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(Spillover) Effects of Labour Market Reforms in Germany and France

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Working Paper no 8

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Socio-economic Sciences and Humanities Europe moving towards a new path of economic growth and social development - Collaborative project

(Spillover) Effects of Labour Market Reforms in Germany and France

Claudia Busl (ZEW), Atilim Seymen (ZEW)

Contribution to the Project

This research paper seeks to empirically identify bivariate as well as higher-order interdependencies between labour market institutions and their joint impact on macroeconomic performance. Based on these findings, recommendations for successful reform packages in specific macroeconomic environments in order to boost a country's labour market performance will be derived.

(Spillover) Effects of Labour Market Reforms in Germany and France*

Claudia Busl[a] Atılım Seymen[b]

June 24, 2013

Abstract

In this paper we analyze the (potential) effects of labour market and fiscal policy reforms by heterogeneous European countries—Germany and France—on the domestic and foreign economy. We test the implications of the gains in matching efficiency and reduced unemployment benefits induced by the German Hartz reforms in a two-country RBC model with frictions in the labour market, which replicates the data quite well. We then explore the reform possibilities in the French labour market and their potential (inter)national effects by calibrating the model to recent data. Both home and foreign economies benefit from labour market reforms in the home economy in our framework.

JEL classification: E24, E61, E65, F42, J38, J63

Keywords: Labour market reforms, search and matching, dynamic stochastic general equilibrium models

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1 Introduction

Structural reforms have often been mentioned as one of the conditions in financial support programs for troubled countries during the recent global financial and economic crisis. Publications of international institutions like the IMF and the OECD repeatedly emphasize the need for structural reforms "for a strong and balanced economic recovery".[1] Currently, the room for fiscal policy measures to stimulate growth in staggering European countries is limited because of the high debt burden of almost all European economies. Monetary policy, on the other hand, seems to have reached its limits as a stimulator of the economies after having already used a number of drastic measures and can only try to keep the financial environment tranquil and stable to give room to in-depth reforms.

Given this background, the aim of this paper is to analyze the macroeconomic (spillover) effects of structural reforms by means of a two-country dynamic stochastic general equilibrium (DSGE) model. While the term "structural reforms" may cover a large number of policy measures and areas, the focus of our paper is on the impact of labour market reforms in an international setting. Changes in the labour market institutions seem of great relevance in Europe given the high unemployment figures in many countries. We calibrate our model to selected European economies—Germany and France—and use it for addressing the following questions:

- Is our model able to capture the quantitative effects of labour market reforms on the main economic aggregates in Germany?
- How do changes in institutions impact on domestic and foreign economies in a two-country world?
- Through which mechanisms do spillovers occur and how strong are they quantitatively?
- What does our model predict with respect to the effects of recently undertaken reforms in France?
- How effective are other plausible reform scenarios in reducing unemployment given the restrictions to public spending?

[1] See, e.g., IMF (2013) and OECD (2013).

The model that serves as the laboratory for our quantitative analysis is taken from Fonseca, Patureau, and Sopraseuth (2009). It is a two-country real business cycle (RBC) model with matching frictions in the labour market. The model comprises two building blocks which are of crucial importance for the analysis we carry out. First, it allows for international macroeconomic spillovers through two channels: (i) international goods trade and (ii) international financial assets. To be more specific, each country specializes in the production of her own good, whereas consumers in both countries consume a composite good comprising the goods of both countries. Furthermore, there is a riskless nominal interest rate bond that helps to enhance the sharing of resources internationally. The second crucial aspect of the model for our analysis is that it features several labour market institutions and fiscal policy parameters. In particular, unemployment results from search and matching frictions in the labour market. The model comprises parameters for the matching efficiency in the labour market and the unemployment benefit ratio both of which policy-makers can control up to some extent. Furthermore, macroeconomic policy directly dictates the rates for three types of taxes in the model: consumption and employers and employee's labour tax rates. We calibrate the model economy by using the same values for most of the parameters in both countries and yet allow heterogeneity in the aforementioned parameters that relate to labour market institutions and fiscal policy. Such a way of calibration allows us isolate the impact of selected institutional differences and abstract from differences in other parameters such as the labour share in output or the depreciation rate of capital.

Our analysis consists of three steps: In our first quantitative exercise, the heterogeneous parameters are initially set in line with the institutional characteristics of Germany and France in 2003. This is the year in which Germany started to introduce its labour market reforms, the so-called Hartz reforms, that are widely seen as a major factor behind the impressive labour market (and also general macroeconomic) performance of Germany in recent years.[2] We then introduce two types of labour market reforms into the German economy: (i) an exogenous increase in matching efficiency in the labour market which mimics the first part of the reforms making the organization of public employment services more efficient and (ii) a decline in the unemployment benefit ratio introduced by the last labour market

[2]See, e.g., Burda and Hunt (2011) and the references therein.

reform law, both of which are in line with the corresponding observations in 2010 compared to 2003. When these two reforms are introduced into the model simultaneously, the model is quite successful in capturing the change in various quantities such as unemployment rate, employment, average hours worked and wages from 2003 to 2010 in Germany. Furthermore, we discuss the spillover effects implied by the reforms on the "French" economy.

Our second experiment deals with reforms currently being implemented in France which consist in lowering labour costs for employers balanced by higher consumption taxes and measures to increase the matching efficiency. We initially explore the predictions of our model as to the potential effects of these reforms, where the heterogeneous labour market institutions are calibrated to the French and German situation in 2010. Our results reveal non-trivial effects of reforms on the unemployment rate and several other macroeconomic quantities in France. In a next step, we test the effects of further plausible reform scenarios. Specifically, given the restrictions to public spending and the positive impact of the decline in the unemployment benefit share on strong employment and output performance of Germany, we investigate the impact of reforms in the hypothetical case where the unemployment benefit share is reduced in order to create even further room to decrease the employers' tax rate. Not surprisingly, the impact of reforms gets yet stronger under such a constellation.

The domestic impact of labour market reforms could be quite significant according to our findings. The exact amount depends on by how much the matching efficiency of the labour market can be increased. As has already been discussed elsewhere in the literature (e.g. Dao (2013a)), the existence of labour market rigidities in the form of search and matching frictions is the attribute of our model which leads to positive international spillovers. Note that such rigidities are deemed rather typical for European economies. Our analysis thus shows that, rather than being detrimental for other countries, domestic labour market reforms impact positively on other countries which is consistent with empirical evidence by Felbermayr, Larch, and Lechthaler (2013). Quantitatively, we find that the long-run increase in the capital stock of the foreign country is roughly one third of the increase in the capital stock of the reforming country.

We present our model framework in the next section. Section 3 investigates the impact of German Hartz reforms on both Germany and "France" and provides sensitivity analyses

as to the parameters of the model with the largest potential impact on our quantitative findings. The subject of Section 4 is the reform possibilities in France in the light of the recently introduced reforms in the country as well as the German Hartz reforms experience. The last section concludes and provides several critical remarks on our findings.

2 The Model

In this section, we describe our model framework which is a two-country RBC model with matching frictions in the labour market and closely follows Fonseca, Patureau, and Sopraseuth (2009). If not stated otherwise, we describe the decision problems of households and firms in the home country, called country 1. The problem set of the foreign country can be found in Appendix A.

2.1 Households

Each country is inhabited by an infinitely living mass of agents normalized to unity. Agents maximize their intertemporal utility at the beginning of each period without knowing whether they will end up unemployed or not. But since they are assumed to be risk averse and have access to complete income insurance markets, their decisions are independent of their individual labour market outcome. Only the aggregate outcome and, correspondingly, the probability of being employed N_{it} in country i at period t matter. A representative agent in country 1 maximizes her expected life-time utility

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[N_{1t} U(C_{1t}^n, h_{1t}) + (1 - N_{1t}) U(C_{1t}^u) \right] \tag{1}$$

where $0 < \beta < 1$ is the discount factor, C_{1t}^n and C_{1t}^u denote consumption in case of employment and unemployment, respectively, and h_{1t} represents the number of hours worked by an employed agent. The number of hours per period is normalized to unity. Thus, time spend on leisure is given by $1 - h_{1t}$. The per-period utility functions of employed and unemployed

individuals are additively separable in consumption and leisure and given by

$$U(C_{1t}^n, h_{1t}) = log\left(C_{1t}^n\right) + \kappa_1^n \frac{\left(1-h_{1t}\right)^{1-\xi}}{1-\xi} \tag{2}$$

$$U(C_{1t}^u) = log\left(C_{1t}^u\right) + \kappa_1^u \tag{3}$$

with κ_1^n and κ_1^u being parameters that affect and determine the value of leisure for employed and unemployed agents, respectively, and $\frac{1}{\xi}$ measuring the intertemporal elasticity of substitution of leisure with $\xi > 0$. Agents receive the income $w_{1t}h_{1t}$ from employment, w_{1t} being the hourly wage rate, subject to an employees' labour tax τ_1^d when they are employed and fixed unemployment benefits b_1 otherwise. In addition, there are direct transfers from the government to households (or lump-sum taxes on households depending on whether the consumption and labour tax revenues are enough to cover the unemployment benefit payments) amounting to T_{1t} and the profits Π_{1t} accruing from the domestic firms owned by the households. Furthermore, agents can hold bonds denominated in terms of the domestic good available in an international bond market which yield an interest payment i_t for each unit. Households spend their income on consumption including a consumption tax τ_1^c and on new bond holdings B_{1t+1}. If the household changes its bond holdings, it faces a portfolio adjustment cost CA_{1t} which is given by

$$CA_{1t} = \frac{\Phi_b}{2}\left(\frac{B_{1t+1}}{P_{1t}^c}\right)^2 \tag{4}$$

that is scaled by the factor $\Phi_b > 0$. The adjustment cost guarantees the stationarity of the model.

Taking the foregoing elements together, the budget constraint of the representative household expressed in terms of the good consumed in country 1 is written as

$$P_{1t}^c\left(1+\tau_1^c\right)C_{1t}^c + B_{1t+1} + P_{1t}^c CA_{1t} = N_{1t}w_{1t}h_{1t}\left(1-\tau_1^d\right) + \left(1-N_{1t}\right)b_1 + B_{1t}\left(1+i_t\right) + T_{1t} + \Pi_{1t} \tag{5}$$

with P_{1t}^c being the consumer price index at home. As will be seen below, both employed and unemployed agents consume the amount C_{1t}^c.

The households' optimization decision problem is summarized by the Bellman equation

$$F_{1t}^{H} = \max_{C_{1t}^{n}, C_{1t}^{u}, B_{1t+1}} \left[N_{1t} U(C_{1t}^{n}, h_{1t}) + (1 - N_{1t}) U(C_{1t}^{u}) + \beta E_t \left(F_{1t+1}^{H} \right) \right] \tag{6}$$

which is subject to the budget constraint (5) and the law of motion of aggregate employment N_{1t}

$$N_{1t+1} = (1 - s_1) N_{1t} + \phi_{1t}(1 - N_{1t}). \tag{7}$$

In this equation, s_1 is the constant job separation rate for employed workers which is exogenously given and ϕ_{1t} the probability of finding a job when being unemployed. Thus, $\phi_{1t}(1 - N_{1t})$ is the number of successful matches which result in hirings H_{1t}. The number of unemployed agents in country 1 is given by $U_{1t} = 1 - N_{1t}$. Since we normalize the mass of the potential workforce to unity, U_{1t} stands for the unemployment rate at the same time. Note that the hours worked h_{1t} do not directly enter the representative household's optimization problem, since they are determined by negotiations between firms and workers through Nash-bargaining which is handled below.

