The Interaction of Direct and Indirect Taxes:
The Prospects of Fiscal Devaluation

PRELIMINARY DRAFT

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Abstract

One way to increase international competitiveness within a monetary union, i.e. with no possibility of exchange rate devaluation, is fiscal devaluation. The concept stipulates the reduction of direct taxes combined with a (revenue-neutral) increase in indirect taxes in order to mimic the real outcome of a nominal exchange rate devaluation. In this paper we derive the theoretical underpinning of fiscal devaluation in a neoclassical growth model. In addition, we calibrate the model to the German economy and quantify the effects associated with the fiscal devaluation carried out in Germany since 2005. The simulation results show that due to the reform a significant amount of revenues were raised without generating negative effect on economic growth. Further, the reform lead to a significant improvement of the trade balance (by around 3.1 percentage points in the short-run) thereby confirming the theoretical considerations associated with fiscal devaluation.

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1 Introduction

Five years after the financial crisis of 2008, the growth prospect for several European countries is still far from looking rosy. One explanation for the long-lasting economic slump and the slow recovery of these countries is that the fiscal policy in most European economies, and especially in Greece, Italy, Portugal and Spain (i.e. the GIPS), was already unsustainable before the crisis. This becomes obvious now, after the stimulating effects from Keynesian motivated fiscal spending have disappeared, and when national budgets have turned from bad to worse.

Moreover, it is highly controversial whether the well-intentioned EU imperative of keeping all Euro member countries within the monetary union is the right cure to foster economic recovery. As long as a country stays within the monetary union, it has no access to monetary instruments to ease its sovereign debt problem or to tackle its lack of competitiveness. By looking at the historical (starting in the 1980s) nominal exchange rate pattern between each of the GIPS countries and Germany, as displayed in Figure 1 and Figure 2, respectively, it becomes quite apparent that national monetary policy and in particular exchange rate devaluations of the national currency have used to be an important policy instrument of these countries.

From a theoretical point of view, exchange rate devaluations have long been identified as an effective mean for countries to re-gain their competitiveness and hence to foster economic growth. In general, an exchange rate devaluation is likely to improve a country's trade balance as well as the domestic demand for home produced goods, two important features when putting an economy back on the growth path. Within the European monetary union, the only policy instrument however left to the highly indebted and largely uncompetitive Euro countries is fiscal policy, i.e. a cut in government spending or a raise in taxes. Both policy measures are however known to be harmful for economic growth and thus for the recovery from an economic slump.

Consequently, the question arises which policy options are still feasible for struggling Euro countries? Is there a way out of the sovereign debt dilemma and the lacking competitiveness by means of solely fiscal instruments? How can highly indebted countries re-gain their competitiveness with this limited number of policy instruments? And why did other European countries, like German for instance, weather the current crisis so well?

One answer to these questions is fiscal devaluation. The concept of fiscal devaluation deals with the issue of which fiscal instruments can be used, despite the fixed nominal exchange rate, to mimic the real outcome of an exchange rate devaluation.

The question about fiscal devaluation was particularly on vogue in times of the gold standard, but became less important after the breakup of the Bretton Woods System. In the current crisis, where highly indebted Euro countries are unable to devaluate, but need to become competitive once again, this old question has become relevant again.

Up to now, there is however little formal analysis on the prospects and limits of a fiscal devaluation and its consequences for national welfare. The very few existing papers such as Farhi et al (2012), Correia (2011) or Lipinska and von Thadden (2009) for instance, deal mainly with the equivalence between exchange rate devaluation and fiscal devaluation but do not analyse the prospects and limits of fiscal devaluation.

The most prominent fiscal instruments used to mimic an exchange rate devaluation are a cut in payroll taxes or employer's social security contributions combined with a simultaneous increase in the value added tax (VAT). The latter measure serves to limit the financial cost of fiscal devaluation or even to ensure a balanced budget reform. In detail, lower payroll taxes or social security contributions reduce domestic firm's production costs and thus enables these firms to sell their goods at lower prices. Hence the competitiveness of domestic firm's has been increased vis-a-vis their foreign competitors. Even though the rise in the VAT might partially offsets the downward movement in domestic prices, it is important to note, that the VAT is not levied on exported goods. Therefore, the VAT is irrelevant for domestic exports and does not affect the domestic firm's gain in competitiveness arising from the cut in payroll taxes or employer's social security contributions.

Further, the VAT is also levied on imported goods, which levels playing field because then domestically produced goods as well as imported goods face an identical VAT burden. In combination with the reduced production costs originating from the cut in payroll taxes or employer's social security contributions, domestically produced goods become relatively cheaper compared to imported goods. In turn, domestic consumer substitute the relatively more expensive imports for relatively cheaper domestic goods and thereby boost the domestic demand for domestically produced goods while simultaneously the demand for foreign produced goods, i.e. imports, falls. In addition, the demand sift from foreign to domestically produced goods has a significant positive impact on the trade balance.

One explanation why the German economy weathered the current crisis so well is that Germany perused a fiscal devaluation already in the years before the financial crisis. In 2005 and the subsequent year, the social security contributions paid by German employers were reduced by more than 2 percentage points, while in 2007 an increase by 3 percentage points in the standard German VAT rate followed. The combination of these two tax measures resembles exactly the idea behind the concept of fiscal devaluation.

