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Is fiscal devaluation welfare enhancing? A model-based analysis

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Is fiscal devaluation welfare enhancing?
A model-based analysis

Abstract:

Large trade imbalances have emerged as major policy challenges for the euro area within the last decade. As fiscal policy is the major macroeconomic policy instrument left with the individual member countries of EMU, fiscal devaluation is a highly debated policy tool to mimic the effects of an external devaluation by implementing a budgetary-neutral tax shift from direct to indirect taxes. This paper uses a two-region two-sector DSGE model with nominal wage and price rigidities to analyse the welfare effects of fiscal devaluation understood as tax shift from social security contributions for employers to value-added tax in a small open economy in monetary union. This paper finds that fiscal devaluation can stabilise excessive trade balance fluctuations but implies welfare losses for the average household. The results are robust to several sensitivity checks.

JEL classification: E62, F32, F41

Keywords: fiscal devaluation, external imbalances, monetary union, welfare

1. Introduction

Since the establishment of the European Monetary Union (EMU) in 1999, the issue of growing and persistent external imbalances among several EMU countries has attracted a lot of interest. Due to the elimination of exchange rate risk and the disappearance of country risk premia, capital flowed into the periphery countries and led to demand booms with concomitant increases in domestic prices and labour costs. The subsequent competitiveness losses resulted in growing trade balance deficits. In consequence of the loss of both autonomous monetary policy and the possibility of nominal exchange rate (external) devaluation, it is of particular interest to analyse alternative stabilisation tools in order to regain price competitiveness. As fiscal policy is the major macroeconomic policy instrument left with the individual member countries of EMU, this poses new challenges for the appropriate design of tax and expenditure policies.

An alternative to nominal exchange rate devaluation might be a fiscal devaluation, which mimics the effects of an external devaluation by implementing a budgetary-neutral tax shift from direct to indirect taxes. In particular, taxes are shifted from social security contributions (SSC) for employers to value-added tax (VAT) in order to make exports cheaper and imports more expensive. The effect of such an internal devaluation is based on the assumption of rigid wages: if a reduction in employers' SSC rate is not immediately accompanied by higher nominal wages, firms face lower labour costs, which lead to lower prices and higher exports (de Mooij and Keen 2012). In the long run, however, labour unions could push through higher wages in order to compensate for higher consumption expenditures.

The existing literature on fiscal devaluation focuses on the reduction of excessive and persistent trade balance deficits within the EMU by analysing a revenue-neutral tax shift, implemented as an exogenous shock (e.g. Engler et al. 2014; Lipinska and von Thadden 2012; Langot et al. 2012). While Lipinska and von Thadden (2012) examine a tax shift from labour income tax to VAT, Engler et al. (2014) use a two-region framework (northern and southern European countries) and analyse a reduction in employers' SSC accompanied by a rise in VAT as a quasi-permanent tax shift. They find that a fiscal devaluation in southern European countries increases output by around 1 percent and improves the trade balance by 0.2 percent of GDP. Stähler and Thomas (2012) use a two-country monetary union model calibrated to Spain to simulate a number of policy measures including fiscal devaluation. They find that a

permanent increase in VAT such that the primary deficit-to-GDP ratio decreases by one percentage point ex ante and a corresponding decrease in employers' SSC can improve Spain's competitiveness significantly in the long run. Langot et al. (2012) provide an optimal tax scheme for a fiscal devaluation that is welfare enhancing for households. The paper closest to ours is Hohberger et al. (2014). They focus their analysis rather on budgetary-neutral government expenditure shifts between tradable and non-tradable goods, but use fiscal devaluation, i.e. a tax shift between labour and consumption tax, as benchmark scenario. Commonly, the existing literature on fiscal devaluation focuses primarily on regaining international competitiveness but neglect associated welfare effects.

This paper builds on the recent literature on fiscal devaluation (e.g., Lipinska and von Thadden 2012; Langot et al. 2012; Stähler and Thomas 2012; Engler et al. 2014; Hohberger et al. 2014) and analyses a revenue-neutral tax shift from employers' SSC to consumption tax (VAT) in order to reduce excessive external fluctuations caused by supply and demand shocks. Additionally, this paper broadens the analysis in several dimensions by (i) modelling fiscal devaluation as a simple instrument rule that adjusts taxes in response to external fluctuations, (ii) examining the welfare effects of fiscal devaluation in the context of a standard assessment of household welfare and (iii) providing sensitivity results for changes in the model structure, including the analysis of welfare effects for fiscal devaluation as an exogenous shock rather than a policy rule.

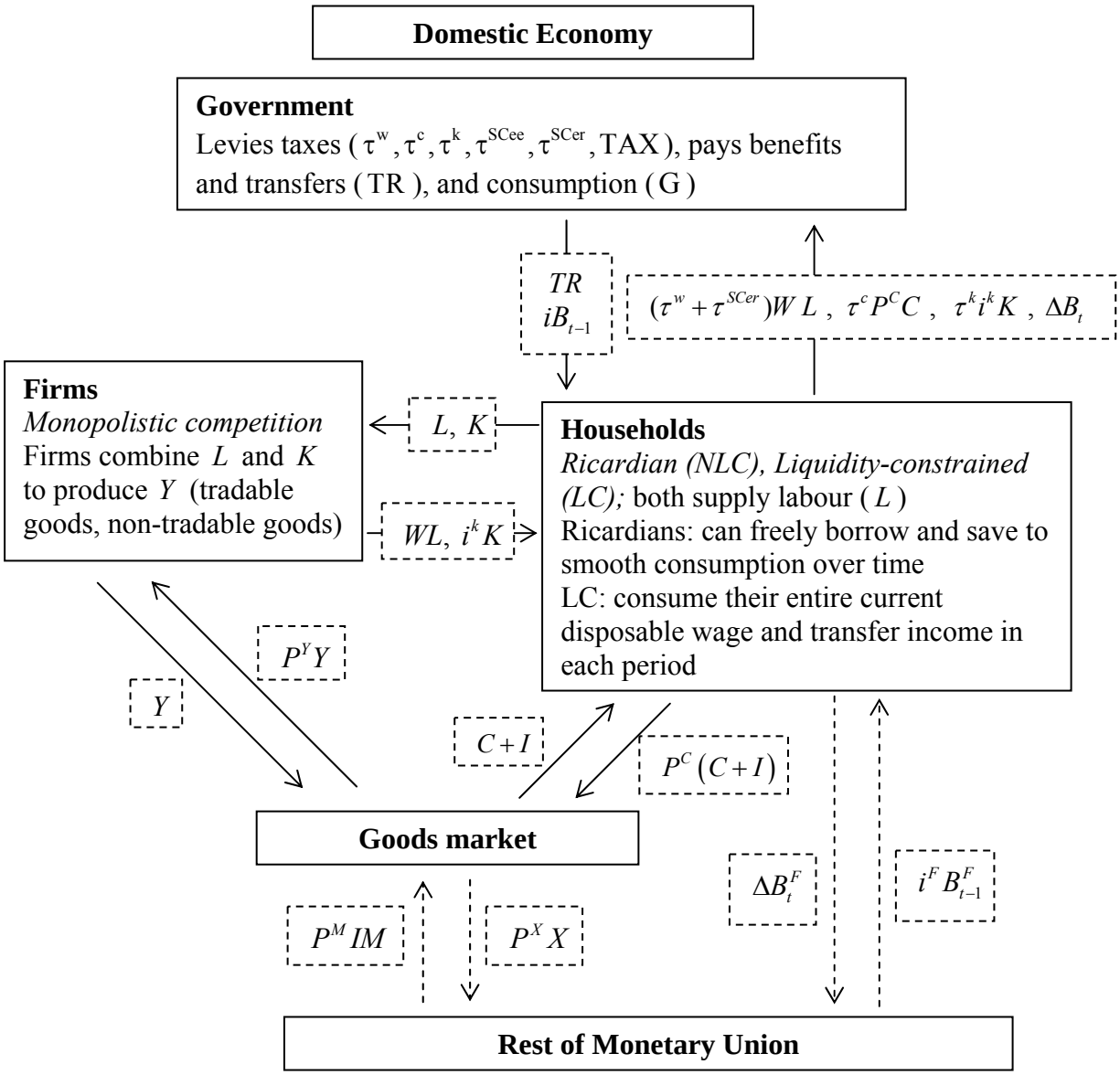
The analytical framework is a two-sector New Keynesian DSGE model of monetary union as in to Hohberger et al. (2014) and follows the small open economy approach by Galí and Monacelli (2008). The focus on a small member country of monetary union excludes feedback effects from domestic events to monetary policy and the rest of monetary union and is of particular interest for analysing stabilisation tools since small countries tend to be more exposed to asymmetric shocks.

