Fiscal Policy, Current Account Dynamics and External Adjustment

Dissertation

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WEHE DIR, DU HINTERHÄLTIGER RÄUBER FREMDER ARBEIT
UND FREMDEN GEISTES; HÜTE DICH, UNBEDACHT HAND
AN DIESES UNSER WERK ZU LEGEN

(Albrecht Dürer, 1511)

For my constants

Danksagung

„Das akademische Leben ist also ein wildes Hasard." (Max Weber, 1919)

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Abstract

The central research question of this thesis is the potential of fiscal policy to stabilise asymmetric shocks and macroeconomic fluctuations at the level of EMU member states, with a special focus on external imbalances.

After a short introduction, Chapter 2 analyses in a small open economy DSGE model the potential of fiscal policy to attenuate current account imbalances. The focus is on fiscal policy rules that adjust the overall level of government expenditure. This chapter finds that, in case of productivity and risk-premium shocks, a counter-cyclical fiscal response to the current account can help stabilising most of the macroeconomic variables, independently of the underlying exchange rate regime. However, stabilising the current account via fiscal policy intervention comes at the price of higher variability of output in the short-run.

Chapter 3 examines in a two-sector DSGE model whether shifting government purchases between tradable and non-tradable goods can help to reduce external fluctuations without large swings in the overall fiscal stance. The policy rules considered are budgetary-neutral in the sense that the overall level of government expenditure is kept constant. This policy rule is compared to fiscal devaluation as a strategy to reduce external imbalances and find that state-dependent changes in the composition of government purchases between tradables and non-tradables (T/NT) can stabilise excessive fluctuations in the event of economy-wide supply and demand shocks. Contrary to fiscal devaluation, the expenditure-shifting rule faces a trade-off between stabilising domestic activity and enhancing household welfare, on the one hand, and reducing excessive fluctuations in external positions, on the other hand.

Chapter 4 builds upon the model developed in Chapter 3 but focuses on budgetary-neutral fiscal rules that adjust the composition of government purchases in response to domestic business cycle indicators as a stabilisation tool when fiscal limits are tight. This chapter finds that state-dependent reallocation of government purchases between tradable and non-tradable goods stabilises domestic activity and reduces the welfare costs of economy-wide and sector-specific shocks. Potential welfare gains of such policy rules are higher than welfare gains from standard counter-cyclical fiscal policy rules. Contrary to standard deficit spending policies, the state-dependent expenditure composition rules avoid the trade-off between, first, counter-cyclical spending and, second, consolidation needs in economic downturns in the presence of explicit or implicit deficit and debt limits.

Chapter 5 deals with TARGET2 imbalances in the euro area. This chapter evaluates the current economic costs and profits of German claims on the Eurosystem through TARGET2. While Germany's nominal profits from holding TARGET2 claims depend on the development of the nominal interest rate, the real profits are determined by the real interest rate as well as the real exchange rate. This chapter finds that at the end of 2013 Germany faces current losses of around 13 billion euros in real terms. Calculating the profits and losses of every member country in the euro area reveals that the TARGET2 system works as an implicit distribution mechanism and underlines the aspect that, even without an euro area break-up or exit of one member-country, holding TARGET2 claims can cause high economic costs in real terms.

Zusammenfassung

Die zentrale Forschungsfrage dieser Dissertation ist, inwiefern Fiskalpolitik stabilisierend auf asymmetrische Schocks und daraus entstehende makroökonomische Konjunkturzyklen wirken kann. Ein besonderer Fokus liegt dabei auf außenwirtschaftlichen Ungleichgewichten. Das einführende Kapitel motiviert die Problemstellung und gibt einen Überblick über die unterschiedlichen Aufsätze und deren Ergebnisse.

Kapitel 2 untersucht mithilfe eines Modells einer kleinen offenen Volkswirtschaft die makroökonomischen Auswirkungen eines Angebots- und Nachfrageschocks innerhalb zweier Wechselkursregime – innerhalb oder außerhalb einer Währungsunion – sowie das Stabilisierungspotential der Fiskalpolitik für Leistungsbilanzungleichgewichte. Die Analyse zeigt für beide Schocks, dass eine bewusste antizyklische Reaktion der Fiskalpolitik auf die Leistungsbilanz stabilisierend wirken kann, unabhängig vom zugrundeliegenden Wechselkursregime. Jedoch entsteht ein Trade-off zwischen Leistungsbilanz- und Produktionsstabilisierung.

Aufbauend auf einem Zweisektorenmodell einer kleinen offenen Volkswirtschaft innerhalb einer Währungsunion geht Kapitel 3 der Frage nach, ob eine sektorale Umschichtung der staatlichen Ausgaben, insbesondere zwischen handelbaren und nicht-handelbaren Gütern, zu einer Stabilisierung der Handelsbilanz beitragen kann. Die Besonderheit dieser sektoralen Umschichtung ist deren Budgetneutralität, d.h., dass die Gesamtausgaben des Staates konstant bleiben. Dabei dient das Szenario einer fiskalischen Abwertung – verstanden als eine einkommensneutrale Umschichtung der Steuerlast zwischen Lohn- und Mehrwertsteuer – als Benchmark, um die Effektivität der budgetneutralen Politikregel zu bewerten. Es zeigt sich, dass temporäre sektorale

Ausgabenumschichtungen des Staates die Handelsbilanz stabilisieren können. Im Gegensatz zur fiskalischen Abwertung ergibt sich jedoch ein Trade-off zwischen der Stabilisierung der inländischen Ökonomie und damit einhergehender positiver Wohlfahrtseffekte einerseits sowie der Reduzierung von hohen Handelsbilanz-ungleichgewichten andererseits.

Kapitel 4 nutzt die Modellstruktur von Kapitel 3, erweitert jedoch die Fragestellung in mehreren Dimensionen: (i) Fokussierung der staatlichen Umschichtungspolitik auf inländische Konjunkturschwankungen, (ii) klassisch antizyklische Staatsausgabenregel als Benchmark, (iii) zusätzliche sektorspezifische Schocks sowie (iv) eine detailliertere Wohlfahrtsanalyse unter Berücksichtigung verschiedener Steuerarten. Die Simulationen zeigen, dass eine sektorale Umschichtung der Staatsausgaben bei den untersuchten Schocks sowohl stabilisierend als auch wohlfahrtssteigernd wirkt. Die potentiellen Wohlfahrtsgewinne liegen über denen der klassischen antizyklischen Staatsausgabenregel. Die Gründe hierfür liegen im Zusammenspiel der Ausgabenneutralität sowie der Stabilisierung der Produktion und der Steuerbasis. Somit generiert eine sektorale Umschichtung der Staatsausgaben gerade bei bereits hohem Schuldenstand potentielle Stabilisierungsmöglichkeiten.

Kapitel 5 beschäftigt sich mit den TARGET2-Bilanzen innerhalb der Währungsunion. Im Speziellen werden die tatsächlichen realen Verluste der TARGET2-Forderungen Deutschlands gegenüber dem Eurosystem berechnet. Während Deutschland durch die Verzinsung der TARGET2-Forderungen zwar nominale Zinsgewinne erwirtschaftet, müssen für eine Berechnung der tatsächlichen realen Gewinne und Verluste die Realzinsen und der reale Wechselkurs berücksichtigt werden. Die Berechnungen weisen darauf hin, dass Deutschland bis Ende 2013 ca. 13 Milliarden Euro an realen Verlusten entstanden sind. Hochrechnungen für die übrigen Mitgliedsländer zeigen, dass das TARGET2-System wie eine Art Umverteilungsmechanismus wirkt, indem auch ohne Zusammenbruch des Euros bzw. dem Austritt eines Mitgliedslandes reale ökonomische Anpassungskosten entstehen können.

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1

Introduction

1.1 Motivation

The issue of intra-European imbalances has attracted a lot of interest in recent years. While the current account for the aggregated euro area has always been nearly balanced since the establishment of the European Monetary Union (EMU) in 1999, growing and persistent divergences have developed among several EMU countries. The reasons for the growing external imbalances represent two sides of the same coin and can be summarised as follows: On the one hand, Germany's current account surplus in the last years was mainly driven by an exogenous increase in private savings and enhancing foreign demand for German exports, as well as labour market reforms and wage restraints (Kollmann et al. 2014). On the other hand, the decline of borrowing costs through the elimination of exchange rate risk and the perceived disappearance of country risk premia in the process of financial integration has led to capital flows into European periphery countries (e.g. Blanchard and Giavazzi 2002; Jaumotte and Sodsriwiboon 2010; Lane and Pels 2012). This contributed to a boost in domestic demand with subsequent increases in domestic prices and unit labour costs, which led to real exchange rate appreciation and competitiveness losses, resulting in growing and persistent current account deficits and external liabilities (e.g. Arghyrou and Chortareas 2008; Zemanek et al. 2010; Belke and Dreger 2013; Chen et al. 2013).

Experiences from the financial crisis and the European debt and banking crisis suggest that external imbalances can raise the risk for macroeconomic stability. Blanchard and Milesi-Ferretti (2012) and Obstfeld (2012) point out that large external deficits raise the risk for sudden stops in capital flows and may lead to financial disruptions and spillover effects, especially in countries or regions (EMU) with extensive cross-border financial links. They argue that these potential risks may justify a preventive role for fiscal policy and prudential measures. Support for fiscal policy's contribution to attenuate external imbalances comes from Lane (2010). As a lesson from the recent crisis, he argues that fiscal policy should not only stabilise the output cycle, but also respond to external imbalances, because of potential spillover-effects to macroeconomic and fiscal stability embedded in such imbalances.

Following the literature on the twin deficit hypothesis (e.g. Corsetti and Müller 2006; Kim and Roubini 2008; Kumhof and Laxton 2013a; Bouakez et al. 2014), the potential role of fiscal policy in facilitating external adjustments is emphasised in several empirical studies (e.g. Abbas et al. 2011; Abiad et al. 2011). The link between fiscal policy and external adjustment typically alludes to the goods market channel. A reduction in government spending decreases public demand for domestic and foreign goods, depreciates the real exchange rate through relative price changes and strengthens the trade balance. Vice versa, an increase in government expenditure would be necessary to reduce a trade balance surplus.

However, especially in the aftermath of the financial crisis, fiscal positions of most EMU member countries have deteriorated substantially due to severe recessions and the increased government spending to mitigate the output losses. As a consequence, government budget constraints are very tight and the scope for fiscal policy as a stabilisation tool is extremely limited. As fiscal policy is the major macroeconomic policy instrument left with the individual member countries of EMU, this poses new und pressing challenges for the appropriate design of tax and expenditure policies. In the end, fiscal policy is expected to help attenuating excessive external fluctuations on the one hand, and ensuring sound public finances to minimise the risks of future crises, on the other hand. It is, hence, of particular interest to analyse the potential of fiscal policy not only to stabilise domestic activity, but also the ability to attenuate or prevent large external imbalances – particularly in times of budgetary stress.

1.2 Synopsis

The aim of the thesis is to analyse the potential of fiscal policy to stabilise asymmetric shocks and macroeconomic fluctuations at the level of EMU member states, with a specific focus on external imbalances. For that reason, I make use of different small open economy models to investigate to what extent fiscal policy can contribute to attenuate and reduce external imbalances, stabilise domestic activity and increase household welfare. Within each model, I use different fiscal policy rules to account for alternative economic scenarios. This allows a broad discussion on how fiscal policy could stabilise economic activities in open economies. Chapter 5 relaxes the focus on the stabilisation potential of fiscal policy and deals with TARGET2 imbalances as a specific characteristic of external imbalances.[1]

Chapter 2 investigates the dynamic macroeconomic responses to different shocks under alternative exchange rate regimes and analyses the stabilising potential of fiscal policy for current account imbalances in a small open economy. Based on a small open economy model in the spirit of Galí and Monacelli (2005) and Justiniano and Preston (2010), the distinction between two monetary regimes, i.e. an economy inside and outside of EMU, and the introduction of fiscal policy rules allow for an endogenous reaction of fiscal policy to changes in the current account under alternative monetary regimes. Within this approach, we examine how fiscal policy affects the adjustment of the current account and other macroeconomic variables to productivity and risk premium shocks. The contribution of this approach to existing literature is to directly link fiscal policy rules to external imbalances and analyse the stabilising properties of such a rule based fiscal policy for the current account. The dynamic simulations show that entry into EMU and the accompanying loss of an autonomous monetary policy makes (i) the economy more vulnerable to a productivity shock with higher variability of output, real exchange rate and current account in the short run and (ii) leads to higher persistence of the real exchange rate. On the contrary, for a risk premium shock, entry into EMU implies lower variability of most macroeconomic variables, but a higher persistence in the adjustment process of the current account. For both shocks, inside as

[1] In the following section, I briefly summarise the content of each chapter, whereas a detailed discussion on how the different approaches contribute to the existing literature is delegated to the respective chapter.

well as outside of EMU, a fiscal response to the current account can help stabilising most of the macroeconomic variables, e.g. real exchange rate and the current account, but at the expense of higher output variability in the short run. Hence, fiscal policy faces a trade-off between stabilising current account and output.

As large external imbalances and fragile fiscal positions have emerged as major policy challenges for the euro area in the financial crisis, Chapter 3 focuses on the question whether a shift of government expenditure between tradable and non-tradable goods is an alternative to a fiscal devaluation in order to support external adjustment. To my knowledge, this approach is the first to assess the stabilisation properties of changes in the composition of government purchases between tradables and non-tradables based on a simple fiscal policy rule. To take into account the current debate on fiscal devaluation (e.g. Correia 2011; Farhi et al. 2011; de Mooij and Keen 2013), we use a fiscal devaluation scenario, i.e. a shift of the tax burden from labour to consumption, as benchmark to evaluate the potential welfare and rebalancing effects of the expenditure-shifting policy rule. The analytical framework is more extensive than in Chapter 2. Following the small open economy approach by Galí and Monacelli (2008) and Vogel et al. (2013), the two-region New Keynesian DSGE model with price and wage stickiness and financial market frictions is extended by a non-tradable goods sector and a relative fiscal policy rule that adjusts its expenditure between T/NT according to fluctuations in macroeconomic variables. This chapter finds that a state-dependent sectoral reallocation of government purchases can dampen excessive fluctuations in the external accounts. However, such a policy is accompanied with average welfare losses due to the trade-off between the stabilisation of external positions and domestic variables. The policy rule generates welfare gains if it targets the stabilisation of domestic output at the cost of amplified external fluctuations. In contrast, fiscal devaluation does not face such a trade-off between lower excess volatility in external positions and domestic variables.

Chapter 4 builds upon the framework studied in Chapter 3, however, we broaden the analysis in a number of dimensions by (i) considering fiscal policy rules that adjust the composition of government purchases in response to domestic cyclical fluctuations, (ii) using a classical counter-cyclical policy rule as benchmark scenario, (iii) introducing sector-specific shocks in addition to economy-wide supply and demand shocks, (iv)

providing a more extensive welfare analysis by decomposing the overall welfare effects in mean and volatility effects and (v) using lump-sum taxes as alternative budget closure. The simulations in this chapter show that the expenditure-switching rule can achieve substantial welfare gains for the population average. Welfare gains are higher compared to a standard counter-cyclical policy rule that adjust the overall level government purchases. The reason is the combination of ex ante neutrality with a stabilisation of activity and tax revenues. The expenditure-switching rule therefore avoids offsetting effects from pro-cyclical budgetary closure rules that, e.g., increase tax rates in recessions in order to stabilise government deficit and debt levels.

Relaxing the focus on the stabilisation potential of fiscal policy, Chapter 5 deals with TARGET2 imbalances within the euro area. Pioneered by Sinn and Wollmershäuser (2012a, 2012b), the discussion on TARGET2 imbalances – and its potential role of perpetuating current account imbalances – has attracted a lot of interest, especially since the onset of the financial crisis in 2008 and during the European debt and banking crisis. Due to the risks to macroeconomic and financial stability, the existing literature focuses mainly on potential risks and costs, which are associated with the TARGET2 system in case of a euro collapse or a member country's exit of the EMU. The contribution of this chapter is to evaluate the current economic costs incurred from holding TARGET2 claims in real terms. Although TARGET2 claims and liabilities are interest-bearing, nominal gains have to be adjusted by price level changes over time, i.e. by the real exchange rate, to account for real structural imbalances within the euro area. Based on a stylised two-period model according to Jin and Choi (2013), this chapter shows that at the end of 2013, Germany faces real losses in the amount of 13 billion euros. Moreover, the real gains and losses of the TARGET2 system can be considered an implicit distribution mechanism, which mirrors the real structural imbalances within the EMU.

Finally, Chapter 6 concludes with a brief summary.

2

Fiscal Policy, Monetary Regimes and Current Account Dynamics*

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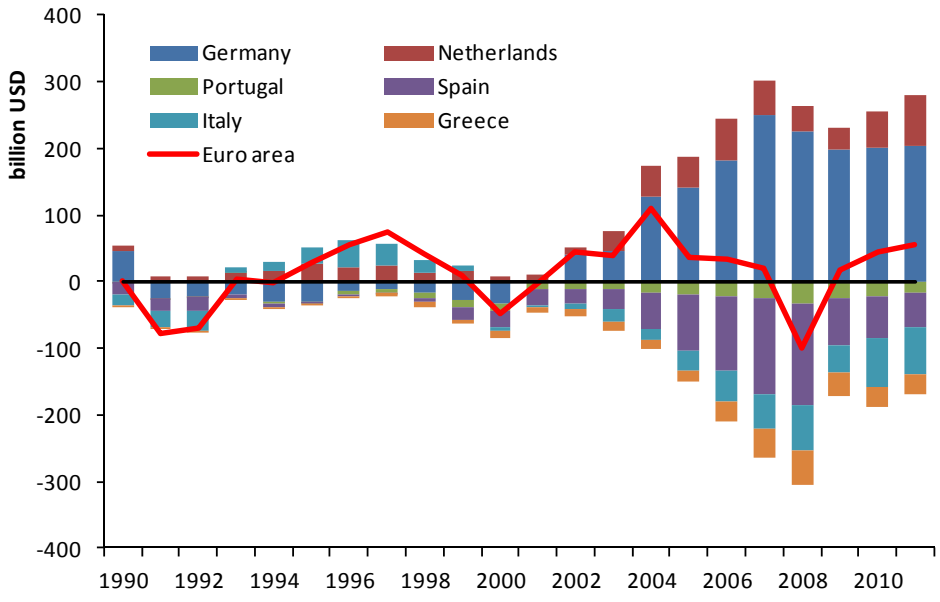
2.1 Introduction

The issue of global imbalances has attracted a lot of interest and controversy in the last decade (e.g. Bernanke 2005; Blanchard and Milesi-Ferretti 2012). On a regional level substantial imbalances within the euro area have developed and are now on the international policy agenda, not least due to the ongoing twin debt and banking crises. While the current account for the aggregated euro area is nearly balanced, a growing and persistent divergence has developed among EMU countries since the establishment of the monetary union in 1999 with considerable current account deficits particularly in some southern European countries like Greece, Italy, Portugal and Spain (see Figure 1).

The debate on these imbalances has so far mainly focused on the role of capital flows for real appreciation, the subsequent loss of competitiveness, and the deterioration of the current account (e.g. Arghyrou and Chortareas 2008; Zemanek et al. 2010; Schnabl and Freitag 2012; Belke and Dreger 2013). In an empirical investigation on the stationarity of current account deficits in the European Union, Holmes et al. (2010) find the strong evidence on deficit sustainability in the core EU members, while evidence is weaker for a large EU panel and a non-EU panel. This might suggest that subsequent EU expansions have weakened sustainability of current account deficits.

Figure 1: Current account balances in the euro area (1990-2011)



Source: World Development Indicators online database.

In the case of the large and persistent current account imbalances within the euro area Jaumotte and Sodsriwiboon (2010) argue that without the possibility of nominal exchange rate revaluation, gradual adjustment to regaining competitiveness is painful and sudden stops in capital flows might lead to abrupt adjustment with sharp contractions in domestic demand. They point out that especially in the current twin banking and debt crisis, fiscal consolidation will play crucial role in lower public debt, reducing domestic demand pressure and improving the current account deficit positions.

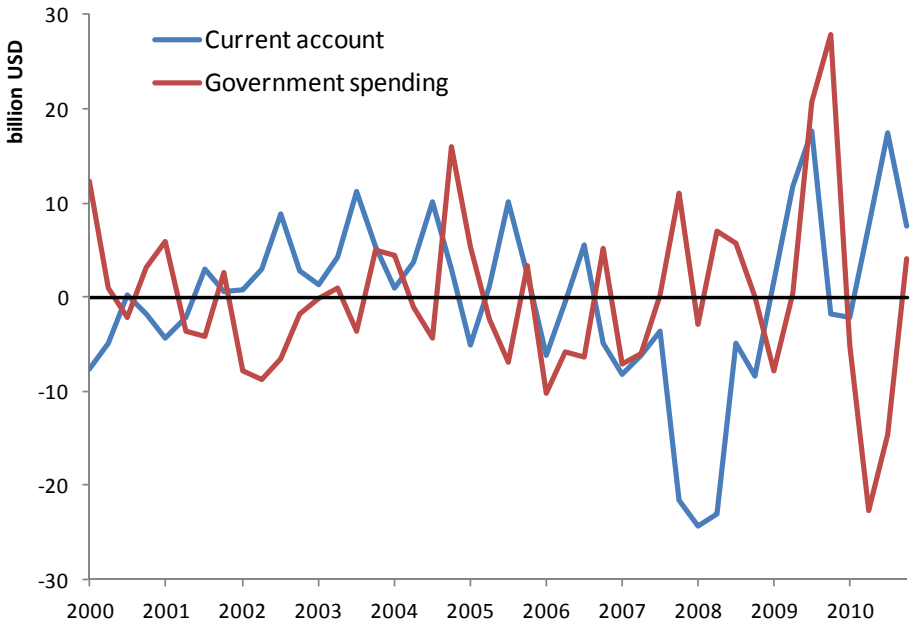
To investigate the potential of fiscal policy to stabilise the current account, i.e. to prevent ex ante excessive imbalances, we use the link between current account and fiscal policy. This analysis typically alludes to the goods market channel with an increase in government spending raising the demand for domestic goods, appreciating the real exchange rate through relative price changes and thereby worsening the trade balance. While there is some controversy on the empirics of these effects, especially concerning the relationship between government spending, real exchange rate and current account deficit in the US (see Corsetti and Müller 2006; Chinn and Ito 2008; Kim and Roubini 2008; Monacelli and Perotti 2010; Bouakez et al. 2014), Abbas et al. (2011) report a statistically significant association between fiscal policy and the current account. Based on a large country sample of 124 countries over the period 1985 – 2007 they find that an 1 percent increase in government consumption typically worsens the current account by about 0.3 percent of GDP on impact with this effect becoming insignificant after two to four years.[2] In the context of the European Union, Beetsma et al. (2008) find for 14 EU countries over the period 1970 – 2004 that an increase in public spending of 1 percent of GDP raises GDP by 1.2 percent, which leads through a decrease in net exports to a fall of the trade balance by 0.5 percent of GDP. Catalán and Lama (2006) provide further support for the stabilisation potential of fiscal policy. They show for the Spanish economy that an 1 percent exogenous fall in real government spending improves the current account balance by about 0.16 percentage points of GDP over the first year. In a recent study on fiscal consolidation and its implications for the

[2] The estimations yield similar results for emerging, low-income and advanced economies. The relationship is significantly stronger when output is above potential output.

current account Abiad et al. (2011)[3] find that a fiscal consolidation of 1 percent of GDP results in an improvement in the current account of over 0.5 percent of GDP within two years. This effect is not only driven through a decline in domestic demand but also an increase in exports as a result of a real depreciation of the domestic currency.

Figure 2 depicts exemplarily the development of government spending and current account balance for three current account deficit countries in the center of the ongoing financial crisis debate, namely Greece, Portugal and Spain. Typically an increase in government spending is accompanied by a decrease in the current account with a short delay. This could indicate that for small open economies with large current account deficits, fiscal policy could be an important policy instrument to stabilise the current account.

Figure 2: Changes in current account and government spending



Source: IHS Global Insight. Note: Changes are measured as deviations from HP-filter trend and for the group of Greece, Portugal and Spain.

The DSGE approach provides a comprehensive framework to analyse fiscal and monetary policy under alternative exchange rate regimes, e.g. being a member of the

[3] This chapter in the World Economic Outlook 2011 – Slowing Growth, Rising Risks – refers on the background paper by Bluedorn and Leigh (2011).

euro area or not. While the coordination and stabilising properties of monetary and fiscal policy are at the core of the extensive DSGE literature (e.g. Beetsma and Jensen 2005; Schmitt-Grohé and Uribe 2007; Ferrero 2009; Vogel et al. 2013), only few studies deal with the potential of monetary or fiscal policy for stabilising the current account. Ferrero et al. (2008) analyse the effects of alternative monetary policy regimes on the behavior of aggregate variables under two different current account rebalancing scenarios, but without considering fiscal policy rules. Di Giorgio and Nisticò (2013) study the role of stabilisation policies for productivity shocks on the dynamics of net foreign assets in a two country DSGE model with overlapping generations. In addition to alternative monetary policy rules, they use a primary-deficit feedback rule for fiscal policy with counter-cyclical response to the output gap and the stock of public debt. For a positive productivity shock they show how a low degree of fiscal discipline, i.e. the extent to which fiscal policy reacts to outstanding debt, leads to a deterioration of the net foreign asset position in the medium run.

Our contribution to this line of research is to link fiscal policy rules directly to external imbalances and analyse the stabilising properties of such a rule based fiscal policy for the current account. As the ongoing current financial crisis reveals current account imbalances can cause far reaching damage to financial stability. As fiscal policy is the major policy instrument left with the individual members of a currency union it seems interesting and necessary to analyse the potential of fiscal policy rules to stabilise the current account. As an example the European Commission explicitly looks into the process of macroeconomic imbalances with her scoreboard framework (see European Commission 2012), so a better understanding of policy rules to stabilise the current account could be of particular interest. We find that inside as well as outside of EMU a fiscal response to the current account can help stabilising most of macroeconomic variables, e.g. real exchange rate, net foreign assets and the current account, but fiscal policy faces a trade-off between stabilising current account and output.

The chapter is organised as follows. Section 2.2 describes a small open economy DSGE model. The design of our monetary and fiscal policy rules with respect to alternative monetary regimes and the model calibration are given in section 2.3. Section 2.4 examines the simulation results of a negative productivity and risk premium shock to macroeconomic variables under alternative scenarios and policy rules, with focus on

current account dynamics. Section 2.5 provides some insights on the sensitivity of our results. Our main findings are summarised in section 2.6.

2.2 A small open economy model

Our model is based on the small open economy approach as in Monacelli (2005), Galí and Monacelli (2005) and Justiniano and Preston (2010). Within this framework, the small open economy is modelled as one among a continuum of small open economies that form a monetary union.[4] Since each union member is infinitesimally small, country specific policies and shocks do not affect the rest of the monetary union, and is large enough to be characterised as a closed economy (see Monacelli 2005; Beltran and Draper 2008). The model includes elements that have become standard in this literature, such as nominal rigidities in price-setting, indexation of domestic prices to past inflation, incomplete pass-through of exchange rate movements to domestic inflation, habit formation in consumption and the use of Taylor rules in monetary policy. We depart from the assumption of complete risk-sharing as in Schmitt-Grohé and Uribe (2003) by introducing a country risk premium. This debt-elastic interest rate is related to the net foreign asset position. Hence, if the economy is a net borrower, domestic households are charged with a risk premium on the foreign interest rate. Due to the loss of an autonomous monetary policy within a currency union, we focus our analysis on the potential of alternative fiscal policy rules to stabilise the current account.

Households

The domestic economy is populated by a continuum of infinitely living households whose preferences are given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{\left(C_t - H_t\right)^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi} \right], \tag{2.1}$$

[4] For the alternative two country monetary union approach, see Benigno (2004), Beetsma and Jensen (2005), Breuss and Rabitsch (2008), and Ferrero (2009).

where N_t is labor input, $0<\beta<1$ is the discount factor and $H_t \equiv hC_{t-1}$ describes the external habit formation of the household. The parameters $\sigma, \varphi > 0$ are the inverse elasticities of intertemporal substitution (or coefficient of relative risk aversion) and labor supply, respectively. C_t is a composite consumption index defined by

$$C_t \equiv \left[(1-\alpha)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}. \tag{2.2}$$

$C_{H,t}$ and $C_{F,t}$ are CES aggregators of the quantities of domestic and foreign goods:

$$C_{H,t} = \left[\int_0^1 C_{H,t}(i)^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}} \quad \text{and} \quad C_{F,t} = \left[\int_0^1 C_{F,t}(i)^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}, \tag{2.3}$$

where $\eta > 0$ is the elasticity of substitution between domestic and foreign goods. The parameters α and $\varepsilon > 1$ are the share of foreign-produced goods in the consumption bundle and the elasticity of substitution between types of differentiated domestic or foreign goods, respectively.

The only available assets are domestic and foreign bonds. So that flow budget constraint of households is given by:

$$\begin{aligned} &P_t C_t + B_t + e_t nfa_t = \\ &W_t N_t + (1+i_{t-1}) B_{t-1} + (1+i_{t-1}^*) \phi_t(nfa_t) e_{t-1} nfa_{t-1} + \Pi_{H,t} + \Pi_{F,t} - T_t \end{aligned} \tag{2.4}$$

The left hand side corresponds to the uses of the resources. Households can utilise these to consume goods or to purchase new bonds, where B_t is the amount of one-period domestic bonds and nfa_t the amount of one-period foreign currency denominated bonds. e_t is the nominal exchange rate. The right hand side represents the resources at the beginning of period t, where $W_t N_t$ is the wage earning, $\Pi_{H,t}$ and $\Pi_{F,t}$ denote profits from holding shares in domestic and imported goods firms and T_t implies lump-sum taxes. Following Benigno (2009) and Schmitt-Grohé and Uribe (2003), the term $\phi_t(nfa_t)$ is a premium on foreign bond holdings, defined as

$$\phi_t = \exp\left[-\chi(nfa_t) + \tilde{\phi}_t \right],$$

where

$$nfa_t \equiv \frac{e_t NFA_t}{P_t}$$

is the real aggregate net foreign asset position of the domestic economy and $\tilde{\phi}_t$ a risk premium shock. The function $\phi_t(nfa_t)$ captures the costs for domestic households of doing transactions in the international asset market. Hence, as net borrowers, domestic households are charged a premium on the foreign interest rate; as net lenders, they receive a remuneration lower than the foreign interest rate. This functional form ensures stationarity of the foreign debt level in a log-linear approximation to the model.

For any given expenditure, the household optimisation problem yields the demand for each category of goods:

$$C_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\varepsilon} C_{H,t} \quad \text{and} \quad C_{F,t}(i) = \left(\frac{P_{F,t}(i)}{P_{F,t}}\right)^{-\varepsilon} C_{F,t} \tag{2.5}$$

for all $i \in [0,1]$, where the price indices of the domestic and foreign consumption bundles are

$$P_{H,t} \equiv \left[\int_0^1 P_{H,t}(i)^{1-\varepsilon}\, di\right]^{\frac{1}{1-\varepsilon}} \quad \text{and} \quad P_{F,t} \equiv \left[\int_0^1 P_{F,t}(i)^{1-\varepsilon}\, di\right]^{\frac{1}{1-\varepsilon}}.$$

Assuming symmetry across all i goods, the optimal allocation of expenditures between domestic and foreign goods implies the demand functions

$$C_{H,t} = (1-\alpha)\left(\frac{P_{H,t}}{P_t}\right)^{-\eta} C_t \tag{2.6}$$

and

$$C_{F,t} = \alpha\left(\frac{P_{F,t}}{P_t}\right)^{-\eta} C_t, \tag{2.7}$$

where the consumer price index (CPI) is defined as

$$P_t \equiv \left[(1-\alpha) P_{H,t}^{1-\eta} + \alpha P_{F,t}^{1-\eta}\right]^{\frac{1}{1-\eta}}. \tag{2.8}$$

The following optimality conditions, derived by maximising equation (2.1) subject to the budget constraint (2.4), must hold in equilibrium:

$$\frac{N_t^{\varphi}}{\left(C_t - H_t\right)^{-\sigma}} = \frac{W_t}{P_t} \tag{2.9}$$

$$\beta E_t\left[\left(\frac{\left(C_{t+1} - H_{t+1}\right)}{\left(C_t - H_t\right)}\right)^{-\sigma}\left(\frac{P_t}{P_{t+1}}\right)\right] = \frac{1}{(1+i_t)}, \tag{2.10}$$

$$\beta E_t\left[\left(\frac{\left(C_{t+1} - H_{t+1}\right)}{\left(C_t - H_t\right)}\right)^{-\sigma}\left(\frac{P_t}{P_{t+1}}\right)\left(\frac{e_{t+1}}{e_t}\right)\right] = \frac{1}{(1+i_t^*)\phi(nfa_t)}. \tag{2.11}$$

Equation (2.9) gives us the first order condition of the consumer's problem for making the intratemporal choice between labor and leisure. It states that the marginal rate of substitution between consumption and labor is equal to the real wage at any point of time. The intertemporal first order condition is given by equation (2.10), which is the standard Euler equation for the holding of domestic bonds. Similarly, equation (2.11) is the optimality condition for the holding of foreign bonds.

