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German Labor Market and Fiscal Reforms 1999 to 2008: Can They be Blamed for Intra-Euro Area Imbalances?☆

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Abstract

In this paper, we assess the impact of major German structural reforms from 1999 to 2008 on key macroeconomic variables within a two-country monetary union DSGE model. By many, these reforms, especially the *Hartz* reforms on the labor market, are considered to be the root of thereafter observed imbalances in the Euro Area. We find that, in terms of German GDP, consumption, investment and (un)employment, the reforms were a clear success albeit the impact on the German trade balance and the current account was only minor. Most importantly, the rest of the Euro Area benefited from positive spillover effects. Hence, our analysis suggests that the reforms cannot be held responsible for the currently observed macroeconomic imbalances within the Euro Area.

Keywords: Fiscal Policy, Labor Market Reforms, DSGE modeling, Macroeconomics
(JEL: H2, J6, E32, E62)

1. Introduction

At the beginning of the 2000s, Germany was called Europe's "sick man" because of comparatively low GDP growth, relatively high unemployment and low international competitiveness. Nowadays, the German economy is frequently called Europe's (growth) engine. Competitiveness has increased significantly since the beginning of the 2000s, building up high current account surpluses and a positive net foreign asset position. Especially the two latter facts have triggered heated debates about Germany's role for intra-Euro Area imbalances (see, among others, Chen et al., 2012, Hobza and Zeugner, 2014, Kollmann et al., *forthcoming*, as well as the literature and newspaper articles discussed in the latter paper for an overview). Academic literature cannot yet entirely explain these developments, but far-reaching labor market reforms in the first

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decade of the new millennium, the so-called *Hartz* reforms, are often considered as a major factor that dampened wage and consumption growth, thereby boosting German competitiveness and the current account (see Kollmann et al., *forthcoming*, or Busl and Seymen, 2013).[1] However, the *Hartz* reforms were only part of a full array of structural reforms, starting already in 1999 to address Germany's sluggish economic performance since the end of the reunification boom and to meet future challenges for the social security system. These reforms included not only labor market reforms, but also fiscal reforms which changed inter alia the mix of taxes. To grasp the full impact of specifically these policy measures on the evolution of key macroeconomic variables in Germany, this paper offers a comprehensive analysis by means of a structural model.

In detail, we assess the contribution of the major German fiscal and labor market reforms from 1999 to 2008 to the development of key domestic and foreign macroeconomic variables and especially intra-Euro Area imbalances. To this end, we build a two-country monetary union DSGE model with a complex frictional labor market structure and a comprehensive fiscal block which is suited to derive quantitative results. We find that, in terms of German GDP, consumption, investment and (un)employment, the reforms were a clear success. The most important measures for these developments were the *Hartz* reforms, followed by the alleviations in labor taxation and by the decrease in social security contributions combined with increases in consumption taxes. We term the latter reform fiscal devaluation throughout this paper. However, it must be stressed that, by the change in the tax mix, German policy was not primarily aiming at devaluating vis-a-vis the rest of the Euro Area at the time these measures were undertaken.

We find that the reforms in general were not harmful to the rest of the Euro Area. To the contrary, spillovers were positive in terms of output and consumption. The reforms also activated intra-European trade generating higher German exports as a result of its improved competitiveness (which we term "price effect") and higher imports resulting from a positive income effect for Germany (which we term "quantity effect"). Because the price and quantity effect more or less even out, the reform impact on the German current account was only minor. Hence, our analysis suggests that the specific reform agenda cannot be held responsible for the currently observed macroeconomic imbalances within the Euro Area.

The model results further imply that the reforms, especially the *Hartz IV* reform in 2005, reduced real wages and may have contributed to the observed wage moderation since the turn of the millennium.[2] However, the reforms did not have a dampening

[1] Some politicians or authors like Kollmann et al. (*forthcoming*) even conclude that similar reforms may be needed in some rest-of-the-Euro Area economies. To see how serious this argument is taken, notice that the current French president Hollande just recently stated in his mid-term speech on September 18, 2014 that France cannot be expected to do reforms within 5 years for which Germany needed 10 years and, according to him, was facing a better (overall) economic environment.

[2] Dustmann et al. (2014) show that even before the *Hartz* reforms, wages declined and international competitiveness of firms rose in Germany. According to them, this evolution was a result of the "localiza-

effect on consumption because the increase in employment overcompensated the decline in real wages such that disposable income rose. Hence, our conclusion is that the reforms did not cause harmful "beggar-thy-neighbor" effects for Germany's trade partners in the Euro Area, but rather the opposite.

Our paper is related to several studies which analyze the effects of the labor market reforms using a structural equilibrium model with search unemployment. Krause and Uhlig (2012) and Launov and Wälde (2013a) focus on *Hartz IV* only, while Krebs and Scheffel (2013) and Busl and Seymen (2013) also consider the effects of *Hartz III*. All papers focus on domestic effects except for Busl and Seymen (2013) who also analyze the spillover effects of structural (labor market) reforms on the Euro Area. Dao (2013a) analyzes international spillovers of *Hartz IV* within a DSGE model, albeit not with search unemployment.

Regarding the effects on domestic macroeconomic variables, in particular unemployment, our results are in the range of the literature, but at the lower bottom. Different results in the literature have their roots in different assumptions about the magnitude of (i) the decrease of unemployment assistance for long-term unemployed and (ii) the increase in matching efficiency. The evidence in these cases, however, is not clear-cut (see Launov and Wälde, 2013b, and Krebs and Scheffel, 2013). In addition, there is no consensus on the pre-reform steady-state unemployment rate which can also be a driver of results (Busl and Seymen, 2013). Similar to Busl and Seymen (2013) and Dao (2013a) we find positive spillover effects on the rest of the Euro Area. This is in line with the theoretical as well as empirical and theoretical literature on the international effects of labor market reforms (see, among others, Dao, 2013b, Felbermayr et al., 2012, 2013, Gomes et al., 2012, or Schwarzmüller and Stähler, 2013).

Further, our paper is related to the political debate on fiscal devaluations. The Euro crisis and the need of some member countries to regain price competitiveness renewed the interest in the tools of fiscal devaluation because bilateral exchange rates are fixed at parity implying that, generally, they can only be changed if a country exits from the currency union and reintroduces a national currency. Originally, the idea of fiscal devaluation considered subsidizing exports and taxing imports to mimic the relative price change between imports and exports that would otherwise have been induced by a devaluation of the nominal exchange rate. As neither export subsidies nor import taxes can be used by Euro Area member countries to fiscally devalue, the proposed tools are value-added (or consumption) tax increases accompanied by a decrease of social security contributions or labor taxes, respectively.

There is surprisingly little (formal) literature on this topic given the high interest in political circles. Farhi et al. (2014) provide the only formal analysis of fiscal devaluations in a New Keynesian open economy DSGE model. They find that an intended nominal devaluation can be robustly replicated with a small set of fiscal instruments.

tion of industrial relations", i.e. a "decentralization of the wage-setting process from the industry level to the firm level".

As their numerical example for Spain shows, a 10% nominal devaluation would require inter alia an increase of VAT taxes of as much as 7.6 percentage points. Our contribution is to show that, in practice, we should not expect too much from the tool of fiscal devaluation. Similarly, Lipinska and von Thadden (2009) robustly show in a two-country DSGE model that fiscal devaluations generate only small quantitative effects. Engler et al. (2014) show that, if only employers' social security contributions are decreased (instead of employees' and employers' contributions or labor taxes per se), expected effects can be somewhat larger. Considering the example of Germany, which undertook these measures – even though not with the primary purpose to devaluate vis-a-vis the rest of the Euro Area –, we show that effects were indeed relatively modest.

The rest of the paper is organized as follows. Section 2 describes the model and the calibration. In section 3, we present the different exercises and the respective results. Section 4 concludes.

2. The model

The model we use for our analysis is an extension of *FiMod* (Stähler and Thomas, 2012), which is a two-country monetary union DSGE model with frictional labor markets and a fiscal block that includes a wide range of taxes and disaggregation of government spending. Households, firms, policymakers and the external sector interact each period by trading final goods, financial assets and production factors. The extension comes in mainly by including short and long-term unemployment along the lines of Moyen and Stähler (2014) and endogenizing labor market participation, while the remaining model features, especially the international structure, is pretty much in line with the base model.

For what follows, we normalize population size of the entire monetary union to unity, of which $\omega \in (0,1)$ live in Germany, while the remaining $(1-\omega)$ live in the rest of EMU. Throughout the paper, quantity variables will be expressed in per capita terms, unless otherwise indicated. Both regions are modeled analogously, while we allow structural parameters to differ. Hence, we restrict ourselves to explaining the home country in detail only. If the explicit description of the foreign country is necessary, we use asterisks to denote decisions made by the corresponding foreign agents as well as the structural parameters.

2.1. Households

Following Galí et al. (2007), we assume that each country is populated by a share $(1-\mu)$ of Ricardian households who have access to capital markets and, therefore, substitute consumption intertemporally. These households are called optimizers. The remaining share $\mu \in [0,1)$ is considered to be liquidity-constrained in the sense that they consume all their labor income in each period.[3] We call this latter type "*rule-of-thumb*"

[3]This assumption implies that this type of household neither saves, invests nor borrows. Furthermore, we assume that only optimizers own firms. See Andrés et al. (2013) for a model relaxing this strict credit

household (RoT, henceforth). The welfare function of each type of representative household at time $t = 0$ is given by

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t \cdot \left(\frac{\left[c_t^i - h \cdot c_{t-1}^i \right]^{1-\sigma_c} - 1}{1-\sigma_c} + \zeta^l \cdot \frac{{l_t^i}^{1-\sigma_l} - 1}{1-\sigma_l} \right) \right\}, \tag{1}$$

where E_t is the expectations operator conditional on time-t information, c_t^i denotes household consumption of final goods, and the superscripts $i = o, r$ denote optimizing and RoT households, respectively. σ_c is the coefficient of relative risk aversion and h denotes the degree of habit formation in consumption.

Inside each household, its members may be employed in the public sector (denoted by $n_t^{g,i}$), in the private sector (denoted by $n_t^{p,i}$), be unemployed (denoted by u_t^i), or not participate in the labor market (denoted by l_t^i for "leisure"). Households obtain utility from leisure (or home production) of those members not participating in the labor market, where σ_l indicates its curvature and $\zeta^l > 0$ is the corresponding scaling parameter relating it to utility stemming from consumption. Given that we assume that unemployment is split into short and long-term unemployment along the lines of Moyen and Stähler (2014), it holds that $1 = n_t^{g,i} + n_t^{p,i} + u_t^i + l_t^i$, with $u_t^i = u_t^{s,i} + u_t^{l,i}$. The superscripts s and l indicate the fraction of household members being short and long-term unemployed, respectively. As becomes clear below, we will assume full consumption insurance within each household, as in Andolfatto (1996) or Merz (1995).

Households in both countries trade consumption and investment goods as well as international nominal bonds. The consumption and investment baskets, c_t^i and I_t^o, respectively, of a household of type i (only type o for investment) in the home country are given by

$$x_t^i = \left(\frac{x_{At}^i}{\omega + \psi} \right)^{\omega+\psi} \left(\frac{x_{Bt}^i}{1-\omega-\psi} \right)^{1-\omega-\psi},$$

with $x_t^i = \left\{ c_t^i, I_t^o \right\}$, where c_{At}^i, I_{At}^o and c_{Bt}^i, I_{Bt}^o represent consumption/investment demand of goods produced in country Germany (country A) and the rest of EMU (region B), respectively, and ψ is a parameter capturing the degree of home bias in consumption. From now onwards, let $p_{Bt} \equiv P_{Bt}/P_{At}$ denote the *terms of trade*, where P_{At} and P_{Bt} are the *producer price indexes* (PPI) in countries A and B, respectively. Cost minimization by the household then implies $x_{At}^i / x_{Bt}^i = (\omega + \psi) / (1 - \omega - \psi) \cdot p_{Bt}$. Nominal expenditure in consumption and investment goods equal $P_{At} c_{At}^i + P_{Bt} c_{Bt}^i = P_t c_t^i$ and $P_{At} I_{At}^o + P_{Bt} I_{Bt}^o = P_t I_t^o$, respectively, where $P_t = (P_{At})^{\omega+\psi} (P_{Bt})^{1-\omega-\psi}$ is the corresponding *consumer price index* (CPI). Notice that $P_t = P_{At} \cdot p_{Bt}^{1-\omega-\psi}$. Therefore, CPI inflation, $\pi_t \equiv P_t / P_{t-1}$, evolves according to $\pi_t = \pi_{At} \left(p_{Bt} / p_{Bt-1} \right)^{1-\omega-\psi}$, where

constraint by allowing for patient and impatient households in a search labor market environment.