The paper finds that fiscal devaluation, understood as a tax shift from employers' SSC to VAT, can stabilise excessive fluctuations in the trade balance, but induces welfare losses for the average household. More precisely, liquidity-constrained households that do not have access to financial markets experience higher welfare losses than those households (Ricardian) that are able to smooth consumption over time. Our results are robust to several sensitivity checks.

2. Model

The model is based on Hohberger et al. (2014) who analyse the potential of sectoral reallocation of government expenditures between tradable and non-tradable goods to stabilise external fluctuations in monetary union. They extend the model by Galí and Monacelli (2008) by a non-tradable goods sector, introduce physical capital and include additional frictions (wage stickiness, financial frictions, and capital adjustment costs). Figure 1 summarises the model structure.

Figure 1: Model structure.



We augment this model by adding social contribution costs for employers and employees as well as lump-sum and capital taxes as alternative budget closures. The model includes monopolistic competition in goods and labour markets, nominal price and wage stickiness, liquidity constraints, capital and labour as production factors, and a set of fiscal instrument rules in order to analyse the impact of fiscal devaluation on domestic activity and household welfare. Households are either intertemporal optimising consumers (NLC) that can freely borrow and save to smooth consumption over time or liquidity-constrained (LC) households without access to financial markets. They consume their entire current disposable wage in each period. We depart from the assumption of complete risk-sharing as in Galí and Monacelli (2008) and introduce a debt-dependent country risk premium (Schmitt-Grohé and Uribe 2003) as external closure. Goods markets are imperfectly integrated across borders in the sense that there is home bias in the demand for goods. Labour is immobile between countries. The rest of monetary union (RoMU) variables and monetary policy are exogenously given from the perspective of the small economy. A detailed description of the model can be found in Hohberger et al. (2014).

Households

Both types of households maximise their utility[1] given their respective budget constraint. For NLC households, who are a fraction (1-*slc*) of the population, the intertemporal budget constraint is:

$$\begin{aligned}&(1-\tau_t^w-\tau_t^{SCee})W_t^i L_t^i+(1+i_{t-1})B_{t-1}+\left(1+i_{t-1}^*-\omega\frac{B_{H,t-1}^*}{4P_{t-1}^Y Y_{t-1}}+\varepsilon_t^r\right)B_{t-1}^*+TR_t+(1-\tau_t^k)i_t^k K_{t-1}^i \\ &+\tau_t^k\delta P_t^C K_{t-1}^i+PR_t=(1+\tau_t^c)P_t^C C_t^{NLC}+P_t^C I_t^i+B_t+B_{H,t}^*+\gamma_w/2(\pi_t^{w,i})^2 P_t^C L_t+TAX_t\end{aligned} \tag{1}$$

The revenue side includes the labour tax and social contribution costs adjusted net nominal wage income $(1-\tau_t^w-\tau_t^{SCee})W_t^i L_t^i$, the payment on maturing one-period domestic government bonds B_{t-1} including interest i_{t-1}, the repayment of one-period net foreign assets $B_{H,t-1}^*$ including interest, which is the sum of the foreign rate i_{t-1}^*, the endogenous part of the risk premium $-\omega B_{H,t-1}^*/(4P_{t-1}^Y Y_{t-1})$ and the exogenous component ε_t^r, lump-sum transfers from the

[1] A detailed description of household welfare will be discussed in section 4.

government TR_t, the return to capital $(1-\tau_t^k)i_t^k K_{t-1}^i + \tau_t^k \delta P_t^C K_{t-1}^i$ net of capital taxes τ_t^k and depreciation allowances $\tau_t^k \delta$, where $K_t^i \equiv K_{T,t}^i + K_{NT,t}^i$, and profit income PR_t from firm ownership. The expenditure side combines nominal consumption $P_t^C C_t^{NLC}$ taxed at rate τ_t^c, where P_t^C is the consumer price index (CPI), nominal investment in the tradable and non-tradable sector $P_t^C I_t^i$, where $I_t^i \equiv I_{T,t}^i + I_{NT,t}^i$, financial investment in domestic bonds and (net) foreign assets, and quadratic costs γ_w of wage adjustment ($\pi_t^{w,i} \equiv W_t^i / W_{t-1}^i - 1$). The introduction of lump-sum tax TAX_t as a non-distortionary tax becomes crucial when discussing alternative budget closures.

The period budget constraint of LC households, constituting the share *slc* of the population, is:

$$(1-\tau_t^w - \tau_t^{SCee})W_t^i L_t^i + TR_t^{LC} = (1+\tau_t^c)P_t^C C_t^{LC} + \gamma_w / 2(\pi_t^{w,i})^2 P_t^C L_t^{LC} \tag{2}$$

The per-capita level of aggregate consumption is the weighted average of NLC and LC consumption:

$$C_t \equiv (1-slc)C_t^{NLC} + slc C_t^{LC} \tag{3}$$

Private demand combines domestically produced tradable ($C_{TH,t}^i, I_{TH,t}^i$), non-tradable ($C_{NT,t}^i, I_{NT,t}^i$) and imported ($C_{TF,t}^i, I_{TF,t}^i$) goods. Assuming the same trade price elasticity for consumption and investment demand, we can aggregate $Z_t \in (C_t^{NLC}, C_t^{LC}, I_t)$ and define Z_t as a CES aggregate of tradable ($Z_{T,t}^i$) and non-tradable goods ($Z_{NT,t}^i$):

$$Z_t = \left[(\phi)^{\frac{1}{\psi}} (Z_{T,t})^{\frac{\psi-1}{\psi}} + (1-\phi)^{\frac{1}{\psi}} (Z_{NT,t})^{\frac{\psi-1}{\psi}} \right]^{\frac{\psi}{\psi-1}} \tag{4}$$

where ϕ and ψ is the share of tradable goods and the elasticity of substitution between tradable and non-tradable goods, respectively. $Z_{T,t}$ is a composite index of domestically produced tradable goods ($Z_{TH,t}$) and imported goods ($Z_{TF,t}$) defined by:

$$Z_{T,t} = \left[(h)^{\frac{1}{\eta}} (Z_{TH,t})^{\frac{\eta-1}{\eta}} + (1-h)^{\frac{1}{\eta}} (Z_{TF,t})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{5}$$

where h represents the steady state home bias and η indicates the elasticity of substitution between domestically produced goods and imports.

The domestic consumer price index (P_t^C) is given by:

$$P_t^C = \left[(\phi)(P_{T,t})^{1-\psi} + (1-\phi)(P_{NT,t})^{1-\psi} \right]^{\frac{1}{1-\psi}} \tag{6}$$

where the domestic country price index for tradable goods ($P_{T,t}$) has the following form:

$$P_{T,t} = \left[(h)(P_{TH,t})^{1-\eta} + (1-h)(P_{TF,t})^{1-\eta} \right]^{\frac{1}{1-\eta}} \tag{7}$$

Households supply labour services to both tradable and non-tradable goods sectors. The labour services are distributed equally across NLC and LC households, and specialised labour unions represent the different types of labour services *i* in the wage setting. The wage setting is subject to quadratic adjustment costs, which provide an incentive to smooth the wage adjustment and lead to nominal wage stickiness. Since we assume identical wages W_t^i for both sectors, the optimisation problem of the labour union representing the labour service *i* is:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(-\frac{\kappa}{1+\varphi}(L_t^i)^{1+\varphi} + \lambda_t^i (1-\tau_t^w - \tau_t^{SCee}) \frac{W_t^i}{P_t^C} L_t^i - \lambda_t^i \frac{\gamma_w}{2} (\pi_t^{w,i})^2 \frac{P_{TH,t}}{P_t^C} L_t \right) \tag{8}$$

The optimisation problem is symmetric across unions *i*, which implies identical wages ($W_t^i = W_t$) and labour demand ($L_t^i = L_t$) across households. Hence, the aggregate wage setting equation is:

$$\begin{aligned} &(1-\tau_t^w - \tau_t^{SCee}) \frac{W_t}{P_t^C} = \\ &\frac{\theta}{\theta-1} \frac{\kappa L_t^{\varphi}}{\lambda_t^{tot}} - \frac{\gamma_w}{\theta-1} \frac{W_t}{W_{t-1}} \frac{P_{TH,t}}{P_t^C} \pi_t^w + \frac{\gamma_w}{\theta-1} \beta E_t \left(\frac{\lambda_{t+1}^{tot}}{\lambda_t^{tot}} \frac{W_{t+1}}{W_t} \frac{P_{TH,t+1}}{P_{t+1}^C} \frac{L_{t+1}}{L_t} \pi_{t+1}^w \right) \end{aligned} \tag{9}$$

where the gross wage claims increase with increasing labour taxation (τ_t^w) and social contribution costs (τ_t^{SCee}) for given levels of employment.