Domestic Producers

Differentiated domestic goods are produced by a continuum of monopolistically competitive firms owned by consumers. Each firm produces with a linear technology represented by the production function $Y_t(i) = A_t N_t(i)$, where A_t is an exogenous productivity shock. We further assume that firms set prices in a staggered fashion as in Calvo (1983). Hence, in any period t only $\left(1-\theta_H\right)$ firms are allowed to adjust their prices and maximise their expected discounted value of profits

$$E_t \sum_{T=t}^{\infty} \theta_H^{T-t} \beta_{t,T} Y_{H,T}(i)\left[P_{H,t}(i) - P_{H,T} MC_{H,T}\right]$$

subject to the demand function

$$Y_{H,T}(i) = \left(\frac{P_{H,T}(i)}{P_{H,T}}\right)^{-\varepsilon}\left(C_{H,T} + C_{H,T}^*\right),$$

where $MC_{H,T} = W_T / P_{H,T}$ is the real marginal cost. θ_H^{T-t} is the probability that the domestic firm will not be able to adjust its price during the next $(T-t)$ periods.

The first order condition is then

$$E_t \sum_{T=t}^{\infty} \theta_H^{T-t} \beta_{t,T} Y_{H,T}(i) \left[P_{H,T}(i) - \frac{\theta_H}{\theta_H - 1} P_{H,T} MC_{H,T} \right] = 0. \tag{2.12}$$

Retail Firms

For incomplete exchange rate pass-through we follow Monacelli (2005). Retail firms import foreign differentiated goods and have a small degree of pricing power because they are assumed to be monopolistically competitive. When selling imported goods to domestic consumers they will charge a mark-up over their cost. In the short run, this creates a wedge between the world market price of foreign goods paid by importing firms $\left(e_t P_{F,t}^*\right)$ and the domestic currency price of these goods when they are sold to consumers $\left(P_{F,t}\right)$. The so called "law of one price (l.o.p.) gap" (Monacelli 2005) is defined as:

$$\Psi_{F,t} = \frac{E_t P_{F,t}^*}{P_{F,t}} \tag{2.13}$$

Retail firms also operate under Calvo-style price setting, with θ_F being the fraction of firms not allowed to set prices optimally in any period t. These maximise the expected stream of discounted profits

$$E_t \sum_{T=t}^{\infty} \theta_F^{T-t} \beta_{t,T} C_{F,T}(i) \left[P_{F,t}(i) - e_T P_{F,T}^* \right]$$

subject to the demand curve

$$C_{F,T}(i) = \left(\frac{P_{F,T}(i)}{P_{F,T}} \right)^{-\varepsilon} C_{F,T}.$$

The associated first order condition yields:

$$E_t \sum_{T=t}^{\infty} \theta_F^{T-t} \beta_{t,T} C_{F,T}(i) \left[P_{F,T}(i) - \frac{\theta_F}{\theta_F - 1} e_T P_{F,T}^* \right] = 0 . \tag{2.14}$$

Uncovered Interest Rate Parity

Because we depart from the assumption of complete risk-sharing and allow for incomplete asset markets, we derive the uncovered interest rate parity condition through the asset-pricing condition in equations (2.10) and (2.11), which determine domestic and foreign bond holdings:

$$(1+i) = (1+i^*)\phi(nfa_t) \left[\frac{e_{t+1}}{e_t} \right]. \tag{2.15}$$

In periods when the economy is a net borrower (net lender), the domestic interest rate is higher (lower) than the foreign interest rate. Thus, movements in the net foreign asset position affect the interest rate differential of the domestic and foreign economy.

Government

To investigate the potential stabilising effects of fiscal policy to correct current account imbalances by regulating domestic demand, we assume that the government only purchases domestically-produced goods. The public consumption index is given by

$$G_{H,t} = \left[\int_0^1 G_{H,t}(i)^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{2.16}$$

where $G_{H,t}(i)$ is the quantity of domestic good i purchased by government. For any given level of public consumption, the government allocates expenditures across goods in order to minimise total cost. Minimisation of $P_H G_H$ under restriction (2.16) yields the government demand function:

$$G_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\varepsilon} G_{H,t} . \tag{2.17}$$

Government spending is financed either through lump-sum taxes to domestic households T_t or by nominal debt denominated in local currency B_t. This yields the government's flow budget constraint, in nominal terms:

$$B_t = (1+i_{t-1})B_{t-1} + G_{H,t} - T_t, \tag{2.18}$$

where $G_{H,t} - T_t$ denotes the nominal primary deficit (see Corsetti et al. 2009; Di Giorgio and Nisticò 2013). The detailed government spending feedback rules are defined in section 2.3.

Terms of Trade, Real Exchange Rate and the Current Account

Terms of trade are defined as

$$S_t = \frac{P_{F,t}}{P_{H,t}}. \tag{2.19}$$

The domestic terms of trade is the price of foreign goods (imports) per unit of domestic goods (exports). An increase in S_t is therefore equivalent to an increase in competitiveness. The real exchange rate is defined as

$$Q_t = \frac{e_t P_t^*}{P_t}, \tag{2.20}$$

the ratio of CPIs expressed in a common currency, where an increase in Q_t implies a depreciation of the home currency and thus an increase in competitiveness.
Finally, real net foreign assets evolve according to

$$\frac{e_t NFA_t}{P_t} = \frac{(1+i_{t-1})}{(1+\pi_H)}\phi_t\left(\frac{e_{t-1}NFA_{t-1}}{P_{t-1}}\right) + NX_t, \tag{2.21}$$

where NX_t denotes net exports and is the difference between output and absorption:

$$NX_t = \frac{P_{H,t}}{P_t}Y_t - (C_t + G_t). \tag{2.22}$$

The current account reflects the change in real net foreign assets:

$$CA_t = \frac{e_t NFA_t - e_{t-1} NFA_{t-1}}{P_t}. \tag{2.23}$$

The derivation of the log-linear model is shown in appendix B, equations (2.35 – 2.53). Following Galí and Monacelli (2005), we assume a symmetric non-stochastic steady state with a zero net foreign asset position and a balanced current account ($NFA = CA = 0$). This implies that relative prices are unity, i.e. purchasing power parity holds ($Q = S = 1$).

Rest of monetary union

We follow Monacelli (2005) and characterise the rest of the EMU by the closed-economy version of the model above. It is assumed that preferences and technology are identical to those of the small economy. Furthermore, since the share of imported goods in the CPI basket is negligible small, CPI inflation equals domestic inflation and output equals consumption ($c_t^* = y_t^*$). The rest of the euro area can be fully described by the following dynamic equations:

$$y_t^* - h y_{t-1}^* = E_t\left(y_{t+1}^* - h y_t^*\right) - \frac{1}{\sigma}(1-h)\left(i_t^* - E_t\left\{\pi_{t+1}^*\right\} - \varepsilon_{pref,t}^*\right) \tag{2.24}$$

and

$$\pi_t^* = \beta E_t\left\{\pi_{t+1}^*\right\} + \kappa_F mc_t^* + \varepsilon_{\pi,t}^* \tag{2.25}$$

with

$$mc_t^* = \varphi y_t^* + \alpha s_t + \frac{\sigma}{1-h}\left(y_t^* - h y_{t-1}^*\right) - (1+\varphi) a_t^* \tag{2.26}$$

and $\varepsilon_{\pi,t}^*$ is an exogenous shock to foreign inflation. The EMU monetary policy follows a Taylor-type rule, e.g.:

$$i_t^* = \rho_{i*} i_{t-1}^* + (1-\rho_{i*})\left(\omega_{\pi*}\pi_t^* + \omega_{\hat{y}*}\hat{y}_t^*\right) + \varepsilon_{i*,t}, \tag{2.27}$$

where $\varepsilon_{i*,t}$ is an exogenous monetary policy shock.

2.3 Monetary and fiscal policy rules

Both, outside of and within a currency union the interaction of monetary and fiscal policies affects macroeconomic adjustments. Concerning the design of alternative monetary regimes and fiscal policy rules and their response to current account imbalances, we distinguish between (I) simple instrument rules and (II) optimal policy rules.[5] The advantage of simple rules is that they are easy to implement and for the public to understand. In order to compare the simple rules with an optimal policy we study an optimal policy rule under discretion where government takes private expectations as given and re-optimises the policy each period. The instrument rules of our model are structured as follows:

Before monetary union the monetary authorities of both countries act independently and are assumed to follow a Taylor-rule (Taylor 1993):

$$i_t = \rho_i i_{t-1} + (1-\rho_i)(\omega_\pi \pi_t + \omega_{\hat{y}} \hat{y}_t) + \varepsilon_{i,t}, \tag{2.28}$$

where ρ_i is the degree of interest rate smoothing and ω_π, $\omega_{\hat{y}}$ are relative weights on inflation and output gap respectively. The output gap $\hat{y}_t = y_t - \overline{y}_t$ is the difference between actual output and steady state output.[6] The residual variable $\varepsilon_{i,t}$ is an exogenous monetary policy shock.

With the final stage of the European Monetary Union, the small open economy adopts the euro area currency with the corresponding loss of an autonomous monetary policy. Thus, the nominal exchange rate in our model is exogenous and the interest rate is set solely by the foreign central bank (2.27). Therefore, the nominal interest rate in the small open economy is defined by:

$$i_t = i_t^* + risk \tag{2.29}$$

Concerning fiscal policy, the governments' real flow budget constraint is defined as:

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[5] According to Rudebusch and Svensson (1999) and Svensson (2000, 2003), targeting rules determine the optimal policy responses given a set of objectives. It minimises the objective loss function that deviates from a target variable.

[6] Some theoretical and empirical literature on monetary policy rules examines a feedback to output growth rather than to output gap (e.g. Walsh 2003; Stracca 2007; Choi and Wen 2010). We have checked both rules for robustness in section 2.5 yielding negligible differences for our further analysis.

$$b_t = (1 + i_{t-1} - \pi_H) b_{t-1} + g_t \,, \tag{2.30}$$

where $b_t = B_t / P_{H,t}$ is the real debt denominated in local currency. We assume that government spending g_t is determined by an endogenous fiscal policy rule, according to Taylor (2000):[7]

$$g_t = \rho_g g_{t-1} + (1 - \rho_g)(-\omega_g (y_{t-1} - y_{t-2}) - \omega_b b_{t-1} + \omega_{ca} ca_{t-1}) + \varepsilon_{g,t} \,, \tag{2.31}$$

where ρ_g is the degree of instrument smoothing and $\omega_g, \omega_b, \omega_{ca}$ are relative weights for output growth, the stock of public debt, and the current account, respectively. The residual term $\varepsilon_{g,t}$ is an exogenous fiscal policy shock. We use this enhanced feedback rule to investigate the dynamic implications of fiscal policy as a stabilisation tool. The parameter ω_g determines to which degree fiscal policy is used to stabilise output growth.[8] The automatic stabiliser includes a 1-quarter delay for taking into account an implementation or reaction lag.[9] To account for the aim of fiscal discipline we follow, e.g. Schmidt-Grohé and Uribe (2007), Colciago et al. (2008), Forni et al. (2009), and Di Giorgio and Nisticò (2013), and introduce the term $\omega_b b_{t-1}$, which captures the degree to which the dynamics of public debt are of concern to the fiscal authorities.[10] With this formulation we can not only ensure long-run debt sustainability but can also account for the European Stability and Growth Pact, namely that the debt ceilings are in practice not strictly binding due to a number of provisional clauses.[11]

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[7] This type of counter-cyclical fiscal policy feedback rule – without the response to the current account – is comparable with a primary deficit-rule, which has become increasingly popular to characterise discretionary fiscal policy in empirical literature (e.g. Galí et al. 2003; Favero and Monacelli 2005; Forni et al. 2009).

[8] The stabilisation of output growth, rather than output gap, is consistent with empirical evidence, that primary balance in OECD economies are more sensitive to output growth (see Fatás and Mihov 2009).

[9] This is in line with Kirsanova et al. (2007), whereas, e.g., Galí and Monacelli (2008), Ferrero (2009), and Di Giorgio and Nistico (2013) use contemporaneous feedback rules.

[10] With that introduction of "fiscal discipline" we focus on "passive" fiscal rules (in the sense of Leeper 1991). This type of "Ricardian"-fiscal policy ensures that fiscal solvency is met at all times. A combination of an active monetary policy and passive fiscal policy produces internally stable adjustment dynamics.

[11] Canzoneri et al. (2006) use a similar approach to take into account the Stability and Growth Pact (SGP) without explicitly implementing the three percent deficit ceiling.

To analyse the stabilisation potential of a current account stabilising fiscal policy, we introduce an additional feedback to lagged current account.[12] The parameter ω_{ca} measures the extent to which fiscal policy is used to stabilise current account imbalances. More specifically, if the home country runs a current account deficit, the fiscal authority should reduce government spending to increase net exports, thereby diminishing the external deficit.

Considering (II), a targeting rule implies the use of all relevant available information in order to minimise a loss function over expected future deviations of the target variable from the target level (see Rudebusch and Svensson 1999). Following Galí and Monacelli (2005), Moons et al. (2007) and Svensson (2003), we consider an intertemporal loss function in quarter t:

$$E_t \sum_{T=0}^{\infty} \beta^T L_{t+T} \,, \tag{2.32}$$

with the period loss function

$$L_t = \pi_t^2 + \lambda_y \hat{y}_t^2 + \lambda_g \hat{g}_t^{\,2} + \lambda_{ca} ca_t^2 \,, \tag{2.33}$$

where $\lambda_y, \lambda_g, \lambda_{ca}$ are the weights on output growth, government spending, and current account, respectively. Following the optimal policy literature, we set the relative weight on output growth to $\lambda_y = 1$ and account for costs of fiscal policy intervention by assigning λ_g to 0.2 (see Kirsanova et al. 2007; Schmitt-Grohé and Uribe 2007; Galí and Monacelli 2008). We introduce the current account with a weight of $\lambda_{ca} = 0.5$ to account for the emergence of external imbalances in the loss function.

As highlighted in Rudebusch and Svensson (1999) and Svensson (2003), when $\beta \to 1$, the value of the intertemporal loss function approaches the infinite sum of unconditional means of the period loss function $E\left[L_t\right]$. Hence, the intertemporal loss function can be interpreted as the unconditional mean of the period loss function, which equals the weighted sum of unconditional variances of the variables. As a result, we are able to

[12] We also assume a 1-quarter delay for an implementation or reaction lag of one period.

measure the loss function by weighting inflation, output growth, current account and fiscal instrument variability in the following manner:

$$E\left[L_t\right] = Var\left[\pi_t\right] + \lambda_y Var\left[\hat{y}_t\right] + \lambda_g Var\left[\hat{g}_t\right] + \lambda_{ca} Var\left[ca_t\right]. \qquad (2.34)$$

Calibration

We parameterise the model on a quarterly frequency based on previous studies. The parameter values refer to empirical findings from the small open economy literature, most of them for the euro area (e.g. Galí and Monacelli 2005; Smets and Wouters 2002, 2003, 2005; Ferrero 2009). The value for the discount factor $\beta = 0.99$ implies an annual return of about 4 percent in the steady state. The coefficient of relative risk aversion is set to $\sigma = 1.5$ and implies an elasticity of intertemporal substitution of $2/3$, which determines the sensitivity of consumption growth to changes in the real interest rate.[13] The parameter $\varphi = 4$ implies a labor supply elasticity of $1/\varphi = 0.25$, which is in the range of microeconomic estimates (e.g. Evers et al. 2008). The elasticity of substitution between domestic and foreign goods equals $\eta = 1.5$. The value α for the degree of openness is assumed to be 0.4, which roughly corresponds to the import/GDP ratio in small open euro area economies. The degree of habit persistence is set to $h = 0.7$.[14] Calvo price stickiness θ is determined to 0.75, a value consistent with an average period of one year between price adjustments (see Altissimo et al. 2006). The share of government spending in GDP is set to $\rho_{gov} = 0.2$, which is the average value for small EMU members countries. The annualised debt-elastic premium on foreign bond holdings is $\chi_t = 0.01$, which implies that a 1 percentage-point deterioration of the NFA-to-GDP position raises annualised borrowing rates by one basis point.[15] The monetary policy parameters are based on standard Taylor-type rule estimations and commonly employed in the literature. The degree of interest rate smoothing is determined by the persistence value of $\rho_i = 0.75$. The feedback coefficients of inflation

[13] For a discussion of the wide variance in the empirical estimates of CRRA, see Beltran (2007).
[14] Setting h=0 leads – for both shocks – to an expected higher amplitude in consumption on impact. The resulting lower current account variability does not have an impact on our main results (see also Table 6 at appendix).
[15] An external risk premium of this magnitude has been recently estimated for Spain by Aspachs-Bracons and Rabanal (2010).

and output gap are set to $\omega_\pi = 1.5$ and $\omega_{\hat{y}} = 0.125$ (corresponding to 0.5 for annual rates), respectively.

Regarding fiscal policy, the automatic stabiliser, ω_g, is set to 0.4 in our instrument rules (see Moons et al. 2007).[16] To ensure stability of debt accumulation process, the feedback on past debt takes the value $\omega_b = 0.02$ (see Corsetti et al. 2009; Motta and Tirelli 2012). The parameter ρ_g reflects the fiscal flexibility to adjust fiscal policy in the short-run. While empirical findings about fiscal smoothing ranges between 0.4 and 0.9 (e.g. van Aarle et al. 2004; Corsetti et al. 2009), DSGE literature often sets fiscal rules without a smoothing parameter. Concerning the trade-off between flexibility of fiscal rules in DSGE models and empirical findings, we set the smoothing parameter to $\rho_g = 0.2$, allowing for difficulties in changing government spending. Depending on the response coefficient ω_{ca}, we distinguish between $\omega_{ca} = 0$ and $\omega_{ca} = 1.5$. An overview of the model calibration is given in Table 3 at the appendix.

2.4 Policy rules and current account dynamics

In this section we study the effects of different shocks on macroeconomic variables, especially the current account dynamics, under alternative monetary regimes and policy rules.[17] Within the scenario, we distinguish between the effects of being outside and inside of the European Monetary Union.[18]

Concerning the design of fiscal policy rules to correct current account imbalances, we analyse the following scenarios: (i) no active fiscal policy, $g_t = 0$, (ii) a conventional fiscal policy without current account response, $\omega_{ca} = 0$, (iii) a current account stabilising fiscal policy as in equation (2.31) with $\omega_{ca} = 1.5$, (iv) a fiscal targeting rule, in which the fiscal authority chooses its policy parameters ω_g, ω_{ca} to minimise the loss function derived in equation (2.33).

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[16] Taylor (2000) has estimated the automatic stabiliser for the US economy to -0.5.
[17] Our computations are performed using DYNARE toolbox for Matlab (Adjemian et al. 2011).
[18] We use standard deviations to compare the efficiency of alternative policy rules (see Taylor 1993).

We concentrate our analysis on a negative productivity shock and a negative risk premium shock for the small open economy. Both kinds of shocks can be seen as main driving forces of the current account deficit countries within the euro area (see Belke and Dreger 2013). All shocks are assumed to be unanticipated (stochastic), to occur in period 0, and to be uncorrelated.

2.4.1 The dynamic response to a negative productivity shock

We assume that the productivity shock evolves as a stationary AR(1) process:

$$a_t = \rho_a a_{t-1} + \varepsilon_{a,t}$$

with a persistence parameter $\rho_a = 0.7$.[19] Table 1 gives an overview of the standard deviations of macroeconomic variables to a negative productivity shock under the four alternative fiscal policy rules in the non-EMU scenario.

Table 1: Standard deviations for a negative productivity shock in the non-EMU scenario

Variable	Standard deviations in % (non-EMU scenario)			
Fiscal policy rule	(i)	(ii)	(iii)	(iv)
	$g_t = 0$	$\omega_g = 0.4$ $\omega_{ca} = 0$	$\omega_g = 0.4$ $\omega_{ca} = 1.5$	$\omega_g = 0.7$ $\omega_{ca} = 1.33$
Consumption	0.5119	0.5108	0.4919	0.4929
Output growth	0.3431	0.3395	0.3467	0.3418
Real exchange rate	0.3362	0.3399	0.2878	0.2955
Government spending	0.0000	0.1186	0.7838	0.6768
Inflation	0.3376	0.3394	0.3226	0.3256
Interest Rate	0.2212	0.2225	0.2014	0.2045
Net foreign assets	4.3998	4.4054	3.9594	4.0071
Current account	0.6681	0.6750	0.5846	0.5984

Comparing fiscal policy rules (i) and (ii), the simulations show that conventional fiscal policy (ii) can help stabilising output with marginal deteriorations for most other

[19] Di Giorgio and Nisticò (2013) estimate the persistence value of 0.7 for the euro area using quarterly HP-filtered data on labor productivity for the period 1970:1 to 2005:4. Vogel et al. (2013) estimate the AR(1) process for labor productivity in 1999:1 to 2009:4 by using the percentage deviations in the small EMU-12 countries from the EMU-12 average and yields 0.92.

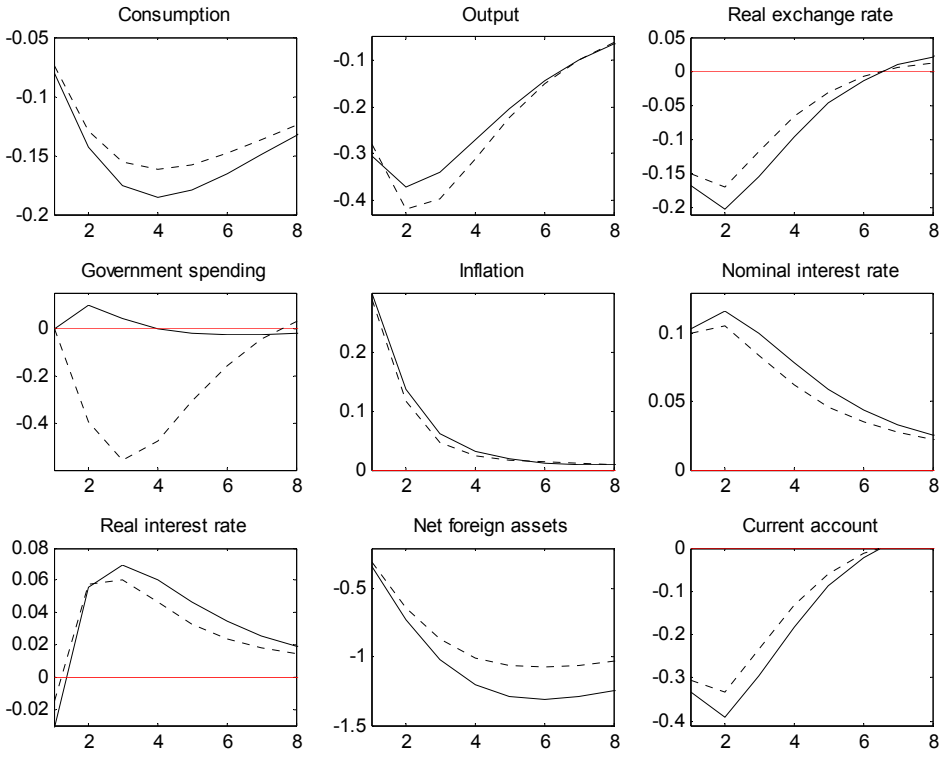
macroeconomic variables, e.g. real exchange rate and the current account. Due to the decline in output – caused by the negative productivity shock – an increase in government spending raises the demand for domestic goods, increases domestic inflation which induces among others a higher real exchange rate appreciation and worsens the current account.

The most relevant findings arise by comparing fiscal rules (ii) and (iii). A fiscal response to the current account (iii) can stabilise the current account as well as most other macro variables. Due to the cyclical response of government spending to the current account, the stabilising effects are accompanied with a higher variability of the output, however. Hence, fiscal policy faces a trade-off between stabilising current account and output. The optimal fiscal policy (iv) shows similar results. In order to minimise the loss function (equation 33), fiscal policy chooses a higher relative response to output – compared to fiscal rule (iii) – and therefore achieves a better stabilising effect of output at the expense of higher standard deviations of other macro variables. Summing up, the stronger the government spending response to the current account, the higher the stabilising effects for the current account and most macro variables at the expense of higher output variability in the short run.

Figure 3 illustrates these dynamic responses. A negative productivity shock raises marginal costs, which induces an increase in domestic inflation and a rise of nominal interest rate by monetary policy. As a result, the terms of trade improve and the real exchange rate appreciates, implying a worsening of international competitiveness. This contributes to a decline in output and a current account deficit over the trade channel. Furthermore, the current account deficit is aggravated via the accumulation of foreign debts and the households' efforts to smooth consumption.[20]

[20] These findings are in line with Ca'Zorzi and Rubaszek (2012). The analysis suggests that consumption smoothing and the removal of exchange rate risk has been one of the main driving forces for the current account divergence in the euro area.

Figure 3: Impulse responses for a negative productivity shock in the non-EMU scenario



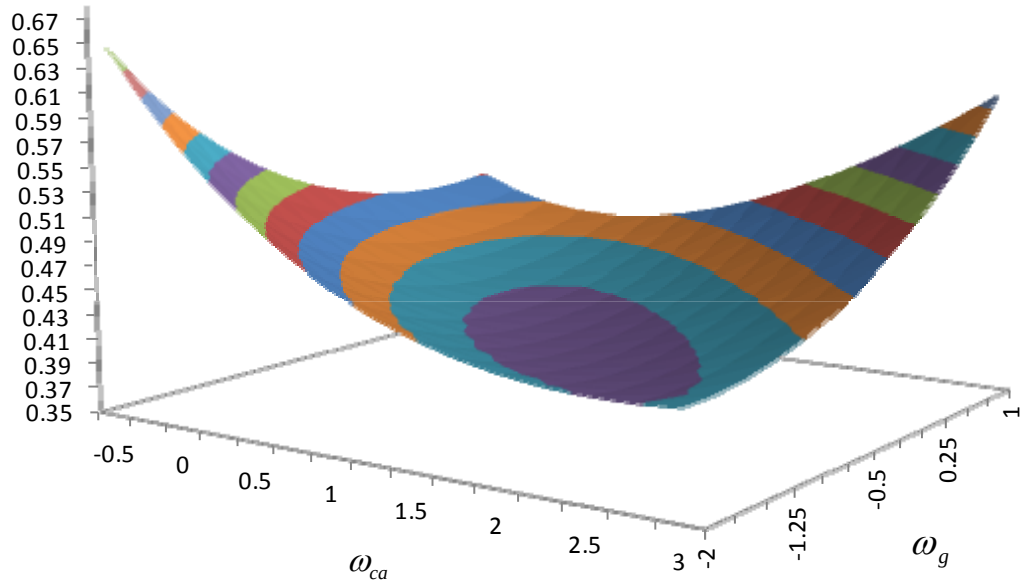
Note: The solid line is the dynamic response of fiscal rule (ii); the dotted line shows the response of fiscal rule (iii).

When fiscal policy reacts according to rule (ii), government raises spending in order to stabilise output.[21] The discrepancies to scenario (iii) in which fiscal policy responds to the current account deficit are shown by the dotted lines in Figure 3. In order to reduce the current account deficit, government spending decreases. Therefore, fiscal policy can stabilise not only the real exchange rate and the current account, but also consumption and net foreign assets. A smaller increase of the nominal interest rate and an almost constant inflation decreases the real interest rate and stabilises consumption, accompanied with less accumulated foreign debts. These stabilising effects of macro variables are more efficient compared to fiscal policy rule (ii), but with a deterioration of the output in the short run.

[21] For fiscal rule (i), the differences in magnitude of dynamic responses are negligible compared to fiscal rule (ii) – the solid lines in Figure 3 – and are therefore omitted for clarity reasons.

For a better insight on the trade-off between stabilising current account and output the policy makers face, we display loss surfaces for various combinations of fiscal policy parameters ω_g and ω_{ca}. Losses are calculated based on equation (2.34) for alternative combinations of fiscal reaction parameters ω_g and ω_{ca} over the interval [-2;1] and [-0.5;3], respectively. Figure 4 displays the governments' losses in case of a negative productivity shock in the non-EMU scenario.

Figure 4: Loss surface for optimal fiscal rule (iv)



The loss is minimised for the fiscal parameter combination of $\omega_g = -1$ and $\omega_{ca} = 1.75$. Furthermore, the loss surface reveals another interesting insight. We can see a relatively stable area with low loss variation for the combinations ω_g and ω_{ca} in the interval [-1.5;0] and [1;2.5], respectively. This area exposes relative weights of the two fiscal policy parameters. Therefore, fiscal response to the current account should be a bit higher relatively to the fiscal response to output. Outside of the area, a more conventional fiscal rule (decrease in ω_g) as well as a more current account stabilising fiscal rule (increase in ω_{ca}) leads to higher losses, because the former stabilises output

at the expense of higher variability of the current account and the latter stabilises the current account at the expense of higher output variability.

In the next step we analyse the consequences for the small open economy when joining the EMU. Comparing the standard deviations of the macroeconomic variables in Table 2, similar results as in the non-EMU scenario become evident. A fiscal response to the current account (iii) stabilises the current account as well as most other macro variables, but is accompanied with a higher variability of the output. Another interesting aspect is the increase in macroeconomic volatility that is associated with the EMU entry (see Tables 2 and 1).

Table 2: Standard deviations for a negative productivity shock in the EMU scenario

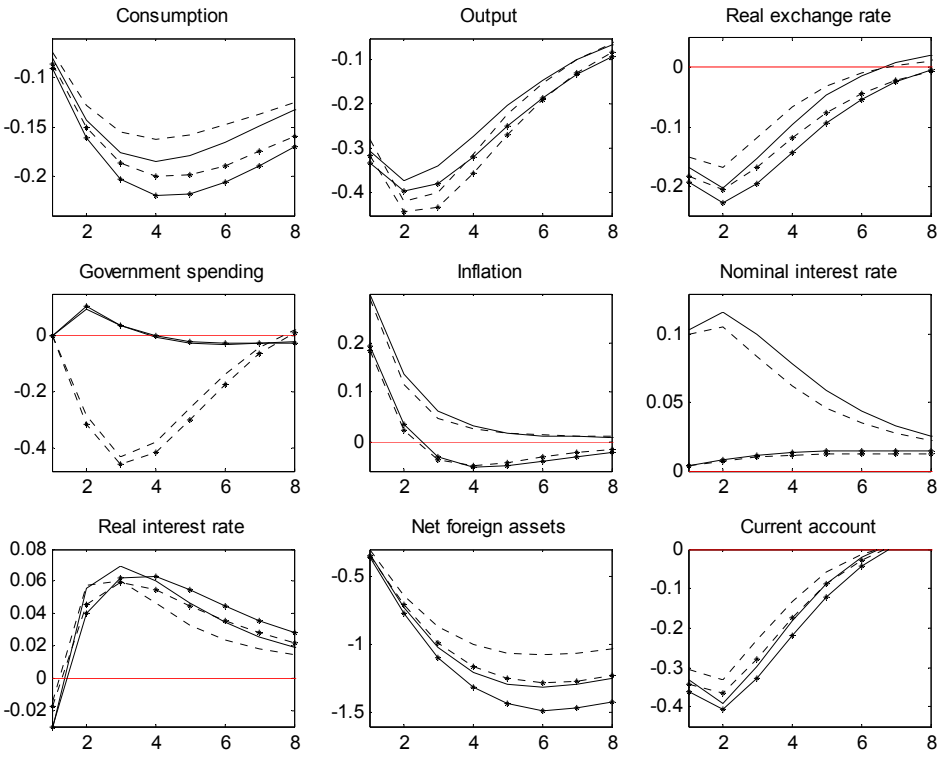
Variable	Standard deviations in % (EMU scenario)			
Fiscal policy rule	(i)	(ii)	(iii)	(iv)
	$g_t = 0$	$\omega_g = 0.4$ $\omega_{ca} = 0$	$\omega_g = 0.4$ $\omega_{ca} = 1.5$	$\omega_g = 0.68$ $\omega_{ca} = 1.24$
Consumption	0.6210	0.6203	0.5965	0.5995
Output growth	0.3667	0.3635	0.3774	0.3710
Real exchange rate	0.4078	0.4113	0.3617	0.3715
Government spending	0.0000	0.1268	0.8743	0.7058
Inflation	0.2166	0.2191	0.2058	0.2095
Interest Rate	0.0495	0.0496	0.0446	0.0454
Net foreign assets	4.9476	4.9567	4.4635	4.5450
Current account	0.7335	0.7409	0.6497	0.6687

This increased vulnerability is confirmed by the dynamic responses in Figure 5, which show both, the dynamic responses for a negative productivity shock in the non-EMU scenario and the EMU scenario. Due to the loss of an autonomous monetary authority and the adoption of the euro, the nominal exchange rate is now exogenous for the small open economy. The small increase in the nominal interest rate is not induced by monetary policy, but via a positive risk premium, because the economy becomes a net borrower.

Entry into EMU implies a higher variability and more persistence in the adjustment process of some macroeconomic variables, e.g. the real exchange rate. A more persistent appreciation and a decrease in competitiveness produce higher negative

output growth and higher current account deficits. As in the non-EMU scenario, stabilising the current account is accompanied with higher output variability. Although a current account stabilising fiscal policy plays an important role to reduce the variability of net foreign assets and the current account, it is not able to fully compensate the absence of an autonomous monetary policy.

Figure 5: Impulse responses for a negative productivity shock in the EMU and non-EMU scenario



Note: The solid and dotted lines are the dynamic responses of fiscal rules (ii) and (iii) of Figure 3 (non-EMU scenario) as a benchmark. The marked (*) solid and dotted lines show the effects of fiscal rule (ii) and (iii) in the EMU-scenario, respectively.

