Is fiscal devaluation welfare enhancing?
A model-based analysis

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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 tow-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, in particular to alternative fiscal budget closures and changes in the relative sector composition.

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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 flows in the periphery countries and led to a demand boom 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 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, leading 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; Stähler and Thomas 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 to simulate a number of policy measures aimed at achieving a

fiscal devaluation in Spain. They find that a shift of employers' SSC to VAT in the sense that the primary deficit-to-GDP ratio decreases by one percentage point ex ante can improve Spain's competitiveness significantly in the long run. Hohberger et al. (2014) 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. Langot et al. (2012) provide an optimal tax scheme for a fiscal devaluation that is welfare enhancing for households. Commonly, however, the existing literature on fiscal devaluation focuses primarily on regaining international competitiveness and 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) considering fiscal devaluation as an 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, e.g. for alternative fiscal budget closures.

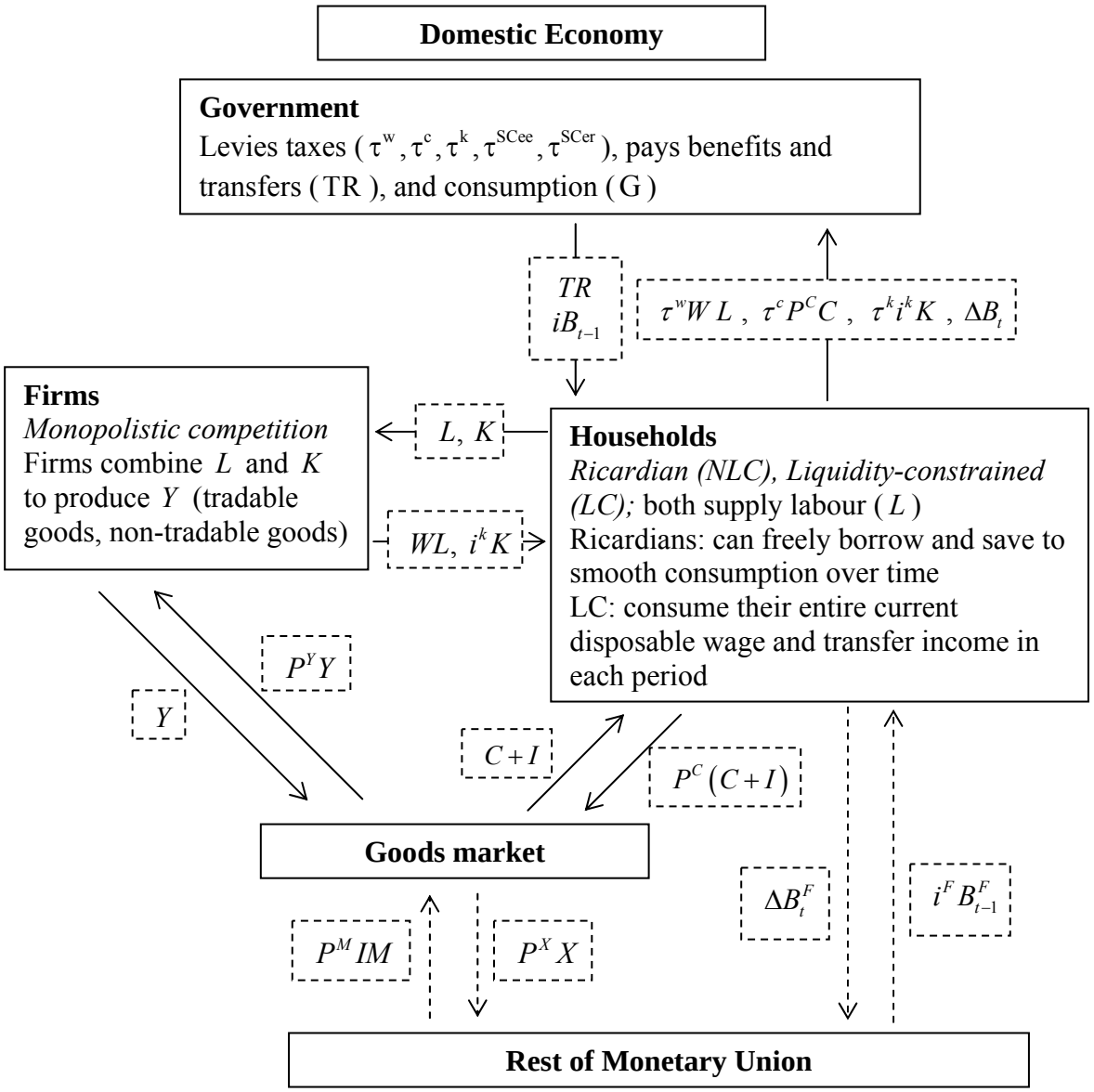
The analytical framework is a two-sector New Keynesian DSGE model of monetary union according to Hohberger et al. (2014) and follows the small open economy approach by Galí and Monacelli (2008). The focus on a small member country of monetary union approach excludes feedback from domestic events to monetary 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 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, LC 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.