Firms

The economy consists of a continuum of monopolistically competitive firms in the tradable and non-tradable sector, are owned by NLC households and produce a differentiated good $Y_{s,t}^{j}$ with capital $K_{s,t-1}^{j}$, labour $L_{s,t}^{j}$ and Cobb-Douglas production technology in each sector s :

$$Y_{s,t}^{j} = A_{s,t}(K_{s,t-1}^{j})^{\alpha}(L_{s,t}^{j})^{1-\alpha} \tag{10}$$

The cost-minimal combination of capital and labour is given by:

$$\frac{L_{s,t}^{j}}{K_{s,t-1}^{j}} = \frac{1-\alpha}{\alpha}\frac{i_t^k}{(1+\tau_t^{SCer})W_t} \tag{11}$$

which implies for the nominal marginal costs $MC_{s,t}^{j}$ of the optimising firm:

$$MC_{s,t}^{j} = \frac{(i_t^k)^{\alpha}[(1+\tau_t^{SCer})W_t]^{1-\alpha}}{A_{s,t}\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \tag{12}$$

The employers' SSC is given by τ_t^{SCer}. The higher the employers' SSC as percentage of gross wage earnings, the lower the use of labour in the production of good $Y_{s,t}^{j}$.

The firms in each sector s face quadratic price adjustment costs γ_p and set prices $P_{s,t}^{j}$ to maximise the discounted expected profit. For each sector, firms profit maximisation has the following form:

$$E_0\sum_{t=0}^{\infty}\beta^t\frac{\lambda_t^{NLC}}{\lambda_0^{NLC}}\left(\frac{P_{s,t}^{j}}{P_{s,t}}Y_{s,t}^{j} - \frac{(1+\tau_t^{SCer})W_{s,t}^{j}}{P_{s,t}}L_{s,t}^{j} - \frac{\gamma_p}{2}(\pi_{s.t}^{p,j})^2 Y_{s,t}\right) \tag{13}$$

The nominal GDP is the sum of domestically produced tradable and non-tradable output:

$$P_t^Y Y_t = P_{TH,t}Y_{T,t} + P_{NT,t}Y_{NT,t} \tag{14}$$

Government sector

The government collects labour, capital, consumption and lump-sum taxes – levied only on NLC households – as well as SSC for employers and employees and issues one-period bonds to finance government purchases, transfers and the servicing of outstanding debt:

$$(\tau_t^w + \tau_t^{SCee} + \tau_t^{SCer})W_t L_t + \tau_t^k (i_t^k - \delta)K_{t-1} + \tau_t^c P_t^C C_t + (1 - slc)TAX_t + B_t = \\ P_t^G G_t + TR_t + (1 + i_{t-1})B_{t-1} \tag{15}$$

Expenditure on total government purchases is the sum of expenditure on tradable and non-tradable goods analogously to private demand:

$$P_t^G G_t = P_t^T G_{T,t} + P_t^{NT} G_{NT,t} \tag{16}$$

Steady state government consumption is given by:

$$\frac{G_t}{Y_t} = \rho_G \frac{G_{t-1}}{Y_{t-1}} \frac{Y_{t-1}}{Y_t} + (1 - \rho_G)\left(\frac{\bar{G}}{Y}\right) \tag{17}$$

In the benchmark model, government adjusts lump-sum taxes to stabilise government debt and the budget deficit at their target levels according to:

$$\frac{TAX_t}{P_t^Y Y_t} = \frac{TAX_{t-1}}{P_{t-1}^Y Y_{t-1}} + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} \tag{18}$$

where *btar* is the target debt-to-GDP ratio. Therefore, the government increases lump-sum taxes to collect additional revenues if debt and/or deficit levels exceed the target values. Lump-sum taxes reduce the complexity of the model dynamics, as it does not affect labour supply decisions of workers and the disposable period income and consumption demand of LC households.

To analyse welfare implications through distortionary taxes, we use labour and capital taxes as alternative budget closures:

$$\tau_t^w = \tau_{t-1}^w + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} \tag{19}$$

$$\tau_t^k = \tau_{t-1}^k + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} \tag{20}$$

Fiscal devaluation is sim ulated as a revenue-neutral tax shift between employers' SSC and consumption tax in response to fluctuations in the trade balance gap $\left(\widehat{TB/Y}\right)$ or the trade balance in absolute terms $\left(TB/Y\right)$, respectively:

$$\tau_t^c = \rho_G \tau_{t-1}^c + (1 - \rho_G)\bar{\tau}^c + (1 - \rho_G)\xi_Z Z_t \tag{21}$$

with $Z_t = [\widehat{TB/Y}, TB/Y]$ and:

$$\tau_t^{SCer} = \rho_G \tau_{t-1}^{SCer} + (1-\rho_G)\overline{\tau}^{SCer} - (\tau_t^c - \overline{\tau}_t^c)\left(\frac{P_t^C C_t}{W_t L_t}\right) \tag{22}$$

The tax shift is revenue-neutral in the sense that the overall level of government revenues is kept ex ante constant. A negative parameter value ($\xi_Z < 0$) implies an increase in consumption tax and a decline in employers' SSC in case of a trade balance deficit in order to mimic the real effects of nominal exchange rate depreciation.

External Account

The total demand for domestic output is the sum of final domestic demand, net exports and the wage/price adjustment costs ADC_t:

$$P_t^Y Y_t = P_t^C (C_t + I_t) + P_t^G G_t + P_t^{TH} X_t - P_{TF,t} M_t + ADC_t \tag{23}$$

Exports X_t correspond to the import demand of the rest of monetary union (RoMU):

$$X_t = (1-h)(P_{TH,t} / P_{TH,t}^*)^{-\eta} Y_t^* \tag{24}$$

which uses the fact that the tradable prices in the RoMU and the prices of tradables produced in RoMU are (almost) identical from the perspective of the small domestic economy. We exclude price discrimination between countries, i.e. the law of one price holds.

The aggregate resource constraint of the domestic economy, which is also the law of motion for the net foreign asset (NFA) position, is given by:

$$B_{H,t}^* = (1+i_{t-1})B_{H,t-1}^* + P_t^Y Y_t - P_t^C (C_t + I_t) - P_t^G G_t - P_t^Y ADC_t \tag{25}$$

The current account equals the change in net foreign assets:

$$CA_t = B_{H,t}^* - B_{H,t-1}^* \tag{26}$$

We treat RoMU as a single, large country, which engages in trade with the small country. However, the trade volume with the small country is low such that RoMU is seen as a closed economy.

Parameterisation

As the model is supposed to reflect an average small open economy in monetary union, data on the exogenous variables and parameters in the model is obtained from the Eurostat database of the European Commission, the OECD database and further sources in the literature of DSGE models. The numerical values of the model parameter and steady state ratios are summarised in Table 1.

The parameters that determine the steady-state ratios are chosen to replicate the average share of private consumption (60 %), investment (20 %), government purchases (20 %) in euro area GDP and the estimated average capital stock of 300 % of annual GDP during 1999-2012. We set the share of tradable goods in total consumption to $\phi = 0.6$ in order to get a steady state ratio of tradable goods to GDP of 60 % (Lombardo and Ravenna 2012).

The parameter $h = 0.51$ matches the average import-to-GDP ratio of eight small euro area countries for the period 1999-2012.[2] The value suggested in the literature for the elasticity of substitution between tradable and non-tradable goods ψ ranges from a low elasticity, such as 0.13 found by Rabanal and Tuesta (2013) when investigating the role of the non-tradable sector for the dynamics of the real exchange rate, to a high elasticity of 0.74 for industrial countries estimated by Mendoza (1995). This paper adheres to $\psi = 0.5$, which is used by Gomes et al. (2010), who establish a model for policy analyses within the euro area.

In the observed time period 1999 – 2012, the average of government debt is 74 % of GDP. The budget closure implies that a 1 percentage point increase in government debt-to-GDP (deficit-to-GDP) ratio increases taxes or decreases transfers by 0.001 (1.0) percentage points.

The low trade elasticity between domestic and imported tradable goods estimated by Imbs and Méjean (2010) with $\eta = 1.5$ is criticised by Simonovska and Waugh (2014) for not giving micro-level heterogeneity sufficient consideration. Therefore, we set the parameter value to $\eta = 2.0$, which is in the range of those used in the DSGE literature.

