Optimal Monetary Policy in an Open Economy Labour Market Frictions*

Alessia Campolmi
Central European University and Magyar Nemzeti Bank

Ester Faia
Goethe University Frankfurt, Kiel IfW and CEPREMAP†

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Abstract

Currency fluctuations are an important determinant of labour market dynamic and stability. Vice-versa relative labour costs affect real exchange rate dynamics. For this reason the optimal choice of exchange rate regime cannot neglect labour market dynamics. We use a two country sticky price DSGE model with matching frictions to analyse those issue. The monetary authority faces a tension between the insulating property of floating exchange rates, which would prescribe an inward-looking strategy, and the de-stabilising effects of currency fluctuations on job flows. Overall, results show that the second motive tends to prevail (for various shocks and parametrization), hence optimal monetary policy prescribes some degree of exchange rate target. We also re-examine the conditions for optimal policy in a currency are whose members experience asymmetries in labour market institutions and find, indeed, that optimal policy should assign asymmetric weights to different countries.

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†Correspondence to: Department of Money and Macro, Goethe University Frankfurt, House of Finance, office 3.47, Grueneburgplatz 1, 60323, Frankfurt am Main, Germany. E-mail: faia@wiwi.uni-frankfurt.de. Webpage: www.wiwi.uni-frankfurt.de/profs/faia.

1 Introduction

This paper studies the optimal choice of exchange rate regime for a two country model with price stickiness and matching frictions. Labor market flows and labor costs are an important determinant of the international transmission mechanism of shocks, hence the optimal choice of the exchange rate target cannot neglect the impact that relative movements of unemployment, wages and job flows have on currency fluctuations. Furthermore, it is well known that both asymmetric shocks and exchange rate fluctuations have a significant impact on labor market dynamics as they affect the dynamic of relative marginal costs across countries[1]. Hence in this context the optimal degree of exchange rate stabilization is an important determinant of fluctuations in the labour market.

To analyze the aforementioned issues we use a DSGE two country model with matching frictions and price rigidity. The labor market is characterized by endogenous job destruction and wages are determined through an efficient Nash bargaining. Those elements allow us to characterize the dynamic of unemployment and labor market participation in response to external shocks and exchange rate fluctuations. The product market is characterized by monopolistic competition with firms facing an adjustment cost of changing prices. This is an essential assumption for the comparison of different monetary policy rules and exchange rate arrangements. Using this model we focus on two questions. First, for a two country model we analyze the international transmissions of shocks and the welfare ranking of different exchange rate regimes. Each country faces a trade-off in terms of optimal exchange rate targeting. On the one side, devaluations allow countries to deal with foreign adverse shocks. On the other side, fluctuations in the exchange rate affect wages and job flows in a way that might destabilize the labour market. The optimal choice of exchange rate target results from this trade-off. The abovementioned analysis is very much inspired by the policy debate on whether the European Central Bank should target the exchange rate with the dollar: this debate has acquired particular significance due to the effects that the persistent dollar depreciation has had on European labour markets in the last decade. Second, we consider a currency area and ask what is the optimal monetary policy rule when area members face asymmetric labour market conditions. The latter question also carries a policy flavor as much discussion exists in Europe on

[1] See Blanchard and Katz (1992), Decressin and Fatas (1995), Obstfeld and Peri (1999) for a decomposition of the adjustment of regional labor markets to asymmetric shocks. See Gourinchas (1998) for an analysis of the impact of exchange rate fluctuations on labor market variables.

whether the European Central Bank should also target unemployment alongside with inflation and on whether it should assign different weights to countries with different degrees of market frictions.

From a methodological point of view a crucial element of the welfare analysis in our paper is the use of second order approximation methods which allows us to study policy rules in a dynamic economy that evolves around a steady-state which remains distorted[2]. In our context, the steady state of the economy is distorted by the presence of matching frictions and of the monopolistic distortion[3].

Simulations of our model economy in response to productivity and government expenditure shocks lead to the following results. First, under floating exchange rate regimes we find that the model is able to generate positive co-movements of employment and output, consistently with empirical evidence. Consider for instance the effects of a foreign productivity shock. Such shock increases foreign output and reduces foreign inflation. There is an expenditure switch from domestic to foreign produced goods that would, considered alone, induce a fall in domestic output (hence negative correlations between domestic and foreign output). However there are two additional effects. First, the fall in domestic inflation is counteracted by the monetary authority which, by reacting according to a Taylor rule, reduces the interest rate and boosts domestic demand. Second, the fall in terms of trade associated with the expenditure switch, induces a fall in marginal costs, which, in a model with non-walrasian labour market, brings about an increase in employment and output.

The comparison among different exchange rate regimes (floating versus pegged) shows that increasing the response to exchange rate fluctuations in the monetary policy rule reduces macroeconomic volatility. As agents are risk averse the fall in macroeconomic volatility implies an increase in welfare. The model features a tension between the beneficial properties of exchange rate movements as insulating devices from asymmetric shocks and the negative impact that currency volatility has on job flows in the trading sector (in response to currency appreciations jobs are destroyed and vacancies reduced; the opposite is true for currency depreciations). The second consideration seems to prevail in our case. Increasing the degree of exchange rate stabilization in the monetary policy

[2] See Kollmann (2003, 2004) and Schmitt-Grohe and Uribe (2003, 2004b),

[3] As emphasized by Kim et al. (2003) and Schmitt-Grohe and Uribe (2004b), this strategy requires that an accurate evaluation of welfare be based on a *higher order approximation* of all the conditions that characterize the competitive equilibrium of the economy.

rule tends to stabilize job flows, employment and output. As agents features less unemployment risk they are able to smooth consumption as well. Finally since agents are risk averse stabilization of consumption comes together with an increase in welfare.

Finally, we compute the optimal monetary policy rule for a currency area, whose area members have different labour market institutions in terms of unemployment benefit coverage. The optimal rule is characterized by a positive response to unemployment and assigns different weights to different countries. Higher replacement rates indeed tend to compress steady state profits and to increase steady state wages. This, in turn, exacerbates the response to shocks of vacancies and labour market tightness and smooths the response to shocks of wages[4]. A monetary authority concerned with stabilization of job flows will want to respond more aggressively to the unemployment fluctuations of the country with higher replacements rates.

