The final part of this section consists of a sensitivity analysis testing for an alternative calibration of the model.

6.1 Impact of Fiscal Drag

6.1.1 Aggregate Effects

A summary of the impact of 3 years of fiscal drag is reported in table 5. The first observation is that aggregate output decreases. For the historical inflation rate of 1.6%, output decreases by 0.4%. Assuming the inflation target of 2% is met, output declines by 0.5%. The decline in output is caused by a decline in both production factors: capital and (effective) labour. As capital decreases more than labour, the interest rate rises relative to the benchmark economy. Aggregate consumption and investment both decrease stronger than output in total. And while

government revenue increases as expected, contributions to the pension system decline in line with output.

Table 5: Aggregate effects of fiscal drag

		Fiscal drag		
Indicator	*BE*	*1.6%*	*2%*	*4%*
Y	100	99.62	99.53	99.06
K	100	99.31	99.14	98.33
H	100	99.81	99.76	99.49
EH	100	99.78	99.72	99.42
C	100	99.59	99.48	98.95
I	100	99.31	99.14	98.33
T	100	102.40	102.98	105.71
P	100	99.62	99.53	99.06
w	100	99.84	99.81	99.64
r	4.57	4.61	4.62	4.66

Normalized to 100 relative to BE, except for r in %

6.1.2 Micro-Level Results

The economic inefficiencies caused by fiscal drag lead to declines in welfare for all types of agents considered. For 1.6% inflation, agents with basic schooling (education level 1) require an increase in lifetime consumption of 0.2% for utility to be equal to the benchmark equilibrium. Agents with higher education are affected more strongly by fiscal drag and experience larger declines in utility. Utility declines less for low income households, as wage taxes increase only modestly, but increases lump-sum transfers are relatively significant compared to prior income. For higher income agents, wage taxes increase more, but the increase in lump-sum payments is insignificant compared to total income. University graduates are still affected by the progressiveness of the tax code, i.e. their income is not high enough to benefit from the decreasing increase in average tax rates. Table 6 presents the welfare effects of fiscal drag.

Table 6: Lifetime impact on utility in consumption equivalence (in %)

		Fiscal drag		
Education level	*BE*	*1.6%*	*2%*	*4%*
1	0.00	-0.20	-0.23	-0.47
2	0.00	-0.30	-0.37	-0.69
3	0.00	-0.37	-0.46	-0.92
4	0.00	-0.47	-0.59	-1.18
5	0.00	-0.51	-0.63	-1.27
6	0.00	-0.64	-0.81	-1.63

Fiscal drag distributes net earnings after taxes and transfers more equally. Lower income groups benefit relatively more strongly from the increase in transfer payments compared to their initial income, but higher income earners are hit relatively strongly by the increase in taxes. It is important to remember that the decrease in inequality does not occur, because the poorest households are better off, but because higher incomes are reduced more strongly than lower ones.

Table 7 Effect on net income Gini index

	Fiscal drag		
BE	*1.6%*	*2%*	*4%*
0.1976	0.1934	0.1925	0.1872

The implications of fiscal drag on the tax burden[4] of the different agents is presented in table 8. Agents of education level 1 face a tax burden of 17.62%, while agents of education level 6 face almost twice that rate with 31.75%. Fiscal drag increases the tax burden for all agents considered. Since university graduates (education level 6) experience the highest increase in tax burden in percentage points, I conclude that under the applied calibration of the model, even the highest income group does not benefit from declining increases in average wage taxes as income increases, as income from labour is not high enough.

[4] As defined in equation (20).

Table 8: Tax burden (in %)

		Fiscal drag		
Education level	*BE*	*1.6%*	*2%*	*4%*
1	17.62	18.76	19.04	20.45
2	20.51	22.20	22.57	24.29
3	24.19	25.69	26.05	27.77
4	27.23	28.75	29.12	30.89
5	28.20	29.73	30.10	31.90
6	31.75	33.37	33.76	35.70

6.2 Fiscal Drag and Alternative Tax Increases

The comparison of fiscal drag to the initial benchmark equilibrium is insightful, but not in itself satisfying. Instead, it gives a more complete picture to compare fiscal drag to explicit increases in taxes and the relative impacts on the economy. I consider a proportional increase in wage taxes and in consumption taxes, both with perfect indexation of the tax code. Hence, fiscal drag has no effect. The size of the increase in taxes is chosen to raise the same amount of tax revenue as fiscal drag.