[2] The respective group of countries comprises Austria, Belgium, Finland, Greece, Ireland, the Netherlands, Portugal and Spain, following Vogel et al. (2013) and Hohberger et al. (2014).

Table 1: Parameter and steady state ratios of the model

Parameters	***Symbol***	***Value***
Households and Firms		
Discount factor	β	0.995
Consumption relative to GDP	C/Y	0.6
Government spending relative to GDP	G/Y	0.2
Investment relative to GDP	I/Y	0.2
Tradable goods share of GDP	T/Y	0.6
Share of LC households	*slc*	0.4
Weight of labour disutility	κ	1.0
Inverse of elasticity of labour supply	φ	4.0
Share of tradable goods in consumption	ϕ	0.6
Elasticity of substitution T/NT goods	ψ	0.5
Intertemporal elasticity of substitution	σ	2.0
Elasticity of substitution between home and foreign goods	η	2.0
Elasticity of substitution between goods varieties *j*	ε	0.6
Elasticity of substitution for labour services *i*	θ	0.6
Steady state level	A	0.47
Cobb-Douglas parameter (capital share)	α	0.4
Coefficient on output growth	ψ_y	0.05
Degree of home bias	*h*	0.51
Wage adjustment costs	γ_w	80.0
Price adjustment costs	γ_p	48.0
Capital adjustment costs	γ_c	30.0
Fiscal Policy		
Debt-to-GDP ratio	*btar*	0.74
Fiscal reaction to debt	ξ_b	0.001
Fiscal reaction to deficit	ξ_d	1.0
Persistence of fiscal instrument	ρ_G	0.5
Consumption tax rate	τ^c	0.197
Labour income tax rate	τ^w	0.16
Social security contribution of employers	τ^{SCer}	0.25
Social security contribution of employees	τ^{SCee}	0.13
Capital tax rate	τ^k	0.3
Lump-sum tax rate relative to GDP	TX/Y	0.0
General transfers relative to GDP	TR/Y	0.12
Shock Calibration		
Persistence of TFP shock	ρ_a	0.92
Standard deviation TFP	σ_a	0.025
Persistence of risk premium shock	ρ_r	0.85
Standard deviation risk premium	σ_r	0.015

The tax rate on consumption of 19.7 % is given by the average VAT rate within the euro area for the period 1999-2012 (European Commission 2013). The average tax rate on capital income is 30 % (OECD Tax Database). Given the total gross earnings, households pay labour income tax and SSC as a percentage share of their gross wage earnings to the general government. The average labour income tax burden for the given period is 16 % of total earnings plus 13 % SSC for the households. Thus, the net income of households amounts to 71 % of total gross wage earnings. Firms contribute on average 25 % SSC as a percentage of total gross wage earnings to the general government. Consequently, the total labour costs of firms reach 125 % of gross wage earnings.

Druant et al. (2009) conduct a firm-level survey for various countries and sectors in the euro area and find an average adjustment of wages after 15 months and an average adjustment of prices after 10 months. Accordingly, we choose wage and price adjustment costs to match durations of wages and prices of five and four quarters, respectively. The value for capital adjustment costs is taken from Hohberger et al. (2014).

The integration of LC households explains the positive correlation between private and public consumption (Galí et al. 2007). The share of liquidity-constrained households varies in the literature. Ratto et al. (2009) set rule-of-thumb households at 40 % of population, Galí and Monacelli (2008) use the factor $slc = 0.5$ and Marto (2013) estimates the share of $slc = 0.58$ for the Portuguese economy. We follow Ratto et al. (2009) and set $slc = 0.4$. Alternative values for the share of LC households are tested in section 5.

Table 2 compares moments of the benchmark model under the combination of a TFP and a risk premium shock and the absence of fiscal devaluation to actual data for the group of eight smaller European member countries for the period 1999q1-2012q4. It shows that the model matches important characteristics fairly well. More precisely, the model replicates the correlation of consumption, employment and the trade balance with output. The high correlation of government purchases with output is caused by the calibration of government purchases as a fixed share of GDP in the baseline calibration. Of particular note is the high volatility of investment, which is in line with the data patterns. The model-generated volatility of employment is slightly higher compared to actual data. The trade balance is negatively correlated with output and matches the data pattern, whereas the volatility of the trade balance

is relatively low. The low volatility of inflation compared to data moments is related to the assumption of constant import prices.

Table 2: Comparing model and data moments

Variable	*Baseline calibration*		*Actual data*					
	Correlation with output	*Standard deviation*	*Correlation with output*			*Standard deviation*		
			Mean	*Max*	*Min*	*Mean*	*Max*	*Min*
Output	1.00	0.03	1.00	1.00	1.00	0.02	0.04	0.01
Consumption	0.83	0.92	0.85	0,92	0.80	0.88	1.21	0.47
Government	0.93	0.85	0.15	0.61	-0.46	1.28	2.43	0.38
Investment	0.86	1.70	0.82	0.93	0.64	3.64	5.83	1.67
Employment	0.25	1.24	0.64	0.93	0.38	0.76	1.06	0.57
Trade balance	-0.21	0.35	-0.27	0.15	-0.75	1.56	2.25	0.81
Inflation	0.13	0.35	0.46	0.82	-0.28	0.64	0.92	0.43

Note: All moments are based on quarterly data. The variables are in logarithms and hp-filtered with λ=1600 for quarterly data (except trade balance, which is relative to GDP, and inflation, which is the year-on-year percentage change of the Consumer Price Index). The actual data mean is calculated for the group of eight smaller EA-countries for 1999q1-2012q4, namely **AUT, BEL, ESP, FIN, GRC, IRL, NLD and PRT**. Maximum and minimum values are given by the lowest and highest ranked country for the particular measure. The standard deviation is the standard deviation relative to the standard deviation of output, which is the absolute standard deviation.

3. Fiscal devaluation as trade balance stabilisation tool

To analyse the stabilising impact of fiscal devaluation we present simulations for productivity (TFP) and risk premium shocks under different model and policy settings: First, we show impulse responses (IRFs) for the frictionless (FLEX) economy without price and wage stickiness and, hence, the optimal reaction of the economy to exogenous shocks. Second, we display the no-policy case (NP) to illustrate the difference between an economy with and without price and wage stickiness. Third, we examine the potential of fiscal devaluation as a tax shift from employers' SSC to consumption tax to stabilise the trade balance. We focus our simulations on the response to both the trade balance in absolute terms as well as the trade balance gap as target variable. The trade balance gap is defined conventionally as percentage point (relative to GDP) deviation of the actual level from the level that would exist without price and wage stickiness. The focus on the trade balance gap allows examining whether fiscal policy can mitigate excess volatility due to price and wage adjustments. Impulse

responses are specified in percent, except those for the trade balance and the tax rates, which are given in percent relative to GDP and percentage points, respectively.

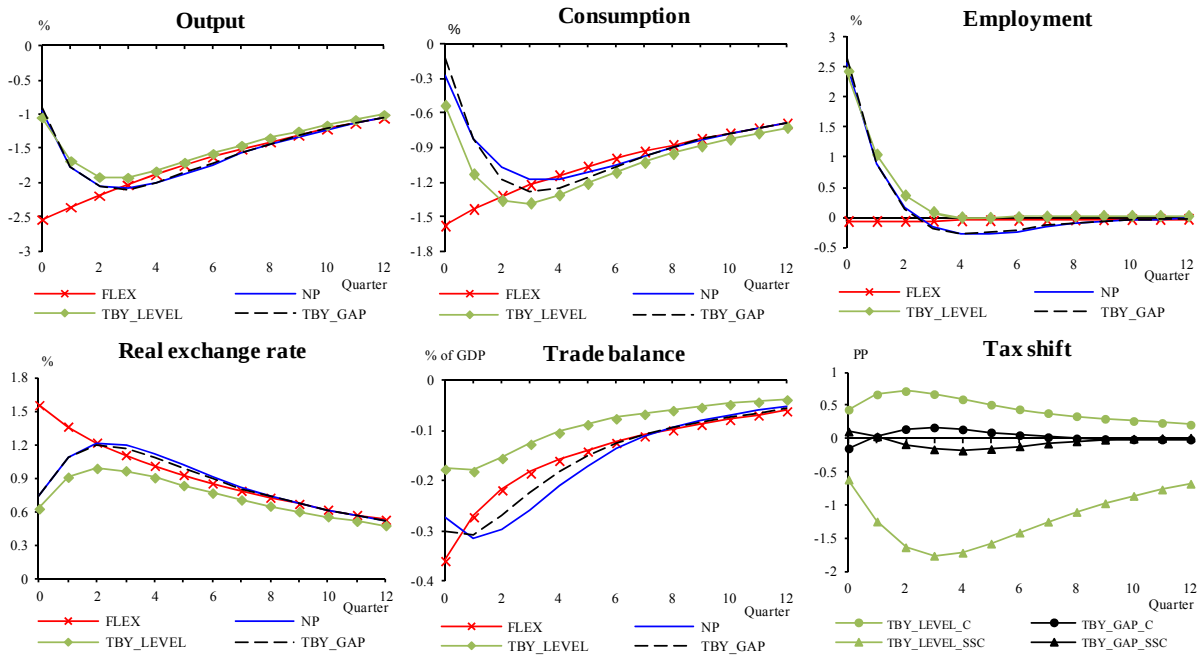
The parameter value $\xi_Z < 0$ for fiscal devaluation is chosen such that a 0.5 percentage point decline in the trade balance leads to a 1 percentage point increase in the consumption tax, with a corresponding SSC reduction so that the tax shift is ex ante revenue-neutral.