Starting with Friedman 1953 the case for flexible exchange rates has often received strong support. The main argument states that in presence of sticky prices foreign shocks will have an impact on the domestic cycle unless exchange rate movements allow to absorb the effects of the shock. The theoretical foundations for the insulating property of flexible exchange rates received a refinement in the Mundell 1961; in his paper indeed he establishes the desiderability of flexible exchange rates using as reference point the welfare of all countries, rather than only that of the domestic economy, therefore allowing to consider spillover effects across countries. The recent NOEM literature has in various parts reconsidered this question in a modern New Keynesian model and in most cases has confirmed the superiority of floating exchange rates as business cycle smoothing device. However most of the recent literature has completely ignored the role of labour market frictions. There is ample empirical evidence showing that exchange rate fluctuations might affect significantly labour market flows and that might severely destabilize those flows. For instance, Branson and Love (1988), Revenga (1992), Burgess and Knetter (1996) and Campa and Goldberg (2001) show that exchange rates have significant implications for employment in the U.S. Glodberg and Tracy (2000) and Aronson, Goldberg and Tracy (1999) show that for the U.S. manufacturing industry (a typical tradable good sector) both wages and job flows are very sensitive to dollar fluctuations. Topel (1986) finds that wages increase in response to current relative demand shocks

[4]See Campolmi and Faia (2004).

and decrease in response to expected future relative demand shocks. Finally Davis and Haltiwanger (2001) find that the labour force adjusts significantly to external shocks such as oil price shocks.

This paper is also related to a strand of the theoretical literature that introduces matching frictions in RBC[5] and New Keynesian models[6]. More recently some authors have studied the impact of matching frictions in an open economy context. Campolmi and Faia (2004) use a two country New Keynesian model with matching frictions to analyze the impact of different labor market institutions on inflation differentials in the EMU and Abbritti and Mueller (2009) consider the implications for monetary policy of different labour market frictions in a currency union. Finally the paper is related to a very recent strand of the literature which studies the principles of optimal monetary policy in presence of labor market rigidities and of an inflation/unemployment trade-off (see Blanchard and Galí (2006), Faia (2008, 2009) and Thomas (2008)).

The paper proceeds as follow. Section 2 presents the model. Section 3 presents the dynamic and quantitative properties of the model and the welfare properties of the different monetary policy rules. Section 4 presents the implications in a currency area version of the model. Finally section 5 concludes.

2 A Two Country Model with Labor Market Frictions

There are two regions of equal size. Each country is inhabited by a continuum of agents with measure one. Each economy is populated by households who consume different varieties of domestically produced and imported goods, save and work. Households save in international non-state contingent securities and in an insurance fund that allows them to smooth income fluctuations associated with periods of unemployment. Each agent can indeed be either employed or unemployed. In the first case he receives a wage that is determined according to a Nash bargaining, in the second case he receives an unemployment benefit. The labor market is characterized by matching frictions and endogenous job separation. The production sector acts as a monopolistic competitive sector which produces a differentiated good using labor as input and faces adjustment costs a' la Rotemberg (1982).

[5] See Merz (1995), Andolfatto (1996), Cooley and Quadrini (2000) among others.

[6] Several other authors, ranging from Walsh (2003) to Blanchard and Galí (2005), have recently introduced matching frictions into new Keynesian models.

2.1 Households

Let's denote by $c_t \equiv [(1-\gamma)^{\frac{1}{\eta}} c_{h,t}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} c_{f,t}^{\frac{\eta-1}{\eta}}]^{\frac{\eta-1}{\eta}}$ a composite consumption index of domestic and imported bundles of goods, where γ is the balanced-trade steady state share of imported goods and by $p_t \equiv [(1-\gamma)p_{h,t}^{1-\eta} + \gamma p_{f,t}^{1-\eta}]^{\frac{1}{1-\eta}}$ the CPI index with $\eta > 0$ being the elasticity of substitution between domestic and foreign goods. Optimal allocation of expenditure between domestic and foreign bundles yields:

$$c_{h,t} = (1-\gamma)\left(\frac{p_{h,t}}{p_t}\right)^{-\eta} c_t;\ c_{f,t} = \gamma\left(\frac{p_{f,t}}{p_t}\right)^{-\eta} c_t \tag{1}$$

Each bundle is composed of imperfectly substitutable varieties, $c_{h,t} \equiv \int_0^1 [(c_{h,t}^i)^{\frac{\epsilon-1}{\epsilon}} di]^{\frac{\epsilon}{\epsilon-1}}$ and $c_{f,t} \equiv \int_0^1 [(c_{f,t}^i)^{\frac{\epsilon-1}{\epsilon}} di]^{\frac{\epsilon}{\epsilon-1}}$, with $\varepsilon > 1$ being the elasticity of substitution. Hence optimal allocation of expenditure for each variety is given by $c_{h,t}^i = \left(\frac{p_{h,t}^i}{p_{h,t}}\right)^{-\varepsilon} c_{h,t}$; $c_{f,t}^i = \left(\frac{p_{f,t}^i}{p_{f,t}}\right)^{-\varepsilon} c_{f,t}$. There is continuum of agents who maximize the expected lifetime utility[7]:

$$E_t\left\{\sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma}\right\} \tag{2}$$

where c denotes aggregate consumption in final goods. Households supply labor hours inelastically h (which is normalized to 1). Total real labor income is given by w_t and is specified below. Unemployed households members, u_t, receive an unemployment benefit, b. The contract signed between the worker and the firm specifies the wage and is obtained through a Nash bargaining process. In order to finance consumption at time t each agent also invests in non-state contingent nominal bonds b_t which pay a gross nominal interest rate $(1+r_t^n)$ one period later and in non-state contingent nominal bonds which are internationally traded, b_t^*, and which pay a gross nominal interest rate $(1+r_t^{n,f})$ one period later. As in Andolfatto (1996) it is assumed that workers can insure themselves against earning uncertainty and unemployment. For this reason the wage earnings have to be interpreted as net of insurance costs. Finally agents receive profits from the monopolistic sector which they own, Θ_t, and pay lump sum taxes, τ_t. The sequence of budget constraints in terms of domestic CPI consumption goods reads as follows:

[7] Let $s^t = \{s_0, ...s_t\}$ denote the history of events up to date t, where s_t denotes the event realization at date t. The date 0 probability of observing history s^t is given by ρ_t. The initial state s^0 is given so that $\rho_0 = 1$. Henceforth, and for the sake of simplifying the notation, let's define the operator $E_t\{.\} \equiv \sum_{s_{t+1}} \rho(s^{t+1}|s^t)$ as the mathematical expectations over all possible states of nature conditional on history s^t.