6.2.1 Aggregate Effects

Summary statistics for aggregate variables are reported below in table 9. The first thing to notice is that fiscal drag reduces output more than an increase in consumption taxes, but less so than a proportional increase in wage taxes. The relative characteristics are similar for all indicators. An increase in consumption taxes is less costly and leads to the smallest levels of distortions. Capital even increases above benchmark equilibrium levels, while labour decreases. Consequently, this tax reform is the only one that causes wages to increase. Higher wage taxes cause the highest inefficiencies. Both capital and labour decrease stronger than in the two other tax reforms considered. The strong decline in output can be explained by the disproportional tax increase for the most efficient households.

Table 9: Aggregate effects of the different tax reforms

	1.6%			*2%*			*4%*		
	FD	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
Y	99.62	99.21	99.88	99.53	99.01	99.85	99.06	98.02	99.72
K	99.31	98.94	100.03	99.14	98.67	100.04	98.33	97.35	100.08
H	99.81	99.35	99.78	99.76	99.18	99.72	99.49	98.35	99.47
EH	99.78	99.35	99.81	99.72	99.18	99.76	99.42	98.35	99.54
C	99.59	99.02	99.77	99.48	98.77	99.72	98.95	97.53	99.47
I	99.31	98.94	100.03	99.14	98.67	100.04	98.33	97.35	100.08
T	102.40	102.40	102.40	102.98	102.98	102.98	105.71	105.71	105.71
P	99.62	99.21	99.88	99.53	99.01	99.85	99.06	98.02	99.72
w	99.84	99.86	100.08	99.81	99.83	100.09	99.64	99.66	100.18
r	4.61	4.60	4.55	4.62	4.61	4.55	4.66	4.65	4.53

Normalized to 100 relative to BE
FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

6.2.2 Micro-level Effects

For an overview of the effects of the different tax increases on utility, please consider table 10. In contrast to fiscal drag, the alternative tax reforms do indeed profit some household relative to the initial benchmark equilibrium. In general, an increase in consumption taxes is preferred by all agents to fiscal drag and higher wage taxes. This is, because lump-sum transfers are equal in all tax reform, but higher consumption taxes cause the least distortions. Relative to the scenario of fiscal drag, consumption taxes are therefore a Pareto improvement. Every agent is strictly better off. The 3 less educated types of households even prefer higher consumption taxes to the benchmark equilibrium. Higher wage taxes are better than fiscal drag for the less educated agents and worse for the more educated ones. The impact of inflation on an agents utility is amplified by a higher inflation rate.

Table 10: Lifetime impact on utility in consumption equivalence (in %)

	1.6%			*2%*			*4%*		
Education level	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
1	-0.20	0.18	0.29	-0.23	0.22	0.35	-0.47	0.42	0.66
2	-0.30	-0.20	0.15	-0.37	-0.25	0.19	-0.69	-0.54	0.35
3	-0.37	-0.55	0.03	-0.46	-0.70	0.04	-0.92	-1.43	0.07
4	-0.47	-0.87	-0.06	-0.59	-1.09	-0.08	-1.18	-2.22	-0.15
5	-0.51	-0.96	-0.09	-0.63	-1.21	-0.11	-1.27	-2.47	-0.21
6	-0.64	-1.31	-0.18	-0.81	-1.65	-0.22	-1.63	-3.37	-0.43

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

An important characteristic to point out is that the most efficient tax reform is also the one that causes the least equal distribution of net income. A reduction in the inequality of net income is hence costly for all agents. For 1.6% inflation, the increase in wage reduces the Gini index by 0.5% relative to fiscal drag. Higher consumption taxes increase the Gini index by 1.5% to 0.1962 relative to fiscal drag. In general, the higher the increase in taxes, the more redistributive is every alternative.

