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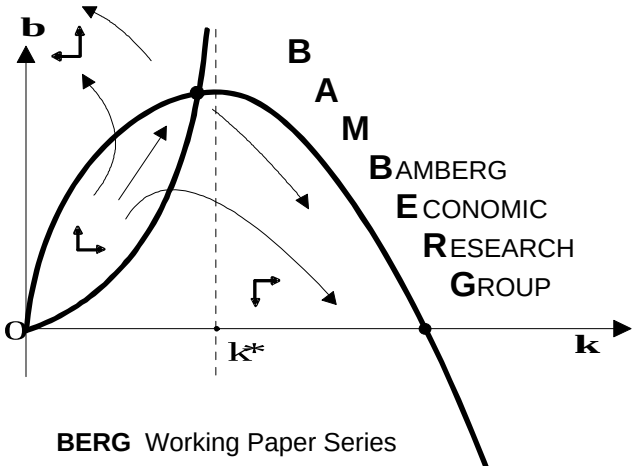

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Bamberg Economic Research Group
Bamberg University
Feldkirchenstraße 21
D-96052 Bamberg
Telefax: (0951) 863 5547
Telephone: (0951) 863 2687
felix.stuebben@uni-bamberg.de
http://www.uni-bamberg.de/vwl/forschung/berg/

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Redaktion:
Dr. Felix Stübben*

* felix.stuebben@uni-bamberg.de

Debt Stabilization and Macroeconomic Volatility in Monetary Unions under Heterogeneous Sovereign Risk Perceptions

Christian R. Proaño* and Benjamin Lojak

Otto-Friedrich-Universität Bamberg, Germany

November 17, 2015

Abstract

This paper studies the dynamics of sovereign risk, fiscal policy and the macroeconomy in a two-country monetary union framework under the assumption of a heterogeneous perception of the determinants of sovereign risk by the government and the market participants. The macroeconomic volatility resulting from various types of fiscal policy rules aimed at the stabilization of sovereign debt are investigated through numerical simulations. Among other things, these simulations show that an extreme focus on debt stabilization can be counterproductive if the financial markets care more about the country's output gap.

Keywords: Behavioral macroeconomics, sovereign risk, fiscal policy rules, monetary unions, macroeconomic stability

*Corresponding author. Email: christian.proano@uni-bamberg.de. We gratefully acknowledge useful comments and suggestions by Willi Semmler, Lopamundra Banerjee, Lena Dräger, Philipp Engler, Sabine Stephan, Daniele Tavani, Ramaa Vasudevan and seminar participants at Colorado State University, the 2013 Eastern Economic Association conference, the 2012 FMM conference, the 2012 CFE conference, and the 2015 EEA conference, as well as Mary Borrowman for excellent research assistance. This is a significantly revised version of Proaño (2013). Financial support by the Macroeconomic Policy Institute (IMK) in the Hans-Böckler Foundation is gratefully acknowledged.

1 Introduction

The assessment of sovereign risk and debt sustainability of euro area countries by financial markets seems to have experienced significant variation since the outbreak of the still unresolved euro area crisis at the end of 2009. During the 2000-2007 period, sovereign yields in the euro area were mainly driven by common international factors related to the global risk perception and not (or to an almost negligible extent) by country-specific factors (see e.g. Codogno et al. (2003) and Geyer et al. (2004)); the sovereign spreads of most euro area government bonds vis-à-vis German government bonds were also quite close to zero, reflecting the market's perception of the relative default risk of individual countries as almost nil despite quite differentiated underlying macroeconomic fundamentals. Since the default of Lehman Brothers in September 2008, in contrast, country-specific macroeconomic fundamentals do not only play a much more important role in the pricing of government bonds, but their influence itself seems to increase with the level of general risk aversion (see e.g. Manganelli and Wolswijk (2009), Haugh et al. (2009), Attinasi et al. (2009), Barrios et al. (2009) Schuknecht et al. (2009, 2010), Arghyrou and Kontonikas (2011), Borgy et al. (2012) and De Grauwe and Ji (2013)).

This indirect evidence for a time-varying and differentiated risk perception of similar macroeconomic fundamentals by the financial market participants suggest that behavioral factors such as perception biases and extrapolative expectations may have played an important role in the recent sovereign bond crisis within euro area. For instance, De Grauwe and Ji (2013) argue that the irrationality of market expectations and its self-fulfilling nature have been the driving factors of sovereign risk premia of government debt of euro area countries not only after the 2007-08 financial crisis and the outbreak of the still ongoing euro area crisis, but in the period before these events. As pointed out by Arghyrou and Kontonikas (2011), "This regime-shift not only explains the sudden escalation of the Greek debt crisis but also the difference in spread values observed between Greece and other periphery EMU countries with not too dissimilar macroeconomic outlook: Compared to Ireland, Portugal and Spain, markets perceive a much higher probability of a Greek voluntary exit from the EMU, and/or a Greek default. In short, Greece's problems are as much about trust as they are about economics."

Along these lines of thought, we set up in this paper a two-country monetary union model characterized by various features which make it useful for the analysis of interaction between the perceived sovereign risk by financial markets and its interaction with the macroeconomy in a rigorous way. The risk premium on government bonds and the related perception of sovereign risk is specified in a behavioral, not necessarily model-consistent manner, in stark contrast to the standard general equilibrium asset pricing specification.[1] Through the explicit modeling and variation of the set of variables used for the assessment of sovereign risk by different market participants, as well as their relative importance in such forecasts, it is possible to analyze the macroeconomic consequences of eventual

[1] In recent times, various studies have investigated the interaction between sovereign risk and economic activity in otherwise rather standard macroeconomic frameworks, see e.g. Adrian et al. (2010).

differences between those sets of variables and the governments' policy targets in a straightforward and clear manner (this approach can be related to the Farmer's "belief function", see e.g. Farmer (2010)). Indeed, as already pointed out, in the real world the link between the pricing of risk and the observable macroeconomic fundamentals seems to be rather loose and cannot account for the changes observable in bond yield- and credit default spreads which are often utilized as measure of sovereign risk. Therefore, there might be other destabilizing sources which can drive the economy into an economic slowdown (see e.g. De Grauwe and Ji (2012), Corsetti et al. (2012)).

The analysis for the present paper thus aims to address the following questions: What if governments pursue other goals than what financial market participants consider as relevant for the pricing of sovereign bonds, and what would be the macroeconomic consequences of such a discrepancy in the financial markets perception and actions? What are the macroeconomic consequences of a strict focus on sovereign debt reduction by the fiscal authorities, if markets do not consider this as a major determinant in their assessment of sovereign risk?

The remainder of this paper is organized as follows: In section 2 a two-country behavioral macroeconomic model of a monetary union is introduced. In section 3 the following investigations are being conducted: various transmission mechanisms are outlined through the analysis of the dynamic adjustments of the model to an exogenous shock in sovereign risk; the consequences of alternative specifications based on different sets of macroeconomic fundamentals determining the sovereign risk premia on macroeconomic volatility of the individual economies, and the monetary union as a whole. Finally, in section 4 some policy implications and concluding remarks from this study are drawn.

2 The Model

We consider a two-country monetary union which is populated by a continuum of agents on the interval $[0, 1]$, a segment $[0, n]$ residing in a country labeled H(ome), the other segment living in the other country labeled F(oreign). There is no migration between regions. Both countries are assumed to produce tradable consumption goods, which are however considered as imperfect substitutes due to a standard home bias argument, and to feature otherwise the same characteristics concerning the structure of their behavioral equations. The governments in the Home and Foreign regions dictate their fiscal policy in an independent and sovereign manner, financing their expenditures through the raise of taxes and the issuance of bonds (with a maturity of m periods). Furthermore, there is a single monetary policy authority (the monetary union's central bank or MUCB) which sets the riskless short-term interest rate which acts as reference for the pricing of the Home and Foreign government bonds. Moreover, the Foreign country's government will be assumed to be considered as more solvent by the market's participants, becoming in the limit a "safe haven" for financial capital.[2]

[2]The following exercise could be related in the EU case to the analysis of the interaction between Germany and Italy or Spain, for example.