$$c_t + \frac{b_t}{p_t} + e_t^r \frac{b_t^*}{p_t^*} \leq w_t(1-u_t) + bu_t + \frac{\Theta_t}{p_t} - \frac{\tau_t}{p_t} + (1+r_{t-1}^n)\frac{b_{t-1}}{p_t} + (1+r_{t-1}^{n,f})e_t^r \frac{b_{t-1}^*}{p_t^*} \tag{3}$$

where e_t^r is the real exchange rate and is given by $e_t^r = e_t \frac{p_t^*}{p_t}$ where e_t is the nominal exchange rate. Households choose the set of processes $\{c_t, b_t, b_t^*\}_{t=0}^{\infty}$ taking as given the set of processes $\{p_t$, w_t, $r_t^n, r_t^{n,f}\}_{t=0}^{\infty}$ and the initial wealth b_0, b_0^* so as to maximize (2) subject to (3). The following optimality conditions must hold:

$$c_t^{-\sigma} = \beta(1+r_t^n)E_t\left\{c_{t+1}^{-\sigma}\frac{p_t}{p_{t+1}}\right\} \tag{4}$$

$$c_t^{-\sigma} = \beta(1+r_t^{n,f})E_t\left\{c_{t+1}^{-\sigma}\frac{p_t^*}{p_{t+1}^*}\frac{e_{t+1}^r}{e_t^r}\right\} \tag{5}$$

$$c_t^{-\sigma} = \lambda_t \tag{6}$$

Equation (4) is the Euler condition with respect to domestic bonds. Equation (5) is the optimality condition with respect to internationally traded bonds. Equations (6) is the marginal utility of consumption. Optimality requires that No-Ponzi condition on wealth is also satisfied. Due to imperfect capital mobility and/or in order to capture the existence of intermediation costs in foreign asset markets workers pay a spread between the interest rate on the foreign currency portfolio and the interest rate of the foreign country. This spread is proportional to the (real) value of the country's net foreign asset position:

$$\frac{(1+r_t^{n,f})}{(1+r_t^{n,*})} = \zeta\left(e_t^r \frac{b_t^*}{p_t^*}\right) \tag{7}$$

where $\zeta > 0$[8], $\zeta' > 0$. In addition we assume that the initial distribution of wealth between the two countries is symmetric.

Workers in the Foreign Country. We assume throughout that all goods are traded, that both countries face the same composition of consumption bundle and that the *law of one price* holds. This implies that $p_{h,t} = e_t p_{h,t}^*$ and $p_{f,t} = e_t p_{f,t}^*$. Foreign workers face an allocation of

[8] As shown in Schmitt-Grohe and Uribe (2003) and Benigno (2002) this assumption is needed in order to maintain the stationarity in the model. Schmitt-Grohe and Uribe (2003) also show that adding this spread - i.e. whose size has been shown negligible in Lane and Milesi-Ferretti (2003) - does not change the dynamic behavior of the economy as compared to the one observed with complete asset market assumption. See also Mendoza (1991) and Senhadji (2003).

expenditure and wealth similar to the one of workers in the domestic economy except for the fact that they do not pay an additional spread for investing in the international portfolio. Arbitrage condition between the two economies implies the following expectational uncovered interest rate parity:

$$E_t\left\{\frac{\lambda^*_{t+1}}{\lambda^*_t}\right\} = E_t\left\{\frac{\lambda_{t+1}}{\lambda_t}\frac{e^r_{t+1}}{e^r_t}\zeta\left(e^r_t\frac{b^*_t}{p^*_t}\right)\right\} \tag{8}$$

which states that marginal utilities across countries are equalized up to the spread for the country risk.

2.2 Production Sector

The maximization problem which characterize the production sector is symmetric across the two economies. Firms in the production sector sell their output in a monopolistic competitive market and meet workers on a matching market. The labor relations are determined according to a standard Mortensen and Pissarides (1999) framework. Workers must be hired from the unemployment pool and searching for a worker involves a fixed cost. Workers' wages are determined through a Nash decentralized bargaining process and the relationship between a matched worker and a firm can be endogenously discontinued.

2.2.1 Search and Matching in the Labor Market

The search for a worker involves a fixed cost κ and the probability of finding a worker depends on a constant return to scale matching technology which converts unemployed workers u and vacancies v into matches, m:

$$m(u_t, v_t) = mu_t^{\xi}v_t^{1-\xi} \tag{9}$$

where $v_t = \int_0^1 v_{i,t}di$. Defining labor market tightness as $\theta_t \equiv \frac{v_t}{u_t}$, the firm meets unemployed workers at rate $q(\theta) = \frac{m(u_t,v_t)}{v_t} = m\theta_t^{-\xi}$, while the unemployed workers meet vacancies at rate $\theta_t q(\theta_t) = m\theta_t^{1-\xi}$. If the search process is successful, the firm in the monopolistic good sector operates the following technology:

$$y_{i,t} = z_t n_{i,t}\int_{\tilde{a}_{i,t}}^{\infty} a\frac{f(a)}{1-F(\tilde{a}_{i,t})}da = z_t n_{i,t}H(\tilde{a}_{i,t}) \tag{10}$$

where z_t is the aggregate productivity shock which follows a first order autoregressive process, $n_{i,t}$ is the number of workers hired by each firm, and a is an idiosyncratic shock to workers' productivity which is assumed to be identically and independently distributed across firms and times with cumulative distribution function $F : [0, \infty] \rightarrow [0, 1]$. It is assumed that the idiosyncratic shock is observed before the firm starts production. The firm will endogenously discontinue the match if the realized shock is below a certain cut-off value, $\tilde{a}_{i,t}$. The threshold for endogenous separation is determined as a function of the state of the economy using firms' optimality conditions. Matches are destroyed at varying rate $\rho(\tilde{a}_{i,t})$ given by the following expression:

$$\rho(\tilde{a}_{i,t}) = \rho^x + \rho^n(\tilde{a}_{i,t})(1 - \rho^x) \tag{11}$$

where ρ^x is the exogenous break-up rate and $\rho^n(\tilde{a}_{i,t}) = F(\tilde{a}_{i,t})$ is the endogenous break-up rate.

