Global Imbalances, Labor Market Reforms and Precautionary Savings†

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Preliminary and incomplete – comments are more than welcome!

Abstract

We build a two-region RBC model with search friction on the labor market, idiosyncratic consumption risk and limited cross-sectional heterogeneity to evaluate how labor market reforms that reduce the workers’ outside option and, thereby, cut labor costs affect international competitiveness and global imbalances. In line with the literature, we find that decreasing wages augment competitiveness and trade. In addition, we can establish a direct link between the reforms and changes in the net foreign asset position via a precautionary savings channel. Applying the model to simulate far-reaching labor market reforms undertaken in Germany in the early 2000s allows us to explain a substantial share of the observed increase in German net foreign assets. A representative agent framework is not able to reproduce any notable current account effect.

JEL classification: E21, E24, F16, F41.

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1 Introduction

"As they [the Germans] see it, their economy was in the doldrums at the end of the 1990s; they then cut labor costs, gaining a huge competitive advantage, and began running gigantic trade surpluses." (Paul Krugman, October, 2014)

Krugman's quote nicely illustrates the repeated line of reasoning when it comes to the question on how labor market reforms that entail a cut in labor costs affect global imbalances. Even though the German labor market reforms in the early 2000s (Hartz reforms) are often taken as an example, the debate is also highly relevant for other countries which plan on implementing similar reforms. As Bertola and Lo Prete (2015) show empirically, countries that recently deregulated labor markets tend to run current account surpluses. However, theoretical contributions disagree on the existence and magnitude of such a relation. Most open-economy models are capable to link lower labor costs to higher international competitiveness. However, they do not find a link to the consequential – and notable – improvements in the current account and the net foreign assets positions, especially in the long run (see literature review below). This is because most relevant studies use the representative agent framework which requires specific assumptions to ensure steady-state determinacy and stationarity of net foreign assets (see, for example, Schmitt-Grohe and Uribe 2003). However, this implies that net foreign assets always return to their initial steady-state level in the long run. Hence, by definition, even permanent labor market reforms have only limited effects on the net foreign asset position.

Against this background, we build a two-region RBC model with search and matching frictions and incomplete insurance that generates permanent effects in response to permanent policy changes. To be more precise, we extend a model in the spirit of Challe and Ragot (2016) which features limited cross-sectional heterogeneity to a two-region model and incorporate a detailed labor market structure. As stressed by Ragot (2017), this modelling strategy has several advantages: It generates an elastic asset demand curve on the household side, introduces quasi-heterogeneity and still remains analytically tractable. We use the model to quantify the contribution of the far-reaching German labor market reform, Hartz IV, on Germany's current account. In addition, we analyze the spillover effects of this labor market reform on the rest of the Euro Area in terms of aggregate as well as labor market outcomes.

The highly-debated evolution of the German current account since the early 2000s, which increased by almost 9 percentage points until 2016, implies that national savings exceed investments. This fact, in combination with a labor market reform that significantly reduced the generosity of unemployment benefits (Hartz IV), makes the Germany case especially suitable to study the effects of a permanent policy reform on the current account. Precautionary savings may result to be one non-negligible element explaining these developments. In theory, after a reform of the unemployment benefit system, agents would like to increase their savings because risk-averse agents want to smooth consumption over their lifetime. If agents expect a drop in consumption when they become unemployed, resulting to relatively increase due to the reduction in the generosity of unemployment benefit system, they want to insure against this. They can do so by building up savings during their employment spell.
The contribution of our paper is threefold. First, on the theoretical side, we show how to overcome the problem of steady state indeterminacy and non-stationarity of net foreign assets by including a first-order precautionary savings motive. Our extension pins down savings and net foreign assets as well as the economy-wide interest rate endogenously in steady state. While still stylized, our model avoids having to use higher-order solution techniques to obtain an endogenous savings motive or to move to a fully-fledged heterogeneous agent model which restricts the number of state variables significantly. Second, we use our model to evaluate the effects of a structural labor market reform in Germany on the German current account. We show that the existing literature may indeed have underestimated the contribution of these reforms on the current account imbalances significantly. And, third, we contribute to the ongoing discussion on spillover effects of labor market policies. We show that a reduction in labor costs in one region may positively affect production of the other region despite the resulting increase in international competitiveness as well as trade and current account surpluses. However, this may come at the cost of lower private consumption demand.

While the question on the impact of structural labor market reforms on external imbalances has been addressed in the literature before (see Kollmann et al. 2015, Gadatsch et al. 2016b, Baas and Belke 2014 and Bertola and Lo Prete 2015), the discussion on the quantitative effects is still ongoing (see, among others, Dao 2013, Busl and Seymen 2013, Baas and Belke 2014, Kollmann et al. 2015 and Gadatsch et al. 2016b). Still, the current account imbalances that supposedly resulted from the cut in labor costs have repeatedly been criticized in the European Commission’s Macroeconomic Imbalance Procedure (MIP) and by the International Monetary Fund (IMF); see among others Chen et al. (2012), Hobza and Zeugner (2014) and Kollmann et al. (2015).
terest rate. Hence, we do not require additional assumptions to ensure stationarity and determinacy of net foreign assets in steady state (as in Schmitt-Grohe and Uribe 2003). Households who become unemployed face a consumption risk and want to insure against it. They can do so in form of saving in interest-bearing assets. Whenever domestic asset demand exceeds supply, households move to international financial markets.

As an example, we apply our model to evaluate the impact of the German labor market reforms (Hartz reforms) on its current account position. We show that Hartz IV can explain a significant share of the increase in Germany’s net foreign asset. In an analogous representative agent version of our model, the German net foreign asset position remains unchanged in the long run, which illustrates the importance of allowing for a savings motive.

Our analysis also contributes to the discussion whether the Hartz IV reform constituted a beggary-thy-neighbor policy via a cut in labor costs. Our model simulations provide a two-sided answer. On the one side, reducing the generosity of the unemployment insurance system decreases wages, fosters job creation and improves international competitiveness, a finding common to the literature. In a standard RBC model with a representative agent, higher employment now overcompensates for the loss in individual wage income such that, from an aggregate perspective, income, private consumption, private investment (when present) and output in the home country increase. As consumption and investment also entail an import content, this then positively affects the trading partners, too, because the price effect (increase in competitiveness) in general does not overcompensate for the quantity effect (higher private demand).

In our model, the reduction in the generosity of the unemployment insurance system additionally augments precautionary savings in Germany because of the increase in consumption risk related to the employment status. Even though the risk to become unemployed has fallen, the income loss in case of unemployment is disproportionately high. The rise in German savings demand cannot be satisfied domestically, such that Germans invest internationally, augmenting their net foreign asset position. This decreases the world interest rate, especially in the long run. A fall in the world interest rate stimulates firms to use more capital in production such that the capital stock, both in Germany and the rest of the Euro area, increase (this is also where higher savings are then channeled to). After a short recessionary effect on impact, the increase in capital and thus, investment, fosters output in Germany and the rest of the Euro area. In both regions, capital intensity increases but, as a result, the marginal value of employing an additional worker falls. Hence, relative to a standard RBC model, the wage decrease and, thus, the resulting loss from labor income in Germany is larger. Because, in Germany, households experience a labor income loss and increase precautionary savings, they reduce aggregate consumption. This effect also dampens demand for rest of the Euro area products and further depresses income gains there. As the foreign capital stock must also be increased, private consumption in the rest of the Euro area falls, too.

Summarizing, we find that, because of an endogenous world-interest rate driven by elastic savings demand, our model generates a capital investment-driven increase in output, while private consumption falls in both regions after the Hartz reforms. Naturally, this also reduces consumption utility and has negative effects from a welfare perspective.

The rest of the paper proceeds as follows. The next section briefly reviews the related litera-
ture. Section 3 derives a search and matching model with incomplete insurance. We explain the calibration in section 4. Section 5 shows results. We compare our model to the representative agent framework in Section 5.4. Section 6 concludes. An appendix outlines some background on the Hartz reforms and the German current account developments.