We define λ_{1t} as the Lagrange multiplier corresponding to the budget constraint (5) and derive the first order conditions of the representative agent's optimization problem (6) as follows. With respect to consumption we obtain

$$\frac{1}{C_{1t}^{n}} = \frac{1}{C_{1t}^{u}} = (1 + \tau_1^{c}) \lambda_{1t} P_{1t}^{c}. \tag{8}$$

This condition implies that the optimal level of consumption does not depend on the agents' employment status. Therefore, we call the aggregate level of consumption C_{1t}^{c} in the following. Regarding the bond holdings, the optimality condition is given by

$$1 + \Phi_b \frac{B_{1t+1}}{P_{1t}^{c}} = \beta E_t \left[\frac{\lambda_{1t+1}}{\lambda_{1t}} (1 + i_{t+1}) \right]. \tag{9}$$

The household's preferences in consumption between foreign and domestic goods are modelled by an Armington aggregator. The consumption level of country 1 is hence given

by

$$C_{1t}^{c} = \left[\kappa^{\frac{1}{\eta}} C_{1t}{}^{\frac{\eta-1}{\eta}} + (1-\kappa)^{\frac{1}{\eta}} C_{2t}{}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}, \tag{10}$$

where $0 < \kappa < 1$ is the weight of domestic goods in domestic spending and $\eta > 0$ is the elasticity of substitution between foreign and domestic goods. C_{1t} denotes the domestic consumption of goods produced in country i. We choose the good produced in country 1 to be our numéraire and fix its price P_{1t} to unity. The terms of trade of the foreign country are accordingly given by $P_t = \frac{P_{2t}}{P_{1t}} = P_{2t}$. With these definitions, the minimization of costs for C_{1t}^{c} results in the demand functions for the goods consumed in country 1 that read

$$C_{1t} = \kappa \left(\frac{1}{P_{1t}^{c}}\right)^{-\eta} C_{1t}^{c} \tag{11}$$

$$C_{2t} = (1-\kappa) \left(\frac{P_t}{P_{1t}^{c}}\right)^{-\eta} C_{1t}^{c}. \tag{12}$$

2.2 Firms

In each country a continuum of firms operate in a perfectly competitive market. Firms produce goods with the Cobb-Douglas production technology using domestic labour N_{1t} and capital K_{1t} as input:

$$Y_{1t} = A_{1t} K_{1t}^{\alpha} \left(N_{1t} h_{1t}\right)^{1-\alpha} \tag{13}$$

where $0 < 1-\alpha < 1$ is the labour share of income. In addition, the output level depends on the level of the technology A_{1t} which follows an autoregressive process and is subject to shocks:[3]

$$\log A_{1t+1} = \rho_a \log A_{1t} + (1-\rho_a) \log \bar{A}_1 + \varepsilon_{1t+1}. \tag{14}$$

Firms pay taxes, denoted by τ_1^f, on employees' compensation, which contribute to the government budget. Furthermore, they incur a cost $\omega_1 > 0$ to post a vacant job. The aggregated number of vacancies posted is V_{1t}. The number of successful matches in the labour market leading to hirings H_{1t} can be expressed as $q_{1t} V_{1t}$, with q_{1t} being the probability

[3]Note that the form of technological progress does not have any impact on the international spillovers from policy changes that we discuss below.

of finding an appropriate match. Hence, we can rewrite the law of motion of aggregate employment in terms of vacancies as

$$N_{1t+1} = (1 - s_1) N_{1t} + q_{1t} V_{1t}. \tag{15}$$

The accumulation of capital occurs according to the standard law of motion for capital

$$K_{1t+1} = (1 - \delta) K_{1t} + I^c_{1t}, \tag{16}$$

where $0 < \delta < 1$ stands for the capital depreciation rate and investment I^c_{1t} is made up of the same combination of domestic and foreign goods as the consumption basket of households. Firms incur costs when adjusting their capital stock amounting to

$$CI_{1t} = \frac{\Phi_I}{2} \frac{(K_{1t+1} - K_{1t})^2}{K_{1t}}, \tag{17}$$

where $\Phi_I > 0$ is a scaling parameter.

Firms maximize their profits Π_{1t} given by

$$\Pi_{1t} = Y_{1t} - w_{1t} h_{1t} N_{1t} \left(1 + \tau^f_1\right) - \omega_1 P^c_{1t} V_{1t} - P^c_{1t} I^c_{1t} - P^c_{1t} CI_{1t}. \tag{18}$$

Their optimization problem can be summarized as

$$F^F_{1t} = \underset{K_{1t}, N_{1t}}{max} \left[\Pi_{1t} + \beta E_t \left(\frac{\lambda_{1t+1}}{\lambda_{1t}} F^F_{1t+1} \right) \right], \tag{19}$$

subject to the production technology (13), and the law of motion of capital (16) and aggregate employment (15). Firms' future profit flows are weighted by the ratio of the future to the present Lagrange multiplier $\lambda_{1t+1}/\lambda_{1t}$ of household's budget constraint, since households are the owners of the firms. This weight assesses the relative importance of wealth changes for households.

The optimality conditions with respect to capital and labour can be combined in

$$q_{1t}^T = \beta E_t \left[\frac{P_{1t+1}^c \lambda_{1t+1}}{P_{1t}^c \lambda_{1t}} \left\{ \frac{1}{P_{1t+1}^c} \alpha \frac{Y_{1t+1}}{K_{1t+1}} + q_{1t+1}^T - \delta + \frac{\Phi_I}{2} \left(\frac{I_{1t+1}^c - \delta K_{1t+1}}{K_{1t+1}} \right)^2 \right\} \right] \tag{20}$$

$$\frac{\omega_1}{q_{1t}} = \beta E_t \left[\frac{P_{1t+1}^c \lambda_{1t+1}}{P_{1t}^c \lambda_{1t}} \left\{ \frac{1}{P_{1t+1}^c} (1-\alpha) \frac{Y_{1t+1}}{N_{1t+1}} - \frac{1}{P_{1t+1}^c} w_{1t+1} h_{1t+1} \left(1 + \tau_1^f\right) + (1 - s_1) \frac{\omega_1}{q_{1t+1}} \right\} \right] \tag{21}$$

In equation (20), we use Tobin's q (q_{1t}^T) defined as

$$q_{1t}^T = 1 + \Phi_I \frac{I_{1t}^c - \delta K_{1t}}{K_{1t}} \tag{22}$$

2.3 Matching and Bargaining in the Labour Market

Successful matching of vacancies and unemployed results in hirings according to the following constant returns-to-scale technology proposed by Pissarides (2000):

$$H_{1t} = \chi_1 V_{1t}^{\psi} (1 - N_{1t})^{1-\psi} \tag{23}$$

where $\chi_1 > 0$ is a parameter that measures the efficiency of the matching process and $0 < \psi < 1$ denotes the elasticity of the matching function with respect to vacancies. Before a match occurs, firms and workers bargain over wages w_{1t} and the number of hours worked per period h_{1t} within a Nash bargaining framework. The outcome of the negotiation process is obtained by maximizing the weighted marginal value of the match for both parties:

$$\underset{w_{1t}, h_{1t}}{max} \left(\lambda_{1t} \frac{\partial F_{1t}^F}{\partial N_{1t}} \right)^{\epsilon} \left(\frac{\partial F_{1t}^H}{\partial N_{1t}} \right)^{1-\epsilon} \tag{24}$$

where $0 < \epsilon < 1$ measures the bargaining power of the firm. For the household the marginal value of a match is given by

$$\frac{\partial F_{1t}^H}{\partial N_{1t}} = \Gamma_{1t}^u - \Gamma_{1t}^n + \lambda_{1t}(w_{1t} h_{1t}(1 - \tau_1^d) - b_1) + (1 - s_i - \phi_{1t}) \beta E_t \left[\frac{\partial F_{1t+1}^H}{\partial N_{1t+1}} \right] \tag{25}$$

For firms it can be written as

$$\frac{\partial F_{1t}^F}{\partial N_{1t}} = (1-\alpha)\frac{Y_{1t}}{h_{1t}N_{1t}}h_{1t} - (1+\tau_1^f)w_{1t}h_{1t} + (1-s_1)\beta E_t\left[\frac{\lambda_{1t+1}}{\lambda_{1t}}\frac{\partial F_{1t+1}^F}{\partial N_{1t+1}}\right] \tag{26}$$

where we assume that the marginal value of work in production is taken as fixed in the bargaining process following Andolfatto (1996).

Defining labour market tightness θ_{1t} as $\frac{V_{1t}}{U_{1t}}$, optimal labour contracts imply

$$w_{1t}h_{1t} = \frac{1-\epsilon}{1+\tau_1^f}\left[\omega_1 P_{1t}^c\theta_{1t} + (1-\alpha)\frac{Y_{1t}}{N_{1t}}\right] + \frac{\epsilon}{1-\tau_1^d}\left[b_1 + \frac{1}{\lambda_{1t}}\left(\kappa_1^u - \kappa_1^n\frac{(1-h_{1t})^{1-\xi}}{1-\xi}\right)\right] \tag{27}$$

$$\frac{\kappa_1^n}{\lambda_{1t}}(1-h_{1t})^{-\xi} = \frac{1-\tau_1^d}{1+\tau_1^f}(1-\alpha)\frac{Y_{1t}}{N_{1t}h_{1t}}. \tag{28}$$

2.4 The Government

The governments in both countries balance their spending on transfers T_{1t} and unemployment benefits b_{1t} with their income from consumption and labour taxation. In case the amount of the unemployment benefits exceeds the tax revenue, the government imposes a lump-sum tax on the household instead of a transfer payment. For the home country the government budget constraint is hence

$$\tau_1^c P_{1t}^c C_{1t}^c + \left(\tau_1^d + \tau_1^f\right)N_{1t}w_{1t}h_{1t} = T_{1t} + (1-N_{1t})\,b_1 \tag{29}$$

With unemployment benefits b_1 fixed, transfer payments endogenously adjust in order to balance the budget.

2.5 Equilibrium

Global equilibrium requires market clearing in financial and goods markets. For the international bond market the equilibrium is defined as

$$B_{1t+1} + B_{2t+1} = 0 \tag{30}$$

In the markets of home and foreign goods, the equilibrium is given by

$$Y_{1t} = \kappa \left(\frac{1}{P_{1t}^c}\right)^{-\eta} D_{1t}^c + (1-\kappa)\left(\frac{1}{P_{2t}^c}\right)^{-\eta} D_{2t}^c \tag{31}$$

$$Y_{2t} = \kappa \left(\frac{P_t}{P_{2t}^c}\right)^{-\eta} D_{2t}^c + (1-\kappa)\left(\frac{P_t}{P_{1t}^c}\right)^{-\eta} D_{1t}^c, \tag{32}$$

where D_{it}^c denotes the aggregate demand in country $i = 1, 2$ which can be expressed as

$$D_{it}^c = C_{it}^c + I_{it}^c + \omega_1 V_{it} + CI_{it} + CA_{it}. \tag{33}$$

Market clearing in the composite good market is obtained if

$$P_{1t}^c D_{1t}^c + P_{2t}^c D_{2t}^c = Y_{1t} + P_t Y_{2t} \tag{34}$$

holds.

Note that, due to Walras' law, one of these market clearing conditions is redundant. Finally, putting equations (5), (18), (29) and (33) together one obtains the evolution of the balance of payments in country 1

$$B_{1t+1} - (1+i_t)\, B_{1t} = Y_{1t} - P_{1t}^c D_{1t}^c. \tag{35}$$

3 The Impact of the German Hartz Reforms

In this section, we start out by describing the calibration of our model. Then, we present the results from our first quantitative analysis, where we analyze the impact of the German labour market reforms introduced in 2003 on the German and the "French" economy.[4] Finally, we discuss the sensitivity of our results.

[4]The second economy, of which some labour market characteristics are matched with the French economy and which is not subject to reforms should rather be understood as a hypothetical rest-of-the-world.

Table 1: Symmetric Calibration

Labour market				Production technology				Preferences				Bond market
ϵ	$\bar{\omega}V/Y$	ψ	q	α	h	δ	Φ_I	β	κ	η	ξ	Φ_b/NX
0.5	0.015	0.5	0.7	0.34	0.33	0.025	7	0.99	0.8	1	4	0.0038

3.1 Calibration of the Symmetric Parameters

We calibrate our model for quarterly data and set most of the parameters symmetrically between countries. Allowing heterogeneity only in labour market and fiscal policy parameters, i.e., potential reform parameters, enables us to abstract from differences between the countries that are irrelevant for our analysis. In this subsection, we only discuss the commonly set parameters, which are summarized in Table 1.

Labour Market We follow the literature on labour market rigidities in Europe (see e.g. Faia, Lechthaler, and Merkl (2013)) in choosing $\epsilon = 0.5$, i.e., by splitting the bargaining power in the Nash-bargaining equally between firms and workers. We set the elasticity of vacancies in the matching function ψ likewise to 0.5 in line with estimates by Petrongolo and Pissarides (2001), thus preserving the Hosios condition.[5] The average vacancy posting cost per hire $\omega_i V_i/Y_i$ for country i is set to 0.015 as in Fonseca, Patureau, and Sopraseuth (2009). In setting the probability of filling a vacancy q to 0.7, we choose the lower bound of values used in the literature. q is typically set between 0.7 (den Haan, Ramey, and Watson (2000) and Krause and Lubik (2007)) and 0.9 (Andolfatto (1996) and Hairault (2002)). We prefer 0.7, since it seems more in line with the European case (see Campolmi and Faia (2011)).