We are now in the position to determine the law of motion for the workers employed and the ones seeking for a job. Labor force is normalized to unity. The number of employed people at time t in each firm i is given by the number of employed people at time $t-1$ plus the flow of new matches concluded in period $t-1$ who did not discontinue the match:

$$n_{i,t} = (1 - \rho(\tilde{a}_{i,t}))(n_{i,t-1} + v_{i,t-1}q(\theta_{t-1})) \tag{12}$$

Finally we define the gross job destruction and job creation rates as follows:

$$jd_t = \rho(\tilde{a}_{i,t}) - \rho^x \tag{13}$$

$$jc_t = \frac{(1 - \rho(\tilde{a}_{i,t}))v_{t-1}q(\theta_{t-1})}{n_{t-1}} - \rho^x \tag{14}$$

2.2.2 Monopolistic Firms

Firms in the monopolistic sector (of the home region) use labor to produce different varieties of consumption good and face a quadratic cost of adjusting prices. Wages are determined through the bargaining problem analyzed in the next section. Here we develop the dynamic optimization decision of firms choosing prices, $p^i_{h,t}$, number of employees, $n_{i,t}$, number of vacancies, $v_{i,t}$, and the endogenous separation threshold, $\tilde{a}_{i,t}$, to maximize the discounted value of future profits and

taking as given the wage schedule. Let's denote the total real wage bill of firm i (measured in CPI goods) by:

$$W_{i,t} = n_{i,t} \int_{\tilde{a}_{i,t}}^{\infty} w(a) \frac{f(a)}{1 - F(\tilde{a}_{i,t})} da \tag{15}$$

where $w(a)$ denotes the fact that the bargained wage depends on idiosyncratic shock. Equation (15) states that total wage costs are given by all individual wages paid to the mass of workers that are matched with firms whose individual productivity is above endogenous separation threshold. Given the definition of the terms of trade, $s_t \equiv \frac{p_{f,t}}{p_{h,t}}$, let's define:

$$\phi_t \equiv \frac{p_t}{p_{h,t}} = [(1-\gamma) + \gamma s_t^{1-\eta}]^{\frac{1}{1-\eta}} \tag{16}$$

as the *CPI/PPI* ratio. This variable, which can be interpreted as a proxy of the terms of trade, has a crucial role in our analysis. As workers and firms evaluate their income in different consumption units (and more specifically as workers evaluate their incomes in terms of CPI price index, p_t,while firms evaluate their profits in terms of domestic price index, the variable ϕ_t is needed in all cases in which there is a mismatch in the units of account. The economic meaning of this variable is twofold. First, it summarizes all the international spillovers from one economy to the other: the features characterizing, for instance, the dynamic of domestic prices is transmitted to the foreign economy through ϕ_t. The higher the degree of openness, γ, the stronger are the international linkages[9]. Secondly, ϕ_t represents a wedge that by entering the wage equation (see equation (30)) distorts the labor market equilibrium on top and above the search externality associated with the matching framework.

The representative firm in the domestic region chooses $\left\{p_{h,t}^i, n_{i,t}, v_{i,t}, \tilde{a}_{i,t}\right\}$ to solve the following maximization problem (in real terms):

$$Max\Pi_{i,t} = E_0 \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \left\{ \frac{p_{h,t}^i}{p_{h,t}} y_t^i - \phi_t W_{i,t} - \kappa v_{i,t} - \frac{\psi}{2} \left(\frac{p_{h,t}^i}{p_{h,t-1}^i} - 1 \right)^2 y_t^i \right\} \tag{17}$$

subject to

$$\text{s.to:} \qquad y_t^i = \left(\frac{p_{h,t}^i}{p_{h,t}} \right)^{-\epsilon} c_{w,t} = z_t n_{i,t} H(\tilde{a}_{i,t}) \tag{18}$$

[9]Notice that the value of γ different than 0.5 characterizes the degree of home bias and determines departures from the purchasing power parity.

$$\text{and: } n_{i,t} = (1-\rho(\tilde{a}_{i,t}))(n_{i,t-1} + v_{i,t-1}q(\theta_{t-1})) \tag{19}$$

where $c_{w,t} = c_{h,t} + c^*_{h,t}$, where $\frac{\psi}{2}\left(\frac{p^i_{h,t}}{p^i_{h,t-1}} - 1\right)^2 y^i_t$ represents the cost of adjusting prices and ψ can be thought as the sluggishness in the price adjustment process and κ as the cost of posting vacancies. Let's define mc_t, the lagrange multiplier on constraint (18), as the marginal cost of firms and μ_t, the lagrange multiplier on constraint (19), as the marginal value of one worker. Since all firms will chose in equilibrium the same price and allocation we can now assume symmetry and drop the index i. First order conditions for the above problem read as follows:

n_t :

$$\mu_t = mc_t z_t H(\tilde{a}_t) - \phi_t \frac{\partial W_t}{\partial n_t} + \beta E_t(\frac{\lambda_{t+1}}{\lambda_t})((1-\rho(\tilde{a}_{t+1}))\mu_{t+1}) \tag{20}$$

v_t :

$$\frac{\kappa}{q(\theta_t)} = \beta E_t(\frac{\lambda_{t+1}}{\lambda_t})((1-\rho(\tilde{a}_{t+1}))\mu_{t+1}) \tag{21}$$

$p_{h,t}$:

$$\frac{c_{w,t}}{y_t}[1-(1-mc_t)\varepsilon] - \psi(\pi_{h,t}-1)\pi_{h,t} + \beta E_t(\frac{\lambda_{t+1}}{\lambda_t})[\psi(\pi_{h,t+1}-1)\pi_{h,t+1}\frac{y_{t+1}}{y_t}] = 0 \tag{22}$$

$\tilde{a}_t$:

$$\mu_t \rho^{'}(\tilde{a}_t)(n_{t-1} + v_{t-1}q(\theta_{t-1})) + \phi_t \frac{\partial W_t}{\partial \tilde{a}_t} = mc_t z_t n_t H'(\tilde{a}_t) \tag{23}$$

Merging equations (20) and (21) gives the marginal value of an extra worker, μ_t, which is obtained by trading-off the cost of maintaining the match with an existing worker with the cost of posting a new vacancy:

$$\mu_t = mc_t z_t H(\tilde{a_t}) - \phi_t \frac{\partial W_t}{\partial n_t} + \frac{\kappa}{q(\theta_t)} \tag{24}$$

Notice that the marginal value of a worker is given not only by his marginal productivity net of the marginal costs but contains also an additional component. By maintaining the match with a worker the firm can save on future costs of posting vacancies. This is exactly the long run value of a worker that in matching models reduces the allocative role of wages.

After substituting the marginal value of an extra worker, μ_t, into the optimality condition, (23), using the constraint which describes the evolution of employment, (19), and simplifying we obtain a relation between the threshold value and the real wage schedule:

$$mc_t z_t \tilde{a}_t - w(\tilde{a}_t)\phi_t + \frac{\kappa}{q(\theta_t)} = 0 \tag{25}$$

This can be interpreted also as a zero profit condition as it states that per period marginal profits from an operating match, $mc_t z_t \tilde{a}_t - w(\tilde{a}_t)\phi_t$, must be equal to the cost of posting vacancies.