3.1 Negative economy-wide productivity shock ("Competitiveness Loss")

Figure 2 shows impulse responses (IRFs) for a negative economy-wide TFP shock, simulated as a temporary 2.5 percentage point decline of the total factor productivity relative to the rest of monetary union. The flexible economy (FLEX) without wage and price stickiness clearly mirrors the TFP decline in output by 2.5 percent. Private consumption declines due to an increase in domestic goods prices, resulting in an appreciation of the real exchange rate and a trade balance deficit. Price stickiness in the no-policy scenario (NP) delays the increase in domestic prices and lowers real interest rates, so that consumption and investment declines more moderately compared to the FLEX economy. The increase in employment by 2.5 percent is associated with the lower productivity level when prices and wages are sticky. The delayed increase in the real exchange rate leads to a negative trade balance gap in the medium term.

A fiscal devaluation in response to both the absolute trade balance deficit (TBY_LEVEL) and the trade balance gap (TBY_GAP) implies a tax shift from employers' SSC rate to consumption tax. More precisely, a fiscal parameter value of $\xi_Z = -5$ in Figure 2 implies an increase in consumption tax of around 0.7 percentage points and a corresponding reduction of employers' SSC rate of around 1.8 percentage points to keep the government tax revenues ex ante constant. As a consequence, fiscal devaluation reduces the trade balance deficit in absolute terms substantially (TBY_LEVEL). For the given parameter value of $\xi_Z = -5$, the stabilisation of the trade balance gap (TBY_GAP) is associated with a smaller tax shift and hence less pronounced than the trade balance stabilisation in absolute terms due to the relatively small difference between the actual and the flexible-economy trade balance.

Figure 2: Fiscal devaluation in response to a negative TFP shock



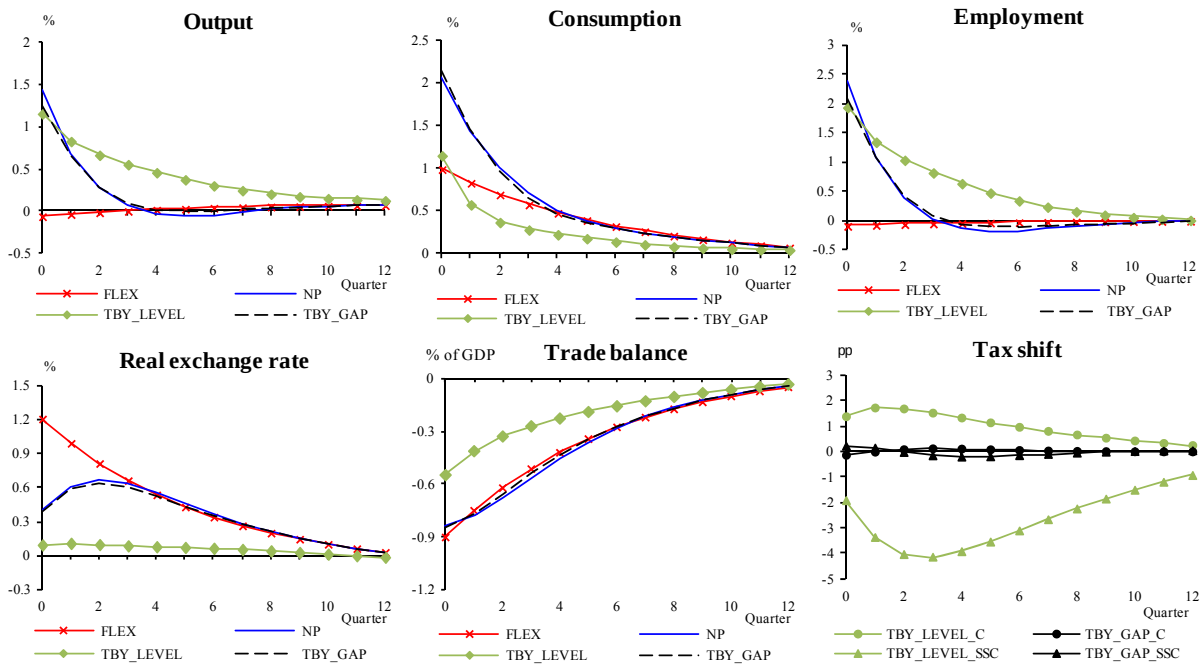
By shifting the tax burden from employers to consumers, export prices decline and import prices increase, as the increase in consumption tax only affects imported goods while exempting exported goods from local firms. The increase in consumption tax of up to 0.7 percentage points and the corresponding reduction of labour costs in the production process through the decrease in SSC dampens the real exchange rate appreciation and the decline in net exports. As a result, the trade balance improves compared to the NP scenario. Figure 2 underlines the finding by Langot et al. (2012) that the increase in consumption taxes (in percentage points) have to be accompanied by larger decreases in employers' SSC in order to ensure budget-neutrality.

The effects of fiscal devaluation on domestic variables, e.g. output, consumption and employment are rather small compared to the simulation results without fiscal intervention in the NP economy. While consumption decreases slightly due to higher consumption taxes, output and employment volatilities remain fairly unchanged.

3.2 Negative risk premium shock ("Demand Boom")

Figure 3 shows impulse responses for a negative risk premium shock of 1.5 percentage points relative to the rest of monetary union. The negative risk premium shock induces a decline in domestic interest rates. Hence, individuals face lower borrowing rates, which strengthen domestic consumption and investment demand and also the demand for imports. The increase in domestic demand puts upward pressure on prices and wages and leads to real exchange rate appreciation. The higher domestic price level relative to the rest of monetary union leads to a loss of price competitiveness and deteriorates the trade balance. These dynamics are even more pronounced in the no-policy (NP) scenario. Price and wage stickiness delay the rise in domestic prices and wages and lead to lower real interest rates, which further boosts domestic demand.

Figure 3: Fiscal devaluation in response to a negative risk premium shock



Similar to the productivity shock, a fiscal parameter value of $\xi_Z = -5$ in Figure 3 implies an increase in consumption tax of around 1.8 percentage points and a corresponding reduction of employers' SSC rate of around 4 percentage points in order to keep the tax revenues ex ante constant and attenuate the trade balance deficit-to-GDP ratio of 0.9 percent (TBY_LEVEL). Figure 3 suggests that such a temporary tax shift towards consumption tax almost halves the

trade balance deficit compared to the NP scenario. The tax shift in response to the trade balance gap (TBY_GAP) and the accompanied adjustment processes are relatively small compared to the absolute trade balance stabilisation due to the small size of the trade balance gap. The analysis of domestic variables shows that the rise in consumption tax decreases private consumption, mitigates the demand boom by reducing upward price pressures and attenuates real exchange rate appreciation. However, Figure 3 shows higher volatilities during the adjustment process of output and employment in the medium term.

To sum up, the simulations suggest that fiscal devaluation can stabilise excessive trade balance fluctuations caused by supply and demand shocks. The effects on domestic variables are rather small, however. In order to make conclusive statements about the effects of fiscal devaluation on household's welfare, we provide a welfare analysis in the following section.

4. Welfare analysis

As welfare analyses are mainly neglected in the literature on fiscal devaluation, we examine the welfare effects in the context of a standard assessment of household welfare.[3] We use a second-order Taylor approximation according to Lucas (2003) and Canzoneri et al. (2007) in order to examine the welfare effects of a fiscal devaluation.