The aim of the paper is to provide a quantitative assessment of the growth effects originating from fiscal devaluation as carried out in Germany. The insights gained from the German experience are useful for future policy advice in the GIPS countries for two distinct reasons. First, our results show to what extend fiscal devaluation is a useful instrument to increase competitiveness. And secondly, the quantitative results provide an informative basis on the magnitude of the fiscal devaluation required in order to stimulate

economic growth. For the quantitative analysis we apply a two country general equilibrium model in line with neoclassical growth theory which is calibrated according to the German economy. The model features endogenous labour demand by two different types of firms as well as endogenous labour supply by an infinitively lived agent. In addition we account for the most important taxes on the firm and household side, including a corporate tax, different taxes on capital income, a tax on labour income, a value added tax, and social security contributions on the side of the employers and the employees. The two country nature of the model allows us to account in detail for the international ramifications arising from fiscal devaluation. The applied focus of our work distinguishes our paper from the few already existing papers in the field which mainly focus on the equivalence between an exchange rate devaluation and fiscal devaluation.

The paper proceeds as follows. The next section provides a short, non-technical summary of the applied computable general equilibrium (CGE) model. Those building blocks of the model which are sensitive to the effects of fiscal devaluation, i.e. the firm and household sector are separately outlined in Section 3. A description of the fiscal devaluation carried out in Germany together with our simulation results are found in Section 4 while Section 5 concludes.

2 The Applied Model

The applied general equilibrium model is based on neoclassical growth theory and incorporates several tax sensitive behavioral margins on the firm and household level. The firm faces an inter-temporal investment decision, an optimal financing problem and a labour input choice. The household is modelled as a representative agent with dynastic linkages, who maximizes life-time utility by choosing optimal inter-temporal consumption and optimal labour supply. The latter is distorted by the existence of a tax on labour income, social security contributions which are partially paid by the employer and the employee, and a value added tax (VAT). Besides the firm and household sector, the model incorporates a government and a foreign economy. The government budget is balanced by lump-sum payments from/to the household and government debt is restricted by a relative threshold to GDP in order to rule out Ponzi game behaviour. Similar to the home economy, foreign consists of a firm, household and government sector. The two economies engage in trade with each other and we allow for cross country ownership of asset. Altogether, the model represents a dynamic, micro based two-country macro model, where the foreign economy is relatively large compared with the home economy. The dynamic feature of the model enables us to account for the whole path of equilibria from the initial to the final steady state equilibrium which is particularly important since investment and savings decisions

are by nature forward looking and thus marked by substantial tax capitalization effects.[1]

3 Effects Associated with Fiscal Devaluation

This section analyses the implication of fiscal devaluation on the different players in an economy, notably the firm and the household sector.

3.1 Firm Sector

The production side of the home economy is represented by a corporate firm which produces a homogeneous output good. The price of the good is normalized to unity. The production function $Y = F(K, \overline{L}, E)$ with $F(0) = 0$ and $F' > 0$, $F'' < 0$ is linearly homogeneous. Input factors are capital, K, a labour composite, $\overline{L}$, and a fixed factor E.[2] The labour composite consists of three different skill types, L^j with $j = \{l, m, h\}$, including low, medium, and high skilled labour. The composite has the form[3]

$$\bar{L}_t = L\left(L_t^j, L_t^m, L_t^h\right) = \left\{\sum_j^3 \left(\alpha^j\right)^{\frac{1}{1+\mu}} \left(L_t^j\right)^{\frac{\mu}{1+\mu}}\right\}^{\frac{1+\mu}{\mu}}. \tag{1}$$

The optimal amount of each skill type of labour employed follows from the firms' cost minimization problem

$$\bar{w}_t = \min_{l_t^j} \sum_j^3 (1+\tau^{SF,j}) w_t^j l_t^j \quad s.t. \quad L\left(l_t^l, l_t^m, l_t^h\right) = 1. \tag{2}$$

$\bar{w}_t$ denotes the unit cost function for producing one unit of the composite and $l^j = L^j/\overline{L}$ are skill specific unit labour inputs. The skill specific wage rate is $(1+\tau^{SF,j})w_t^j$, where $\tau^{SF,j}$ denotes the skill specific social security contribution paid by the employer. Optimal skill specific labour demands are given by

$$L_t^j = l_t^j \overline{L}_t = \frac{\alpha^j (1+\tau^{SF,j})(w_t^j)^{-(1+\mu)}}{\left[\sum_j^3 \alpha^j (1+\tau^{Sj,F})(w_t^j)^{-\mu}\right]^{\frac{1+\mu}{\mu}}} \overline{L}_t. \tag{3}$$

[1] A full length description in addition to the theoretical foundation of the applied CGE model can be found in Radulescu and Stimmelmayr (2010) or Stimmelmayr (2007).

[2] The fixed factor, E, determines sector specific economic rent which can be realized.

[3] The weighting factor $\alpha_j = L_j \left[(1+\tau^{SF,j})w_j\right]^{1+\mu} / \left[\sum_j^3 L_j (1+\tau^{SF,j}) w_j\right]^{1+\mu}$, determines the relevance of the different skill types in production and is calibrated following the empirical evidence on skill specific wage rates and the distribution of skill types across sectors.

Capital depreciates at a constant rate δ. The equation of motion for capital is

$$GK_{t+1} = I_t + (1-\delta)K_t, \tag{4}$$

where $G = 1 + g$ denotes an exogenous growth factor and g is the rate of trend growth of labour productivity. The growth of the capital stock, $GK_{t+1} - K_t$, arises from gross investment, I, less capital depreciation, $-\delta K$, i.e. equals net investment, $IN = GK_{t+1} - K_t = I_t - \delta K_t$.

Firms finance investments either by retained earnings, $(\pi - \chi)$ that is profits π less dividend distributions χ, or bank debt, BN. The stock of debt B_t accumulates by the amount of new debt, BN_t, incurred in each period.

$$GB_{t+1} = BN_t + B_t. \tag{5}$$

Whenever new debt is incurred, the firm's debt-asset ratio increases and therewith its risk of bankruptcy. Hence, banks may charge higher interest for firms facing a larger indebtedness in order to be compensate for the higher risk of default of more indebted firms. We account for this mechanism by introducing convex agency cost of debt finance, $m(b)$ with $m'(b) > 0$ and $m''(b) > 0$, which are added to the interest firms have to pay for loans. The agency cost of debt finance depend on the firm's debt asset ratio $b = B_t/K_t$ and are thus firm specific.