2 Related literature [to be extended...]

Our paper is related to several strands of the literature. First, it relates to papers discussing labor market reforms in general, with a special focus on the German Hartz reforms. Second, it relates to the part of the literature that addresses the impact of such reforms on international competitiveness and the current account. And third, it is related to the literature of precautionary savings and the linkages to international asset trade. In what follows, we will discuss this literature in more detail.

Prominent studies focusing on the effects of Hartz IV on German unemployment from a macroeconomic perspective are Krebs and Scheffel (2013), Krause and Uhlig (2012) and Launov and Wälde (2013). Krebs and Scheffel (2013) and Krause and Uhlig (2012) find that decreasing the generosity of the unemployment insurance system reduces wages and unemployment, whereas Launov and Wälde (2013) find only negligible effects. Not specifically related to the German Hartz reforms, Cacciatore et al. (2016) and Cacciatore and Fiori (2016) also find that a cut in unemployment benefits fosters job creation and output. However, these papers are mostly concerned with domestic labor market effects and do not include precautionary savings motives.

Focusing on the effect of labor market reforms on the current account, Kennedy and Slok (2006) argue that a deregulation on the labor market (such as Hartz IV) leads to an immediate fall in prices and wages. Therefore, the trade balance increases immediately. However, in the long run, the capital balance adjusts because the increased profitability of domestic capital leads to an influx of foreign capital. This effect counteracts the increase in net exports and reverses the current account. Bertola and Lo Prete (2015) use the second angle, the savings-investment balance, to argue that deregulations of labor market institutions increase the uninsurable risk of becoming unemployed. This increase in risk leads to higher precautionary savings and has a positive effect on current accounts. Kennedy and Slok (2005) Bertola and Lo Prete (2015) both find a (weak) positive relationship between labor market deregulations on current accounts. Nonetheless, neither of them quantifies the effect of a specific deregulation.

Kollmann et al. (2015), Gadatsch et al. (2016b) and Baas and Belke (2014) try to quantify the effect of Hartz IV on the current account in a state-of-the-art macro model. However, no consensus on the quantitative impact of the Hartz reforms on international imbalances has yet been reached. On the one hand, in an estimated three-region DSGE model, Kollmann et al. (2015) find that the Hartz reforms were indeed one of the main drivers of the German current account surplus. On the other hand, Gadatsch et al. (2016b) show in a model with frictional labor markets that the Hartz reforms had basically no effect on Germany’s built-up of international assets.2

2 While, in their model, German international competitiveness indeed increases after the Hartz reforms, this also augments German income and demand for foreign goods. The price and quantity effects, in the end, even out in the model such that there are basically no current account effects.
Baas and Belke (2014) draw a similar conclusion using a two-country/two-sector DSGE model with search frictions and endogenous job separations. They argue that there is no danger of a *beggar-thy-neighbor-policy* due to the reform. However, all these studies have in common that they use the standard representative agent framework. Given that the flip-side of the current account is the saving-investment balance, in all these models, there is no savings motive.

One of the earliest contributions with a focus on the interaction of savings and the current account is Ghosh and Ostry (1997). They extend the intertemporal approach to the current account (see Obstfeld and Rogoff 1995) and allow for effects of aggregate income shocks on the current account via an external savings channel. Furthermore, there exist several important contributions regarding the effects of precautionary savings on the US current account deficit. Caballero et al. (2008) argue that the reason for the current account imbalance lies in different growth rates of developed economies. Fogli and Perri (2006) argue that the decreased business cycle volatility after the Great Moderation caused the US current account deficit. Mendoza et al. (2009) make the point that different financial market developments across countries constitute a reason for global imbalances and Carroll and Jeanne (2009) endogenize the optimal level of domestic and precautionary wealth which serves to insure against idiosyncratic risk.

3 The Model

We build a two-region RBC model with search frictions on the labor market in the spirit of Pissarides (2000). In each region, there is a continuum of workers on the unit interval who can either be employed or unemployed. Our model features incomplete insurance of idiosyncratic unemployment risk. While employed workers live in a large family and consume and save the same (“perfect insurance”). A worker who becomes unemployed has to leave the family and takes a fair share of the family’s savings with him (a modelling choice building on Challe and Ragot 2016). All unemployed workers receive government-financed unemployment benefits $\kappa_B$ which differ for short and long-term unemployed. When unemployed, workers have to consume their entire savings within $S > 0$ periods. How much of their assets they consume each period arises endogenously.3 If an unemployed worker is hired again, he re-enters the family. In such an environment, there is a true consumption risk related to the employment status that gives rise to precautionary savings without altering much in the standard RBC model.

As is common in the RBC literature, there is a representative firm owned by the family. It uses labor as its sole production input. Firms post vacancies and pay vacancy posting costs $\kappa_\nu$ to hire unemployed workers. Matches between workers and firms are formed through a standard Cobb-Douglas matching function, and wages are determined by Nash-bargaining. The two regions, Home (Germany) and Foreign (the Rest of the Euro Area), trade imperfect substitutable goods on competitive markets in a currency union. Labor is immobile across countries. We model both countries analogously. However, the countries differ by size (with the German population share amounting to 27.1%). We denote Home with subscript $H$ and Foreign with $F$.

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3 While this assumption may seem restrictive, we see below that, when choosing $S$ to be large enough, unemployed workers have virtually spent all their assets before they reach period $S$. Furthermore, using survey data evidence, we observe that unemployed have very little assets left once their unemployment spell approaches one year.
3.1 Households: The family and unemployed workers

As stressed above, all employed workers live in a family. Within the family, all workers pool their earnings consisting of net wage income, firm profits and interest payments on previous asset purchases. Family members make the same consumption and asset holding decision. Independent of the employment status \(i \in \{e, e_{uk}, uu, \}\), where \(k \in K\), employed (e), short-term unemployed for \(k\) periods (\(e_{uk}\)) and long-term unemployed (\(uu\)) workers have CRRA utility with intertemporal risk aversion parameter \(\sigma_e\)

\[
u(e_t^i) = \frac{(e_t^i)^{1-\sigma_e}}{1-\sigma_e}.
\] (3.1)

An employed worker maximizes

\[
V_t^e(c_t^e, a_t) = \max_{\{c_t^e, a_t\}} u(c_t^e) + \beta E_t[1-s(1-\rho_{t+1})]V_{t+1}^e(c_{t+1}^e, a_{t+1}) + s(1-\rho_{t+1})V_{t+1}^{e_{uk}}(c_{t+1}^e)\] (3.2)

each period \(t\), where \(c_t^e\) is real per-capita consumption of a family member and \(a_t\) are par-capita assets/bonds that pay gross interest \(r_t^w\). If the worker is separated, which happens at the exogenously given probability \(s\), and is not immediately re-hired, which happens at the endogenous job-finding rate \(\rho_t\), he has to leave the family and faces utility of being unemployed (for one period), \(V_{t+1}^{e_{uk}}\). As we will see below, he subsequently moves to states \(V_t^{e_{u_1}}, ..., V_t^{e_{u_k}}, V_{t+1}^{uu}\) if he is not re-hired during the process.