$\pi_{At} \equiv P_{At}/P_{At-1}$ is PPI inflation in country A.

Each household's real labor income (gross of taxes) is given by $w_t^p n_t^{p,i} + w_t^g n_t^{g,i}$, where w_t^p is the real wage paid in the private sector (to be derived later), w_t^g is the real wage of the government sector, and $n_t^{p,i}$ and $n_t^{g,i}$ are the number of type-i household members employed in the private and government sector, respectively. The labor income tax rate is denoted by τ_t^w. Household members who are short-term unemployed receive unemployment benefits κ_t^{Bs}, while long-term unemployed members receive κ_t^{Bl}. Those members not participating in the labor market receive a constant per-period payment κ^{SA}, which can be interpreted as social assistance. τ_t^c denotes the consumption tax rate and T_t^r are lump-sum taxes (or, if negative, subsidies).

Optimizing households can further invest in physical capital, domestic government bonds or international assets. Investments in physical capital k_t^o earn a real rental rate r_t^k, while the capital depreciates at rate δ^k. Returns on physical capital net of depreciation allowances are taxed at rate τ_t^k. Nominal government bonds B_t^o pay a gross nominal interest rate R_t. Finally, D_t^o denote holdings of international nominal bonds, which pay the gross nominal interest rate R_t^{ecb}.[4] Π_t^o are nominal per capita profits generated by firms net of vacancy posting costs. We assume that all firms are owned by the optimizing households and that profits are redistributed in a lump-sum manner. Summarizing, and bearing in mind that RoT households consume all their income each period, the budget constraint of the representative household i in real terms is

$$\begin{aligned}(1+\tau^c)c_t^i + I_t^i + \frac{B_t^i + D_t^i}{P_t} \quad + \quad & T_t^i = \frac{\Pi_t^i}{P_t} + \left((1-\tau^k)r_t^k + \tau^k\delta^k\right)k_{t-1}^i \\ & + \frac{R_{t-1}B_{t-1}^i}{P_t} + \frac{R_{t-1}^{ecb}D_{t-1}^i}{P_t} - \frac{\psi_d}{2}\cdot\left(\frac{D_t^i}{P_t} - \frac{\bar{D}^i}{\bar{P}}\right)^2 \\ & + (1-\tau^w)\left(w_t^p n_t^{p,i} + w_t^g n_t^{g,i}\right) + u_t^{s,i}\kappa_t^{Bs} \\ & + u_t^{l,i}\kappa_t^{Bl} + l_t^i\kappa^{SA},\end{aligned} \tag{2}$$

with $I_t^r = B_t^r = D_t^r = k_t^r = \Pi_t^r = 0\,\forall t$. Taking into account that RoT households do not own physical capital, its law of motion is given by

$$k_t^o = (1-\delta^k)k_{t-1}^o + \left[1 - S\left(I_t^o/I_{t-1}^o\right)\right]I_t^o, \tag{3}$$

where $S\left(I_t^o/I_{t-1}^o\right) = \frac{\kappa_I}{2}\left(I_t^o/I_{t-1}^o - 1\right)^2$ represents investment adjustment costs (see Christiano et al., 2005, for discussion). Maximizing (1) subject to equations (2) and (3)

[4] In order to ensure stationarity of international bond holdings, we follow Schmitt-Grohé and Uribe (2003) and assume that there exist portfolio adjustment costs of the form $\psi_d/2\left(d_t - \bar{d}\right)^2$, with $\psi_d > 0$ and $d_t \equiv D_t/P_t$. Hence, $(-)\,d_t/Y_t$ is the ratio of net foreign debt over output. We assume for simplicity that trading in domestic government bonds and in international bonds is not taxed.

yields standard first-order conditions for optimizing households. These plus the corresponding marginal utility of consumption for RoT households are analogous to those in Stähler and Thomas (2012).

Given the above description, domestic per capita consumption in the home country equals the weighted average of consumption for each household type, i.e. $C_t = (1-\mu)\cdot c_t^o + \mu \cdot c_t^r$. Per capita domestic demand for the home country's and the foreign country's consumption good equals $C_{At} = (1-\mu)\, c_{At}^o + \mu c_{At}^r$ and $C_{Bt} = (1-\mu)\, c_{Bt}^o + \mu c_{Bt}^r$, respectively. For the quantity variables that exclusively concern optimizing households, per capita amounts are given simply by $Z_t = (1-\mu)Z_t^o$, where $Z_t \in \{k_t, B_t/P_t, I_t, D_t, I_{At}, I_{Bt}\}$ and $Z_t^o \in \{k_t^o, B_t^o/P_t, I_t^o, D_t^o, I_{At}^o, I_{Bt}^o\}$. Employment aggregation will be described in the labor market section below.

2.2. Production

The retail and intermediate goods sectors of the economy are similar to Smets and Wouters (2003, 2007) or Christiano et al. (2005), with the exception that labor services are not hired directly from the households but from a sector of firms that produce homogenous labor services in the manner of Christoffel at al. (2009) or de Walque et al. (2009). In this subsection, we focus on the retail and intermediate goods sectors, postponing the description of the labor market to the next subsection.

2.2.1. Final goods producer

There is a measure-ω continuum of firms in the final goods sector, in which firms purchase a variety of differentiated intermediate goods and bundle these into a final good, which is sold under perfect competition. Assuming that the law of one price holds within the union, the price of the home country's final good is the same in both countries, equal to P_{At}. The problem of the representative retail firm reads

$$\max_{\{\tilde{y}_t(j):j\in[0,\omega]\}} P_{At}Y_t - \int_0^\omega P_{At}(j)\tilde{y}_t(j)dj, \tag{4}$$

where

$$Y_t = \left(\int_0^\omega \left(\frac{1}{\omega}\right)^{1/\epsilon} \tilde{y}_t(j)^{(\epsilon-1)/\epsilon} dj\right)^{\epsilon/(\epsilon-1)}, \ \epsilon > 1, \tag{5}$$

is the retailer's production function, $\tilde{y}_t(j)$ is the retailer's demand for each differentiated input $j \in [0,\omega]$, and $P_{At}(j)$ is the nominal price of each input. The standard first-order condition for the problem is given by $\tilde{y}_t(j) = (P_{At}(j)/P_{At})^{-\epsilon}\frac{Y_t}{\omega}$. Combining the latter with (4) and the zero profit condition, we obtain that the producer price index in the home country must equal $P_{At} = \left(\int_0^\omega \frac{1}{\omega} P_{At}(j)^{1-\epsilon} dj\right)^{1/(1-\epsilon)}$. Total demand for each intermediate input equals

$$\omega\tilde{y}_t(j) \equiv y_t(j) = \left(\frac{P_{At}(j)}{P_{At}}\right)^{-\epsilon} Y_t. \tag{6}$$

as there are ω retail firms.

2.2.2. Intermediate goods

Each intermediate goods producer $j \in [0, \omega]$ faces the technology

$$y_t(j) = \epsilon^a \cdot \left(k^g_{t-1}\right)^{\eta} \cdot \left[\tilde{k}_t(j)\right]^{\alpha} \cdot \left[lab_t(j)\right]^{(1-\alpha)}, \tag{7}$$

where $\alpha \in [0, 1]$ is the elasticity of output with respect to private capital, $lab_t(j)$ denotes the demand for labor services, $\tilde{k}_t(j)$ is the demand for capital services and ϵ^a is total factor productivity. k^g_{t-1} is the public capital stock available in period t, which is determined by the government and is assumed to be productivity-enhancing; the parameter $\eta \in [0, 1)$ measures how influential public capital is on private production (see Leeper et al., 2010, and Pappa, 2010, for discussion). Intermediate goods firms acquire labor and capital services in perfectly competitive factor markets at real (CPI-deflated) prices x_t and r^k_t, respectively. Cost minimization subject to (7) implies the factor demand conditions for capital and labor $r^k_t = mc_t \cdot \alpha \cdot y_t(j)/\tilde{k}_t(j)$ and $x_t = mc_t \cdot (1-\alpha) \cdot y_t(j)/lab_t(j)$, where mc_t is the real (CPI-deflated) marginal cost common to all intermediate good producers. The ratios $y_t(j)/\tilde{k}_t(j)$ and $y_t(j)/lab_t(j)$ are equalized across firms because of constant returns to scale in private capital and labor and perfectly competitive input prices.

As is standard in the literature, intermediate goods firms set nominal prices à la Calvo (1983). This implies that a randomly chosen fraction $\theta_P \in [0, 1)$ of firms cannot re-optimize their price in each period. A firm that has the chance to re-optimize its price in period t chooses the nominal price $P_{At}(j)$ that maximizes

$$E_t \sum_{z=0}^{\infty} (\beta\theta_P)^z \frac{\lambda^o_{t+z}}{\lambda^o_t} \left[\frac{P_{At}(j)}{P_{t+z}} - mc_{t+z}\right] y_{t+z}(j), \tag{8}$$

subject to $y_{t+z}(j) = \left(P_{At}(j)/P_{At+z}\right)^{-\epsilon} Y_{t+z}$. The first-order condition is standard implying the law of motion of the price level

$$1 = \theta_P \left(\frac{1}{\pi_{At}}\right)^{1-\epsilon} + (1-\theta_P)\tilde{p}_t^{1-\epsilon}, \tag{9}$$

where $\tilde{p}_t \equiv \tilde{P}_{At}/P_{At}$ is the relative (PPI-deflated) optimal price and $\tilde{P}_{At}$ is the optimal price chosen by all period-t price setters.

2.3. The labor market

Following Christoffel et al. (2009) or de Walque et al. (2009), we assume that labor firms hire workers from the household sector in order to produce homogenous labor services, which they sell to intermediate goods producers at the perfectly competitive price x_t. The production function of each labor firm is linear in the number of hours worked by its employee, which is fixed at the level $\bar{h}$. With N^p_t being the fraction of

the total labor force employed in the private sector, the total per-capita supply of labor services is given by $Lab_t = N_t^P \cdot \bar{h}$. Equilibrium in the market for labor services requires that $\omega Lab_t = \int_0^\omega lab_t(j)dj$.

Using equations (6) and (7) and the fact that the capital-labor ratio is equalized across intermediate goods firms, this yields $Y_t D_t = \epsilon^a \left(k_{t-1}^g\right)^\eta k_{t-1}^\alpha Lab_t^{1-\alpha}$, where $D_t \equiv \int_0^\omega \omega^{-1} \left(P_{At}(j)/P_{At}\right)^{-\epsilon} dj$ is a measure of price dispersion. In what follows, we will specify the matching process, flows in the labor market, private-sector vacancy creation, the corresponding wage determination and labor market participation decisions. Government wages and employment are autonomously chosen by the fiscal authority (see section 2.4).

2.3.1. Matching process and labor market flows

As stated in Section 2.1 already, a household member can be in one of five states: (i) employed in the public sector, (ii) employed in the private sector, (iii) short-term unemployed, (iv) long-term unemployed, or (v) not participating in the labor market. When participating in the labor market, long-term unemployment is the residual state in the sense that a worker whose employment relationship ends and who does not find a job while being short-term unemployed flows into long-term unemployment. All unemployed workers look for job opportunities and only non-participants do not search. We assume that searchers are randomly matched to the private or the public sector.