While the agents' behavior is modeled in terms of log deviations from the model's steady state, we make use of the level expressions to link the main economic variables as well as to define market equilibria. Accordingly, we have

$$\log(X_t) = \log(\mathbb{X}_t) + x_t,$$

where X_t represents the level of the variable X_t, $\mathbb{X}_t$ its steady state value and x_t the log deviation of X_t from $\mathbb{X}_t$.

2.1 Households

The preferences of the Home households concerning the consumption of Home- and Foreign-produced goods $C_{h,t}$ and $C_{f,t}$, respectively, is described by the CES composite

$$C_t^H = \left[\gamma_h^{1/a}(C_{h,t})^{(a-1)/a} + (1-\gamma_h^{1/a})(C_{f,t})^{(a-1)/a}\right]^{a/(a-1)} \tag{1}$$

with $a > 1$ denoting the price elasticity of goods demand and $\frac{1}{2} < \gamma < 1$ representing the degree of home bias towards domestic consumption. As discussed e.g. by Walsh (2010, p.431), households minimize the cost of achieving a given level of C_t under the cost constraint $P_t^h C_{h,t} + P_t^f C_{f,t}$ taking P_t^h and P_t^f as given, by demanding in each period an amount of home- and foreign produced goods determined by

$$C_{h,t}^H = \gamma_h \left(\frac{P_t^h}{P_{c,t}^H}\right)^{-a} C_t^H, \quad \text{and} \quad C_{f,t}^H = (1-\gamma_h)\left(\frac{P_t^f}{P_{c,t}^H}\right)^{-a} C_t^H \tag{2}$$

where $P_{c,t}^H$ is the corresponding aggregate Consumer Price Index in the Home country, i.e.

$$P_{c,t}^H \equiv [\gamma_h (P_t^h)^{1-a} + (1-\gamma_h)(P_t^f)^{1-a}]^{1/(1-a)}. \tag{3}$$

Assuming an analogous behavior of the Foreign households, their optimal consumption of Home- and Foreign-produced goods is given by

$$C_{f,t}^F = \gamma_f \left(\frac{P_t^f}{P_{c,t}^F}\right)^{-a} C_t^F, \quad \text{and} \quad C_{h,t}^F = (1-\gamma_f)\left(\frac{P_t^h}{P_{c,t}^F}\right)^{-a} C_t^F, \tag{4}$$

respectively, with

$$P_{c,t}^F \equiv [\gamma_f (P_t^f)^{1-a} + (1-\gamma_f)(P_t^h)^{1-a}]^{1/(1-a)}. \tag{5}$$

being the aggregate Consumer Price Index in the Foreign country.

Concerning the evolution of (the log deviations of) aggregate consumption c_t over time, we assume the following behavioral Euler-type specification

$$c_t^k = \tilde{E}_t[c_{t+1}^k] - \alpha_{yr}(R_{t-1}^k - \pi_{c,t}^k - r^o) + \varepsilon_t^c, \qquad k = \{H, F\} \tag{6}$$

where R_t^k is the nominal interest rate on k-government bonds, r^o the long-term real interest rate, $\pi_{c,t}^k$ is the price inflation (measured in CPI terms), ε_t^c is a stochastic shock (to be defined further below) and $\tilde{E}_t[c_{t+1}^k]$ represents the households' subjective expectation of their future consumption c_{t+1}. For the sake of simplicity, let us consider that households expect that consumption of the next period corresponds to a constant fraction α_c of the log deviation of consumption observed in the previous period to the respective level when the economy is at its potential, formally $\tilde{E}_t[c_{t+1}^k] = \alpha_c c_{t-1}^k$.[3] For the evolution of C_t, it holds

$$C_t = \exp(\log(\mathbb{C}_t) + c_t)$$

where $\mathbb{C}_t$ is the steady state consumption level, assumed to be exogenously given.

2.2 Firms

Firms production is assumed to be entirely aggregate demand driven, with firms' adjusting their prices according to a standard backward-looking Phillips curve relationship

$$\pi_t^k = \beta_{py} y_t^k + \alpha_\pi \pi_{t-1}^k + \varepsilon_t^{k,p} \tag{7}$$

where β_{py} is the slope of the Phillips curve, $y_t^k = \log(Y_t^k/\mathbb{Y}_t^k)$ the output gap (defined as the log deviation of current output from its steady state level), and $\alpha_\pi \in [0,1]$ represents the degree of persistence in the inflation dynamics, and ε_t^p is a cost-push shock to be defined further below. We opt for this simple theory of inflation and against the use of a New Keynesian Phillips curve derived from an intertemporal profit maximizing behavior by monopolistic firms, as discussed e.g. Walsh (2010) to keep the key transmission mechanisms as transparent as possible, and also because assuming a firms' behavior based on rational expectations would have been inconsistent with the households' bounded rationality assumption.

2.3 Monetary Authorities

Concerning the behavior of the monetary union's central bank (MUCB), the following simple operational monetary instrument rule is assumed[4]

$$i_{\mathrm{T}} \quad = \quad i_o + \phi_i i_{t-1} + (1-\phi_i)\phi_\pi(\pi_t^{\mathrm{T}} - \pi^*) + \varepsilon_t^i \tag{8}$$

where i_o denotes the steady state nominal interest rate, π_t^{T} the target inflation rate (to be defined below) and π^* the inflation target (which in the following will be assumed to be equal to the steady state inflation rate π_o), ϕ_π the responsiveness of the monetary policy instrument interest rate to

[3] Given the behavioral approach of the present paper we do not include the expected future consumption as it is done in the standard Euler equations derived from intertemporal utility maximization under rational expectations.

[4] That is, in the words of Svensson (2003, p.1), a rule which "expresses the central bank's instrument (usually a short interest rate, the *instrument* rate [...]) as an explicit function of information available to the central bank".

deviations of inflation from its target level (with $\phi_\pi > 1$) and ε_t^i is a random shock. Given the implicit focus of this paper on the EMU, this specification seems to be appropriate for this baseline scenario since it describes a *systematic* conduction of monetary policy which literally comprises the mandate of the European Central Bank as determined by Article 105 of the Maastricht Treaty, whereafter "the primary objective of the ESCB [European System of Central Banks] is to maintain price stability."[5]

The MUCB's target inflation rate π^T – which in the case of EMU is given by the aggregate Monetary Union Index of Consumer Prices (MUICP) –, is defined here as

$$\pi_t^T = \omega_H \pi_t^H + (1 - \omega_H)\pi_t^F \tag{9}$$

where ω_H represents the weighting parameter for the member country H to be discretionarily determined by the MUCB.

2.4 Fiscal Authorities

As in Beetsma and Jensen (2005), national governments are assumed to purchase only goods produced in their own country in order to highlight the stabilizing role of fiscal policy at the national level, and denote by G_t^H and G_t^F the government spendings within the respective Home and Foreign countries. The fiscal policy rule, expressed as the log deviation of government expenditures from its long term counterpart $\mathbb{G}_t$, is assumed to be determined by

$$g_t^k = -\phi_{gy} y_{t-1}^k - \phi_{b,t}^k \left(\frac{B_{t-1}^k}{Y_{t-1}^k} - \psi^k \right) \tag{10}$$

Eq.(10) consists thus of an anticyclical term meant to summarize the automatic stabilizers in public finances, and a long-run term aimed at the stabilization of the debt-GDP ratio.[6]

In contrast, government taxes are assumed to be determined by

$$T_t^k = \mathbb{T}^k \exp(y_t^k)^{\tau_y} \tag{11}$$

where $\mathbb{T}_t^k$ is the long-run component of tax revenues.

The country k's government is assumed to finance its expenditures G_t^k and the interest on outstanding debt $R_{t-1}^k B_t^k$ through tax revenues T_t^k as well as through the issuance of new bonds. Under these assumptions, the governments' flow budget constraint (GBC) in real terms is described by

$$G_t^k + (1 + R_{t-1}^k - \pi_t^k) B_{t-1}^k = B_t^k + T_t^k, \tag{12}$$

where government debt is held by foreign as well as domestic households in each country k ($B_{h,t}^k, B_{f,t}^k$).