Production Technology The production technology parameters are calibrated to reflect the German/European production environment. While the labour share in production has been roughly constant over the past decades in the US, it was subject to a considerable decline in many European countries including Germany and France and the gap between

[5]The condition derived by Hosios (1990) implies that the outcome and thus the level of unemployment in equilibrium is efficient (i.e. welfare maximizing). It is met when the firm's share of surplus is equal to the elasticity of the matching function with respect to vacancies.

the US and Europe has narrowed.[6] In our benchmark calibration we set the elasticity of substitution for capital α in the production function to 0.34 in accordance with German and French data for the past decade. Following the literature, the steady state value of hours worked is set to 1/3 and the capital depreciation rate δ to 0.025.[7] The scaling factor of capital adjustment costs is chosen to be $\Phi_I = 7$, which is taken from Patureau (2007) and reflects the volatility of investment (relative to output) in the G7 countries.[8]

Preferences The discount rate of households is given by $\beta = 0.99$, which corresponds to an annual real interest rate of about 4% according to equation (9) in the steady state.[9] ξ is derived to have the value 4 assuming a (Frisch) labour supply elasticity of $(1-h)/(h \times \xi) = 0.5$ following the recommendation of Chetty, Guren, Manoli, and Weber (2011).[10] The elasticity of internationally traded goods η is set to 1 as in Fonseca, Patureau, and Sopraseuth (2009). The parameter defining the home bias of consumed products κ is calibrated by setting the import-to-GDP ratio $1-\kappa$ to a value of 0.2 which is the lower bound of total import shares in Germany and France since the introduction of the Euro. This value is higher than 0.1 which is often used in the literature for the US, but considerably lower than the peak of the German import share which exceeds 0.35. Since the home bias in the consumption bundle as well as the elasticity of substitution between domestic and foreign goods might influence spillovers significantly via the trade channel, we carry out a sensitivity analysis

[6] According to the EU KLEMS database, the labour share of income in France declined from 0.75 in the 1970s to 0.65 in the 2000s and in Germany from 0.72 to around 0.66. On the other hand, it shrank only by roughly 0.02 points from 0.64 to 0.62 in the US over the same period. See also Hogrefe and Kappler (2012).

[7] Our results in the next sections are hardly sensitive to the choice of the depreciation rate.

[8] We performed a sensitivity analysis setting Φ_I to very low and very high values. Our quantitative results in the next sections are not sensitive to variations in Φ_I. There occurs only a slight change in the initial dynamics of wages and consumption.

[9] The long term average in annual real interest rates in France and Germany till 2003 amounted to roughly 3 to 4% (depending on the starting year) which would imply a discount rate between 0.993 and 0.99. Considering only the past decade, on the other hand, would yield a significantly lower interest rate of about 1% and a higher discount rate of 0.998. Since our study rests upon a steady state analysis, we deem the long term average to be the appropriate choice. Yet, we checked the implication of lower interest rates and higher discount rates as indicated by the recent past. Since the consequent changes in the response to our reforms are minimal, we refrain from reporting detailed results.

[10] Chetty, Guren, Manoli, and Weber (2011) show that the estimates of the Frisch elasticity of aggregate hours worked differ substantially between micro and macro models, but not the elasticity on the intensive margin. Since our model differentiates between the intensive and extensive margins, we use the value of 0.5 recommended for the Frisch elasticity on the intensive margin. Furthermore, Bargain, Orsini, and Peichl (2011) show that labour supply elasticities do not differ much across countries.

Table 2: Calibration of Heterogeneity in the Labour Market Institutions and Fiscal Policy

		2003		2010	
		France	Germany	France	Germany
$1-N$	Unemployment	8.89	9.81	9.73	7.08
$1/\phi$	Av. duration of unemployment	15.50	9.53	13.30	8.68
ϕ	Job finding probability	19.35	31.48	22.56	34.57
b/wh	Unemployment benefit ratio	35.66	31.89	35.53	21.54
τ_f	Employers' labour tax	26.74	15.40	26.76	15.28
τ_d	Employees' labour tax	9.95	11.42	9.40	11.80
τ_c	Consumption tax	19.05	13.84	18.12	14.53

Note: All numbers are in percentage points except of the average duration of unemployment which is given in months.

with respect to κ and η below.

Finally, the scaling parameter for portfolio adjustment of households Φ_b is derived using empirical estimates of the ratio of the scaling parameter and steady state export share reported to be 0.0038 by Lane and Milesi-Ferretti (2002).

3.2 Calibration of Heterogeneity in Labour Market Institutions and Fiscal Policy

In our basic setup, several parameters and steady state values of variables in country 1 are calibrated to the French situation in 2003, whereas country 2 is matched to German data in 2003. Since our reform scenarios are partially based on institutions observed in 2010, we report for both countries the values corresponding to 2010 as well. The corresponding figures are displayed in Table 2.

We use annual harmonised unemployment rates from the OECD Reference Series Dataset to calibrate the steady state unemployment rate $1-N$. This definition excludes short term fluctuations that last less than one year in unemployment. The job finding probability ϕ is set by using the inverse of the average unemployment duration. Data on average duration of unemployment in months stem from the German Federal Employment Agency (Bunde-

sagentur für Arbeit) and annual publications of the French INSEE. Consequently, we derive the labour market tightness in the steady state from the relationship $\theta = q \times \phi$. We use the data on gross replacement rates (GRR) provided by the OECD in order to obtain the unemployment benefit ratios of both countries and calibrate b_i by setting the steady state value of $b_i/w_i h_i$ equal to the GRR values in the data in 2003.[11] The data on employers' and employees' tax rates on wages (τ^f, τ^d) as well as the consumption tax rate τ^c are constructed using the approach by Nickell (2006) based on the OECD Revenue Statistics and National Accounts.[12] The parameters for the matching efficiency χ_i are calibrated using the steady state relationships of both countries in 2003. The same applies to the parameters κ_i^n and κ_i^u that relate to the impact of leisure on utility.

In the next subsection, we provide a more detailed discussion of the heterogeneity in our calibration of the two countries. Note that this heterogeneity is also accompanied by differences in the exogenously given job separation rate. The steady state condition derived from equation (7) implies $s = \phi(1 - N)/N$, which yields $s_1 = 0.019$ and $s_2 = 0.034$ in our model calibrated based on 2003 values.

3.3 The Impact of the Reforms in Germany

The German labour market performed remarkably well during and in the aftermath of the economic crisis of 2008 and 2009, in contrast to many other countries. Table 2 summarizes a few telling observations. First, between 2003 and 2010, the unemployment rate increased by 0.8 percentage points in France, whereas it decreased by 2.65 percentage points in Germany. Second, the job finding probability increased by roughly 3 percentage points in both countries.[13] Third, the unemployment benefit ratio decreased by more than 10 percentage points in Germany, whereas it stayed constant in France during the period 2003-2010. Fourth, the three tax rates that we focus on in this study stayed roughly constant

[11] The GRR data consist of unemployment insurance and unemployment assistance benefits and do not take tax and social security contributions on earnings and on benefits into account. Furthermore, the GRR data are based on three different household types. They are a weighted average of the payments over the first five years of unemployment with the first year being weighted more heavily.

[12] With some changes caused by changed data availability though. See Appendix B for details.

[13] Note that the average length of unemployment may decrease in times of crisis thus increasing the job finding probability because of a strong increase in the number of short-term unemployed.

over time in both countries. Note, however, that the two countries differ significantly in this respect, particularly in terms of the employers' labour tax rate.

There is still an ongoing discussion in the literature on how much of the German success story is attributable to wage moderation, short-time working benefits, flexible work arrangements and the comprehensive Hartz reforms of the years 2003 to 2005.[14] According to recent studies by Krause and Uhlig (2012) and Krebs and Scheffel (2013), a sizeable part of the reduction in the German unemployment rate, namely about 1.4 to 2.8 percentage points, has been due to the last reform law, Hartz IV, which modified the unemployment benefit and social assistance schemes. But also the earlier laws Hartz I-III, which aimed at increasing the efficiency of job matching, i.e., reducing the time needed for a successful matching of vacant jobs with the unemployed (see, e.g., Fahr and Sunde (2009)), made a significant contribution.[15] The match efficiency refers to the parameter χ_i in the matching function given by equation (23) in our framework. The estimates of Fahr and Sunde (2009) that refer to the impact of the Hartz I/II reforms measured over the period March 2000–December 2003 point to a 5-10% increase in match efficiency. The authors measure the impact of the Hartz III reform over the period March 2003–December 2004 to be somewhat weaker. Yet, the joint impact of the first three reforms of the Hartz package on the match efficiency has been a visible 10-15% within a very short period after their introduction. In a more recent study, Hertweck and Sigrist (2013) estimate the range of increase in the efficiency of the matching process in Western Germany of the combined reforms to lie between 12% and 31%.

The foregoing numbers and studies suggest that a large portion of the strong labour market performance of Germany might be traced back to the increase in the matching efficiency and the decline in the unemployment benefit ratio due to the last reform law, Hartz IV.[16] Therefore, we ask in this subsection to what extent the changes in these two

[14] See, e.g., Burda and Hunt (2011) and the references therein.

[15] Hartz I-III included a number of efforts to improve the matching efficiency by improving the performance of public employment services and of Active Labour Market Policies (ALMP). In specific, the public employment services were modernized in terms of their organizational structure and were geared to be result- and customer-oriented. In addition, incentives for alternative private placement services were introduced to generate market forces and the allocation of measures was subordinated to cost effectiveness. Furthermore, direct integration measures were boosted vis-á-vis training and job creation measures which prevent participants from a fast return into work. See Jacobi and Kluve (2006) for a detailed review of all reform measures.

[16] Hartz IV completely restructured the German unemployment assistance scheme reducing the benefits of

Table 3: Percentage Change in Selected Variables of Germany between 2003 and 2010

	Nh	N	h	w	Y	C	ToT		
							CPI	GDP Defl.	Exports Defl.
Data	2.9	5.0	-1.9	0.7	8.6	3.6	-0.8	-5.9	-4.5
$\chi \uparrow$	1.0	1.7	-0.7	0.4	0.9	1.1		-0.8	
$b \downarrow$	1.3	1.7	-0.4	-0.8	1.1	0.5		-1.0	
$\chi \uparrow$ & $b \downarrow$	2.1	3.1	-1.0	-0.3	1.9	1.5		-1.7	

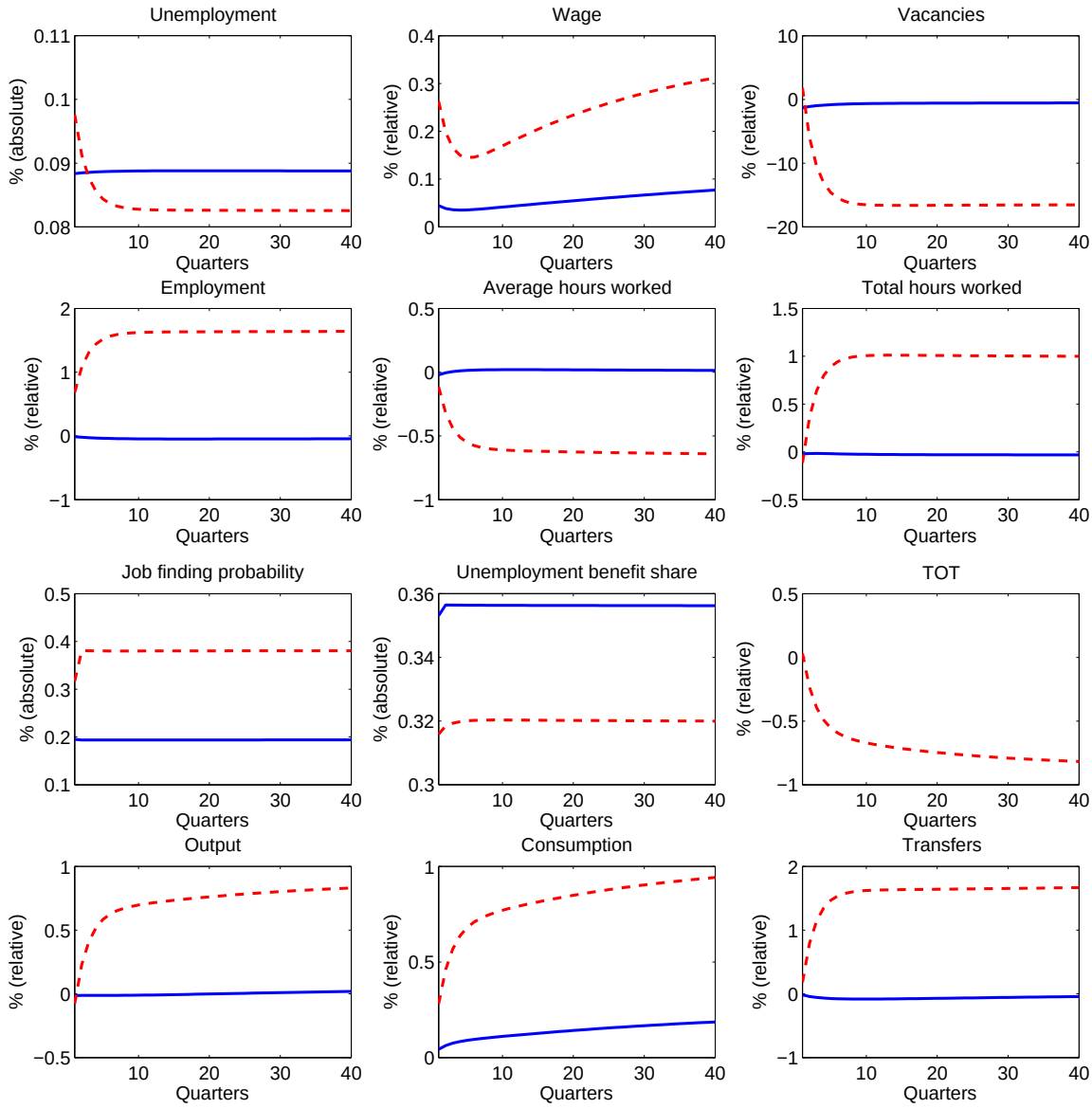
Data source: OECD.Stat Database. *Notes*: ToT stands for terms of trade and relates to P_t in the model. All other variables are as defined in Section 2.

parameters can explain the evolution of several variables in Germany between 2003 and 2010 and how good our model performs in predicting the changes in quantitative terms. However, before we present the results from our quantitative experiments, we find it useful to have a look at the first row of Table 3 which summarizes the evolution in selected variables over the period 2003-2010.[17] We observe that total hours worked increased by 2.9% in Germany over this period. This increase resulted from the increase in employment by 5.0% and occurred despite the decline in average hours worked per worker of 1.9%. At the same time, the real wages stagnated to a large extent and increased by merely 0.7% over the 8-year period. Furthermore, the increase in GDP was with 8.6% much higher than the increase in consumption which was only 3.6% higher in 2010 than its 2003 level. Finally, the terms of trade of Germany in comparison to France declined by 0.8%, 5.9% or 4.5%, depending on whether one refers to the consumer price index, GDP deflator or the deflator for the exports of goods and services, respectively, in the computation.