2. Model

Our model is based on Hohberger et al. (2014) who analyse the potential of sectoral reallocation of government expenditure 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 wells 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 tax variables 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 who 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 RoEA 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:

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

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 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

[1] A detailed description of household welfare will be discussed in section 0.

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 non-distortionary tax becomes is 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 consumption in the aggregate 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:

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

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' social security contributions, while prices of foreign produced goods do not change. Therefore, tradable goods as a composite of foreign and domestic produced tradable goods are relative expensive compared to non-tradable goods after fiscal devaluation has taken place. In section 5, we examine the role of the relative size between the two sectors and the subsequent welfare effects in a sensitivity analysis.

The 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:

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

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 is as percentage of gross wage earnings, the lower is 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 maximization has the following form:

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

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 social contribution costs and issues one-period bonds to finance government purchases, transfers and the servicing of outstanding debt:

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

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:

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

where *btar* is the target debt-to-GDP ratio. Therefore, the government increases lump-sum tax rate to collect additional revenue 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:

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

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

Fiscal devaluation is simulated 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 trade balance level $\left(TB/Y\right)$:

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

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 constant. A negative parameter value ($\xi_Z < 0$) implies an increase in consumption tax and a decline in employers' SSC in case of an excessive 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 economy in a monetary union, data information for the exogenous variables and parameters in the model are 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 parameter $h = 0.51$, which is modelled as the home bias for the consumption of goods, is calculated by deducting the average import-to-GDP ratio of eight small euro area countries from one 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.

The euro area average 1999-2012 of government debt/deficit is 74 percent of GDP. Once debt relative to GDP exceeds its target level of 74 percent, the budget closure rule for debt-to-GDP stabilisation applies by raising taxes or lowering general transfers. A one percentage point increase in government debt-to-GDP and the deficit-to-GDP ratio implies a tax increase or transfer decline of 0.001 percentage points in the case of debt stabilisation and one percentage point in the case of deficit stabilisation.

[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

Structural Parameters	***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 percent is given by the average VAT rate within the euro area for the period 1999-2012 (Taxation Trends in the European Union 2013, EC). The average tax rate on capital income is 30 percent (OECD Tax Database). Given the total gross earnings before tax, 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 percent of total earnings plus 13 percent SSC for the households. Thus, the net income of households amounts to 71 percent of total gross wage earnings. Firms contribute on average 25 percent social security as a percentage of total gross wage earnings to the general government. Consequently, the total labour costs of firms reach 125 percent of gross wage earnings.

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, the parameter value is increased to $\eta = 2.0$, which is a value in the range of those used in the literature.

While 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 about every 15 months and an average adjustment of prices about every 10 months, which are used by Engler et al. (2014), the duration of wage adjustments is two months lower for the group of the eight small euro area countries. We choose wage and price adjustment costs to match durations of wages and prices of five and four quarters. The value for capital adjustment costs is taken from Hohberger et al. (2014).