[5] This quote, however, goes on as following: "Without prejudice of the objective of price stability the ESCB shall support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community [...]."

[6] Mayer and Stähler (2013, p.13), using a DSGE framework, analyze also the performance of a balanced budget rule, finding that "due to erratic spending behavior, the balance budget rule tends to destabilize the economic and gives rise to sunspot equilibria. Cyclical fluctuations tend to be more pronounced under this regime and cyclical smoothing does not take place. In terms of welfare considerations, this regime also does comparatively poor."

2.5 Sovereign Risk

A range of papers on sovereign risk and contagion in currency unions tend to emphasize the role of government bond yield spreads (or Credit Default Swap (CDS) spreads) as the reference measure of sovereign risk (see e.g. Metiu (2012), Beirne and Fratzscher (2013), De Grauwe and Ji (2013), among others). In order to employ such measure of sovereign risk, we consider two countries, both members of the Monetary Union, where the Home economy should be prone to sovereign risk induced by the agents' perception based on fluctuations in macroeconomic fundamentals, while the Foreign economy enjoys a "safe haven" status. Therefore, government bonds of the Foreign economy should be treated as a safe investment opportunity.

Following Adrian et al. (2010), the perceived sovereign risk at time t is specified as a linear combination of various macroeconomic fundamentals contained in a vector $\mathcal{F}_{t-1}^{H} \in \Re^{1\times 3}$, i.e.

$$\zeta_t^H = \begin{cases} \boldsymbol{\xi}_{\mathcal{F}} \mathcal{F}_{t-1}^{H\prime} + \varepsilon_t^{\zeta} & \text{if } \geq 0 \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

where $\boldsymbol{\xi}_{\mathcal{F}}$ is a exogenously given coefficient vector which determines the relative importance of a particular variable in $\mathcal{F}_{t-1}^{H}$ in the assessment of ζ_t^H. More specifically, let

$$\mathbb{F}_{t-1}^{H} = \left[\left(\frac{Y_{t-1}^{H}}{\mathbb{Y}^{H}} - 1 \right), \left(\frac{B_{t-1}^{H}}{Y_{t-1}^{H}} - \psi \right), \left(R_{t-1}^{H} - R_{t-1}^{F} \right) \right],$$

so that

$$\zeta_t^H = -\xi_y y_{t-1}^{H} + \xi_b \left(\frac{B_{t-1}^{H}}{Y_{t-1}^{H}} - \psi \right) + \xi_r \left(R_{t-1}^{H} - R_{t-1}^{F} \right) + \varepsilon_t^{\zeta}. \tag{14}$$

At this point, we assume that the actual values of the respective variables are not known to the financial market participants so that the agents base their perception of sovereign risk on the previous observed magnitudes in period $t-1$. As it can be easily seen, the values of $\boldsymbol{\xi}_{\mathcal{F}} = \{-\xi_y, \xi_b, \xi_r\}$ are central to the assessment of the Home's sovereign risk and allow us to investigate the consequences of a differentiated perception of sovereign risk by the financial markets at the macroeconomic level. According to eq. (14), the perceived sovereign risk is a negative function of Home economy's output gap in the previous period (which is observable to all agents in the economy), a positive function of the country's indebtedness (relative to GDP) at date $t-1$, and a positive function of the aforementioned bond spreads $(R_{t-1}^{H} - R_{t-1}^{F})$, where ε_t^{ζ} is a stochastic shock.[7] At this point it should be noted that even though the above specification is linear in all its terms, in the analysis of the next section we will let the coefficients vary in order to reflect recent findings e.g. by De Grauwe and Ji (2013) in the context of the euro area crisis.[8]

[7] An early investigation referring to the driving forces of government bond yield spreads was carried out by Edwards (1984), who figured out that domestic fundamentals, such that public debt, inflation, etc. are important for the determination of the development of government spreads.

[8] Indeed, as previously mentioned, a stylized fact of the recent euro area debt crisis is the non-linear, apparently country-specific and state-dependent link between the sovereign risk premium and the underlying macroeconomic fundamentals of various euro area countries.

At this point it should be noted that, as these expressions are formulated, there is no endogenous variation in the link between the sovereign risk and the different fundamentals contained in $\mathcal{F}_{t-1}^k$. Obviously, a possible approach to endogenize the relative importance of these variables would be to follow the increasing literature on macroeconomics and behavioral heterogeneous expectations (see e.g. Branch and McGough (2009), Proaño (2011, 2013), De Grauwe (2012), Bask (2012) and Lengnick and Wohltmann (2013)) and let the perceived sovereign risk be endogenously determined through different behavioral forecasting rules. However, for the sake of simplicity and clarity of exposition these coefficients will not become endogenously determined, but directly varied in an exogenous manner in the simulation analysis below.

Concerning the pricing of bonds, there is no need to impose a no-arbitrage condition between the two financial assets. Instead it is sufficient to specify the corresponding nominal yield to maturity $R_{k,t}^{(m)}$ (with maturity of 1). The gross return on holding bonds should be considered by

$$R_t^k = \begin{cases} i_t + \zeta_t^H & \text{for } k = H \\ i_t & \text{for } k = F \end{cases} \tag{15}$$

where i_t is the short-term interest rate and ζ_t^H the risk premium on the pricing of bonds in the Home economy. For simplicity, we assume that the yield on bonds of the Foreign economy corresponds to the short-term interest rate i_t. Using the specification of the bond returns in eq. (15), one can easily see that the bond spread component in eq. (14) corresponds to the previously perceived sovereign risk ζ_{t-1}^H.

2.6 Market Clearing and External Imbalances

The market equilibrium condition for the Home and Foreign country $k = \{H, F\}$ is given by

$$Y_t^k = C_t^k + G_t^k + TB_t^k \tag{16}$$

The respective trade balances for each country are easily obtained by subtracting the amount of domestically produced goods sold abroad and the domestic demand for foreign goods. Thus we get

$$TB_t^H = \underbrace{(1-\gamma)\left(\frac{P_t^h}{P_{c,t}^F}\right)^{-a} C_t^F}_{\text{Exports}} - \underbrace{(1-\gamma)\left(\frac{P_t^f}{P_{c,t}^H}\right)^{-a} C_t^H}_{\text{Imports}}, \tag{17}$$

and

$$TB_t^F = \underbrace{(1-\gamma)\left(\frac{P_t^f}{P_{c,t}^H}\right)^{-a} C_t^H}_{\text{Exports}} - \underbrace{(1-\gamma)\left(\frac{P_t^h}{P_{c,t}^F}\right)^{-a} C_t^F}_{\text{Imports}}, \tag{18}$$

We obtain the output gap by log-linearization of the market clearing condition, therefore, we get

$$y_t^k = \theta_c c_t^k + \theta_g g_t^k \tag{19}$$

where $\theta_c = \mathbb{C}/\mathbb{Y}$ and $\theta_g = \mathbb{G}/\mathbb{Y}$.[9]

3 Model Analysis

Since the present framework deviates in various dimensions from standard DSGE Models, and a proper estimation of the same is beyond the scope of this paper, the choice of the model's parameters is not quite straightforward. However, whenever possible, we take parameters widely accepted in the literature. For instance, we set the long-run trend components of consumption, government expenditures and lump-sum taxes equal to $\mathbb{C} = 80$, $\mathbb{G} = 20$ and $\mathbb{T} = 20$, respectively, which in turn leads to a steady state output level of $\mathbb{Y} = 100$, and thus to a long-run private consumption to GDP ratio of 0.8, a government expenditures to GDP ratio of 0.20 (and thus a ratio of private to government consumption of four), and a balanced government budget in the long-run, as it is standard in the literature, see e.g. Beetsma and Jensen (2005). The degree of home bias is set equal to 0.8, what implies a share of imports to GDP of 0.15, under a long-run zero trade balance. Further, the cyclical elasticity of government expenditures and tax revenues is set equal to $\phi_y = 0.20$ and $t_y = 0.12$, respectively, following Mayer and Stähler (2013), who set a total cyclical elasticity of the structural budget deficit equal to 0.32. For simplicity, we set the elasticity of the government expenditures to the debt-to-GDP as $\phi_b = 1$. This configuration follows the rationale, that the government cuts its expenditures by the same amount of the increase in sovereign debt. The real interest rate elasticity of consumption demand (more precisely, the log-linear approximation around its steady state level) α_{yr} have been estimated several times by a number of authors. Although these estimates refer to the New Keynesian baseline model including rational expectations, we use the value $\alpha_{yr} = 0.164$ obtained by McCallum and Nelson (1999).