In real terms, the family member is subject to the following per-period budget constraint:

\[
c_t^e + a_t + \bar{r} = (1-\tau_t^w)\omega_t + \frac{\Pi_t}{N_t} + \frac{R_{t-1}^w a_{t-1}}{1+\pi_t} + \rho_t \sum_{k=1}^{N_t} (\mu_t^{e_{u_k}} r_t^{e_{u_k}}) \frac{R_{t-k}^{w} a_{t-k}}{1+\pi_{t-k}}.
\] (3.3)

Consumption, \(c_t^e\), and asset purchases, \(a_t\), as well as a lump-sum tax, \(\bar{r}\), have to be financed by the wage income, \(\omega_t\), which is subject to a labor income tax at rate \(\tau_t^w\), firm profits, \(\Pi_t\), divided by the number of family members, \(N_t\), and interest payments on assets \(R_{t-1}^w a_{t-1}/(1+\pi_t)\). In addition, each family member takes into account that workers who lost their job in some previous periods may find a job and return to the family. In that case, they bring the share of assets they have not yet consumed back to the family (of which the individual family member then receives a share \(1/N_t\)). This corresponds to the last term on the right-hand side of equation 3.3, where \(r_t^{e_{u_k}}\) defines the remaining share of assets a worker being unemployed in state \(k\) brings back the family when re-hired (ie the “rest” of the assets he has left the family with). It holds that \(r_t^{e_{u_k}} = (1-\theta_{t-1}^{1-1}) \) and \(r_t^{e_{u_k}} = r_t^{e_{u_{k-1}}} - \theta_t^{k} \), where \(\theta_t^{k}\) is the share of assets consumed in unemployment state \(k\).\(^4\) Note that the maximization problem of the family head is the maximization of an employed worker multiplied by the number of family members \(N_t\). In addition, the family head takes into account that some members become unemployed in the next period and take their assets with them.

Taking first order conditions of 3.2 subject to 3.3 with respect to consumption \(c_t^e\) and assets

\(^4\) Remember that unemployed workers in period \(S\) do not have any assets left at the time they would return to the family. Hence, the sum only goes to \(S - 1\).
\( a_t \) results in the family member’s marginal utility of consumption and optimal asset holdings choice given by

\[
\lambda^e_t = (c^e_t)^{-\sigma_e}
\]  

(3.4)

and

\[
\Omega_t = \frac{1}{R^{W_t}} = \beta E_t \left[ \left( 1 - \sigma(1 - \rho_{t+1}) \right) \frac{\lambda^e_{t+1}}{\lambda^e_t} \left( \frac{1}{1 + \pi_t} + \sum_{k=1}^{S-1} \beta^{k-1} \frac{\lambda^e_{t+k} \rho_{t+k} \mu^{e_k}_{t+k-1} \sigma^{e_k}_{t+k}}{1 + \pi_{t+k}} \right) \right] + s(1 - \rho_{t+1}) \left( \sum_{k=1}^{S} \frac{r^{e_k}_{t+k}}{1 + \pi_{t+k}} \right),
\]

(3.5)

where \( r^{e_k}_{t+k} = \theta^{k}_{t+k}/(1 + \pi_{t+k}) + \beta (1 - \rho_{t+k}) \lambda^{e_{u+k}}_{t+k} / \lambda^{e_k}_{t+1} \) as long as \( k < S \) and \( r^{e_k}_{t+S} = \theta^{S}_{t+S} / (1 + \pi_{t+S}) \). Equation 3.5 is the Euler equation in our setting. In the standard representative agent framework, all but the first term on the right-hand side would be zero, boiling down to the standard Euler equation. When taking the precautionary savings motive into account, \( \Omega_t \) is now the stochastic discount factor from period \( t \) to the next, and \( \lambda^e_t \) equals the marginal utility of consumption of an employed worker. The family members take into account that workers who are unemployed today may find a job in the next period and bring assets back to the family. This results in the second term on the right-hand side of equation 3.5. Furthermore, an employed worker also considers that all short-term unemployed workers who live off their savings in period \( k \) after dismissal derive some marginal utility \( \lambda^{e_{u+k}} \), resulting in the last term of equation 3.5.

As we aim at analyzing the German Hartz reforms as an exemplary case study, we need to match the basic institutional settings of the German unemployment insurance system. Hence, we distinguish between short and long-term unemployed workers. Short-term unemployed workers in unemployment state \( k \) receive a more generous unemployment benefits payment \( \kappa^{BS}_t = r s (1 - \sigma_{t-k}) u_{t-k} \), where \( r s \) is the replacement rate related to their net wage income in their last period of being employed. In the pre-Hartz reform steady state, unemployed workers move short to long-term unemployment after \( K \) periods. When this happens, they receive an analogous payment \( \kappa^{BS}_t \), with the that the replacement rate is lower, \( r s < r s \). In period \( t \) the maximization problem of a short-term unemployed worker in state \( k \in \{1, \ldots, K - 1\} \) is given by

\[
V^{e_{u+k}}_t(c^e_t, c^{e_k}_t, \theta^e_t, \theta^k_t) = \max_{\{c^e_t, c^{e_k}_t, \theta^e_t, \theta^k_t\}} u(c^e_t, c^{e_k}_t) + \beta E_t [\rho_{t+1} V^{e_{u+k+1}}_{t+1}(c^e_{t+1}, \theta^e_{t+1}, \theta^k_{t+1}) + \sigma^{e_{u+k+1}}_{t+1} \theta^e_{t+1}]
\]

(3.6)

while, in the \( K^{th} \) state, the maximization problem reads,

\[
V^{e_{u,K}}_t(c^e_t, c^{e_K}_t, \theta^e_t, \theta^K_t) = \max_{\{c^e_t, c^{e_K}_t, \theta^e_t, \theta^K_t\}} u(c^e_t, c^{e_K}_t) + \beta E_t [\rho_{t+1} V^{e_{u+1}}_{t+1}(c^e_{t+1}, \theta^e_{t+1}) + \sigma^{e_{u+1}}_{t+1} \theta^e_{t+1}]
\]

(3.7)
All short-term unemployed workers face the budget constraint

\[ c_t^{e u, k} + \bar{t} = \kappa^{B S_t} + \theta^k R^{W}_{t-1} \frac{a_{t-k}}{\pi_t}. \]  

(3.8)

The maximization problem for a long-term unemployed worker is given by

\[ V^{u u}(c_t^{u u}) = \max_{\{c_t^{u u}\}} u(c_t^{u u}) + \beta E_t[\rho_{t+1} V^{e u}_{t+1}(c_{t+1}^{e}, a_{t+1}) + (1 - \rho_{t+1}) V^{u u}_{t+1}(c_t^{u u})] \]  

(3.9)

subject to

\[ c_t^{u u} + \bar{t} = \kappa^{B L_k}. \]  

(3.10)

Short-term unemployed workers in \( k \) consume a share \( \theta^k_t \) of their assets each period. However, after \( S \) periods, all assets are spent. Therefore, long-term unemployed workers only have the (less generous) unemployment benefits left to use for consumption for \( S < K \) (which we assume to hold). Maximization of 3.6, 3.7 and 3.9 subject to 3.8 and 3.10 respectively, results in the corresponding marginal utilities of consumption for unemployed workers \( i \in \{e, e u, u u\} \):

\[ \lambda_t^i = (c_t^i)^{-\sigma_c}. \]  

(3.11)

Furthermore, short-term unemployed workers decide each period which share \( \theta^k_t \) of their assets they consume.\(^5\) Since all assets have to be consumed within \( S \) periods, it holds that \( \sum_{k=1}^{S} \theta^k_{t-S+k} = 1 \). The first-order conditions with respect to any \( \theta^k_t \) are given by:

\[ \lambda_{t}^{e u} = \beta \rho_{t+1} \lambda_{t+1}^{e} \frac{\rho_{t+1}}{N_{t+1}} \mu_{t}^{e u} + \beta (1 - \rho_{t+1}) \lambda_{t+1}^{u u}. \]  

(3.12)

3.2 Production

The representative firm faces the Cobb-Douglas production function \( y_t = e^{prod_t} k_{t-1}^{a} N_{t}^{1-a} \) with input factors capital \( k_{t-1} \) and labor \( N_t \). Productivity \( e^{prod_t} \) follows an AR(1)-process.