The integration of LC households explains the simultaneous movement of private consumption and government spending (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 percent of population, Galí and Monacelli (2005) 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 for the purpose of robustness in section 5.

Table 2 compares moments of the benchmark model under the combination of TFP and risk premium shocks and the absence of fiscal devaluation to actual data for the group of eigth 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 quite well. 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 lower than the lowest ranked country in the group of small euro area countries in actual data. 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	-075	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.

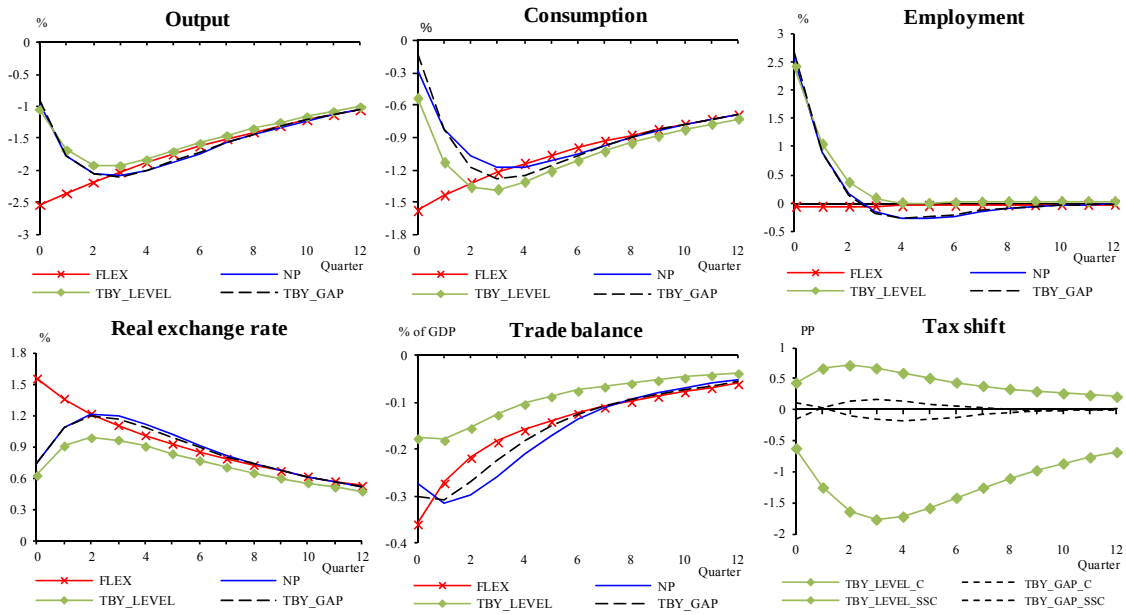
3. Fiscal devaluation as trade balance stabilisation tool

To analyse the stabilising impact of fiscal devaluation we present simulations for negative 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 absolute trade balance as well as the trade balance gap as target variable. The trade balance gap is defined conventionally as percentage point (relative to GDP) deviations of actual level from the level that would exist without price and wage stickiness. Hence, the focus on the trade balance gap allows examining whether fiscal policy can mitigate excess volatility due to price and wage adjustment. IRF values are specified in percent, except those for the trade balance, government debt, and the tax rates, which are given in percentage points.

3.1 Negative economy-wide productivity shock

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 deteriorates the trade balance, resulting in a negative trade balance gap in the medium term.

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



A fiscal devaluation in response to the absolute trade balance deficit (TBY_LEVEL) or the trade balance gap (TBY_GAP), respectively, implies a tax shift from employers' SSC rate to consumption tax. More specifically, a fiscal parameter value of $\xi_Z = -5$ in Figure 2 implies a reduction of employers' SSC rate of around 1.8 percentage points and an increase in consumption tax of around 0.7 percentage points for stabilising TBY_LEVEL. As a consequence, fiscal devaluation reduces the trade balance deficit substantially in the case of level stabilisation (TBY_LEVEL). For the given parameter value of $\xi_Z = -5$, the reduction of the trade balance gap (TBY_GAP) is less pronounced because the trade balance gap, i.e. the difference between the actual and the flexible-economy trade balance, and hence the associated tax shift is smaller than the trade balance deficit in absolute terms.