2.2.3 Wage Setting and Nash Bargaining

The wage schedule is obtained through the solution to an individual Nash bargaining process. To solve for it we need first to derive the marginal values of a match for both, firms and workers. Those values will indeed enter the sharing rule of the bargaining process. Let's denote by $V_t^J(a_t)$ the marginal discounted value of a match for a domestic firm measured in terms of CPI goods:

$$V_t^J(a_t) = \frac{mc_t z_t a_t}{\phi_t} - w_t(a_t) + \beta E_t \left\{ \left(\frac{\lambda_{t+1}}{\lambda_t} \right) (1 - \rho(\tilde{a}_{t+1})) \int_{\tilde{a}_{t+1}}^{\infty} V_{t+1}^J(a_{t+1}) \frac{f(a)}{1 - F(\tilde{a}_{t+1})} da \right\} \quad (26)$$

The marginal value of a match depends on real revenues minus the real wage plus the discounted continuation value. With probability $(1 - \rho(\tilde{a}_{t+1}))$ the job remains filled and earns the expected value and with probability, $\rho(\tilde{a}_{t+1})$, the job is destroyed and has zero value. For each worker, the values of being employed and unemployed are given by V_t^E and V_t^U (expressed in terms of CPI):

$$V_t^E(a_t) = w_t(a_t) + \beta E_t \left\{ \left(\frac{\lambda_{t+1}}{\lambda_t} \right) \left[(1 - \rho(\tilde{a}_{t+1})) \int_{\tilde{a}_{t+1}}^{\infty} V_{t+1}^E(a_{t+1}) \frac{f(a)}{1 - F(\tilde{a}_{t+1})} da + \rho(\tilde{a}_{t+1}) V_{t+1}^U \right] \right\} \quad (27)$$

$$V_t^U = b + \beta E_t \left\{ \left(\frac{\lambda_{t+1}}{\lambda_t} \right) \left[\theta_t q(\theta_t)(1 - \rho(\tilde{a}_{t+1})) \int_{\tilde{a}_{t+1}}^{\infty} V_{t+1}^E(a_{t+1}) \frac{f(a)}{1 - F(\tilde{a}_{t+1})} da + (1 - \theta_t q(\theta_t)(1 - \rho(\tilde{a}_{t+1}))) V_{t+1}^U \right] \right\} \quad (28)$$

where b denotes real unemployment benefits. The value of being employed depends on current wages and on the expected discounted future value function. With a probability $(1 - \rho(\tilde{a}_{t+1})$ the match is preserved and the worker will stay into the employment pool, viceversa he will move to the unemployment pool. The value of being unemployed are given by the a monetary measure of unemployment benefit and non-market returns b, and by the expected discounted future value function. With a probability $\theta_t q(\theta_t)(1 - \rho(\tilde{a}_{t+1}))$ a match is formed and is continued into the next period so that the worker enters the employment pool and remains there for the subsequent period. The reverse is true in the alternative case.

Nash bargaining. Workers and firms are engaged in a Nash bargaining process to determine wages. The standard Nash bargaining problem is given by:

$$\max_{w} \left((V_t^E(a_t) - V_t^U) \right)^{\varsigma} \left(V_t^J(a_t) \right)^{1-\varsigma} \tag{29}$$

where ς stands for the bargaining weight of the workers. After substituting the previously defined value functions in the optimal sharing rule $(1-\varsigma)(V_t^E(a_t) - V_t^U) = \varsigma V_t^J(a_t)$ it is possible to derive the following wage schedule:

$$w_t(a_t) = \varsigma(mc_t z_t a_t + \theta_t \kappa)\frac{1}{\phi_t} + (1-\varsigma)b \tag{30}$$

Importantly, it must be noticed that wages depend on the unemployment benefit and on a proxy of the terms of trade, ϕ_t. Differential labor market and marginal cost dynamics, as determined by differences in labor market institutions, feed into terms of trade dynamic which in turn affect wages in the two economies. This is at the heart of the spillover effect between labor market dynamics and relative prices across countries.

Total real wage is obtained by aggregating across employees: $w_t = \int_{\tilde{a}_t}^{\infty} w(a)\frac{f(a)}{1-F(\tilde{a}_t)}da$. Equation (30) shows how the replacement rate affects the real wage which in turn has an impact on the threshold value of the idiosyncratic shock, as shown by equation (25), and on the marginal cost. From equation (24) indeed we can derive a measure of the marginal cost in our model which reads as follows:

$$mc_t = \frac{1}{z_t H(\tilde{a}_t)} \left[\phi_t \frac{\partial W_t}{\partial n_t} + \mu_t - \frac{\kappa}{q(\theta_t)} \right]$$

The first component of this measure is given by the marginal wage bargained divided by the labor productivity. This relation shows that the dynamic of the real wage has an impact on the dynamic of the marginal cost which in turn has an impact on the dynamic of inflation via equation (22). Another important feature to notice is that the measure of the marginal cost in this model, an contrary to the standard new keynesian model, depends on the cost of posting vacancies alongside with the worker marginal productivity (see Krause and Lubik (2007)). Firms attach an long run value to the worker as by maintaining the current match they can save on future costs of posting vacancies.

Real wage rigidity. As shown in Shimer (2005), Hall (2005) and Krause and Lubik (2007) introducing real wage rigidity improves the performance of the matching model in terms of the

dynamic of labor market variables. We thus consider two versions of the model, with and without real wage rigidity. As modeling strategy we borrow from Hall (2005) and assume that the individual real wage is a weighted average of the one obtained through the Nash bargaining process and the one obtained as solution to the steady state:

$$w_t(a) = \lambda \left[\varsigma(mc_t z_t a_t + \theta_t \kappa) \frac{1}{\phi_t} + (1-\varsigma) b \right] + (1-\lambda) w(a) \tag{31}$$

Wage rigidity is consistent with evidence on euro area countries as estimates by Smets and Wouters (2003) report a value for λ on the magnitude of 0.6. In this respect, wage rigidity allows the model to reproduce more closely the labor market characteristics of euro area economies. As for their relevance in terms of the dynamic results, the main mechanisms characterizing our models' dynamic remain unaltered in absence of wage rigidity.