Based on the empirical estimates of Goodhart and Hofmann (2005) for the euro area, we set the past inflation rate coefficient to 0.75 where the slope of the Phillips curve is set equal to 0.15. Concerning the MUCB monetary policy rule, as in Proaño (2012) we assume that $\phi_\pi = 2.0$ and $\phi_y = 0.0$, as this specification seems to be appropriate since it describes a *systematic* conduction of monetary policy which comprises literally the mandate of the European Central Bank as determined by Article 105 of the Maastricht Treaty, whereafter "the primary objective of the ESCB [European System of Central Banks] is to maintain price stability."[10] Further, the weighting parameter for the member country H in the interest rate rule is set $\omega_{_H} = 0.5$, assuming an equal weight of both countries in the MUCB's

[9] Note that we assume that the trade accounts of both countries are balanced in the point of rest, $\mathbb{TB}^k = 0$. Doing so, the perceived sovereign risk, expressed by the term ζ_t^H becomes zero in steady state and the nominal yields on bonds becomes equal the long term interest rate $R_o = i_o$.

[10] This quote, however, goes on as following: "Without prejudice of the objective of price stability the ESCB shall

Table 1: Parameter Values

Parameter	Symbol	Value
Long-run component of consumption	$\mathbb{C}$	80
Elasticity of substitution in consumption	a	1.1
Degree of home bias in consumption	γ_h	0.8
Interest rate elasticity of consumption	α_{yr}	0.164
Elasticity of past consumption on consumption	α_c	0.7
Long-run component of government expenditures	$\mathbb{G}$	20
Output gap elasticity of cyclical government expenditures	ϕ_{gy}	0.2
Debt elasticity of cyclical government expenditures	ϕ_b^k	0.5
Target Debt-to-GDP ratio	ψ	0.6
Lump-sum Taxes	$\mathbb{T}$	20
Output gap elasticity of cyclical tax revenues	τ_y	0.12
Output gap coefficient in Phillips Curve	β_{py}	0.15
Lagged inflation coefficient in Phillips Curve	α_π	0.0
Inflation gap coefficient in interest rule	ϕ_π	2.0
Output gap coefficient in interest rule	ϕ_y	0.0
Home's weight in the interest rate rule	ω_H	0.5
Country k's sovereign debt coefficient in risk	ξ_b	0.0744
Output gap coefficient in the risk expectation equation	ξ_y	0.2
Return differential coefficient in risk expectations	ξ_r	0.2

loss function. With respect to the reaction parameters in the market perceptions of Home's sovereign risk, given the lack of empirical estimates, we set it arbitrarily to $\xi_y = 0.2$ and $\xi_r = 0.2$. The value of the investors sensitivity to fluctuations in the debt-GDP ratio corresponds to $\xi_b = 0.0744$ for Home and is taken from the estimates provided by De Grauwe and Ji (2013, table 1). Table 1 summarizes all these parameter values.

Finally, concerning the stochastic shocks to the system, we assume in a standard manner that all of them follow an AR(1) process and that the corresponding autoregressive coefficients and standard deviations of the innovations are given by the values summarized in Table 2.

Table 2: Standard Deviations of Stochastic Shocks

Variable	Autoregressive Term	Std. Dev.
Home and Foreign consumption	0.7	0.20
Home's perception of sovereign risk	0.7	0.24
Home and Foreign price mark-up	0.7	0.14
Monetary policy	0.7	0.24

support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community [. . .]."

3.1 Transmission Mechanisms and Dynamic Adjustments

Before we turn to our main analysis where we focus on the macroeconomic consequences of alternative fiscal policy rules aimed towards either debt or aggregate demand stabilization, it is worthwhile to discuss the model's dynamic adjustments to a one-time exogenous increase in the perceived sovereign risk of the Home country's government.[11]

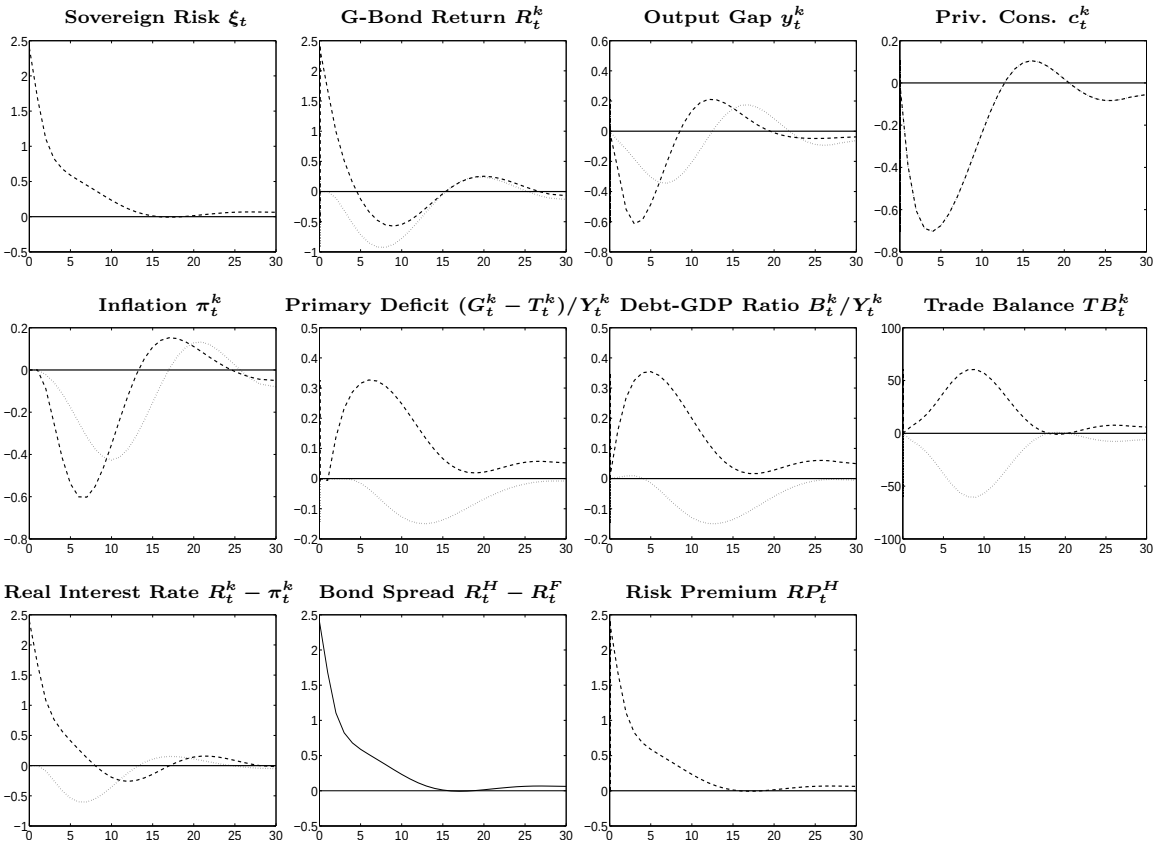

Figure 1: Dynamic responses in Home (dashed line) and Foreign (dotted line) to a one-time one std. dev. increase in the market's expectations of Home's sovereign risk .