By shifting the tax burden from employers to consumers, export prices decline and import prices increase, as the increase in consumption tax is only levied on 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 case. As the real exchange rate appreciation under fiscal devaluation is only slightly lower than without policy

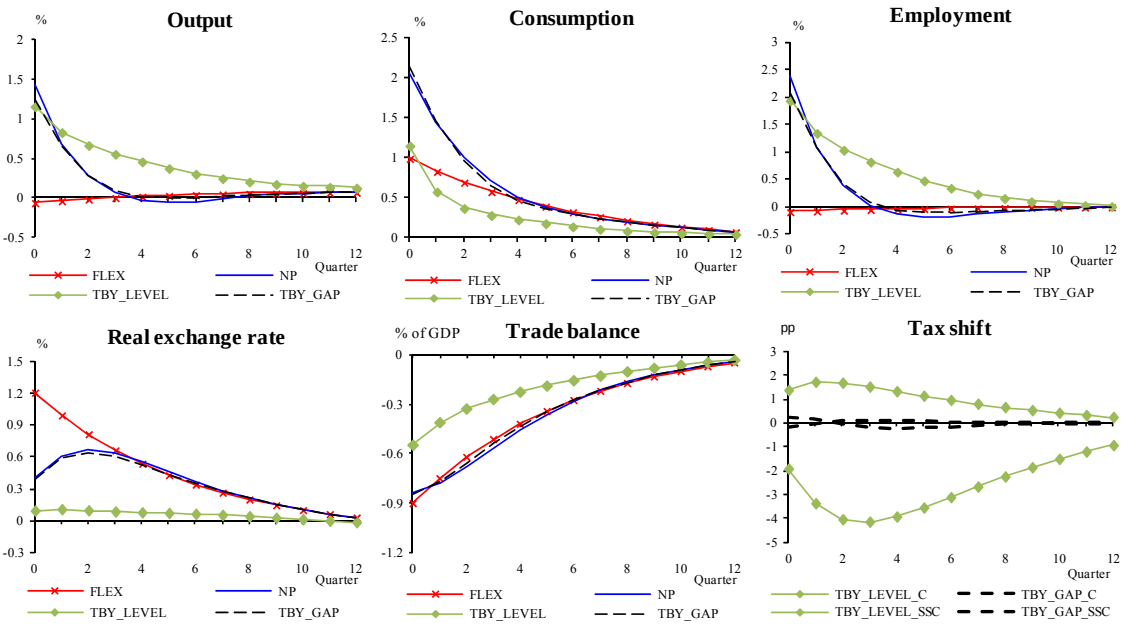
intervention, the mitigation of a fall in net exports and the trade balance improvement are rather small, in particular when concentrating on the trade balance gaps. Furthermore, Figure 2 underlines the necessity that increasing taxes on consumption (in percentage points) are less than decreasing employers' SSC in order to ensure that the fiscal reform is budgetary-neutral. This is in line with Langot et al. (2012), who attribute this unproportional tax shift to a higher tax base for consumption tax than for employers' SSC.

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.

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



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

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 price and wage 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.

Similar to the TFP shock, a budgetary-neutral tax shift from employers' SSC to consumption tax results in a relatively smaller increase in consumption tax compared to the decrease in employers' SSC due to different tax bases. Figure 3 suggests that a temporary tax shift towards the consumption tax by around 1.5 percentage points (TBY_LEVEL) 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 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. Furthermore, Figure 3 shows higher volatilities during the adjustment process of output and employment in the medium term.

To sum up, our 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 comprehensive welfare analysis.

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.