2.3 Monetary Policy Regimes

Two country model. An active monetary policy in the foreign economy sets the nominal interest rate by reacting to inflation and output:

$$r_t^{n,*} = \exp\left(\frac{1-\chi}{\beta}\right) (r_{t-1}^{n,*})^{\chi} (\pi_t^*)^{b_\pi(1-\chi)} (y_t^*)^{b_y(1-\chi)} m_t^* \tag{32}$$

where b_π is the weight that the monetary authority puts on the deviation of CPI inflation from the steady state, b_y is the weight that the monetary authority puts on the deviation of output, χ is the interest rate smoothing parameter and m_t^* is a monetary policy shock. To compare different exchange rate arrangements we assume that the domestic monetary authority follows the rule:

$$r_t^{n} = \exp\left(\frac{1-\chi}{\beta}\right) (r_{t-1}^{n})^{\chi} (\pi_t)^{b_\pi(1-\chi)} (y_t)^{b_y(1-\chi)} (e_t)^{b_e(1-\chi)} m_t \tag{33}$$

where b_e is the weight that the foreign monetary authority puts on the deviation of the exchange rate from the steady state. In a regime of floating exchange rates b_e is set to zero, while it has a positive value in a regime of pegged exchange rates.

Currency area. An active monetary policy sets the short term nominal interest rate by reacting to an average of the inflation levels in the area. This rule rationalizes the behavior of the stability pact signed by euro area countries:

$$r_t^{n} = \exp\left(\frac{1-\chi}{\beta}\right) (r_t^{n})^{\chi} \left(V_H \pi_t + V_F \pi_t^*\right)^{b_\pi(1-\chi)} \tag{34}$$

where V_H and V_F are the weights used to build up an aggregate measure of inflation for the currency area.

2.4 Equilibrium Conditions

Aggregate output is obtained by aggregating production of individual firms and by subtracting for the aggregate costs of posting vacancies:

$$Y_t = n_t z_t \int_{\tilde{a}_t}^{\infty} a \frac{f(a)}{1 - F(\tilde{a}_t)} da - \kappa v_t \tag{35}$$

We allow for government spending shocks in both domestic and foreign country. We assume full home bias in government spending. After imposing market clearing and aggregating we can express the resource constraint for the domestic country as:

$$n_t z_t \int_{\tilde{a}_t}^{\infty} a_t \frac{f(a)}{1 - F(\tilde{a}_t)} da - \kappa v_t = \left(\frac{p_{h,t}}{p_t}\right)^{-\eta} (1-\gamma)\, c_t + \left(\frac{p^*_{h,t}}{p^*_t}\right)^{-\eta} \gamma^* c^*_t + g_t + \frac{\psi}{2}\left(\frac{p_{h,t}}{p_{h,t-1}} - 1\right)^2 y_t \tag{36}$$

An analogous one holds for the foreign country. We assume zero total net supply of bonds.

2.5 Real Exchange Rate Fluctuations and Job Flows

Before turning to the dynamic simulation and welfare evaluation of the model it is instructive to consider the impact of real exchange rate movements on the reduced form equations of the model. Of particular interest is the analysis of the impact of real exchange rate movements on marginal costs and job flows. First, let's consider the expression for the marginal cost:

$$mc_t = \frac{w(\tilde{a}_t)\phi_t}{z_t \tilde{a}_t} + \frac{\kappa}{q(\theta_t) z_t \tilde{a}_t} \tag{37}$$

From equation (37) we see that movements in the terms of trade have an impact on marginal costs through their impact on the CPI-PPI ratio. This implies that fluctuations in the terms of trade and consequently in the real exchange rate tend to exacerbate fluctuations in marginal costs. Consider for instance a foreign productivity shocks with devaluation pressure. The fall in terms of trade and the CPI/PPI ratio will induce a fall in domestic marginal costs.

Variability in wage earnings tends to amplify fluctuations in consumption (through the wealth effect), in labour tightness and job flows. Indeed merging equations (20) and (24) and substituting

equation (30), we obtain the equation that describes the evolution of labour market tightness:

$$\frac{\kappa}{m}\theta_t^{\xi} = E_t\left\{\beta\left(\frac{c_{t+1}}{c_t}\right)^{-\sigma}(1-\rho(\tilde{a}_{t+1}))\left[(1-\varsigma)mc_{t+1}z_{t+1}H(\tilde{a}_{t+1}) - \varsigma\theta_{t+1}\kappa - (1-\varsigma)\phi_{t+1}b + \frac{\kappa}{m}\theta_{t+1}^{\xi}\right]\right\} \tag{38}$$

The higher are fluctuations in the CPI-PPI ratio the higher are fluctuations in the labour market tightness, which in turn induce higher fluctuations in job destruction and employment. For instance, a foreign productivity shocks, by reducing the CPI-PPI ratios, increases the value of the outside option to workers. An increase in the value of the unemployment benefit tends to smooth the response of wages to shocks and to amplify the response of job flows (see Hagedorn and Manoviskii (2008), Campolmi and Faia (2004)).

A policy maker concerned with macroeconomic stabilization must trade-off two conflicting effects associated with exchange rate fluctuations. On the one side the classical insulating property due to which currency fluctuations can act as business cycle smoothing devices. On the other side the amplifying effect that currency fluctuations have on marginal costs and job flows dynamics.

2.6 Calibration

When not stated otherwise, countries are calibrated perfectly symmetric.

Preferences. Time is taken as quarters. We set the discount factor $\beta = 0.99$, so that the annual interest rate is equal to 4 percent. We set the elasticity of substitution between domestic and foreign goods η equal to 1.5 as in Backus, Kehoe and Kydland (1992). The parameter on consumption in the utility function is set equal to 2, compatibly with estimates by Smets and Wouters (2003). We set γ to 0.25, a value compatible with data for trade between US and Europe and for trade within Europe. Finally we assume that the steady state net asset position is symmetric between the two countries. Following Schmitt-Grohe and Uribe (2003) and consistently with Lane and Milesi-Ferretti (2003) we set the elasticity of the spread on foreign bonds to the net asset position equal to 0.000742.

Production. Following Basu and Fernald (1997) we set the value added mark-up of prices over marginal cost to 0.2. This generates a value for the price elasticity of demand ε of 6. We set the cost of adjusting prices $\psi = 100$ to generate a slope of the log-linear Phillips curve equal to 0.10. This is compatible with the estimates by Benigno and Lopez-Salido (2002) for France and Germany. We

have also checked our results with different values for ψ and verified that they remain unchanged.