As Figure 1 clearly illustrates, an increase in the market's perception of Home's sovereign risk reduces economic activity through one main channel, namely through the immediate rise in the nominal yield on bonds and thus in the respective bond spreads. According to the fiscal policy rules, an increase in sovereign risk which is associated with a rise in return on bonds, leads to an increase in Home's sovereign debt and the subsequent fiscal consolidation efforts, see eq. (10). Given the international trade interactions between Home and Foreign, an increase in ζ_t^H has a negative impact on economic activity not only of Home, but also of Foreign due to the reduction in Home's aggregate demand for

[11] All numerical simulations in this paper were done using Dynare 4.3.3, see Adjemian et al. (2011). The codes are available from the author upon request.

Foreign's consumption goods, what leads to a temporary trade account imbalance between the two countries.[12] The decrease in economic activity in the Home country leads to a downward pressure on inflation and, by extension, an improvement in the relative competitiveness of the Home economy. This – together with the decrease in aggregate consumption and imports – leads to an expansion of Home's trade balance and – by definition – a deterioration of Foreign's trade balance. The boom in net exports leads in turn to an increase in economic activity in Home, which allows aggregate consumption to recover.

Due to the anticyclical terms in the government expenditures and tax collection rules, the downturn in Home's economic activity leads to an increase in the government deficit in the Home country. This effect is magnified by the higher Home government bond yields, which increase the financing costs of the fiscal deficits. Finally, it is worthwhile to highlight the fact that this asymmetric shock in the perceived sovereign risk of Home's government bonds leads to an increase in the Home's government bond spreads w.r.t. the monetary policy interest rate, and to the opposite development in the Foreign economy, which profits from its "safe haven" status.

3.2 Debt Stabilization Policy and its Effect on the Macroeconomic Stability

In this subsection, we assess the macroeconomic consequences in our two-country model for the case in which a policy of procyclical austerity is implemented in the Home country. For this purpose, we compute the cumulative impulse response functions (IRF's) for increasing values of the sensitivity parameter linking the debt-to-GDP ratio to the fiscal policy rule in a range of $\phi_b \in [0.5, 1]$. For the computation of the adjustment processes we use the values listed in table 1. In the following we associate the occurrence of large and persistent deviations of the key variables from their corresponding steady state levels with an excess volatility which is likely to infer macroeconomic and, from a wider perspective, welfare costs.

The cumulative IRF's are depicted in figure 2. For illustrative purposes, we select the cumulative IRF's of the Home countries output gap (left panel), the agents' perception of sovereign risk (middle panel) and the debt-to-GDP ratio (right panel) over a time span of $t = 30$ quarters. As it can be clearly observed, the cumulated output gaps of the Home country are a positive function of the debt stabilization coefficient ϕ_b^H. It follows that if the government puts too much emphasis on sovereign debt stabilization and enforces it by means of expenditure cuts, both the duration and dimension of the deviation of output from its equilibrium level increase significantly. The economic rationale for this outcome is relatively straightforward: An initial shock to the agents' perception of sovereign risk immediately raises Home's government yield spreads as it can be clearly observed by eq. (15). Consequently, aggregate consumption and thus total demand and inflation decrease whereas the associated

[12] As previously mentioned, while Home could be related to Spain or Italy in the current euro area crisis, Foreign would represent Germany.

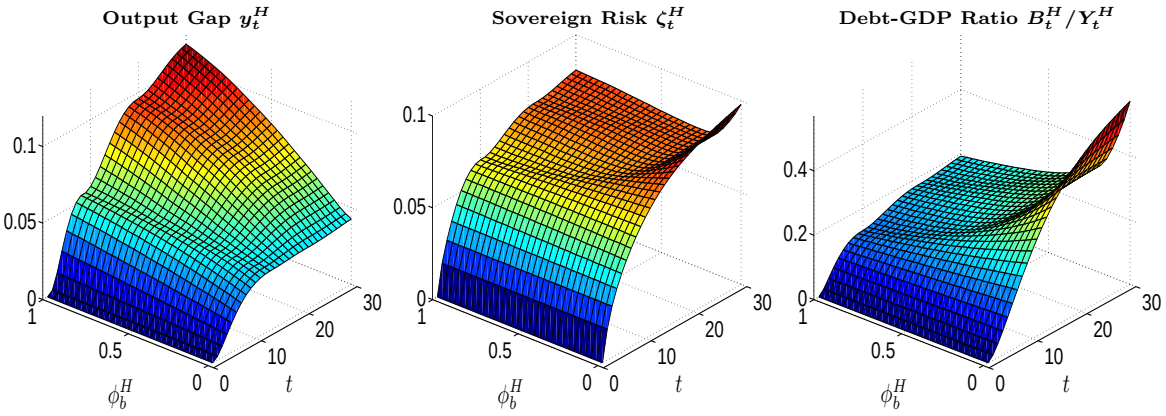

Figure 2: Cumulative dynamic adjustments in the Home country to a one-time one std. dev. increase in the Home's sovereign risk perception for different values of ϕ_b.

higher fiscal debt burden cuts the Home country's government expenditures. Its extent critically depends upon the debt stabilization coefficient ϕ_b^H. If the Home's government turns its primary objective on stabilization of the debt-to-GDP ratio (reflected by *ceteris paribus* larger values of ϕ_b^H), the role of output stabilization in the fiscal policy rule becomes increasingly unimportant. Hence, the associated spending cuts succeed more abruptly, what leads to a higher output volatility. It follows that the increased risk premium – which in turn raises the interest payments on government bonds – makes a stabilization of real economic activity difficult to achieve. The greater the spending cuts in the Home economy in response to exogenous perturbations, the larger is the fall in aggregate demand for Homes's private consumption goods within the economy and abroad. It follows a decline in Foreign's exports as well as imports (primarily due to the change in the relative prices of Home's and Foreign's consumption goods) which in turn eases the output gap adjustment volatility of the Foreign country. A second channel through which the Foreign economy is affected concerns to the interest rate channel. As the MUCB reacts to the price inflation developments on both countries to the same extent and the adjustments of inflation are driven by the fluctuations of the output gap, increased volatility in Home leads to higher short-term interest rate volatility, which in turn affects Foreign's economy through its effect on private consumption and on the pricing of Foreign's government debt.

It is interesting to note that a stronger orientation of fiscal policy towards debt stabilization may reduce sovereign risk only at low ranges of ϕ_b^H, as the middle graph in figure 2 clearly shows. Accordingly, all-too excessive austerity endeavours seem to hit a lower bound in the sovereign risk assessment, leading thus only to excessive output fluctuations. This point will be further investigated in the next section.

3.3 Adjustment Volatility under Alternative Sovereign Risk Perceptions and Fiscal Policy Rules

As it is well-known, in the standard DSGE framework the performance of monetary and fiscal policy is analyzed using a welfare criterion derived from the utility function of the representative agent(s) and the flexible-price equilibrium under rational expectations, see e.g. Rotemberg and Woodford (1997). Since the present framework is not "microfounded" in the sense of the DSGE approach, and does not rely on the rational expectations assumption, but on the notion of behavioral heuristics concerning the agent's perception of sovereign risk eventually determined by specific fundamentals only, such an evaluation strategy is not applicable here.

In the latter subsection we illustrated how the cumulated dynamic adjustments of some key variables after a one-time exogenous shock in the perception of sovereign risk are the more long-lasting the more the fiscal authority focuses on debt stabilization. In the following, we compute the same cumulated dynamic adjustments, now however under different fiscal policy rules and perceived sovereign risk specifications. Doing so, we distinguish between four different scenarios. The first scenario considers the case where policy makers as well as market participants both consider sovereign debt as the main determinant of sovereign risk. The second scenario discusses the effect on the cumulated macroeconomic adjustment when the government focuses on fiscal consolidation while the markets consider the output gap as the main variable driving the sovereign risk. In the third scenario, our aim is to analyze the cumulated macroeconomic adjustment in a consensus case where both, fiscal authority and the markets, consider aggregate demand stabilization as the main driver of a sovereign risk reduction. The final scenario emphasis the interaction between a Home government that aims to stabilize the economy by strict debt stabilization programs where the markets focus on the development of the bond yield spreads instead. For this purpose, the cumulative absolute IRF's are employed as evaluation measure for the cumulated macroeconomic adjustment.[13]

Figure 3 illustrates the cumulative absolute IRF's of the output gap of Home, Foreign and the Monetary Union as a whole for variations of the debt stabilization parameter ϕ_b^H and the debt-to-GDP coefficient in the sovereign risk equation ξ_b, where the remaining coefficients within the equation should be treated equal to zero $\xi_y = \xi_r = 0$ in order to emphasize its effects in isolation. The coefficient of the Foreign country is constant and set to $\phi_b^F = 0.5$ (see table 1). Note that each node in the grid represents the cumulative absolute IRF of the Home's output gap for the respective parameter specification.