2.4.2 The dynamic response to a negative risk premium shock

A specific development during the establishment of EMU was the sharp drop in long-run interest rates, which was associated with a drastic decline of government bond spreads within the euro area (see Figure 8 in the appendix). We analyse such a negative risk premium shock, defined as a stationary AR(1) process:

$$\varepsilon_{risk,t} = \rho_{risk}\varepsilon_{t-1}^{risk} + \Phi_{risk,t},$$

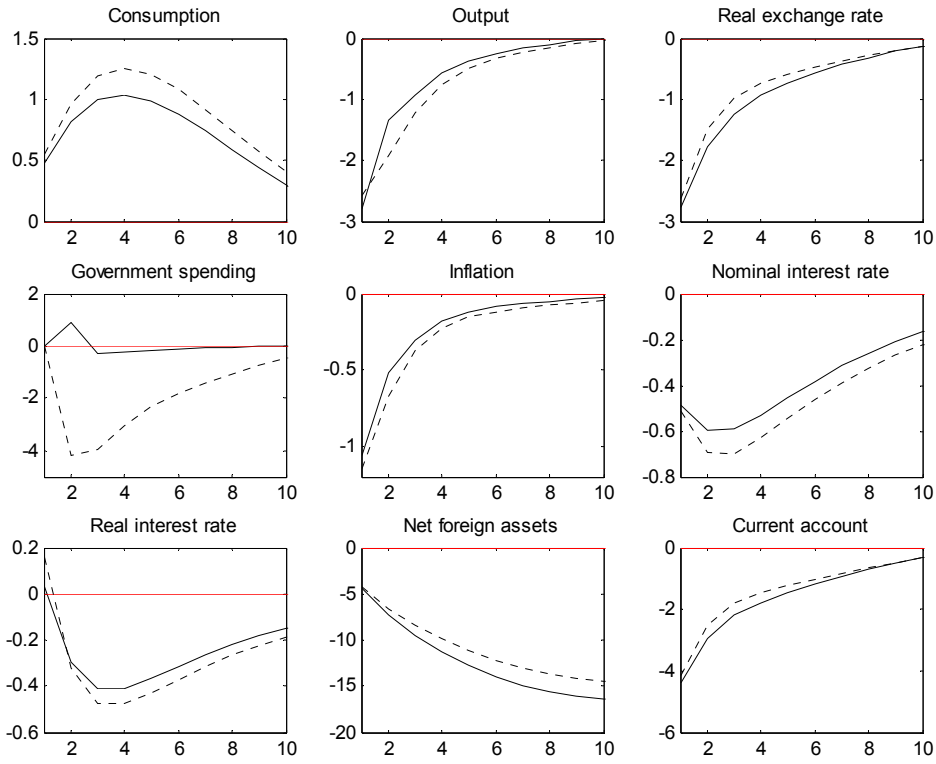
where ρ_{risk} is set to 0.9 to accommodate the long persistence.[22]

Figure 6 shows the dynamic responses corresponding to fiscal rules (ii) and (iii). Similar to negative productivity shock, we start analysing the dynamic responses in the non-EMU scenario.[23]. A negative risk premium shock lowers nominal interest rates and induces an appreciation of the real exchange rate. The loss in competitiveness lowers output and the current account. A decrease in domestic inflation, caused by lower marginal costs, reduces the real interest rate and raises consumption. Due to the decrease in output, conventional fiscal policy (solid line) increase government spending in order to stabilise output. A current account stabilising fiscal rule (dotted line) decreases government spending and reduces the variability of real exchange rate and current account deficit. Analogously to the productivity shock, the stabilising effects for the current account are accompanied by a higher variability of output.

In a next step we analyse the effects when the small open economy is inside the EMU. Considering only the stabilising effects for fiscal rules (ii) and (iii) in the EMU scenario (*-marked lines in Figure 7), similar results as for the non-EMU scenario become evident. Hence, a fiscal response to the current account (*-dotted lines) stabilises the current account and real exchange rate, but is accompanied with higher variability of the output.

[22] The negative risk premium shock affects the interest rate on foreign bond holdings and can also be interpreted as a preference shock on foreign assets.
[23] The standard deviations for the risk premium shock in the non-EMU and EMU scenario can be found in Table 4 and 5 at the appendix.

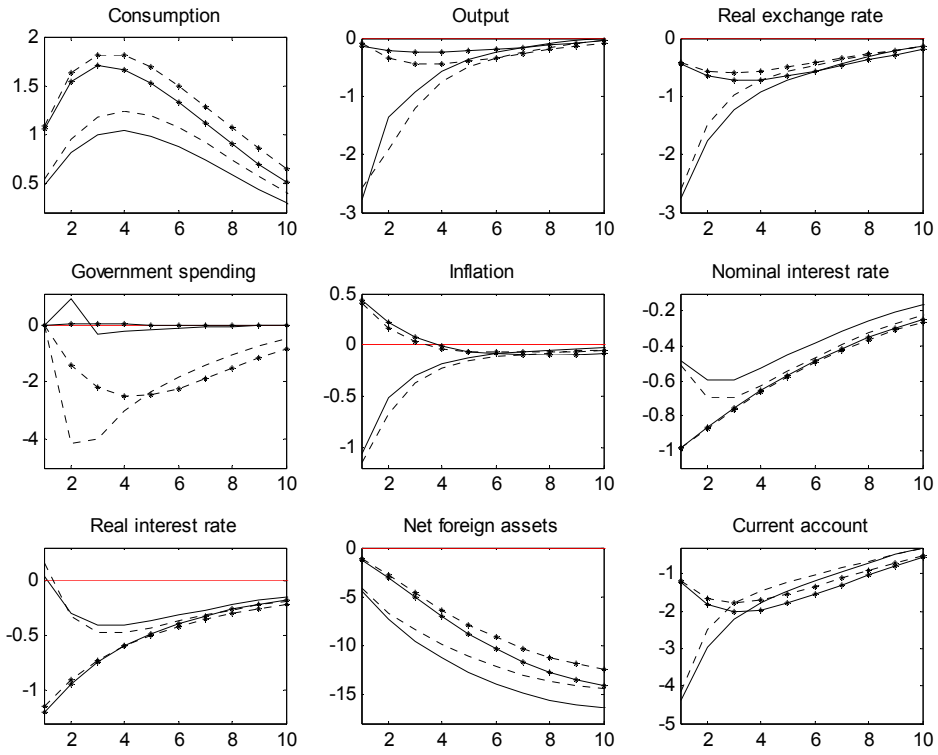
Figure 6: Impulse responses for a negative risk premium shock in the non-EMU scenario



Note: The solid line is the dynamic response of conventional fiscal rule (ii); the dotted line shows the current account stabilising fiscal rule (iii).

Comparing the dynamic responses for both scenarios, the EMU scenario reveals remarkable effects for the variability of macroeconomics variables that are contrary to those for the negative productivity shock. Therefore, entry into EMU diminishes the volatility for most macroeconomic variables, especially in the first four quarters. This is due to the absence of nominal exchange rate fluctuations. In the non-EMU scenario, nominal exchange rate appreciates rapidly of about 3% and remains almost at the higher level. This leads to a stronger appreciation of the real exchange rate and a more drastic decline in output which worsens the current account. Due to the loss of monetary policy in the EMU scenario, nominal interest rate is more affected by a negative risk premium shock. Therefore, the increase in consumption variability is caused by a sharp decrease in the real interest rate.

Figure 7: Impulse responses for a negative risk premium shock in the EMU and non-EMU scenario



Note: The solid and dotted lines are the dynamic responses of fiscal rules (ii) and (iii) of Figure 6 (non-EMU scenario) as a benchmark. The marked (*) solid and dotted lines show the effects of fiscal rule (ii) and (iii) in the EMU-scenario, respectively.

Comparing the stabilising properties of alternative fiscal policy rules, similar results as for the negative productivity shock become evident. A counter-cyclical fiscal response to the current account stabilises most macroeconomic variables better than a conventional counter-cyclical response to output, independently of the underlying exchange rate regime. But, stabilising the current account via fiscal policy intervention is accompanied by higher variability of output. Furthermore, on the contrary to the productivity shock, entry into EMU implies lower variability of most macroeconomic variables, e.g. output, real exchange rate, current account, but a higher persistence in the adjustment process of the current account. The higher variability in the first four quarters of the non-EMU scenario is due to the high and persistent nominal exchange rate appreciation which leads to a higher real exchange rate appreciation. The decrease

in competitiveness produces higher negative output growth and higher current account deficits.

2.5 Sensitivity Analysis

For a better insight on the sensitivity of our empirical results, we do a comprehensive sensitivity analysis to evaluate the effect of alternative parameter settings (Table 6 at appendix). The simulations for alternative values of important parameter, e.g. the elasticity of substitution between domestic and foreign goods, η, the elasticity of intertemporal substitution, σ, as well as the degree of habit formation, h, and openness, α, indicate that our main results are robust for both monetary regimes, shocks, and fiscal rules – the conventional (ii) and the current account stabilising fiscal rule (iii). Hence, a fiscal response to the current account can help stabilising most of macroeconomic variables, e.g. real exchange rate and the current account, but at the expense of higher output variability.

Furthermore, the sensitivity analysis provides interesting insights into the amplitude and variability of the macroeconomic variables.[24] Compared to the results of the baseline calibration (first column in Table 6), the smaller η the smaller the domestic reaction to relative price changes and hence the smaller the variability of the current account and output. A smaller CRRA parameter σ (i.e. the higher elasticity of intertemporal substitution) points in the same direction due to the fact that the current account deficit is alleviated via the accumulation of foreign debts through the households' smaller efforts to smooth consumption. The analysis for the openness parameter shows that the more open the economy the higher the variability of the current account, but the smaller the amplitude of the domestic internal variables.

[24] Since we are interested in the sensitivity of the main macroeconomic variables, we focus on consumption, output, real exchange rate, government spending and the current account. Furthermore, we can omit the variables inflation and interest rate due to the co movement with the real exchange rate, and the net foreign asset position due to the current account, respectively.

2.6 Conclusion

This chapter analyses the stabilising potential of fiscal policy for current account imbalances in a small open economy. Examining two monetary regimes, i.e. an economy inside and outside of EMU, we introduce alternative fiscal policy rules to allow for an endogenous reaction of fiscal policy to changes in the current account. Within this approach, we analyse how fiscal policy as a stabilisation tool affects the adjustment of the current account and other macroeconomic variables to productivity and risk premium shocks.

We find that the entry into the EMU and the accompanying loss of an autonomous monetary policy makes the economy more vulnerable to a productivity shock with higher variability of output, real exchange rate and current account in the short run and higher persistence of the real exchange rate. On the contrary, for a risk premium shock, entry into EMU implies lower variability of most macroeconomic variables, e.g. output, real exchange rate, current account, but a higher persistence in the adjustment process of the current account. For both shocks, inside as well as outside of EMU a fiscal response to the current account can help stabilising most of macroeconomic variables, e.g. real exchange rate, net foreign assets and the current account, but at the expense of higher output variability in the short run. Hence, fiscal policy faces a trade-off between stabilising current account and output.

2.7 Appendix

2.7.1 Figures and Tables

Table 3: Calibration

Parameter	Symbol	Value
Discount factor	β	0.99
Coefficient of relative risk aversion / Invers of elasticity of intertemporal substitution	σ	1.5
Elasticity of labor supply	$1/\varphi$	0.25
Elasticity of substitution between domestic and foreign goods	η	1.5
Degree of openness	α	0.4
Habit persistence	h	0.7
Calvo price stickiness	θ	0.75
Government spending share in GDP	ρ_{gov}	0.2
Annualised debt elasticity of interest rate	χ	0.01
Interest rate smoothing	ρ_i	0.75
Feedback coefficients of inflation	ω_π	1.5
Feedback coefficients of output gap	$\omega_{\hat{y}}$	0.125
Government instrument smoothing	ρ_g	0.2
Automatic stabiliser	ω_g	0.4
Debt elasticity of government spending	ω_b	0.02

Table 4: Standard deviations for a negative risk premium shock in the non-EMU scenario

Variable	Standard deviations in % (non-EMU scenario)			
Fiscal policy rule	(i)	(ii)	(iii)	(iv)
	$g_t = 0$	$\omega_g = 0.4$ $\omega_{ca} = 0$	$\omega_g = 0.4$ $\omega_{ca} = 1.5$	$\omega_g = 1.00$ $\omega_{ca} = 1.52$
Consumption	3.0557	3.0595	3.7567	3.7674
Output growth	3.3982	3.3703	3.6679	3.6203
Real exchange rate	3.9081	3.9155	3.4617	3.4718
Government spending	0.0000	0.9861	8.4664	8.4101
Inflation	1.2526	1.2454	1.4204	1.4115
Interest Rate	1.3753	1.3731	1.6281	1.6267
Net foreign assets	74.2345	74.1871	68.6447	68.5366
Current account	6.9018	6.9129	6.1493	6.1635

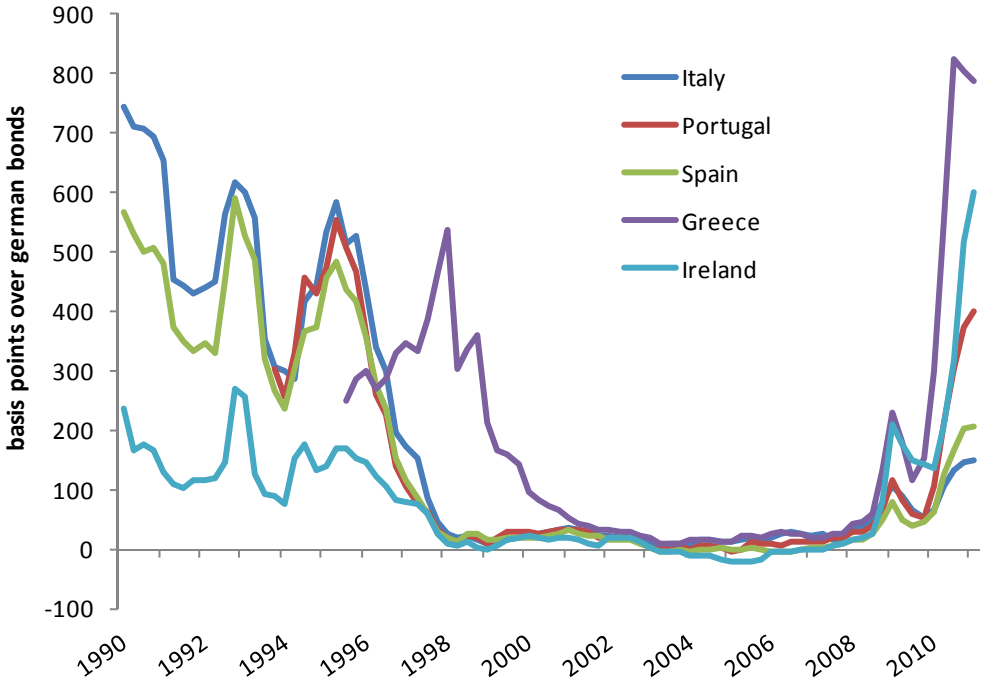
Table 5: Standard deviations for a negative risk premium shock in the EMU scenario

Variable	Standard deviations in % (EMU scenario)			
Fiscal policy rule	(i)	(ii)	(iii)	(iv)
	$g_t = 0$	$\omega_g = 0.4$ $\omega_{ca} = 0$	$\omega_g = 0.4$ $\omega_{ca} = 1.5$	$\omega_g = 1.78$ $\omega_{ca} = 2.54$
Consumption	4.3901	4.3895	4.9343	5.2537
Output growth	0.7406	0.7388	1.1783	1.4234
Real exchange rate	1.9046	1.9056	1.5055	1.2958
Government spending	0.0000	0.0713	6.7336	10.4458
Inflation	0.5549	0.5562	0.4842	0.4533
Interest Rate	1.9834	1.9687	1.9969	2.0123
Net foreign assets	65.2263	65.2210	60.4933	57.7807
Current account	5.2359	5.2375	4.6022	4.2684

Table 6: Sensitivity analysis for various parameter settings

Variable / Parameter	Baseline	$\eta = 0.5$	$\sigma = 0.5$	$h = 0$	$\alpha = 0.6$
Standard deviations of a negative productivity shock in % (non-EMU scenario)					
Conventional fiscal policy rule (ii)					
Consumption	0.5108	0.5640	0.8378	0.5885	0.4764
Output growth	0.3395	0.2163	0.3703	0.3953	0.3273
Real exchange rate	0.3399	0.6056	0.2939	0.3161	0.1375
Gov. spending	0.1186	0.0763	0.1300	0.1358	0.1160
Current account	0.6750	0.5309	0.5113	0.5605	0.7657
Current account stabilising fiscal policy rule (iii)					
Consumption	0.4919	0.5391	0.8022	0.5593	0.4639
Output growth	0.3467	0.2342	0.3781	0.3898	0.3397
Real exchange rate	0.2878	0.5348	0.2609	0.2740	0.1029
Gov. spending	0.7838	0.6314	0.5748	0.6717	0.8831
Current account	0.5846	0.4719	0.4614	0.4929	0.6473
(EMU scenario)					
Current account stabilising fiscal policy rule (iii)					
Consumption	0.5965	0.6229	0.9740	0.6686	0.6065
Output growth	0.3774	0.2256	0.4175	0.4304	0.4230
Real exchange rate	0.3617	0.5761	0.3354	0.3458	0.2116
Gov. spending	0.8743	0.6552	0.6375	0.7370	1.0516
Current account	0.6497	0.4830	0.5131	0.5400	0.7776
Standard deviations of a negative risk premium shock in % (EMU scenario)					
Conventional fiscal policy rule (ii)					
Consumption	4.3895	3.9455	8.7766	5.5523	4.6511
Output growth	0.7388	0.4095	0.6850	1.1087	1.0791
Real exchange rate	1.9056	3.3755	2.5415	1.9540	0.8583
Gov. spending	0.0713	0.0709	0.1402	0.3314	0.1316
Current account	5.2375	4.7103	7.9092	5.6133	5.8011
Current account stabilising fiscal policy rule (iii)					
Consumption	4.9343	4.5262	10.1947	6.1207	5.2024
Output growth	1.1783	0.5826	0.6806	1.5340	1.5323
Real exchange rate	1.5055	2.7123	1.9933	1.5475	0.6066
Gov. Spending	6.7336	6.1875	10.6861	7.2453	7.2955
Current account	4.6022	4.2299	7.2729	5.0282	4.9860

Figure 8: 10-year government bond spreads



Source: IHS Global Insight.

2.7.2 Log-linear model

The model is log-linearised around a non-stochastic steady state, so that variables are expressed in percent deviations from their respected steady state value. A log-linear approximation of the domestic household's Euler equation (2.10) gives

$$c_t - hc_{t-1} = E_t\left(c_{t+1} - hc_t\right) - \frac{1}{\sigma}(1-h)\left(i_t - E_t\left\{\pi_{t+1}\right\} - \varepsilon_{pref}\right). \tag{2.35}$$

In the absence of habit formation – by setting $h = 0$ – one obtains the standard Euler equation.

The market clearing condition implies that the economy's output can either be consumed domestically or exported to the foreign country, therefore we can write:

$$y_t = (1-\rho_{gov})(1-\alpha)c_{H,t} + \alpha c_{F,t} + \rho_{gov} g_t \tag{2.36}$$

By using the log-linearised versions of the two demand functions (2.6) and (2.7) $c_{H,t} = -\eta(p_{H,t} - p_t) + c_t$ and $c_{F,t} = -\eta(p_{F,t} - p_t) + c_t^*$, the CPI definition (2.8) $p_t = (1-\alpha)\,p_{H,t} + \alpha\, p_{F,t}$, and the terms of trade definition (2.19) $s_t = p_{F,t} - p_{H,t}$, we can derive the following goods market clearing condition

$$y_t = (1-\rho_{gov})(1-\alpha)(c_t + \alpha\eta s_t) + \alpha(\eta(s_t + \psi_t) + c_t^*) + \rho_{gov} g_t, \tag{2.37}$$

where $\psi_{F,t} = (e_t + p_t^*) - p_{F,t}$ denotes the law of one price gap. Notice that for a large foreign economy, output equals domestic consumption $c_t^* = y_t^*$.

First order condition (2.12) implies the log-linear equation for newly set prices:

$$p_{H,t}^{new} = (1-\beta\theta_H)E_t\left[\sum_{T=t}^{\infty}\left(\beta\theta_H\right)^{T-t}\left(mc_t + p_{H,t}\right)\right]. \tag{2.38}$$

The evolution of the domestic aggregate price index is given by

$$P_{H,t} = \left[\theta_H\left(P_{H,t-1}\right)^{1-\varepsilon} + \left(1-\theta_H\right)\left(P_{H,t}^{new}\right)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}}. \tag{2.39}$$

Combining (2.38) with the log-linearised version of (2.39) yields the forward-looking Phillips curve relating domestic inflation and real marginal cost:[25]

$$\pi_{H,t} = \beta E_t\left\{\pi_{H,t+1}\right\} + \kappa_H mc_t + \varepsilon_{\pi_H,t}, \tag{2.40}$$

where $\kappa_H \equiv \left(\frac{(1-\theta_H)(1-\beta\theta_H)}{\theta_H}\right)$ and $\varepsilon_{\pi_H,t}$ is an exogenous AR(1) shock to domestic inflation.

Differentiating the real total cost $TC_t = \frac{W_t}{P_{H,t}}\frac{Y_t}{A_t}$ w.r.t. Y_t gives the real marginal cost in logs:

$$mc_t = (w_t - p_{H,t}) - a_t. \tag{2.41}$$

The log-linearised intratemporal labor/leisure choice (2.9) is given by:

$$w_t - p_t = \sigma\frac{\left(c_t - hc_{t-1}\right)}{\left(1-h\right)} + \varphi n_t. \tag{2.42}$$

Combining equations (2.41) and (2.42), the production function in logs $y_t = a_t + n_t$, and the Terms of Trade definition, we can derive the equilibrium condition for the domestic real marginal cost:

$$mc_t = \varphi y_t + \alpha s_t + \frac{\sigma}{1-h}\left(c_t - hc_{t-1}\right) - \left(1+\varphi\right)a_t. \tag{2.43}$$

Similarly, foreign goods price inflation follows a forward-looking Phillips curve and is given by:

$$\pi_{F,t} = \beta E_t\left\{\pi_{F,t+1}\right\} + \kappa_F \psi_{F,t} + \varepsilon_{\pi_F,t}, \tag{2.44}$$

where $\kappa_F = \left(\frac{(1-\theta_F)(1-\beta\theta_F)}{\theta_F}\right)$, $\psi_{F,t}$ is the law of one price gap and $\varepsilon_{\pi_F,t}$ is an exogenous AR(1) shock to imported goods inflation.

The domestic consumer price index (2.8) in log-linear form is therefore defined as:

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[25] For a detailed derivation see the appendix in Galí and Monacelli (2005).

$$\pi_t = (1-\alpha)\pi_{H,t} + \alpha\pi_{F,t}\,. \tag{2.45}$$

The change in the Terms of Trade (2.19) can be expressed in terms of the relative inflation rates between foreign goods and domestic goods:

$$\Delta s_t = \pi_{F,t} - \pi_{H,t}\,. \tag{2.46}$$

By combining the real exchange rate (2.20) with the l.o.p. gap, the log real exchange rate can be expressed as:

$$q_t = \psi_{F,t} + (1-\alpha)s_t\,, \tag{2.47}$$

where the log terms of trade is defined as $s_t = p_{F,t} - p_{H,t}$. Equation (2.47) shows that the real exchange rate is positively related to both, the l.o.p. gap and Terms of Trade.

Time differencing the real exchange rate yields the relationship between real and nominal depreciation rates as follows:

$$q_t - q_{t-1} = \Delta e_t + \pi_t^* - \pi_t\,. \tag{2.48}$$

The uncovered interest parity condition (2.15), expressed in logs, becomes

$$i_t - i_t^* - \phi_t = E_t\{\Delta e_{t+1}\} \tag{2.49}$$

with

$$\phi_t = -\chi nfa_t - \varepsilon_{risk,t}\,. \tag{2.50}$$

Equation (2.39) captures a time-varying country risk premium and is the sum of the net foreign asset position of the domestic country and an exogenous component $\varepsilon_{risk,t}$, which follows an AR(1) process. The term χ is an elasticity parameter negatively related to the net foreign asset position. The UIP can also be written as:

$$\left(i_t - E_t\{\pi_{t+1}\}\right) - \left(i_t^* - E_t\{\pi_{t+1}^*\}\right) - \phi_t = E_t\{\Delta q_{t+1}\} \tag{2.51}$$

and implies that expected changes in real exchange rate are determined by current real interest rate differentials.

The real net foreign asset position, equation (2.21) and (2.22), evolves over time according to

$$nfa_t = (1 + i_{t-1} - \pi_H)\phi_{t-1} nfa_{t-1} + nx \tag{2.52}$$

with $nx = y_t - (1-\rho_{gov})c_t - (1-\rho_{gov})\alpha(s_t + \psi_{F,t}) - \rho_{gov} g_t$ and $nfa_t = \frac{e_t NFA_t}{P_t}$.

Given the evolution of assets determined by the model, we may express the current account as the change in net foreign assets:

$$ca_t = nfa_t - nfa_{t-1}. \tag{2.53}$$

3

Budgetary-neutral fiscal policy rules and external adjustment*

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3.1 Introduction

Large external imbalances and fragile fiscal positions have emerged as major policy challenges for the euro area in the ongoing financial crisis. The vast external deficits of some member countries of the European Monetary Union (EMU) have been associated with alarming instabilities in their banking and financial sectors. As fiscal policy is the only macroeconomic stabilisation instrument left with the individual member countries of EMU, it comes as no surprise that the euro area crisis has provoked extensive discussions on the appropriate design of fiscal policy. In addition, the fiscal position of most EMU member countries has deteriorated substantially in the aftermath of the crisis due to the severe output losses and the increased government spending to mitigate the recession. As a consequence, government budget constraints are very tight and the scope for fiscal policy as a stabilisation tool is extremely limited. Ultimately, fiscal policy is expected to both help attenuate excessive external fluctuations and safeguard public finances to minimise the risks of future crises.

This poses new and pressing challenges for the design of tax and expenditure policies. In this situation, fiscal devaluation has been discussed as a budgetary-neutral stabilisation policy with focus on the revenue side. In particular a shift of the tax burden from labour taxes or social security contributions to consumption taxes, e.g. the VAT, has been advocated to mimic nominal exchange rate depreciation in a fixed exchange rate regime/currency union, in order to restore competitiveness of countries with large and persistent external deficits (e.g. Correia 2011; Farhi et al. 2011; de Mooij and Keen 2013; ECB 2012; Engler et al. 2013).

As an alternative to fiscal devaluation, this approach focuses in an analogous way on the expenditure side of fiscal policy, namely a state-dependent reallocation of government purchases from tradable (T) to non-tradable (NT) goods. Accounting for budgetary restrictions we analyse to what extent a budgetary-neutral government expenditure-shift between T and NT goods can reduce excessive external fluctuations that emerge from the combination of structural distortions/rigidities and country-specific shocks. The chapter also analyses the welfare effects of alternative policy rules in the context of a standard assessment of household welfare.

Adao et al. (2010) show that a combinations of fiscal measures can fully stabilise shocks even in an environment with price and wage stickiness and replicate the flexible economy solution and the adjustment dynamics under flexible nominal exchange rates. Perfect stabilisation, however, requires that governments are fully informed, including the ability to distinguish between the various supply and demand shocks in real time, and implement the full commitment solution to manage the expectation of households and firms. Our approach is more modest with respect to the potential role of fiscal policy. We focus on one instrument combination at one time (tradable versus non-tradable goods' purchases, consumption versus labour tax) and on simple policy rules including an indicator of domestic activity or external imbalances. Simple policy rules mitigate the problem of limited information by focusing on standard indicators and the commitment problem by making commitment to the rule easier to observe. Commitment to the policy rule comes at the cost of a uniform response to different shocks that might trigger a differentiated response in the fully optimal policy case.

The analytical framework is a two-region New Keynesian DSGE model with tradable (T) and non-tradable (NT) goods sectors, price and wage stickiness and financial market frictions. Our framework follows the small open economy approach by Galí and Monacelli (2008) and Vogel et al. (2013). Small member countries of monetary union have negligible impact on EMU-wide policies and tend to be more exposed to asymmetric shocks because of higher openness and specialisation. In the model, focus on a small member country in monetary union excludes feedback to monetary policy and the rest of monetary union. This set-up is obviously equivalent to a small open economy that pegs the exchange rate of her anchor currency thereby mimicking the anchor country's monetary policy, e.g. in a currency board framework.

To our knowledge, this approach is the first to assess the stabilisation properties of changing the composition in government purchases in the sense of state-dependent shifts between T and NT goods based on a simple fiscal instrument rule. As mentioned above this analysis is related to the current debate on revenue-neutral fiscal devaluation which focuses on the revenue side of fiscal policy (Correia 2011; Farhi et al. 2011; de Mooij and Keen 2013; ECB 2012; Engler et al. 2013).

Obstfeld and Rogoff (2005, 2007) and Engler et al. (2009) analyse the effects of expenditure switching from tradable to non-tradable goods on the U.S. current account deficit. However, they take a longer term perspective and examine the change in the real exchange rate necessary to structurally reduce the U.S. current account deficit. In contrast, we focus on reducing trade balance volatility by state-dependent fiscal policy that changes the composition of government purchases under the restriction of budgetary neutrality.

Following the literature on the twin deficit hypothesis (e.g. Corsetti and Müller 2006; Kim and Roubini 2008; Kumhof and Laxton 2013a), we motivate the analysis of fiscal instrument rules reacting to external account variables by building on empirical studies that emphasise the role of fiscal policy in facilitating external adjustments (e.g. Abbas et al. 2011; Abiad et al. 2011). Furceri and Zdzienicka (2012) show that an increase in financial integration, which is characteristic for monetary union, has disciplinary effects on fiscal policy as measured by the budget balance and dampens the volatility of government spending. A budgetary-neutral expenditure-composition rule as analysed in this chapter is compatible with both observations as it does not lead to large fluctuations in the government balance or the overall level of government expenditure.

As a lesson to be drawn from the financial crisis, Lane (2010) argues that the stabilisation role of fiscal policy should not only relate to the output cycle, but also respond to external imbalances, because of potential spillover-effects to macroeconomic and fiscal stability embedded in such imbalances. These potential risks can motivate precautionary operations and may justify a preventive role for fiscal policy to limit the scale of external imbalances. Herz and Hohberger (2013) show in a two-country DSGE model that a counter-cyclical fiscal response to the current account can help stabilising external variables (e.g. real exchange rate and current account) at the expense of higher output variability, however.

The main findings from the analysis are that a state-dependent sectoral reallocation of government purchases between tradables and non-tradables can dampen excessive fluctuations in the external accounts. However, such a policy is accompanied with average welfare losses of up to 0.6% within the parameter space considered due to the trade-off between the stabilisation of external positions and domestic variables under

this policy rule. The policy rule generates welfare gains of up to 1% of steady-state consumption for the average household if it targets the stabilisation of domestic output at the cost of amplified external fluctuations. Fiscal devaluation as an alternative policy does not face such a trade-off between lower excess volatility in external positions and domestic variables, so that a tax-shift policy reducing excessive swings in the trade balance is compatible with average welfare gains of up to 0.6% for the average household within the parameter space considered.

3.2 Model

The analytical framework is in the spirit of Galí and Monacelli (2008) who discuss optimal monetary and fiscal policy in a monetary union of small open economies. Specifically, our model is based on Vogel et al. (2013) who investigate the potential of simple fiscal policy rules to stabilise cyclical fluctuations in monetary union. They extend the Galí/Monacelli model to allow for a larger variety of policy instruments (government purchases, transfers, taxes), introduce physical capital and include additional frictions (wage stickiness, financial frictions, and capital adjustment costs). We augment this model by adding a non-tradable goods sector, so that our model consists of two regions, i.e. a small (domestic) member country of monetary union and the (foreign) rest of monetary union, and of two sectors, i.e. tradable (T) and non-tradable (NT) goods sectors.[26] The model includes monopolistic competition in goods and labour markets, nominal price and wage stickiness, liquidity constraints, capital and labour as inputs into production, and a set of fiscal variables that allow to change the composition of government spending in T and NT goods. Households are either intertemporal optimising consumers (NLC), i.e. households that can freely borrow and save to smooth consumption over time, or liquidity-constrained (LC) households, i.e. households without access to financial markets who consume their entire current disposable wage and transfer income in each period. The introduction of LC households can account for the positive correlation between private and government consumption at

[26] Rabanal and Tuesta (2013) show that the distinction between tradable and non-tradable goods is important to understand real exchange rate fluctuations and that non-tradable technology shocks explain about one third of real exchange rate volatility.

business cycle frequencies (Galí et al. 2007). In light of the empirical evidence (Kollmann 1996) we depart from the assumption of complete risk-sharing as in Beetsma and Jensen (2004), Ferrero (2009), Galí and Monacelli (2008) and Kirsanova et al. (2007) 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 euro area (RoEA) variables and monetary policy are exogenously given from the perspective of the small economy.[27]

Households

The household sector consists of a continuum of households *i*. The welfare of household *i* is the discounted sum of the period utilities:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} (C_t^i)^{1-\sigma} - \frac{\kappa}{1+\varphi} (L_t^i)^{1+\varphi} \right) \tag{3.1}$$

Household utility is additive in private consumption C_t^i and work L_t^i. The parameters β, 1/σ, κ and 1/φ are the discount factor, the intertemporal elasticity of substitution, the disutility weight work, and the elasticity of labour supply. The benchmark model assumes log consumption utility, i.e. σ=1. The households decide about private consumption and labour supply given their respective budget constraints.