Table 11: Effect on net income Gini index

Inflation rate	*FD*	*TW*	*TC*
1.6%	0.1934	0.1924	0.1962
2%	0.1925	0.1911	0.1959
4%	0.1872	0.1846	0.1944

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

The tax burden of the different households provides further insight about the alternative tax reforms. Most interestingly, higher consumption taxes lead to a slightly lower tax burden for all types of households relatively to fiscal drag. This can be explained by a reduction in labour and also by the fact that consumption increases over life, reducing the present value of these payments. A proportional increase in wage taxes reduces the tax burden for lower income agents, but increases it for earners of higher incomes. Relative to this tax increase, fiscal drag favours earners of higher incomes. Furthermore, the connection between the tax burden and the impacts on inequality are clearly observable. Higher consumption taxes lower the tax

burden the most for high income earners and cause the least equality of earning. Higher wage taxes exhibit the opposite characteristics.

Table 12: Tax burden (in %)

	1.6%			*2%*			*4%*		
Education level	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
1	18.8	18.0	18.4	19.0	18.0	18.6	20.5	18.4	19.4
2	22.2	21.1	21.3	22.6	21.2	21.5	24.3	22.0	22.3
3	25.7	25.2	25.0	26.1	25.4	25.2	27.8	26.6	26.1
4	28.8	28.6	28.0	29.1	28.9	28.2	30.9	30.6	29.2
5	29.7	29.7	29.0	30.1	30.0	29.2	31.9	31.9	30.1
6	33.4	33.7	32.6	33.8	34.2	32.8	35.7	36.7	33.8

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

6.3 Sensitivity Analysis

In this section, I test the robustness of the results to an alternative calibration of the model. Instead of calibrating tax credits as a proportion of income, I disregard any tax credit and instead set the amount of government consumption exogenously to match the target ratio G/Y of 0.2. Excess tax revenue is distributed in a lump-sum fashion across all agents. To keep the calibration to the German economy valid, I increase the weight on bequests μ to 5 compared to 3 in the initial analysis.

From the changed calibration, there follow two main implications for the benchmark equilibrium. First, the tax burden is higher, as there are no tax credit and, second, net income is distributed more equally because of the transfers. The tax burden for education group one changes from 17.6% to 25.9% and from 31.75% to 42.1% for education group 6. The Gini index decreases from 0.197 to 0.163. Tables with statistics of the sensitivity analysis are to be found in appendix E.

The impact of fiscal drag is smaller than in the original calibration. For 1.6% inflation, output is reduced by 0.3% compared to 0.4%. Consequently the negative impact on utility is also smaller. This can be explained by all agents having higher taxable incomes and hence being located at less progressive parts of the tax code.

The relative characteristics of fiscal drag relative to the two alternative tax forms considered remain. It is less efficient than higher consumption taxes, but more than higher wage taxes. Compared to the original analysis, countering fiscal drag increases output by 0.3% and using consumption taxes instead of fiscal drag to increase tax revenue still increases output by 0.2%. Therefore, although changing in size, the general results from the original discussion turn out to be relatively robust.

7 Conclusion

In this thesis, I analyse the effect of fiscal drag in Germany. Central aspects of the analysis are the implications on efficiency, welfare, inequality and tax revenue. To analyse the efficiency of using fiscal drag to increase tax revenue, I compare it to 2 alternative tax increases that raise tax revenue equally. I consider a proportional increase in wage taxes and an increase in consumption taxes. My analysis is based on a dynamic general equilibrium model calibrated to Germany.

I find that fiscal drag caused by 1.6% inflation of 3 years causes the economy to decline by 0.4% in steady state. The inefficiencies caused by the tax reform leave all types of agents considered worse off, while at the same time reducing inequality. Fiscal drag causes tax revenue to increase by 2.4%. Furthermore, I analyse the costs of using fiscal drag as a mean to raise tax revenue by comparing to two alternative tax increases raising the additional tax revenue. A proportional increase in wage taxes reduces efficiency even stronger, but raises utility for lower income groups. Also this is the tax reform that distributes income most equally. In the end, an increase in consumption taxes is the most efficient way to increase tax revenue. Output only decreases by 0.12% compared to the benchmark economy and every agent is strictly better off than under fiscal drag. Consumption taxes, however, cause net income to be distributed less equally than under the two alternative tax reforms. Inflation rates higher than 1.6% exhibit the same relative characteristics of the different means of increasing tax revenue, but are bigger in size.