Welfare of household i is given by the discounted sum of the period utilities with the discount factor β:

$$W = E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} (C_t^i)^{1-\sigma} - \frac{\kappa}{1+\varphi} (L_t^i)^{1+\varphi} \right) \tag{27}$$

As utility has a constant risk aversion σ, the elasticity of intertemporal substitution is given by $1/\sigma$, κ specifies the weight on the disutility of work, and $1/\varphi$ stands for the elasticity of labour supply. Ricardian (NLC) households as well as rule-of-thumb (LC) households maximise their utility given their respective budget constraint in equation (1) and (2). According to Canzoneri et al. (2007), we measure the cost of policy intervention with a second-order approximation of a value function for aggregate welfare $W(\xi_Z)$ for NLC and

[3] Langot et al. (2012) seek to close that gap by providing an optimal tax scheme for an improvement in households' welfare using a small open-economy model with labour market frictions.

LC households. According to Lucas (2003), $CC(\xi_Z = 0)$ is a cardinal number defining the cost of nominal rigidities in percentages of consumption:

$$CC(\xi_Z = 0) = W(\xi_Z \neq 0) - W(\xi_Z = 0) \tag{28}$$

with

$$W(\xi_Z) \approx \sum_{t=0}^{\infty} \beta^t \begin{bmatrix} \frac{(\bar{c}^i)^{1-\sigma}}{1-\sigma} - \frac{\kappa \bar{l}^{1+\varphi}}{1+\varphi} + (\bar{c}^i)^{-\sigma} E\hat{c}_t^i - \kappa \bar{l}^{\varphi} E\hat{l}_t \\ -\frac{\sigma(\bar{c}^i)^{-1-\sigma}}{2} Var(\hat{c}_t^i) - \frac{\kappa\varphi \bar{l}^{-1+\varphi}}{2} Var(\hat{l}_t) \end{bmatrix} \tag{29}$$

The cost of fiscal devaluation $CC(\xi_Z \neq 0)$ [4] is given by $100*\left[1-(1-\beta)*CC(\xi_Z = 0)\right]$ (see Canzoneri et al. 2007) and leads to:

$$CC(\xi_Z \neq 0) = 100*\left\{1-(1-\beta)\left[W(\xi_Z \neq 0) - W(\xi_Z = 0)\right]\right\} \tag{30}$$

We run simulations over the interval [-10; 2] for the fiscal policy parameter ξ_Z in steps of 0.2. Welfare gains and losses are measured relative to non-stabilisation and are expressed in percent of steady state consumption for NLC households, LC households and the weighted average of both household types (TOTAL).[5] According to Hohberger et al. (2014), we show welfare gains (positive values) and welfare losses (negative values) for a range of policy parameter values ξ_Z to provide information on the robustness of welfare effects. The welfare effects are simulated for the combination of TFP and risk premium shocks. In order to attenuate trade balance deficits, fiscal policy aims at increasing net exports by decreasing employers' SSC and increasing VAT for consumers, which implies a negative value for the fiscal policy parameter ξ_Z. Hence, a positive parameter value ξ_Z implies a tax shift from VAT to employers' SSC.

Figure 4 shows that fiscal devaluation leads to welfare losses for NLC and LC households in the case of stabilising both the trade balance gap (TBY_GAP) and the trade balance in

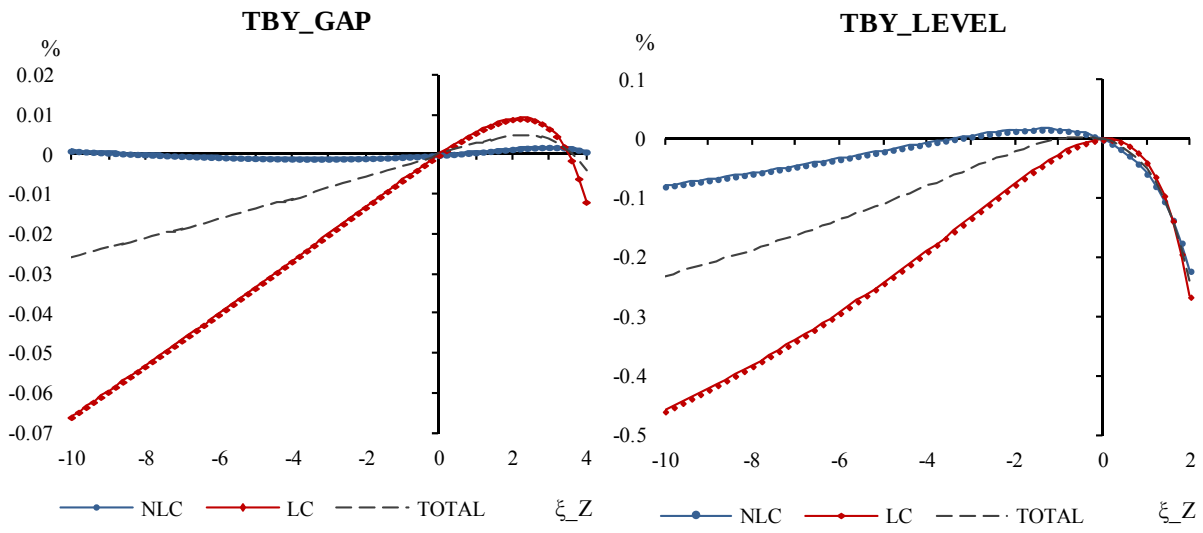
[4] In the specific case of fiscal devaluation, $CC(\xi_Z \neq 0)$ has to be $CC(\xi_Z < 0)$ in order to simulate a tax shift from employers' SSC to consumption tax.

[5] Similar contributions measuring welfare effects relative to non-stabilisation can be found in Hohberger et al. (2014) and Vogel et al. (2013).

absolute terms (TBY_LEVEL). Given a fiscal parameter value of $\xi_Z = -5$ (as used in our simulations in section 3) and lump-sum taxes as fiscal budget closure, fiscal devaluation generates welfare losses of up to 0.02 % and 0.11 % of steady state consumption for households average when stabilising TBY_GAP and TBY_LEVEL, respectively.

Given the identical utility functions for both types of households, the welfare losses for NLC households are considerably lower compared to LC households, as they are able to smooth their consumption over time. LC households, however, suffer (benefit) more than NLC households from policy interventions that amplify (stabilise) temporary income fluctuations, which is line with findings by Vogel et al. (2013).

Figure 4: Welfare effects of fiscal devaluation



Note: Welfare is measured relative to non-stabilisation and expressed in % of steady state consumption.

In case of TBY_LEVEL stabilisation, a tax shift from SCC to consumption tax generates welfare losses for LC households of 0.24 % of steady state consumption ($\xi_Z = -5$), as the consumption tax increase reduces purchasing power of disposable period income of LC households. NLC households experience welfare losses of 0.02 % of steady state consumption. However, NLC households also experience relatively small welfare gains for the policy parameters range [-3; 0]. Increasing prices and higher consumption taxes encourage NLC households to decrease private consumption in order to maximise their intertemporal welfare. Furthermore, NLC households smooth their consumption by increasing savings,

which immediately leads to an increase in net foreign assets compared to the no-policy (NP) scenario and, thus, to a decline in the trade balance deficit. Additionally, as the decrease in consumption demand caused by higher VAT rates counteracts lower labour and production costs caused by the decrease in SSC, employment remains fairly stable and, hence, welfare effects are mainly driven by changes in consumption.