NLC households, who are a fraction 1-*slc* of the population, make optimal intertemporal choices given their intertemporal budget constraint:

$$\begin{aligned} &(1-\tau_t^w) W_t^i L_t^i + (1+i_{t-1}) B_{t-1} + \left(1 + i_{t-1}^* - \omega \frac{B_{H,t-1}^*}{4 P_{t-1}^Y Y_{t-1}} + \varepsilon_t^r \right) B_{t-1}^* + TR_t + (1-\tau_t^k) i_t^k K_{t-1}^i \\ &+ \tau_t^k \delta P_t^C K_{t-1}^i + PR_t = (1+\tau_t^c) P_t^C C_t^{NLC} + P_t^C I_t^i + B_t + B_{H,t}^* + \gamma_w / 2 (\pi_t^{w,i})^2 P_t^C L_t \end{aligned} \tag{3.2}$$

[27] The small-country setting differs from other research that has focused on fiscal policy in monetary unions of two large/symmetric countries (e.g. Beetsma and Jensen 2004; Kirsanova et al. 2007; Ferrero 2009).

The revenue side includes the nominal wage income $W_t^i L_t^i$ net of the (linear) labour income tax τ_t^w, 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 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 accumulation of physical capital in the tradable and non-tradable goods sector follows the law of motion:

$$K_{T,t}^i = I_{T,t}^i + (1-\delta) K_{T,t-1}^i - \frac{\gamma_k}{2}\left(\frac{I_{T,t}^i}{K_{T,t-1}^i} - \delta \right)^2 K_{T,t-1}^i \tag{3.3}$$

$$K_{NT,t}^i = I_{NT,t}^i + (1-\delta) K_{NT,t-1}^i - \frac{\gamma_k}{2}\left(\frac{I_{NT,t}^i}{K_{NT,t-1}^i} - \delta \right)^2 K_{NT,t-1}^i$$

including capital depreciation at rate δ and quadratic cost γ_k of capital stock adjustment.

The NLC households maximise (3.1) given the budget constraint (3.2) which provides the first-order conditions (FOC) for consumption and financial asset holdings:

$$1/(C_t^{NLC})^\sigma - (1+\tau_t^c)\lambda_t^{NLC} = 0 \tag{3.4}$$

$$\lambda_t^{NLC} / P_t^C - \beta(1+i_t) E_t(\lambda_{t+1}^{NLC} / P_{t+1}^C) = 0$$

$$\frac{\lambda_t^{NLC}}{P_t^C} - \beta\left(1 + i_t^* - \omega\frac{B_{H,t-1}^*}{4P_{t-1}^Y Y_{t-1}} + \varepsilon_t^r\right)E_t\left(\frac{\lambda_{t+1}^{NLC}}{P_{t+1}^C}\right) = 0$$

$$P_t^C\lambda_t^{NLC} - \mu_t\left(1 - \gamma_k NI_{T,t}^i\right) = 0$$

$$P_t^C\lambda_t^{NLC} - \mu_t\left(1 - \gamma_k NI_{NT,t}^i\right) = 0$$

$$\beta E_t\lambda_{t+1}^{NLC}\left(\left(1-\tau_{t+1}^k\right)i_{t+1}^k + \tau_{t+1}^k\delta P_{t+1}^C\right)$$
$$-\mu_t + \beta E_t\mu_{t+1}\left(1 - \delta - \frac{\gamma_k}{2}(NI_{T,t+1}^i)^2 + \gamma_k NI_{T,t+1}^i\frac{I_{T,t+1}^i}{K_{T,t}^i}\right) = 0$$

$$\beta E_t\lambda_{t+1}^{NLC}\left(\left(1-\tau_{t+1}^k\right)i_{t+1}^k + \tau_{t+1}^k\delta P_{t+1}^C\right)$$
$$-\mu_t + \beta E_t\mu_{t+1}\left(1 - \delta - \frac{\gamma_k}{2}(NI_{NT,t+1}^i)^2 + \gamma_k NI_{NT,t+1}^i\frac{I_{NT,t+1}^i}{K_{NT,t}^i}\right) = 0$$

where E_t is the expectations operator, λ_t^{NLC} is the Lagrange multiplier associated with (3.2), μ_t is the Lagrange multiplier associated with (3.3) and $NI_{s,t}^i \equiv I_{s,t}^i / K_{s,t-1}^i - \delta$, for $s = T, NT$.

Combining the first two FOCs gives the Euler equation for the optimal path of NLC consumption:

$$\beta E_t\left(\frac{1+\tau_t^c}{1+\tau_{t+1}^c}\frac{P_t^C}{P_{t+1}^C}\left(\frac{C_t^{NLC}}{C_{t+1}^{NLC}}\right)^\sigma\right) = \frac{1}{1+i_t} \tag{3.5}$$

Combing the second and third FOC for domestic bonds and foreign assets gives an interest parity condition including the risk premium:

$$i_t = i_t^* - \omega\frac{B_{H,t-1}^*}{4P_{t-1}^Y Y_{t-1}} + \varepsilon_t^r \tag{3.6}$$

with ω>0 and the exogenous AR(1) risk-premium shock:

$$\varepsilon_t^r = \rho_r\varepsilon_{t-1}^r + \nu_t^r \tag{3.7}$$

where ρ_r is the shock persistence and ν_t^r an innovation with zero mean and standard deviation σ_r. Note that equation (3.6) does not include an exchange rate term as we consider regions in a monetary union.

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

$$(1-\tau_t^w)W_t^i L_t^i + TR_t^{LC} = (1+\tau_t^c)P_t^C C_t^{LC} + \gamma_w / 2(\pi_t^{w,i})^2 P_t^C L_t^{LC} \tag{3.8}$$

Real consumption by LC households is constrained by the disposable labour and transfer income and equals:

$$C_t^{LC} = \frac{1-\tau_t^w}{1+\tau_t^c}\frac{W_t^i}{P_t^C}L_t^i + \frac{1}{1+\tau_t^c}\frac{TR_t^{LC}}{P_t^C} - \frac{1}{1+\tau_t^c}\frac{\gamma_w}{2}\left(\frac{W_t^i}{W_{t-1}^i}-1\right)^2 L_t^{LC} \tag{3.9}$$

The marginal value of the LC households' income is analogous to the FOC for NLC households:

$$(1-\chi)/(C_t^{LC})^{\sigma} - (1+\tau_t^c)\lambda_t^{LC} = 0 \tag{3.10}$$

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

$$C_t \equiv (1-slc)C_t^{NLC} + slcC_t^{LC} \tag{3.11}$$

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 ($Z_{NT,t}^i$):

$$Z_t = \left[(\phi)^{\frac{1}{\psi}}(Z_{T,t})^{\frac{\psi-1}{\psi}} + (1-\phi)^{\frac{1}{\psi}}(Z_{NT,t})^{\frac{\psi-1}{\psi}}\right]^{\frac{\psi}{\psi-1}} \tag{3.12}$$

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:

$$Z_{T,t} = \left[(h)^{\frac{1}{\eta}} (Z_{TH,t})^{\frac{\eta-1}{\eta}} + (1-h)^{\frac{1}{\eta}} (Z_{TF,t})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{3.13}$$

where h represents the steady-state home bias and η indicates the elasticity of substitution between domestically produced goods and imports. $Z_{TH,t}$, $Z_{TF,t}$ and $Z_{NT,t}$ are aggregates of the continuum of varieties j given by:

$$Z_{TH,t} = \left(\int_0^1 (Z_{TH,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}}, \; Z_{TF,t} = \left(\int_0^1 (Z_{TF,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}}, \; Z_{NT,t} = \left(\int_0^1 (Z_{NT,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{3.14}$$

where ε is the elasticity of substitution between these varieties. Each variety is produced by a specialised firm *j*.

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

$$P_t^C = \left[(\phi)(P_{T,t})^{1-\psi} + (1-\phi)(P_{NT,t})^{1-\psi} \right]^{\frac{1}{1-\psi}} \tag{3.15}$$

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

$$P_{T,t} = \left[(h)(P_{TH,t})^{1-\eta} + (1-h)(P_{TF,t})^{1-\eta} \right]^{\frac{1}{1-\eta}} \tag{3.16}$$

The optimal allocation for any given expenditure yields the demand for each category of goods *j*:

$$Z_{TH,t}^j = \left(\frac{P_{TH,t}^j}{P_{TH,t}} \right)^{-\varepsilon} Z_{TH,t}, \; Z_{TF,t}^j = \left(\frac{P_{TF,t}^j}{P_{TF,t}} \right)^{-\varepsilon} Z_{TF,t}, \; Z_{NT,t}^j = \left(\frac{P_{NT,t}^j}{P_{NT,t}} \right)^{-\varepsilon} Z_{NT,t} \tag{3.17}$$

The elasticity ε determines the price setting power of individual firms. The pricing margin of firms declines with increasing ε, because higher values of ε magnify the impact of deviations from competitor prices on firm *j*'s market share.

Finally, the optimal allocation of expenditures between traded and non-traded goods and between traded domestically produced and imported goods is:

$$Z_{T,t} = \phi \left(\frac{P_{T,t}}{P_t^C} \right)^{-\psi} Z_t \tag{3.18}$$

$$Z_{NT,t} = (1-\phi)\left(\frac{P_{NT,t}}{P_t^C}\right)^{-\psi} Z_t \tag{3.19}$$

$$Z_{TH,t} = h\left(\frac{P_{TH,t}}{P_{T,t}}\right)^{-\eta} Z_{T,t} \tag{3.20}$$

$$Z_{TF,t} = (1-h)\left(\frac{P_{TF,t}}{P_{T,t}}\right)^{-\eta} Z_{T,t} \tag{3.21}$$

The households *i* supply labour services L_t^i to both tradable and non-tradable goods sectors:

$$L_t^i = L_{T,t}^i + L_{NT,t}^i \tag{3.22}$$

We assume that labour is mobile across both sectors, which equalises wages between the tradable and non-tradable goods sector. Total labour is a composite of the differentiated labour services:

$$L_t = \left(\int_0^1 (L_t^i)^{\frac{\theta-1}{\theta}} di\right)^{\frac{\theta}{\theta-1}} \tag{3.23}$$

with θ being the elasticity of substitution between the varieties of labour services. The minimisation of labour costs by firms gives the demand function for variety *i* as:

$$L_t^i = \left(\frac{W_t^i}{W}\right)^{-\theta} L_t \tag{3.24}$$

The market power of worker *i* declines with increasing θ, because higher values of θ amplify the fall in the relative demand for L_t^i in response to higher individual wage claims.

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:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(-\frac{\kappa}{1+\varphi} (L_t^i)^{1+\varphi} + \lambda_t^i (1-\tau_t^w) \frac{W_t^i}{P_t^C} L_t^i - \lambda_t^i \frac{\gamma_w}{2} (\pi_t^{w,i})^2 \frac{P_{TH,t}}{P_t^C} L_t \right) \quad (3.25)$$

The optimal wage maximises (3.25) given labour demand (3.24) and the marginal value of NLC income (3.4) and LC income (3.10). NLC and LC households receive the same wage, and the unions average the marginal value of NLC and LC income according to the population share of the two types of households.

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:

$$(1-\tau_t^w) \frac{W_t}{P_t^C} = \frac{\theta}{\theta - 1} \frac{\kappa L_t^{\varphi}}{\lambda_t^{tot}} - \frac{\gamma_w}{\theta - 1} \frac{W_t}{W_{t-1}} \frac{P_{TH,t}}{P_t^C} \pi_t^w + \frac{\gamma_w}{\theta - 1} \beta E_t \left(\frac{\lambda_{t+1}^{tot}}{\lambda_t^{tot}} \frac{W_{t+1}}{W_t} \frac{P_{TH,t+1}}{P_{t+1}^C} \frac{L_{t+1}}{L_t} \pi_{t+1}^w \right) \quad (3.26)$$

with

$$\lambda_t^{tot} \equiv (1 - slc) \lambda_t^{NLC} + slc \lambda_t^{LC} \quad (3.27)$$

where the gross wage claims increase with increasing labour taxation (τ_t^w) for given levels of employment.

Firms

The economy consists of a continuum of monopolistically competitive firms in the tradable and non-tradable sector. Firms are owned by NLC households, which consequently receive the firms' profits. Each firm *j* in each sector *s* produces a differentiated good $Y_{s,t}^j$ with capital $K_{s,t-1}^j$, labour $L_{s,t}^j$ and Cobb-Douglas production technology:

$$Y_{T,t}^j = A_{T,t} (K_{T,t-1}^j)^{\alpha} (L_{T,t}^j)^{1-\alpha} \quad (3.28)$$

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

The sector-specific total factor productivity $A_{s,t}$ is identical across firms and follows the AR(1) process:

$$\ln A_{s,t} = (1-\rho_a)\ln \bar{A} + \rho_a \ln A_{s,t-1} + \nu^a_{s,t} \tag{3.29}$$

where ρ_a indicates the shock persistence and $\nu^a_{s,t}$ is a sector-specific innovation with zero mean and standard deviation σ_a.

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

$$\frac{L^j_{s,t}}{K^j_{s,t-1}} = \frac{1-\alpha}{\alpha}\frac{i^k_t}{W_t} \tag{3.30}$$

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

$$MC^j_{s,t} = \frac{(i^k_t)^\alpha W_t^{1-\alpha}}{A_{s,t}\alpha^\alpha (1-\alpha)^{1-\alpha}} \tag{3.31}$$

and $MC^j_{s,t} = MC_{s,t}$. The firms in each sector u face quadratic price adjustment costs γ_p and set prices $P^j_{TH,t}$ and $P^j_{NT,t}$ to maximise the discounted expected profit. For the tradable sector and non-tradable sector firms profit maximisation has the following form:

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\lambda^{NLC}_t}{\lambda^{NLC}_0}\left(\frac{P^j_{TH,t}}{P_{TH,t}} Y^j_{T,t} - \frac{W^j_{T,t}}{P_{TH,t}} L^j_{T,t} - \frac{\gamma_p}{2}(\pi^{p,j}_{TH.t})^2 Y_{T,t}\right) \tag{3.32}$$

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\lambda^{NLC}_t}{\lambda^{NLC}_0}\left(\frac{P^j_{NT,t}}{P_{NT,t}} Y^j_{NT,t} - \frac{W^j_{NT,t}}{P_{NT,t}} L^j_{NT,t} - \frac{\gamma_p}{2}(\pi^{p,j}_{NT.t})^2 Y_{NT,t}\right)$$

The FOC with respect to $P^j_{TH,t}$ ($P^j_{NT,t}$) given the demand functions (3.17) and (3.42), the production technology (3.28) and the marginal utility of wealth of NLC households (3.4) describes the pricing behaviour of firm *j* in the tradable (non-tradable) sector:

$$P_{TH,t} = \frac{\varepsilon}{\varepsilon - 1 + \gamma_p(1+\pi_{TH,t})\pi_{TH,t} - \gamma_p \beta E_t\left(\frac{\lambda^{NLC}_{t+1}}{\lambda^{NLC}_t}(1+\pi_{TH,t+1})\pi_{TH,t+1}\frac{Y_{TH,t+1}}{Y_{TH,t}}\right)} MC_{TH,t} \tag{3.33}$$

$$P_{NT,t} = \frac{\varepsilon}{\varepsilon - 1 + \gamma_p(1+\pi_{NT,t})\pi_{NT,t} - \gamma_p \beta E_t\left(\frac{\lambda^{NLC}_{t+1}}{\lambda^{NLC}_t}(1+\pi_{NT,t+1})\pi_{NT,t+1}\frac{Y_{NT,t+1}}{Y_{NT,t}}\right)} MC_{NT,t}$$

with $\pi_{TH,t} \equiv P_{TH,t} / P_{TH,t-1} - 1$ and $\pi_{NT,t} \equiv P_{NT,t} / P_{NT,t-1} - 1$ as the percentage change of the sectoral price deflator in the tradable and non-tradable sector.[28] Contrary to the Calvo model of staggered price setting which implies price dispersion, the pricing behaviour under quadratic adjustment is symmetric across firms at each period in time, so that firm-level output in both sectors s can be aggregated easily to total domestic production:

$$Y_t = \int_0^1 A_{s,t} (K_{s,t-1}^j)^{\alpha} (L_{s,t}^j)^{1-\alpha} dj = A_{s,t} K_{s,t-1}^{\alpha} L_{s,t}^{1-\alpha} \tag{3.34}$$

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

$$P_t^Y Y_t = P_{TH,t} Y_{T,t} + P_{NT,t} Y_{NT,t} \tag{3.35}$$

Government sector

The government collects labour, capital and consumption taxes and issues one-period bonds to finance government purchases, transfers and the servicing of outstanding debt:

$$\tau_t^w W_t L_t + \tau_t^k (i_t^k - \delta) K_{t-1} + \tau_t^c P_t^C C_t + B_t = P_t^G G_t + TR_t + (1 + i_{t-1}) B_{t-1} \tag{3.36}$$

Government purchases are an aggregate of tradable and non-tradable goods as well as domestically produced traded and imported goods analogously to private demand in (3.12) and (3.14):[29]

$$G_t^{(\psi-1)/\psi} = \phi^{1/\psi} G_{T,t}^{(\psi-1)/\psi} + \left(1-\phi\right)^{1/\psi} G_{NT,t}^{(\psi-1)/\psi} \tag{3.37}$$

$$G_{T,t}^{(\eta-1)/\eta} = h^{1/\eta} G_{TH,t}^{(\eta-1)/\eta} + \left(1-h\right)^{1/\eta} G_{TF,t}^{(\eta-1)/\eta} \tag{3.38}$$

$$G_{TH,t} = \left(\int_0^1 (G_{TH,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}},\ G_{TF,t} = \left(\int_0^1 (G_{TF,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}},\ G_{NT,t} = \left(\int_0^1 (G_{NT,t}^j)^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{3.39}$$

[28] Kumhof and Laxton (2013b) use inflation adjustment instead of price adjustment costs in their discussion of simple fiscal policy rules for open economies. Contrary to the standard *price* adjustment costs implying purely forward-looking inflation dynamics, *inflation* adjustment costs are a mechanism to generate endogenous inflation persistence.

[29] The EU's internal market and public procurement policies have weakened the case for the alternative assumption of strong/full home bias in government consumption.

which gives equivalent demand functions for the alternative bundles and varieties j:

$$G_{TH,t} = h(P_{TH,t} / P_t)^{-\eta} G_{T,t} \tag{3.40}$$

$$G_{TF,t} = (1-h)(P_{TF,t} / P_t)^{-\eta} G_{T,t} \tag{3.41}$$

$$G^j_{TH,t} = \left(\frac{P^j_{TH,t}}{P_{TH,t}}\right)^{-\varepsilon} G_{TH,t}, \quad G^j_{TF,t} = \left(\frac{P^j_{TF,t}}{P_{TF,t}}\right)^{-\varepsilon} G_{TF,t}, \quad G^j_{NT,t} = \left(\frac{P^j_{NT,t}}{P_{NT,t}}\right)^{-\varepsilon} G_{NT,t} \tag{3.42}$$

In order to analyse the stabilising properties of budgetary neutral government spending shifting, the government can adjust purchases between the tradable and non-tradable goods sector in response to cyclical fluctuations. The policy takes the form of simple fiscal instrument rules[30] that are similar to simple interest rate rules in monetary policy:

$$\frac{G_t}{Y_t} = \rho_G \frac{G_{t-1}}{Y_{t-1}} \frac{Y_{t-1}}{Y_t} + (1-\rho_G)\left(\frac{\bar{G}}{Y}\right) \tag{3.43}$$

$$\frac{G_{NT,t}}{G_t} = \rho_G \frac{G_{NT,t-1}}{G_{t-1}} + (1-\rho_G)\left(1-\phi\right) + (1-\rho_G)\xi_Z Z_t \tag{3.44}$$

Fiscal rule (3.43) determines the share of government purchases in GDP and, for $\rho_G > 0$, contains some persistence in the absolute level of government purchases. The instrument rule (3.44) determines the composition of government purchases between the non-tradable and tradable goods sector, where $Z = [\widehat{TB/Y}, \hat{Y}, \hat{L}]$ implies a sectoral shift of government purchases in response to fluctuations in the trade balance gap, the output gap, and the employment gap, respectively. The rule also includes endogenous persistence of ρ_G to capture a preference of policy makers for smoothing changes in the policy stance.

The government adjusts labour taxes to stabilise government debt and the budget deficit at their target levels according to:

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[30] The emphasis on simple instrument rules owes to their practical advantages over fully optimal policy solutions. Contrary to the fully optimal policy solution, simple rules use a limited set of information. Compliance with simple rules is, consequently, easier to monitor than the commitment to fully optimal policy, and the feasibility of compliance monitoring mitigates the credibility/time-consistency problem. Credibility is crucial, because it determines the policy maker's ability to anchor the expectations of households and firms.

$$\tau_t^w = \tau_{t-1}^w + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} \tag{3.45}$$

where $btar$ is the target debt-to-GDP ratio. Therefore, the government increases the labour tax rate to collect additional revenue if debt and/or deficit levels exceed the target values. The labour tax closure increases the complexity of the model dynamics by affecting the labour supply decision of workers and the disposable period income and consumption demand of LC households.

External accounts

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

$$P_t^Y Y_t = P_t^C (C_t + I_t) + P_t^G G_t + P_t^{TH} X_t - P_{TF,t} M_t + ADC_t \tag{3.46}$$

$$ADC_t \equiv \frac{\gamma_w}{2} (\pi_t^w)^2 L_t + \frac{\gamma_p}{2} (\pi_{TH,t})^2 Y_{T,t} + \frac{\gamma_p}{2} (\pi_{NT,t})^2 Y_{NT,t}$$

Exports X_t correspond to the import demand of the RoEA analogously to equation (3.21):

$$X_t = (1-h)(P_{TH,t} / P_{TH,t}^*)^{-\eta} Y_t^* \tag{3.47}$$

which uses the fact that the tradable prices in the RoEA and the prices of RoEA-produced tradables 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.

Combining the budget constraints of the private sector, i.e. (3.2) and (3.8), and the government (3.36) with the revenue-side definition of GDP as the sum of factor and profit income gives the aggregate resource constraint of the domestic economy:

$$B_{H,t}^* = (1 + i_{t-1}) B_{H,t-1}^* + P_t^Y Y_t - P_t^C (C_t + I_t) - P_t^G G_t - P_t^Y ADC_t \tag{3.48}$$

which is also the law of motion for the net foreign asset (NFA) position. The current account reflects the change in net foreign assets:

$$CA_t = B^*_{H,t} - B^*_{H,t-1} \tag{3.49}$$

As specified in (3.6), the nominal interest rate in the domestic economy depends on the NFA position to rule out explosive NFA dynamics (Schmitt-Grohé and Uribe 2003) and the exogenous risk-premium shock.

Rest of monetary union

The RoEA is treated as one single block. Trade with the small country is negligible in relation to output and domestic demand, so that we approximate the RoEA as closed economy. The welfare function parallels the one for households in the small member country:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} (C_t^{i*})^{1-\sigma} - \frac{\kappa}{1+\varphi} (L_t^{i*})^{1+\varphi} \right) \tag{3.50}$$

The equivalent budget constraints imply analogous consumption and labour supply decisions:

$$1/(C_t^{NLC*})^{\sigma} - (1+\tau_t^{c*})\lambda_t^{NLC*} = 0$$

$$\lambda_t^{NLC*} / P_t^* - \beta(1+i_t^*) E_t(\lambda_{t+1}^{NLC*} / P_{t+1}^*) = 0$$

$$P_t^* \lambda_t^{NLC*} - \mu_t^* (1 - \gamma_k NI_{T,t}^{i*}) = 0$$

$$P_t^* \lambda_t^{NLC*} - \mu_t^* (1 - \gamma_k NI_{NT,t}^{i*}) = 0$$

$$\beta E_t \lambda_{t+1}^{NLC*} ((1-\tau_{t+1}^{k*}) i_{t+1}^{k*} + \tau_{t+1}^{k*} \delta P_{t+1}^*)$$
$$-\mu_t^* + \beta E_t \mu_{t+1}^* \left(1 - \delta - \frac{\gamma_k}{2} (NI_{T,t+1}^{i*})^2 + \gamma_k NI_{T,t+1}^{i*} \frac{I_{T,t+1}^{i,*}}{K_{T,t}^{i,*}} \right) = 0$$

$$\beta E_t \lambda_{t+1}^{NLC*} ((1-\tau_{t+1}^{k*}) i_{t+1}^{k*} + \tau_{t+1}^{k*} \delta P_{t+1}^*)$$
$$-\mu_t^* + \beta E_t \mu_{t+1}^* \left(1 - \delta - \frac{\gamma_k}{2} (NI_{NT,t+1}^{i*})^2 + \gamma_k NI_{NT,t+1}^{i*} \frac{I_{NT,t+1}^{i,*}}{K_{NT,t}^{i,*}} \right) = 0$$

$$(1+\tau_t^{c*}) P_t^* C_t^{LC*} = (1-\tau_t^{w*}) W_t^{i*} L_t^{i*} + TR_t^* - \gamma_w / 2 (\pi_t^{w,i*})^2 L_t^* \tag{3.51}$$

$$C_t^* \equiv (1-slc) C_t^{NLC*} + slc C_t^{LC*} \tag{3.52}$$

$$(1-\tau_t^{w*})\frac{W_t^*}{P_t^*}=\frac{\theta}{\theta-1}\frac{\kappa(L_t^*)^{\varphi}}{\lambda_t^{tot*}}-\frac{\gamma_w}{\theta-1}\frac{W_t^*}{W_{t-1}^*}\pi_t^{w*}+\frac{\gamma_w}{\theta-1}\beta E_t\left(\frac{\lambda_{t+1}^{tot*}}{\lambda_t^{tot*}}\frac{W_{t+1}^*}{W_t^*}\frac{L_{t+1}^*}{L_t^*}\pi_{t+1}^{w*}\right) \quad (3.53)$$

The government budget constraint is:

$$\tau_t^{w*}W_t^*L_t^*+\tau_t^{c*}P_t^*C_t^*+B_t^*=P_t^*G_t^*+TR_t^*+(1+i_{t-1}^*)B_{t-1}^* \quad (3.54)$$

where $B_t^*\equiv B_{H,t}^*+B_{F,t}^*$. The fraction $B_{H,t}^*$ equals the NFA position of the small domestic economy and $B_{F,t}^*$ is RoEA government debt held by RoEA households.

The government adjusts labour income taxes when public debt and deficits deviate from the target levels:

$$\tau_t^{w*}=\tau_{t-1}^{w*}+\xi_b\left(\frac{B_{t-1}^*}{4P_{t-1}^*Y_{t-1}^*}-btar\right)+\xi_d\Delta\frac{B_{t-1}^*}{4P_{t-1}^*Y_{t-1}^*} \quad (3.55)$$

Fiscal authorities in the RoEA may also react to cyclical fluctuations. However, given our focus on the small domestic member country and the availability of monetary policy at the aggregate RoEA level, we abstract from counter-cyclical fiscal rules in the RoEA. The central bank sets interest rates according to the simple rule:

$$i_t^*=\psi_i i_{t-1}^*+(1-\psi_i)(1-\beta)/\beta+(1-\psi_i)(\psi_y\Delta\ln Y_{t-1}^*+\psi_\pi\pi_{t-1}^*) \quad (3.56)$$

The RoEA firms face a profit maximisation problem analogous to firms in the small domestic economy, which determines the foreign price level:

$$P_{TH,t}^*=\frac{\varepsilon}{\varepsilon-1+\gamma_p(1+\pi_{TH,t}^*)\pi_{TH,t}^*-\gamma_p\beta E_t\left(\frac{\lambda_{t+1}^{NLC*}}{\lambda_t^{NLC*}}(1+\pi_{TH,t+1}^*)\pi_{TH,t+1}^*\frac{Y_{t+1}^*}{Y_t^*}\right)}MC_{TH,t}^* \quad (3.57)$$

$$P_{NT,t}^*=\frac{\varepsilon}{\varepsilon-1+\gamma_p(1+\pi_{NT,t}^*)\pi_{NT,t}^*-\gamma_p\beta E_t\left(\frac{\lambda_{t+1}^{NLC*}}{\lambda_t^{NLC*}}(1+\pi_{NT,t+1}^*)\pi_{NT,t+1}^*\frac{Y_{t+1}^*}{Y_t^*}\right)}MC_{NT,t}^* \quad (3.58)$$

With $\pi_{TH,t}^*\equiv P_{TH,t}^*/P_{TH,t-1}^*-1$ and $\pi_{NT,t}^*\equiv P_{NT,t}^*/P_{NT,t-1}^*-1$. Total production is the aggregate of firm-level production in both sectors s:

$$Y_t^*=\int_0^1 A_{s,t}^*(K_{s,t-1}^{j*})^{\alpha}(L_{s,t}^{j*})^{1-\alpha}dj=A_{s,t}^*(K_{s,t-1}^*)^{\alpha}(L_{s,t}^*)^{1-\alpha} \quad (3.59)$$

Demand in the RoEA region is the sum of private consumption, investment, government purchases and adjustment costs:

$$Y_t^* = C_t^* + I_t^* + G_t^* + ADC_t^* \tag{3.60}$$

$$ADC_t^* \equiv \frac{\gamma_w}{2}(\pi_t^{w*})^2 L_t^* + \frac{\gamma_p}{2}(\pi_{TH,t}^*)^2 Y_{T,t}^* + \frac{\gamma_p}{2}(\pi_{NT,t}^*)^2 Y_{NT,t}^*$$

The NFA position of the RoEA is the mirror image of the small domestic economy's NFA position. However, given the small size of the small open economy, the NFA position can be neglected in the aggregate resource constraint of the RoEA.

3.3 Parameterisation

The numerical values of the model parameters and exogenous variables are summarised in Table 7. The data for the calibration are taken from the European Commission's AMECO and the OECD Main Economic Indicator (MEI) database.

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 1999-2009. 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 tax rates on consumption, labour and capital income are euro area averages for 1999-2009 from the European Commission's Taxation Trends in the European Union database. Given the level of government purchases and the distortionary tax revenue, the steady-state volume of labour taxes is chosen to stabilise government debt at 70% of GDP, which is the euro area average 1999-2009. The parameters of the debt-stabilisation rule imply tax rate increases of 0.001 (1.0) percentage points per percentage-point increase in government debt-to-GDP (deficit-to-GDP) ratios beyond their target levels. The parameters of the monetary policy rule are standard and without bearing on our results.

Table 7: Parameters and steady-state ratios of the model

Parameter	Symbol	Value
Consumption	C/Y	0.60
Investment	I/Y	0.20
Government purchases	G/Y	0.20
Tradable goods	T/Y	0.60
Capital stock	K/Y	12.0
Consumption tax rate	τ^c	0.18
Labour tax rate	τ^w	0.35
Capital tax rate	τ^k	0.44
General transfers	TR/Y	0.12
Debt-to-GDP target	btar	0.70
Fiscal reaction to debt	ξ_b	0.001
Fiscal reaction to deficits	ξ_d	1.00
Fiscal instrument persistence	ρ_G	0.50
Interest rate persistence	ψ_i	0.75
Coefficient on output growth	ψ_y	0.05
Coefficient on inflation	ψ_π	1.15
Cobb-Douglas parameter	α	0.40
Discount factor	β	0.995
Country risk premium	ω	-0.0025
Steady-state TFP level	A	0.47
Substitution elasticity for goods varieties j	ε	6.0
Substitution elasticity between T/NT goods	ψ	0.5
Substitution elasticity for labour services i	θ	6.0
Home bias	h	0.5
Weight of utility of government purchases	χ	0.20
Weight of labour disutility	κ	1.00
Intertemporal elasticity of substitution	$1/\sigma$	1.00
Labour supply elasticity	$1/\varphi$	0.25
Share LC households	slc	0.40
Share of tradable goods on consumption	ϕ	0.6
Trade elasticity between home and foreign goods	η	2
Price adjustment costs	γ_p	48
Wage adjustment costs	γ_w	80
Capital adjustment costs	γ_k	30
Persistence of TFP shock	ρ_a	0.92
Persistence of risk premium shock	ρ_r	0.85
Standard deviation TFP innovation	σ_a	0.025
Standard deviation of risk innovation	σ_r	0.024

The Cobb-Douglas parameter α=0.40 is derived from the average labour income share and the marginal return to capital in the steady state. The quarterly capital depreciation rate compatible with the steady-state ratios of investment and capital is 1.7%, which together with the tax rate on capital income implies a quarterly equity premium of 2.2%, a quarterly interest rate on bonds of 0.6% and the quarterly discount factor β=0.995. The

endogenous component of the country risk premium is set to ω=0.0025, i.e. one percentage-point deterioration in the NFA-to-GDP position increases the annualised borrowing rate by one basis point. An external risk premium of this size has been estimated for Spain by Aspachs-Bracons and Rabanal (2010).

The values of ε=6 and θ=6 for the elasticity of substitution between differentiated goods and labour services imply steady-state price and wage mark-ups of 20% that are in line with empirical estimates by Christopoulou and Vermeulen (2012). The elasticity of substitution between tradable and non-tradable goods is ψ=0.5 (Rabanal 2009).[31] The consumption home bias in the demand for domestically produced tradable goods is set to h=0.5 to match the average import-to-GDP ratio of a group of eight smaller EA-12 countries during 1999-2009.[32]

The weights of public purchases (χ=0.2) and employment (κ=1) in the utility function are chosen so that the euro area average levels of consumption, government purchases and employment for 1999-2009 satisfy the households' optimality conditions. The intertemporal elasticity of substitution is set to $1/\sigma$=1.0 in the benchmark model, i.e. standard logarithmic consumption utility. The value $1/\varphi$=0.25 for the elasticity of labour supply lies in the range of microeconomic estimates, even though DSGE models often use higher values (Evers et al. 2008; Fiorito and Zanella 2008).