The firm's flow of funds equations states

$$IN = (\pi - \chi) + BN \tag{6}$$

Firm maximizes profit

$$\begin{aligned} \pi_t \quad = \quad & (1-\tau^P)\Bigg[Y(K_t, \overline{L}_t, E_t) - J(I_t, K_t) - \sum_j^3 (1+\tau^{SF,j}) w_t^j L_t^j \\ & -(i_t + m_t)B_t - \delta K_t\Bigg]. \end{aligned} \tag{7}$$

Net of tax profits are given by output, Y, less adjustment costs of vestment,[4] $J(I,K)$, less wage costs, $\sum_j^3 (1+\tau^{SF,j}) w^j L^j$, less expenses for debt capital, $(i+m)\,B$, and capital depreciation, δK.

Arbitrage assures that an capital market investment yielding a net of tax return of $r = (1-\tau^i)i$, is equally profitable as an investment in the firm which yields net of tax

[4]Investment incur convex adjustment cost of $J(I,K)$, with $J_I > 0$ and $J_{II} > 0$, per unit of capital installed. Adjustment costs reflect positive but diminishing marginal returns to capital formation and can be interpreted as the costs arising due to a firm's internal reorganization. Steady state adjustment costs are zero.

dividends, $(1-\tau^{Df})\chi$, and net of tax capital gains $(1-\tau^G)\left[GV_{t+1}-V_t-VN_t\right]$.

$$r_tV_t=(1-\tau^D)\chi_t+(1-\tau^G)\left[GV_{t+1}-V_t-VN_t\right]. \tag{8}$$

Variables τ^i, τ^D and τ^G denote taxes on interest income, dividends and capital gains.[5] Solving forward (8) yields an explicit expression for the firm value

$$V_t=\sum_{z=t}^{\infty}\frac{\frac{1-\tau^D}{1-\tau^G}\overline{\chi}_z}{1+\frac{r_z}{1-\tau^G}}\prod_{u=t}^{z+1}\frac{1+g}{1+\frac{r_u}{1-\tau^G}}. \tag{9}$$

The firm value is determined by the discounted sum of all future tax adjusted distributions to the firm owners less equity injections.

Inserting (6) and (7) into (8) yields the firms' maximization problem

$$\begin{aligned}
V_t^e(K_t,B_t) \quad &= \quad \max_{L_t^j,I_t,BN_t}\left[\overline{\chi}_t+\frac{GV^e(K_{t+1},B_{t+1}}{1+\frac{r_{t+1}}{1-\tau^G}}\right] \\
\textit{with} \quad \overline{\chi}_t \quad &= \frac{(1-\tau^P)(1-\tau^D)}{1-\tau^G}\Big[Y(K_t,\overline{L}_t,E_t)-J(I_t,K_t)-\sum_j^3(1+\tau^{SF,j})w_t^jL_t^j \\
&\quad -(i+m)B_t-\delta K_t\Big]+\frac{1-\tau^D}{1-\tau^G}\left[BN_t-I_t-\delta K_t\right] \\
\textit{s.t.} \quad &\quad GK_{t+1}=I_t+(1-\delta)K_t, \\
\textit{and} \quad &\quad GB_{t+1}=BN_t+B_t,
\end{aligned} \tag{10}$$

which is expressed in terms of end of period firm values, $V_t^e=\left(1+\frac{r_t}{1-\tau^G}\right)V_t$. The value function depends on each of the two stock variable capital and debt.

The first order conditions to the firms' maximization problem are

$$\begin{aligned}
&\text{(a)} \quad L_t^j: \quad (1+\tau^{SF,j})w_t^j=F_{L_t^j}, \\
&\text{(b)} \quad I_t: \quad q_{t+1}^e=\left(1+\tfrac{r_{t+1}}{1-\tau^G}\right)\tfrac{1-\tau^D}{1-\tau^G}\left[1+\left(1-\tau^P\right)J_I\right], \\
&\qquad \Rightarrow \quad q_{t+1}=\tfrac{1-\tau^D}{1-\tau^G}\left[1+\left(1-\tau^P\right)J_I\right] \quad \textit{with: } q_{t+1}^f=q_{t+1}^{e,f}/\left(1+\tfrac{r_{t+1}}{1-\tau^{G,f}}\right), \\
&\text{(c)} \quad BN_t: \quad \lambda_{t+1}^e=-\left(1+\tfrac{r_{t+1}}{1-\tau^G}\right)\tfrac{1-\tau^D}{1-\tau^G}, \\
&\qquad \Rightarrow \quad \lambda_{t+1}=-\tfrac{1-\tau^D}{1-\tau^G} \quad \textit{with: } \lambda_{t+1}=\lambda_{t+1}^e/\left(1+\tfrac{r_{t+1}}{1-\tau^G}\right).
\end{aligned} \tag{11}$$

The shadow prices of capital, $q_t^e\equiv\partial V_t^e/\partial K_t$ and debt, $\lambda_t^e\equiv\partial V_t^e/\partial B_t$, determine the change in the value function resulting from an additional unit of capital or debt accumulated.

Following (11a) the optimal demand for each skill type of labour is determined by

[5]Note that distributions of unincorporated firms are only subject to profit taxation, which implies $\tau^{D,N}=0$.

the equality between the marginal product of the respective labour skill type and the corresponding gross of social security contribution wage rate.