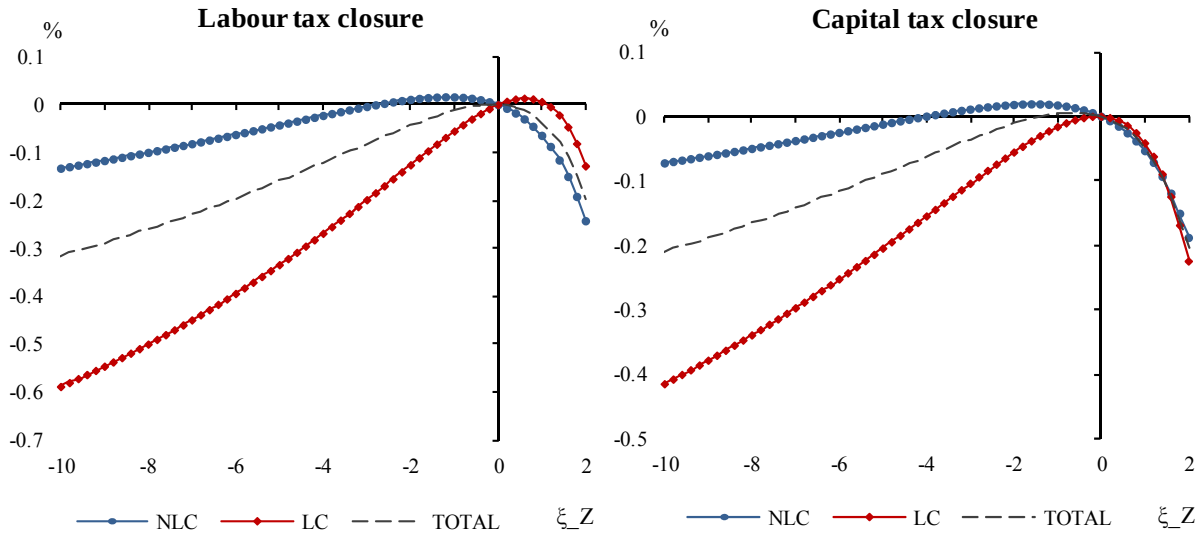
5. Sensitivity analysis

This section provides several sensitivity analyses for alternative fiscal closure rules and distinctions in the tradable and non-tradable sector sizes in order to check the effects of changes in the model structure. Additionally, we address fiscal devaluation as a quasi-permanent exogenous shock in order to highlight differences to the implementation of fiscal devaluation as a policy rule and make the results comparable to other papers on that topic. We focus our robustness checks on the stabilisation of the trade balance in absolute terms (TBY_LEVEL), as stabilising the trade balance gap implies qualitatively similar welfare effects.

Fiscal budget closures

As fiscal devaluation is supposed to be budgetary-neutral, deviations from the targeted government debt/deficit-to-GDP ratio can arise due to output and price changes. For example, a rise in output after the tax shift reduces government debt-to-GDP ratio, implies a tax decrease and, hence, a reduction of the crowding-out of private consumption. Therefore, tax reforms can generate distortionary effects, which influence households' welfare. Lump-sum taxes are non-distortionary and therefore considered as efficient taxes, as they do not imply second-round effects from government debt/deficit stabilisation. In order to gain some intuition about the sensitivity of our welfare results with respect to alternative budget closures, we modify the model by using labour income and capital taxes to stabilise government debt and budget deficit.

Figure 5: Welfare analysis for alternative fiscal budget closures



Note: Welfare is measured relative to non-stabilisation and expressed in % of steady state consumption.

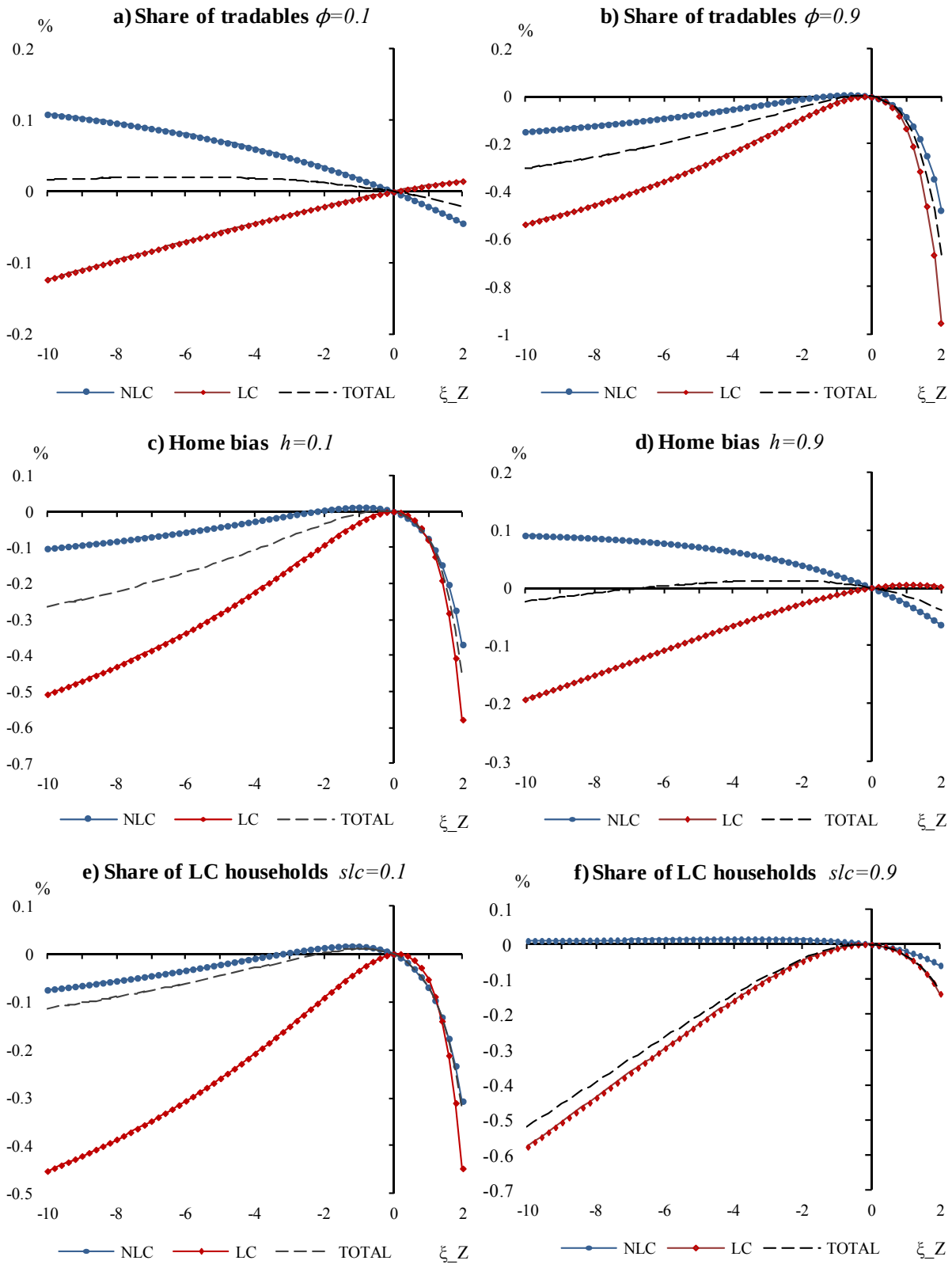
Figure 5 depicts that alternative budget closures perform very similarly to lump-sum taxes. Labour income tax as budget closure induces higher welfare losses for both household types, while capital tax as closure reduces households' welfare losses slightly. The overall welfare performance, however, remains fairly similar.

Tradable vs. non-tradable goods sector

Franco (2011) states that the effects of fiscal devaluation on the trade balance is mitigated by an increase in the non-tradable sector, as the price of tradables and non-tradables of domestic produced goods decreases through the tax shift away from employers' SSC, while prices of foreign produced goods do not change. As a consequence, tradable goods as a composite of foreign and domestic produced tradable goods are relatively expensive compared to non-tradable goods after fiscal devaluation. Therefore, the relative size of both sectors should have an impact on the welfare effects.

Panels a) and b) in Figure 6 depict the welfare effects for tradable goods shares of $\phi = 0.1$ and $\phi = 0.9$ instead of $\phi = 0.6$ in the baseline calibration. Panels a) and b) suggest that the higher the share of tradable goods relative to non-tradable goods, the higher the welfare losses for LC and NLC households. This is due to the fact that a tax shift from SSC to consumption induces non-tradable goods to become cheaper relative to tradable goods.

Figure 6: Welfare analysis for alternative robustness checks



Note: Welfare is measured relative to non-stabilisation and expressed in % of steady state consumption.

Panels c) and d) in Figure 6 show the welfare effects for changes in the home bias ($h = 0.1$ and $h = 0.9$ instead of $h = 0.51$ in the baseline calibration). As the consumption index of tradable goods is separated in domestic produced tradable and imported goods (see equation 4 and 5), an increasing consumption share of domestic produced tradables (increasing home bias) should reduce the welfare losses and vice versa. This hypothesis is supported by Panels c) and d). Therefore, in scenarios of a low tradable goods share (a) or a high degree of home bias (d) average households can achieve moderate welfare gains.