The estimates for the share of liquidity-constrained households (slc) in the euro area cluster around 0.40 (e.g. Forni et al. 2009; Ratto et al. 2009). The trade elasticity between domestic and foreign tradable goods is η=2 and corresponds to euro area estimates by Imbs and Méjean (2010). Price and wage adjustment costs are set to match the average price and wage durations of 4 and 5 quarters reported by Druant et al. (2009) and Knell (2013) and to generate demand and employment volatility in the range of empirical values for the group of eight smaller EA-12 members given the exogenous shocks. The parameter for capital adjustment costs is chosen to obtain empirically plausible values for the volatility of investment.

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[31] The relatively low value is common in the literature that estimates open economy sticky price models because it explains higher volatility of relative prices than relative quantities (Lubik and Schorfheide 2006; Rabanal 2009).

[32] The countries are AUT, BEL, ESP, FIN, GRC, IRL, NLD and PRT. The focus on this group of smaller countries among the early EA members is motivated by the fact that these countries have already more than one decade of EA history to quantify the role of asymmetric shocks.

The technology (TFP) shock in the tradable and non-tradable sector is the estimated AR(1) process for the model-consistent Solow residual given the data on real output and factor inputs. The shock is estimated on the gap between the Solow residuals of the eight smaller EA-12 countries and the euro area average TFP level in 1999q1-2009q4. The use of TFP gaps relative to the euro area average rather than of absolute TFP levels derives from the focus on asymmetric shocks. In the same spirit, the risk-premium shock is the estimated AR(1) dynamics of the eight smaller EA-12 countries' interest rate spread over the German rate for 10-year government bonds in 1999q1-2009q4.

Table 8: 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	0.03	0.01
Consumption	0.78	1.32	0.78	0.94	0.42	0.74	1.21	0.26
Employment	0.50	1.39	0.63	0.96	0.29	0.70	1.40	0.47
Investment	0.86	2.03	0.82	0.94	0.68	2.77	3.59	1.70
Trade balance	-0.39	0.59	-0.25	0.20	-0.66	1.13	1.42	0.80
Gov. purchases	1.00	1.00	0.17	0.48	-0.12	0.97	2.47	0.42
Inflation	0.37	0.30	0.12	0.68	-0.40	0.57	1.05	0.37

Note: All moments are based on quarterly data. Except for inflation and the trade balance, the variables are in logarithms and model-generated and data series HP-filtered (λ=1600). The mean for actual data is the non-weighted average AUT, BEL, ESP, FIN, GRC, IRL, NLD and PRT during 1999q1-2009q4; maximum and minimum values refer to the highest and lowest ranking country in this group for a particular measure. The data are seasonally and working-day adjusted. The trade balance is relative to GDP, and inflation is the year-on-year percentage change in the core CPI. The standard deviation is the absolute standard deviation for output and the standard deviation relative to the standard deviation of output for all other variables.

Table 8 compares characteristic moments of the benchmark model under the combination of TFP and risk premium shocks and in the absence of fiscal stabilisation of business cycle fluctuations to data for the group of smaller EA12 countries in the period 1999q1-2009q4. It shows that the model matches important aspects of the data fairly well. Namely, the model replicates the correlation of private demand, investment,

the trade balance, employment and inflation with output at business cycle frequencies in qualitative terms. Data patterns of the relative volatility are also replicated. Namely, the model replicates the observed high volatility of investment. The size of model-generated employment and government purchases volatility lies within the range of values in the data; however, the trade balance is less volatile in the model. Compared to the data, private consumption is more volatile in the model, which is linked to fixing the share of government purchases to GDP in the baseline model, so that private demand absorbs additional fluctuations in aggregate demand. The low volatility of CPI inflation in the model relative to the data can be linked partly to the assumption of constant import prices in the model simulations, which derives from the exclusive focus on country-specific shocks.

3.4 Impulse responses

In order to analyse the stabilising effects of budgetary-neutral shifts of government purchases between T and NT goods and compare it to the effects of fiscal devaluation we present simulations for economy-wide TFP and risk premium shocks under different model and policy settings (Table 9).

Table 9: Alternative policy versions for impulse responses

Model version	Assumptions
No policy (NP)	No cyclical fiscal policy response
Fiscal devaluation (FD)	Tax shift from labour tax to consumption tax to stabilise trade balance gap (TBY_GAP)
Budgetary-neutral fiscal policy (BN_TBY; BN_Y)	Counter-cyclical fiscal policy response to trade balance gap (TBY_GAP) and output gap (Y_GAP)

First, we portray the no-policy case (NP) to illustrate the differences between an economy with and without price and wage stickiness. Second, we show impulse responses (IRFs) for fiscal devaluation (FD) as (ex ante) budgetary-neutral tax shift that affects the real exchange rate and external accounts. Third, we examine the stabilisation potential of a budgetary-neutral reallocation of government purchases between T/NT

goods. To illustrate the trade-off between domestic (output) stabilisation and the dampening of swings in the external position, we show IRFs for expenditure-switching rules in which the policy instrument reacts either to external imbalances (excessive volatility in the trade balance) or domestic fluctuations (output gap).

The policy rules that are discussed in this chapter focus on trade balance and output gaps rather than absolute levels as target variables. The gaps are defined conventionally as per-cent (output gap) or percentage-point (trade balance to GDP) deviations of actual levels from the levels that would prevail in an economy with fully flexible prices and wages. The focus on the fiscal response to gaps rather than levels allows considering variations in the variables as excess volatility and examining whether fiscal policy can mitigate excess volatility associated with sticky price and wage adjustment.

Given the loss of autonomous monetary policy in monetary union, fiscal policy may take over (part of) the stabilisation role at the national level. The most prominent budget-neutral policy to mimic nominal depreciation in order to stabilise domestic activity and external positions is fiscal devaluation. Correia (2011), de Mooij and Keen (2013), and Farhi et al. (2011), among others, show that a shift of government revenue from social security contributions to the VAT can replicate the real effects of nominal exchange rate devaluation. We simulate a temporary fiscal devaluation as a benchmark for our government expenditure shifting rule similar to (3.44):

$$\tau_t^c = \rho_G \tau_{t-1}^c + (1-\rho_G)\overline{\tau}^c + (1-\rho_G)\xi_Z \left(\widehat{TB/Y}_t\right) \tag{3.61}$$

where (3.61) implies a shift in the consumption tax in response to fluctuations in the trade balance gap. The tax shift is revenue-neutral in the sense that the overall level of government revenues is kept constant. Thus, the labour tax is adjusted by the increase in consumption tax:

$$\tau_t^w = \tau_{t-1}^w + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - \left(\tau_t^c - \overline{\tau}^c\right)\left(\frac{P_t^C C_t}{W_t L_t}\right) \tag{3.62}$$

A negative parameter value ($\xi_Z < 0$) implies an increase in consumption tax and a decline in the labour tax rate in case of an excessive trade balance deficit.

The alternative policy of a budgetary-neutral expenditure rule adjusts the T/NT composition of government consumption according to (3.44):

$$\frac{G_{NT,t}}{G_t} = \rho_G \frac{G_{NT,t-1}}{G_{t-1}} + (1-\rho_G)\left(1-\phi\right) + (1-\rho_G)\xi_Z Z_t \tag{3.44}$$

where $Z = [\widehat{TB/Y}, \hat{Y}]$ implies a shift in the composition of government consumption in response to fluctuations in the trade balance gap as an indicator of external imbalances or the output gap as an indicator of domestic imbalances.[33] A counter-cyclical response in our setting implies that the government responds to stabilise the chosen indicator. Specifically, if the trade balance gap is negative, implying lower net exports compared to the flexible economy, the government aims at increasing net exports by shifting purchases from T to NT sector ($\xi_Z < 0$) in order to reduce import demand and to bring the economy closer to the flexible-economy trade balance response.

The parameter values ξ_Z for fiscal devaluation (3.61) and the budgetary-neutral expenditure rule (3.44) are chosen such that a 0.5 percentage-point decline in the trade balance gap leads, respectively, to a 1 percentage-point increase in the consumption tax, with a corresponding labour tax reduction, or an expenditure shift in government purchases from T to NT goods by 1 percentage point of GDP.

3.4.1 Negative economy-wide productivity shock (competitiveness loss)

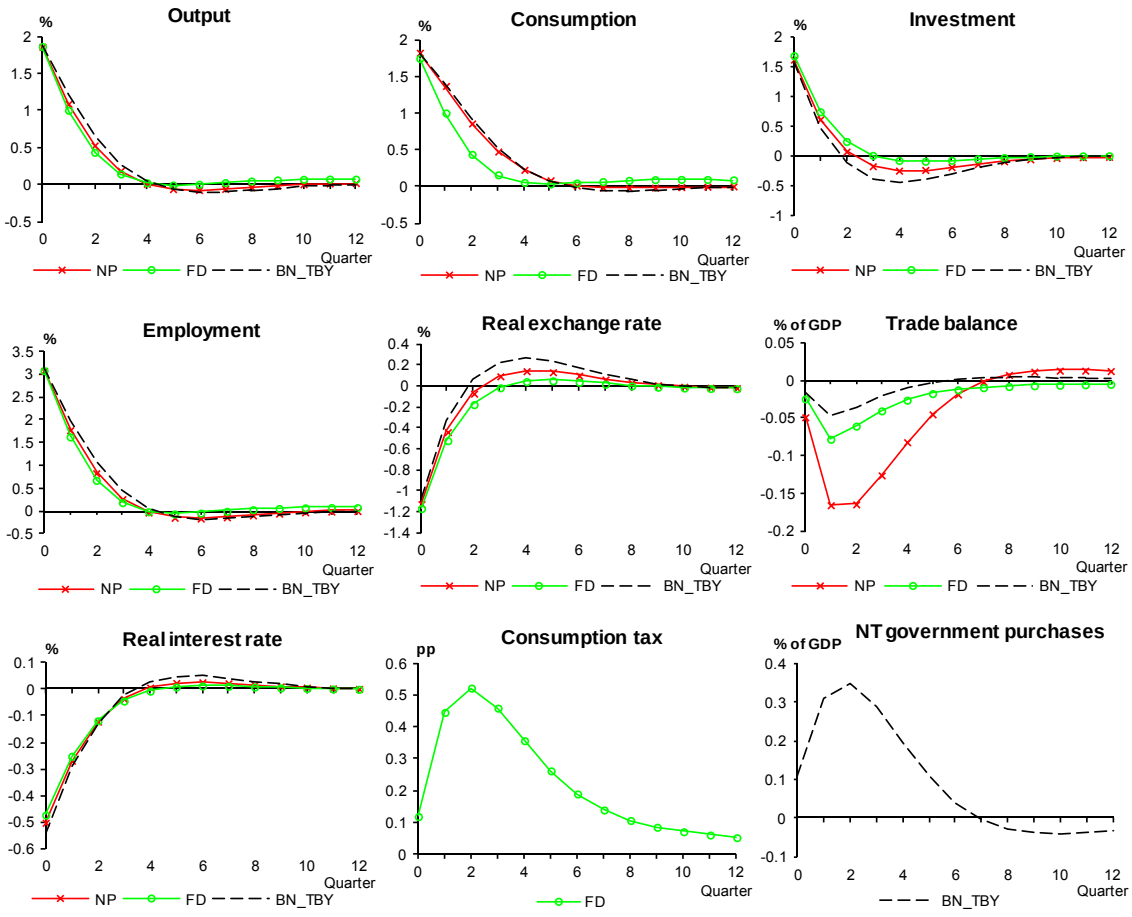
The dynamic responses to a temporary decline in factor productivity (TFP) by 2.5 percentage points in the small open economy relative to the rest of euro area (RoEA) are depicted in Figure 9.[34] As the impulse responses are expressed in gaps, they show per-cent deviations (percentage-point deviations for trade balance, government debt, tax rates and government purchases) of actual levels from levels in the flexible economy, i.e. the economy without wage and price stickiness. In a frictionless economy, a decline

[33] To keep the analysis concise, we only show the results for output gap stabilisation. Results for a policy rule reacting to the employment gap are similar to the results for the policy rule responding to the output gap.

[34] More detailed impulse responses, including separate IRFs for the frictionless economy, can be found in the related working paper (Hohberger et al. 2013).

in TFP decreases the level of output, investment and consumption through an increase in domestic goods prices which is also associated with an appreciation of the real exchange rate and a deteriorating trade balance. In the economy with price/wage stickiness, the output reduction in response to the negative TFP shock is less pronounced. Price stickiness delays the increase in domestic goods prices and leads to a period of lower real interest rates, so that consumption and investment decline more moderately with productivity. Taken together this no-policy scenario (NP) leads to positive output, consumption and investment gaps. The real exchange rate appreciation is less pronounced on impact, i.e. a negative real exchange rate gap, but with higher persistence in the adjustment process which further deteriorates the trade balance, leading to a negative trade balance gap in the medium term.

Figure 9: Negative TFP shock and policy responses to the trade balance gap

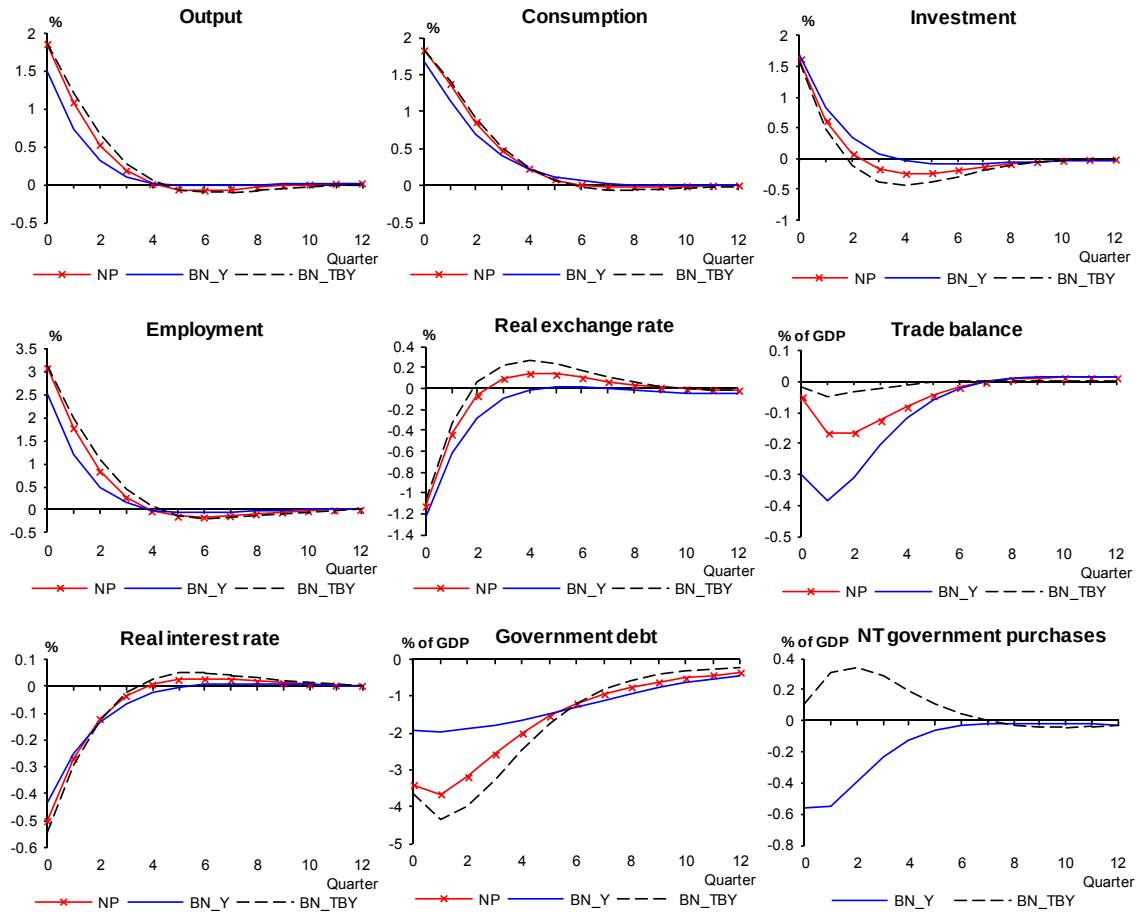


In response to the negative TFP shock, fiscal devaluation (FD), i.e. an (ex ante) revenue-neutral combination of labour tax reduction and consumption tax increase reduces the trade balance gap (Figure 9). More specifically, a temporary increase in consumption tax by 0.5 percentage points in response to the excessive trade balance deterioration more than halves the trade balance gap. At the same time, it also reduces the consumption, employment and output gaps slightly.

A response of the budgetary-neutral expenditure-composition rule to the trade balance gap (BN_TBY) that shifts government purchases from T to NT in order to reduce the demand for imports and the trade deficit, reduces the trade balance gap substantially, but does not contribute to the stabilisation of consumption, employment and output (Figure 9). Instead, consumption, employment and output gaps become slightly larger compared to the no-policy case. The one-to-one shift of government purchases from T to NT reduces import demand and improves the trade balance, but at the same time increases the demand for domestic output (tradables are partly imported, whereas non-tradables are 100% produced domestically). Hence, the demand shift towards NT increases the demand for domestic output and the employment and output gap. This puts upward pressure on prices (illustrated in Figure 9 by less REER depreciation), which further reduces the real interest rate.

Stabilising the output gap (BN_Y) with the expenditure-switching rule rather than the trade balance gap (BN_TBY) requires a shift of government expenditures from NT to T in the case of a negative TFP shock to reduce the positive output gap (output being higher in the economy with nominal rigidities than in the flexible economy). Specifically, the parameter value of $\xi_Z = -4$ in Figure 10 implies a shift in government purchases from NT to T goods of 0.5 percentage points of GDP. The shift in government purchases from NT to T reduces the demand for domestic output, i.e. dampens the positive employment and output gaps. It also dampens upward pressure on prices, which mitigates the fall in the real interest rate and reduces the positive consumption gap. The switch towards T demand does also strengthen the demand for imports, however, leading to further deterioration in the trade balance. In the example of Figure 10, the trade balance gap more than doubles compared to the no-policy case.

Figure 10: Negative TFP shock and domestic (Y_GAP) vs. external (TBY_GAP) stabilisation policies



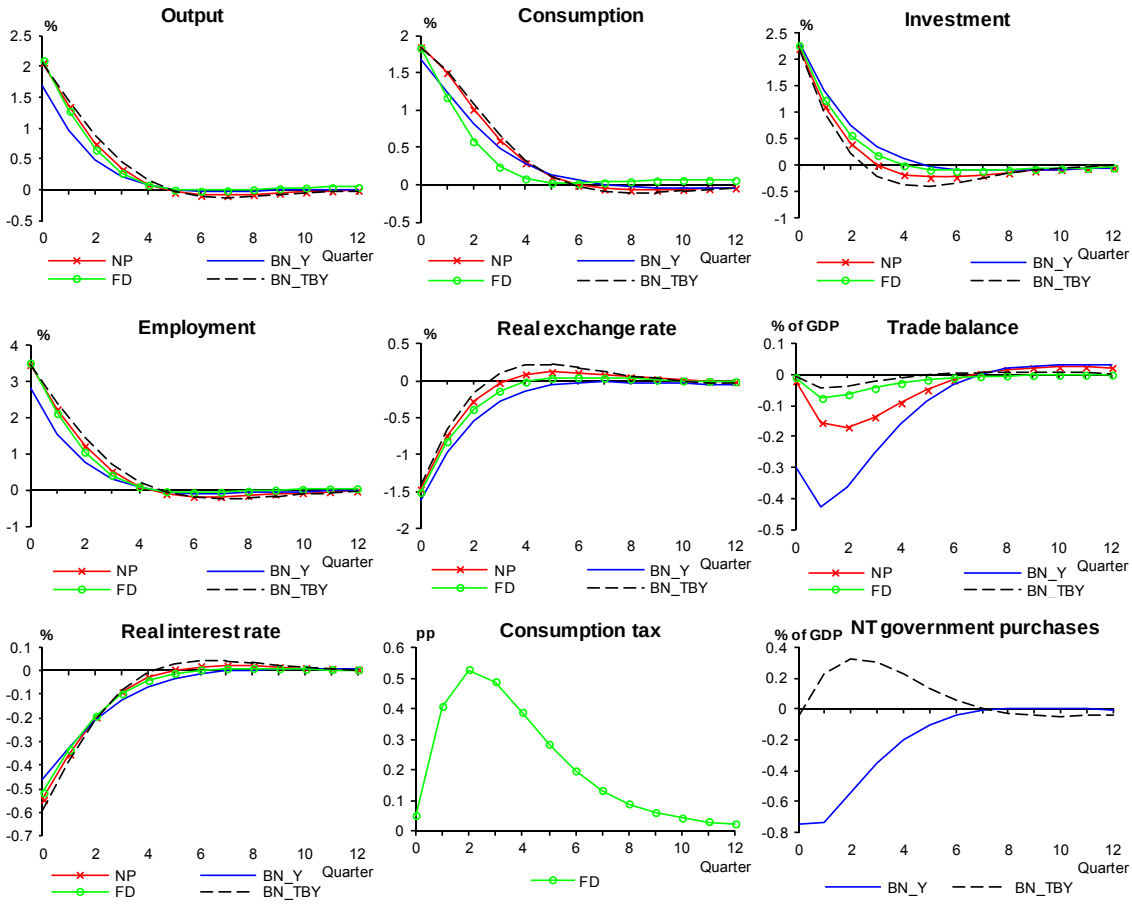
3.4.2 Negative risk premium shock (demand boom)

The dynamic responses to a temporary negative risk premium shock of 2.4 percentage points relative to the rest of euro area (RoEA) are depicted in Figure 11.[35] Again, the impulse responses are shown in gaps, i.e. relative to the economy without wage and price rigidities. The negative risk premium shock reduces domestic borrowing rates in the economy without nominal rigidities, which strengthens domestic consumption and investment demand and, consequently, the demand for imports. The increase in

[35] Here, we combine the different policy instruments (Table 9) in one Figure.

domestic demand increases factor demand and puts upward pressure on wage and price, which leads to real exchange rate appreciation and a loss in price competitiveness. Both, the increase in import demand and the loss in price competitiveness deteriorate the trade balance. Price and wage stickiness in the no-policy scenario (NP) delay the rise in prices/wages in response to higher demand and lead to a period of low real interest rates, which further strengthens domestic and import demand and deteriorates the trade balance response despite the dampening of REER appreciation.

Figure 11: Demand boom and alternative stabilisation policies



A fiscal devaluation (FD) policy that reduces the labour tax burden at the expense of higher consumption taxes in response to trade balance deterioration due to the demand boom reduces consumption demand and dampens the upward pressure on factor costs and prices. The demand and supply effects of the tax shift dampen import demand and

the REER appreciation compared to the no-policy case, which mitigates the deterioration in the trade balance. Figure 11 suggests that a temporary shift towards the consumption tax by circa 0.5 percentage points more than halves the trade balance gap compared to the NP scenario.

Similar to the TFP shock, a response of the composition of government purchases to the trade balance gap (BN_TBY) implies a shift of government consumption from T to NT goods to reduce import demand and the trade balance deficit. Compared to fiscal devaluation which dampens both domestic and import demand, the shift from T to NT in government purchases reduces imports but increase the demand for domestic output. The additional demand for domestic output increases the domestic employment and output gap and puts additional upward pressure on production costs and prices as illustrated by a smaller negative REER gap in Figure 11. The stronger price pressure despite price stickiness reduces the real interest rate, which increases consumption demand. Figure 11 shows that a shift in government purchases from T to NT goods by 0.4 percentage point of GDP dampens the trade balance deterioration substantially, but at the cost of a stronger cyclical response of domestic demand, employment and output.

In contrast, stabilising domestic activity (BN_Y) requires a shift in government purchases from NT to T in response to the risk premium decline to dampen the demand for domestic output and reduce the domestic employment and output gap, bringing domestic variables closer to the solution without wage and price stickiness. Again, increasing government purchases of T leads to further deterioration of the trade balance, highlighting the trade-off between stabilising domestic activity (BN_Y) and reducing excessive swings in the trade balance (BN_TBY) in the short and medium term.

Table 10 shows the standard deviations of the output, consumption, employment and trade balance gaps and their correlation with the output gap under the combination of TFP and demand shocks to summarise the impulse responses under the different policy rules. The numbers illustrate the trade-off for the expenditure switching rule. Lower output gaps (BN_Y) are associated with higher trade balance gaps compared to the no-policy case, whereas smaller trade balance gaps (BN_TBY) are associated with stronger volatility of domestic variables. As show above, fiscal devaluation (FD) does not face

this trade-off and reduces fluctuations in domestic variables and the trade balance compared to the no-policy case.

Table 10: Standard deviations and correlations under different policy rules

Standard deviations under the combination of TFP and demand shocks in %				
	Output	Private Consumption	Employment	Trade balance
No policy	0.0344	0.0367	0.0570	0.0042
Fiscal devaluation	0.0337	0.0310	0.0558	0.0017
External stabilisation	0.0361	0.0374	0.0598	0.0010
Domestic stabilisation	0.0265	0.0321	0.0438	0.0097

Note: Results refer to the variables in gaps, i.e. per-cent deviations of actual levels from levels in the flexible economy (percentage-point deviations for the trade balance relative to GDP). The parameter values for the different policy rules correspond to those in Figures 9-11.

3.5 Welfare analysis

In a final step we illustrate the welfare effects of the budgetary-neutral expenditure-switching rule for government purchases (3.44) in the context of external and domestic stabilisation and of fiscal devaluation (3.61-3.62). Following, e.g., Evers (2012), we compute welfare effects based on a second-order Taylor expansion of the household utility function (3.1) around the deterministic steady state. In terms of log-deviation, the second-order Taylor approximation of the period utility yields:

$$Eu(c_t, l_t) \approx \frac{\bar{c}^{1-\sigma}}{1-\sigma} - \frac{\bar{l}^{1+\varphi}\kappa}{1+\varphi} + \bar{c}^{-\sigma} E\hat{c}_t - \kappa \bar{l}^{\varphi} E\hat{l}_t - \frac{1}{2}\left(\bar{c}^{-1-\sigma}\sigma\right) E\hat{c}_t^{\,2} - \frac{1}{2}\left(\kappa \bar{l}^{-1+\varphi}\varphi\right) E\hat{l}_t^{\,2} \quad (3.63)$$

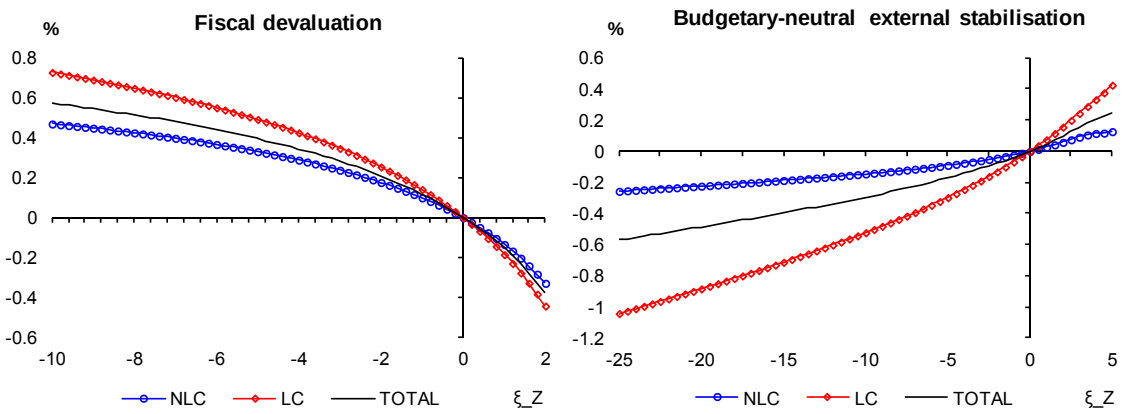
where $\bar{c}$ and $\bar{l}$ denote the steady-state level and $\hat{c}_t$ and $\hat{l}_t$ the period log-deviation from the steady state. The quantitative results refer to the overall welfare effects, i.e. the combination of mean and variance effects.

We run simulations over the interval [-25; 10] for the fiscal stabilisation parameter ξ_Z in steps of 0.2. Welfare is measured relative to non-stabilisation and gains are expressed

in percent of steady-state consumption for NLC households, LC households and the population average (TOTAL), which is the weighted mean of the NLC and LC welfare gains.[36]

We show welfare gains (positive values) or losses (negative values) for a range of policy parameter values ξ_Z instead of focusing exclusively on the welfare-maximising parameter values within this range. Looking at a broader range for ξ_Z highlights the loss associated with non-optimal policy and provides information on the robustness of welfare effects with respect to variations in ξ_Z. The welfare effects are computed for the combination of TFP and risk premium shocks that underlies the model calibration.[37]

Figure 12: Welfare effects for external stabilisation policies



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

Figure 12 shows that a fiscal devaluation leads to welfare gains for both LC and NLC households for values of ξ_Z that stabilise both domestic variables and the trade balance. An FD response that lowers the labour tax and increases the consumption tax in response to a negative trade balance gap generates average welfare gains of up to 0.6% of steady state consumption for the parameter range considered here. While increasing

[36] Previous contributions measuring welfare effects of fiscal policy relative to non-stabilisation and in per cent of steady state consumption include Ferrero (2009), Evers (2012), Kumhof and Laxton (2013b) and Vogel et al. (2013).

[37] The different illustrated parameter ranges in Figure 12 are chosen to assume that both policies responds to a 0.5 percentage-point decline in the trade balance gap by a tax (expenditure) shift from labour to consumption tax (T to NT goods) of approximately 1 percentage point (1 percentage point of GDP).

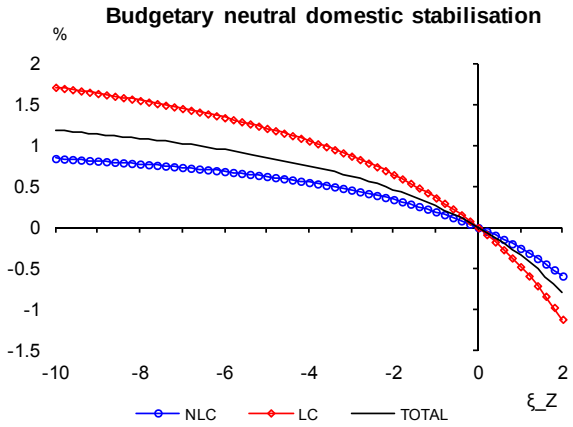
the VAT in periods of trade balance deterioration, which under TFP and demand shocks are also periods of increasing consumer prices, reduces the purchasing power of income, LC income effects are overcompensated by the labour tax reduction and the stabilisation of labour demand, leading to LC welfare gains. In the case of NLC households, the VAT increase replicates the real interest rate increase under flexible prices, which is otherwise less pronounced under sticky prices. Replication of the real interest rate of the flexible economy reduces the NLC consumption gap and improves the welfare of NLC households.

In contrast, budgetary-neutral shift in government purchases between T and NT goods to dampen swings in the trade balance deteriorate the welfare of domestic households by up to 1% and 0.2% of steady-state consumption for LC households and NLC households, respectively, because of the trade-off between the stabilisation of the trade balance and the stabilisation of domestic variables discussed in section 3.4. LC households without access to financial markets to smooth income and consumption over time suffer particularly from higher employment volatility associated with trade balance stabilisation under the expenditure-switching rule.

A budgetary-neutral expenditure-switching rule with focus on stabilising domestic activity (BN_Y) increases household welfare by up to 1.7% and 0.8% of steady-state consumption for LC households and NLC households, respectively, for the parameter range considered here (Figure 13). As both types of households have identical period utility functions (2.1), the welfare effects are larger for LC consumers, who are unable to smooth their consumption over time and, hence, benefit more than NLC consumers from fiscal policies that stabilise temporary income fluctuations by stabilising domestic activity.

Comparing the potential welfare and stabilisation effects of the expenditure-switching rule for government purchases with the fiscal devaluation scenario shows, again, that fiscal devaluation can achieve external stabilisation and welfare gains simultaneously, whereas the expenditure-switching policy rule implies a trade-off. The expenditure-switching rule achieves substantial welfare gains for both household groups by stabilising domestic activity, but generates welfare losses when focusing on trade balance stabilisation.

Figure 13: Welfare effects for domestic devaluation



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

The magnitude of potential welfare gains (or losses) is in line with Kirsanova et al. (2007) and Vogel et al. (2013), but high compared to the results in Dellas and Tavlas (2005). Dellas and Tavlas (2005) use a model with nominal wage rigidity but fully flexible prices, contrary to our combination of nominal wage stickiness, price stickiness and a fixed nominal exchange rate regime that induces more gradual wage and price adjustment and a stronger initial response of real variables. The combination of sticky nominal wages and prices in our model generates real wage rigidity and induces higher fluctuations in welfare terms compared to models with only wage or price stickiness as shown in Erceg et al. (2000) and Duval and Vogel (2012). This is supported by a sensitivity analysis, which shows that welfare effects in our model diminish with declining price stickiness. In case of fully flexible prices, maximum welfare losses for the expenditure-switching rule focusing on trade balance stabilisation would decline from 0.6% of steady-state consumption in Figure 12 to 0.03% of steady-state consumption for the household average.

3.6 Conclusion

This chapter develops a two-sector (tradables and non-tradables) DSGE model of a small open economy in monetary union with nominal and real rigidities to analyse the potential of simple fiscal policy rules to stabilise macroeconomic fluctuations, notably excess volatility in the external accounts. We focus on simple policy rules that adjust the composition of government purchases between tradable and non-tradable goods in response to excessive fluctuations in the trade balance or domestic activity. The policy rules are budgetary-neutral in the sense that the level of government expenditure is kept ex-ante constant. We compare the performance of this expenditure-composition rule to fiscal devaluation understood as a shift of the tax burden from labour to consumption in response to trade deficits.