Possible extension and adaptations of my model might lead additional insights. First, also analysing the transitional period would allow to analyse inter-generational effects. As an example, Altig et al. (2001) find that consumption and wage taxes have very different effects on agents depending on age. Given the small changes in policies the transition period should,

however, be shorter and the economy would converge relatively quickly close to the new steady state. Second, a more detailed calibration of the human capital with more subgroups would provide more detailed insights, especially about households with very high incomes that are currently not represented in the model. Finally, one could model the social security system in more detail. Low income households would then face the decision whether to receive government assistance or to work and lose this assistance. Opportunity costs of labour would hence increase. Although both extensions would probably provide interesting additional insights, the current results should nevertheless be valid for most representatives of the current education groups considered and the general economy.

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9 Appendix

9.1 Appendix A: Data

I calculate the indicators for the German economy using 2010 values for Germany based on the German Federal Statistical Office. Instead of GDP, I calculate the ratios using domestic uses, since I analyse a closed economy. Pension expenditures are for the year 2009, since final values for 2010 are not yet available. .

Table A1: German macroeconomic data 2010 in bn. €

C	1444.71
+ G	486.69
+ I	448.14
= Sum	2379.54
- Changes in inventories and acquisitions less disposals of valuables	-10.95
= Domestic uses = Y	2368.59

Source: German Federal Statistical Office

Table A2: Gross stock of fixed assets (at replacement prices) 2010 in bn. €

Tangible assets	13440.97
- Dwellings	-6708.60
= K	6732.37

Source: German Federal Statistical Office

Table A3: Pensions

Pension expenditures 2009 in bn. €	239.33

Source: German statutory pension insurance scheme – Deutsche Rentenversicherung

Table A4: Core indicators for Germany

K/Y	2.84
C/Y	0.61
G/Y	0.21
I/Y	0.18
P/Y	0.10

9.2 Appendix B: Human Capital Formation

Here, I present more on human capital formation than presented in section 4.3. In model 5 of their paper, Dustman and van Soest (1998) estimate log wage per hour for employed men in Germany on: education level, marital status, experience, experience squared, age, age squared, being a blue collar worker and hours worked. Regressions are run individually for public and private worker. They estimate the following coefficients:

Table A5: Wage equations

	Private sector		Public sector	
	Coef.	t-value	Coef.	t-value
Constant	1.592	2.56	0.541	0.62
Ed level 2	0.172	3.51	0.271	4.49
Ed level 3	0.305	3.67	0.613	7.23
Ed level 4	0.459	4.74	0.837	8.81
Ed level 5	0.507	5.14	0.909	6.48
Ed level 6	0.631	4.81	1.286	10.41
Married	0.088	2.94	0.119	2.77
Exp/10	0.013	0.14	0.438	4.35
Exp/10 sqrd	-0.027	-2.36	-0.037	-2.98
Age/10	0.497	3.95	-0.123	-0.67
Age/10 sqrd	0.036	-3.23	0.003	0.22
Blue	0.157	-8.24	-0.065	-2.25
Hours	0.032	2.42	0.061	3.27

Source: Dustman and van Soest (1998)

I use the values for the different education levels to get the difference in earnings between the different education groups and the estimations for exp/10, exp/10 sqrd, age/10 and age/10 sqrd to get the life-time earning profiles. I take the weighted average for private (70%) and public (30%) workers. The parameters married, blue and hours are not included.

9.3 Appendix C: Wage Taxes

The equation to determine the level of taxes T for a taxable income x is given by the following equation taken from OECD (2009).

$$T = \begin{cases} 0 & if \quad x \le 8004 \\ (912.17 \times y + 1400) \times y & if \quad 8005 \le x \le 13469 \\ (228.74 \times z + 2397) \times z + 1038 & if \quad 13470 \le x \le 52881 \\ 0.42 \times x - 8172 & if \quad 52882 \le x \le 250730 \\ 0.45 \times x - 15694 & if \quad 250731 \le x \end{cases}$$

with

$$y = \frac{(x - 8004)}{10000}$$

$$z = \frac{(x - 13469)}{10000}$$

The marginal tax rate used in equation (12) to determine labour is the following:

$$\frac{dT}{dx} = \begin{cases} 0 & if \quad x \le 8004 \\ 2 \times 912.17\, y \frac{dy}{dx} + 1400 \frac{dy}{dx} & if \quad 8005 \le x \le 13469 \\ 2 \times 228.74\, z \frac{dz}{dx} + 2397 \frac{dz}{dx} & if \quad 13470 \le x \le 52881 \\ 0.42 & if \quad 52882 \le x \le 250730 \\ 0.45 & if \quad 250731 \le x \end{cases}$$

with

$$\frac{dy}{dx} = \frac{dz}{dx} = \frac{1}{10000}$$

9.4 Appendix D: Solving the Model

To solve the model, I make use of the Gauss-Seidel-algorithm. First, I guess aggregate levels for capital and labour and calculate the corresponding values for interest rates, wages, transfers and pension income. Then, I calculate the optimal behaviour of the different agents and their choices of asset holdings, consumption, bequests and labour. These values are aggregated and used to update the initial guess for capital and labour. This process repeats until a convergence criterion is met.

To find the tax rates that raise the same amount of tax revenue as bracket creep, I use the bisection method. First, I guess the range in which the tax increase lies. For the point in the middle of this range, I check the resulting tax revenue. Depending on whether the tax revenue collected is bigger or smaller than the tax revenue under fiscal drag, the middle of the range is set as either the upper or lower bound of the updated range. Again, this process repeats until a convergence criterion is met.

9.5 Appendix E: Sensitivity Analysis

Table A6: Aggregate effects of the different tax reforms

	1.6%			*2%*			*4%*		
	FD	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
Y	99,71	99,52	99,93	99,64	99,39	99,91	99,32	98,74	99,82
K	99,51	99,33	100,02	99,38	99,16	100,03	98,80	98,27	100,05
H	99,79	99,62	99,87	99,74	99,53	99,83	99,51	99,02	99,67
EH	99,81	99,61	99,88	99,76	99,51	99,85	99,58	98,98	99,71
C	99,67	99,41	99,87	99,59	99,26	99,83	99,25	98,47	99,66
I	99,51	99,33	100,02	99,38	99,16	100,03	98,80	98,27	100,05
T	101,21	101,21	101,21	101,52	101,52	101,52	103,05	103,05	103,05
P	99,71	99,52	99,93	99,64	99,39	99,91	99,32	98,74	99,82
w	99,90	99,91	100,05	99,87	99,88	100,06	99,74	99,76	100,11
r	4,68	0,05	0,05	4,69	0,05	0,05	4,72	0,05	0,05

Normalized to 100 relative to BE
FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

Table A7: Lifetime impact on utility in consumption equivalence (in %)

	1.6%			*2%*			*4%*		
Education level	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
1	-0,04	-0,04	0,14	-0,05	-0,05	0,17	-0,08	-0,12	0,35
2	-0,15	-0,21	0,07	-0,19	-0,27	0,09	-0,35	-0,57	0,17
3	-0,27	-0,38	0,01	-0,34	-0,48	0,01	-0,66	-1,01	0,02
4	-0,39	-0,54	-0,04	-0,49	-0,68	-0,05	-0,95	-1,43	-0,10
5	-0,42	-0,60	-0,05	-0,53	-0,75	-0,07	-1,02	-1,56	-0,14
6	-0,47	-0,80	-0,10	-0,58	-1,01	-0,13	-1,10	-2,10	-0,26

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

Table A8: Effect on net income Gini index

Inflation rate	*FD*	*TW*	*TC*
1.6%	0,1616	0,1606	0,1632
2%	0,1610	0,1597	0,1630
4%	0,1584	0,1555	0,1622

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes

Table A9: Tax burden (in %)

	1.6%			*2%*			*4%*		
Education level	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*	*FD*	*TW*	*TC*
1	0,3	26,3	26,3	0,0	26,4	26,4	0,0	27,0	27,0
2	0,3	30,0	29,9	0,0	30,2	30,0	0,0	31,0	30,6
3	0,3	33,9	33,6	0,0	34,1	33,7	0,0	35,2	34,3
4	0,4	37,7	37,2	0,0	38,0	37,3	0,0	39,4	37,9
5	0,4	39,0	38,4	0,0	39,3	38,5	0,0	40,7	39,1
6	0,4	43,5	42,6	0,0	43,8	42,8	0,0	45,7	43,4

FD = Fiscal drag, TW = proportional increase in wage taxes, TC = proportional increase in consumption taxes