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

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

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

with

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

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

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

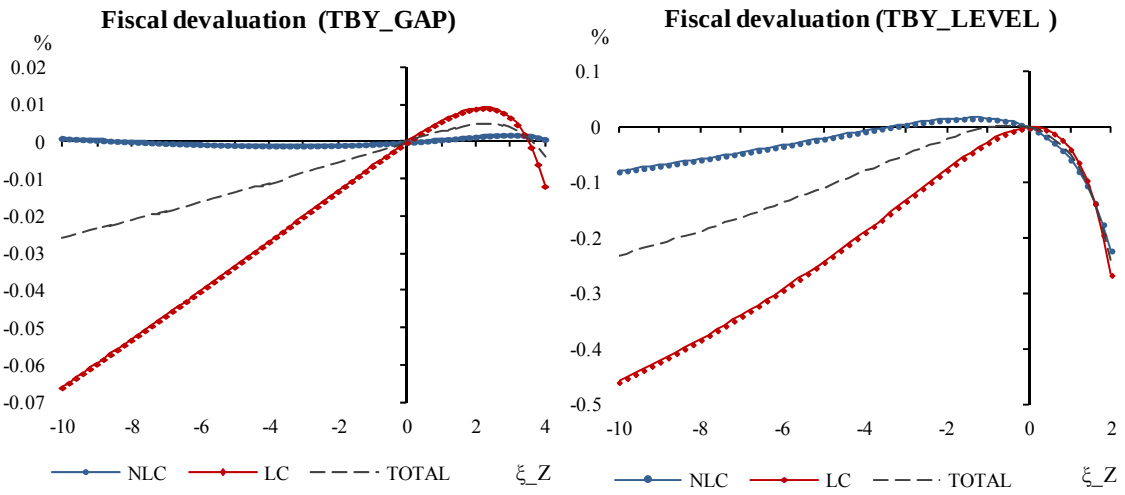
We run simulations over the interval [-10; 2] for the fiscal policy parameter ξ_Z in steps of 0.2. Welfare gains and losses are measured relative to non-stabilisation and are expressed in percent of steady state consumption for NLC households, LC households and the weighted

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

average of both household types (TOTAL).[5] 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 (see Hohberger et al. 2014). 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 absolute terms (TBY_LEVEL). Given a fiscal parameter value of $\xi_Z = -10$, fiscal devaluation generates welfare losses of up to 0.03 % and 0.25 % of steady state consumption for households average when stabilising TBY_GAP and TBY_LEVEL, respectively.

Figure 4: Welfare effects of fiscal devaluation.



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

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

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

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 Hohberger et al. (2014) and Vogel et al. (2013).

In case of TBY_LEVEL stabilisation, a tax shift from SCC to consumption tax generates welfare losses for LC households up to 0.5 % of steady state consumption as consumption tax increase reduces purchasing power of disposable period income of LC households. NLC households experience welfare losses of up to 0.08 % of steady state consumption. NLC households also experience welfare gains for the policy parameters range [-3; 0]; however, these welfare gains are negligible small. 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 and increase 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