Share of LC households

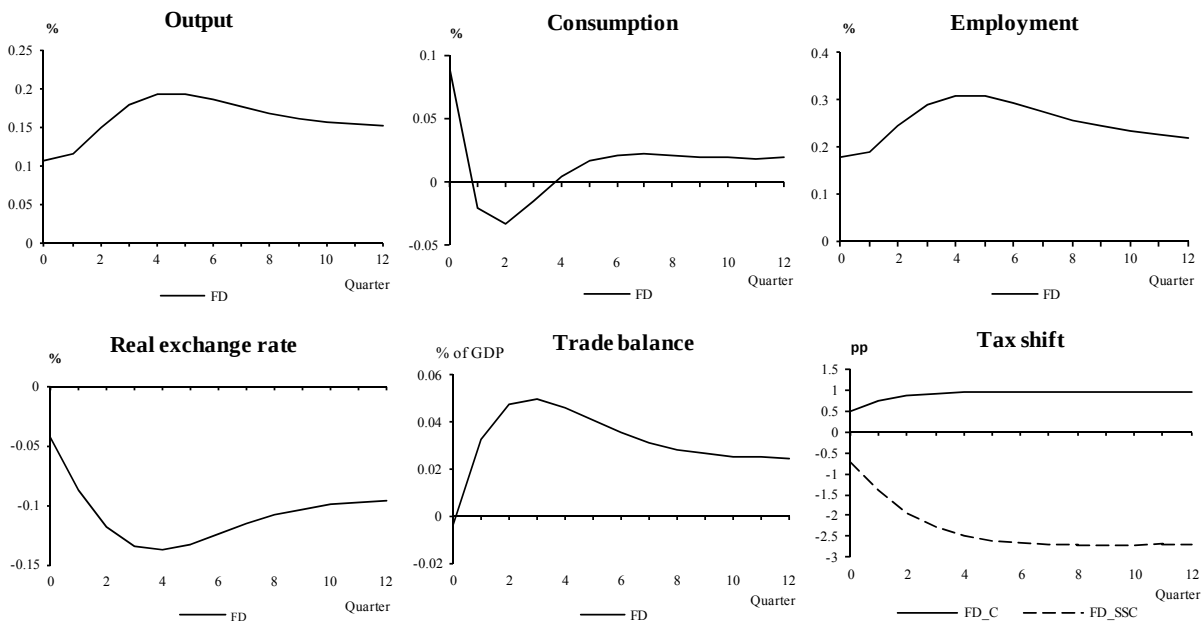
The impact of changing the share *slc* of the LC households is depicted in panels e) and f) in Figure 6 (*slc*=0.1 and *slc*=0.9 instead of *slc*=0.4 in the baseline calibration). The welfare results in Figure 6 show that the higher the share of LC households, the higher the welfare losses for the average household as total welfare is the weighted average of NLC and LC households. While the overall welfare effects for LC and NLC do not change considerably, variations in the compositions of the two household types induce corresponding changes in total household welfare.

Fiscal devaluation as quasi-permanent exogenous shock

To give some intuition on how our simulation results and model structure corresponds to existing literature, we simulate fiscal devaluation according to Engler et al. (2014), who use a quasi-permanent tax shift from employers' SSC to VAT generated by an exogenous AR(1) shock. Figure 7 shows the impulse responses (IRFs) for an exogenous tax shift from employers' SSC to VAT under budget-neutrality. A permanent 1 percentage point increase in consumption tax with a corresponding 2.5 percentage point decrease in employers' SSC increases output by around 0.2 percent, depreciates the real exchange rate by around 0.1 percent and improves the trade balance by around 0.05 % of GDP at its peak. Engler et al. (2014) simulate a tax shift of similar size for a one-sector model and find qualitatively similar, but quantitatively stronger effects on domestic variables with an improvement in the trade balance by 0.2 % of GDP in the medium run. The quantitative differences are mainly driven by two distinctions in the model structure: First, the introduction of a non-tradable goods sector dampens the real exchange rate depreciation (0.15 % instead of 0.3 % as in Engel et al. 2014) of a fiscal devaluation due to changes in the relative prices between tradables and non-tradables. Second, our small open economy approach excludes feedback effects from the

fiscal devaluation to the rest of monetary union. Hence, the import demand from RoMU is only negligible affected compared to the two-country monetary union approach by Engler et al. (2014).[6]

Figure 7: Fiscal devaluation as quasi-permanent exogenous shock



As the existing literature mainly neglect examining potential welfare effects of fiscal devaluations, we analyse the welfare effects of such persistent exogenous tax shift by using the consistent analysis as in section 4. However, we do not calculate the welfare effects relative to non-stabilisation over a range of parameter values, but relative to the steady state level and express the results in percent of steady state consumption for NLC households, LC households and the weighted average of both household types. Hence, the percent welfare changes indicate the gains or losses caused by the quasi-permanent tax shift. The analysis supports our results in section 4 that fiscal devaluation, understood here as quasi-permanent tax shift, implies welfare losses for the average household of about 0.26 % of steady state consumption relative to steady state (see Table 3). In line with our calculations above, the

[6] As we use "the small country within a big monetary union" approach in the tradition of Galí and Monacelli (2008), the small open economy is modelled as one among a continuum of small open economies forming up the monetary union. In our case, which is particularly relevant in the current discussion of fiscal devaluation for countries such as Greece or Portugal, an economy can expect neither to have an impact on the overall development of the euro zone nor that the ECB reacts to country specific developments.

losses are mainly driven by LC households (0.64 % of steady state consumption), while fiscal devaluation is nearly welfare-neutral for NLC households.

Comparison across policies and shocks

In order to summarise and evaluate fiscal devaluation as policy tool to mimic the effects of nominal exchange rate depreciation in a currency union, Table 3 provides an overview of our welfare results. In general, fiscal devaluation tends to induce average welfare losses, whereby LC households, who cannot smooth their consumption over time, are substantially more affected. Furthermore, the implementation of fiscal devaluation as quasi-permanent tax shift implies higher welfare losses due to more persistent effects on relative prices in the medium and long run. However, changes in the model structure show that fiscal devaluation might also induce small welfare gains (grey marked numbers in Table 3).

Table 3: Welfare effects for alternative model and policy settings

Sensitivity Analysis				
Model and policy setting		***NLC Welfare***	***LC Welfare***	***Total Welfare***
Benchmark model		- 0.02 %	- 0.24 %	- 0.11 %
Fiscal closures	*Labour Income Tax*	- 0.04 %	- 0.33 %	- 0.16 %
	Capital Tax	- 0.01 %	- 0.20 %	- 0.09 %
Sector size	*ϕ=0.1*	0.07 %	- 0.06 %	0.02 %
	ϕ=0.9	- 0.07 %	- 0.30 %	- 0.16 %
Home bias	*h=0.1*	- 0.04 %	- 0.28 %	- 0.14 %
	h=0.9	0.07 %	- 0.09 %	- 0.01 %
Household share	*slc=0.1*	- 0.02 %	- 0.03 %	- 0.02 %
	slc=0.9	0.01 %	- 0.23 %	- 0.20 %
Exogenous shock	*SSC(-2.5pp)->VAT(+1pp)*	- 0.01 %	- 0.64 %	- 0.26 %

6. Conclusion

This paper develops a two-region two-sector DSGE model of a small open economy in monetary union with nominal and real rigidities to analyse the potential of fiscal devaluation to stabilise external fluctuations in the trade balance. We contribute to the existing literature by (i) modelling fiscal devaluation as a simple instrument rule that adjusts taxes in response to trade balance fluctuations and (ii) examining the welfare effects of fiscal devaluation in the context of a standard assessment of household welfare. Fiscal devaluation is designed as budgetary-neutral tax shift from employers' social security contributions (SSC) to value-added tax (VAT). We compare the performance of fiscal devaluation with alternative budget closures and provide several robustness checks for changes in the model structure.

Our simulation results suggest that fiscal devaluation can stabilise excessive trade balance fluctuations both in absolute terms and gaps in the event of economy-wide supply and demand shocks. In our benchmark simulation, however, the associated temporary tax shift from employers' SSC to consumption tax is accompanied by welfare losses of 0.11 % of steady state consumption for the average household. Thereby, LC households who have no access to financial markets and cannot smooth their consumption over time suffer more from fiscal devaluation with welfare losses of 0.24 % of steady state consumption compared to 0.02 % for NLC households. This is due to the fact that indirect benefits for the average household from regaining price competitiveness and higher real wages are overcompensated by higher consumption costs. The welfare losses for both types of households are substantially smaller when stabilising the trade balance gap, but it does not change our main findings qualitatively. Our simulation results are robust to several sensitivity checks, e.g. alternative fiscal budget closures, changes in the relative sector size and the share of LC households. At the end, our results suggest that fiscal devaluation might be a potential policy tool to support regaining price competitiveness in monetary union, but implies welfare losses for the average household. These welfare losses are higher, the higher the relative size of the tradable goods sector and the more persistent the tax shifts.

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