Denoting total sector-specific per capita employment in period t by $N_t^f = (1-\mu)n_t^{f,o} + \mu n_t^{f,r}$, where $f = p, g$ stands for private and government employment, and the total number of non-participants as $L_t = (1-\mu)l_t^o + \mu l_t^r$, the total economy-wide employment rate is given by $N_t^{tot} = N_t^p + N_t^g$, while the aggregate unemployment rate is given by $U_t = 1 - N_t^{tot} - L_t$. Following Blanchard and Galí (2010), we assume that the hiring round takes place at the beginning of each period, and that new hires start producing immediately. We also assume that workers dismissed at the end of period $t-1$ start searching for a new job at the beginning of period t. Therefore, the pool of searching workers at the beginning of period t is given by

$$\tilde{U}_t = U_{t-1} + s^p N_{t-1}^p + s^g N_{t-1}^g - L_{t-1} = 1 - (1-s^p)N_{t-1}^p - (1-s^g)N_{t-1}^g - L_{t-1},$$

where s^f, with $f = p, g$, represents the constant separation rate in the private (p) and public (g) sector. The matching process is governed by a standard Cobb-Douglas aggregate matching function for each sector $f = p, g$,

$$M_t^f = \kappa_e^f \cdot \left(\tilde{U}_t\right)^{\varphi^f} \cdot \left(v_t^f\right)^{(1-\varphi^f)}, \tag{10}$$

where $\kappa_e^f > 0$ is the sector-specific matching efficiency parameter, $\varphi^f \in (0,1)$ the sector-specific matching elasticity and M_t^f the number of new matches formed in period t resulting from the total number of searchers and the number of sector-specific vacancies

v_t^f. The probability for an unemployed worker to find a job in sector f can thus be stated as $p_t^f = M_t^f / \tilde{U}_t$, while the probability of filling a vacancy is given by $q_t^f = M_t^f / v_t^f$. The law of motion for sector and household type-specific employment rates is therefore given by

$$n_t^{f,i} = \left(1 - s^f\right) \cdot n_{t-1}^{f,i} + p_t^f \cdot \left(u_{t-1}^{s,i} + u_{t-1}^{l,i} + s^p n_{t-1}^{p,i} + s^g n_{t-1}^{g,i}\right). \tag{11}$$

Employment in sector f today is given by yesterday's employment that has not been destroyed plus newly created matches in that sector. Notice that, in contrast to the base model of Stähler and Thomas (2012), employment rates for optimizing and RoT households can differ as we have to take into account potentially different labor market participation rates, l_{t-1}^i, which we will detail in the last subsection of the labor market description. Furthermore, we have to take into account that unemployed workers are now divided into short and long-term unemployment. Following Moyen and Stähler (2014), we assume that, when dismissed, a workers flows into the pool of short-term unemployment. With (a fixed) probability ϑ, workers in this pool become long-term unemployed unless they find a job (which happens at probability p_t^f). ϑ is a fixed policy parameter which may, however, be changed when the government decides to change the entitlement duration for "premium" benefits κ_t^{Bs}. When in the pool of long-term unemployment, a worker only flows out when finding a job at probability p_t^f. This can be summarized by the following two equations:

$$u_t^{s,i} = \left(1 - \vartheta - p_t^p - p_t^g\right) u_{t-1}^{s,i} + s^p n_{t-1}^{p,i} + s^g n_{t-1}^{g,i} \tag{12}$$

$$u_t^{l,i} = \left(1 - p_t^p - p_t^g\right) u_{t-1}^{s,i} + \vartheta u_{t-1}^{s,i}, \tag{13}$$

where we have to bear in mind that $u_t^i = u^{s,i} + u_t^{l,i}$ holds. For further reference, we define $\gamma_t^i = u_t^{s,i} / u_t^i$ as the fraction of short-term unemployment (or premium benefit recipients, respectively) to total unemployment. Aggregation across household types is analogous to the employment aggregation.

2.3.2. Asset value of jobs, wage bargaining and job creation

As is standard in the literature, we assume that firms and workers bargain about their share of the overall match surplus to determine wages. Following Boscá et al. (2009, 2010, 2011), we assume that a union, which takes into account (aggregate) utility of optimizing and RoT households, undertakes the bargaining.[5] Furthermore, we assume staggered bargaining of nominal wages similar to Gertler et al. (2008). This im-

[5] Assuming individual bargaining between each worker with the firm does not change the steady-state results at all. But it (slightly) changes the magnitude of wage evolution across the cycle. This is due to the fact that rule-of-thumb households discount differently. Following Stähler and Thomas (2012), we stick to the union assumption.

plies that, each period, a randomly chosen fraction θ_w of continuing firms cannot renegotiate wages, while a fraction θ_w^n of newly created firms does not bargain over wages and simply pays the average nominal wage of the previous period. Letting $J_t\left(\tilde{W}_t^p\right)$ be the value function of employment for firms that are allowed to bargain over wages and $\Omega_t \equiv (1-\mu)H_t^{o,p}\left(\tilde{W}_t^p\right) + \mu H_t^{r,p}\left(\tilde{W}_t^p\right)$ that of the union, where $H_t^{i,p}\left(\tilde{W}_t^p\right)$ is the corresponding household type-i utility, the Nash problem is given by

$$\max_{\tilde{W}_t^p} \; [\Omega_t]^{\xi} \left[J_t\left(\tilde{W}_t^p\right)\right]^{1-\xi}, \tag{14}$$

where $\xi \in [0,1)$ is the union's bargaining power and $\tilde{W}_t^p$ denotes the nominal wage negotiated in period t. The value function of a firm that renegotiates in that period is given by

$$\begin{aligned} J_t\left(\tilde{W}_t^p\right) &= E_t \sum_{z=0}^{\infty} \left\{ [\beta\cdot(1-s^p)\cdot\theta_w]^z \cdot \frac{\lambda_{t+z}^o}{\lambda_t^o} \cdot \left[\bar{h}\cdot x_{t+z} - (1+\tau_{t+z}^{sc})\cdot \frac{\tilde{W}_t^p}{P_{t+z}} \right] \right\} \\ &\quad + (1-\theta_w)\cdot E_t \sum_{z=1}^{\infty} \left\{ [\beta\cdot(1-s^p)]^z \cdot \theta_w^{z-1} \cdot \frac{\lambda_{t+z}^o}{\lambda_t^o} \cdot J_{t+z}\left(\tilde{W}_{t+z}^p\right) \right\}, \end{aligned} \tag{15}$$

where τ_t^{sc} is the social security contribution rate. The value of the firm is the discounted profit flow in those future states in which it is not allowed to renegotiate plus its continuation value should it have the chance to reoptimize in the next period. For new jobs where firm and worker do not bargain, the nominal wage equals last period's average nominal wage, W_{t-1}^p, and the value of the job equals

$$J_t\left(W_{t-1}^p\right) = J_t\left(\tilde{W}_t^p\right) - E_t \sum_{z=0}^{\infty} \left\{ [\beta\cdot(1-s^p)\cdot\theta_w]^z \cdot \frac{\lambda_{t+z}^o}{\lambda_t^o} \cdot (1+\tau_{t+z}^{sc}) \cdot \frac{W_{t-1}^p - \tilde{W}_t^p}{P_{t+z}} \right\}.$$

The derivation and a more detailed description can be found in Stähler and Thomas (2012). Analogously, we can derive how workers value a match surplus. Since different household types use different stochastic discount factors, we must distinguish between the surplus for an optimizing and a rule-of-thumb household. For a worker belonging to a type-i household, the surplus value of a job in a renegotiating firm is given by

$$\begin{aligned} H_t^{i,p}\left(\tilde{W}_t^p\right) &= E_t \sum_{z=0}^{\infty} \left\{ [\beta\cdot(1-s^p)\cdot\theta_w]^z \cdot \frac{\lambda_{t+z}^i}{\lambda_t^i} \cdot \left[(1-\tau_{t+z}^w)\cdot \frac{\tilde{W}_t^p}{P_{t+z}} - \Xi_{t+z}^{i,p} \right] \right\} \\ &\quad + (1-\theta_w)\cdot E_t \sum_{z=1}^{\infty} \left\{ [\beta\cdot(1-s^p)]^z \cdot \theta_w^{z-1} \cdot \frac{\lambda_{t+z}^i}{\lambda_t^i} \cdot H_{t+z}^{i,p}(\tilde{W}_{t+z}^p) \right\}, \end{aligned} \tag{16}$$

for $i = o, r$, where

$$\begin{aligned}\Xi_t^{i,f} \equiv\ & \gamma_t^i \kappa_t^{Bs} + (1-\gamma_t^i)\kappa_t^{Bl} + \beta(1-s^f)E_t \frac{\lambda_{t+1}^i}{\lambda_t^i}\left\{ p_{t+1}^g H_{t+1}^{i,g} \right. \\ & \left. + p_{t+1}^p \left[(1-\theta_w^n) H_{t+1}^{i,p}\left(\tilde{W}_{t+1}^p\right) + \theta_w^n H_{t+1}^{i,p}\left(W_t^p\right) \right] \right\} \\ & - \beta(1-s^f)E_t \frac{\lambda_{t+1}^i}{\lambda_t^i}\left\{ \vartheta \cdot \gamma_{t+1} \cdot \mathcal{V}_{t+1}^i \right\},\end{aligned} \tag{17}$$

represents the outside option of a type-i worker employed in sector $f = p, g$ at time t. The latter is the sum of the household's average unemployment benefits, $\gamma_t^i \kappa_t^{Bs} + (1-\gamma_t^i)\kappa_t^{Bl}$, the expected value of searching for a job in the following period,[6] and the expected utility difference of of being in the short-term unemployment pool and the long-term unemployment pool (see Moyen and Stähler, 2014, for details on the derivation and a more elaborated description). The latter is given by

$$\mathcal{V}_t^i = \kappa_t^{Bs} - \kappa_t^{Bl} + \beta E_t \frac{\lambda_{t+1}^i}{\lambda_t^i}\left\{ \left(1 - p_{t+1}^p - p_{t+1}^g - \vartheta\right) \mathcal{V}_{t+1}^i \right\}. \tag{18}$$

In new jobs where the wage is not optimally bargained, the surplus value enjoyed by type-i workers is given by

$$H_t^{i,p}\left(W_{t-1}^p\right) = H_t^{i,p}\left(\tilde{W}_t^p\right) + E_t \sum_{z=0}^{\infty} \left\{ \left[\beta \cdot (1-s^p) \cdot \theta_w\right]^z \cdot \frac{\lambda_{t+z}^i}{\lambda_t^i} \cdot (1-\tau_{t+z}^w) \cdot \frac{W_{t-1}^p - \tilde{W}_t^p}{P_{t+z}} \right\}.$$

Note that $H_t^{i,g}$ denotes the surplus value of a government job for a type-i worker. As wages there are autonomously set by the fiscal authority, the asset value function simplifies to

$$H_t^{i,g} = (1-\tau_t^w) w_t^g - \Xi_t^{i,g} + \beta(1-s^g)E_t \left\{ \frac{\lambda_{t+1}^i}{\lambda_t^i} \cdot H_{t+1}^{i,g} \right\}, \tag{19}$$

where w_t^g is the real wage paid by the government. Given the asset value functions of firms and workers, equations (15) to (19), we are now in a position to solve the wage bargaining game (14). The resulting sharing rule is given by

$$\Omega_t = \frac{\xi}{1-\xi} \cdot \frac{E_t \sum_{z=0}^{\infty} \left\{ \left((1-\mu)\frac{\lambda_{t+z}^o}{\lambda_t^o} + \mu \frac{\lambda_{t+z}^r}{\lambda_t^r} \right) \left[\beta(1-s^p)\theta_w\right]^z \frac{(1-\tau_{t+z}^w)}{P_{t+z}} \right\}}{E_t \sum_{z=0}^{\infty} \left\{ \frac{\lambda_{t+z}^o}{\lambda_t^o} \left[\beta(1-s^p)\theta_w\right]^z \frac{(1+\tau_{t+z}^{sc})}{P_{t+z}} \right\}} \cdot J_t\left(\tilde{W}_t^p\right). \tag{20}$$

[6] Notice that we have to take into account that, conditional on landing on a private-sector job ($f = p$), the surplus value for the worker is contingent on whether the firm is allowed to bargain (in which case the worker receives $\tilde{W}_{t+1}^p$) or not (in which case she receives today's average wage, W_t^p).

Solving equation (20) for $\tilde{W}_t^p$ by using the corresponding asset value functions gives the optimal wage bargained in period t. The average real wage in the private sector, $w_t^p \equiv W_t^p / P_t$, hence evolves according to

$$w_t^p = \frac{(1-s^p)N_{t-1}^p}{N_t^p}\left[(1-\theta_w)\tilde{w}_t^p + \theta_w \cdot \frac{w_{t-1}^p}{\pi_t}\right] + \frac{M_t^p}{N_t^p}\left[(1-\theta_w^n)\tilde{w}_t^p + \theta_w^n \cdot \frac{w_{t-1}^p}{\pi_t}\right], \quad (21)$$

where $\tilde{w}_t^p \equiv \tilde{W}_t^p / P_t$ is the real optimally bargained wage and $w_{t-1}^p/\pi_t = W_{t-1}^p/P_t$ is the real value of yesterday's average nominal wage at today's prices. We have also taken into account the fact that new and continuing jobs pay the optimally bargained wage with probabilities $1-\theta_w^n$ and $1-\theta_w$, respectively.