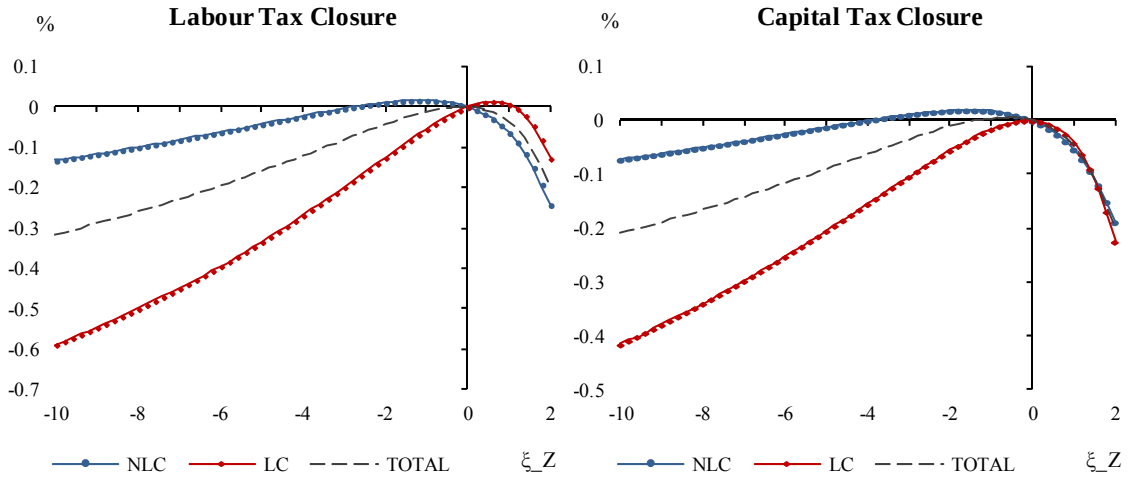
This section provides several sensitivity analyses for alternative fiscal closure rules and distinctions in the tradable and non-tradable sector sizes in order to check the effect of changes in the model structure. We focus in this section on stabilising the trade balance in absolute terms (TBY_LEVEL), as stabilising the trade balance gap implies qualitatively similar welfare effects.

Alternative Budget Closure Rules

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. They represent immediate

government revenues without having additional effects on economic decision-making by NLC households. 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 the budget deficit.

Figure 5: Welfare analysis for alternative budget closures



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

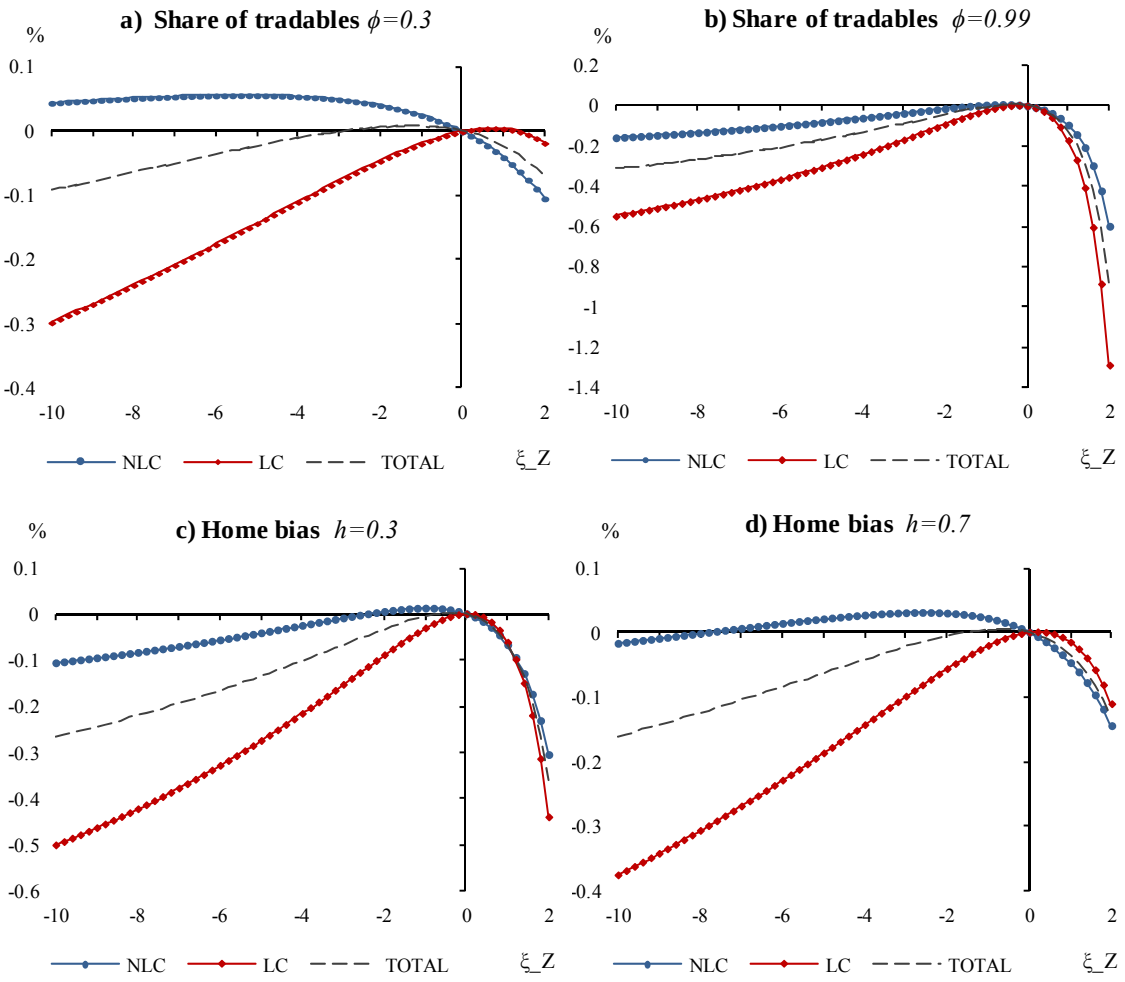
Figure 5 depicts that alternative budget closures perform very similarly to lump-sum taxes. Labour income tax as budget closure induces higher welfare losses for both household types, while capital tax as closure reduces households' welfare losses slightly. The overall welfare performance, however, remains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