Increasing the matching efficiency In our first exercise, we increase the matching efficiency parameter by 20% in Germany in line with the estimates provided by Hertweck and Sigrist (2013). Starting out with the parametrization of Germany and France as described above for 2003, the adjustment paths of the selected variables of both economies are illustrated in Figure 1. The corresponding equilibrium effects can be found in the second row of Table 3.

long-term unemployed considerably.

[17] The underlying data are extracted from the OECD.Stat Database.



Notes: Red-dashed (blue-solid) line shows the adjustment in Germany (France) after a 20% increase in the matching efficiency parameter χ of Germany. The initial parametrization follows from the values for Germany and France in 2003 given in Table 2.

Figure 1: Adjustment after a 20% increase in the matching efficiency χ in the German economy

The efficiency increase in matching means that for given levels of vacancies and unemployment more people are hired by firms. In our experiment, the decline in the steady-state vacancy level is 15.1%, whereas the equilibrium output rises by slightly less than 1% over the long run. Hence, the share of vacancy filling costs of firms in national output declines from 1.5% to 1.26%. At the same time, unemployed agents find a job more easily for a given level of vacancies lowering the equilibrium German unemployment rate to a new equilibrium level of 8.2%. Consequently, with a non-increasing labour force in our model world, German employment is predicted to grow by 1.7% in the long run.

With the job finding probability rising by 6.4 percentage points to 38.1% and complete income insurance, the working members of the household slightly decrease their average hours worked by 0.7%, i.e., the income effect dominates, and the hourly wages hence go up by 0.4% in the long run. The combined effect of the changes in employment and hours worked per employee on total hours worked amounts to an increase of 1.0%. Since the increase in wages is accompanied by a decline in hours worked per employee of roughly the same order and the unemployment benefits are fixed, however, the unemployment benefit ratio is hardly affected by the increase in the matching efficiency. Note that the total wage earnings of an employee (wh) decrease by 0.26% in comparison to the former steady state. Nevertheless, the total wage income of the representative household (Nwh) increases by 1.4%, since more members of the household find a job in the new steady state.

Finally, output and consumption respectively increase by 0.9% and 1.1% in the long run following the match efficiency increase. That the consumption increases by slightly more than output in percentage terms reflects the fact that some of the resources that are set free from search activity can be channelled to private consumption.

Decreasing the unemployment benefit ratio While the increase in the matching efficiency reduces the frictions in the labour market and thus facilitates higher output and consumption levels, the impact of the second policy reform that we now analyze, the decline in the unemployment benefit ratio by more than 10 percentage points, impacts directly on the labour supply and reduces the outside option of workers in the Nash bargaining. Note

that the unemployment benefit ratio is not a parameter that we control directly.[18] Therefore, what we do in our exercise is to compute a new unemployment benefit level (b) that is obtained by imposing the unemployment benefit ratio of 2010 in Table 2 to total wage per employee (wh) as computed with our initial calibration with 2003 values for Germany.

The unemployment effects of this reform are similar to the effects of the reforms that increased the matching efficiency as an inspection of Figure 2 and the third row of Table 3 shows. The unemployment rate declines to 8.3%, accompanied by a 1.7% increase in employment, in the long run. Thereby, the deterioration in the bargaining power of workers is the main factor behind the falling wages and corresponding increase in the labour demand. The decline in the unemployment benefit ratio induces more unemployed agents to work at the steady state through the decline in their income. The subsequent decline in wages generates a negative substitution effect on the hours worked of agents in employment and leads the firms to post 22% more vacancies than at the former steady state. Consequently, hirings rise by 1.7% and the job finding probability increases to 38.1% at the steady state.

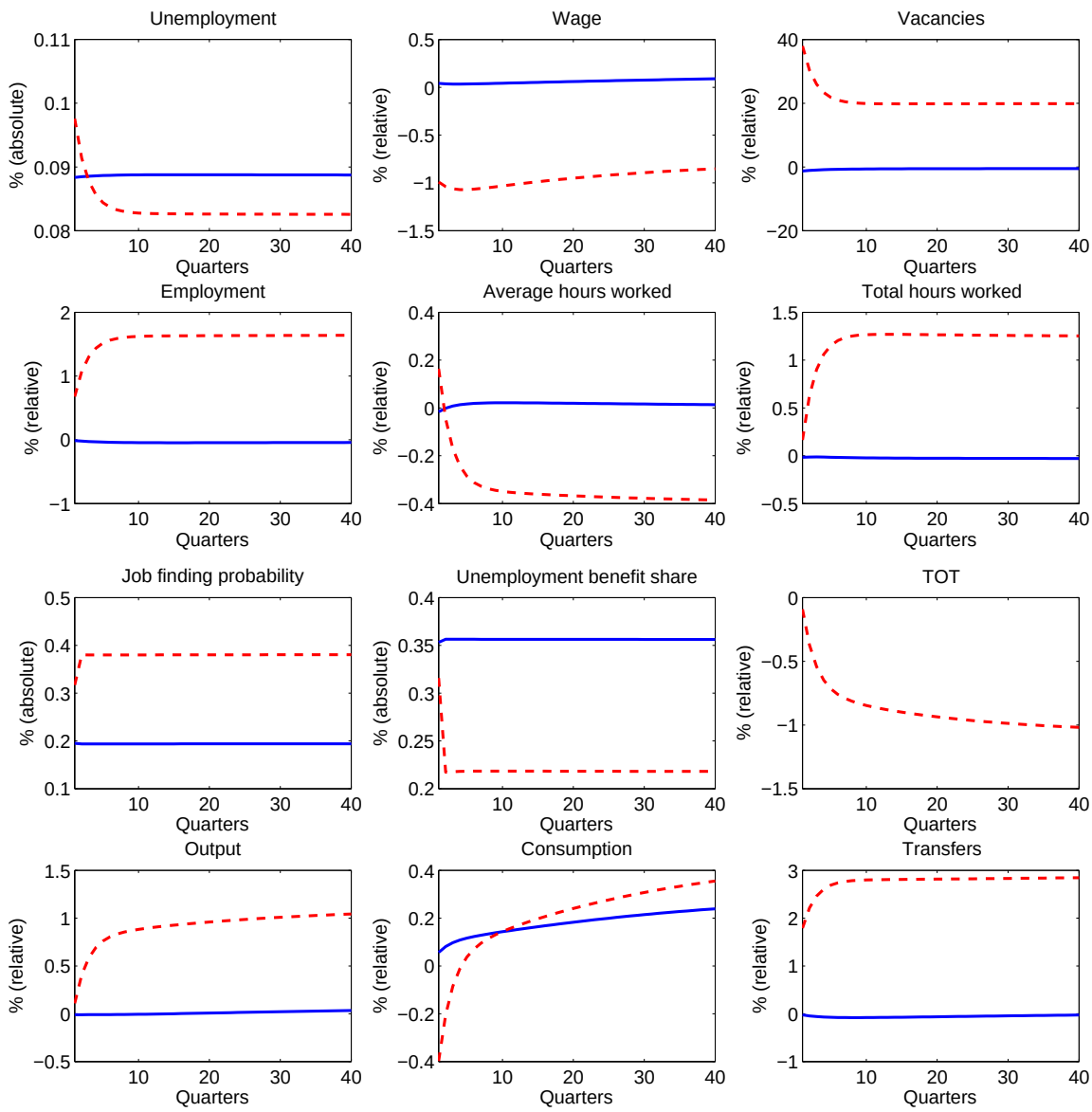
The total hours worked increases more strongly, by 1.3%, after the decline in unemployment benefits than after the increase in the matching efficiency. As to the total income of the households from wages and unemployment benefits, the increase in equilibrium employment more than compensates for the decline in the hourly wages and unemployment benefit level, the total wage and unemployment benefit before-tax income ($Nwh + (1 - N)\, b$) being 2.0% higher at the new steady state. Note that we decrease the unemployment benefit level by 10.35% with this reform in comparison to its 2003 level in Germany. Total wages per employee decline, however, by 1.1% as well. Therefore, the effective decline in the unemployment benefit ratio reads 10.1%.

Despite the significant positive impact of the decline in the unemployment benefit on employment, output is only weakly affected by the reform in the short run, since the income loss

[18] One possibility would be to endogenize the unemployment benefit instead of fixing it to a certain value as, e.g.,

$$b_{it} = rr_i w_{it} h_{it},$$

where rr_i stand for the replacement ratio in country i. Such a modification of the model leads, however, to an implausibly high volatility in the unemployment benefit level as it adjusts to changes in current wages (w) and hours worked per employee (h). Fixing the unemployment benefit ratio only at the steady state is, on the other hand, more successful in reflecting the data.



Notes: Red-dashed (blue-solid) line shows the adjustment in Germany (France) after a 10 percentage point decline in the unemployment benefit ratio of Germany. The initial parametrization follows from the values for Germany and France in 2003 given in Table 2.

Figure 2: Adjustment after a 10 percentage point decline in the unemployment benefit ratio in the German economy

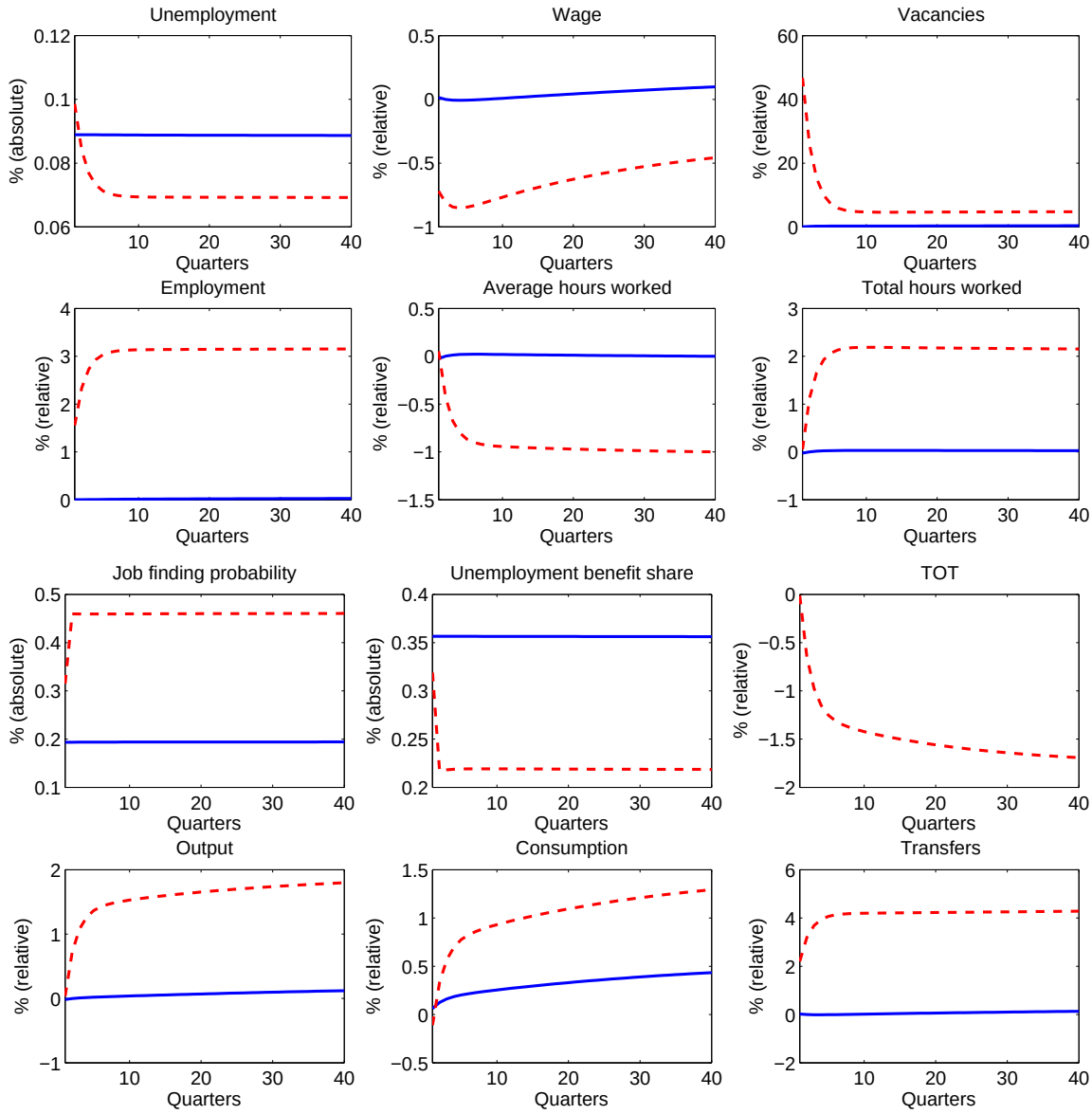
due to the sharp decline in the unemployment benefit and hourly wages depresses the consumption of households strongly. Consumption even declines by 0.4% on impact, although it steeply rises in the periods afterwards for a while and then gradually approaches its new steady state level which is 0.5% higher than its previous steady state level. In contrast to the reform which increases the matching efficiency, the long-run increase in the output level after the decline in the unemployment benefits is with 1.1% more than twice as large as the increase in consumption in terms of percentage points.