Our results suggest that a state-dependent sectoral reallocation of government purchases between tradables and non-tradables can stabilise excessive fluctuations in external positions (trade balance gap), but with accompanying welfare losses of up to 0.6% on average household. In contrast, welfare gains of up to 1% of steady-state consumption for the average household are obtained when the policy rule targets the stabilisation of domestic activity (output gap). The findings show a trade-off between stabilising domestic activity and enhancing household welfare, on the one hand, and reducing excessive trade balance fluctuations , on the other hand, for the expenditure-switching policy rule. The trade-off does not exist for fiscal devaluation as a tax shift from labour to consumption in response to excessive trade deficits. The fiscal devaluation as implemented in the model reduces both fluctuations in the trade balance and fluctuations in domestic activity and demand and generates welfare gains of up to 0.6% on average in our simulations.

While the magnitude of potential welfare gains or costs is similar to other studies with models including a multitude of nominal and real frictions, such as Kirsanova et al. (2007) and Vogel et al. (2013), the welfare effects are rather large compared to, e.g., Dellas and Tavlas (2005). Contrary to Dellas and Tavlas (2005), our model structure includes both nominal wage and price stickiness, which gives rise to real wage rigidity

(see Erceg et al. 2000; Duval and Vogel 2012), and real frictions that amplify the costs of volume rather than price adjustment.

4

The sectoral reallocation of government purchases as budgetary-neutral stabilisation tool: a model-based analysis*

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4.1 Introduction

This chapter deals with a classical theme of the currency union literature, namely the role and potential of fiscal policy to stabilise asymmetric shocks and macroeconomic fluctuations at the level of member states, i.e. shocks that are not stabilised by a common monetary policy that focuses on union-wide aggregates. A key lesson from the euro area crisis is that the room for fiscal policy as stabilisation device becomes very restricted when fiscal limits are tight. Against this background, this approach analyses the potential of a state-dependent reallocation of government purchases between tradable and non-tradable goods as tool for business-cycle stabilisation and assesses associated welfare gains. A main characteristic of the state-dependent sectoral reallocation of government purchases is its (ex ante) budgetary neutrality, which makes it a feasible policy even when fiscal limits are tight, i.e. when the government cannot adopt classical counter-cyclical deficit spending.

This approach builds on the recent literature on fiscal policy rules for macroeconomic stabilisation (e.g. Schmitt-Grohé and Uribe 2007; Kollmann 2008; Galí and Monacelli 2008; Kumhof and Laxton 2013b). We use a two-sector New Keynesian DSGE model of monetary union with Ricardian and liquidity-constraint households, nominal price and wage stickiness and labour and capital as production factors and implement simple fiscal instrument rules that adjust the composition of government purchases between tradables and non-tradables in response to business cycle indicators such as employment or output gaps. Following Galí and Monacelli (2008), and contrary to Beetsma and Jensen (2004), Kirsanova et al. (2007), and Ferrero (2009), the analysis focuses on a small member country of monetary union, which excludes feedback to monetary policy and the rest of monetary union. The rational for the small-member focus is the stronger exposure of small economies to asymmetric shocks and their small weight in union-wide macroeconomic aggregates, which a common monetary policy focuses on.

This chapter finds that shifting government expenditure between tradable and non-tradable goods can be a useful instrument to stabilise domestic activity in response to asymmetric (economy-wide or sector-specific) supply and demand shocks. Potential welfare gains are higher than welfare gains from a classical deficit spending rule that

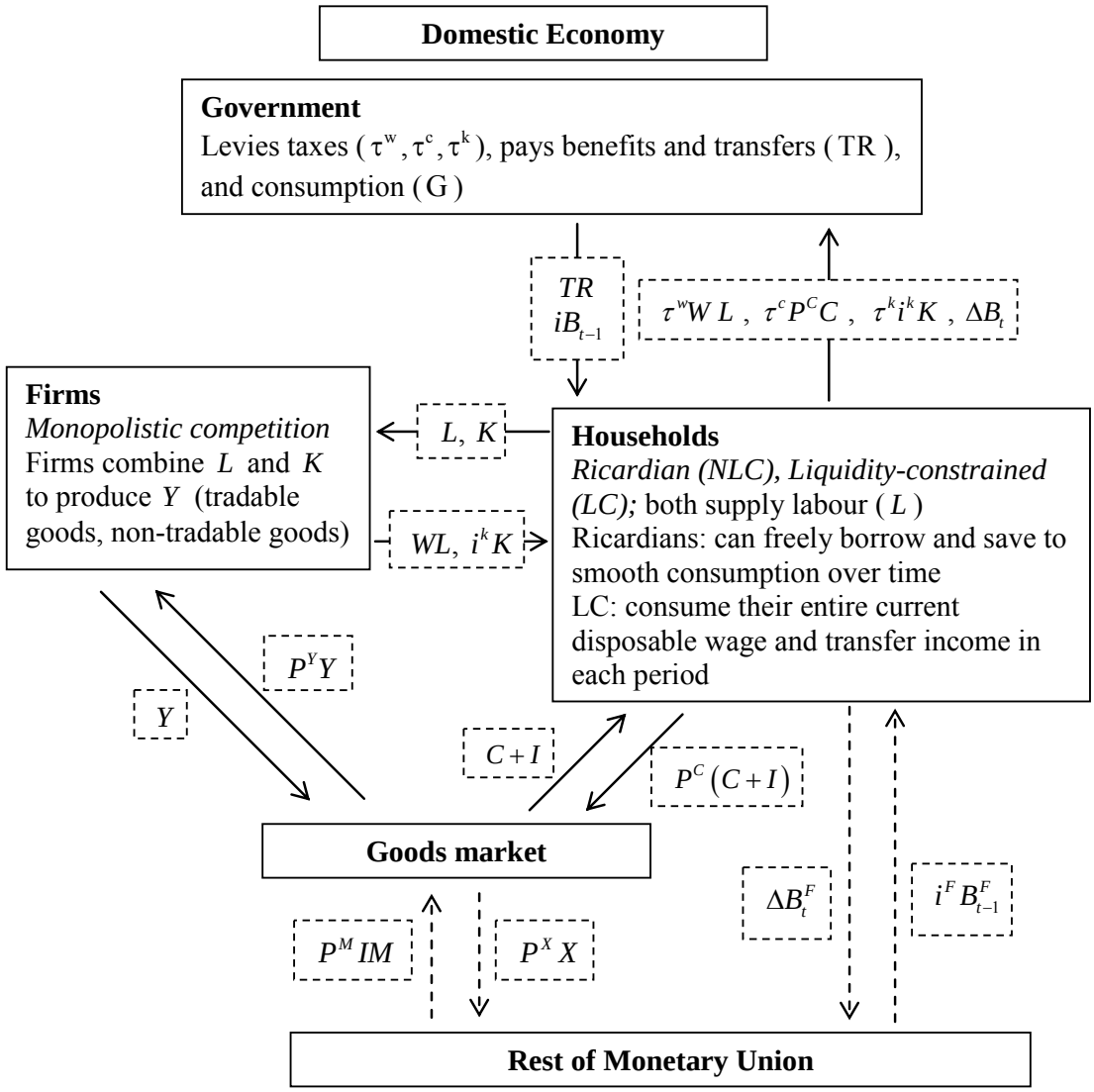
adjusts the overall amount of government purchases in response to cyclical indicators. The higher welfare gains derive from the fact that the state-dependent reallocation of government purchases across sectors is less subject to a trade-off between counter-cyclical demand stabilisation and the stabilisation of government deficit or debt levels, which is characteristic for the standard deficit spending.

4.2 Model

The model is in the spirit of Galí and Monacelli (2008) who discuss optimal monetary and fiscal policy in a monetary union. The small open economy is modeled as one among a continuum of small open economies forming the monetary union. The small economy does not have significant impact on the overall development of the union aggregate or the common monetary policy. Our set-up consists of two regions, namely a small (domestic) member country and the rest of monetary union, and two sectors, namely tradable (T) and non-tradable (NT) goods production. The model features monopolistic competition in goods and labour markets, nominal price and wage stickiness, and capital and labour as production factors. Households are either intertemporal optimising consumers (NLC) that can freely borrow and save to smooth consumption over time, or liquidity-constrained (LC) households who consume their entire current disposable net wage and transfer income (Galí et al. 2007). In light of the empirical evidence (Kollmann 1996), we depart from the assumption of complete risk-sharing as in Beetsma and Jensen (2004), Galí and Monacelli (2008), and Kirsanova et al. (2007) and introduce a debt-dependent country risk premium as external closure (Schmitt-Grohé and Uribe 2003). Goods markets are imperfectly integrated across borders in the sense that there is a home bias in the demand for tradable goods. Labour is immobile between countries. The rest of monetary union and monetary policy are exogenously given from the small economy's perspective. The model parameters are calibrated to key characteristics of an average small EMU member country. For the sake of brevity, this chapter only displays the equations for the government sector to focus on the fiscal policy rules. Figure 14 summarises the structure of the model.[38]

[38] The detailed description of the model structure can be found in Chapter 3.

Figure 14: Model structure



Given the focus on (ex ante) budgetary-neutral expenditure adjustment, the modelling of the public sector deserves more detail.[39] The government collects labour income (τ^w), capital income (τ^k) and consumption (τ^c) taxes and issues one-period bonds (B_t) to finance government purchases (G_t), transfers (TR_t) and the servicing of outstanding debt, $(1+i_{t-1})B_{t-1}$:

[39] The policy is budgetary neutral ex ante. The ex post impact on the government balance can differ due to endogenous changes in the tax base in response to the policy and due to endogenous changes in the relative price of tradable/non-tradable goods.

$$\tau_t^w W_t L_t + \tau_t^k (i_t^k - \delta) K_{t-1} + \tau_t^c P_t^C C_t + B_t = P_t^G G_t + TR_t + (1 + i_{t-1}) B_{t-1} \tag{4.1}$$

Government purchases G_t are composed of tradables ($G_{T,t}^i$) and non-tradables ($G_{NT,t}^i$), where $G_{T,t}$ is a composite of domestically-produced tradables ($G_{TH,t}$) and imported goods ($G_{TF,t}$):[40]

$$G_{T,t}^{(\eta-1)/\eta} = h^{1/\eta} G_{TH,t}^{(\eta-1)/\eta} + \left(1-h\right)^{1/\eta} G_{TF,t}^{(\eta-1)/\eta} \tag{4.2}$$

The parameter h represents the steady-state home bias, and η is the elasticity of substitution between domestically produced tradables and imports.

Expenditure for total government purchases is the sum of expenditure on tradable and non-tradable goods:

$$P_t^G G_t = P_t^T G_{T,t} + P_t^{NT} G_{NT,t} \tag{4.3}$$

The government can allocate purchases between tradables and non-tradables in response to cyclical fluctuations. The policy takes the form of simple fiscal instrument rules in analogy to simple interest rate rules in monetary policy:[41]

$$\frac{G_{NT,t}}{G_t} = \rho_G \frac{G_{NT,t-1}}{G_{t-1}} + (1-\rho_G) \frac{\bar{G}_{NT}}{\bar{G}} + (1-\rho_G) \xi_Z Z_t \tag{4.4}$$

The instrument rule (4.4) determines shifts in the allocation of government spending between non-tradables and tradables, where $Z = [\hat{Y}, \hat{L}, P_T / P_{NT}]$ implies a response to indicators such as the output gap, the employment gap or the relative price of the sectoral output.[42]

The government adjusts labour taxes to stabilise government debt and the budget deficit according to:

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[40] In the case of EMU, the EU's internal market and public procurement policies have weakened the plausibility of assuming full home bias in government purchases.

[41] The focus on simple instrument rules to assess the stabilising potential of fiscal policy is widely-used in the literature (e.g. van Aarle et al. 2008; Kumhof and Laxton 2013b; Vogel et al. 2013). The practical advantages of simple rules over fully optimal policy solutions are that simple rules use limited information sets and are (hence) easier to monitor than the commitment to fully optimal policy. Better compliance monitoring mitigates the credibility/time-consistency problem.

[42] Within this framework, I do not address the potential of fiscal policy to correct external imbalances, which is an important aspect in the literature on fiscal devaluation (Farhi et al. 2011; de Mooij and Keen 2013; Hohberger et al. 2014a).

$$\tau_t^w = \tau_{t-1}^w + \xi_b \left(\frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} - btar \right) + \xi_d \Delta \frac{B_{t-1}}{4P_{t-1}^Y Y_{t-1}} \quad (4.5)$$

where *btar* is the target debt-to-GDP ratio (here, 70%). The parameters ξ_b and ξ_d in (4.5) are set to imply tax rate increases of 0.001 and 1.0 percentage point per percentage-point increase in government debt-to-GDP and deficit-to-GDP ratios, respectively. Changes in the labour tax affect the labour supply decision of workers, the disposable period income and, hence, consumption demand by LC households. The detailed model calibration can be found in Chapter 3.3.

4.3 The stabilising potential of sectoral expenditure reallocation

To illustrate the stabilising effect of government expenditure reallocation between tradable and non-tradable goods we present simulations for demand (interest rate/risk premium) shocks and economy-wide as well as sectoral supply (TFP) shocks under alternative model and policy settings (see Table 11).

Table 11: Alternative model versions and policy rules

Model version	Assumptions
Frictionless (FLEX)	No wage/price stickiness No cyclical fiscal policy response
No policy (NRIG)	Model with nominal rigidities No cyclical fiscal policy response
Standard fiscal policy rule (CCPOL)	Model with nominal rigidities Counter-cyclical fiscal response to employment gap and the relative price
Budgetary-neutral fiscal policy rule (BNPOL)	Model with nominal rigidities Budgetary-neutral fiscal response to employment gap and the relative price

The ex ante budgetary-neutral policy is captured by the fiscal instrument rule (4.4):

$$\frac{G_{NT,t}}{G_t} = \rho_G \frac{G_{NT,t-1}}{G_{t-1}} + (1-\rho_G)\frac{\bar{G}_{NT}}{\bar{G}} + (1-\rho_G)\xi_Z Z_t$$

where $Z = [\hat{L}, \hat{Y}, P_T / P_{NT}]$ implies a shift in the composition of government consumption in response to fluctuations in the employment gap, the output gap, and the relative price between both sectors, respectively. Gaps are expressed as per-cent deviations of actual levels from levels in the flexible economy without wage and price stickiness. To keep the analysis short, we only show results for employment gap stabilisation in the case of economy-wide shocks and for a response to sectoral output prices in the case of sectoral shocks. Results for output gap stabilisation are similar to results for policy rules targeting the employment gap. For example, in the case of cyclical unemployment (negative employment gap), the government shifts purchases from the tradable to the non-tradable sector ($\xi_Z < 0$) to reduce imports and increase demand in the non-tradable sector instead. We focus our analysis on the fiscal response to gaps rather than absolute levels of employment in order to examine how fiscal policy may contribute to stabilising business cycle fluctuations that emerge from the combination of structural rigidities and country-specific shocks. Hence, the policy aims at bringing employment (output) in an economy with nominal rigidities closer to the flexible-economy solution.

Impulse responses for the expenditure-switching policy (BNPOL) in this section use a parameter value $\xi_Z = -10$, which implies that a 1 percentage-point decline in the employment gap is accompanied by an expenditure shift from tradables to non-tradables of 1 percentage point of GDP. The policy rule also includes some endogenous persistence in the policy instrument ($\rho_G = 0.5$) to proxy the tendency of policy makers to smooth variations in the policy instrument.

As benchmark for comparison we use the simple counter-cyclical spending rule (CCPOL) that adjusts the overall level of government purchases in response to the employment gap:

$$\frac{G_t}{Y_t} = \rho_G \frac{G_{t-1}}{Y_{t-1}} + (1-\rho_G)\frac{\bar{G}}{Y} + (1-\rho_G)\xi_Z \hat{L}_t \qquad (4.6)$$

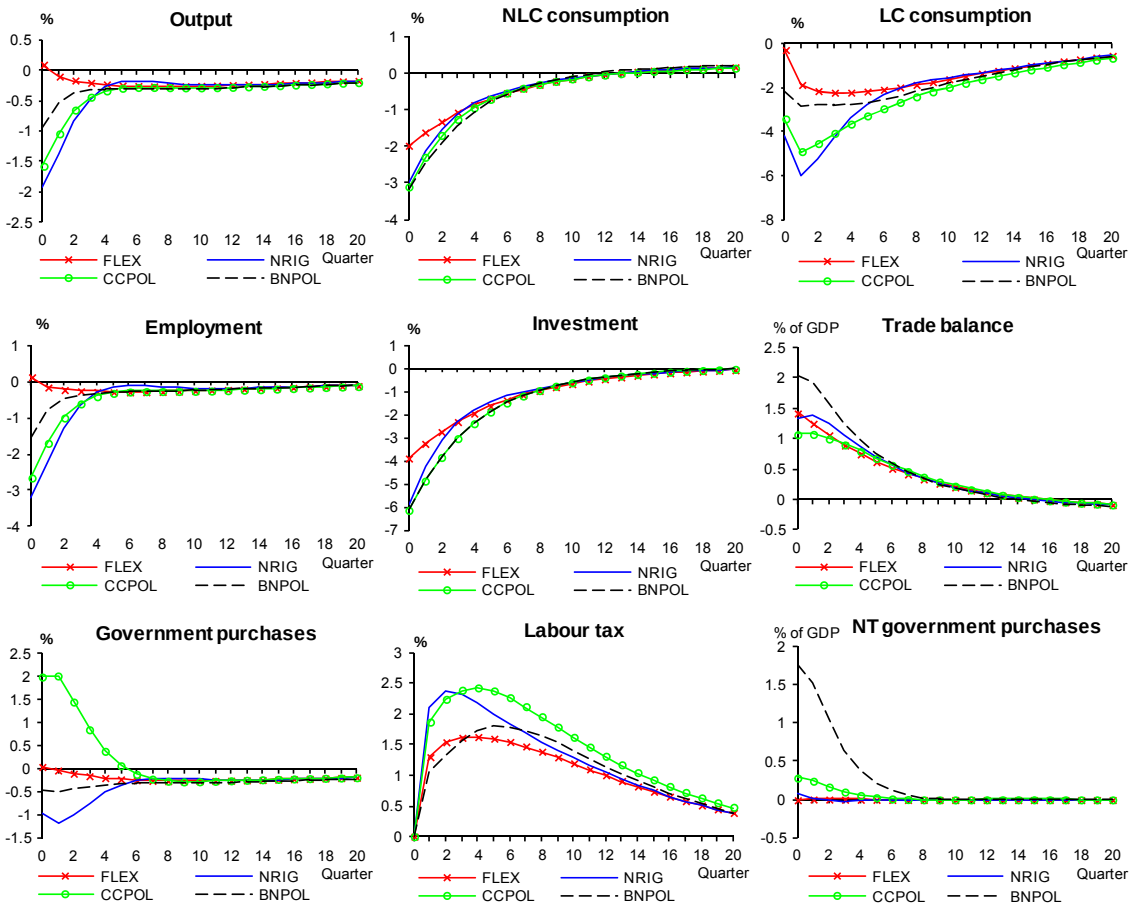
Stabilising the employment gap under CCPOL implies an increase in government purchases under cyclical unemployment to bring employment in the economy with nominal rigidities closer to its potential level. A parameter value of $\xi_Z = -2$ is chosen

for the CCPOL rule, so that a negative employment gap of 1% triggers an expenditure increase by 1 percentage points of GDP.

4.3.1 Positive interest rate shock (economy-wide demand contraction)

Impulse responses for a positive interest rate shock (increasing risk premia) in the frictionless economy (FLEX), the economy with nominal rigidities (NRIG), the economy with standard counter-cyclical government spending (CCPOL) and the budgetary-neutral expenditure shift (BNPOL) responding to the employment gap are shown in Figure 15.

Figure 15: Positive interest rate shock and policy response to the employment gap



A temporary increase in interest rates relative to the rest of monetary union increases domestic borrowing costs and dampens domestic consumption and investment demand. Falling domestic demand triggers sharp wage and price adjustment in the frictionless economy (FLEX) and leads to sharp real exchange rate depreciation that improves the trade balance. Price and wage stickiness (NRIG) delay the drop in prices and wages. The gradual price adjustment leads to a period of high real interest rates, which further reduces domestic demand and activity compared to the flexible economy.

The classical deficit-spending policy (CCPOL) responds to the employment gap by increasing government purchases. The policy reduces the output and employment gap compared to the NRIG economy. However, the deficit spending approach leads to a further deterioration of the government debt-to-GDP position on top of the impact of lower tax revenue and the decline in the denominator of the debt-to-GDP ratio.

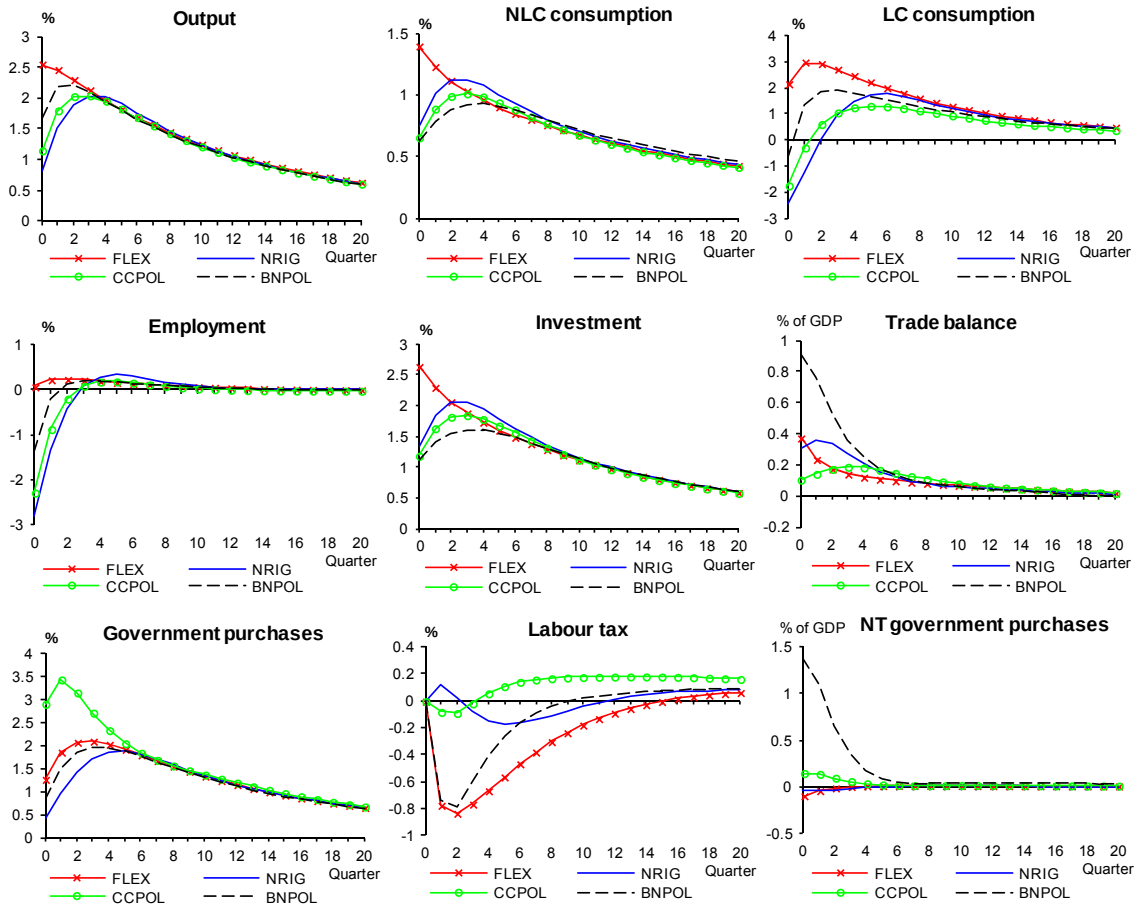
Contrary to CCPOL, the expenditure-switching rule policy BNPOL shifts government purchases from tradables to non-tradables to increase the demand for domestic output at the expense of lower imports to stabilise domestic activity and employment.[43] The IRFs in Figure 15 suggest that this policy outperforms the standard counter-cyclical policy rule with respect to the stabilisation of domestic activity and leads to further trade balance improvement through lower import demand. The partial leakage of fiscal stimulus to imports associated with the CCPOL rule is absent in the BNPOL case. Finally, BNPOL succeeds in dampening the increase of government debt to GDP in the recession. The combination of ex ante constant total government purchases under BNPOL with the superior output and employment stabilisation, which dampens the tax revenue decline and the negative denominator effect substantially, leads to only moderate increases in government debt to GDP compared to CCPOL. The government debt increase is low even in comparison with the no-policy case (NRIG).

[43] The policy response is shown by the strong increase of non-tradable (NT) government purchases relative to GDP in Figure 15, which is accompanied by a reduction in tradable (T) government purchases. The IRFs also show an increase in NT government purchases for CCPOL. However, the increase of NT government purchases relative to GDP in the case of CCPOL derives from the increase in overall government purchases relative to GDP under the counter-cyclical policy response. The composition of government purchases (NT versus T goods) remains unchanged under CCPOL.

4.3.2 Positive productivity shock (economy-wide supply expansion)

Impulse responses for a temporary productivity (TFP) increase in the small open economy are shown in Figure 16.

Figure 16: Positive TFP shock and policy response to the employment gap



Output in the frictionless economy (FLEX) closely tracks the TFP rise. Private consumption increases in response to the shock and employment remains fairly stable.[44] Net exports and the trade balance increase because of the depreciation of the real exchange rate associated with falling costs of domestic production. The output increase

[44] More particularly, employment increases slightly in reaction to the temporary labour tax decline, which is a consequence of the budgetary closure rule given the temporary decrease in the government debt-to-GDP ratio.

is less pronounced in the economy with price and wage stickiness (NRIG). Price stickiness delays the fall in domestic goods prices and leads to a period of higher real interest rates, so that consumption increases less than the production potential. As aggregate demand falls short of the higher potential output, employment falls sharply due to declining labour demand. Lower employment reduces labour income, so that LC consumption even declines on impact. The gradual decline in domestic prices and the subdued response of domestic demand to the productivity gain lead to more persistent real exchange rate depreciation and a more persistent trade balance surplus in the medium term compared to the FLEX case.

In response to an economy-wide positive supply shock, the standard counter-cyclical fiscal policy response (CCPOL) consists of increasing government purchases to bring output closer to potential and reduce the negative employment gap (Figure 16). Again, a fiscal parameter value of $\xi_Z = -2$ implies that a negative employment gap of 2.5% on impact is accompanied by an expenditure increase of 2.5 percentage points of GDP. The increase in government purchases reduces the gap between FLEX economy and NRIG economy, but the government debt-to-GDP ratio increases in the medium term. Higher government purchases also increase imports and dampen the trade balance improvement.

The budgetary-neutral government expenditure switching (BNPOL), on the other hand, shifts government consumption from tradables to non-tradables to increase the demand for domestic output at the expense of lower import demand. A fiscal parameter value of $\xi_Z = -10$ implies that the 2.8 percentage-point negative employment gap on impact triggers an expenditure shift to non-tradables of 1.4 percentage points of GDP. Similar to the interest rate shock, the IRFs suggest that a budgetary-neutral shift of government consumption to non-tradable goods can achieve stronger stabilisation of domestic activity than a standard counter-cyclical expenditure rule. The temporary decrease of government consumption of tradables reduces the import demand and further increases the trade balance surplus. The adjustment of the composition of government purchases leaves the overall level of government expenditure (approximately) constant and lowers government debt to GDP through the increase of the denominator and the stabilisation of tax revenues.

4.3.3 Sector-specific productivity shock (tradable supply expansion)

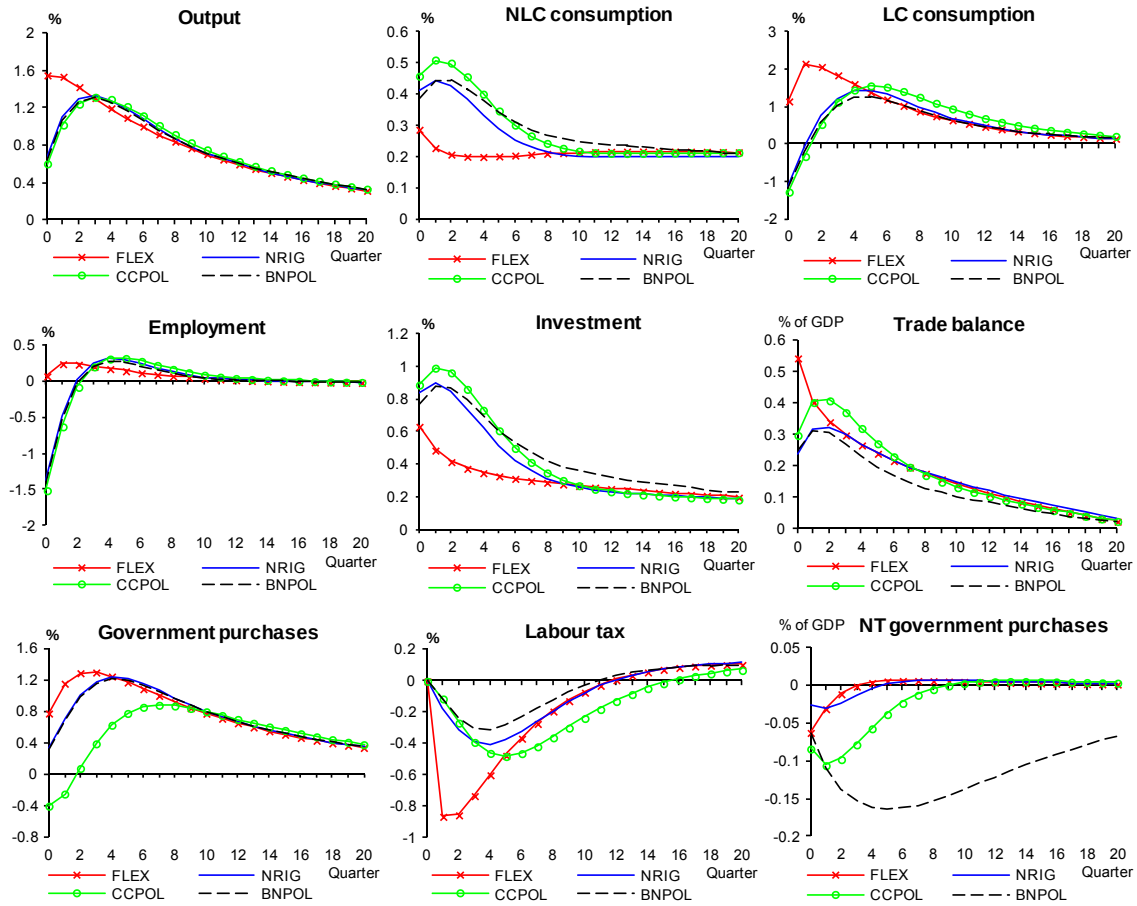
We, finally, discuss IRFs for a scenario with sector-specific shocks, namely an exogenous increase in tradable relative to non-tradable sector productivity (Figure 17). Since the positive TFP shock in the tradable sector reduces tradable relative to non-tradable production costs and prices in the economy without nominal stickiness, household in FLEX adjust the composition of demand away from non-tradables to tradables. Price stickiness in NRIG delays the fall in T/NT relative prices, however, and therefore leads to inefficient T/NT demand and T/NT output patterns that deteriorate the consumption-leisure trade-off relative to the FLEX economy. Given price stickiness, household demand contains too much non-tradables, that are relatively costly to produce, and too little tradables, that are produced with higher resource efficiency.

We have tested the standard counter-cyclical pending rule (CCPOL) and the budgetary-neutral expenditure shifting rules (BNPOL) as before with the employment gap as indicator of the cyclical position, but also using relative T/NT prices instead. In the case of BNPOL, the latter takes the form of including the relative price P_T / P_{NT} in the policy rule:

$$\frac{G_{NT,t}}{G_t} = \rho_G \frac{G_{NT,t-1}}{G_{t-1}} + (1-\rho_G)\frac{\bar{G}_{NT}}{\bar{G}} + (1-\rho_G)\xi_P \ln\left(\frac{P_T}{P_{NT}}\right) \tag{4.7}$$

We set $\xi_P = 2$ for illustrate purposes, which implies that a 1 percentage-point decline in the relative price is accompanied by an expenditure shift from non-tradables to tradables of 0.2 percentage points of GDP. Contrary to the standard counter-cyclical spending rule, which only adjust overall expenditure, the reallocation in government purchases from non-tradables to tradables directly targets relative T/NT demand.

Figure 17: Positive tradable TFP shock and policy response to the relative goods price



The policy rule (4.7) implies a shift from non-tradables to tradables in response to higher relative non-tradable prices to exploit the efficiency gains and absorb the increasing output potential in the tradable sector. Lower demand for non-tradables reduces the relative price of non-tradables. Given that government purchases of tradables are a bundle of domestically produced output and imports, the rise in government demand for tradable goods also increases import demand, however, and reduces the trade balance surplus associated with lower tradable production costs.[45]

[45] As the standard policy rule (CCPOL in Figure 17) only adjust overall levels of government purchases, a fiscal parameter value of $\xi_P = 1$ implies a reduction in government purchases in response to lower tradable prices.