Labor market frictions parameters. Parametrization for labour market variables is done in accordance with data for industrialized countries (which includes both Europe and the US). The matching technology is a homogenous of degree one function which is characterized by the parameter ξ. Consistently with estimates by Blanchard and Diamond (1991) for the US and Petrognolo and Pissarides (2001) for Europe, we set this parameter to 0.5. We set the firm matching rate, $q(\theta)$, to 0.7 which is the value used by denHaan, Ramey and Watson (2000) and is consistent with evidence for Europe as reported in the ECB report 2002 and in Weber (2000). The probability for a worker of finding a job, $\theta q(\theta)$, is set equal to 0.6, which implies an average duration of unemployment of 1.67 as reported ion Cole and Rogerson (1999). With those values it is possible to determine the number of vacancies as well as the vacancy/unemployment ratio. We set the exogenous separation probability, ρ^x, to 0.08[10] and the steady state overall separation rate, $\rho(\tilde{a})$, to 0.1. With those values it is possible to obtain the endogenous separation rate, $\rho^n(\tilde{a}) = \frac{(\rho(\tilde{a})-\rho^x)}{(1-\rho^x)}$, and the threshold value, $\tilde{a} = F^{-1}(\rho^n)$. The idiosyncratic shock is distributed as a uniform distribution with unitary mean over the interval $[0.6536, 1.3464]$. This interval allows to obtain a variance of the shock equal to 0.20, a value compatible with empirical evidence and in line with Krause and Lubik (2007).

Labor market institutions. As Krause and Lubik (2007) the unemployment benefit is obtained as solution to the steady state. In particular we assign values for the bargaining power, ς we then compute the unemployment benefit parameter, b, from the steady state job destruction equation so as to generate values for the $\frac{b}{w}$ ratio which are in the range of the ones reported by Nickell and Nunziata 2007 for euro area countries over the sample 1998-2004. In particular, we calibrate ς such that $b/w = 0.66$.

Monetary Policy. In our benchmark analysis for the two-country model we consider a standard Taylor's rule with $b_\pi = b^*_{pi} = 1.5$ and $b_y = b^*_y = 0.5/4$. In addition, following several empirical studies for Europe (see Clarida, Galí and Gertler (2000), Angeloni and Dedola (1999) and Andrés, Ortega and Vallés (2003) among others) we set the interest rate smoothing parameter χ equal to 0.8. For the currency area version of the model we will consider $V_H = V_F = 0.5$ as benchmark and study the welfare consequences of allowing for different weights when countries are characterized

[10] Estimates for Europe, see Hobijn and Sahin (2007), give a slightly lower value of 0.07.

by different labour market institutions.

Exogenous shocks. We consider domestic and foreign aggregate productivity shocks, z_t and z_t^*. We follow Backus, Kehoe and Kydland (1992) and calibrate their standard deviations to 0.008, their correlation to 0.258 and their persistence to 0.95. We also consider domestic and foreign government expenditure shock. Log-government consumption evolves according to the following exogenous process, $\ln\left(\frac{g_t}{g}\right) = \rho_g \ln\left(\frac{g_{t-1}}{g}\right) + \varepsilon_t^g$, where the steady-state share of government consumption, g, is set so that $\frac{g}{y} = 0.25$ and ε_t^g is an i.i.d. shock with standard deviation σ_g. Empirical evidence for the US in Perotti (2005) suggests $\sigma_g = 0.008$ and $\rho_g = 0.9$. Shocks in the two countries are uncorrelated. We also consider an i.i.d. monetary policy shock m_t with st.dev. $\sigma_m = 0.008$.

3 International Transmission Under Different Exchange Rate Regimes

In this section we analyze the international transmission of shocks and compare different exchange rate regimes. As a benchmark, we consider foreign productivity shocks.

Figure (1) shows the impact on selected domestic variables to a 1% increase in foreign productivity under floating and pegged exchange rates. For this experiment we are assuming that the foreign monetary policy follows a standard Taylor rule, while for the domestic economy we compare results under a standard Taylor rule (floating exchange rates) versus a currency peg (a rule with a positive response to exchange rates[11]). The qualitative dynamic of all variables is the same under both regimes; they differ for the magnitude of the dynamic responses. More specifically, floating exchange rates seem to be more de-stabilizing than pegged exchange rates: we will return on this point later.

Concerning the international transmission of shocks, we find that the model is able to generate positive co-movements of employment and output as an increase in foreign productivity induces an increase in domestic output and employment. This result is consistent with empirical evidence on the transmission of shocks across countries [12]. The international transmission of shocks in this model can be described as follows. A foreign productivity shock increases foreign output and reduces foreign inflation. There is an *expenditure switch* from domestic to foreign produced goods

[11] For the impule responses analysis we set $b_e = 0.5$. In the subsequent analysis we show how the model behaves under different degrees of exchange rate peg.

[12] See Backus, Kehoe and Kydland (1992) and Faia (2007).

that would, considered alone, induce a fall in domestic output (hence negative correlations between domestic and foreign output). However there are two additional effects. First, under floating exchange rates the fall in domestic inflation is counteracted by the monetary authority which, by reacting according to a Taylor rule, reduces the interest rate and boosts domestic demand. Second, the fall in terms of trade associated with the expenditure switch, induces a fall in marginal costs, which in turn increases firms marginal profits and the endogenous separation threshold. On the one hand this increases vacancy posting, on the other hand the higher separation threshold increases the job destruction rate. Overall, labour market tightness increases. The latter effects are more amplified in a regime of floating exchange rates as fluctuations in terms of trade are higher in this regime. Thus, currency fluctuations exacerbate movements in relative prices which in turn increase relative movements in employment, participation and wages.

3.1 Exchange Rate Regimes, Macroeconomic Volatility and Welfare

To establish whether a positive degree of exchange rate stabilization allows to increase macroeconomic stabilization we now compute changes in the second moments of selected (domestic) variables in response to changes in the parameter reflecting the reaction to exchange rate movements in the policy rule of the domestic monetary authority. Figure (2) shows changes in the volatility of (domestic) CPI inflation, output, vacancies and unemployment in response to changes in the degree of exchange rate stabilization as captured by the parameter b_e in the monetary policy rule. We consider a range for this parameter that goes from zero to 4[13]. The volatilities of all the four variables is reduced as soon as we move from flex to a small degree of peg. While the volatility of CPI is monotonically decreasing in the level of the peg, the volatility of the other variables increases again for high values of b_e. Thus, we can expect that, even though targeting exchange rate reduces the volatility of all the variables, the optimal solution in terms of exchange rate peg will not be the extreme case of fix exchange rate.