It remains to determine how jobs are created. As is standard in the literature, we assume that opening a vacancy has a real (CPI-deflated) flow cost of κ_v^p. Following Pissarides (2009), we further assume that free entry into the vacancy posting market drives the expected value of a vacancy to zero. Under our assumption of instantaneous hiring, real vacancy posting costs, κ_v^p, must equal the time-t vacancy filling probability, q_t^p, times the expected value of a filled job in period t net of training costs. The latter condition can be expressed as

$$\frac{\kappa_v^p}{q_t^p} = (1-\theta_w^n)\cdot J_t\left(\tilde{W}_t^p\right) + \theta_w^n \cdot J_t\left(W_{t-1}^p\right), \quad (22)$$

where we take into account that the wage of the newly-created job may be optimally bargained with probability $1-\theta_w^n$.

2.3.3. Labor market participation

The labor market equilibrium of the previous subsections was derived taken as given labor market participation. It is endogenous in our model, however. In order to decide whether or not (or how much) to participate in the labor market, the household maximizes (1) subject to the budget constraint, equation (2), and the labor market flows, equations (11) to (13), taking into account that $1 = n_t^{g,i} + n_t^{p,i} + u_t^i + l_t^i$, with $u_t^i = u_t^{s,i} + u_t^{l,i}$ and $\gamma_t^i = u_t^{s,i}/u_t^i$, plus the fact that only a fraction of newly created jobs can bargain over wages. This yields

$$\begin{aligned} \zeta^l \cdot {l_t^i}^{-\sigma_l} \;=\; & \lambda_t^i \Bigg[\gamma_t^i \kappa_t^{Bs} + (1-\gamma_t^i)\kappa_t^{Bl} - \kappa^{SA} + \beta E_t \frac{\lambda_{t+1}^i}{\lambda_t^i}\Big\{p_{t+1}^g H_{t+1}^{i,g} \\ & + p_{t+1}^p\left[(1-\theta_w^n)H_{t+1}^{i,p}\left(\tilde{W}_{t+1}^p\right) + \theta_w^n H_{t+1}^{i,p}\left(W_t^p\right)\right]\Big\}\Bigg], \end{aligned} \quad (23)$$

where use has been made of the fact that $\lambda_t^i \cdot H_{t+1}^{i,p}\left(W_t^p\right)$, $\lambda_t^i \cdot H_{t+1}^{i,p}\left(\tilde{W}_{t+1}^p\right)$ and $\lambda_t^i \cdot H_{t+1}^{i,g}$ are the Lagrangian multipliers for equation (11) conditional on landing in the private or

the public sector.[7] The former further has to be differentiated between whether or not wage bargaining is allowed. Equation (23) itself is actually quite intuitive. It equates the marginal utility of leisure with the expected return of participating in the labor market. The latter consists of unemployment benefits and the expectation value of finding employment. The higher it is, the lower is the non-participation rate. Analogously, the higher social assistance payments for non-participants are, the lower is labor market participation.

2.4. Fiscal authorities

Defining the (CPI-deflated) per capita value of end-of-period government debt as $b_t \equiv B_t/P_t$, we can state that it evolves according to a standard debt accumulation equation,

$$b_t = \frac{R_{t-1}}{\pi_t} b_{t-1} + PD_t,$$

where PD_t denotes real (CPI-deflated) per capita primary deficit. The latter is given by per capita fiscal expenditures minus per capita fiscal revenues,

$$\begin{aligned} PD_t \;=\; & \left[\frac{G_t}{p_{Bt}^{1-\omega-\psi}} + \left(\gamma_t \kappa_t^{Bs} + (1-\gamma_t)\kappa_t^{Bl}\right) U_t + \kappa^{SA} L_t + \kappa_v^g v_t^g\right] \\ & - \Big[(\tau_t^w + \tau_t^{sc})\left[w_t^p N_t^P + w_t^g N_t^g\right] + \tau_t^c C_t \\ & + \tau_t^k (r_t^k - \delta^k) k_{t-1} + (1-\mu) T_t^o + \mu T_t^r\Big], \end{aligned} \tag{24}$$

where G_t denotes per capita government spending in goods and services expressed in PPI terms (hence the correction for the CPI-to-PPI ratio, $P_t/P_{At} = p_{Bt}^{1-\omega-\psi}$). Letting C_t^g and I_t^g denote real per capita public purchases and public investment, respectively, we have the following nominal relationship: $P_{At} G_t = P_{At}\left(C_t^g + I_t^g\right) + (1+\tau_t^{sc}) P_t w_t^g N_t^g$. Dividing by P_{At} and using $P_t/P_{At} = p_{Bt}^{1-\omega-\psi}$, we obtain

$$G_t = C_t^g + I_t^g + \left[(1+\tau_t^{sc}) w_t^g N_t^g\right] p_{Bt}^{1-\omega-\psi}. \tag{25}$$

Given public investment, the stock of public physical capital evolves as follows,

$$k_t^g = (1-\delta^g) k_{t-1}^g + I_t^g, \tag{26}$$

where we assume that the public capital stock depreciates at rate δ^g. To guarantee stationarity of public debt, for *at least* one fiscal instrument $X \in \{\tau^w, \tau^{sc}, \tau^b, \tau^c, \tau^k, C^g, I^g, w^g, N^g, T^o, T^r\}$, the government must follow a fiscal rule of the

[7] See the appendix in Moyen and Stähler (2014) for more formal details on this issue.

form

$$X_t = \bar{X} + \rho_X \left(X_{t-1} - \bar{X}\right) + \left(1 - \rho_X\right) \phi_X \cdot \left(\frac{b_{t-1}}{Y_{t-1}^{tot}} p_{Bt-1}^{1-\omega-\psi} - \omega^b \right) + \epsilon_t^X, \tag{27}$$

in which the coefficient ϕ_X, i.e. fiscal policy's stance on debt deviations from target, is non-zero (positive for revenue instruments, negative for expenditure instruments). ρ_X is a smoothing parameter.

In addition to Stähler and Thomas (2012), we further allow unemployment benefits to be time-varying. To be precise, we assume that unemployment benefits depend on the previous period's net wage, i.e. $\kappa_t^{Bs} = rrs \cdot (1 - \tau_t^w) w_t^p$ and $\kappa_t^{Bl} = rrl \cdot (1 - \tau_t^w) w_t^p$ in line with German (previous) legislation.

2.5. The foreign country block, international linkages and union-wide monetary policy

This section describes important structural relationships corresponding to the foreign country block not yet captured by the previous model description, points out the international linkages via trade in goods and foreign assets, and describes the union-wide monetary policy rule.

2.5.1. The foreign country

The consumption basket of foreign households is given by

$$c_t^{i*} = \left(\frac{c_{At}^{i*}}{\omega - \psi^*} \right)^{\omega - \psi^*} \left(\frac{c_{Bt}^{i*}}{1 - \omega + \psi^*} \right)^{1 - \omega + \psi^*},$$

for $i = o, r$, while ψ^* captures the degree of home bias in foreign households' preferences. The foreign country's investment basket is analogously defined. The corresponding consumer price index in the foreign country (which is used as numeraire by households and firms in that country) is given by $P_t^* = P_{At}^{\omega-\psi^*} P_{Bt}^{1-\omega+\psi^*} = P_{Bt} \left(1/p_{Bt}\right)^{\omega-\psi^*}$. Analogously to the home country, we can then calculate the foreign country's before-VAT consumer price inflation and the corresponding producer price index/inflation.

2.5.2. International linkages

International linkages between the two countries are given by trade in goods and services as well as in international bonds. The home country's net foreign asset position, expressed in terms of PPI, evolves according to

$$d_t = \frac{R_{t-1}^{ecb} \cdot d_{t-1}}{\pi_{At}} + \frac{1 - \omega}{\omega} \left(C_{At}^* + I_{At}^*\right) - p_{Bt} \left(C_{Bt} + I_{Bt}\right), \tag{28}$$

where $(1 - \omega) \left(C_{At}^* + I_{At}^*\right) / \omega$ are real per capita exports and $p_{Bt} \left(C_{Bt} + I_{Bt}\right)$ are real per capita imports. Zero net supply of international bonds implies $\omega d_t + (1 - \omega) p_t^B d_t^* = 0$. Finally, terms of trade $p_{Bt} = P_{Bt}/P_{At}$ evolve according to $p_{Bt} = \left(\pi_{Bt}/\pi_{At}\right) p_{Bt-1}$.

2.5.3. Equilibrium in goods markets and GDP

Market clearing implies that private per capita production in the home and foreign country, Y_t and Y_t^* respectively, is used for private and public consumption as well as private and public investment demand,

$$Y_t = C_{At} + I_{At} + C_t^g + I_t^g + \frac{1-\omega}{\omega}\left(C_{At}^* + I_{At}^*\right), \tag{29}$$

$$Y_t^* = C_{Bt}^* + I_{Bt}^* + C_t^{g*} + I_t^{g*} + \frac{\omega}{1-\omega}\left(C_{Bt} + I_{Bt}\right). \tag{30}$$

Consistent with national accounting, and in line with Stähler and Thomas (2012), each country's GDP is the sum of private-sector production and government production of goods and services. The latter is measured at input costs, that is, by the gross government wage bill. Hence, home and foreign real (PPI-deflated) per capita GDP are thus given by $Y_t^{tot} = Y_t + (1+\tau_t^{sc}) w_t^g N_t^g p_{Bt}^{1-\omega-\psi}$ and $Y_t^{tot,*} = Y_t^* + (1+\tau_t^{sc*}) w_t^{g*} N_t^{g*} p_{Bt}^{-(\omega-\psi^*)}$, respectively.

2.5.4. Monetary authority

We assume that the area-wide monetary authority has its nominal interest rate, R_t^{ecb}, respond to deviations of area-wide after-VAT CPI inflation from its long-run target, $\bar{\pi}$, and to area-wide GDP growth, according to a simple Taylor rule,

$$\frac{R_t^{ecb}}{\bar{R}^{ecb}} = \left(\frac{R_{t-1}^{ecb}}{\bar{R}^{ecb}}\right)^{\rho_R} \left\{ \left[\left(\frac{\pi_t^{\tau^c}}{\bar{\pi}^{\tau^c}}\right)^{\omega} \left(\frac{\pi_t^{\tau^c,*}}{\bar{\pi}^{\tau^c,*}}\right)^{1-\omega} \right]^{\phi_\pi} \left[\left(\frac{Y_t^{tot}}{Y_{t-1}^{tot}}\right)^{\omega} \left(\frac{Y_t^{tot,*}}{Y_{t-1}^{tot,*}}\right)^{1-\omega} \right]^{\phi_y} \right\}^{(1-\rho_R)},$$

where ρ_R is a smoothing parameter, ϕ_π and ϕ_y are the monetary policy's stance on inflation and output growth, respectively. This completes the model description. We now turn to the model calibration.

2.6. Calibration

We calibrate our model to quarterly frequency, where the home country (A) represents the Germany and the foreign country (B) is the rest of the European Monetary Union. For the general calibration strategy, we strongly rely on Stähler and Thomas (2012). This implies that we, first, set some steady-state target values derived from data which we want to be matched by our model. Hence, some parameters will have to be chosen such that the model's deterministic steady state replicates these targets. The remaining parameters are set according to estimates for Germany and the rest of the Euro Area as well as microeconomic evidence. The data we use to calibrate our model is based on a large innovative data set for the Euro Area containing a rich set of quarterly fiscal variables described in more detail in Gadatsch et al. (2014). The primary sources for the various variables are the European System of Accounts (ESA) for the main aggregates and the European Commission for the fiscal variables. Some labor market variables come from OECD data. The size of the home country is set to $\omega = 0.271$, which roughly corresponds to Germany's population share in the EMU. Furthermore, we normalize per-capita GDP and PPI inflation in both countries to one and set the net foreign asset position to zero.[8]

The long-run targets of the data that we want our model to replicate are summarized in Table 1. The parameters choice is summarized in Table 2. For the sake of brevity, the reader is referred to Gadatsch et al. (2014) for a discussion of the estimated values and to Stähler and Thomas (2012) as well as Schwarzmüller and Stähler (2013) for a description of the literature the remaining parameter choices are based on. Given these targets and parameter values, calculating the steady state is analogous to Stähler and Thomas (2012), which also implies that, given the targets, we are able to analytically solve for the model's deterministic steady.