4.4 Welfare analysis

The welfare implications of the expenditure-reallocation rule (4.4) can be evaluated based on a second-order Taylor expansion of the underlying utility function:[46]

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} (C_t^i)^{1-\sigma} - \frac{\kappa}{1+\varphi} (L_t^i)^{1+\varphi} \right) \tag{4.8}$$

around the deterministic steady state. Household utility is additive in private consumption C_t^i and work L_t^i. The parameters β, 1/σ, κ and 1/φ are the discount factor, the intertemporal elasticity of substitution, the weight of the disutility of work in total utility, and the elasticity of labour supply, respectively. The calibrated model uses β=0.995, σ=1, κ=1 and 1/φ=0.25 (see Chapter 3). The second-order Taylor approximation of (4.8) around the steady state yields:

$$\begin{aligned} EU(C_t^i, L_t) \approx & \frac{(\bar{C}^i)^{1-\sigma}}{1-\sigma} - \frac{\kappa \bar{L}^{1+\varphi}}{1+\varphi} + (\bar{C}^i)^{-\sigma} E\hat{c}_t^i - \kappa \bar{L}^{\varphi} E\hat{L}_t - \\ & \frac{\sigma(\bar{C}^i)^{-1-\sigma}}{2} Var(\hat{C}_t^i) - \frac{\kappa\varphi \bar{L}^{-1+\varphi}}{2} (\bar{C}^i) Var(\hat{L}_t) \end{aligned} \tag{4.9}$$

where $\hat{C}_t^i$ with $i = (NLC, LC)$ and $\hat{L}_t$ $(\hat{L}_{NLC} = \hat{L}_{LC})$ denote log-deviations of consumption and employment from their deterministic steady-state values.[47] Following Bergin et al. (2007) and Evers (2012), unconditional welfare can be decomposed into the mean effect (ζ^{mean}) and the volatility effect (ζ^{var}):

$$\zeta^{mean} = (\bar{C}^i)^{-\sigma} E\hat{C}_t - \kappa \bar{L}^{\varphi} E\hat{L}_t \tag{4.10}$$

$$\zeta^{\text{var}} = -\frac{\sigma}{2} (\bar{C}^i)^{-1-\sigma} Var(\hat{C}_t) - \frac{\kappa\varphi}{2} \bar{L}^{-1+\varphi} \text{var}(\hat{L}_t) \tag{4.11}$$

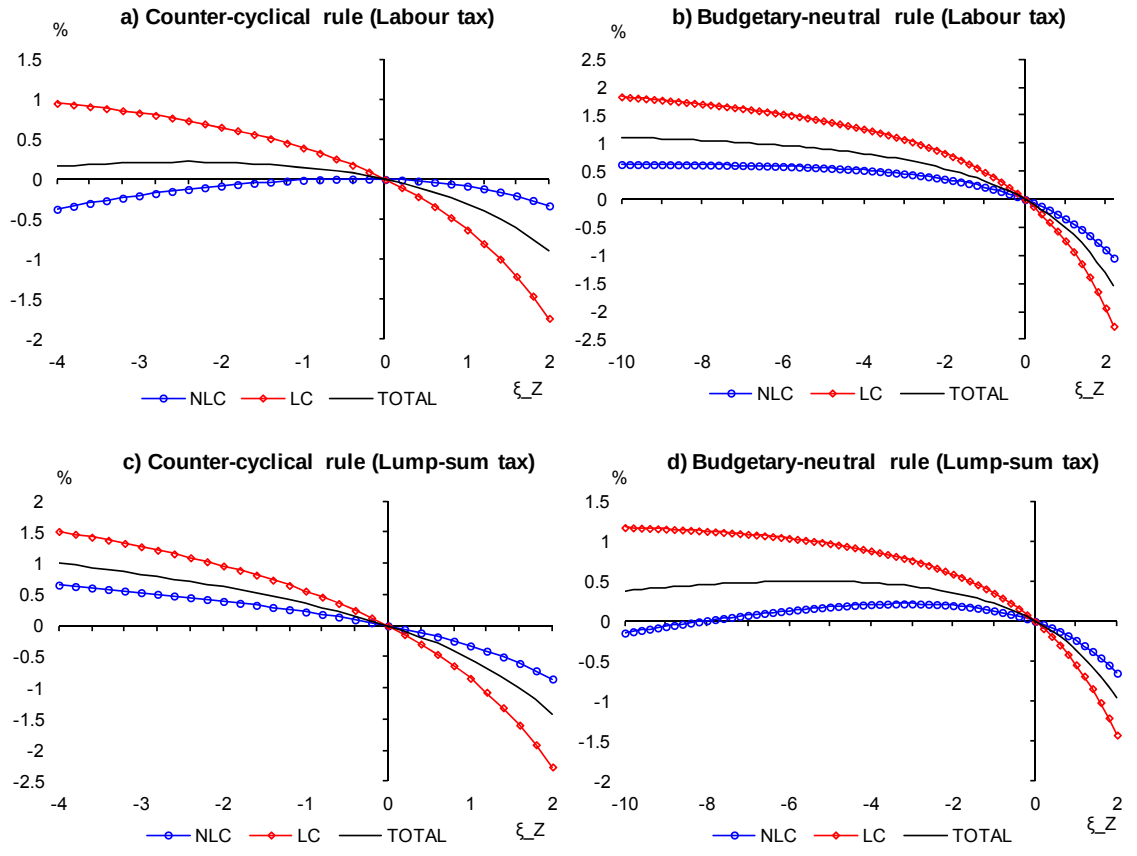
---

[46] A detailed description of the methodology of welfare comparisons is available in Kim and Kim (2003) and Schmitt-Grohé and Uribe (2004). Similar exercises of measuring welfare include Elekdağ and Tchakarov (2007), Bergin et al. (2007), Ferrero (2009), Evers (2012), Kumhof and Laxton (2013b) and Vogel et al. (2013).

[47] We have also computed household welfare based on a utility function including government purchases as in Tervala (2008) and Vogel et al. (2013), where the steady-state share of government purchases in GDP is assumed to fulfil the optimality conditions for household utility. While the inclusion of government purchases in utility affects the numerical results for the welfare effects, it does not affect the relative performance of the policy rules and the order of magnitude of welfare gains in our simulations.

where the overall welfare impact is: $\zeta^{welf} = \zeta^{mean} + \zeta^{var}$. We show overall welfare effects (ζ^{welf}) for a fiscal reaction to the employment gap under the combination of economy-wide interest rate and TFP shocks and measure welfare gains or losses relative to the sticky economy without fiscal stabilisation. Welfare effects are reported in per cent of steady-state consumption. We show results over intervals for the fiscal rule parameter (ξ_Z) instead of focusing exclusively on welfare-maximising values within the range. The broader parameter range illustrates differences between LC and NLC welfare, highlights the loss associated with non-optimal policy and provides information on the robustness of welfare effects with respect to variations in ξ_Z.

Figure 18: Welfare effects for policy response to the employment gap



Note: Welfare is measured relative to non-stabilisation and expressed in % of steady state consumption. Panels a) and b) provide welfare effects for a budget closure based on distortionary labour taxes. Panels c) and d) provide welfare effects for a budget closure based on non-distorting lump-sum taxes.

In the case of the standard counter-cyclical fiscal policy rule (4.6), the government increases the level of its expenditure for $\xi_Z < 0$ in response to negative employment gaps to increase domestic demand and stabilise employment and activity. For a parameter value of $\xi_Z = -2$, this policy improves average welfare by 0.25% of steady state consumption, but with opposite effects for both types of households (see Figure 18). LC household welfare increases by around 0.7%, while NLC households experience moderate welfare losses of around 0.1% of steady state consumption compared to the no-policy case. The asymmetry between LC and NLC households holds for TFP and interest shocks. The result is in line with Kumhof and Laxton (2013b) who show that a large share of welfare improvements from fiscal stabilisation is due to the ability of fiscal policy to stabilise the income of LC households.

The expenditure-switching rule (4.4) achieves welfare gains for both LC and NLC households for $\xi_Z < 0$. For $\xi_Z = -10$, a shift in the composition of government purchases implies welfare gains of around 0.7% of steady-state consumption for NLC households and circa 1.9% for LC households. The welfare gains for LC households are substantial higher than in the case of the standard deficit spending rule due to the fact that the T/NT expenditure rule is more efficient in stabilising domestic activity, wage income and LC consumption and avoids offsetting effects from higher distortionary taxes in the context of budgetary stabilisation. The welfare effects of counter-cyclical policies are generally larger for LC consumers, who are unable to smooth their consumption over time and, hence, benefit more than NLC consumers from fiscal policies that stabilise temporary income fluctuations. Contrary to the standard deficit spending rule, the expenditure-shifting rule does not imply a trade-off between LC and NLC welfare, however.[48]

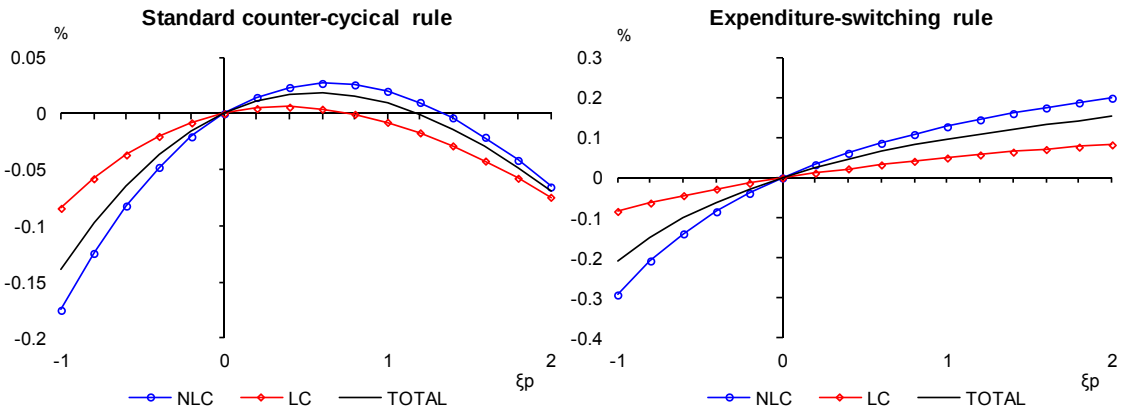
To highlight the second-round effects from the budget closure by distortionary taxation, Figure 18 also displays welfare effects under a budget closure based on non-distorting lump-sum taxes levied on NLC households (panels c and d). We find that the lump-sum closure increases welfare gains from the standard counter-cyclical fiscal expenditure

[48] The welfare effects for output stabilisation (output gap) are similar in magnitude and distribution for NLC and LC households to the results for employment stabilisation and are omitted for the sake of brevity.

rule (CCPOL) for both types of households, with the biggest increase (up to 1% of steady-state consumption) for NLC households. The higher stabilisation gain under the lump-sum closure derives from the lack of offsetting welfare losses associated with increasing labour taxes in the context of a rising government debt-to-GDP ratio. In contrast, welfare results for the expenditure-switching rule (BNPOL) do not indicate higher welfare gains under the lump-sum closure. This is due to the fact that the state-dependent sectoral shift of purchases keeps overall government purchases (approximately) constant and stabilises employment and output more efficiently than the standard counter-cyclical fiscal policy rule. Hence, the increase in the government deficit and debt-to-GDP ratio and the associated increase in labour taxes are on average less pronounced under BNPOL than in the no-policy case (NRIG). Consequently, the welfare gains from BNPOL relative to NRIG increase with the labour tax closure. This finding suggests that a budgetary-neutral expenditure shift (BNPOL) becomes particularly attractive in situations where stabilisation policies have to be financed by distorting taxes in the medium run.

The welfare effects for a sector-specific TFP shock under policy responses to the relative price (P_T/P_{NT}) are shown in Figure 19.

Figure 19: Welfare effects for policy response to relative prices



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

The standard counter-cyclical rule implies a temporary reduction in government purchases for $\xi_P > 0$. The associated welfare gains are very moderate, however, and

mainly accrue to NLC households. In contrast, a shift in government purchases from the non-tradable to the tradable sector ($\xi_P > 0$) increases welfare by 0.1% – 0.2% of steady-state consumption for LC and NLC households within the interval displayed.

Table 12 decomposes overall welfare into mean and variance effects to gain more insights into the origin of welfare effects.

Table 12: Welfare decomposition for different policy and shock scenarios

	Standard policy rule (CL)	Budgetary-neutral policy rule (BN)
	Economy-wide supply and demand shock Employment stabilisation (L_GAP)	
Ricardians (NLC)		
W-overall	0.0205	0.8109
W-mean overall	-0.0835	0.5847
W-mean Consumption	0.1898	1.3393
W-mean Labour	-0.2733	-0.7546
W-variance overall	0.1040	0.2262
W-variance Consumption	0.0001	-0.0033
W-variance Labour	0.1039	0.2295
Liquidity-constrained (LC)		
W-overall	0.7615	2.1351
W-mean overall	0.6278	1.7765
W-mean Consumption	0.9011	2.5310
W-mean Labour	-0.2733	-0.7546
W-variance overall	0.1337	0.3586
W-variance Consumption	0.0298	0.1291
W-variance Labour	0.1039	0.2295
	Sector-specific TFP shock Relative price stabilisation (P_T/P_{NT})	
Ricardians (NLC)		
W-overall	0.0273	0.2051
W-mean	0.0267	0.1973
W-mean Consumption	0.0286	0.2294
W-mean Labour	-0.0019	-0.0321
W-variance	0.0006	0.0078
W-variance Consumption	0.0002	0.0008
W-variance Labour	0.0004	0.0070
Liquidity-constrained (LC)		
W-overall	0.0017	0.0835
W-mean	0.0040	0.0821
W-mean Consumption	0.0058	0.1142
W-mean Labour	-0.0018	-0.0321
W-variance	-0.0023	0.0014
W-mean Consumption	-0.0026	0.0008
W-mean Labour	0.0003	0.0070

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

The decomposition indicates to which extent welfare gains and losses derive from changes in the mean levels of consumption and employment or from changes in the volatility of these variables. As we run simulations over a range of the fiscal stabilisation parameter (ξ_Z), Table 12 only shows the maximum average welfare gains for both policy rules and economy-wide versus sectoral shocks.

The decomposition in Table 12 illustrates that welfare gains are associated predominantly with level rather than volatility changes. For example, circa ¾ of the welfare gains from a simple policy rule adjusting the sectoral composition of government purchases in response to the size of the employment gap are related to level effects and circa ¼ to volatility reduction. The welfare gains associated with the fiscal policy rules in Table 12 are due mainly to higher consumption levels for both types of households. Employment increases on average given the higher marginal return to labour in the context of capital deepening and the smoother path of labour tax rates associated with the stabilisation of government finances. The higher average levels of consumption in the presence of fiscal stabilisation are accompanied by lower average wealth accumulation by NLC households, indicating that stabilisation policy dampens the incentive for households to accumulate wealth to insure against income shocks (precautionary savings).

4.5 Conclusion

Using a two-sector New Keynesian DSGE model with nominal and real rigidities, this chapter analyses the stabilising properties of simple fiscal policy rules in a small member country of monetary union. The model is parameterised to replicate time series features of small euro area countries. In counterfactual experiments, this approach focuses on simple policy rules that adjust the composition of government purchases between tradable and non-tradable goods in response to indicators of the economy's cyclical position. The expenditure-switching policy is ex ante budgetary-neutral, which allows for stabilisation policy even when the government's fiscal limit is tight.

This chapter shows that a temporary shift in government purchases between tradables and non-tradables in response to fluctuations in domestic activity can achieve substantial welfare gains of more than 1% of steady-state consumption for the population average and around 2% for liquidity-constrained households in the event of economy-wide supply and demand shocks as well as sector-specific shocks. Welfare gains of the expenditure-switching rule are higher compared to a standard counter-cyclical policy rule that adjusts the overall level government purchases. The expenditure-switching policy is budgetary neutral ex ante, but even tends to improve the budgetary situation in a recession relative to the no-policy case and contrary to the standard deficit spending rule. The reason is the combination of ex ante neutrality with a stabilisation of activity and tax revenues. The expenditure-switching rule therefore avoids offsetting effects from pro-cyclical budgetary closure rules that, e.g., lead to additional increases in tax rates in recessions in order to stabilise government deficit and debt levels in the context of higher expenditure. Hence, the expenditure-switching approach may provide stabilisation when the fiscal policy is severely constraint by high debt and borrowing costs.

5

The real profits and losses of TARGET2 balances*

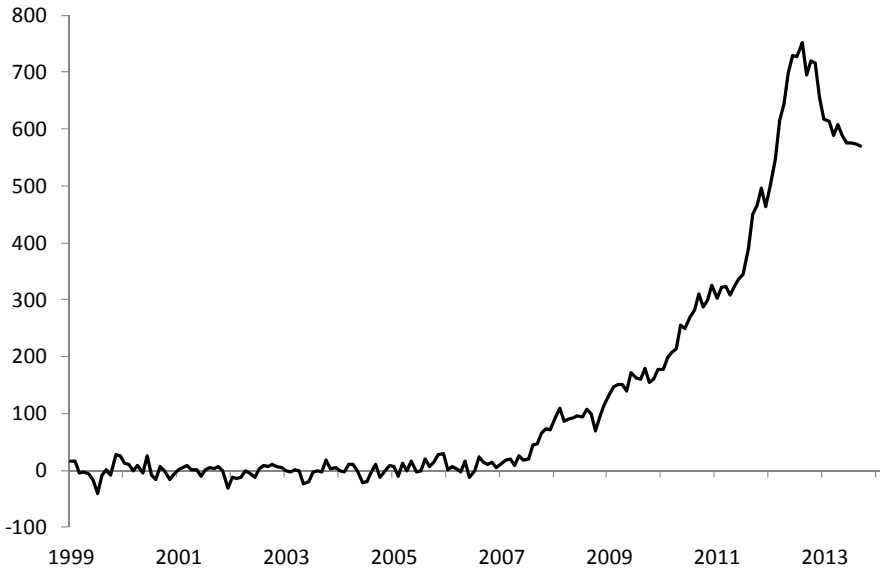
* Chapter 5 is based on Erler and Hohberger (2014). I would like to thank Bernhard Herz and Matthias Kollenda for helpful comments and suggestions.

5.1 Introduction

The existence of German claims on the Eurosystem through TARGET2[49] has gained increasing attention since the beginning of the financial crisis in 2007 as well as during the twin debt and banking crisis in the euro area. Figure 20 shows that claims of the Deutsche Bundesbank on the Eurosystem increase from close to zero to more than 700 billion euros at the end of 2012. During 2013 the claims reduce slightly to around 600 billion euros.[50]

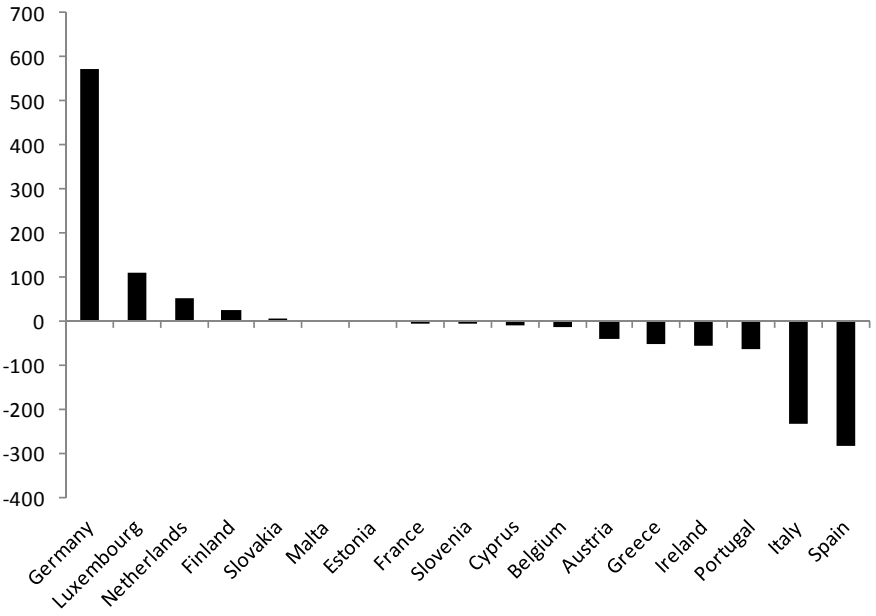
A closer look at the TARGET2 balances within the European Monetary Union (EMU) reveals that TARGET2 imbalances are concentrated on a few member countries (see Figure 21). Apart from Germany's almost 600 billion euros, Luxembourg, the Netherlands and Finland additionally accumulated 200 billion euros of TARGET2 claims vis-à-vis Austria, Greece, Ireland, Portugal, Italy, and Spain. Particularly Italy and Spain have accumulated TARGET2 liabilities of about 550 billion euros.

Figure 20: Germany's TARGET2 claims on the Eurosystem (in bn. euros)



[49] TARGET denotes *Trans-European Automated Real-Time Gross Settlement Express Transfer* and refers to the European transaction settlement system through which commercial banks make payments.
[50] For a detailed balance sheet description of the TARGET2 mechanism, see Cecchetti et al. (2012). For a more analytical framework of the origins and development of TARGET2 positions and their potential financial risks, see Bindseil and König (2012).

Figure 21: TARGET2 balances within EMU, August 2013 (in bn. euros)



The literature on TARGET balances has become quite extensive over the last three years. While some authors deal with several problems at once and others with specific aspects, the academic literature on TARGET2 balances cannot easily be classified. To highlight two main directions, one strand focuses specifically on the time period during the financial crisis in 2007 when countries like Greece and Portugal apparently financed their current account deficits through TARGET2 liabilities (Sinn and Wollmershäuser 2012a,b; Cecchetti et al. 2012; Mayer et al. 2012). This interpretation is confirmed, for instance, by a panel analysis by Auer (2013). He finds that current account balances were entirely unrelated to the evolution of TARGET2 balances before the onset of the financial crisis 2007; however, in the period after 2007 a correlation of 0.808 supports the interpretation that current account imbalances are being financed by central bank liquidity that has replaced private capital flows. The other strand argues that TARGET2 balances reflect a funding crisis within the euro area since 2011 (Buiter et al. 2011; Bindseil and König 2012; Cecioni and Ferrero 2012; Mody and Bornhorst 2012). Mody and Bornhorst (2012) argue that TARGET2 mirrors a reversal of capital flows within Europe. During the European debt and banking crisis, increasing capital flows from southern European economies to Germany hint to capital flight that led to a lack of financial resources in the distressed economies. Cour-Thimann (2013) provides a

comprehensive analysis and an extensive literature review of TARGET2 balances in the context of the crisis in the euro area.

The studies have in common that they focus on the dynamics of the TARGET2 system, in particular, by answering questions like, how do TARGET2 balances arise, and what are the economic implications of holding TARGET2 claims. CESifo (2014), for instance, calculates the potential losses for Germany in case of a euro area collapse and the subsequent insolvencies of the respective crisis economies. The calculation points out that holding TARGET2 claims might lead to potential losses of about 470 bn. euros. Contrary, Fahrholz and Freytag (2012) discuss potential economic costs in real terms, which would be associated with future developments of TARGET2 balances – however, these costs are not quantified.

Summarising, the existing literature primarily focuses on potential risks and costs, which are associated with a breakdown of the TARGET2 system, e.g. the costs in case of a euro area collapse or a member country exit. In contrast, this chapter evaluates the current economic losses incurred from holding TARGET2 claims in real terms. Since TARGET2 claims and liabilities are interest-bearing and generally remunerated at the interest rate of the ECB's main refinancing operations (Deutsche Bundesbank 2011), Germany receives, on the one hand, nominal interest for holding TARGET2 claims vis-à-vis the deficit countries. On the other hand, the nominal revenues have to be adjusted by price level changes over time, i.e. by the real exchange rate to account for real imbalances within the euro area. Due to the focus on real terms, this approach is able to shed light on the dimension of TARGET2 to misallocations of real resources within the euro area.

Using a stylised two-period model based on the approach by Jin and Choi (2013), we find that by the end of 2013 Germany has incurred accumulated losses of around 13 billion euros in real terms. Additionally, calculating the real profits and losses for every euro area member country reveals that the TARGET2 system acts as an implicit distribution mechanism with a cumulated distribution volume of about 30 billion euros.

This chapter is organised as follows. Section 5.2 presents the stylised background of TARGET2 as a balance of payment adjustment mechanism. Section 5.3 describes the

empirical framework, evaluates and discusses the real profits and losses of TARGET2 balances. The main findings are summarised in section 5.4.

5.2 Adjustment mechanism in a currency union by TARGET2

In order to assess the real costs and profits of Germany's TARGET2 claims we follow the approach by Jin and Choi (2013) and compare the accumulation of TARGET2 claims in a currency union with an accumulation of foreign reserves in a fixed exchange rate regime.[51] Analogously to, e.g., Sinn and Wollmershäuser (2012b), Neumann (2012) and Homburg (2012), we make use of the balance of payment identity:

$$CA + KA + \Delta S \equiv 0 \tag{5.1}$$

where $KA = KI - KE$. The current account balance, CA, mirrors the capital account balance, KA, defined as the difference of private and public capital imports KI over capital exports KE. The term ΔS depicts the balance of payment equilibrating mechanism and should be zero in floating exchange rate regimes. In a fixed exchange rate regime the term ΔS corresponds to the changes in foreign exchange reserves. Assuming a country whose current account deficit cannot be financed by capital inflows (net borrowing), the central bank sells her foreign reserves to provide domestic debtors with foreign currency to balance their liabilities. In EMU, the foreign reserves (ΔS) are replaced by TARGET2 balances due to the loss of autonomous monetary policy and the abandonment of national currencies (see Sinn and Wollmershäuser 2012a).

The similarity in the adjustment mechanism of foreign reserves and TARGET2 balances is illustrated in a very stylised balance sheet of a central bank (see Figure 22). We assume two current account surplus countries, one in a fixed exchange rate regime (e.g. China) and one in a currency union (e.g. Germany as member of EMU).

[51] For further discussions about the similarities between TARGET2 balances and balance of payment crisis in fixed exchange rate regimes, see Kohler (2012) and Bernholz (2012).

Figure 22: Central bank's balance sheet

Fixed Exchange Rate Regime

A			L
Reserves	10	Base Money	100
Domestic Credit	90		
Reserves	+5	Base Money	+5

Currency Union

A			L
Reserves	10	Base Money	100
Domestic Credit	90		
TARGET claims	+5	Base Money	+5

Basically, assets like gold, government bonds, and foreign reserves (Reserves) as well as loans granted to commercial banks (Domestic Credit) are booked on the left-hand side, while the financing base (Base Money), which has been created by the central bank, is booked on the right-hand side as liabilities. In a fixed exchange rate regime without corresponding net private capital outflows the central bank of a current account surplus economy has to accumulate foreign exchange reserves to avoid appreciation pressure on the nominal exchange rate, thereby increasing the monetary base.[52] In the case of a currency union the accumulation of foreign reserves is replaced by creating TARGET2 claims vis-à-vis the deficit countries to substitute for private capital flows. These similarities are also described in Sinn and Wollmershäuser (2012a, 2012b). They point out that contrary to a fixed exchange rate regime there is no natural restriction in the sense of a limited stock of foreign reserves in the deficit countries. The central bank of a deficit country can incur as much TARGET2 liabilities as the banking system of the deficit country is able to provide sufficiently good collaterals. Since the standard of eligible collaterals can be lowered by the central bank there are de facto no limits for TARGET2 liabilities and claims.

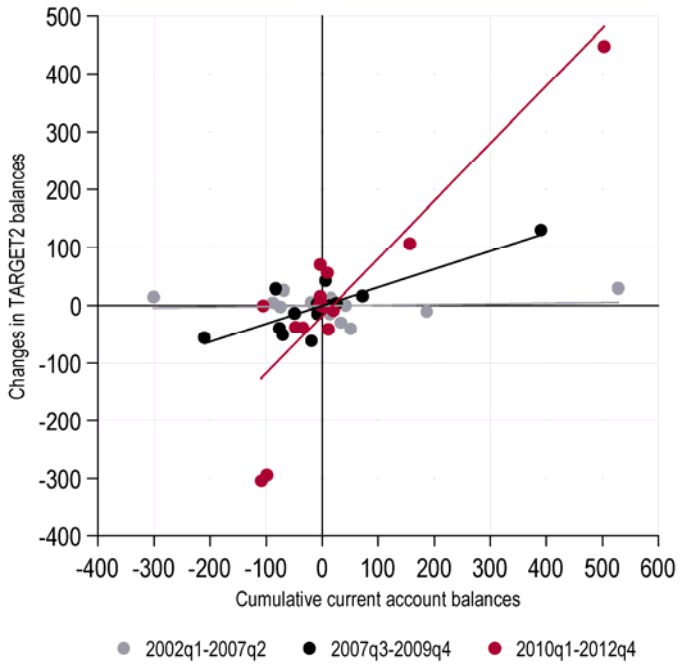
5.3 Quantifying real TARGET2 profits and losses

As long as trade is financed by private capital flows, TARGET2 does not play an important role. Accordingly, Figure 23 depicts that during the pre-crisis period (2002 – 2007) current account balances are financed by private capital flows as no clear

[52] Accompanying risks of inflation and required sterilising options by reducing domestic credit have been left out for the sake of simplicity.

relationship between TARGET2 balances and the current account can be observed. Since the beginning of the European debt and banking crisis in 2010 there seems to be a one-to-one relationship between current account balances and TARGET2 balances. This supports the assumption that private capital flows are replaced by TARGET2 balances (see Cecchetti et al. 2012; Sinn and Wollmershäuser 2012b).

Figure 23: Current account and changes in TARGET2 balances (in bn. Euros, based on Cecchetti et al. 2012)[53]



To keep the calculation of current profits and losses as simple as possible, we subsume the dynamics of the TARGET2 mechanism in a two-period framework, following the approach by Jin and Choi (2013). In order to justify the simplification of our calculation approach, we show impulse response functions of a stylised small open economy model to gain some intuition behind the dynamics of the TARGET2 system.[54] Macroeconomic data indicate that during the last decade Germany faced a persistent real exchange rate

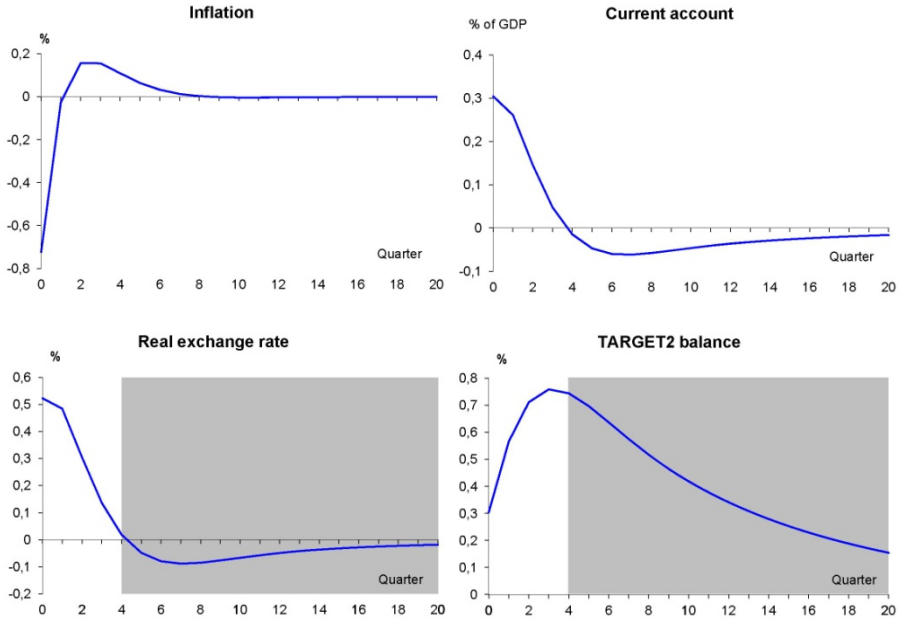
[53] Data of the national central bank TARGET2 balances were obtained from the CESifo institute and current account data from the European Commission.

[54] The simulation is based on a small open economy model within a monetary union according to Herz and Hohberger (2013). Some stylised information about the model structure and model equations can be found in the appendix. For a detailed description of the model see Herz and Hohberger (2013).

depreciation vis-à-vis the rest of the euro area (RoEA), which boosted exports and led to a growing trade surplus. We therefore simulate dynamic responses to a negative price shock in order to imitate Germany's real exchange rate depreciation.[55]

Figure 24 shows that a decline in domestic prices depreciates (increase) the real exchange rate, implying a current account surplus through an improvement of international competitiveness. Based on our assumption that private capital flows are substituted by TARGET2 balances, an increase in the current account is accompanied by an increase in TARGET2 claims.

Figure 24: Impulse responses for a negative price shock



The crucial point for the subsequent simplification derives from the adjustment dynamics to the steady state. A future appreciation (decrease) of the real exchange rate induces a reduction of the current account surplus as well as the TARGET2 claims. Hence, real exchange rate depreciation today must be balanced by real exchange rate appreciation in the future to ensure stationarity in the long-run. In Figure 24, the first period reflects the real exchange rate depreciation and the accumulation of TARGET2

[55] A productivity shock or a risk premium shock would have similar effects on the real exchange rate (depreciation) and the current account.

claims, the second period (shaded gray) reflects the real exchange rate appreciation and the reduction of TARGET2 claims.

5.3.1 Real profits and losses in a two-period model

Within our two-period framework, we assume that Germany's trade surplus is financed by holding TARGET2 claims as private capital flows suddenly stop between countries (see Cecchetti et al. 2012; Sinn and Wollmershäuser 2012b). Furthermore, we assume that trade depends on the real exchange rate (ε).

As baseline scenario, we assume that trade is balanced at the equilibrium real exchange rate ε_0 ($CA_0 = 0$).[56] If the real exchange rate differs from the equilibrium rate, Germany faces a trade surplus or deficit. For example, if Germany faces a real exchange rate depreciation vis-à-vis the RoEA ($\varepsilon_1 \uparrow$, since $\varepsilon_1 = g[CA]$ with $g'[CA] > 0$), a trade surplus ($+CA$) occurs given the Marshall-Lerner-condition holds. Since trade must be balanced over two periods, Germany must have a trade deficit ($-CA$) in period 2. As private capital flows between both countries are replaced by TARGET2 balances (TB), the RoEA's trade deficit is financed through Germany's TARGET2 claims vis-à-vis the ECB, thus $TB = CA$.