The firm maximizes profits \( \Pi_t \) by choosing the level of investment \( I_t \), employment \( N_t \) and the number of vacancies \( V_t \). Therefore, the maximization problem reads

\[ \Pi_t = \max_{\{k_{t+1}, N_t, V_t\}} E_t \sum_{t=0}^{\infty} \Omega_t \frac{P_t}{P_i} Y_t - \omega_t N_t - \kappa^{u} V_t - I_t \]  

(3.13)

subject to the law of motion for employment and capital

\[ N_t = (1 - s) N_{t-1} + q_t V_{t-1}. \]  

(3.14)

\[ k_t = (1 - \delta) k_{t-1} + I_t. \]  

(3.15)

\( q_t \) denotes the vacancy-filling probability, derived in the next subsection, and real vacancy post-

\(^5\) This corresponds to the basic cake-eating problem of Gale (1967) where, in our context, the cake is the value of assets with which a recently unemployed worker leaves the family.
ing costs are given by $k^\nu$. Since firms belong to the family, they discount the future with the family’s discount factor $\Omega_t$.

Taking first-order conditions of 3.13 subject to 3.14 and 3.15 with respect to $k_t$, $N_t$ and $V_t$, results in the firm’s optimality conditions (in real terms):

$$R^t = \alpha \frac{p_t}{P_t} e^{prod} \left( \frac{N_{t+1}}{k_t} \right)^{1-\alpha} + 1 - \delta \quad (3.16)$$

$$J_t = \frac{p_t}{P_t} e^{prod} (1-\alpha) \left( \frac{k_{t-1}}{N_t} \right) - \omega_t + E_t \{\Omega_t (1-s) J_{t+1}\}, \quad (3.17)$$

where $p_t$ corresponds to the producer price index, $P_t$ denotes the consumer price index (both to be derived later), and use has been made of the fact that $\Omega_t = 1/R^t$ in equilibrium. Equation 3.16 corresponds to the marginal value of an additional employed worker. The job-creation condition is given by

$$\frac{k^\nu}{q_t} = J_t. \quad (3.18)$$

### 3.3 Matching and Wage Bargaining

The following section describes the modelling of the labor market block in our model. We follow Blanchard and Galí (2010) and allow for immediate rehiring.

#### 3.3.1 Matching and Worker Flows

Matches between workers and firms are established via a constant-return Cobb-Douglas matching function,

$$M_t = \kappa^e U^\eta_t V^{1-\eta}_t \quad (3.19)$$

where the total number of searching workers (who enter the matching function) is given by $U_t = 1 - (1-s)N_{t-1}$. The firm’s vacancy filling rate is given by the ratio of matches over vacancies, $q_t = M_t/V_t$, and, from the worker’s perspective, the probability of finding a job is defined as $\rho_t = M_t/U_t$. The resulting employment-law-of-motion is given by

$$N_t = (1-s)N_{t-1} + M_t \quad (3.20)$$

Note that, due to immediate rehiring, the number of searching worker exceeds the total number of unemployed workers in one period. Unemployment is, thus, given by

$$u_t = 1 - N_t = \sum_{k=1}^{K} \mu^e u_k + \mu^u u$$

The number of unemployed workers in their first period of unemployment (who were not immediately rehired) is given by $\mu^e u = s(1-\rho_t)N_{t-1}$. The number of short-term unemployed workers in subsequent states is then determined by the those unemployed workers who did not find a job
in the previous period, i.e. \( \mu^{e_{u,k}}_t = (1 - \rho_t)\mu^{e_{u,k-1}}_t \). The number of long-term unemployed workers is \( \mu^{u_{u}}_t = (1 - \rho_t)\mu^{u_{u}}_{t-1} + \mu^{e_{u,K}}_{t-1} \).

### 3.3.2 Workers Marginal Value [to be updated to states \( k \)]

In order to calculate the Nash-bargained wage, we need to derive the worker’s marginal value of employment. It depends on whether she is part of the family or unemployed. The marginal value of an employed worker can be derived by taking the first-order condition of the family’s value function subject to the family’s budget constraint with respect to the level of employment \( N_t \). This yields

\[
\psi^e_t = \frac{u(c^e_t)}{\lambda^e_t} - \left[ c^e_t + a_t + \tau_t - (1 - \pi^u_t)\omega_t \right] - \beta E_t \left[ \lambda^{e_{t+1}}_t (1 - s(1 - \rho_{t+1})) \frac{R^w_t}{1 + \pi_{t-1}} \right] \\
+ \beta E_t \left[ \lambda^{e_{t+1}}_t (1 - s(1 - \rho_{t+1})) \psi^e_{t+1}^u + \lambda^{e_{u_k}}_t \rho_{t+1} \psi^e_{t+1} \right]
\] (3.22)

Hence, every employed worker adds utility \( \frac{u(c^e_t)}{\lambda^e_t} \) to the family. In addition, every family member contributes labor income and returns to their share of assets to the family (taking into account that some members become unemployed and leave with their savings). Furthermore, every employed worker consumes, saves and pays taxes. If the family member is still employed in the next period, the gain for the family is \( \psi^e_{t+1} \), however, with probability \( s(1 - \rho_{t+1}) \), the member has to leave the family because she becomes unemployed. In this case, there is an expected utility gain for the family of \( \psi^e_{t+1}^u \).

The marginal values of a short-term unemployed up to \( k \in \{1, ..., K - 1\} \) is given by

\[
\psi^e_t^{u_{u_k}} = \frac{u(c^e_t^{u_{u_k}})}{\lambda^e_t^{u_{u_k}}} + \beta E_t \left[ \frac{\lambda^{e_{u_{k+1}}}_t}{\lambda^e_t} \psi^e_{t+1}^{u_{u_{k+1}}} + \frac{\lambda^{e_{t+1}}_t}{\lambda^e_t} \rho_{t+1} \psi^e_{t+1} \right]
\] (3.23)

A short-term unemployed worker in period \( K \) generates the following marginal utility of working:

\[
\psi^e_t^{u_{u_K}} = \frac{u(c^e_t^{u_{u_K}})}{\lambda^e_t^{u_{u_K}}} + \beta E_t \left[ \frac{\lambda^{u_{u_K}}_t}{\lambda^{e_{u_K}}_t} \psi^e_{t+1}^{u_{u_K}} + \frac{\lambda^{e_{t+1}}_t}{\lambda^e_t} \rho_{t+1} \psi^e_{t+1} \right]
\] (3.24)

For the long-term unemployed worker, the utility value is given by

\[
\psi^e_t^{u_{u}} = \frac{u(c^e_t^{u_{u}})}{\lambda^e_t^{u_{u}}} + \beta E_t \left[ \frac{\lambda^{u_{u}}_t}{\lambda^{e_{u}}_t} \psi^e_{t+1}^{u_{u}} + \frac{\lambda^{e_{t+1}}_t}{\lambda^e_t} \rho_{t+1} \psi^e_{t+1} \right]
\] (3.25)

### 3.3.3 Wage Bargaining

Using the marginal utilities of working for different household types derived in the previous subsection, we can solve for the Nash-bargained wage. We assume that firms and the family head bargain for new as well as existing matches. The family head’s bargaining power is \( \zeta \) and the surplus of having one additional employed member is given by \( \psi^e_t - \psi^e_t^{u_{u_k}} \). The firm’s surplus
of hiring one additional worker is $J_t$. Therefore, the wage solves

$$\omega_t = \max_{\omega_t} \frac{\hat{\omega}_t}{\omega_t}^{1-\zeta}$$

(3.26)

which results in the following wage sharing rule:

$$\hat{\omega}_t = \frac{\zeta}{1-\zeta}(1-\tau_w)^t J_t.$$  

(3.27)

### 3.4 Fiscal authority

The fiscal authority finances government spending $G_t$ and unemployment benefits for short and long-term unemployed workers ($\sum_{k=1}^{K} \kappa_k B S_k \mu_t^e u_k + \kappa_t^{B L} \mu_t^u$) as well as interest payments on outstanding government debt ($\frac{R_t W_t - b_t^{-1}}{1+\pi_t}$) by a lump-sum tax $\bar{i}$, a labor-income tax $\tau_w^t$ and by issuing new government bonds $b_t$:

$$G_t + \sum_{k=1}^{K} \kappa_k B S_k \mu_k^e u_k + \kappa_t^{B L} \mu_t^u + \frac{R_t W_t - b_t^{-1}}{1+\pi_t} = \tau_w^t \omega_t N_t + \bar{i} + b_t$$