[8]Setting the net foreign asset position to a higher value, for example, to Germany's net foreign asset position in 2013, does not change the results qualitatively.

Table 1: Targeted values

Target	Symbol	Value	
		Germany	Rest of EMU
GDP	$\bar{Y}^{tot}$	1	
PPI inflation	$\bar{\pi}_A = \bar{\pi}_B$	1	
Net foreign assets	$\bar{d} = \bar{d}^*$	0	
(Average) Labor income tax rate	$\bar{\tau}^w$	0.3039	0.2765
VAT rate	$\bar{\tau}^c$	0.1831	0.1960
Social security contribution rate	$\bar{\tau}^{sc}$	0.1667	0.3280
Capital tax rate	$\bar{\tau}^k$	0.2143	0.3158
Rate of non-participants	$\bar{L}$	0.1000	0.0600
Unemployment rate	$\bar{U}$	0.0818	0.0946
Fraction of publ. employment	$fracpub = \frac{\bar{N}^g}{1-\bar{U}}$	0.1278	0.1848
Vacancy filling rate (private)†	$\bar{q}^p$	0.70	
Vacancy filling rate (public)†	$\bar{q}^g$	0.80	
Gov. SS spending	$\omega^G = \bar{G}/\bar{Y}^{tot}$	0.2131	0.2256
Gov. SS purchases	$\omega^{Cg} = \bar{C}^g/\bar{Y}^{tot}$	0.1112	0.1006
Gov. SS investment	$\omega^{Ig} = \bar{I}^g/\bar{Y}^{tot}$	0.0165	0.0277
SS debt-to-annual-GDP ratio	$\omega^b = \bar{p}_B^{1-\omega-\psi}\bar{b}/(4\bar{Y}^{tot})$	0.6000	0.6000
Entitlement duration	ϑ	0.0833	0.0833
Replacement ratio u^s	$rrs = \frac{\bar{\kappa}^{Bs}}{(1-\bar{\tau}^w)\bar{w}}$	0.60	0.59
Replacement ratio u^l	$rrl = \frac{\bar{\kappa}^{Bl}}{(1-\bar{\tau}^w)\bar{w}}$	0.53	0.46
Social assistance ratio	$rrsa = \frac{\bar{\kappa}^{SA}}{(1-\bar{\tau}^w)\bar{w}}$	0.40	0.35

Source: Target values are calculated as in Gadatsch et al. (2014), where the original data comes from the European System of Accounts (ESA) for the main aggregates and the European Commission for the fiscal variables. Replacement ratios are calculated for average wage earners according to OECD data for 2000 as our initial steady state dates at the beginning of the millennium. Labor market targets marked by an † are from Christoffel et al. (2009), who estimate a matching model to European data.

Table 2: Baseline parameter calibration

Target	Symbol	Value	
		Germany	Rest of EMU
Relative size of home country	$\omega; (1-\omega)$	0.271	0.729
Monetary policy			
Interest rate smoothing	ρ_R	0.9	
Stance on inflation	ϕ_π	1.5	
Stance on output gap	ϕ_y	0.5	
Fiscal policy			
Lump-sum tax smoothing	ρ_T	0.01	
Stance on debt (lump-sum tax)	ϕ_T	0.9	
Price stickiness			
Calvo parameter (prices)*	θ_P	0.8150	0.8380
Market power (markup)	ϵ	4	
Trade in internat. bonds			
Risk premium parameter	ψ_d	0.001	
Preferences			
Share of RoT consumers	μ	0.3289	0.4668
Discount rate	β	0.9938	0.9938
Risk aversion	σ_c	2	
Utility of leisure	σ_l	2	
Habits in consumption	h	0.5092	0.7945
Home bias	ψ	0.1689	0.0816
Production			
Private-sector capital depreciation	δ^k	0.025	
Public-sector capital depreciation	δ^g	0.025	
Private-sector capital share in prod.	α	0.333	
Public-sector capital influence in prod.	η	0.0729	0.1029
Adjustment cost parameter	κ_I	4.9396	4.9480
TFP scaling parameter^e	ϵ^a	0.6256	0.6143

Table 2 continued: Baseline parameter calibration

Target	Symbol	Value	
		Germany	Rest of EMU
Labor market			
Matching elasticity (private sector)†	φ^p	0.5	
Matching elasticity (public sector)†	φ^g	0.3	
Separation rate (public sector)†	s^g	0.03	
Separation rate (private sector)†	s^p	0.06	
Bargaining power†	ξ	0.5	
Calvo parameter (wages of existing jobs)*	θ_w	0.8250	0.8320
Calvo parameter (wages of newly created jobs)*	θ_w^n	0.8000	0.8100
Private-sector matching efficiency^e	κ_e^p	0.4844	0.4537
Public-sector sector matching efficiency^e	κ_e^g	0.2813	0.3083
Vacancy posting costs^e	$\kappa_v^p = \kappa_v^g$	0.2309	0.3092

Source: Parameter values based on the *GEAR* model by Gadatsch et al. (2014), which is estimated for Germany and the rest of the Euro Area. The $*$ indicates that, as the *GEAR* model assumes Rotemberg pricing, the Calvo parameter has been transformed along the lines of Ascari et al. (2011) and Ascari and Rossi (2011). All parameters marked by an † are obtained from microeconomic evidence discussed in Stähler and Thomas (2012) and Schwarzmüller and Stähler (2013). Those marked by an *e* are derived endogenously to match the steady-state targets of Table 1.

3. Analysis

3.1. Major German labor market and fiscal reforms 1999 to 2008

In the late 1990s and early 2000s, Germany experienced a period of sluggish economic growth and high unemployment. During this time, it was often called "the sick man of Europe" (Dustmann et al, 2014). Beginning in 1999, Germany enacted several fiscal and labor market reforms to counteract this development, among them the *Hartz* reforms which were probably the most prominent reform packages.

Fiscal reforms included several effective tax changes. Beginning in 1999 until 2003, Germany raised indirect taxes (ecological taxes) and, at the same time, decreased social security contributions in order to decrease the price of labor (Deutscher Bundestag, 1998 and Deutscher Bundestag, 1999). These measures can be interpreted as fiscal devaluations. In 2001, Germany decreased corporate taxes and from 2001 to 2005 labor taxes in order to boost competitiveness, growth and employment (Deutscher Bundestag, 2000). The increase in the value added tax in 2007 was primarily aimed to ensure the stability of public finances (Deutscher Bundestag, 2006). However, since one third of the revenues were used to decrease social security contributions, this measure can also be interpreted as a fiscal devaluation. Finally, in 2008 Germany decreased corporate taxes in order avoid losses in the tax base (Deutscher Bundestag, 2007).

From 2003 to 2005, Germany implemented far reaching labor market reforms, the *Hartz* reforms. For our analysis, we focus on *Hartz III* and *Hartz IV* which were put in place in 2004 and 2005, respectively. The goal of *Hartz III* was to increase the matching efficiency on the labor market by restructuring the Federal Employment Agency. The goal of *Hartz IV* was to increase the incentives for unemployed to search for a job. It comprised (i) a decrease in entitlement duration of unemployment benefits for short-term unemployed (*Arbeitslosengeld I*) and (ii) a merger of unemployment assistance for long-term unemployed (*Arbeitslosenhilfe*) into social welfare assistance (*Sozialhilfe*). The merger led to lower unemployment assistance for long-term unemployed but slightly higher social welfare assistance and was called *Arbeitslosengeld II*.

Table 3: Reform instruments and timing

Year	$d\tau^c$	$d\tau^{sc}_{employee}$	$d\tau^{sc}_{employer}$	$d\tau^w$	$d\tau^k$	$d\kappa^e$	$d\vartheta$	$drrl$
1999	+0.51%	-0.42%	-0.42%					
2000	+0.22%	-0.15%	-0.15%					
2001	+0.23%	-0.15%	-0.15%	-1.59%	-1.08%			
2002	+0.22%	-0.15%	-0.15%					
2003	+0.22%	-0.15%	-0.15%					
2004				-0.75%		+7.00%		
2005				-2.12%			+11.67pp	-8pp
2006								
2007	+1.45%	-0.35%	-0.35%					
2008					-0.64%			

Notes: Table reflects paths of policy parameters resulting from reforms. For tax rate changes, official expected changes in the tax base are taken from the corresponding draft laws (ie Deutscher Bundestag, 1998, 1999, 2000, 2006 and 2007) and transformed into implied tax rate changes using the taxation trends from European Commission (2014). Note that, for the labor income tax rate changes 2001, 2004 and 2005, we take an updated estimation by the German Ministry of Finance (BMF, 2000). Further, the labor tax decrease in 2003 was postponed to 2004 due to the floods in 2002. Social security contributions on the employee's side are captured by changes in τ^w_t in the model, while changes in social security contributions on the employer's side are captured by changes in τ^{sc}_t. The increase in the probability ϑ by about 11 percentage points reflects the fact that average entitlement duration for *Arbeitslosengeld I* is decreased from three years to only one and a half. In addition to reducing the replacement rate *rrl*, we have to take into account that, in the *Hartz IV* reform, *Arbeitslosengeld II* is now independent of previous wages but a fixed amount depending on the initial steady-state wage. Also notice that social assistance, κ^{SA}, is increased accordingly.

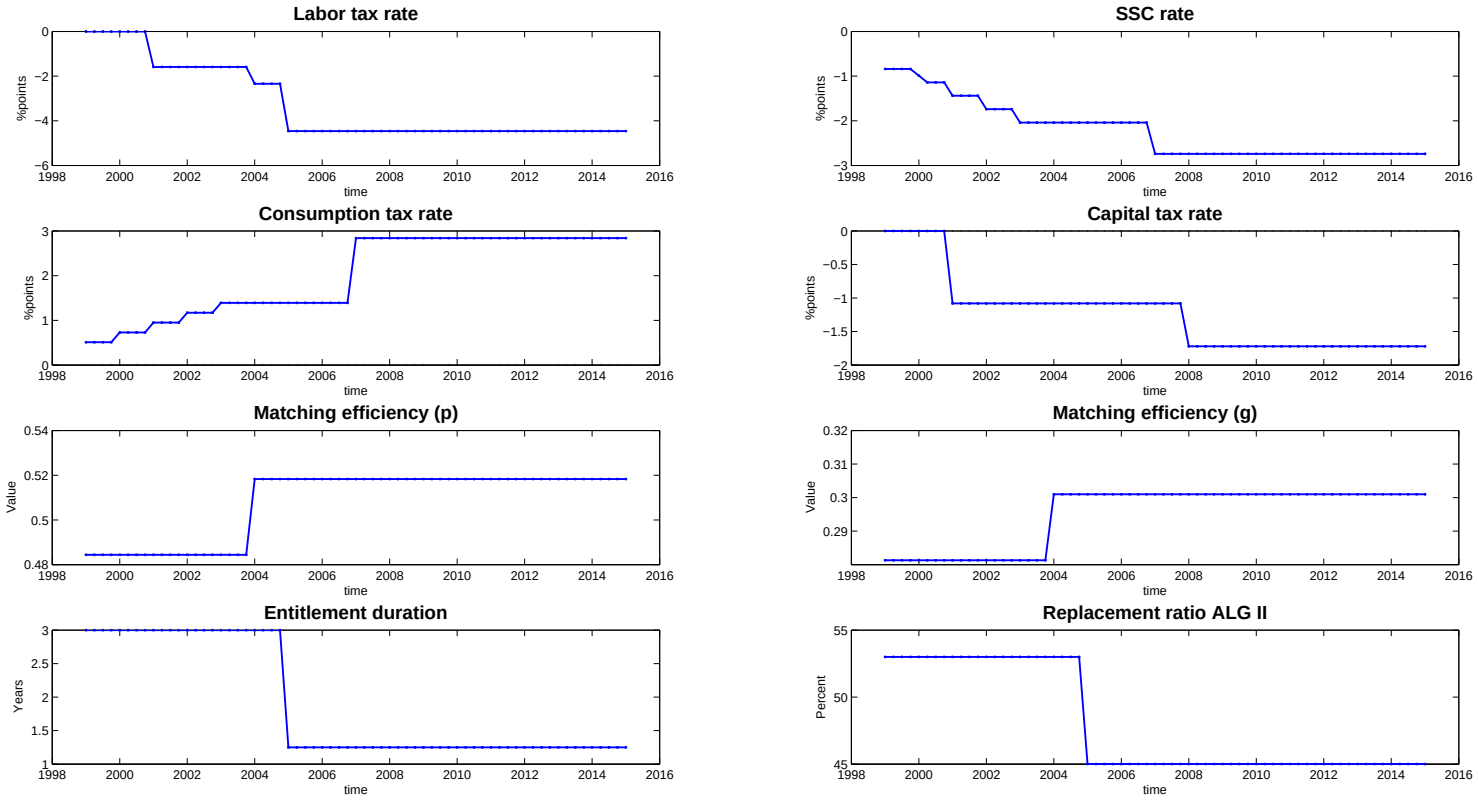
3.2. Model implementation of the fiscal and labor market reforms