According to figure 3, the magnitude of the cumulated adjustment fluctuation of the Home coun-

[13]Note that Proaño (2013) analyzed the impact of different fiscal policy rules under various sovereign risk perception configurations on aggregate volatility. He computed a loss function over several simulation runs which he employed as evaluation measure of aggregate volatility. He also highlighted the role of the trade balance as determinant of sovereign risk perceptions and its effect on the fluctuations of real economic activity in a monetary union.

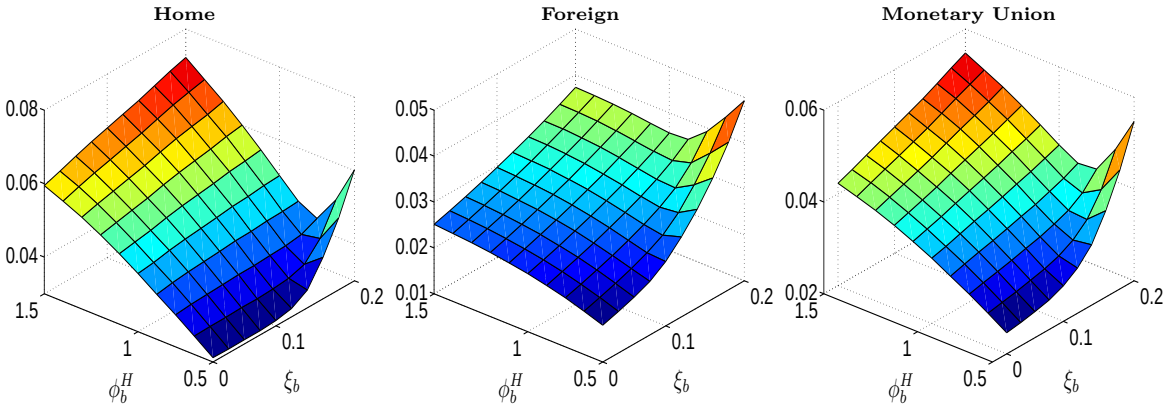

Figure 3: Scenario 1: Adjustment volatility of Home's, Foreign's and the union wide output gap for varying parameter values of ϕ_b^H and ξ_b after a one-time shock in the agents' perception of sovereign risk.

try's output gap is a strictly positive function of ϕ_b^H for low values of ξ_b, and a nonlinear function for high values of ξ_b as can be clearly seen from the slope of the surface w.r.t. both parameters. Figure 3 delivers thus two important insights. First, when financial markets do not care particularly for debt stabilization, a pronounced austerity policy is harmful for the economy, as it produces excessive fluctuations in the economic activity in the Home and Foreign economies, as thus at the monetary union level. And second, when financial markets do care particularly about debt stabilization – a situation represented here by higher values of ξ_b –, an accordant fiscal policy is beneficial only for small values of ϕ_b^H, but not for larger values, when the counterproductive effects overweight the positive effects of a reduction in the sovereign risk perception due to a fiscal policy oriented towards debt stabilization. As in the previous figure, we find here that an all-to-strong orientation of fiscal policy towards debt stabilization is harmful for the economy, as recent empirical findings e.g. by Blanchard and Leigh (2013) have shown.

The second scenario to be considered refers to the case where Home's perceived sovereign risk is driven by the output gap ξ_y. Strictly speaking, the scenario describes what happens if the perceived sovereign risk is indeed driven by the fluctuations in GDP but fiscal policy merely focuses on sovereign debt stabilization. In order to provide an answer to this question, we choose the range $\xi_y \in [0, 0.2]$ and $\phi_b^H \in [0.5, 1.5]$ for the respective coefficients. The counterpart abroad should be held constant at its default value of $\phi_b^F = 0.5$ depicted in table 1.

The absolute cumulative IRF'S after a one-time one-standard deviation increase in the sovereign risk perception are represented in figure 4. The results are similar to the results obtained in the previous scenario, though of a larger dimension. The intuition behind that mechanism is relatively straightforward: The initial shock effects Home's market participants perception of risk in the same

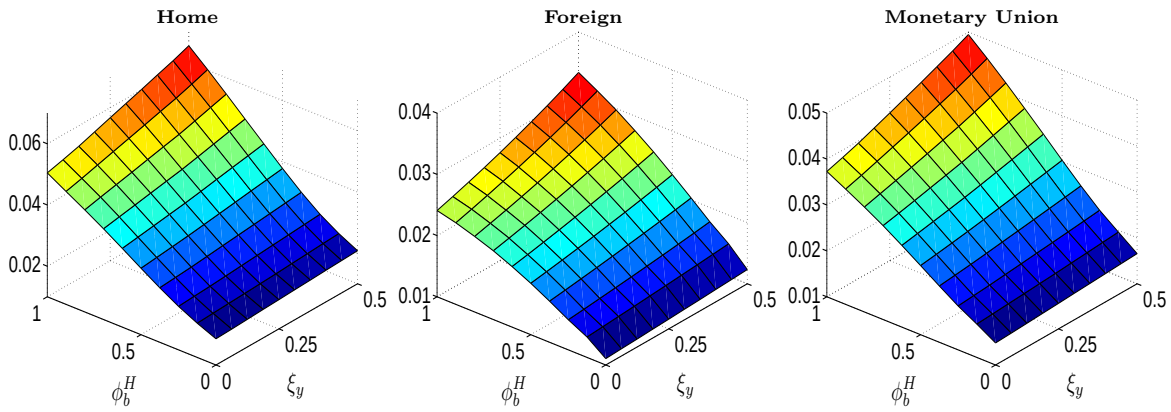

Figure 4: Scenario 2: Adjustment volatility of Home's, Foreign's and the union wide output gap for varying parameter values of ϕ_b^H and ξ_y after a one-time shock in the agents' perception of sovereign risk.

manner as mentioned above. The immediate increase in the risk premium and thus the nominal yield on the government bonds of the Home country lead to a massive cut in Home's government expenditures. It follows a stark decline in aggregate demand. This time, the financial markets react with a stronger response regarding the updating of sovereign risk associated with a sharp increase of the risk premium. In this case, where the fiscal authority focuses on debt stabilization whereas the financial markets assess the sovereign risk as being mainly driven by fluctuations of the Home country's output gap, the result is a more volatile scenario as in the previous consensus case where both put their emphasis on sovereign debt. The decline in Home's aggregate demand for consumption goods shortens not just aggregate output, it also decreases the Home's imports and therefore Foreign's exports. The decline of Home's prices for consumption goods amplifies this process. As the figure illustrates, this configuration increases not just the adjustment volatility in Home, but also in Foreign and in the whole Monetary Union.