(3.28)

Asset market clearing implies that total assets in the home economy, $N_t a_t$, have to equal government debt plus net foreign assets and capital, $b_t + N F A_t + k_t$. Hence, for government debt, it holds that

$$b_t = N_t a_t - N F A_t - k_t.$$  

(3.29)

As we are interested in the steady-state comparison and the corresponding transition path after a policy change in the analysis below, we assume that government spending is exogenously given by $\bar{G}$. However, for a stochastic analysis, it would be straightforward to extend this to an AR(1)-process. The labor tax rule is given by

$$\log(\tau_w^t / \tau_w) = \rho \tau_w \log(\tau_w^{t-1} / \tau_w) + \chi^b(b_t / \bar{b}),$$

(3.30)

where $\rho \tau_w$ is a smoothing parameter and $\chi^b$ determines the elasticity of the labor income tax rate to deviations from the steady-state level of government debt. This ensures stationarity of government debt (see Schmitt-Grohe and Uribe 2007).

### 3.5 International Linkages

In our model, the two countries are linked by trade in consumption goods and international assets. We define the terms of trade $T o T_t$ as the ratio of producer prices $T o T_t = p_{t,H} / p_{t,F}$ and the real exchange rate $R E R_t$ as the ratio of consumer prices $R E R_t = P_{t,F} / P_{t,H}$.

As households are assumed to consume home and foreign goods, the consumption bundle
in country $j \in (H,F)$ is given by

$$C_{t,j} = (\gamma_j^C)^{1/\eta_c} c i n t_{t,j}^{(\eta_c-1)/\eta_c} + (1 - \gamma_j^C)^{1/\eta_c} c e x t_{t,j}^{(\eta_c-1)/\eta_c} (H,F),$$

(3.31)

(3.32)

where $c i n t_{t,j}$ denotes goods produced and consumed in the Home country and $c e x t_{t,j}$ denote imports from the rest of the Euro Area. The intra-temporal allocation across goods is given by

$$c i n t_{t,H} = \gamma_H^C (P_{t,H}/P_{t,H})^{-\eta_c} c i n t_{t,H},$$

(3.33)

for Home goods and analogously for imported goods from Foreign:

$$c e x t_{t,H} = (1 - \gamma_H^C) (P_{t,F}/P_{t,H})^{-\eta_c} c i n t_{t,H}.$$

(3.34)

$\gamma_c$ denotes the consumption bias towards goods produced in Home and $\eta_c$ is a constant price elasticity parameter. A rise in the relative price ratio $p_{t,H}/p_{t,F}$ lowers demand for local goods. The Consumer Price index for Home is given by

$$P_{t,H} = [\gamma H^C P_{t,H}^{1-\eta_c} + (1 - \gamma H^C) P_{t,F}^{1-\eta_c}]^{1/(1-\eta_c)}$$

and analogously for Foreign.

A country’s net foreign asset position is defined as last period’s assets plus current net exports,

$$P_t N F A_t = R_{t-1} W_{t-1} N F A_{t-1} + N X_t,$$

(3.35)

and the current account is given by $C A_t = N F A_t - N F A_{t-1}/(1 + \pi_t)$. Furthermore, it must hold that Home’s net foreign asset position equals Foreign’s net foreign asset position $r s^a N F A_{t,H} + (1 - r s^a) R E R_{t,H} N F A_{t,F} = 0$, where $r s^a$ is the relative size of region $a$.

### 3.6 Market Clearing

Equilibrium in the goods market implies that the economy-wide resource constraint must hold in Home ($H$) and in Foreign ($F$):

$$Y_{t,H} = C_{t,H} + G_{t,H} + \kappa^V V_{t,H} + E X P_{t,H} - p_{t,H} I M P_{t,H},$$

(3.36)

$$Y_{t,F} = C_{t,F} + G_{t,F} + \kappa^V V_{t,F} + E X P_{t,F} - p_{t,F} I M P_{t,F},$$

(3.37)

### 4 Calibration

We calibrate the model to quarterly frequency. We build on the calibration of Moyen and Stähler (2014) and Christoffel et al. (2009). Table 1 shows the baseline calibration. The calibration of Home (Germany) and Foreign (Rest of Euro Area) is symmetric except for country size. This is not a restrictive assumption given that unemployment rates across the Euro Area and Germany
were virtually the same in the pre-Hartz era (see below). The size of the Home country, Germany, amounts to 27.1 percent. The Rest of the Euro Area (Foreign) is therefore almost four times bigger than Germany (see Gadatsch et al. 2016b). We set the discount factor to 0.992 and the risk aversion parameter to 1.5 as in Christoffel et al. (2009).

Regarding the labor market, we set the elasticity of matches with respect to unemployment to 0.6 following Christoffel et al. (2009). Workers and firms have equal bargaining power, hence, $\zeta = 0.5$, which is the conventional value in the literature. Furthermore, we set the separation rate to 4 percent and normalize productivity to one in steady state. The target of the job-filling rate of 0.7 as in Christoffel et al. (2009), see Table 2, then pins down the matching efficiency, vacancy posting costs and the job-finding rate.

Regarding the policy parameters, we set the replacement rate for short-term unemployed to 0.67 and the initial replacement rate for long-term unemployed to 0.57. This corresponds to the legal value for recipients with children (hence, the upper bound). Furthermore, the autocorrelation of the tax rate and government spending amounts to 0.8. In our baseline scenario, we set the lump-sum tax rate to zero and the labor tax rate is 0.24 in steady state (see Gadatsch et al. 2016a). In addition, we allow the tax rate to respond the deviations in government debt to ensure stationarity in government spending. The parameter $\chi^b$ determines the elasticity of this response and is set to 0.05 (see Kirsanova and Wren-Lewis 2012).

Table 2 shows the targets in our calibration. GDP results to be equal to the steady state employment level $\bar{N} = (1 - \bar{u})$. In the initial steady state, inflation is assumed to be zero and all prices are normalized to one which, by construction, then also holds for the real exchange rate as well as the terms of trade. The current account is defined as $CA_t = NA_t - NA_{t-1}/(1 + \pi_t)$ and is, therefore, zero in steady state. The steady-state target for the unemployment rates in both countries is 8.8 percent. They refer to the average harmonized unemployment rates between 2000 and 2004, which are remarkably close in both regions and amount to 8.9 percent in Germany and 8.7% in the Rest of the Euro Area (Data source: OECD, Main Economic Indicators, 2017).
<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Home</td>
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<tr>
<td>Country size</td>
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<td>Capital depreciation</td>
<td>δ</td>
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<tr>
<td>Preferences</td>
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<tr>
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<tr>
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<tr>
<td>Bargaining and Production</td>
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<td></td>
</tr>
<tr>
<td>Matching elasticity</td>
<td>η</td>
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<tr>
<td>Separation rate</td>
<td>s</td>
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</tr>
<tr>
<td>Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement rate for short-term unemployed</td>
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<td>0.6</td>
</tr>
<tr>
<td>Replacement rate for long-term unemployed</td>
<td>rrl</td>
<td>0.5</td>
</tr>
<tr>
<td>Autocorrelation government spending</td>
<td>ρ_G</td>
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</tr>
<tr>
<td>Autocorrelation tax rate</td>
<td>ρ_τ</td>
<td>0.99</td>
</tr>
<tr>
<td>Lump-sum Tax rate (SS)</td>
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</tr>
<tr>
<td>Elasticity of tax rate response to debt deviations</td>
<td>χ_b</td>
<td>0.05</td>
</tr>
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</table>

**Table 1:** Baseline Calibration

<table>
<thead>
<tr>
<th>Target</th>
<th>Symbol</th>
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</thead>
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<td>GDP</td>
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<tr>
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<td>π</td>
<td>0</td>
</tr>
<tr>
<td>PPI</td>
<td>p</td>
<td>1</td>
</tr>
<tr>
<td>CPI</td>
<td>P</td>
<td>1</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>RER</td>
<td>1</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>ToT</td>
<td>1</td>
</tr>
<tr>
<td>Current Account</td>
<td>CA</td>
<td>0</td>
</tr>
<tr>
<td>unemployment rate</td>
<td>u</td>
<td>0.088</td>
</tr>
<tr>
<td>Job-filling rate</td>
<td>q</td>
<td>0.7</td>
</tr>
<tr>
<td>Firms' Profits</td>
<td>Π</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 2:** Targets
5 The effects of the Hartz IV reform

In this section we describe how we implement the entire German labor market reform, Hartz IV, in our model environment and present the results.