To implement the fiscal reforms, we have to identify the associated tax shocks. To this end, we take the official expected changes in the tax base and transform them into changes of the implied tax rate using the implied tax rates published by the European Commission (European Commission, 2014). We feel comfortable with this procedure given that the official expected changes of the tax base normally do not take into account the endogenous reaction of the tax base to the change in the tax rate. The resulting changes can be found in Table 3. In the model, we simulate a corresponding shock path for ϵ_t^X, with $X \in \{\tau^w, \tau^{sc}, \tau^c, \tau^k, \}$ and set $\rho_X = 1$. Note that, by assuming $\rho_X = 1$, the implied changes are of permanent nature and, as this also implies no feedback of debt-deviations from target, the corresponding fiscal rule is switched off for $X \in \{\tau^w, \tau^{sc}, \tau^c, \tau^k, \}$. In order to guarantee stationarity of public debt, we assume that *only* lump-sum taxes levied on optimizers react to such deviations, ie *only* $\phi_{T^o} = 0.01$, with $\rho_{T^o} = 0.9$, while all other fiscal instruments are constant or change as summarized in Table 3. We assume lump-sum taxes to be the only fiscal rule for both, Germany and the rest of EMU, as well as for all simulated scenarios. The advantage of this simulation design is that, as lump-sum taxes levied on optimizers create no further distortions in the model economy, we are able to examine the isolated effects of each measure (or all measures in aggregation) without having to take into account distortionary effects stemming from, for example, the reaction of fiscal rules other than lump-sum taxes. Furthermore, note that, for simulating fiscal devaluations 1999 to 2003 and 2007, social security contributions on the employee's side, $\tau^{sc}_{employee}$, are part of the labor tax rate τ^w_t, while social security contributions on the employer's side, $\tau^{sc}_{employer}$, are captured by τ^{sc}_t in our model.

As regards the labor market reforms, we assume that, following the *Hartz III* reform in 2004, matching efficiency in the public and the private sector, κ^p_e and κ^g_e, respectively, are both permanently increased by 7%. This choice is in line with Krebs and Scheffel (2014) and a conservative choice given the available empirical evidence, provided in their appendix. For the *Hartz IV* reform, we proceed in three steps. First, entitlement duration for *Arbeitslosengeld I* is reduced from three to a bit more than one year.[9] This is reflected by a corresponding increase in the probability ϑ of moving from $u^{s,i}_t$ to $u^{l,i}_t$. Second, the replacement rate of long-term unemployed *rrl* is reduced from 53% to 45% according to OECD data. Furthermore, we have to take into account that, after the *Hartz IV* reform, unemployment assistance for long-term unemployed now is a fixed amount independent of previous wages, such that it $\kappa^{Bl}_t = \bar{\kappa}^{Bl} = rrl \cdot (1 - \bar{\tau}^w)\bar{w}^p \; \forall t$ holds. Finally, unemployment assistance for long-term unemployed was merged into social welfare assistance such that $\bar{\kappa}^{SA} = \bar{\kappa}^{Bl}$. The paths for all policy variables that we feed into the model simulations are visualized in Figure 1.

[9] Entitlement duration for *Arbeitslosengeld I* was generally cut to 12 months. However, elderly workers still face a duration of 18 months. Hence, assuming 15 months can be considered an average.

Figure 1: Paths of policy variables



Notes: Figure plots simulated paths of policy variables in percentage point deviations from initial steady state except for entitlement duration [which shows years] and the replacement ratio of second-pillar benefits [which is shown in percent of average or (steady-state) wages]. The social security contribution rate pools employee's and employer's contributions. Furthermore, we have to take into account merging of unemployment and social assistance after the *Hartz IV* reform (as described in the main text) in the simulation to follow.

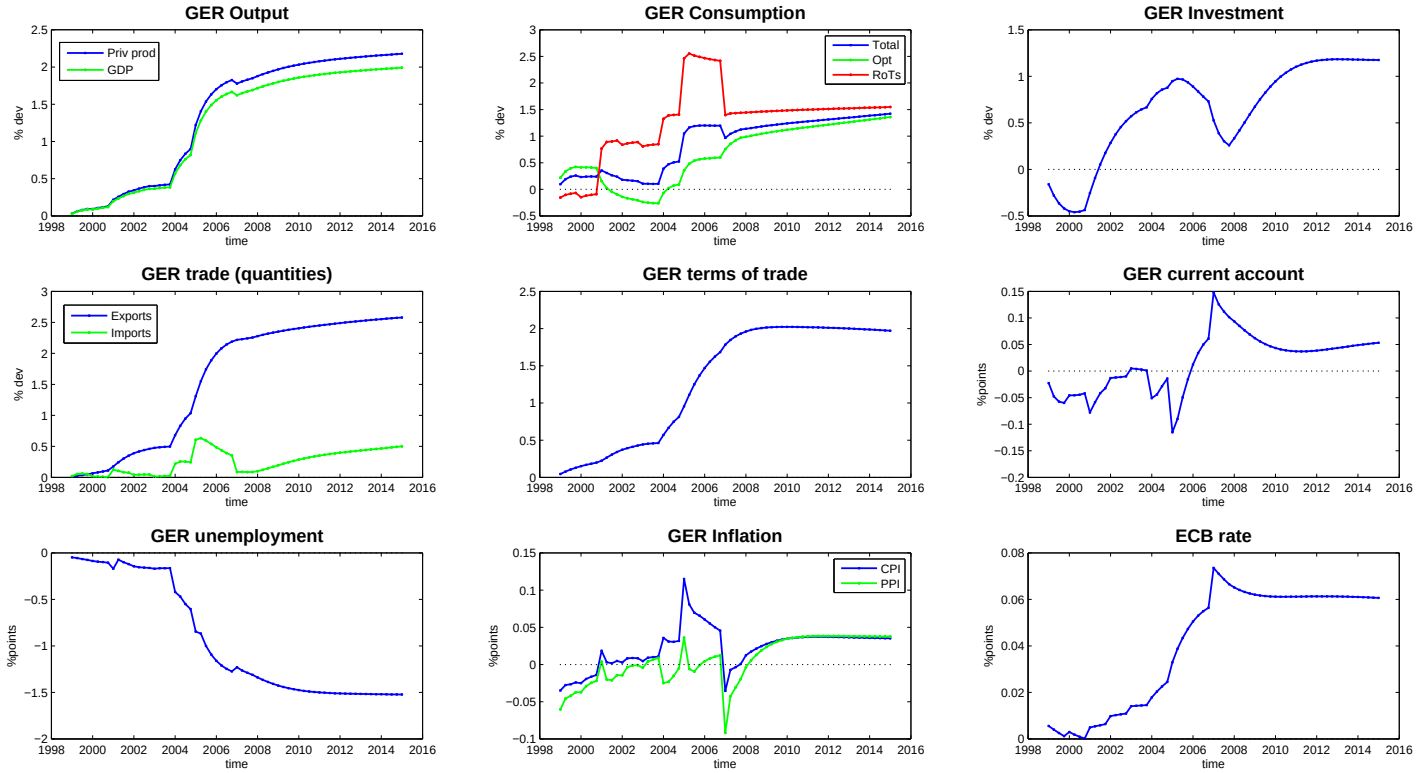
3.3. Results

This section presents the results of simulating the agenda path described in the previous subsection. We will start off by describing the consequences for key macroeconomic variables of the entire agenda before describing in more detail how large each measures's contribution to these developments was.

Figures 2 and 3 show the evolution of selected key macroeconomic variables following the reform agenda for Germany and the rest of the Euro Area, respectively. All deviations are presented in percent to initial steady-state values (percentage point deviations for unemployment, for yearly CPI inflation and interest rates as well as for all ratios).

We observe that the reform agenda had a relatively large impact on German GDP and private production. It slowly but steadily increased German GDP up to roughly 0.8% above its initial steady-state value until 2005. Then, after the *Hartz IV* reforms, we observe a large jump pushing it up to about 2% above its initial steady state in 2015. Hence, the reforms pushed Germany to a higher growth path. Private consumption in Germany increased by about 1.9% until 2015. Total consumption increased in 1999, started falling in 2001, and again rose significantly after 2004 and 2005. Still, total private consumption was always positively affected by the reforms when compared to its initial steady state. There is a notable differences in RoTs' and optimizers' consumption behavior, however. While RoT households decreased consumption when the fiscal devaluation 1999 started, optimizers' consumption increased. This is due to the fact that RoTs are directly affected by the increase in consumption taxes, which makes consumption expenditures more expensive, while optimizers were able bring forward the efficiency gains resulting from the decrease in social security contributions. The decrease in labor taxes in 2001, however, again increased RoT households' disposable income, implying and increase RoTs' consumption. Optimizers knew that their permanent income will decline due to higher lump-sum taxes in the long run. Hence, they started saving for the additional tax burden. Both *Hartz* reforms generated and increase in optimizers' and RoT households' consumption, primarily driven by the significant decrease in unemployment, which, in the end, is about 1.5 percentage points below its initial steady-state level. This boost in employment overcompensated the loss in real wages (not shown here; see Figure 7). The latter was a result of the lower fall-back position due to shorter entitlement duration and lower unemployment assistance payments. Private investment is also about 1.5% higher in 2015 than it was in the initial steady state. The decrease of social security contribution as a result of the fiscal devaluation in 1999 made labor input cheaper. Firms substituted labor for capital, which lowered the incentive for private capital investment. However, the capital tax reform in 2001 changed this, and private investment started rising again. The *Hartz* reforms, again, increased the attractiveness to employ labor instead of capital, while the capital tax reform in 2008 was able to, finally, regain the attractiveness to invest.

Figure 2: Effects of reform agenda on key macro variables (Germany)



Overall, the reforms allowed German firms to decrease producer prices and, hence, fostered international competitiveness, the terms of trade and exports. Higher income in Germany also fostered demand for rest of the Euro Area products implying more imports and an increase in rest of the Euro Area GDP close to about 0.5% compared to its initial steady-state value (see Figure 3). It also encouraged rest of the Euro Area firms to increase producer prices, however. This contributed to the increase in the German terms of trade as the European price increase was a little stronger. The primary impact of German reforms on rest of the Euro Area GDP was in 2004 and 2005 (*Hartz III* and *IV* reforms) and thereafter, which coincides with the jump in private demand in Germany (see Figure 2). Higher output in the rest of the Euro Area was produced by more labor input, which led to a fall in the unemployment rate by roughly 0.6 percentage points in 2015. Higher employment implies higher income, which fostered private consumption. Additionally, as our simulation scenario implies that no reforms were conducted in the rest of the Euro Area, higher output and less unemployment improved the rest of the Euro Area's fiscal position, which is displayed by a decrease in the deficit ratio. In the long run, this allows the government to decrease lump-sum taxes for optimizers permanently. As they are able to smooth consumption intertemporally, they bring forward future income gains to today already, which explains their relatively strong consumption reaction. As producer prices in the rest of the Euro Area increased relatively more, this not only increased consumer prices in the rest of the Euro Area but also in Germany due to higher real imports (which, because of improved terms of trade, became even more expensive in terms of German products). Higher consumer price inflation made the common central bank increase interest rates (see Figure 2).

Our description hitherto hints at the conclusion that both, Germany and the rest of the Euro Area benefited from the reforms undertaken in Germany. In relative terms, however, Germany seems to have benefited more than the rest of the Euro Area, which especially holds for GDP developments (2% in Germany versus 0.5% in the rest of EMU) and, to a lesser extent, for consumption (1.9% versus 1%). This is also visible in the increase in the German terms of trade. The impact on the current account, however, was only relatively small as Figure 2 reveals. This can be explained by the fact that the evolution of the current account entails a price and a quantity effect in the trade balance, the former given by the terms of trade and the latter by the trade quantities; see equation (28). Overall, both effects seem to even out. Hence, the reform agenda cannot be held responsible for the persistent increase in the current account in Germany since 2000. In this respect, our analysis slightly disagrees with Kollmann et al. (*forthcoming*) who find that the *Hartz* reforms had a significant effect on the current account.