Figure 5 illustrates the cumulated adjustment of real economic activity in the case that Home's government implements a pronounced countercyclical fiscal policy, and the markets assess sovereign risk as mainly driven by output gap fluctuations. In order to carry out this investigation, we choose ϕ_y^H and ξ_y as parameters to be varied and set the foreign counterpart to its default value $\phi_y^F = 0.2$. It is worth mentioning that the cumulated adjustment of the respective economy's output gap is a decreasing function of the output-stabilization parameter ϕ_y^H but increasing in ξ_y. Therefore, an increase in the Home country's sovereign risk raises the nominal yields on government bonds that in turn increases the debt-to-GDP ratio and reduces private consumption within the respective economy. The associated decline in aggregate output causes Home's government to expand its expenditures (due to its increasing focus reflected by variations of ϕ_y^H). Note that even in this scenario, we did not drop the assumption of a debt stabilization mechanism ($\phi_b^H = 0.5$) which counteracts the positive

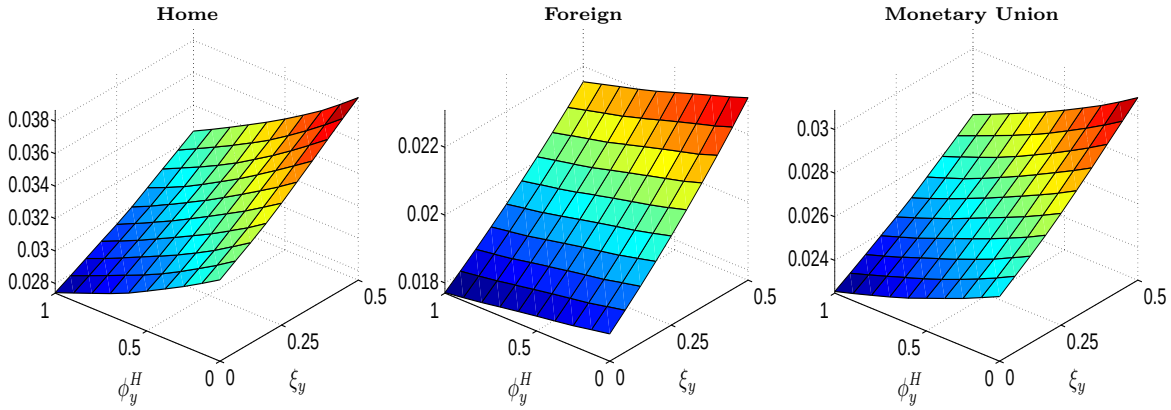

Figure 5: Scenario 3: Adjustment volatility of Home's, Foreign's and the union wide output gap for varying parameter values of ϕ_y^H and ξ_y after a one-time shock in the agents' perception of sovereign risk.

stabilizing effects of countercyclical fiscal policy (with a lag of unity). If we had done this, the adjustment volatilities would be even lower than in the current case illustrated in figure 5. Since the countercyclical fiscal policy of Home's government neutralizes the destabilizing forces, resulting from spending cuts due to the increase in sovereign risk and thus government debt, at least to some extent, the transmission to the foreign country of the Monetary Union is much weaker than in the previous scenarios where the Home economy's government was stuck down to austerity programs. It should be emphasized that the spending expansions that counteract the cuts emerging from debt stabilization results in much lower adjustment volatilities of Home's, Foreign's as well as of the union wide output gap, as can be clearly observed in figure 5. Accordingly, a more pronounced countercyclical fiscal policy is more advantageous in terms of macroeconomic stabilization.

In the final scenario we stress the interaction of increasing importance of debt stabilization policy while the markets increasingly focus on the development of the bond spreads as an early indicator for sovereign risk and its contemporaneous effects on output volatility. In this case, the market participants follow extrapolative rules. This case is perhaps the most important since the fluctuations of the returns on bonds, and thus the bond yield spreads, are widely used as representative for sovereign risk in the strand of the literature focusing on the EMU sovereign debt crisis and contagion dynamics within the EMU (see e.g. Metiu (2012), Baldacci and Kumar (2010) among others). For the computation of the absolute cumulative IRF's, we widely used the parameter values depicted in table 1.

Figure 6 illustrates the consequences for the cumulated macroeconomic adjustment of an increasing importance of debt stabilization for the government of the Home economy (as already carried out in scenario 1 and 2) when the market participants increasingly spend their emphasis on the nominal bond

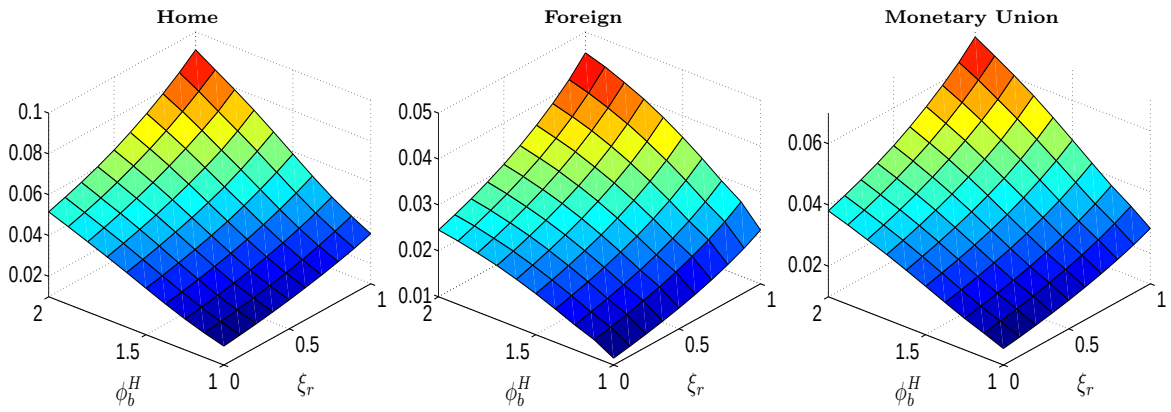

Figure 6: Scenario 4: Adjustment volatility of Home's, Foreign's and the union wide output gap for varying parameter values of ϕ_b^H and ξ_r after a one-time shock in the agents' perception of sovereign risk.

yields. As the figure clearly suggests, increasing values of ϕ_b^H and ξ_r raises Home's, Foreign's as well as the union wide adjustment volatilities after an initial shock in the agents' perception of sovereign risk in Home, which can be observed by the increasing slope of the surfaces in both directions. This time, the magnitude of the respective adjustment paths proceeds more volatile than observed in the previous cases. This finding is not necessarily surprising, as the sovereign risk is assumed to be decisively responsible for the risk premium on bonds, see eq. (14), and thus for its nominal yields, eq. (15). The Home government's debt services increases its fiscal solvency concerns and feed immediately back into real economic activity by increasing spending cuts and through a decline in private consumption. The rise in the bond spreads triggers the markets to reassess their subjective valuation of sovereign risk upwards which in turn reinforces the whole process and thus the adjustment volatility of the output gap. The spread to the Foreign economy takes place in the same manner as discussed before.

4 Concluding Remarks

The main motivation of this paper was to assess the interaction between fiscal policy and the financial markets in a monetary union under occasional discrepant perceptions concerning the main determinants of sovereign risk. We aimed to address the following question: What if governments pursue other goals that what financial market participants consider as relevant for the assessment of sovereign risk - and the subsequent pricing of sovereign bonds - and what would be the macroeconomic consequences of such discrepancy?

In order to shed some light on these issues, a theoretical model of a two-country monetary union was developed which featured a variety of innovative modeling aspects existent in the literature so far. A behavioral specification of the risk premium on the prices of government bonds has been used. In

this context, the risk premium on government bond returns was determined by the agent's sovereign risk perceptions.

Concerning the methodology, various scenarios were investigated where the fiscal authority of the Home economy spent their emphasis on increasing debt- or demand/output-stabilization while the financial markets contemporaneously focus on output, the government's debt as a ratio of GDP or the development of the bond yield spreads to assess the economies sovereign risk. The absolute cumulative IRF's of the respective output gap were then utilized as a measure of adjustment costs. The first scenario concerned the case where the fiscal policy was increasingly oriented towards meeting a specific debt-to-GDP target, while the market participants based their assessment of sovereign risk in terms of fiscal deterioration as well. The second main scenario concerned the case where the perceived sovereign risk depended exclusively on the current state of the business cycle. Up to this point, we found that increasing efforts of Home's government towards debt stabilization increased the volatility of the dynamic adjustments of the output gap significantly for the Home-, the Foreign-country as well as for the Monetary Union as a whole. The third scenario, the case where the Home government faced countercyclical fiscal policy represented the most stable regime. From that approach we inferred that the adjustment volatilities were decreasing when the fiscal policy put increasing attention towards output stabilization. This finding could be observed at the union-wide level. The final case, where Home's government was stuck down to austerity programs and the financial markets utilized the government bond yield spreads as an indicator for the overall sovereign risk, provided us with the most volatile dynamic responses.