Tradables vs. non-tradables

As fiscal devaluation increases the price for tradable relative to non-tradable goods, 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 $\phi = 0.3$ and $\phi = 0.99$ 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 as a composite of domestic produced and imported goods.

Panels c) and d) in Figure 6 show the welfare effects for changes in the home bias ($h = 0.3$ and $h = 0.7$ 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. Panels c) and d) in Figure 6 suggest that an increasing home bias for domestic produced tradables relative to imports reduces the welfare losses for both types of household.

Figure 6: Welfare analysis for alternative robustness checks



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

Share of LC households

The impact of changing the share *slc* of the LC households in the model calibration can be concluded from the model setup. The higher the share of LC households, the higher the welfare losses for total households as the weighted average of NLC and LC households. For

checking the robustness of this assumption, we set *slc*=0.1 and *slc*=0.7 with the result that the separated welfare effects for LC and NLC do not change considerably. However, variations in the compositions of the two household types induce corresponding changes in welfare of total households.

6. Conclusion

This paper uses 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 imbalances. We contribute to the existing literature on fiscal devaluation by focussing mainly on the effects on households' welfare. Fiscal devaluation is designed as a budgetary-neutral tax shift from employers' social security contribution (SSC) to value-added tax (VAT). We compare the performance of fiscal devaluation with alternative budget closures and provide several robustness checks.

The simulation results suggest that fiscal devaluation can stabilise excessive trade balance fluctuations in absolute terms (TBY_LEVEL). However, the associated tax shift from social security contribution to consumption tax is accompanied with welfare losses of up to 0.25 % 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 a fiscal devaluation with welfare losses of up to 0.5 % of steady state consumption. However, the welfare losses for both types of households are fairly moderate when stabilising the trade balance gap. Our findings are robust to several sensitivity checks, i.e. alternative distortionary budget closures and changes in the relative sector size between tradable and non-tradable goods.

References

Annicchiarico B, Di Dio F, Felici F (2013) "IGEM: A Dynamic General Equilibrium Model for Italy", Working Papers, No 1.

Auray S, Eyquem A, Ma, X (2014) " Fiscal Devaluations in a Monetary Union and the Extensive Margin of Trade", CREST Série des documents de travail, No. 2014-11.

Brzoza-Brzezina M, Kolasa M, Makarski K (2013) "Macroprudential policy instruments and economic imbalances in the euro area", European Central Bank Working Paper Series, 1589.