Figure 3: Effects of reform agenda on key macro variables (rest of Europe)

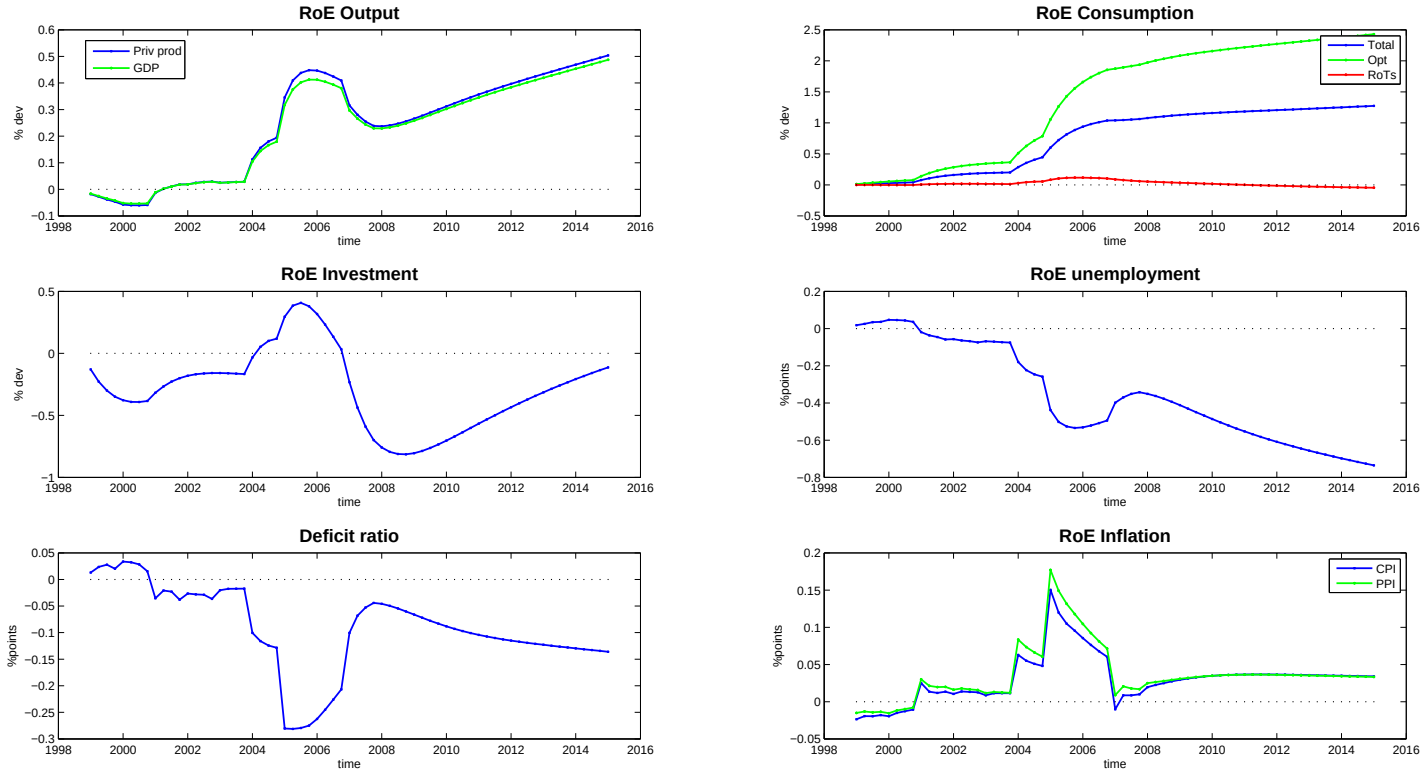
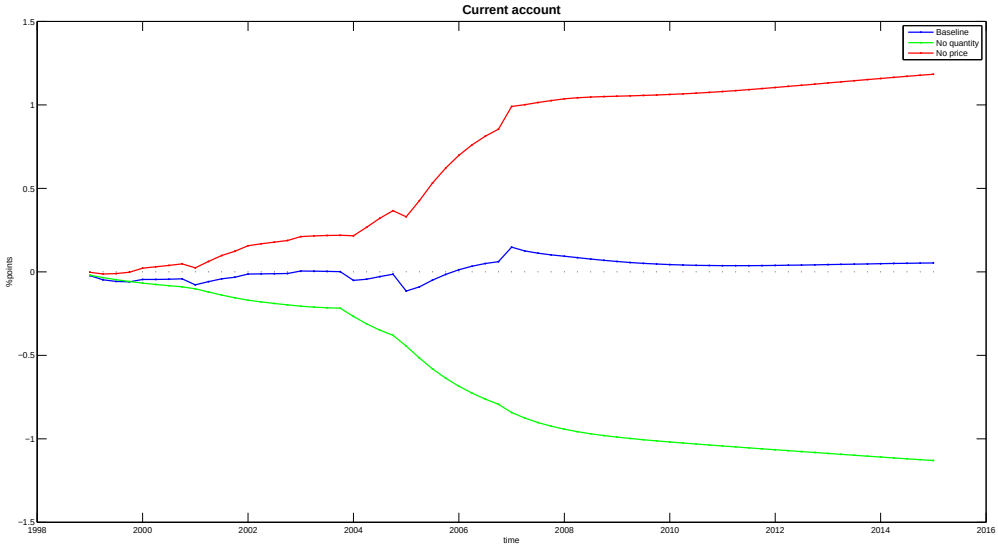


Figure 4 decomposes the impact of the reforms on the German current into price and quantity effects. The red line shows the model-implied evolution of the current account without the price effect, ie assuming the terms of trade, $\bar{p}^B$, to be constant. The green line shows the evolution without quantity effect, ie assuming that imports and exports, $\bar{C}_B + \bar{I}_B$ and $\bar{C}^*_A + \bar{I}^*_A$, are held constant. We see that without price effect, the current account increases, while the opposite is true when ignoring the quantity effect. Our decomposition shows that one needs to identify other reforms or shocks. They must (i.) keep the reaction of the terms of trade low taking as given the model-implied export/import developments and/or (ii.) increase the export-import differential taking as given the model-implied terms of trade effects. Candidates could be higher foreign preferences for German goods or generally lower consumption preferences in Germany. Kollmann et al. (*forthcoming*) also hint at the latter and argue this to be a result of an ageing society. However, the literature does not yet give a clear picture explaining these developments. Our paper contributes to the discussion by showing that the reform agenda – claimed by many to be one of the main drivers – probably only plaid a minor role.

Figure 4: Germany's trade relations



Having described the impact of the entire agenda path, it is now interesting to disentangle how the different measures affected important variables of our model economy. To assess this question, we plot the contribution different reform measures, ie fiscal devaluations 1999 to 2003 and 2007, labor tax reductions 2001, 2004 and 2005, capital tax decreases 2001 and 2008 as well *Hartz III* and *Hartz IV*, respectively, to the development

of selected macro variables (in Figure 5), main international variables (in Figure 6) and labor market variables (in Figure 7).

We observe in Figure 5 that fiscal devaluation starting in 1999 persistently improved German GDP by about 0.2% compared to initial steady state. At the same time, it harmed rest of the Euro Area GDP slightly. As expected, the effect on German exports was persistently positive, and also imports increased due to increased consumption demand described previously already. Average real wages were positively affected by the reform but unemployment still fell (see Figure 7). The reason for this is that decreasing employee's and employer's social security contributions decreased the firms' unit labor costs, directly through a decrease in τ_t^{sc} and indirectly through the bargaining channel by decreasing τ_t^w, see also equation (20). This encouraged firms to employ more workers. Lower (expected) unemployment increased the workers' fall-back position in the bargaining process, which made them demand higher wages. Still, as unit labor costs were lowered, German producers reduced prices, which improved the terms of trade persistently and favored German current account balances; see Figure 6. Prices in the rest of the Euro Area were not affected significantly. These effects are in line with the literature (see, among others, Farhi et al., 2014, Lipińska and von Thadden, 2009, or Stähler and Thomas, 2012, for a further discussion). Fiscal devaluation in 2007, however, had much smaller positive effects in Germany, mainly because the reduction of the social security contributions was relatively less pronounced compared to the increase in the consumption tax rate, which was partly used for debt reductions this time. Hence, the "competitiveness increasing" effect was diminished. The consumption tax rate hike also augmented the drop in German consumption demand and generated a higher negative spillover to the rest of the Euro Area.

The labor tax rate reductions in 2001, 2004 and 2005 had qualitatively analogous effects on German GDP, imports, exports, its competitiveness and unit labor costs for similar reasons. Wages now decreased, however, because net income increased. Regarding the spillovers to the rest of the Euro Area, we now observe that they were exclusively positive driven by higher German demand for foreign products. Rest of the Euro Area GDP persistently increased by 0.1%.

Figure 5: Impact of reform measures on macro variables (disaggregated)

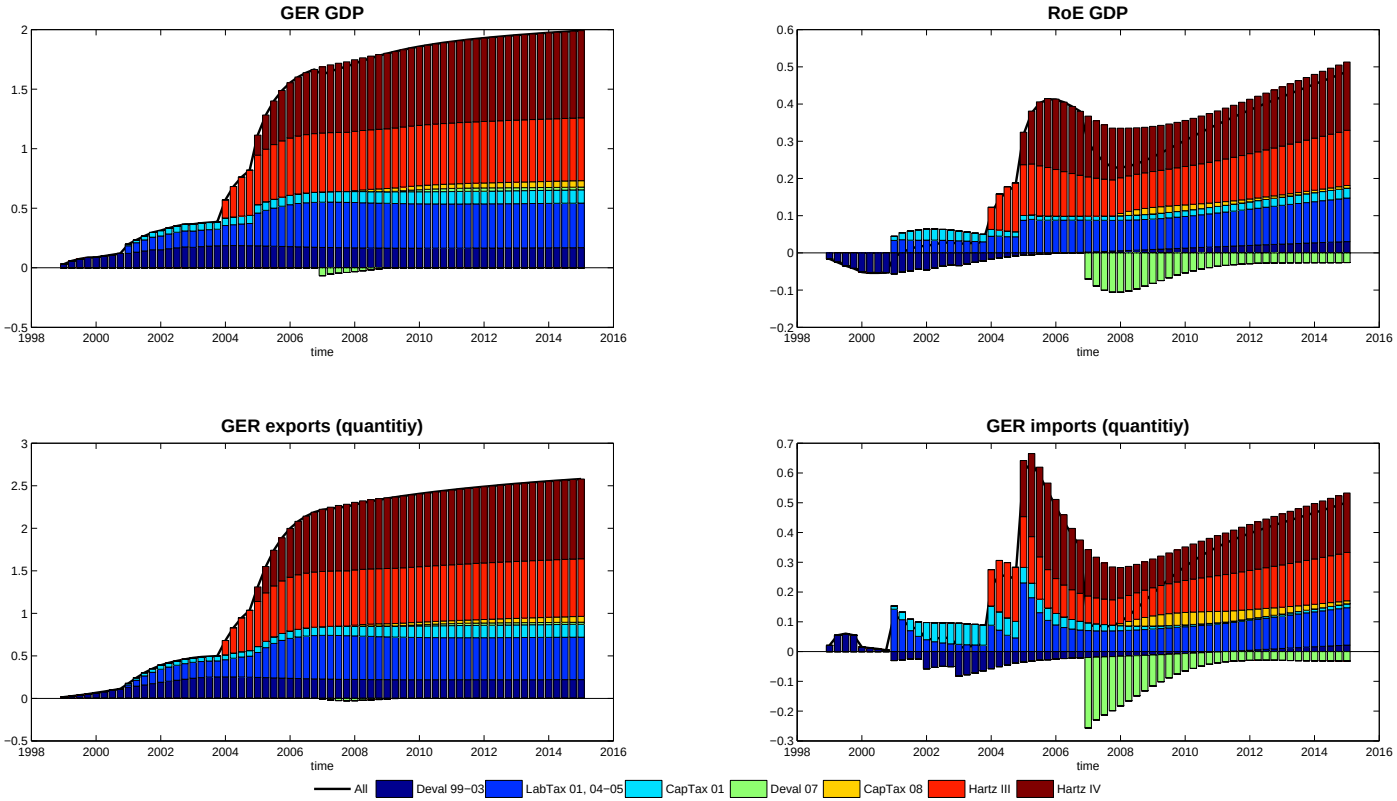


Figure 6: Impact of reform measures on international variables (disaggregated)