Increasing the matching efficiency and decreasing the unemployment benefit ratio simultaneously We now introduce the two reforms simultaneously in the model in order to see to what extent they can account for the changes we observe in the data. The quantitative effects of this exercise are shown in Figure 3 and the fourth row of Table 3. When the reforms are introduced simultaneously, their combined effects are roughly equal to the sum of their individual effects, as a comparison of the sum of the second and third rows of the same table with the numbers in the fourth row suggests. That the sum of the second and third rows is not exactly the same as the fourth row points to the existence of some nonlinearities when the two reforms are introduced simultaneously.

A striking observation is that the model gets most of the qualitative changes in the numbers correct following the two reforms. The only exception to this assessment is the change in the wage rate, which increased by 0.7% in the data and decreases by 0.3% in our calculations.[19] All in all, our quantitative model suggests that these two reforms are able to explain a large portion of what happened in the German data between 2003 and 2010. The estimate of our model of the change in employment (hours worked per employee) is, for example, 3.1% (-1.0%), whereas it happens to be 5.0% (-1.9%) in the data. The total hours worked, which increase by 2.1% due to the two reforms in the model, increased by 2.9% in the data.

As to the output and consumption, the percentage increase in output was with 8.6% more than twice as large as the percentage increase in consumption. The model estimates point, however, to a discrepancy of only 25%, i.e., the output percentage increase must have

[19]This may be due to the fact that we do not take technological improvements into account; see our discussion below.



Notes: Red-dashed (blue-solid) line shows the adjustment in Germany (France) after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio of Germany. The initial parametrization follows from the values for Germany and France in 2003 given in Table 2.

Figure 3: Adjustment after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio in the German economy

exceeded the percentage increase in consumption by only a quarter if the only change in the German economy had been the two reforms between 2003 and 2010 according to our model. Furthermore, the model underestimates the increase in output (consumption) by 6.8 (2.1) percentage points. Finally, the model overestimates the decline in the unemployment rate: it must have fallen to 6.9% after the introduction of the two reforms according to the model, while it declined to 7.1% in 2010 in reality.

In general, the calibrated model is able to mimic what happened in the German data to a large extent when it is driven by the increase in the matching efficiency and the decline in the unemployment benefit ratio. The model is certainly not a perfect reflection of reality. An important aspect that we abstract from is the technological improvement that occurred between 2003 and 2010. Assuming a 0.4% average annual improvement in the total factor productivity level, for example, the steady state level of total factor productivity would have exceeded its 2003 level by 2.8% in 2010. That we abstract from this channel probably explains a large part of our underestimation of the growth for almost all variables—particularly output and consumption.

As to the unemployment rate, however, notice that we have overestimated its decline despite the absence of technological improvement. If that factor had also been integrated into our exercise, our overestimation would have been even larger. One partial explanation for this discrepancy could be the absence of demographics from the model. Recall that the working-age population is constant in the model, whereas it declined by 2.1% between 2003 and 2010 in Germany according to the OECD.Stat database. Another partial explanation could be the global financial and economic crisis: the decline in the German unemployment rate might have been closer to the levels estimated by our model, had the crisis not taken place.

All in all, notwithstanding the lack of the aforementioned three factors—technological improvement, demographics and the latest economic crisis—that are abstracted from the model, our quantitative exercise shows that the model does a good job in explaining a large part of what happened in the German data between 2003 and 2010 from a long-run perspective. Therefore, we will use the same framework for evaluating various reform possibilities in France in Section 4.

3.4 International Spillovers

Before discussing the reform potential for the French economy, however, it is in order to discuss the spillover effects of the German reforms on the outside world, i.e., in our case on the "French" economy which is to be interpreted rather as rest of Europe or rest of the world. When our two reforms take effect simultaneously, the long-run increase in French output is 0.2%.[20] The impact on the French consumption is with 0.5% stronger than the impact on output. These effects are driven mainly by the terms-of-trade channel and follow partly from the existence of international capital markets as we show in the following.

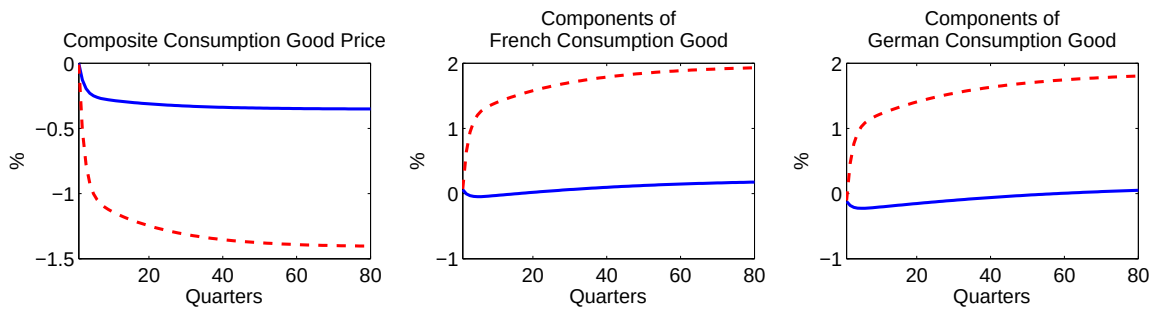
International spillovers are initiated by changes in the terms of trade P_t in our framework, as discussed by Dao (2013a).[21] Following the German reforms, the German output increases, which induces a reduction in the relative price of the German good. The combined effect on the terms of trade of Germany, when the reforms are introduced simultaneously, is a decline of 1.7% as can be seen from Figure 3. Note that this value is in line with what is reported for the change in the German terms of trade vis-à-vis France in the data, see the first row of Table 3. The higher valuation of the French good increases the surplus to be shared between firms and workers through Nash bargaining and has positive employment and output effects on the French economy. It should be noted, however, that the labour market effects of the German reforms on the French economy are rather limited: the French employment hardly moves in the short run and increases negligibly by 0.02% in the long run after the German reforms.

The decline in the terms of trade of Germany manifests itself as a decline in the prices P^c_{1t} and P^c_{2t} of the composite consumption goods of both countries as shown in the first graph of Figure 4.[22] Not surprisingly, the households of both countries increase the amount of the German good that goes into their composite consumption good as the second and third

[20] Just to put the numbers into context, 0.2% of German (French) GDP amounts to 4.9 (3.6) billion EUR in 2012.

[21] Dao (2013a) investigates the international spillover effects of reductions in the employers' labour tax rate. Her main analysis is empirical and based on a panel regression, which is motivated by a two-country model similar to ours. The main differences to our model are that Dao's model excludes the intensive margin of hours worked and the consumption and employees' labour taxes. See also Faia, Lechthaler, and Merkl (2013) who emphasize the role of the terms of trade in international spillovers by means of a labour selection model with turnover costs and Nash-bargained wages.

[22] Note that $P^c_{1t} = \left[\kappa + (1-\kappa)\, P_t^{1-\eta}\right]^{\frac{1}{1-\eta}}$ and $P^c_{2t} = \left[\kappa P_t^{1-\eta} + (1-\kappa)\right]^{\frac{1}{1-\eta}}$.



Notes: In the first graph, red-dashed (blue-solid) line shows the adjustment in Germany (France) after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio of Germany. In the second and third graphs, red-dashed (blue-solid) lines show the percentage change in the German (French) components of the French and German composite goods, respectively. The initial parametrization follows from the values for Germany and France in 2003 given in Table 2.

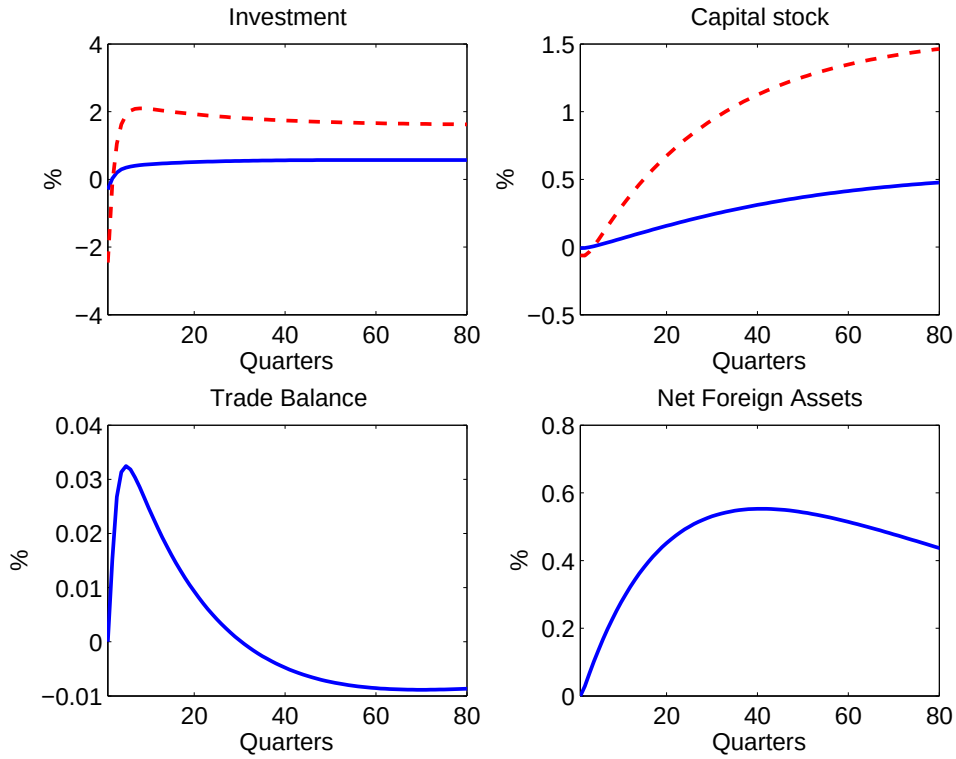
Figure 4: Adjustment after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio in the German economy

graphs of the same figure illustrate. The amount of the French good in the consumption good of both countries, on the other hand, decreases slightly in the first periods after the joint reforms, whereas it also increases in the long run in both countries.

With the same logic as for consumption, the decline in the German terms of trade renders investments in both German and French economies cheaper.[23] This leads to an increase in investment and hence accumulation of more capital as a result of the reforms in both countries as illustrated in the upper panel of Figure 5. Note that the increase in the German capital stock also partly occurs thanks to the existence of the international bond market. Whereas none of the countries holds any bonds at the steady state in our two-country world, the favourable macroeconomic conditions that follow from reforms in the German economy motivates French households to save some of their gain from German reforms and buy German bonds with those savings which in turn are used for increasing German firms' capital stock even further in the middle run. This is reflected in the positive trade balance of the French economy in the first 6-7 years after the introduction of the German reforms.[24]

[23]Note that there is no distinction between consumption and investment goods in our model economy, i.e. there is only one good of which price has been given in the previous footnote.

[24]Note that the French trade balance reads $Y_{1t} - P^c_{1t}D^c_{1t}$ and the German $P_tY_{2t} - P^c_{2t}D^c_{2t}$.



Notes: Red-dashed (blue-solid) line shows the adjustment in Germany (France) after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio of Germany. The initial parametrization follows from the values for Germany and France in 2003 given in Table 2.

Figure 5: Adjustment after a 20% increase in the matching efficiency parameter χ and a 10 percentage point decline in the unemployment benefit ratio in the German economy

The French trade balance turns slightly negative after that period and approaches gradually to zero in the very long run. Thereby, the net foreign asset position of France as a share of GDP improves gradually, reaching a share of 0.5% about 40 quarters after the introduction of the reforms as illustrated in Figure 5. These assets are liquidated very slowly after that peak and are mainly used for building capital in France. In the long run, the French capital stock increases by a significant 0.5%, which is about one third of the relative increase in the German capital stock of 1.6%.