Optimality condition (11b) requires that the shadow price of capital equals the incurred cost of an additional investment which consist of tax cost $\left(\frac{1-\tau^D}{1-\tau^G}\right)$ and adjustment cost of $\left(\frac{(1-\tau^D)(1-\tau^P)}{1-\tau^G}\right) J_I^f$.[6]

The third optimality condition (11c) postulates that debt is the preferred source of finance as long as the marginal cost of using debt, i.e. $\left(\frac{1-\tau^D}{1-\tau^G}\right)$, are smaller compared to the change in firm value as determined by λ_{t+1}^e.[7]

Differentiating (10) with respect to the two stock variables capital and debt yields the *envelope conditions*

$$\begin{aligned} \text{(a)} \quad q_t^e &= \tfrac{(1-\tau^D)(1-\tau^P)}{1-\tau^G}\left[F_K - J_K + m'b^2\right] + \tfrac{\tau^P(1-\tau^D)}{1-\tau^G}\delta + \tfrac{q_{t+1}^e}{1+\frac{r_{t+1}}{1-\tau^G}}(1-\delta), \\ \text{(b)} \quad \lambda_t^e &= \tfrac{(1-\tau^D)(1-\tau^P)}{1-\tau^G}\left[-(i+m) - m'b\right] + \tfrac{\lambda_{t+1}^e}{1+\frac{r_{t+1}}{1-\tau^G}}. \end{aligned} \tag{12}$$

Equation (12a) denotes the value of an induced marginal profit, i.e. adding one unit of capital increase the firm value by the marginal product of capital less the increase in adjustment cost plus the reduced marginal agency cost arising from the improved equity base of the firm.

Equation (12b) shows that an additional unit of debt capital has a negative impact on the firm value. The latter comprises of the additional cost of debt finance plus the increase in agency costs due to the higher debt asset ratio.

3.2 Household Sector

The household is modelled as an infinitely lived agent who derives utility from consumption C_t less disutility of work $\phi(l_t^s)$ with l_t^s denoting individual labour supply. The variable $\rho < 1$ indicates the agent's rate of time preference.[8]

$$U_t = u[C_t - \phi(l_t^s)] + \rho U_{t+1} = \sum_{z=t}^{\infty} \rho^{z-t} u[C_z - \phi(l_z^s)]. \tag{13}$$

The agent's inter-temporal budget constraint is given by

$$GA_{t+1} = (1 + r_t A_t + (1-\tau_t^L)(1-\tau_t^{S,H}) w_t l_t^s + X_t - (1+\tau_t^C) C_t. \tag{14}$$

[6] In the absence of taxation, the marginal cost of an additional unit of capital equals one plus adjustment cost J_I. Given that adjustment costs are zero in the steady state, the shadow price of capital is equal to one steady state.

[7] Note, the shadow price of debt is defined as a negative variable.

[8] A high value for ρ indicates an "inpatient"agent, which implies that he or she has a strong preference for current vis-a-vis future consumption. In case of a dynastic interpretation, ρ denotes the weight assigned to future generations.

Household wealth accumulates by means of financial income, $(1+r_t)A_t$, net of tax and social security contribution labour income $(1-\tau^L)(1-\tau_t^{S,H})w_t l_t^s$, transfer payments X_t, and less gross consumption expenditures $(1+\tau_t^C)C_t$. The variable $G = 1+g$ reflects the growth factor in the economy and $r_t = (1-\tau_t^i)i_t$ denotes the net of tax interest earned on financial assets A_t. τ_t^i, τ_t^L and τ_t^C denote the tax rates on interest income, labour income and consumption, respectively.

The inter-temporal optimization problem of the household is solved by dynamic programming. The value function given in (15) is maximized subject to the household's inter-temporal budget constraint (14).

$$\max_{l_t^s, C_t} \qquad U(A_t) = \left\{ u\left[C_t - \phi(l_t^s)\right] + \rho U(A_{t+1}) \quad s.t. \quad (14) \right\}. \tag{15}$$

The first order conditions (16a) and (16b) determine optimal labour supply and optimal consumption.

$$\begin{aligned} \text{(a)} \quad \tfrac{\partial U(A_t)}{\partial l_t^s}: \quad \varphi'\left(l_t^s\right) &= \tfrac{\left(1-\tau_t^L\right)\left(1-\tau_t^{S,H}\right)}{\left(1+\tau^{C_t}\right)} w_t, \\ \text{(b)} \quad \tfrac{\partial U(A_t)}{\partial C_t}: \quad u'\left(C_t\right) &= \kappa_{t+1} \tfrac{\rho(1+\tau_t^C)}{1+g}, \\ => \qquad \kappa_{t+1} &= \tfrac{(1+g)}{\rho} \tfrac{u'(C_t)}{(1+\tau_t^C)}. \end{aligned} \tag{16}$$

Optimal labour supply is determined by the point where the marginal disutility from supplying labour is equal to the marginal, net of tax and net of social security wage income expressed in purchasing power terms, i.e. adjusted by the consumption tax rate τ_t^C. Applying a *CES* function for the disutility of work

$$\varphi(l_t^s) \equiv \frac{\gamma^{-1/\varepsilon}}{1+\frac{1}{\varepsilon}} l_t^{1+\frac{1}{\varepsilon}}, \quad \varphi'(l_t^s) = \left(\frac{l_t}{\gamma}\right)^{\frac{1}{\varepsilon}}$$

optimal labour supply can be written as a function of net wage income and the labour supply elasticity ε

$$l_t^s = \gamma \left[\frac{(1-\tau_t^L)(1-\tau_t^{S,H})}{1+\tau_t^C} w_t \right]^{\varepsilon}. \tag{17}$$

The variable γ denotes a scaling parameter. Combining the envelope condition[9]

$$\frac{\partial U(A_{t+1})}{\partial A_{t+1}}: \quad \kappa_{t+1} = \frac{\rho(1+r_{t+1})}{1+g} \kappa_{t+2}. \tag{18}$$

with optimality condition (16b) yields the household's optimal inter-temporal consumption pattern, i.e. the *Euler Equation*. The latter determines the marginal rate of sub-