The numerical computations of these scenarios highlighted in a clear manner the pitfalls of the conduction of economic policy in the real world, where it cannot be taken for granted that markets and governments may share the same goals, targets and expectations, and where a learning mechanism along the lines of Evans and Honkapohja (2001) may not be feasible due to various reasons. Furthermore, in the context of the current euro area crisis, this paper highlighted the dangers of a too restrictive fiscal policy aimed at the stabilization of sovereign debt. Indeed, as acknowledged even by IMF staff (Anderson et al., 2013), a too restrictive fiscal consolidation is quite likely to affect a country's macroeconomic activity, especially if the markets do not share the same views or targets as the governments following such a fiscal austerity path.

On more general grounds, this paper highlights the importance of the analysis of situations which may not be accurately represented by a rational expectations model, where agents share the same information sets and have consistent beliefs with respect to the future evolution of the economy. Indeed, as the wide empirical evidence on behavioral finance as well as recent studies on euro area sovereign spreads suggest, the pricing of sovereign debt seems to be much more complex than what the rational expectations framework may allow for.

References

Adjemian, S., Bastani, H., Juillard, M., Mihoubi, F., Perendia, G., Ratto, M. and Villemot, S. (2011), Dynare: Reference manual, version 4, Dynare Working Papers 1, CEPREMAP.

Adrian, T., Moench, E. and Shin, H. S. (2010), 'Macro risk premium and intermediary balance sheet quantities', *IMF Economic Review* **58**, 179–207.

Anderson, D., Hunt, B. and Snudden, S. (2013), Fiscal consolidation in the euro area: How much pain can structural reforms ease?, Technical report, International Monetary Fund.

Arghyrou, M. G. and Kontonikas, A. (2011), The EMU sovereign-debt crisis: Fundamentals, expectations and contagion, Economic Papers 436, European Commission, DG Economic and Financial Affairs.

Attinasi, M.-G., Checherita, C. and Nickel, C. (2009), What explains the surge in euro area sovereign spreads during the financial crisis of 2007-09?, Working Paper 1131, European Central Bank.

Baldacci, E. and Kumar, M. S. (2010), Fiscal deficits, public debt and sovereign bond yields, IMF Working Paper 10/184, IMF.

Barrios, S., Iversen, P., Lewandowska, M. and Setzer, R. (2009), Determinants of intra-euro area government bond spreads during the financial crisis, Economic Papers 388, European Commission, DG Economic and Financial Affairs.

Bask, M. (2012), 'Asset price misalignments and monetary policy', *International Journal of Finance & Economics* **17**(3), 221–41.

Beetsma, R. M. and Jensen, H. (2005), 'Monetary and fiscal policy interactions in a microfounded model of a monetary union', *Journal of International Economics* **67**, 320–352.

Beirne, J. and Fratzscher, M. (2013), 'The pricing of sovereign risk and contagion during the european sovereign debt crisis', *Journal of International Money and Finance* **34**(C), 60–82.

Blanchard, O. and Leigh, D. (2013), Growth forecast errors and fiscal multipliers, Working Paper WP/13/1, International Monetary Fund.

Borgy, V., Laubach, T., Mésonnier, J.-S. and Renne, J.-P. (2012), Fiscal sustainability, default risk and euro area sovereign bond spreads, Document de Travail 350, Banque de France. first version Oct. 2011.

Branch, W. A. and McGough, B. (2009), 'A New Keynesian model with heterogeneous expectations', *Journal of Economic Dynamics and Control* **33**(5), 1036–51.

Codogno, L., Favero, C. and Missale, A. (2003), 'Yield spreads on EMU government bonds', *Economic Policy* **18**(37), 503–532.

Corsetti, G., Kuester, K., Meier, A. and Mueller, G. K. (2012), Sovereign risk, fiscal policy and macroeconomic stability, Working Paper 12/33, International Monetary Fund.

De Grauwe, P. (2012), 'Booms and busts in economic activity: A behavioral explanation', *Journal of Economic Behavior and Organization* . forthcoming.

De Grauwe, P. and Ji, J. (2013), 'Self-fulfilling crises in the eurozone: An empirical test', *Journal of International Money and Finance* **34**, 15–36.

De Grauwe, P. and Ji, Y. (2012), 'Mispricing of sovereign risk and macroeconomic stability in the eurozone', *Journal of Common Market Studies* **50**(6), 866–880.

Edwards, S. (1984), 'Ldc foreign borrowing and default risk: An empirical investigation, 1976-80', *American Economic Review* **74**(4), 726–34.

Evans, G. W. and Honkapohja, S. (2001), *Learning and Expectations in Macroeconomics*, Princeton University Press, Princeton, NJ.

Farmer, R. E. A. (2010), 'How to reduce unemployment: A new policy proposal', *Journal of Monetary Economics* . Carnegie Rochester Conference Series on Public Policy, forthcoming.

Geyer, A., Kossmeier, S. and Pichler, S. (2004), 'Measuring systemic risk in EMU government yield spreads', *Review of Finance* **8**(2), 171–197.

Goodhart, C. and Hofmann, B. (2005), 'The Phillips Curve, the IS curve and monetary transmission: Evidence for the US and the euro area', *CESifo Economic Studies* **51**(4), 757–775.

Haugh, D., Ollivaud, P. and Turner, D. (2009), What drives sovereign risk premiums? An analysis of recent evidence from the euro area, Working Paper 718, OECD Economics Department.

Lengnick, M. and Wohltmann, H.-W. (2013), 'Agent-based financial markets and new keynesian macroeconomics: a synthesis', *Journal of Economic Interaction and Coordination* **8**, 1–32.

Manganelli, S. and Wolswijk, G. (2009), 'What drives spreads in the euro area government bond market?', *Economic Policy* **24**(58), 191–240.

Mayer, E. and Stähler, N. (2013), 'The debt brake: business cycle and welfare consequences of Germany's new fiscal policy rule', *Empirica* **40**, 39–74.

McCallum, B. T. and Nelson, E. (1999), Performance of operational policy rules in an estimated semiclassical structural model, *in* 'Monetary Policy Rules', NBER Chapters, National Bureau of Economic Research, Inc, pp. 15–56.

Metiu, N. (2012), 'Sovereign risk contagion in the eurozone', *Economics Letters* **117**(1), 35–38.

Proaño, C. R. (2011), 'Exchange rate determination, macroeconomic dynamics and stability under heterogeneous behavioral FX expectations', *Journal of Economic Behavior and Organization* **77**(2), 177–88.

Proaño, C. R. (2012), 'Should monetary policy take account of national labor market asymmetries in a currency union?', *Economics Bulletin* **32**(3), 1878–89.

Proaño, C. R. (2013), 'Monetary policy rules and macroeconomic stabilization in small open economies under behavioral FX trading: Insights from numerical simulations', *Manchester School* **81,**(6), 992–1011.

Proaño, C. R. (2013), Macroeconomic risk, fiscal policy rules and aggregate volatility in asymmetric currency unions: A behavioral perspective, IMK Working Paper 129-2013, IMK at the Hans Boeckler Foundation, Macroeconomic Policy Institute.

Rotemberg, J. J. and Woodford, M. (1997), An optimization-based econometric framework for the evaluation of monetary policy, *in* B. S. Bernanke and J. J. Rotemberg, eds, 'NBER macroeconomics annual 1997', MIT Press, Cambridge, MA, pp. 297–346.

Schuknecht, L., von Hagen, J. and Wolswijk, G. (2009), 'Government risk premiums in the bond market: EMU and Canada', *European Journal of Political Economy* **25**(3), 371–384.

Schuknecht, L., von Hagen, J. and Wolswijk, G. (2010), Government bond risk premiums in the EU revisited. The impact of the financial crisis, Working Paper 1152, European Central Bank.

Svensson, L. E. (2003), 'What is wrong with taylor rules? using judgement in monetary policy through targeting rules', *Journal of Economic Literature* **41**, 426–477.

Walsh, C. E. (2010), *Monetary Theory and Policy*, 3rd edn, MIT Press, Cambridge, MA.

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