There is an ongoing discussion as to the spillover effects of labour market reforms among academicians as well as policy-makers. A popular view is that reforms represent a beggar-thy-neighbour type of policy-making which generates cost advantages for the reforming country vis-à-vis its trading partners, particularly by increasing the relative labour costs.[25] Contrary to this view, Alessandria and Delacroix (2008) find, based on a model with Ricardian trade and without search and matching frictions, that major part of the gains created through labour market reforms is exported to trading partners because of worsened terms of trade. The authors argue that this explains the reluctance for labour market reforms in many countries. Our model belongs to a third group: it implies positive effects on the reforming country and either small and positive or neutral spillover effects of labour market reforms to other countries.

Wage moderation plays a central role in the aforementioned discussion. According to our model, hourly wages increase as a result of a matching efficiency increase in both countries, the increase even being relatively higher in the reforming country. On the other hand, both a reduction of unemployment benefits and a combination of both types of reforms lead to a wage decline (increase) in the home (foreign) country. Nevertheless, combined reforms have virtually no effect on the (un)employment in the foreign country[26] and generate positive effects on output and consumption through the terms-of-trade channel. These results are in line with the empirical findings of Dao (2013a) and Felbermayr, Larch, and Lechthaler (2012a), for example, who report positive spillover effects of a reduction in labour taxes. Our model belongs to the same class of theoretical models used by, e.g., Dao (2013a, 2013b)

[25] See Felbermayr, Larch, and Lechthaler (2012a) for a discussion on the issue.

[26] Only the effect of the German unemployment benefit decline alone on the French employment (unemployment) is slightly—graphically hardly possible to recognize—negative (positive).

and Felbermayr, Larch, and Lechthaler (2013), which generate positive spillovers due to the existence of both intra-industry (Armingtonian) trade and search frictions in the labour market.

Finally, Felbermayr, Larch, and Lechthaler (2012b) find that a multi-country trade model with heterogeneous firms and search-and-matching unemployment underestimates relatively large spillover effects found in the data, as it is the case with our model as well. The authors then introduce real wage rigidity into the model and observe that under perfect real wage rigidity, for example, spillovers of reforms in terms of unemployment to the foreign country can be almost half as large as in the home country. The increase in spillovers with more rigid wages results from the fact that quantities are adjusted even more strongly due to a lack of adjustment possibilities through prices in the latter case. Thus, the quantitative positive spillover effects that we obtain in this paper can be seen to be on a lower bound.

3.5 Short-Run vs. Long-Run Effects

Our hitherto evaluation of the model has focused predominantly on the long-run effects of reforms. Yet, in debates on the implementation of structural reforms, their short-run effects also take a central stage. Indeed, structural reforms may incur costs for states as well as for some groups in the society which may hinder their implementation in practice, although their long-run benefits may by far exceed the short-run costs. Another question of interest is how long it takes for structural reforms to take effect.

An inspection of Figures 1 to 5 shows that the sign of the impact of reforms on both economies is the same in the short and long run. One exception to this observation is the evolution of average hours worked and consumption in Germany after a 10 percentage point decline in the unemployment benefit ratio, depicted in Figure 2. Although the long-run consumption increase following such a reform is 0.5% and the consumption level exceeds its before-reform steady-state level already one year after the reform, the immediate decline in consumption, by 0.4% in the German case, may render the implementation of that reform alone rather difficult. Nevertheless, if the unemployment benefit reform is introduced simultaneously with the matching efficiency reforms, the immediate impact on consumption is

virtually zero and increases gradually following the initial reform period. This result points to the meaningfulness of introducing reforms jointly and the importance of timing. In terms of government budget, on the other hand, both reforms considered for Germany swell the government coffers as the increase in transfers to households indicate. Thus, such type of reforms could even be desirable at times where government debt levels do not allow other measures that would incur costs for the government budget.

With respect to investment in Germany, we observe that the simultaneous introduction of both reforms reduces domestic investments at impact, although they increase significantly in the long run. On the other hand, the capital stock in the German economy shows only a negligible decline at the impact as a result of reforms, since the loss from the decline in investment is compensated by the flow of international bonds, i.e. capital, from France.

As to the adjustment to the new equilibrium after reforms, we can differentiate among three groups of variables. First, job finding probability and unemployment benefit share adjust immediately after the introduction of reforms, both at home and abroad. Second, labour market variables—unemployment, vacancies, employment, average hours worked and total hours worked come very close to their new equilibrium values after reforms within roughly two years. This suggests that labour market reforms of the type considered here lead to a relatively fast adjustment in terms of (un)employment. Third, on the other hand, the adjustment of the remaining variables takes much longer than the ones in the aforementioned two groups. In particular, the very slow adjustment of the trade balance and net foreign assets is responsible for the slow adjustment of output and consumption. It should be noted, however, that a large part of the adjustment in the latter variables occurs within the horizon of the first two years, where the labour markets almost complete their long-run adjustment to reforms. The rest of the adjustment in output and consumption has to do with the accumulation and liquidation of international bonds, is quantitatively small and occurs very slowly over the long run.

3.6 Sensitivity Analysis

In this subsection, we turn our attention to the impact of a few parameters that might influence the quantitative results significantly if set to different values than we used in our exercises, namely the parameters κ and η subsuming preferences with respect to the consumption bundle and those determining the bargaining and the matching function, ϵ and ψ. Note that these are at the same time parameters which are relatively hard to measure. While κ and η may be expected to affect the size of spillovers through the trade channel, ϵ and ψ can in particular affect the impact of reforms in the reforming country by influencing the bargaining power of firms vs. workers. In Table 4 we summarize the reform-induced changes in the steady-state values under different scenarios and compare them with our baseline calibration where $\kappa = 0.8$, $\eta = 1$ and $\epsilon = \psi = 0.5$. The first row of the table states the modification made in comparison to the baseline case.

Differences in the preferences of the consumption good composition The choice of the home-bias κ in the country-specific consumption goods as well as the elasticity of substitution between foreign and domestic goods η both have some impact on the response of domestic and foreign output, consumption, investment and wages in quantitative terms. The qualitative results described in the foregoing section, in contrast, are not altered. These parameters basically determine how the 'cake'—the benefits in terms of economic outcome resulting from the reforms in the home country—is divided up between the foreign and domestic economies. The smaller the home-bias, i.e., κ and the lower the elasticity parameter η the more the foreign country participates in the reform effects. In the first scenario, we set $\kappa = 0.7$ which corresponds to the average import share in Germany in the past decade. Since for η there is no observable empirical counterpart available, we consider a relatively low value of 0.75 suggested by Corsetti, Dedola, and Leduc (2008) and higher value of 1.5 which has often been used in international real business cycle models starting with Backus, Kehoe, and Kydland (1992).

If the share of the domestic good in the foreign consumption bundle is larger (and smaller in the domestic bundle), foreign consumers profit from the price reduction in domestic goods as a result of the reforms more strongly (and domestic consumers accordingly less strongly)

than in the baseline scenario. This goes in line with the fact that the terms of trade P_t drop after reforms less with lower κ. In addition, the adjustment through the international bond market occurs faster leading to a stronger (weaker) increase in investment and capital abroad (at home). Lower values of η imply that consumers in both countries are more prone to adjusting the composition of their final consumption good. Hence, the consumption bundle in both countries is shifted more strongly towards the German good after reforms giving rise to similar effects as with a lower home bias in the composition. The adjustments in the labour market in terms of employment, hours worked or unemployment after the reform are hardly effected by changes in the preference parameters. To summarize, alternative values for κ and η change the size of spillovers and thus the division of reform effects between countries, but the qualitative effects of the reforms remain unaltered.

Changes in the bargaining power and the elasticity of the matching function Since the bargaining power of firms versus workers is hard to measure, we used the balancing value of 0.5 in our baseline scenario. Furthermore, we set the elasticity of unemployment in the matching function $1 - \psi = 0.5$ and are thus at the lower bound of the range from 0.5 to 0.7 labeled plausible by Petrongolo and Pissarides (2001). We test the sensitivity of these choices by calculating the reform effects when ϵ and ψ respectively take a lower value of 0.4. Higher bargaining power of workers in Europe vis-á-vis Anglo-Saxon countries, referred to in many studies where ϵ is set to 0.5, seems a plausible scenario, since union coverage is higher and may play an important role in the bargaining process. The results of both scenarios are displayed in the last two columns of Table 4.

By comparing the implied outcomes with our baseline calibration (in the first column), the importance of these parameters becomes clear. Both scenarios imply sizeable quantitative changes but no qualitative changes to our conclusions from above. With lower ϵ or ψ the reforms have weaker effects in the labour market reducing thus the gains in economic output.

If workers' bargaining power is higher, i.e., $\epsilon < 0.5$, the response of domestic as well as foreign variables to the reforms is dampened considerably. Due to their increased power in the Nash-bargaining, employees obtain higher wages and work on average more than in the baseline case, i.e., the income effect prevails. As firms post less vacancies, the job finding

probability is reduced and the increase of employment in steady state is lower. Consequently, the increase in domestic output, consumption and investment is less pronounced in this scenario. Finally, terms of trade and net foreign asset position exhibit a weaker response which implies smaller spillover effects for France.

Similarly, we observe smaller effects of the reforms on the economy, in comparison to the benchmark case, if a lower elasticity of vacancies (and hence a higher elasticity of unemployment) is assumed. However, wages shrink less and firms increase their vacancy posting relative to the steady state stronger than in the baseline scenario coming from lower steady state value though (since posting an additional vacancy is not as effective as before). This comprises higher search costs for firms which are passed over to workers in the bargaining process resulting in lower wages, as mentioned. That in turn induces workers to reduce their hours worked a little less than in the baseline case, i.e., the substitution effect prevails.

4 Reform Possibilities in France

The strong labour market performance of the German economy, particularly the decline in its unemployment rate even during the global financial and economic crisis, has been praised in a number of reports by international institutions[27] and motivated labour market reforms in other countries. Thereby, it is not to forget that countries may differ substantially in terms of their labour market institutions. Moreover, the fiscal space of many countries has been restricted due to the strong and still ongoing impacts of the 2008-2009 recession. Both of these factors crucially shape the extent to which German type reforms can be introduced in other countries. In this section, we turn our attention to reform possibilities in the French economy in the light of our hitherto discussion with respect to German Hartz reforms. To this end, we use as initial steady state the institutional framework of France and "Germany " in 2010 and investigate the potential impact of various reform possibilities in the same way as in the previous section.

France has already initiated a reform to raise the matching efficiency in its labour market. According to its 2012 National Reform Programme (NRP), a report which all members of

[27] See, e.g., ECB (2012).

Table 4: Sensitivity Scenarios: Percentage Change in Selected Variables after Reforming χ and b in Germany

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parameters		Baseline	$\kappa = .7$	$\eta = .75$	$\eta = 1.5$	$\psi = .4$	$\epsilon = .4$
Germany	Nh	2.15	2.14	2.14	2.15	1.98	1.87
	N	3.21	3.20	3.20	3.22	2.91	2.84
	U	-2.90	-2.89	-2.89	-2.90	-2.63	-2.56
	ϕ	14.63	14.57	14.56	14.68	12.76	12.35
	h	-1.03	-1.03	-1.03	-1.03	-0.91	-0.95
	w	-0.28	-0.35	-0.37	-0.21	-0.38	-0.10
	Y	1.96	1.89	1.87	2.04	1.81	1.71
	C	1.54	1.34	1.27	1.76	1.34	1.44
	I	1.61	1.40	1.34	1.83	1.48	1.40
	P	-1.73	-1.58	-2.55	-1.05	-1.59	-1.51
France	Nh	0.02	0.03	0.03	0.01	0.02	0.02
	N	0.04	0.05	0.05	0.02	0.03	0.03
	U	-0.03	-0.05	-0.05	-0.02	-0.02	-0.03
	ϕ	0.08	0.11	0.12	0.05	0.06	0.06
	h	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01
	w	0.18	0.25	0.27	0.11	0.17	0.16
	Y	0.20	0.28	0.30	0.12	0.18	0.18
	C	0.55	0.76	0.82	0.34	0.51	0.48
	I	0.55	0.76	0.82	0.33	0.51	0.48
	P	-1.73	-1.58	-2.55	-1.05	-1.59	-1.51

Notes: In the baseline scenario $\kappa = 0.8$, $\eta = 1$ and $\epsilon = \psi = 0.5$. Percentage change in U und ϕ is absolute, in all other variables relative.

the EU are obliged to issue annually due to the Stability and Growth Pact (SGP), France has signed an agreement with the EU in January 2012 to improve the organization of the decision-making process of the Public Employment Service (Pôle Emploi) quite in the spirit of Hartz I-III reforms of Germany discussed above. The agreement targets at personalizing services and enhancing support functions, improving local coordination and optimizing the effective allocation of resources. In terms of our model, this reform can be expected to increase the matching efficiency χ_i of the French labour market.

Another concern in the discussion about labour market reforms is the need for a reduction in labour costs in order to enhance the competitiveness of a national economy.[28] Therefore, a reform initiative has been in the field of fiscal policy, where France shifts tax burden away from labour. Notably, the country adopted a 1.6 percentage points increase in the VAT while lowering employers' social contribution. In the "Council Recommendation on the National Reform Programme 2012" of France, the European Council recommends further reforms to improve the international cost competitiveness of French firms financed by an additional raise in consumption taxation.