5.1 Reform implementation

In our model, we simulate both components of the Hartz IV reform. In a first step, we reduce the replacement rate for long-term unemployed by 20 percent. From 2005 onwards, ALG II was purely means tested and independent of prior earnings. For this reason, we set \( \kappa_{BL_t} = \kappa_{BL} \) to a fixed value in the simulation below (while, in the initial steady state, \( \kappa_{BL_t} = (1-\tau_w t - K - 1)w_{t-K-1}\rho \), it is assumed to be given by \( \kappa_{BL} = (1-\bar{\tau}_w)\bar{w}\rho \times 0.8 \) after 2005, where \( \bar{w} \) is the initial steady-state wage). In a second step, we reduce the maximum entitlement duration of short-term unemployment benefits from a maximum of three years to approximately 12 months. We implement this reform component by setting the replacement rate for workers who are in their second and third year of unemployment (i.e. for \( \mu_{ue} e_k \) and \( k \in [5,12] \)) to the long-term unemployment benefits \( \kappa_{BL} \). For simplicity, we assume that, at the time of the policy change, the economy is in its initial steady state, that the changes are unanticipated and that there are no future shocks in the economy after the policy change. This allows us to isolate the effects of changes in property taxation from other shocks.

5.2 Results

In what follows, we will describe the results of the model analysis just described. We will first describe the effects resulting in Germany and, then, turn to spillovers to the rest of the Euro Area. We differentiate between a reduction of the replacement rate alone and the results of the entire Hartz IV package.

5.2.1 Effects in Germany

Figures 1 and 2 illustrate the transition after the two Hartz IV reform components in Germany (everything expressed in percent or percentage point deviation from the initial steady state). The first reform step (the reduction in the replacement rate for long-term unemployed workers only) is depicted with blue shaded areas and the entire reform effects are represented by the black solid line. From 2005 onwards, the depicted results illustrate only the effects of the reduction in the replacement rate. From 2006 onwards the solid black line also included the effect of the entitlement cut which was implemented in February 2006.

---

6 This corresponds to the reduction of the average net replacement rate of two earnings levels, 67% and 100% of an average adult full-time worker, respectively (Source: CESifo Dice, 2013 based on OECD Benefits and Wages statistics, 2013). Note that the discussion on how much the replacement rate due to Hartz IV actually declined is still ongoing. Launov and Wilde (2013) use a decline of 7 percent, whereas Krebs and Scheffel (2013) implement a reduction of the replacement rate for long-term unemployed by 20 percent and Krause and Uhlig (2012) assume a reduction of 67 percent for high-skilled and around 24 percent for low skilled. We are closest to the value used by Krebs and Scheffel (2013).
To describe the results, we will proceed in two steps. First, we will discuss the aggregate effects of both reform steps; and, then, highlight the most important differences between the reduction in the replacement rate and the cut in the entitlement period.

As expected, the reduction in the generosity of the unemployment benefit scheme leads to a decrease in wages because the workers’ bargaining position worsens. This effect is stronger when both, replacement rates for long-term unemployed workers and the entitlement duration to receive “premium benefits” are cut (see Figure 1). Lower wages increase the marginal value of a worker to the firm, which, therefore, posts more vacancies which augments the job-finding rate and reduces the aggregate unemployment rate. The drop in unemployment differs by duration of unemployment. It is highest for long-term unemployed workers. The reason is obvious: Given a higher job finding rate, the probability to actually enter the pool of long-term unemployment declines.

A falling unemployment rate fosters production. After the cut in entitlement duration, the demand for savings increases because the income loss when being unemployed has increased in relative terms. Agents want to insure against this risk. As these assets are not fully provided domestically (being restricted by government bonds and capital), agents also buy international assets. The current account as well as the net foreign asset position rise. Lower wages and an increase in savings lead to a decrease in aggregate consumption and, thus, imports. Because exports exceed imports, net exports rise. In the long run, consumption in the Rest of the Euro Area also declines (see 3). This dampens the demand for exports and leads to a fall in net exports. The real exchange rate (RER) increases due to a fall in home prices triggered by lower wages. When the cut in entitlement length is implemented, there is a second spike since wages fall even more and, thereby, reduce producer prices more. Because consumption starts to pick up again, and wages also fall in the foreign country, the RER starts falling again. But it stabilizes at a higher steady-state level relative to the initial steady state.

Turning to the disaggregated effects of each reform step, we note the following: On impact, when only the reduction in the replacement rate is simulated, the interest rate increases slightly because asset supply exceeds asset demand. But as soon as asset demand is picking up as a result of the entitlement cut, the interest rate starts declining again. Due to an increase in the supply of world assets, the new steady state interest rates is below its initial level.\footnote{Remember that the interest rate is the inverse of the discount factor. As labor market conditions improve on the aggregate, the discount factor is reduced on impact and, then, rises again.}

However, in Figure 2, we observe that there are notable difference between only considering the cut in the replacement rate for long-term unemployed workers and the whole Hartz IV reform, especially with regard to the savings decision. When only considering the effect of a reduction in the replacement rate for long-term unemployed workers, we have already noted that it becomes less likely to enter the long-term unemployment’s pool. Hence, average expected income increases. Overall, there are two effects at work. On the one hand, benefits fall when becoming long-term unemployed. This decreases the reservation wage. On the other hand, the likelihood for this to happen also falls. As the latter effect dominates the former, households immediately reduce savings slightly because the income risk from unemployment has fallen. This also implies that the effects on the net foreign asset position of this reform step are only minor,
Figure 1: Effects of the Hartz IV reform package on labor market outcomes.

Figure 2: Aggregate effects of the Hartz IV reform package.
and negative (see Table 3, which summarizes the long-run results).

When taking into account the reduction in the entitlement duration, which came into action in 2006, the beneficial effects on the labor market are no longer strong enough to overcompensate for the consumption risk when becoming unemployed. The reason is that, now, the increase in the job finding rate is not high enough to compensate short-term unemployed households for the fact that the actual risk of facing consumption losses now approaches relatively quicker. This can also be seen in Table 3. There we see that, even in the medium-term, all but the employed and the very short-term unemployed households now decrease consumption after the implementation of the Hartz IV reforms, despite the fact that aggregate wage income has increased. The reason is that households now want to prepare for the potential income loss in case of an unemployment spell. Thus, they increase precautionary savings. As this increase in savings cannot be supplied domestically, the demand for net foreign assets increases, as does the demand for world savings (as already noted above). Given the rise in net foreign assets, the current account must increase as well.

Summarizing, we find that the German unemployment rate falls by more than 1 percentage point as a result of the implemented reform. Our results are remarkably well in line with the results found in Krebs and Scheffel (2013). They evaluate the reform effects in a closed-economy, applying a fully heterogeneous agent model with incomplete insurance and human capital formation. We feel comfortable with this finding as it supports the claim that our model generates plausible results.