Canzoneri M, Cumby R, Diba B (2007) "The Cost of Nominal Rigidity in NNS Models", Journal of Money, Credit and Banking, 39(7), 1563-1586.

de Mooij R, Keen M (2012) "'Fiscal devaluation' and fiscal consolidation. The VAT in troubled times", IMF Working Paper, 12/85.

DIW Berlin (2014) "Innovation in Greece", Economic Bulletin, 4(10), 12-18.

Druant M, Fabiani S, Kezdi G, Lamo A, Martins F, Sabbatici, R (2009) "How are firms wages and prices linked. Survey evidence in Europe", European Central Bank Working Paper Series, 1084.

Engler P, Ganelli G, Tervala J, Voigts S (2014) "Fiscal Devaluation in a Monetary Union", IMF Working Paper 14/201.

European Union (2013) "Taxation trends in the European Union. Data for the EU member states, Iceland and Norway", Eurostat statistical books, 2013 ed., Publications Office of the European Union, Luxembourg.

Galí J (2008) " Monetary Policy, Inflation, and the Business Cycle - An Introduction to the New Keynesian Framework", Princeton University Press.

Galí J, López-Salido J, Vallés J (2007) "Understanding the effects of government spending on consumption", in: Journal of the European Economic Association, 5(1), 227-270.

Galí J, Monacelli T (2005) "Optimal monetary and fiscal policy in a currency union", National Bureau of Economic Research Working Paper, 11815.

Gomes S, Jacquinot P, Pisani M (2010) "The eagle. A model for policy analysis of macroeconomic interdependence in the euro area", European Central Bank Working Paper Series, 1195.

Hohberger S, Vogel L, Herz B (2014) "Budgetary-Neutral Fiscal Policy Rules and External Adjustment", Open Economies Review, 25(5), 909-936.

Imbs J, Méjean, I (2010) "Trade Elasticities. A Final Report for the European Commission", Economic Papers, 432.

Langot F, Patureau L, Sopraseuth T (2012) "Optimal fiscal devaluation", IZA Discussion Paper No. 6624.

Lipinska A, von Thadden L (2012) "On the (In)effectiveness of Fiscal Devaluations in a Monetary Union", Finance and Economics Discussion Series.

Lombardo G, Ravenna L (2012) "The size of the tradable and non-tradable sectors. Evidence from input-output tables for 25 countries", in: Economics letters, 116(3), 558–561.

Lucas R (2003) "Macroeconomic Priorities", American Economic Review, 93(1), 1-14.

Marto R (2013) "Assessing the Impacts of Non-Ricardian Households in an Estimated New Keynesian DSGE Model", MPRA Paper No. 55647.

Mendoza E (1995) "The Terms of Trade, the Real Exchange Rate, and Economic Fluctuations", in: International Economic Review, 36(1), 101–137.

Poterba, J, Rotemberg, J, Summers, L (1986): "A tax-based test for nominal rigidities", American Economic Review, 76(4), 659–675.

Rabanal P, Aspachs-Bracons O (2009) "The Drivers of Housing Cycles in Spain", IMF Working Papers 09/203.

Rabanal P, Rubio-Ramírez J (2003) "Comparing New Keynesian Models of the Business Cycle: A Bayesian Approach", Federal Reserve Bank of Atlanta Working Paper 2001-22a.

Rabanal P, Tuesta V (2013) "Nontradable Goods and the Real Exchange Rate", Open Economies Review, 24(3), 495–535.

Ratto M, Roeger W, in't Veld J (2009) "QUEST III. An estimated open-economy DSGE model of the euro area with fiscal and monetary policy", Economic Modelling, 26(1), 222–233.

Simonovska I, Waugh M (2014) "The elasticity of trade: Estimates and evidence", Journal of International Economics, 92(1), 34-50.

Stähler N, Thomas C (2012) "FiMod – a DSGE model for fiscal policy simulations", in: Economic Modelling, 29(2), 239-261.

Vogel L, Roeger W, Herz B (2013) "The Performance of Simple Fiscal Policy Rules in Monetary Union", Open Economic Review, 24, 165–196.