Note that both the improvements in the Public Employment Service and the reduction of labour costs through lowering employers' taxes can have negative effects on the government budget with potential detrimental effects on the economy. In particular, although the costs of the Public Employment Service reforms may be small and offset by the gains through increases in the matching efficiency within a very short period of time, the cost of lowering employers' social contribution can be larger and permanent. Furthermore, the French gross government debt-to-GDP ratio was above the SGP criteria of 60% even prior to the 2008-2009 crisis and has risen to above 80% in the aftermath of the crisis. The IMF (2013) database estimates expect it to stay around 90% in the coming years. This is probably why the European Council recommends the lowering of employers' social contribution to be accompanied by a VAT increase.

In our model framework, we do not directly include government debt. Yet, the transfers T_{it} in the government budget constraint (29) can serve as a proxy for government debt.[29]

[28] See, e.g., Dao (2013b, 2013a).

[29] Negative transfers mean a lump-sum tax on households through the household budget constraint (5). However, transfers are positive with the calibration that we use in this paper at the steady state.

Therefore, an increase (a decline) in transfers is taken for an improvement (a worsening) in (of) government debt in the following. In Figures 1 and 3, we observe for Germany that both an increase in matching efficiency and a reduction in unemployment benefit ratio lead the transfers to increase more than output in percentage terms. Thus, the debt-to-GDP ratio is expected to decline as a result of such reforms.

4.1 "National Reform Programme"

In this subsection, we investigate the potential impact of the National Reform Programme of France by means of our model, where the common parameters of the model are set to the values in Table 1 and the heterogeneous parameters are set to their 2010 values in Table 2. We evaluate the impact of four types of reforms:

1. We increase the consumption tax rate by 1.6 percentage points as has already been done in reality.

2. We increase the consumption tax rate by 1.6 percentage points and decrease the employers' labour tax rate to the extent that the transfers-to-GDP ratio stays constant in the model. In order words, we treat this tax rate as a free parameter, of which lower limit is determined by the budgetary concerns of the government.

3. Since it is hard to have an educated guess on by how much the Public Employment Agency measures can increase the matching efficiency, we use the foregoing German figure of a 20% increase as the upper limit in our experiment and try out more conservative guesses of 10% and 5% as well.

4. We simultaneously increase the consumption tax rate by 1.6 percentage points and the matching efficiency by 5/10/20 % and decrease the employers' labour tax rate to the extent that the transfers-to-GDP ratio stays constant in the model in the same spirit as in the second reform.

While the qualitative effects of an increase in the matching efficiency is very similar to what we have already reported corresponding to the Hartz reforms in Germany, the increase

in the consumption tax rate and the reduction in the employers' labour tax rate bear on the economy through channels that we have not discussed in the paper before. Namely, the consumption tax increase generates a negative demand effect leading to a decline in consumption, output, employment and average hours worked. Hourly wages increase because of the decline in average hours worked and firms hence post less vacancies than in the previous steady state. Yet, the transfers increase following a raise in the consumption tax. The qualitative effect of the increase in employers' tax rate is similar to the effect of a technology shock in an RBC model with search and matching frictions.[30] It has positive effects on both the demand and supply sides of the economy. The only negative effect occurs, however, in government transfers.

The long-run effects of various reform combinations on selected variables of both countries are shown in Table 5. In the upper block of the table, we report if and/or by how much the reform parameters τ^c_{FR}, χ_{FR} and τ^f_{FR} have been changed in each exercise. The results from the first exercise, where we increase the consumption tax rate by 1.6 percentage points to 19.7% and leave the matching efficiency and employers' labour tax rate unchanged, can be seen in column (3) of the table. As mentioned in the previous paragraph, an increase in the consumption tax affects the aggregate demand negatively. However, the quantitative impact of a 1.6 percentage point increase in the consumption tax rate is expected to be small on output and consumption with about 0.3%. The unemployment rate rises slightly by 0.04 percentage points. In contrast, not shown in the table, the transfers increase by almost 4%, leading to a rise in the transfers-to-GDP ratio from 30.5% to 31.8% in our model.

Since the main motivation behind increasing the consumption tax rate is to create room for a reduction in the employers' labour tax rate, the next alternative we explore is to reduce the labour tax rate in the face of a consumption tax increase such that the transfers-to-GDP ratio does not change. Our calculations imply that a 1.6 percentage points increase in the consumption tax allows to reduce the labour tax by 3.0 percentage points, which is done in column (4) of Table 5. It turns out that such a change in the tax system would have small but non-negligible positive effects on the economy. The unemployment rate would decline by 0.45 percentage points and output and consumption would increase by roughly

[30] See Dao (2013a).

Table 5: Reform Possibilities in France

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Reforms	τ^c_{FR}	$\uparrow$ 1.6	$\uparrow$ 1.6	–	–	–	$\uparrow$ 1.6	$\uparrow$ 1.6	$\uparrow$ 1.6
	χ_{FR}	–	–	$\uparrow$ 0.05	$\uparrow$ 0.1	$\uparrow$ 0.2	$\uparrow$ 0.05	$\uparrow$ 0.1	$\uparrow$ 0.2
	τ^f_{FR}	–	$\downarrow$ 3.0	–	–	–	$\downarrow$ 3.1	$\downarrow$ 3.2	$\downarrow$ 3.4
France	Nh	-0.48	0.49	0.30	0.57	1.05	0.83	1.13	1.67
	N	-0.05	0.20	0.49	0.94	1.74	0.70	1.15	1.94
	U	0.04	-0.18	-0.45	-0.85	-1.57	-0.6	-1.04	-1.75
	ϕ	-0.11	0.48	1.20	2.40	4.80	1.73	2.98	5.49
	h	-0.43	0.28	-0.19	-0.37	-0.67	0.13	-0.02	-0.27
	w	0.05	2.28	0.11	0.22	0.41	2.52	2.70	3.06
	Y	-0.44	0.45	0.28	0.52	0.96	0.76	1.04	1.53
	C	-0.36	0.33	0.31	0.59	1.09	0.67	0.97	1.52
	I	-0.36	0.37	0.23	0.43	0.79	0.62	0.85	1.25
	P	0.40	-0.40	-0.25	-0.47	-0.86	-0.68	-0.92	-1.35
Germany	Nh	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	N	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02
	U	0.00	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.02
	ϕ	-0.02	0.03	0.02	0.04	0.06	0.05	0.07	0.09
	h	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
	w	-0.04	0.04	0.03	0.05	0.09	0.07	0.10	0.14
	Y	-0.04	0.05	0.03	0.05	0.10	0.08	0.10	0.15
	C	-0.12	0.13	0.08	0.15	0.27	0.21	0.29	0.43
	I	-0.12	0.13	0.08	0.15	0.27	0.21	0.29	0.43
	P	0.40	-0.40	-0.25	-0.47	-0.86	-0.68	-0.92	-1.35

Notes: The table shows the long-run percentage change in selected variables after a variety of reform combinations listed in each column of the upper block. Percentage point change is shown for consumption tax τ^c_{FR}, employers' labour tax τ^f_{FR}, unemployment rate U and job finding probability ϕ; percentage change for all remaining variables. $\uparrow, \downarrow$ and $-$ show an increase, decrease or no-change in the corresponding reform parameter, respectively.

0.3%. Obviously, increasing the consumption tax rate by more would provide the French government also a larger room for decreasing the labour tax and thus boost output and employment.

In the next three policy reform exercises, of which results are given in columns (5)-(7) of Table 5, we increase the matching efficiency by 5%, 10% and 20%, respectively, while leaving the consumption and employers' labour tax rates as in 2010 in France. The quantitative results corresponding to a 20% increase in the matching efficiency of France are very similar to what we have reported before for Germany in Figure 1 and Table 3. This is not surprising, since most of the parameters of the two countries are set identically in our framework. Most importantly for our forthcoming exercise, the increase in the matching efficiency, say, of 20% leads to an increase in transfers of 1.63% which is, however, accompanied by a 0.96% increase in output as well. Therefore, the improvement in the transfers-to-output ratio to merely 30.7% from 30.5% is rather limited. If the matching efficiency increases only by 5%, the share of transfers in output remains constant in effect.

In our last group of quantitative exercises in this subsection, we increase the consumption tax rate by 1.6 percentage points and the matching efficiency by either 5%, 10% or 20%, and decrease the employers' labour tax rate for each of these possibilities by so much that the steady state transfers-to-output ratio stays at the same level as before the reforms. This implies decreasing the labour tax rate by 3.1, 3.2 or 3.4 percentage points, depending on whether the increase in the matching efficiency is 5%, 10% or 20%, respectively. For our benchmark calibration, the expected increase in output and consumption is between 0.7% and 1.5%, accompanied by a decline in the unemployment rate of 0.63–1.75 percentage points.

4.2 Alternative Scenarios

In the section on German Hartz reforms, we have seen that a decline in unemployment benefit ratio might also lead to a significant improvement of government finances together with positive employment and output effects. Notwithstanding the potential political difficulties for such a reform, we first consider the impact of a decline in the unemployment

benefit ratio of France by an amount of 4 percentage points in the following. We start out with the impact of such a change in policy alone, of which results are shown in the third column of Table 6. Not surprisingly, the results are qualitatively the same as in our analysis of the German Hartz reforms. A decline in the 2010 unemployment benefit level by 4 percentage points vis-à-vis the initial 2010 level brings a 0.67 percentage points decline in the unemployment rate, accompanied by further positive effects on output, consumption and total hours worked.

In the columns (4) and (5) of the table, we carry out four reforms simultaneously: a decline of 1.6 percentage points in the consumption tax, an increase in the matching efficiency of either 0.05 or 0.2 percent, a decline in the unemployment benefit level ratio of 4 percentage points and a reduction in the employers' labour tax rate so high that the transfers-to-output ratio stays constant. The aim is here to see by how much the inclusion of the unemployment benefit reduction in the reform package facilitates a further reduction of the employers' labour tax rate and thus a yet lower unemployment rate than in our previous exercise of trivariate simultaneous reforms. A matching efficiency improvement of 0.05 (0.2) implies thus a reduction in the employers' labour tax rate of 3.4 (3.7) percentage points. These alternative scenarios lead to even more favourable outcomes than the joint trivariate reforms without the reduction in the unemployment benefit ratio, of which results were listed in columns (8)–(10) of Table 5. The government-budget-neutral range of unemployment rate improvement, when the unemployment benefit ratio is decreased by 4 percentage points, lies between 1.25 and 2.29 percentage points depending on by how much the matching efficiency increases as a result of the reforms.

Finally, in the last four columns of Table 6, we investigate the long-run quantitative effects of the triple (in columns (6)–(7)) and quadruple (in columns (8)–(9)) reform packages if the parameter ϵ determining bargaining power of firms in the Nash bargaining is reduced from 0.5 to 0.4 and accordingly the vacancy elasticity parameter ψ in the hiring function as well. As we have seen in Table 4 above, the reduction in the bargaining power of firms implies relatively less pronounced, but still significant, effects of reform packages. The range of decline in the unemployment rate after the quadruple reform package lies for instance between 0.89 and 1.97 percentage points.

Table 6: Alternative Reform Possibilities in France

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reforms	τ^c_{FR}	–	$\uparrow$ 1.6	$\uparrow$ 1.6	$\uparrow$ 1.6	$\uparrow$ 1.6	$\uparrow$ 1.6	$\uparrow$ 1.6
	χ_{FR}	–	$\uparrow$ 0.05	$\uparrow$ 0.2	$\uparrow$ 0.05	$\uparrow$ 0.2	$\uparrow$ 0.05	$\uparrow$ 0.2
	τ^f_{FR}	–	$\downarrow$ 3.4	$\downarrow$ 3.7	$\downarrow$ 3.1	$\downarrow$ 3.4	$\downarrow$ 3.1	$\downarrow$ 3.4
	b_{FR}	$\downarrow$ 4.0	$\downarrow$ 4.0	$\downarrow$ 4.0	–	–	$\downarrow$ 4.0	$\downarrow$ 4.0
	ψ, ϵ	–	–	–	$\downarrow$ 0.1	$\downarrow$ 0.1	$\downarrow$ 0.1	$\downarrow$ 0.1
France	Nh	0.55	1.42	2.18	0.76	1.59	1.15	1.94
	N	0.75	1.38	2.54	0.60	1.83	0.99	2.18
	U	-0.67	-1.25	-2.29	-0.54	-1.65	-0.89	-1.97
	ϕ	1.86	3.67	7.71	1.46	5.12	2.52	6.33
	h	-0.19	0.04	-0.35	0.17	-0.23	0.16	-0.24
	w	-0.33	2.43	2.99	2.55	3.07	2.53	3.07
	Y	0.51	1.30	2.00	0.70	1.46	1.05	1.77
	C	0.24	0.94	1.76	0.63	1.46	0.78	1.60
	I	0.42	1.06	1.63	0.57	1.19	0.86	1.45
	P	-0.45	-1.15	-1.76	-0.62	-1.30	-0.94	-1.57
Germany	Nh	0.00	0.01	0.02	0.00	0.01	0.01	0.01
	N	0.01	0.02	0.03	0.01	0.01	0.01	0.02
	U	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01	-0.02
	ϕ	0.03	0.08	0.12	0.03	0.06	0.05	0.08
	h	0.00	-0.01	-0.01	0.00	-0.01	0.00	-0.01
	w	0.05	0.12	0.19	0.07	0.14	0.10	0.17
	Y	0.05	0.13	0.20	0.07	0.14	0.10	0.17
	C	0.14	0.36	0.56	0.19	0.41	0.29	0.49
	I	0.14	0.36	0.56	0.19	0.40	0.29	0.49
	P	-0.45	-1.15	-1.76	-0.62	-1.30	-0.94	-1.57

Notes: The table shows the long-run change in selected variables after a variety of reform combinations listed in each column of the upper block. Percentage point change is shown for consumption tax τ^c_{FR}, employers' labour tax τ^f_{FR}, unemployment rate U and job finding probability ϕ; percentage change for all remaining variables. $\uparrow, \downarrow$ and $-$ show an increase, decrease or no-change in the corresponding reform parameter, respectively.