Given that TARGET2 balances are remunerated at the ECB's main refinancing rate, i, Germany's real trade surplus measured in foreign goods (TARGET2 claim vis-à-vis RoEA) grows to $TB(1+r)$ in the second period, where r is defined as the difference between nominal interest rate and RoEA's inflation. Reversing this amount in period 2 to finance the trade deficit, it has to be adjusted by the real exchange rate in period 2 to measure the revenues in domestic goods, $TB(1+r)\varepsilon_2$, where $\varepsilon_2 = g[-TB(1+r)]$. Hence, the total real profit in period 1, which is realised in the second period is:

$$\begin{aligned} \pi_1 &= TB_1((1+r_1)g[-TB_1(1+r_1)] - g[TB_1]) \\ &= TB_1(1+r_1)\varepsilon_2 - TB_1\varepsilon_1 = TB_1\varepsilon_2 + r_1 TB_1\varepsilon_2 - TB_1\varepsilon_1 \end{aligned} \tag{5.2}$$

[56] For the sake of simplicity we assume that the equilibrium real exchange rate is unity.

The profit equals the market value of the TARGET2 balance in period 2 plus the interest rate income in period 2 stemming from holding the TARGET2 balance in period 1 less the costs of setting up the balance in period 1.

If Germany faces a real depreciation in period 1 and chooses to hold TARGET2 claims in order to finance its exports – private capital flows are no longer available – then $\varepsilon_1 > 1$ and $TB_1 > 0$. Under this scenario, the development of profits and losses depends on the real interest rate r. This can be seen by differentiating (5.2) with respect to TB:

$$\frac{\partial \pi}{\partial TB} = (1+r)g[-TB(1+r)] - g(TB) - TB((1+r)^2 g'[-TB(1+r)] + g'(TB)) \qquad (5.3)$$

Evaluating equation (5.3) at $TB = 0$, we get

$$\frac{\partial \pi}{\partial TB} = (1+r)g(0) - g(0) = r < 0, \qquad (5.4)$$

which implies that profit is decreasing in TB. In case of positive (negative) real interest rates, i.e. $r > 0$ $(r < 0)$, Germany gains (incurs losses) by holding TARGET2 claims.

5.3.2 Cumulative real profits and losses

Since TARGET2 balances are not completely liquidated in each period, it is of particular interest to assess the cumulative profits and losses of Germany's TARGET2 claims. In order to accumulate the profits in each period, we assume that TB_i is the TARGET2 balance in period i, which is zero at the beginning of period 1. Hence, at the end of period 1, the TARGET2 balance (TB_1) equals the trade surplus $(TB_1 = CA_1)$. The corresponding TARGET2 balance in period 2 is given by $TB_2 = TB_1 + \Delta TB_2$. As Germany holds a TARGET2 balance in period 2 (TB_2) its real costs are mirrored by $TB_2\varepsilon_2$. Therefore, the corresponding profit in period 2 can be formulated as:

$$\pi_2 = TB_2(1+r_2)\varepsilon_3 - TB_2\varepsilon_2 = TB_2\varepsilon_3 + r_2 TB_2\varepsilon_3 - TB_2\varepsilon_2 \qquad (5.5)$$

The profit in period 2 equals the market value of the TARGET2 balance in beginning of period 3 plus the interest rate income in period 3 stemming from holding the TARGET2 balance in period 2 minus the costs of holding the balance in period 2. Analogously, the profit of period t can be expressed as follows:

$$\pi_t = TB_t(1+r_t)\varepsilon_{t+1} - TB_t\varepsilon_t = TB_t\varepsilon_{t+1} + r_t TB_t\varepsilon_{t+1} - TB_t\varepsilon_t \tag{5.6}$$

In order to get the real value of cumulative TARGET2 profits at the end of period 2, the profit has to be evaluated with the real exchange rate in period 3 (market value of TB_2). Additionally, the interest rate income resulting from previous TARGET2 balances and the costs of TARGET2 "interventions" in previous periods have to be considered. The cumulative profit in period 2 is given by:

$$\prod_2 = TB_2\varepsilon_3 + r_1 TB_1\varepsilon_2 + r_2 TB_2\varepsilon_3 - (\Delta TB_1\varepsilon_1 + \Delta TB_2\varepsilon_2) \tag{5.7}$$

Since $TB_0 = 0$ and $\Delta TB_2 = TB_2 - TB_1$, equation (5.7) can be rewritten as:

$$\begin{aligned} \prod_2 &= TB_2\varepsilon_3 + r_1 TB_1\varepsilon_2 + r_2 TB_2\varepsilon_3 - (TB_1\varepsilon_1 + (TB_2 - TB_1)\varepsilon_2) \\ &= TB_1\varepsilon_2 + r_1 TB_1\varepsilon_2 - TB_1\varepsilon_1 + TB_2\varepsilon_3 + r_2 TB_2\varepsilon_3 - TB_2\varepsilon_2 \\ &= \pi_1 + \pi_2 \end{aligned} \tag{5.8}$$

According to equation (5.8), the cumulative real profit of holding TARGET2 balance in period T is:

$$\prod_T = TB_T\varepsilon_{T+1} + \sum_{t=1}^{T} r_t TB_t\varepsilon_{t+1} - \sum_{t=1}^{T} \Delta TB_t\varepsilon_t = \sum_{t=1}^{T} \pi(t) \tag{5.9}$$

In other words, the cumulative real profit of holding TARGET2 claims or liabilities can be obtained by adding up the real profits of each previous period.

5.3.3 Data

The calculation of real profits and losses is based on monthly data and covers the years from 1999 to 2013. The real exchange rate between Germany and RoEA – based on seasonally adjusted HCPIs[57] – is calculated with data from the European Commission. Precisely, the real exchange rate is given by $\varepsilon = P^* / P$, where P^* is the HCPI of the euro area without Germany and P is the HCPI of Germany, respectively. Both HCPIs are set to 100 in January 1999. As the RoEA's HCPI is not available by itself, it is constructed in the following way: Firstly, the monthly relative changes of the HCPI of the euro area and the HCPI of Germany are calculated. Secondly, based on the ECB's CPI weights, the German contribution to the monthly change of the HCPI of the euro area is removed to obtain a time series that only mirrors the monthly changes of the HCPI of the euro area without Germany. Lastly, these changes are accumulated to construct the HCPI of the rest of the euro area (RoEA).

The monthly real interest rate is computed by dividing the difference between the ECB's main refinancing rate and the RoEA's annual inflation rate by 12. Specifically, $r = (i - \pi^*) / 12$.

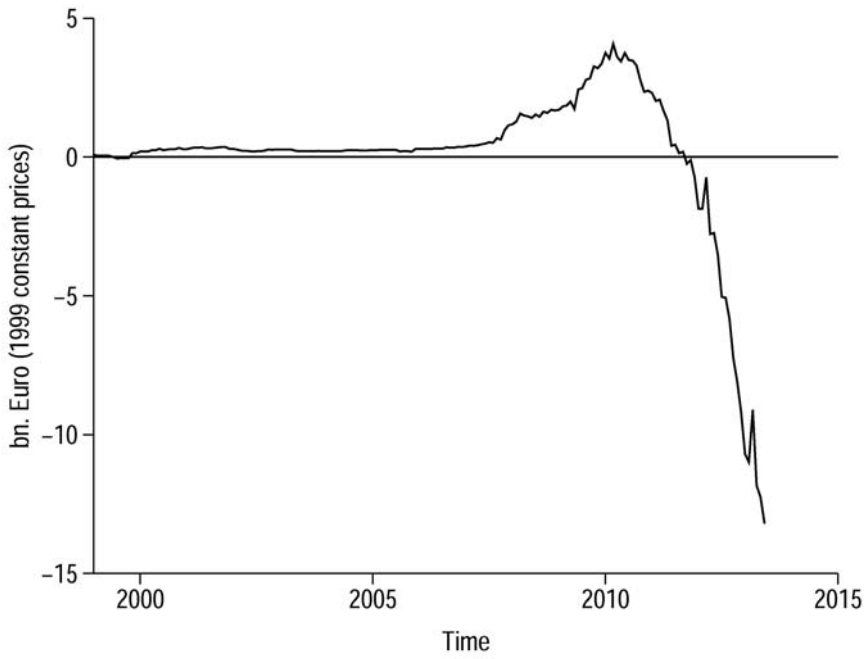
Data of the national central bank TARGET2 balances are available from CESifo institute.[58] In order to take into account price differentials between Germany and RoEA, the nominal TARGET2 balance of Germany is deflated by the HCPI of the RoEA to express the TARGET2 balance in units of foreign goods.

[57] Seasonally adjusted HCPIs were constructed by using the X-12 procedure.
[58] For more detailed information, see: http://www.cesifo-group.de/ifoHome/policy/Spezialthemen/Policy-Issues-Archive/Target.html.

5.3.4 Current profits and losses for Germany

Based on equation (5.2), we calculate Germany's real monthly profits from holding TARGET2 balances.

Figure 25: Cumulative real profits and losses of Germany

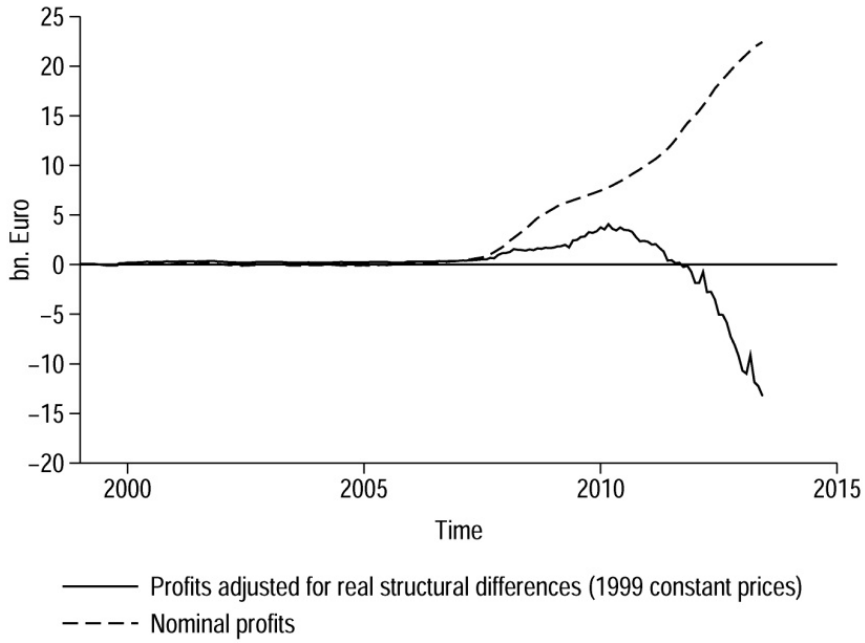


According to the implementation of the common currency in January 1999 we compute the respective profits and losses in real terms for the period 1999m1 – 2013m6. The results for the accumulated profits are shown in Figure 25. It illustrates that in the early years of the currency union the accumulated profits in real terms, namely in constant 1999 prices, were close to zero until 2007. The profits started to increase with the beginning of the global financial crisis, reaching its peak of nearly 4 billion euros in 2010. The profits within this period were mainly driven by the accumulation of TARGET2 claims, positive real interest rates and expected future real exchange rate depreciation.[59] However, since the end of 2011 Germany's profits declined sharply and turned into losses. Since 2012, Germany's real losses increase to around 13 billion

[59] More intuition about the driving forces of profits and losses and the decomposition of annual profits is given later (see Figure 27).

euros. The results underline that even without an euro area break-up or exit of one member country, holding TARGET2 claims can cause high economic costs.

Figure 26: Cumulative nominal and real profits and losses of Germany



Looking at TARGET2 balances in nominal terms would yield a different picture (see Figure 26). As TARGET2 balances are remunerated at the ECB's main refinancing rate – which is still positive – and because of the absence of nominal exchange rate fluctuations, holding TARGET2 claims results in respective profits in nominal terms. Adjusting for (real) differences, i.e. by incorporating the real exchange rate between Germany and the RoEA, it becomes evident that holding nominal TARGET2 claims incurs losses in real terms, however.

After calculating Germany's current losses it is of particular interest to assess what future profits and losses can be expected from holding TARGET2 claims. To analyse the driving forces we differentiate equation (5.2) with respect to TB_t, r_t, ε_t, ε_{t+1}, in order to gain some intuition on the general properties concerning the profit development:

$$\frac{\partial \pi_t}{\partial TB_t} = \varepsilon_{t+1}(1+r) - \varepsilon_t - TB_t \frac{\partial \varepsilon_t}{\partial TB_t} \tag{5.10}$$

$$\frac{\partial \pi_t}{\partial r_t} = TB_t \varepsilon_{t+1} \tag{5.11}$$

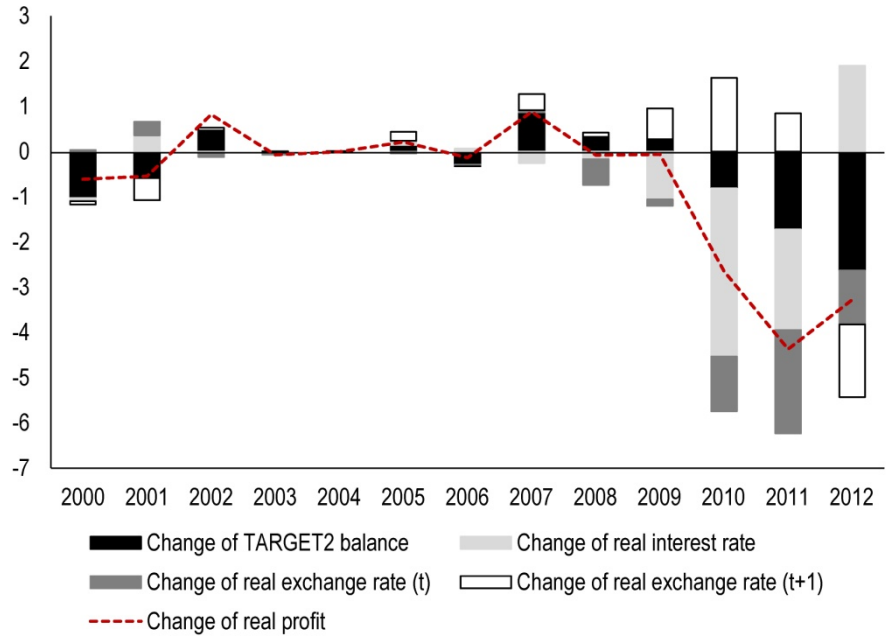
$$\frac{\partial \pi_t}{\partial \varepsilon_t} = -TB_t + \left(\varepsilon_{t+1}(1+r_t) - \varepsilon_t\right) \frac{\partial TB_t}{\partial \varepsilon_t} \tag{5.12}$$

$$\frac{\partial \pi_t}{\partial \varepsilon_{t+1}} = TB_t(1+r_t) \tag{5.13}$$

Although future profits depend on the change of TARGET2 balances (5.10), the TARGET2 balances itself might be considered an endogenous process in the sense that a change in the trade balance is automatically accompanied by a change in TARGET2 balance. Nevertheless, evaluating equation (5.10) at $TB = 0$ implies that the development of profits in real terms depends on the real interest rate r. For instance, in case of positive real interest rates, holding TARGET2 claims is associated with real profits and vice versa. This effect is based on the balance of payment adjustment mechanism in the currency union when private capital does not flow between member countries. Likewise, an increase in the real interest rate increases Germany's profits from holding TARGET2 claims (5.11).

A real exchange rate depreciation ($\varepsilon_t \uparrow$) due to domestic prices decreasing relative to foreign prices, lowers Germany's profit in real terms due to a deterioration of the terms of trade (5.12), i.e. a given amount in domestic goods realises a smaller amount in foreign goods. On the other hand, a future real exchange rate appreciation ($\varepsilon_{t+1} \downarrow$) decreases current profits (5.13), i.e. a given amount in foreign goods realises a smaller amount in domestic goods. Based on the partial derivatives, we are able to decompose the respective profit evolution of Germany. Figure 27 illustrates that since 2008 the losses were mainly driven by decreasing real interest rates and real exchange rate depreciations.

Figure 27: Decomposition of annual real profits and losses (in bn. euros)



5.3.5 Future profits and losses for Germany

Given the status quo, what can we expect to be a likely scenario concerning the future development of profits and losses in real terms? In order to give some intuition we calculate real profits and losses under 4 different scenarios. Specifically, we focus on the question what would happen if Germany liquidated its TARGET2 balance in period 2.[60] We assume that Germany has TARGET2 claims in real terms of about 418.5 bn. euros in period 1 and liquidates its claims in period 2. The theoretical discussion at the beginning of this sections points out that – from a German point of view – a real appreciation is needed in order to return to a balanced current account. As the current ratio of Germany's consumer price index (HCPI) to the RoEA's HCPI is 1.08, Germany is undervalued by 8 %. Based on a linear relationship between the TARGET2 balance and the real exchange rate, an appreciation rate of more than 15% would be necessary to reduce the TARGET2 balance to zero. Precisely, TARGET2 claims in real terms of about 418.5 bn. euros associated with a real exchange rate of about 1.08 in period 1

[60] For simplicity reasons, the 4 scenarios are based on annual calculations.

implies a real exchange rate of 0.92 in period 2 in order to liquidate TARGET2 claims completely. This hypothetical scenario, namely a future real appreciation, can basically be achieved in two ways, all other things being equal: *(i)* inflation in Germany (*domestic adjustmen*t) or *(ii)* deflation in RoEA (*external adjustment*).

Table 13: Alternative liquidation scenarios of Germany's TARGET2 claims

Variable	Scenario (1)	Scenario (1)	Scenario (1)	Scenario (1)
Nominal interest rate	0.00	2.00	4.00	6.00
TARGET2 balance	418.50	418.50	418.50	418.50
∆TARGET2 balance	- 418.50	- 418.50	- 418.50	- 418.50
ε_t	1.08	1.08	1.08	1.08
ε_{t+1}	0.92	0.92	0.92	0.92
Domestic adjustment				
Inflation in Germany	17.05	17.05	17.05	17.05
Inflation in RoEA	0.00	0.00	0.00	0.00
Real interest rate	0.00	2.00	4.00	6.00
Cumulative profits	- 78.94	- 71.23	- 63.51	- 55.80
External adjustment (RoEA)				
Inflation in Germany	0.00	0.00	0.00	0.00
Inflation in RoEA	- 14.57	- 14.57	- 14.57	- 14.57
Real interest rate	14.57	16.57	18.57	20.57
Cumulative profits	- 22.76	- 15.04	- 7.33	0.38

Table 13 reports the expected profits and losses from the liquidation of the German TARGET2 claims in case of domestic adjustment and external adjustment (RoEA) with respect to 4 different nominal interest rate scenarios. It indicates that both adjustment scenarios would imply different losses and highlight the sensitivity to alternative macroeconomic developments. If, for instance, Germany would liquidate its TARGET2 claims in period 2, the accumulated losses would be substantial higher in case of a German inflation compared to a deflation in RoEA. The reason is that a future real exchange rate appreciation increases current losses (measured in domestic goods) due to an improvement in the terms of trade, as the given amount in foreign goods realises a smaller amount in domestic goods. As monetary policy is typically interested in preventing deflation, it is in our sense more plausible to assume that the real appreciation will be attained through an increasing price level in Germany. For that

reason the current German accumulated losses of about 13 bn. euros are expected to increase even further.

Concerning the interest rate development, an increasing nominal interest rate would increase the profits from holding TARGET2 claims in period 1. As the current interest rate level appears to be very low in a historical context, we could expect rising interest rates that would in general contribute to increasing profits or decreasing losses, respectively. Nevertheless, it seems to be unlikely that interest rate increases might lead to profits which would outweigh the losses stemming from the real appreciation.

Table 13 also indicates that – in theory – it would be possible to reduce the real TARGET2 balance back to zero without incurring any losses (scenario 4, external adjustment). Though, this scenario seems to be unlikely as in this situation the RoEA would face a sharp deflation accompanied by high nominal interest rates.

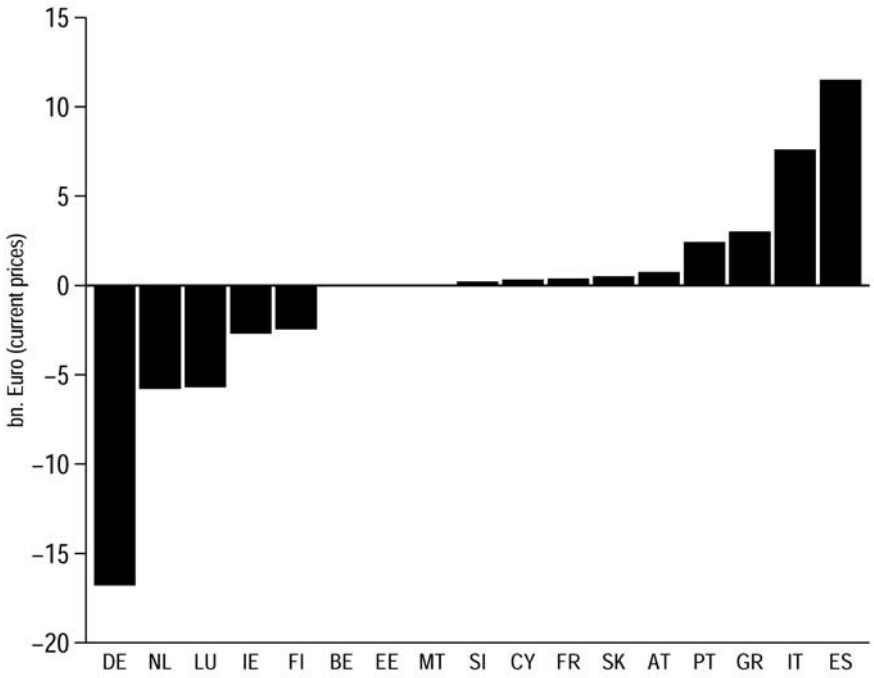
Summarising the potential future developments – from a German perspective – further losses in real terms seem to be a likely scenario. Basically, the results are in line with Fahrholz and Freytag (2012). They argue that the emergence of TARGET2 balances contributes to persistent real misalignments. These misalignments are in principle mirrored by our quantified TARGET2 profits and losses in real terms. Fahrholz and Freytag (2012) point out that the TARGET2 balances have been substituted for the missing private capital flows between EMU countries. Thus, the TARGET2 balances can be considered non market based subsidies. In particular they help current account deficit economies to receive the necessary capital imports, which financial markets no longer offer to these countries. As long as these capital flows are non market based they no longer reflect the decision-making process of private agents and will therefore lead to an inefficient capital allocation. Accordingly, this development will result in high economic costs, which mainly have to be borne by economies with positive TARGET2 balances such as Germany.

5.3.6 Distribution across the EMU member countries

The TARGET2 system by itself is a "closed" system between EMU countries, i.e. if there is a country that incurs losses then there has to be a country, which gains. Therefore, the question arises how the profits and losses are distributed across the EMU member countries.

Adapting the profit calculation approach to each member country of the EMU, the results indicate that the TARGET2 system implies a distribution mechanism. Figure 28 shows that especially surplus European countries are associated with losses, while deficit European countries benefit from the TARGET2 system.

Figure 28: TARGET2 system as distribution mechanism



The respective profits and losses in Figure 28 are calculated in real terms but are reported in current prices for comparison reasons. The gross distribution volume is about 30 billion euros. Compared to all European "rescue packages" this volume appears to be relatively small. However, compared to the EU budget (payments appropriations) of about 130 billion euros in 2013, the volume seems to be quite high (nearly 25%). To some extent the implicit distribution mechanism of the TARGET2

system is similar to the economic effects of the introduction of Eurobonds, which would also lead to distributional effects between euro area member countries (e.g. Homburg 2012; Hild et al. 2014). Through the adaption of Eurobonds, member countries with recently higher interest rates would benefit from the lower average interest rate of the Eurobond. In contrast, countries with relatively low interest rates, e.g. Germany, would face higher interest rate payments.

Following Bindseil and König (2012), the TARGET2 system is a fundamental component of a well-functioning euro area and serves as an adjustment-buffer mechanism in the current European debt and banking crisis. TARGET2 balances buy time to implement structural reforms that may remove intra-European imbalances. Therefore, it is not only the southern European countries that provide an essential contribution to the structural adjustment process within the euro area.

5.4 Conclusion

It is often stated that TARGET2 balances mirror missing private capital flows due to structural imbalances in the euro area. Economists argue that if structural imbalances have been removed, private capital flows would recover and, thus, TARGET2 balances would disappear – without causing economic costs. The existing literature only focuses on potential costs and risks, which are associated with the TARGET2 system, e.g. the costs in case of a euro area collapse or a member country exit. These studies, however, seem to neglect the aspect that the TARGET2 system might be associated with current economic costs. The aim of this chapter was to evaluate the economic losses in real terms and gain insights into the distributional effects that come along with the TARGET2 system.

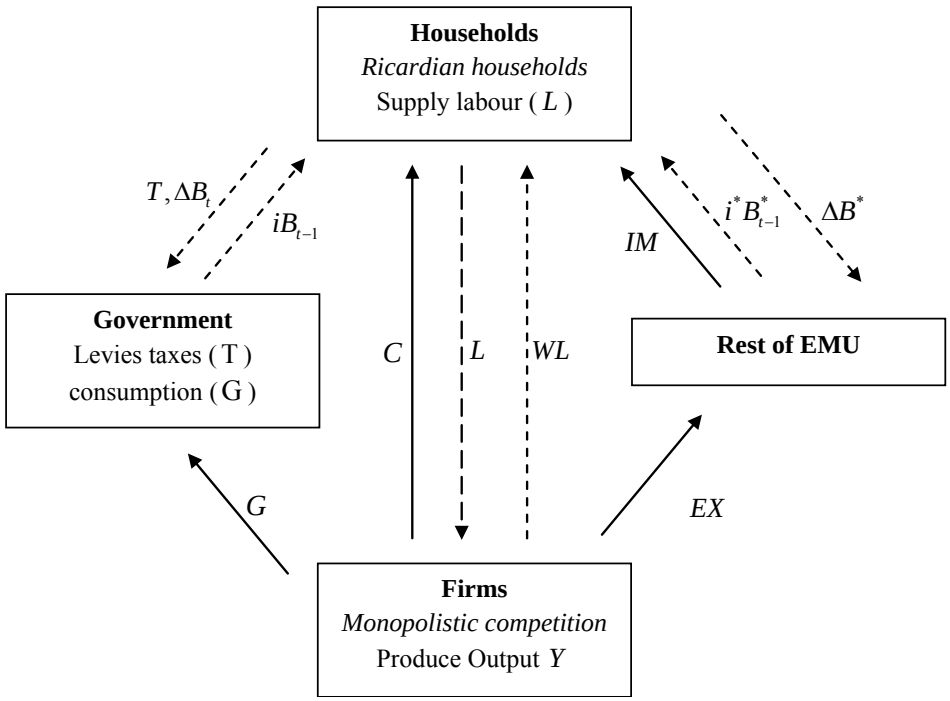
Since TARGET2 balances are published in current prices, it seems to be inappropriate to provide arguments concerning the TARGET2 system on a nominal basis, while price differentials between member countries are in place. Taking these imbalances reliably into account, holding TARGET2 claims can incur losses in real terms – even without a collapse of the euro area.

The analysis suggests that by the end of 2013 Germany has incurred losses from holding TARGET2 claims of around 13 billion euros in real terms (in constant 1999 prices). By adapting the calculation approach to each EMU member country, the results point out that the TARGET2 system can be considered as a distribution mechanism. On the one hand, this mechanism might help to finance necessary (real) adjustments. On the other hand, as real profits and losses basically mirror real differences within the EMU, the TARGET2 system cannot replace necessary reforms, but can provide time to reduce intra-EMU imbalances. TARGET2 balances are therefore economically equivalent to Eurobonds and the ESM. We should be aware of the fact that the TARGET2 system can incur losses in real terms, but doubting the TARGET2 system in general puts into question the existence of the monetary union.

5.5 Appendix

To illustrate the dynamics of the TARGET2 mechanism we use a small open economy approach within a monetary union. The specific model is based on the small open economy model in Chapter 2. Figure 29 summarises the structure of the model.[61]

Figure 29: Small open economy structure



In the small open economy model in Chapter 2, trade is financed through private capital flows (NFA_t). As we now assume now that private capital flows are totally substituted by TARGET2 (see Cecchetti et al. 2012; Sinn and Wollmershäuser 2012b), we can substitute NFA_t through TARGET2 balance, TB_t, so that a trade surplus corresponds with a TARGET2 claim vis-à-vis the deficit country. To illustrate TARGET2 in Figure 29, the financial flows between the domestic economy and Rest of EMU can be replaced by TARGET2 balances. Thus, we can rewrite the evolution of TARGET2 balances as:

[61] A detailed log-linear version of the model can be found in chapter 2.7.2.

$$TB_t = (1 + i_{t-1} - \pi_H)TB_{t-1} + nx \tag{5.14}$$

where $nx = y_t - c_t - \alpha\Delta\varepsilon_t$ denotes net exports.

Given the evolution of TARGET2 determined by the model, we may express the current account as the change in the TARGET2 balance (TB_t):

$$ca_t = TB_t - TB_{t-1}. \tag{5.15}$$

6

Conclusions

The main focus of this thesis was to analyse the potential of fiscal policy to stabilise asymmetric shocks and macroeconomic fluctuations for small open economies, with a specific focus on external imbalances.

Chapter 2 has presented a small open economy model within two different monetary regimes, i.e. an economy inside and outside of a currency union. This setting has been used to analyse how fiscal policy affects the adjustment of the current account and other macroeconomic variables to productivity and risk premium shocks. The contribution of this approach to existing literature is to link fiscal policy directly to external imbalances and analyse the stabilising properties of such a rule based fiscal policy. The main findings from the analysis are that entry into the EMU makes the economy more vulnerable to productivity shocks – contrary to a risk premium shock. Beyond that, independent from the monetary regime and the nature of the shocks, fiscal policy faces a trade-off between stabilising fluctuations in the current account and output.

In Chapter 3 a two-sector (tradable and non-tradable goods) DSGE model of a small open economy within a monetary union has been set up to tackle two policy relevant questions: First, to what extent can fiscal policy – that adjusts the composition of government purchases between tradables and non-tradables – help to stabilise fluctuations in the trade balance or domestic activity. And second, how does such an expenditure-composition rule perform in contrast to fiscal devaluation understood as a shift of the tax burden from labour to consumption in response to trade balance deficits. The analysis contributes to the existing literature by focussing on fiscal policy rules that adjust the composition of government purchases (tradables/non-tradables) in response to cyclical fluctuations. The policy rule is budgetary-neutral in the sense that the level of government expenditure is kept ex-ante constant. The main insights suggest that a state-dependent sectoral reallocation of government purchases can dampen excessive fluctuations in the external accounts, but with accompanying welfare losses. In contrast, welfare gains can be obtained when fiscal policy targets the stabilisation of domestic activity. These findings highlight a trade-off between stabilising domestic activity and enhancing household welfare, on the one hand, and reducing excessive trade balance fluctuations, on the other hand. Fiscal devaluation as an alternative policy does not face

such a trade-off between lower excess volatility in external positions and domestic demand and generates welfare gains in our simulations.

The analysis in Chapter 4 is based on the two-sector DSGE model of Chapter 3, but broadens the analysis of Chapter 3 by considering fiscal policy rules that adjust the composition of government purchases in response to domestic cyclical fluctuations, using a classical counter-cyclical policy rule as benchmark scenario, introducing sector-specific shocks and providing a more extensive welfare analysis by adding lump-sum taxes as alternative budget closure. As the potential of fiscal policy as a stabilisation device is very restricted when fiscal limits are tight, the main characteristic of the policy rule is that the overall government expenditure is kept ex ante constant. We focus on the question whether a government expenditure-shift between tradables and non-tradables is an alternative to adjustment in the overall level of public sector demand in response to business cycle indicators. The main insights of this analysis suggest that an expenditure-switching rule can achieve higher welfare gains compared to a standard counter-cyclical policy rule that adjust the overall level of government purchases. Beyond that, the budgetary-neutral expenditure policy tends to improve the budgetary situation in a recession relative to the no-policy case and contrary to the standard deficit spending rule. The reason is the combination of ex ante neutrality with a stabilisation of activity and tax revenues. This approach of a budgetary-neutral policy shift may provide stabilisation even in times of budgetary stress, i.e. when fiscal policy is severely constraint by high debt and borrowing costs.

In Chapter 5 a stylised two-period model has been used to deal with the issue of TARGET2 imbalances within the euro area. The contribution of this approach is to evaluate the current economic losses in real terms incurred from holding TARGET2 balances – even without an euro area collapse or a member country exit. The analysis highlights that in the last years, Germany's real losses from holding TARGET2 claims have increased to 13 billion euros. The TARGET2 system can be considered a distribution mechanism with a volume of 30 billion euros. It acts as an emergency mechanism in times where private capital does not flow properly and, hence, might help to finance necessary (real) structural adjustments, on the one hand, and provide time to reduce intra-EMU imbalances, on the other hand.

Of course, the stabilisation potential of fiscal policy has many different dimensions and this thesis cannot provide a comprehensive picture of all possible channels through which fiscal policy may affect the adjustment process of macroeconomic fluctuations and external imbalances. Moreover, to keep the analysis tractable, the different small open economy frameworks rely on several simplifying assumptions, which help to concentrate on the main issues that are focus of this thesis. By shedding light on these new, so far unexplored research questions, I hope that my findings encourage further research on the stabilising potential of fiscal policy and the issue of external imbalances.

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