[9]The shadow price $\kappa \equiv \frac{\partial U(A_t)}{\partial A_t}$ defines the marginal increase in the household's utility arising from one additional unit of assets endowment.

stitution between present and future consumption and thereby the household' s optimal inter-temporal savings pattern

$$\frac{u'\left(C_t\right)}{u'\left(C_{t+1}\right)} = \frac{\rho(1+r_{t+1})}{1+g}\frac{1+\tau_t^C}{1+\tau_{t+1}^C}. \tag{19}$$

Solving forward the household's inter-temporal budget constraint (14) yields

$$(1+r_t)A_t = \sum_{z=t}^{\infty}(1+\tau_z^C)C_z - (1-\tau_z^L)(1-\tau_z^{S,H})w_z l_z^s - X_z \prod_{u=t+1}^{z}\frac{1+g}{1+r_u}. \tag{20}$$

The household's maximal level of consumption is limited by the amount of financial capital, $(1+r_t)A_t$, and human capital, H_t, which, taken together, constitute the household's total wealth, TW_t

$$\begin{aligned} \sum_{z=t}^{\infty}(1+\tau_z^C)C_z \prod_{u=t+1}^{z}\frac{1+g}{1+r_u} &= (1+r_t)A_t \\ + \underbrace{\sum_{z=t}^{\infty}(1-\tau_z^L)(1-\tau_z^{S,H})w_z l_z^s + X_z \prod_{u=t+1}^{z}\frac{1+g}{1+r_u}}_{H_t} &= TW_t. \end{aligned} \tag{21}$$

Human capital is defined as the present value of all future net of tax and social security contribution labour income plus transfers.

Accounting for (20) and applying a *CES* utility function of the form $u(C_t) = \frac{1}{1-1/\sigma}C_t^{1-1/\sigma}$ with σ denoting the inter-temporal elasticity of substitution, the explicit expression for optimal consumption states

$$(1+\tau_t^C)C_t = \underbrace{\frac{(1+\tau_t^C)^{1-\sigma}}{\sum_{z=t}^{\infty}(1+\tau_z^C)^{1-\sigma}\prod_{u=t+1}^{z}\rho^{\sigma}\left(\frac{1+g}{1+r_u}\right)^{1-\sigma}}}_{mpc_t} TW_t = mpc_t TW_t, \tag{22}$$

with

$$TW_t = (1+r_t)A_t + \underbrace{\sum_{z=t}^{\infty}\{(1-\tau_z^L)(1-\tau_z^{S,H})w_z l_z^s + X_z - \prod_{u=t+1}^{z}\frac{1+g}{1+r_u}}_{H_t}. \tag{23}$$

mpc_t denotes the marginal propensity to consume.

Comparative Statics Analysis

In order to evaluate the impact of the different types of taxes and the social security

contributions on the household's optimal labour supply, we totally differentiate (17a)

$$dl_t^s = \gamma\varepsilon \left[\frac{(1-\tau_t^L)(1-\tau_t^{S,H})}{1+\tau_t^C} w_t\right]^{\varepsilon} \tag{24}$$

$$\left(-\frac{1}{1-\tau_t^L} d\tau_t^L - \frac{1}{1-\tau_t^{S,H}} d\tau_t^{S,H} - \frac{1}{1+\tau_t^C} d\tau_t^C + \frac{1}{w_t} dw_t\right). \tag{25}$$

Following (24), an increase in the labour tax rate, τ^L, the social security contribution $\tau^{S,H}$, and the VAT τ^C, have a negative effect on labour supply while an increase in the gross wage w_t rises labour supply.

As outlined before, most frequent policy instruments applied for fiscal devaluation is a reduction in the social security contributions paid by firms accompanied by an increase in the VAT rate in order to assure a balanced government budget. Accordingly, the increase in the value added tax features a negative impact on labour supply, i.e.

$$\frac{dl_t^s}{d\tau_t^C} = \gamma\varepsilon \left[\frac{(1-\tau_t^L)(1-\tau_t^{S,H})}{1+\tau_t^C} w_t\right]^{\varepsilon} \frac{1}{+\tau_t^C} < 0. \tag{26}$$

In addition the increase in the VAT rate will affect the household's optimal consumption pattern and thus savings. Differentiating (19) with respect to the VAT rate yields

$$\frac{d\left(\frac{u'(C_t)}{u'(C_{t+1})}\right)}{d\tau_t^C} = \frac{\rho(1+r_{t+1})}{1+g} \frac{1}{1+\tau_{t+1}^C} > 0. \tag{27}$$

$$\frac{d\left(\frac{u'(C_t)}{u'(C_{t+1})}\right)}{d\tau_{t+1}^C} = -\frac{\rho(1+r_{t+1})}{1+g} \frac{1+\tau_t^C}{\left(1+\tau_{t+1}^C\right)^2} < 0. \tag{28}$$

An increase in the current VAT rate leads to a substitution of current consumption for future consumption, which implies a rise in savings. The opposite is true, if the future VAT rate is increased, i.e. the household substitutes future consumption for current consumption and as a consequence savings fall.

4 The German Experience of Fiscal Devaluation

4.1 The German Fiscal Devaluation

The fiscal devaluation carried out in Germany was initiated by the coalition agreement between the Christian Democratic parties (CDU and CSU) and the Social Democratic party (SPD) in 2005. In this agreement the parties decided that the employer's contribution to the unemployment insurance is reduced from 6.5% to 4.5% (which were later on reduced to even 3.0% in 2010). In addition it was decided that the social security

contribution to health insurance are no longer split equally between employers and employees, but employees have to bare an 0.9 percentage point larger fraction compared to employers. Thus, the social security contributions of employers for health insurance of employed workers is computed by subtracting 0.9 percentage points form the total cost before the the remaining value is split into half. The reaming cost are born by employees. Finally, in 2013 the social security contribution to the public pension system, which is split equally between the employer and the employees is reduced by 1 percentage point. As a consequence of this different reforms, the employer's total contribution to the social security system decreased from 21.025% in 2005 to 19.275% in 2013. For employees, the reduction in the social security contribution amounts to 0.85 percentage points from initially 21.025% in 2005 to 20.175% in 2013.