5.2.2 Spillover-effects to the Rest of the Euro Area

In public discussions on the Hartz reforms, Germany has been repeatedly criticized that the labor market reforms resulting in an increase in international competitiveness constitutes a beggar-thy-neighbor policy. Our model simulations provide a two-sided answer to the question whether the Hartz IV reform actually harmed its trading partners. On the one hand, we observe an increase in output in the rest of the Euro area, too. On the other hand, we also note that consumption falls (see Figure 3). We can explain these seemingly contradictory developments as follows. Firms increase the use of capital in production because factor prices for capital have fallen as a result of higher savings demand in Germany (lowering the world interest rate). After a short recessionary impact, this leads to higher output in the Rest of the Euro Area which starts kicking in one year after the implementation of the entitlement cut in Germany. Higher production also fosters employment, which leads to a decrease in precautionary savings and net foreign assets in the Rest of the Euro Area. However, stronger use of capital in production also reduces the marginal product of labor, and wages eventually fall. They fall enough to reduce aggregate labor income. In combination with an increase in the capital stock in the Rest of the Euro Area (positively contributing to output) and lower asset returns, this leads to a fall in private consumption while output can be increased. These effects are amplified by weaker demand for rest of the Euro area-products in Germany because of the increase in precautionary savings there.

Table 3 provides an overview of the long-run effects of both components of the Hartz IV reform on Germany as well as on the rest of the Euro Area. Note that the effects denote percent
deviations (percentage points if indicated) from the initial steady state at the beginning of 2005 (prior to the reduction in the replacement rate).

5.3 Contribution of Hartz IV to Germany's current account surplus

Figure 4 depicts the share of Germany’s current account that can be explained by the labor market reform. The upper panel shows the cumulated development of the German current account (solid line) for the years 2005 to 2016 in comparison to the cumulated current account effects generated by our model in response to the Hartz IV reform. In 2005, the German current account surplus was 4.6 percent of GDP and reached a level of 8.7 percent by 2016. In our model, the initial effect is negative due to the decrease in savings after the cut in the replacement rate. Figure 4 illustrates the fraction of the current account surplus that can be explained by our model. In 2007, around 30 percent of the cumulated current account surplus can be explained by the reform. On average, the explanatory value amounts to 20 percent.

5.4 Comparison to the representative agent framework

Next, we turn to a representative agent version of our model. In the representative agent setting, workers who fall into unemployment are not expelled and continue living as part of the family. Hence, there is complete insurance for all agents (see Appendix B for a formal description of the representative agent model version). In order to ensure stationarity of net foreign assets, we introduce portfolio adjustment costs as proposed in Schmitt-Grohe and Uribe (2003). They take the form \( \phi (NFA_t - NFA)^2 \), where we set \( \phi \) to 0.001. The remaining parameters are derived.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Germany</th>
<th>Rest of the Euro Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Cut in rrl Entitlement cut</td>
<td></td>
</tr>
<tr>
<td>Aggregates</td>
<td></td>
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</tr>
<tr>
<td>Output</td>
<td>1.29 0.41 0.87</td>
<td>0.20 -0.03 0.23</td>
</tr>
<tr>
<td>Consumption</td>
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<td>-1.74 -0.29 -1.44</td>
</tr>
<tr>
<td>Savings</td>
<td>24.18 -0.61 24.79</td>
<td>-8.69 0.19 -8.88</td>
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<tr>
<td>NFA in percent of GDP</td>
<td>15.62 -0.38 16.00</td>
<td>-1.22 0.02 -1.23</td>
</tr>
<tr>
<td>Labor market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wages</td>
<td>-3.93 -1.68 -2.25</td>
<td>-2.63 -0.78 -1.85</td>
</tr>
<tr>
<td>Vacancies</td>
<td>21.43 6.90 14.53</td>
<td>C. of employed</td>
</tr>
<tr>
<td>Job-finding Rate</td>
<td>12.92 0.64 12.28</td>
<td>-2.63 -0.78 -1.85</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>-12.42 -0.39 -12.03</td>
<td>C. of unemployed in period 1</td>
</tr>
<tr>
<td>Share of unemployed in period 1</td>
<td>-1.11 0.00 -1.10</td>
<td>1.90 -0.53 2.43</td>
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<td>Share of unemployed in period 8</td>
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<td>-33.33 -1.87 -31.47</td>
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<td>Share of unemployed in period 12</td>
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<td>-33.33 -1.87 -31.47</td>
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<td>C. of unemployed in period 1</td>
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<td>C. of unemployed in period 4</td>
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<tr>
<td>C. of unemployed in period 12</td>
<td>-33.33 -1.87 -31.47</td>
<td></td>
</tr>
<tr>
<td>C. of long-term unemployed</td>
<td>-20.00 -20.00 0.00</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Long-run effects of Hartz IV: Total and by reform step
as described in the main text. Figure 5 highlights the importance of allowing for a precautionary savings motive. The solid line shows the impulse responses in our baseline model and the dashed lines illustrate a representative agent version of our model.

Unsurprisingly, in the representative agent framework, agents do not react to the decrease in the generosity of unemployment benefits by increasing savings. On the contrary, they decrease savings and, instead, prefer to consume more. The increase in consumption also raises output and leads to a decline in the unemployment rate. Furthermore, the rise in consumption (or the decline in savings) leads to a fall in the current account balance and the net foreign asset position. However, the stable consumption path after the Hartz IV reform also leads to higher net-exports in the medium and long run. In addition, due to the missing precautionary savings motive and subsequent small effect on the current account, spillover effects to the rest of the Euro Area are negligible small.

This confirms our prediction that as long as households are perfectly insured against the risk of becoming unemployed, a drop in the replacement rate and a cut in the entitlement duration has hardly any effect on the current account.

6 Conclusion Remarks

This paper proposes a two-region RBC model with labor market frictions and incomplete insurance to study the effects of a reduction in the generosity of the unemployment benefit system on global imbalances. We take a far-reaching unemployment benefit reform in Germany (Hartz
IV) as an example and find that a decline in workers’ fall-back option in case of unemployment significantly increases their precautionary savings. Our findings can be summarized as follows. First, we propose a solution to the problem of steady state indeterminacy and non-stationarity of net foreign assets while allowing for permanent effects in response to structural reforms. We do so by including a precautionary savings motive into a tractable model with quasi-heterogeneity. This endogenizes demand and supply for assets and pins down the economy-wide interest rate in steady state. We further illustrate that a representative agent version of our model is not suitable to study the effects on the current account.

Second, we show that besides of a substantial decline in unemployment of more than 1 percentage point, the Hartz IV reform contributed substantially to Germany’s current account surplus. Since 2005, on average 20 percent of the German current account surplus can be attributed to the Hartz IV reform.

Third, we find that the labor market reform leads to an increase in competitiveness of the home country while generating positive spillover effects in terms of output to the Rest of the Euro Area. However, an increase in the capital stock and lower returns to assets cause a drop in consumption abroad.

Therefore, even though output rises, the reform leads to welfare losses.

References


THE ECONOMIST (2017a): “The good and bad in Germany’s economic model are strongly linked,” July 8th 2017.


A Background

This section briefly outlines the background on Germany’s current account and its net foreign asset position. We also summarize the main points of the cluster of labor market reforms which were implemented in Germany between 2003 and 2005, the so-called Hartz-reforms.

A.1 The German Current Account and Net Foreign Asset Position

The current account is defined as a country’s increase in domestic net claims on foreign incomes or outputs (see Obstfeld and Rogoff 1995). Hence, the current account balance is given by the difference between national savings and domestic investment. If savings exceed investment, residents hold claims on foreign goods or assets.