4.3 Further Discussion and Remarks

Through similar channels as in the case of German Hartz reforms, the French reforms could have positive spillover effects on the "German " economy as shown in the lower panels of Tables 5 and 6. Yet, those effects are somewhat lower than the spillover effects on the "French " economy of the German Hartz reforms reported in the previous section. This can be explained by the relatively stronger starting position of the "German " economy when the French economy starts reforms than the starting position of the "French " economy as the Hartz reforms were introduced.

Note that we have considered budget-neutral reform possibilities for France in this section. Alternatively, it is possible to follow less generous reforms in the labour market with the objective to decrease the government debt. The figures that we provide with respect to long-run effects might also be more favourable in reality when there are improvements in the total productivity level giving even more room to the government, e.g., to decrease the employers' tax rate or decrease its debt. While the extent of reforms that can be introduced in France is open to discussion, our results suggest that several combinations of policy parameters exist to improve the macroeconomic performance through labour market reforms.

5 Conclusion

The still ongoing effects of the 2008-2009 global recession and the slow adjustment in its aftermath, accompanied by monetary and fiscal policies that have already reached their limits as growth stimulator, have put structural reforms on top of the reform agenda of policy makers in many countries. Thereby, labour market reforms feature a high priority, particularly in the European Union where unemployment rates reached a high level in most member economies. In this context, the perceived conspicuous success of the German labour market reforms of 2003-2005 seems exemplary. In the current paper, our goal has been to investigate the (potential) impact of various reform options both nationally and in terms of international spillovers. We chose a two-country DSGE model with labour market frictions as our laboratory to this end.

Since our focus has been on European economies, which are known to have more rigid labour markets in comparison to Anglo-Saxon countries, the calibration of the two economies in our model has been with respect to France and Germany. The choice of these countries was by no means random, but followed from a few observations. First, they are the largest two economies of the euro area and their economic health (or sickness) impacts beyond their borders. Second, Germany impressed other countries with its performance after the introduction of its labour market reforms, whereas France has increasingly been said to be in need of reforms. Third, both economies are intertwined with each other as well as the rest of the euro area and the world. All of these three factors made these two countries good candidates for our analysis.

For our quantitative analysis, we calibrated most of the parameters of both countries to identical values in order to place our focus on a few labour-market-related institutions which have been set heterogeneously. In particular, we carried out our quantitative analysis in two steps. First, we calibrated the heterogeneous parameters relating to the unemployment rate, the job finding probability, the unemployment benefit ratio as well as the consumption and labour taxes to their values in 2003 for both countries. This allowed us to examine whether our model as such was able to reflect the developments in the German economy to a large extent. This was indeed the case. We found that allowing for an efficiency increase in the matching between firms and unemployed workers and a substantial decline in the unemployment benefit ratio, as it took place in the data, might explain the difference between several macroeconomic quantities of Germany over the period 2003 to 2010 rather well.

Second, encouraged by the quantitative success of the model from our initial experiment, we investigated the reform possibilities for the French economy in the light of what has already been brought into action and/or is being planned by the French government since 2012. When considering several reform possibilities for France, we paid particular attention to having constellations with either no extra burden for the government budget or even budget-improving qualifications. Our findings show that increasing matching efficiency through similar measures as in Germany and increasing the consumption tax in order to create room for reducing employers' social security contributions might have significant positive

effects on the overall macroeconomic performance in general and the unemployment rate in specific.

Several sensitivity analyses and other potential reform constellations where the unemployment benefit ratio is also decreased in order to create even more room for decreasing employers' social security contributions suggest that the range of decline in the French unemployment ratio due to reforms might lie between 0.5 and 2.3 percentage points, depending on how effective the measures for increasing the matching efficiency will be. The positive long-run output effects of potential labour market reforms lie between 0.8 and 2.0 percent.

As to the spillover effects of reforms, we found them to be positive, yet much smaller than in the reforming country. The positive spillovers, particularly on consumption and output, follow from the existence of frictions in the labour market and materialise through a deterioration in the terms of trade of the reforming country and accompanying capital flows to the reforming country. Thus, our framework does not imply beggar-thy-neighbour effects of reforming countries on their trading partners. Moreover, recent literature shows that the spillover effects we obtain might get much stronger if we included real wage rigidities in the model as well.

It should be noted that the quantitative predictions that we provide are only suggestive figures. The positive effects could be even larger if technological improvement had also been taken into account in our quantitative experiments. Moreover, the model does not include government debt or financial markets. The macroeconomic improvement following from labour market reforms might also lead to more favourable effects through this channel. The government might use some proceeds from the labour market reforms to decrease its debt and thus the macroeconomic uncertainty. Positive budget effects accompanied by a favourable macroeconomic environment could lead to larger effects than we estimated due to the financial accelerator channel as well. We thus see our quantitative exercise as providing a lower bound on the potential positive long-run effects of reforms and leave the investigation of the latter channels to future work.

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A Optimization of the foreign country

A.1 Foreign Households

Similar to its domestic counterpart, the representative foreign household maximizes its expected life-time utility

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[N_{2t} U(C_{2t}^n, h_{2t}) + (1 - N_{2t}) U(C_{2t}^u) \right] \tag{36}$$

where the functional form of the per-period utility is the same as for country 1 (see Equations (2) and (3)). Foreign households' optimization is subject to the budget constraint (in terms of the good produced in the domestic economy)

$$\begin{aligned} P_{2t}^c \left(1 + \tau_2^c\right) C_{2t}^c + B_{2t+1} + P_{2t}^c CA_{2t} = \\ = P_t N_{2t} w_{2t} h_{2t} \left(1 - \tau_2^d\right) + \left(1 - N_{2t}\right) P_t b_{2t} + B_{2t} \left(1 + i_t\right) + T_{2t} + P_t \Pi_{2t}^F \end{aligned} \tag{37}$$

and to the law of motion of employment symmetric to equation (7). In addition foreign bond holders face the same portfolio adjustment costs as domestic bond holders.

The first order conditions for this optimization problem are given by

$$\frac{1}{C_{2t}^c} = \left(1 + \tau_2^c\right) \lambda_{2t} P_{2t}^c \tag{38}$$

$$1 + \Phi_b \frac{B_{2t+1}}{P_{2t}^c} = \beta E_t \left[\frac{\lambda_{2t+1}}{\lambda_{2t}} \left(1 + i_{t+1}\right) \right] \tag{39}$$

The preferences of foreign households regarding the composition of the final consumption bundle resemble the domestic one and can be written as

$$C_{2t}^c = \left[\kappa^{\frac{1}{\eta}} C_{2t}^{*\,\frac{\eta-1}{\eta}} + (1 - \kappa)^{\frac{1}{\eta}} C_{1t}^{*\,\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{40}$$

By minimizing the costs for C^c_{2t} the following foreign demand functions are obtained:

$$C^*_{2t} = \kappa \left(\frac{P_t}{P^c_{2t}}\right)^{-\eta} C^c_{2t} \tag{41}$$

$$C^*_{1t} = (1-\kappa) \left(\frac{1}{P^c_{2t}}\right)^{-\eta} C^c_{2t} \tag{42}$$

A.2 Foreign Firms

Foreign firms face the same production technology, capital adjustment costs and law of motion for capital and employment as domestic firms when maximizing their profits given by

$$\Pi^F_{2t} = P_t Y_{2t} - P_t w_{2t} h_{2t} N_{2t} \left(1+\tau^f_2\right) - \omega_2 P^c_{2t} V_{2t} - P^c_{2t} I^c_{2t} - P^c_{2t} CI_{2t} \tag{43}$$

with respect to capital, labour and vacancies. The resulting optimality conditions read as

$$q^T_{2t} = \beta E_t \left[\frac{P^c_{2t+1}\lambda_{2t+1}}{P^c_{2t}\lambda_{2t}} \left\{ \frac{P_{t+1}}{P^c_{2t+1}} \alpha \frac{Y_{2t+1}}{K_{2t+1}} + q^T_{2t+1} - \delta + \frac{\Phi_I}{2} \left(\frac{I_{2t+1} - \delta K_{2t+1}}{K_{2t+1}} \right)^2 \right\} \right] \tag{44}$$

$$\frac{\omega_2}{q_{2t}} = \beta E_t \left[\frac{P^c_{2t+1}\lambda_{2t+1}}{P^c_{2t}\lambda_{2t}} \left\{ \frac{P_{t+1}}{P^c_{2t+1}} (1-\alpha) \frac{Y_{2t+1}}{N_{2t+1}} - \frac{P_{t+1}}{P^c_{2t+1}} w_{2t+1} h_{2t+1} \left(1+\tau^f_2\right) + (1-s_2) \frac{\omega_2}{q_{2t+1}} \right\} \right] \tag{45}$$

where q^T_{2t} is Tobin's q and defined as in equation (22).

A.3 Matching and Bargaining in the Foreign Labour Market

The matching and bargaining process follow exactly the same rules as in the domestic labour market (see equations (23) and (24)). The labour contract defining the optimal level of wages and hours worked should satisfy the following first order conditions:

$$\frac{\kappa^n_2}{\lambda_{2t}} (1-h_{2t})^{-\xi} = \frac{1-\tau^d_2}{1+\tau^f_2} P_t (1-\alpha) \frac{Y_{2t}}{N_{2t} h_{2t}} \tag{46}$$

$$w_{2t}h_{2t} = \frac{1-\epsilon}{1+\tau_2^f}\left[\omega_2 \frac{P_{2t}^c}{P_t}\theta_{2t} + (1-\alpha)\frac{Y_{2t}}{N_{2t}}\right] + \frac{\epsilon}{1-\tau_2^d}\left[b_{2t} + \frac{1}{P_t\lambda_{2t}}\left(\kappa_2^u - \kappa_2^n \frac{(1-h_{2t})^{1-\xi}}{1-\xi}\right)\right] \tag{47}$$

B Tax data

Employers tax rate τ^f Employers tax rate is calculated by employers' social security contribution (ESS) divided by the difference between total compensation for employees and ESS. Data on the ESS stem from the OECD Revenue Statistics, total compensation for employees is taken from the OECD National Accounts detailed tables.

Employees tax rate τ^d Employees tax rate equals the sum of income tax and employees' social security contributions divided by household current receipts. The latter are composed by the sum of compensation of employees, property income, social contributions and benefits, other current transfers taken from the OECD National Accounts as well as data income tax. Employees' social security contributions stem from the OECD Revenue Statistics. Our source on income tax differs from Nickell (2006), since the OECD Revenue Statistics stopped to provide this time series. Apparently, income tax statistics used by Nickell must have been higher than the one reported by the OECD National Accounts. In consequence, our computed tax rates are around three to five percentage points higher. But they lie in the range of average income tax rates by type of household from the OECD Revenue Statistics.

Consumption tax rate τ^c Consumption tax rate consists of the difference between indirect taxes (taxes on production and imports) and subsidies divided by household final (consumption) expenditures. All components stem from the OECD National Accounts as suggested by Nickell. Nevertheless, there has been some change in calculation of the aggregates leading to consumption taxes rates which are about five percentage below those computed by Nickell (2006).

Our differences in employees and consumption tax to the Nickell data lead to a difference in the average tax wedge of about 10 percentage points. But our average tax wedge lies in

the range of wedges by household type reported by the OECD National Accounts whereas Nickell's does not. Furthermore, since the differences to the Nickell data are consistent between countries they have no consequence on the comparison of reform effects between countries. Of course, they imply symmetric quantitative changes in the responses of countries to reforms.

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Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs a change: The financial crisis has exposed long neglected deficiencies in the present growth path, most visibly in unemployment and public debt. At the same time Europe has to cope with new challenges ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundations for a new development strategy that enables a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four year research project within the 7th Framework Programme funded by the European Commission started in April 2012. The consortium brings together researchers from 33 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). Project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

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