In order to finance the reduction in the the employer's contribution to the social security system, the standard VAT rate is increased from 16 to 19% with the beginning of January the 1^{st}, 2007 while the reduced VAT rate stays constant at 7%. Accordingly, the average VAT tax burden for households increases from 10.72% in 2006 to 12.73% in 2007.

4.2 Quantitative Impact of the Fiscal Devaluation

In order to analyse the effects of the different reform elements we quantify in Table 1 the effects arising from the reduction in the social security contribution (SSC) on firm and household level. The reduction in the SSC paid by firms reduces average labour cost by 0.25 percent and thus stimulates labour supply by 0.36 percent. The reduction in the SSC is associated with an increase in the factor productivity of labour by 0.08 percent. The increased labour demand resulting from the reduction in the SSC leads to an increase in long run wage rates, which explains that the decline in long-run average labour cost is with 0.1 percent significantly smaller than the respective short-run change. The increased labour demand enhances output by 0.3 percent in the long-run which generates additional income and an increase in consumption.

In terms of revenue, the reduction in the SSC generates a loss of about 14.7 bn. Euro in the short-run which is, due to the increasing labour demand reduced to 14.3 bn. Euro in the long-run. The enhanced labour demand features a positive impact on revenues due to several channels. The higher long-run employment level generates directly revenues by additional social security contribution paid by employers (+3.81 bn Euro) and increased labour tax revenues (4.27 bn. Euro). Given that additional income is also spent on consumption, indirect revenues effects arising from the VAT amount to 0.5 bn. Euro. Thus, the total long-run effect on the government budget amounts to 5.3 bn. Euro.

One further indirect effect emerging from the reduction in the firm's SSC is the substitution between foreign and domestic goods consumed. The reduction in the firm's SSC

has the same impact as a reduction in marginal costs, which, under perfect competition, implies a reduction of domestic goods prices. As a consequence, the trade balance improves by about 6 percent in the short-run, and a level effect of about 0.7 percent pertains even in the long-run.

Table 1: Reduction in the Social Security Contribution on Firm and HH Level

Reduction of SSC	1.75%-Pts Firm Level		0.85%-Pts HH Level	
	Short-Run	Long-Run	Short-Run	Long-Run
Av. Labour Costs	-0.254	-0.095	-0.187	-0.069
Labour Demand	0.361	0.413	0.265	0.300
Productivity	0.081	0.103	0.056	0.076
Output (GDP)	0.19 (4.43)[1)]	0.34 (8.15)[1)]	0.14 (3.26)[1)]	0.25 (6.00)[1)]
Revenue SSC Firms	-6.88 (-14.7)[1)]	-6.69 (-14.3)[1)]	0.08 (0.17)[1)]	0.23 (0.49)[1)]
Revenue SSC HH	1.58 (3.36)[1)]	1.79 (3.81)[1)]	-3.98 (-8.47)[1)]	-3.82 (-8.15)[1)]
Labour Tax Rev.	2.68 (4.27)[1)]	3.04 (4.84)[1)]	1.97 (3.13)[1)]	2.23 (3.55)[1)]
Consumpt. Tax Rev.	0.30 (0.47)[1)]	0.44 (0.70)[1)]	0.22 (0.35)[1)]	0.33 (0.51)[1)]
Government Budget	-0.62 (-5.27)[1)]	-0.40 (-3.53)[1)]	-0.46 (-3.86)[1)]	-0.29 (-2.58)[1)]
Trade Balance	6.221	0.675	4.57	0.496
Welfare	0.245[2)] / 0.154[3)]		0.180[2)] / 0.110[3)]	
All changes in %; [1)]in billion Euro; [2)] in % of HH wealth; [2)] in % of GDP;				

Source: Own Calculations

The reduction in the SSC paid by households can be seen as a rightward movement of the labour supply curve. Accordingly, the new equilibrium is characterized by a higher level of employment and a lower wage rate. As reported in Table1, long-run employment increases by 0.3 percent and average wage cost decrease slightly by 0.07 percent. Output rises by 0.25 percent. The expansionary effect following the reduction in the household's SSC reduces the cost of initially 8.15 bn. Euro to about 2.6 bn. Euro. The main counteracting force which compensates the loss in household's SSC comes through increased revenues from labour taxation.

Table 2 reports the effect arising from the joint reduction in the firm's and the household's SSC. In qualitative terms, the results are identical to the ones discussed in Table 1 but larger in magnitude.

Further, the results from the increase in the VAT are shown in Table 2, as well. The increase in the value added tax resembles a reduction in the household's real wage and thus the household's labour supply becomes more respective. The larger wage rate required by the household as a compensation for the increase in the VAT, implies an boost in the average labour cost for firms (+0.12 percent in the long-run) and thus leads to a decrease in labour demand. The latter declines by 0.5 percent in the long-run and implies a decline in output by 0.4 percent in addition.