Figure 6 shows the German unemployment rate, the evolution of the German current account ($CA$), the net foreign asset position ($NFA$), exports ($EX$) and imports ($IM$) as well as the savings ($S$)-investment ($I$) balance (in percent of GDP) from 1991 onwards. Between 1991 and the early 2000s, a decade that was characterized by high unemployment rates and low GDP growth, Germany has repeatedly been called ‘the sick man of Europe’ (see for example The Economist 2017a). During that time, there were no imbalances worth mentioning. However, starting in 2001, the German economy experienced a complete reversal: International competitiveness rose and exports started to persistently exceed imports. In addition, savings and investment diverged dramatically. By the (simplified) identity of the current account, $CA = EX - IM = S - I$, this implies large current account surpluses and an increasing net foreign asset position. In fact, Germany’s NFA position reached a level of 51 percent of GDP in 2016 and, therefore, makes the country a big net lender. These imbalances have been subject to worldwide criticism (see, for example, Eichengreen’s comment in The Guardian 2017, and The Economist 2017b).

The natural question to ask is, what caused the dramatic increase in the German current account? In a comprehensive analysis based on an estimated DSGE model, Kollmann et al. (2015) name financial integration (the interest rate convergence of the rest of the Euro Area to the German), strong economic growth in emerging markets, the German labor market reforms (i.e. Hartz reforms) and low domestic demand caused by an ageing population and a pension reform as potential causes. In this paper, we focus on the most prominent German labor market reform in the German post-war era (Hartz IV) and quantify its contribution to the existing global imbalance of Germany vis-à-vis the Euro Area.

A.2 The Hartz Reforms

Germany’s bad economic performance around the 2000s motivated a comprehensive reform package. The centrepiece of the reform agenda was a set of extensive labour market reforms, commonly known as the “Hartz reforms” (named after Peter Hartz, the chairman of the independent committee which drew up the package of reforms; for a detailed description of the Hartz

8 Interestingly, the reversal of the German unemployment rate started several years after. Beginning in 2005, unemployment halved from around 12 percent to 6 percent in 2016, and it is currently still falling.
reforms, see Jacobi and Kluve 2006). Their objectives were to improve job matching efficiency and incentives to take up employment (Hartz I), promote the transition to self-employment and introduce more flexible arrangements for minor employment relationships (Hartz II), further support the matching process between firms and workers through a reorganisation of the Federal Labour Agency (Hartz III).

In 2005, the fairest-reaching and most discussed Hartz IV reform was implemented with the aim to reduce workers’ reservation wages and increase labor supply. Prior to Hartz IV, short-term unemployed workers were entitled to unemployment benefits of 60 percent of their previous net wage ("Arbeitslosengeld"). Short-term unemployment benefits expired after three years on average. Unemployed workers were then considered long-term unemployed and received a less generous unemployment benefit ("Arbeitslosenhilfe") amounting to 53 percent of their previously earned net wage. For unemployed workers with children, the replacement rates were 67 and 57 percent, respectively. Persons who were not eligible for unemployment benefits received means-tested social assistance ("Sozialhilfe"; in 2004, the standard rate for a single household was around 300 euros, not including one-time benefits).

The Hartz IV reform had two components: First, social assistance and long-term unemployment benefits were merged into the purely means-tested "Arbeitslosengeld II" (ALG II). Hence, from 2005 onwards, long-term unemployment benefits were independent of previous earnings. Second, the entitlement duration of short-term unemployment benefits was reduced from around three years to approximately twelve months. The entitlement duration depends on the age of the unemployed worker. The maximum duration of one year refers to workers younger than 45 years. Older unemployed were entitled to 18 months of ALG II. In 2008, the maximum duration for older workers was softened again to a maximum entitlement duration of 24 months. The policy change became effective 2006. For many, these reforms were an important driver of the increase in the German competitiveness and its current account surplus.
B Derivation for representative worker version

B.1 Representative Family Head

\[ V_t^E = u(c_t^E) \]

subject to

\[ c_t^R + a_t + \bar{t} = (1 - \tau_t) \omega_t N_t + (1 - N_t - \mu_t^{uu}) \kappa_t^{BS} + \mu_t^{uu} \kappa_t^{BL} + \Pi_t + R_{t-1}^W \frac{a_{t-1}}{1 + \pi_t} \]

B.2 Lagrangian and FOCs

\[ L^R = u(c_t^e) + \beta E_t \left[ V_{t+1}^R - \lambda_t^R (c_t^e + a_t + \bar{t} - (1 - \tau_t) \omega_t N_t - (1 - N_t - \mu_t^{uu}) \kappa_t^{BS} - \mu_t^{uu} \kappa_t^{BL} \right] - \pi_t - \frac{R_{t-1}^W a_{t-1}}{1 + \pi_t} \]  

This results in the FOCs:

\[ \frac{\partial L^R}{\partial c_t^e} : \lambda_t^R = (c_t^e)^{-\sigma_c} \]  

which corresponds to the marginal utility of an employed worker.

\[ \frac{\partial L^R}{\partial a_t} : \lambda_t^R = \beta \lambda_t^{t+1} \frac{R_t^W}{1 + \pi_t} \]  

Using the Envelope theorem and plugging in gives:

\[ \lambda_t^R = \beta \lambda_t^{t+1} \frac{R_t^W}{1 + \pi_t} \]  

Rearranging results in the Euler equation for optimal asset holdings:

\[ DR e t = \frac{1}{R_t^W} = \beta E_t \left[ \frac{\lambda_t^{t+1}}{\lambda_t^R} \frac{1}{1 + \pi_t} \right] \]

B.3 Employment Dynamics

Evolution of employment level

\[ N_t = (1 - s) N_{t-1} + M_t \]
Number of employed workers

$$\mu^e_t = N_t$$

Number of recent short-term unemployed workers were fired and did not immediately get a new job in period 1

$$\mu^e_{u,1} = s(1 - \rho_t)N_{t-1}$$

Number of short-term unemployed workers in further periods k

$$\mu^e_{u,k} = (1 - \rho_t)\mu^e_{u,k-1}$$

Number of long-term unemployed workers

$$\mu^u_t = [1 - \rho_t](\mu^u_{t-1} + \mu^e_{u,K})$$

### B.4 Workers Marginal Utility

The family head maximizes:

$$w^e_t = (1 - \tau_t)\omega_t + \beta E_t\left\{ \frac{\lambda^e_{t+1}}{\lambda^e_t}(1 - s(1 - \rho_{t+1}))w^e_{t+1} + \frac{\lambda^{e,1}_{t+1}}{\lambda^e_t}s(1 - \rho_{t+1})w^{e,1}_{t+1} \right\}$$

Short-term unemployed up to K-1:

$$w^{e,u}_t = \kappa^{BS}_t \lambda^e_t + \beta E_t\left\{ \frac{\lambda^{e,u,k+1}_{t+1}}{\lambda^{e,u}_t}(1 - \rho_{t+1})w^{e,u}_{t+1} + \frac{\lambda^{e,u+1}_{t+1}}{\lambda^{e,u}_t}\rho_{t+1}w^{e,u}_{t+1} \right\} \quad \text{(B.4)}$$

Short-term unemployed in K (last period of short-term UB):

$$w^{e,u,K} = \kappa^{BS}_t \lambda^{e,u,K}_t + \beta E_t\left\{ \frac{\lambda^{u,u}_{t+1}}{\lambda^{e,u}_t}(1 - \rho_{t+1})w^{u,u}_{t+1} + \frac{\lambda^{e,u+1}_{t+1}}{\lambda^{e,u}_t}\rho_{t+1}w^{e,u}_{t+1} \right\} \quad \text{(B.5)}$$

Long-term unemployed:

$$w^{u,u}_t = \kappa^{BL}_t \lambda^{u,u}_t + \beta E_t\left\{ \frac{\lambda^{u,u}_{t+1}}{\lambda^{u,u}_t}(1 - \rho_{t+1})w^{u,u}_{t+1} + \frac{\lambda^{e,u+1}_{t+1}}{\lambda^{u,u}_t}\rho_{t+1}w^{e,u}_{t+1} \right\} \quad \text{(B.6)}$$