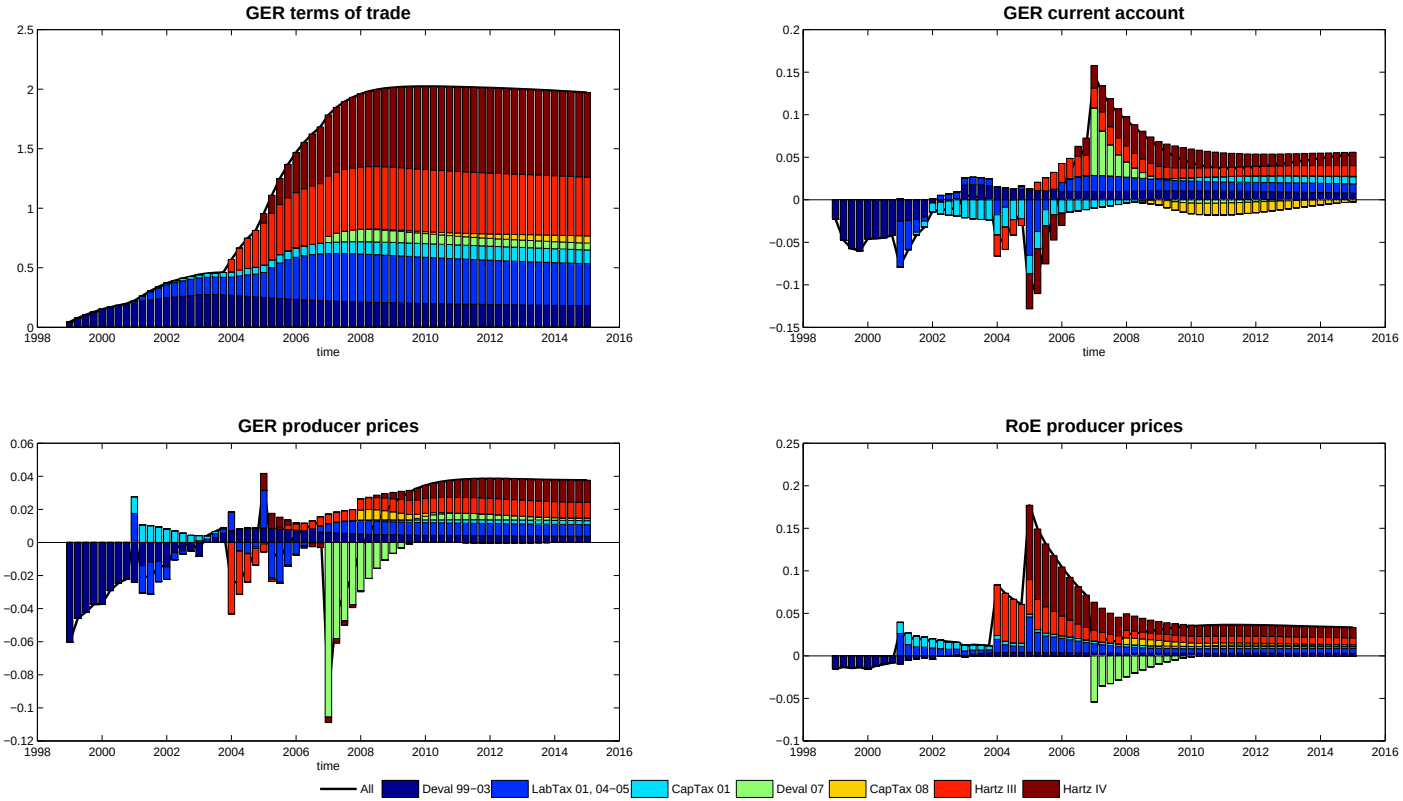
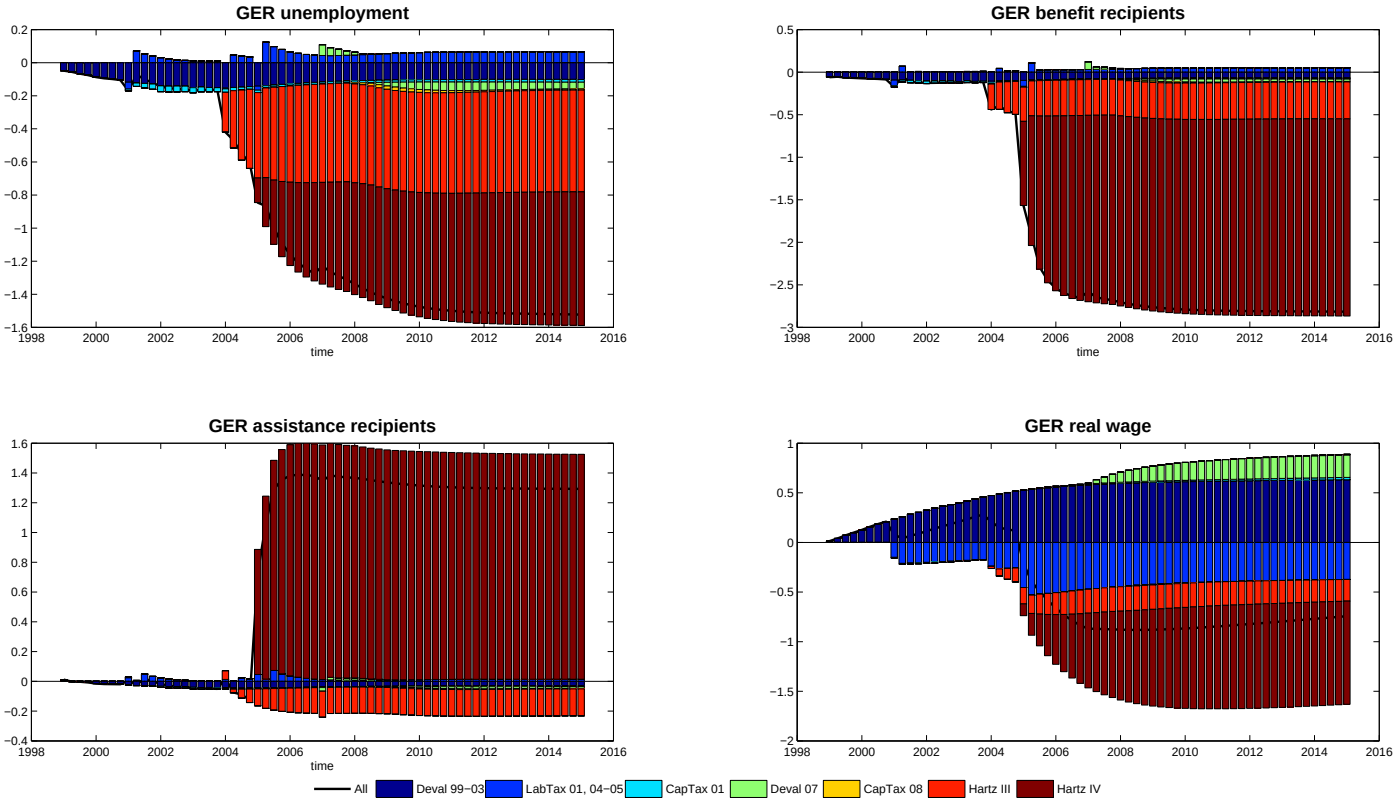


Figure 7: Impact of reform measures on labor variables (disaggregated)



The impact of the fall in capital taxes in 2001 and 2007 was fairly small (see Figures 5 to 7). According to our calibration, the share of capital in production is one third, which implies that, for a decrease in the capital tax rate to have the same effect on GDP, it must be larger than a decrease in the labor tax rate, because production costs of only one third of the inputs are affected. Hence, it does not come as a surprise that an even lower decrease of the capital tax rate as compared to the decrease in labor taxes had much smaller effects.

Turning to the labor market reforms, we observe that *Hartz III* had persistent positive effects on German GDP. The reason is that, because of higher matching efficiency, the labor firms' search costs were decreased. This fostered job creation and made employing workers more attractive. Hence, production increased and unemployment fell. The increased probability of finding a job put upward pressure on wages. But because overall labor costs and the marginal product of labor, represented by x_t in equation (15), decreased, labor firms lost profits per employed worker, which generated a wage-dampening effect. The latter slightly overcompensated the former such that *Hartz III* led to a moderate wage reduction. Still, due to an increase in employment, average income increased, which fostered German demand for domestic and foreign products. The latter incentivized firms to increase prices, both in Germany and the rest of the Euro Area. As the price increases were larger in the rest of the Euro Area, German terms of trade increased. However, because of comparatively small trade balance effects, its current account was hardly affected.

The effects of the *Hartz IV* reform were similar to those of the *Hartz III* reform, qualitatively and quantitatively. The reduction in the entitlement duration increased the fraction of unemployment assistance recipients relative to total unemployment and, therefore, implied a sharp decrease in the aggregate fall-back position of workers. It was further reduced by merging unemployment and social assistance at a lower level than the former unemployment assistance. Naturally, this decreased wages and fostered employment. The fall in unemployment rate by almost one percentage points due to the *Hartz IV* reform is in line with what is found by the literature (see, for example, Krebs and Scheffel, 2013; Krause and Uhlig, 2012, find even higher values using a heterogenous agent model). The higher employment rate clearly overcompensated the fall in per capita wage rate, which becomes evident by inspecting the RoTs' consumption path in Figure 2. Therefore, German demand for home and foreign products significantly increased which made firms in Germany and the rest of the Euro Area increase prices significantly. In contrast to German firms, rest of the Euro Area firms did not face a wage dampening effect resulting in their prices to increase relatively more strongly. Hence, German terms of trade improved significantly. However, given the relatively sharp increase in German imports in combination with the corresponding highly improved terms of trade (which made imported good more valuable expressed in terms of German goods), its current account was merely affected.

4. Conclusions

In this paper, we built a two-country monetary union DSGE model with a complex frictional labor market structure and a comprehensive fiscal block to evaluate the impact of German fiscal and labor market reforms on key domestic and foreign macroeconomic variables and to evaluate how much they have contributed to the observed intra-Euro Area imbalances. By many, mostly the *Hartz* reforms on the labor market are considered to be the root of imbalances in the Euro Area. This paper pursues a comprehensive approach and simulates all major fiscal and labor market reforms from 1999 to 2008.

We find that, in terms of German GDP, consumption, investment and (un)employment, the reforms were a clear success albeit the impact on the German trade balance and the current account was only minor. The most important measures for these developments were the *Hartz* reforms, followed by the alleviations in labor taxation and fiscal devaluation. The rest of the Euro Area mainly benefited from these measures in terms of output and consumption. The reforms also activated intra-European trade including higher German exports as a result of its improved competitiveness (which we term "price effect") and higher imports resulting from a positive income effect (which we term "quantity effect"). Because the price and quantity effect more or less even out, the impact on the German trade balance and its current account was only minor. Hence, our analysis suggests that the reform undertaken cannot be held responsible for the thereafter observed macroeconomic imbalances within the Euro Area.[10]

To explain the persistent German current account surplus one therefore needs to search for and find other arguments. Possible candidates could be higher foreign preferences for German goods or generally lower consumption and higher savings preferences in Germany. The latter could potentially be a result of an ageing society realizing that expected pensions may be lower than previously anticipated (Kollmann et al, *forthcoming*) or of increased income uncertainty because of massive cuts in the generosity of the unemployment benefit system. All that, however, cannot be analyzed in a model which does not explicitly account for the demographic structure of the economy and/or which does not include precautionary savings motives. Overall, the literature is not yet able to give a clear picture explaining these developments and further research in this direction is certainly needed. Our paper contributes to the discussion by showing that not only the *Hartz* reforms, but German fiscal and labor market reforms from 1999 to 2008 in general seemed to have plaid a minor role only.

[10] Andrés et al. (2014) further show that if trade flows do not respond sufficiently to the reform-induced terms-of-trade depreciation because relatively low elasticity of substitution between home and foreign goods in preferences, labor market reforms may actually be contractionary in the short run. Under the assumption of Cobb-Douglas preferences in our model (ie substitution elasticity of 1), it is not possible to perform such a robustness exercise. However, the presence of such effects would even strengthen our result.

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