Table 2: Reduction in the SSC and Increase in VAT

	2.6%-Pts Reduction in SSC		2.0%-Pts Increase in VAT	
	Short-Run	Long-Run	Short-Run	Long-Run
Av. Labour Costs	-0.440	-0.165	0.314	0.117
Labour Demand	0.628	0.711	-0.444	-0.503
Productivity	0.140	0.180	-0.100	-0.127
Output (GDP)	0.32 (7.69)[1)]	0.60 (14.2)[1)]	-0.23 (-5.48)[1)]	-0.42 (-10.0)[1)]
Revenue SSC Firms	-6.81 (-14.5)[1)]	-6.47 (-13.8)[1)]	-0.13 (-0.28)[1)]	-0.39 (-0.82)[1)]
Revenue SSC HH	-2.46 (-5.24)[1)]	-2.10 (-4.49)[1)]	-0.13 (-0.28)[1)]	-0.38 (-0.83)[1)]
Labour Tax Rev.	4.68 (7.45)[1)]	5.31 (8.45)[1)]	-0.22 (-0.36)[1)]	-0.66 (-1.05)[1)]
Consumpt. Tax Rev.	0.53 (0.82)[1)]	0.77 (1.21)[1)]	18.3 (28.7)[1)]	18.1 (28.4)[1)]
Government Budget	-1.09 (-9.23)[1)]	-0.71 (-6.22)[1)]	3.02 (26.2)[1)]	2.74 (23.9)[1)]
Trade Balance	10.81	1.171	x.xx	-0.835
Welfare	0.424[2)] / 0.267[3)]		-0.304[2)] /-0.192[3)]	

All changes in %; [1)]in billion Euro; [2)] in % of HH wealth; [2)] in % of GDP;

Source: Own Calculations

Nevertheless, the increase in the effective VAT rate is sufficiently high to generate a positive amount of revenue despite the negative revenue effects associated with the economic contraction arising from the increase in the VAT. The figures presented in Table 2 show, that the long-run revenue effect of the VAT increase amounts to 28.4 bn Euro while the government budget rises by roughly 24 bn. Euro. Accordingly, the loss due to the economic contraction add up to about 4.4 bn Euro.

Even though the increase in the VAT has no direct impact on the substitutability between domestic and foreign goods - since both types of goods are equally burdened by the domestic VAT - the simulation results show a slight deterioration of the trade balance by 0.8 percent in the long run. The outcome is due to the indirect effect of the VAT on average labour cost which increases the relative price of domestic vis-a-vis foreign goods.

Table 3 presents the quantitative impact resulting from the joint consideration of the different reform elements. In aggregate, the expansionary effect resulting from the reduction in the SSC on the firm and household level dominates only slightly the contracting effect emerging from the higher VAT. In total, long-run output rises by just 0.17 percent which is the result of a small increase in labour demand (+0.2 percent) originating from the reduction in the firm's and household's SSC, i.e. the lower average labour cost. Factor productivity of labour is in aggregate positively affected by the reform an rises by 0.05 percent.

In terms of revenue, the reform rises the government budget by 18 bn. Euro, which are mainly the outcome of the additional consumption and labour tax revenue of almost 30 and 7.4 bn. Euro less the reduction in firm and household SSC of 14.6 and 5.3 bn. Euro. Beside the slightly positive growth stimulus and the significant rise in government

revenues, the reform additionally features a positive impact on the trade balance which improves by about 3.1 and 0.34 percent in the short-run and long-run, respectively.

Table 3: Reduction in the SSC and Increase in VAT

	Full Reform Scenario		Revenue Neutral Alt.	
	Short-Run	Long-Run	Short-Run	Long-Run
Av. Labour Costs	-0.127	-0.047	-0.329	-0.123
Labour Demand	0.180	0.204	0.469	0.531
Fact. Productivity	0.040	0.052	0.104	0.134
Output (GDP)	0.09 (2.22)[1)]	0.17 (4.07)[1)]	0.24 (5.75)[1)]	0.45 (10.6)[1)]
Revenue SSC Firms	-6.93 (-14.8)[1)]	-6.83 (-14.6)[1)]	-6.85 (-14.6)[1)]	-6.60 (-14.1)[1)]
Revenue SSC HH	-2.58 (-5.51)[1)]	-2.48 (-5.30)[1)]	-2.50 (-5.34)[1)]	-2.24 (-4.78)[1)]
Labour Tax Rev.	4.45 (7.09)[1)]	4.63 (7.38)[1)]	4.60 (7.32)[1)]	5.07 (8.07)[1)]
Consumpt. Tax Rev.	18.9 (29.7)[1)]	19.0 (29.8)[1)]	7.04 (11.0)[1)]	7.24 (11.3)[1)]
Government Budget	1.95 (17.1)[1)]	2.06 (18.0)[1)]	0.01 (0.09)[1)]	0.27 (2.35)[1)]
Trade Balance	3.106	0.338	8.067	0.8750
Welfare	0.123[2)] / 0.077[3)]		0.317[2)] / 0.200[3)]	
All changes in %; [1)]in billion Euro; [2)] in % of HH wealth; [2)] in % of GDP;				

Source: Own Calculations

A by for more positive picture arises, if instead a revenue-neutral reform scenario is considered. Given the excess revenues collected under the higher VAT, a much smaller increase in the VAT would be sufficient to counteract the revenue shortfall from the reduction in the firms' and households' SSC. Under the revenue neutral reform alternative, the reduction in average labour cost amounts to 0.33 percent in the short run which rises the respective factor productivity by 0.1 percent. As a consequence employment increase by 0.47 percent and resulting output growth amounts to 0.24 percent. In the long-run, the reduction in the average labour costs and the increase in factor productivity are attenuated due to the general equilibrium repercussions (in particular the increase in labour demand). long-run employment and output amount to 0.53 and 0.45 percent, respectively. By construction, the reform alternative is revenue neutral, i.e. the short-run impact on government budget is zero. Due to the positive growth effect initiated by the reform alternative, a small positive impact occurs on the government budget (+2.35 bn Euro).

Finally, the revenue-neutral reform alternative shows a significantly larger impact on the trade balance which improves by around 8 and almost 0.9 percent in the short- and long-run, respectively.

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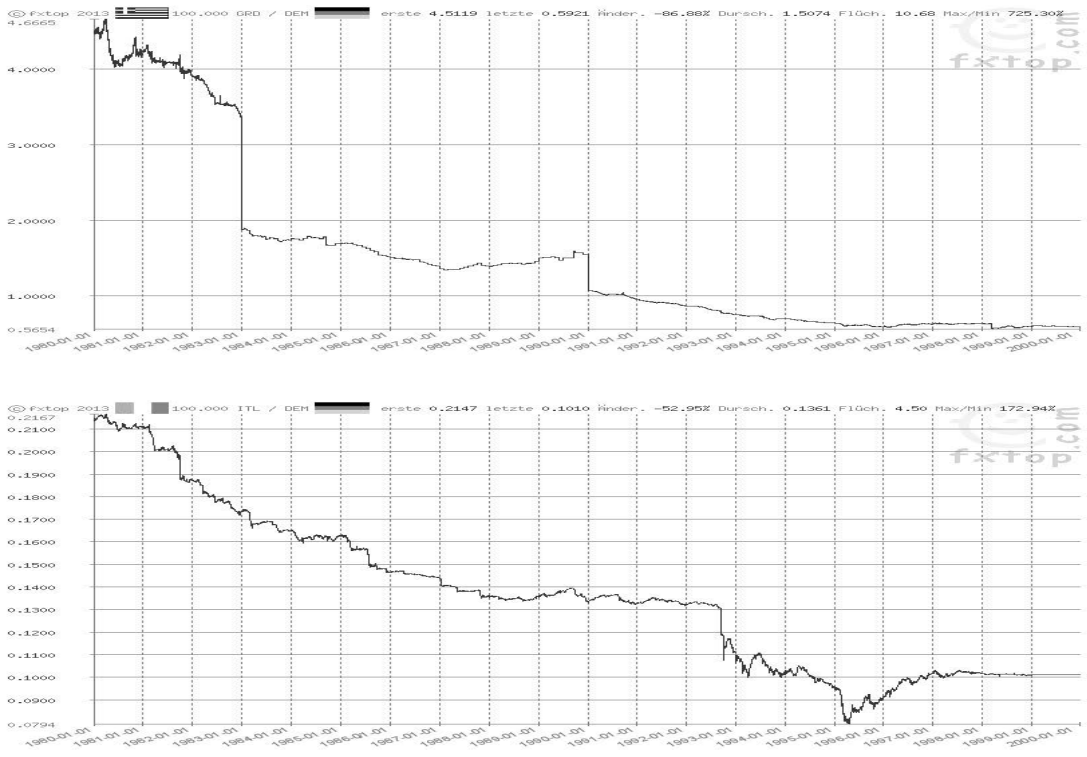

Figure 1: Historical exchange Rate between the former Greek Drachma (GRM) and the former Deutsch Mark (DEM) (upper graph) and between the the former Italian Lira (ITL) and the former Deutsch Mark (DEM) (lower graph). Source: fxtop.com.

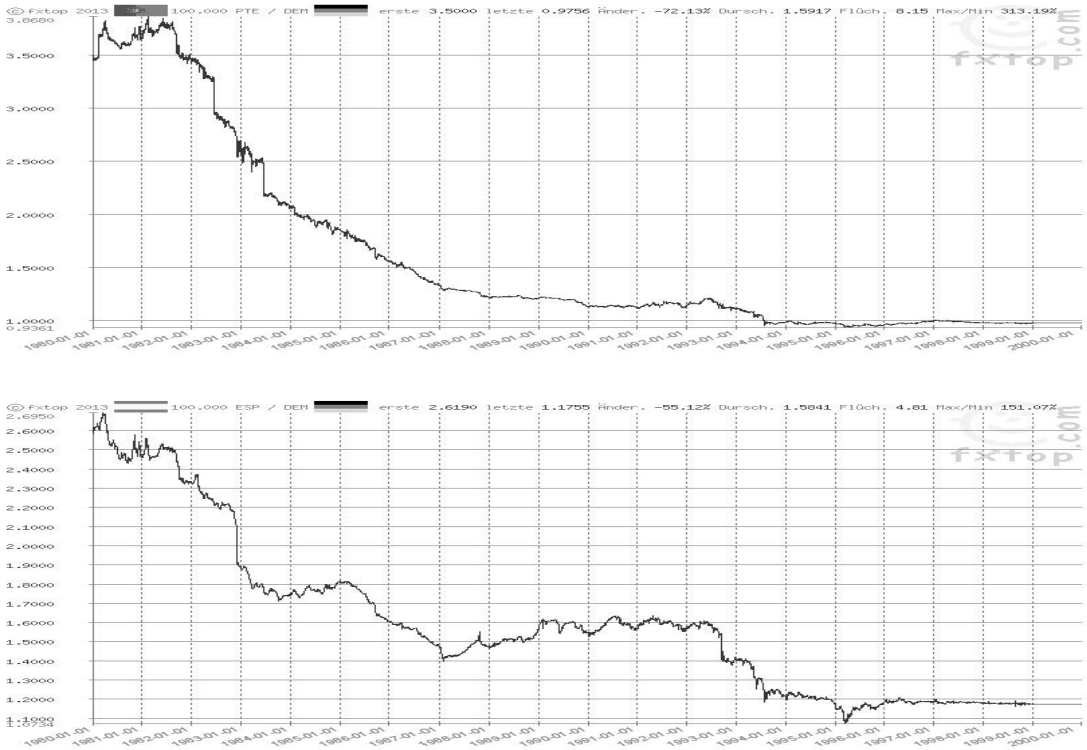

Figure 2: Historical exchange Rate between the former Portuguese Escudo (PTE) and the former Deutsch Mark (DEM) (upper graph) and between the the former Spanish Peseta (ESP) and the former Deutsch Mark (DEM) (lower graph). Source: fxtop.com.