Typically exchange rate flexibility allows the monetary authority to focus on domestic stabilization since it is free from external constraints. In our context however currency fluctuations

[13] In choosing the range of possible values for b_e we used the following strategy. Let $b_e = \frac{\xi}{1-\xi}$. Then $\xi = 0$ is equivalent to floating exchange rate while $\xi = 1$ correspond to the case of fix exchange rate. In this exercise we let $\xi \in [0, 0.8]$.

increase the volatilities of job destruction, wages and vacancies. The monetary authority must trade-off between those conflicting forces. The resolution of this conflict brings the monetary authority to follow rules that feature the exchange rate as an independent target. The coefficient that optimizes this trade-off in terms of stabilization of all variables stays around a value of 1.5.

An important dimension to consider in the evaluation of the optimal choice of the exchange rate regime is the welfare effect of exchange rate stabilization. Some observations on the computation of welfare in this context are in order. First, one cannot safely rely on standard first order approximation methods to evaluate welfare since in an economy with a distorted steady state stochastic volatility affects both first and second moments of those variables that are critical for welfare. Hence, policy arrangements can be correctly ranked only by resorting to a higher order approximation of the policy functions.[14] Additionally, one needs to focus on the *conditional* expected discounted utility of the representative agent. This allows to account for the transitional effects from the deterministic to the different stochastic steady states respectively implied by each alternative policy rule.[15]The following provides a description of the welfare metric which applies symmetrically to both countries. Define Ω as the fraction of household's consumption that would be needed to equate conditional welfare under regime A, $\mathcal{W}_0^A \equiv E_0 \sum_{t=0}^{\infty} \beta^t U(C_t^A)$ to the level of welfare under regime B, $\mathcal{W}_0^B \equiv E_0 \sum_{t=0}^{\infty} \beta^t U(C_t^B)$. Hence Ω should satisfy the following equation:

$$\mathcal{W}_{0,\Omega} \equiv E_0 \left\{ \sum_{t=0}^{\infty} \beta^t U((1+\Omega)C_t^A) \right\} = \mathcal{W}_0^B$$

Under our specification of utility one can solve for Ω and obtain:

$$\Omega = \frac{\mathcal{W}_0^B + [(1-\beta)(1-\sigma)]^{-1}}{\mathcal{W}_0^A + [(1-\beta)(1-\sigma)]^{-1}} - 1 \tag{39}$$

As our model economy is characterized by significant spillover effects we look at the effects of exchange rate targets on domestic and foreign welfare and on a weighted average of the two. In particular, we consider regime A to be the flexible exchange rate ($b_e = 0$) case while regime B is characterized by $b_e > 0$. More specifically, in all case we set $\chi = 0.8$, $b_p = 1.5$ and $b_y = 0.5/4$ in both countries for both regimes. In regime B the home country targets the nominal exchange rate with

[14]See Kim and Kim (2003) for an analysis of the inaccuracy of welfare calculations based on log-linear approximations in dynamic open economies.

[15]See Kim and Levin (2004) for a detailed analysis on this point.

$b_e \in [1, 4]$. Figure (3) shows the value of Ω for the Home country, Foreign and the World economy for different values of the parameter b_e. Figure (3) shows that in all cases there are welfare gains from a positive degree of exchange rate target. Increasing the degree of exchange rate stabilization tends to stabilize most labour market variables. Smoothing fluctuations in labour income helps in smoothing fluctuations in consumption. Since agents are risk averse stabilization of consumption comes together with an increase in welfare. To show the robustness of this result we repeat the exercise allowing for $b_p \in [1.5, 5]$. Results are reported in figure (4) for the Home country. It is clear from the picture that, independently on how strongly the monetary authority reacts to inflation, a positive degree of exchange rate targeting brings a welfare gain.

Finally we compute the optimal value of b_e for the domestic monetary rule by searching on the following grid of parameters $b_e = [0, 9]$, for the different values of b_p. When both countries choose $b_p \in [1.5, 2.5]$, home maximizes welfare choosing $b_e = 5.6$. When $b_p \in [3, 3.5]$ then $b_e = 4$. When $b_p \in [4, 5]$ then $b_e = 1.5$. Thus the optimal target on the exchange rate is decreasing in the aggressiveness of the central banks in fighting inflation.

We also repeated the exercise for the case of log utility and zero real wage rigidity. Results are unaffected.

4 Optimal Policy in a Currency Area

In the previous section we have seen how the presence of frictions in the labor market calls for a partial stabilization of the exchange rate. The extreme case of fix exchange rate coincides with the currency union. As shown in Campolmi and Faia (2004), differences in labor market institutions across EMU countries generate inflation volatility differentials. In particular, countries with relatively high replacement ratios tend to display relatively lower inflation volatility. It does sound natural to investigate whether, once the exchange rate is fix, the common central bank should assign different weight to different countries depending on their labor market structure. We thus depart from the assumption of symmetric countries and calibrate the bargaining power in the two countries so as to obtain $(b/w) = 0.38$ and $(b/w)^* = 0.75$. As in all the previous exercises, we set $b_y = 0.5/4$ and $\chi = 0.8$. We then allow for $b_p \in [1.5, 5]$ and for $V_H = (0, 0.25, 0.5, 0.75, 1)$. Currency area welfare is maximized for $b_p = 5$ and $V_H = 0.75$ i.e the central bank should target more aggres-

sively the inflation of the country with the lower replacement ratio. Conditional welfare for the two countries and for the world economy are reported in figure (5). The (%) welfare gains/losses (in terms of consumption equivalent) of deviating from $V_H = 0.5$ are reported in figure (6) for different levels of b_p. The foreign country is actually better off in the case of equal weights, but the overall increase in welfare at home when $V_H > 0.5$ more than compensate for the losses in foreign.

5 Conclusion

Labor market flows and labor costs are an important determinant of the international transmission mechanism of shocks as they impact the dynamics of terms of trade. In addition it is well known that both asymmetric shocks and exchange rate fluctuations have a significant impact on labor market dynamics. This implies that the optimal choice of the exchange rate target cannot neglect all considerations related to the relative movements of unemployment, wages and job flows. This paper analyzes the international transmission of shocks in a two country model with matching frictions and evaluates the performance of different exchange rate arrangements in terms of macroeconomic volatility and welfare. We find that exchange rate targeting allows to reduce macroeconomic volatility and to increase welfare. Currency fluctuations, indeed, induce movements in relative prices which destabilize job flows. Higher volatility in the labor market variables translates into higher volatility for the whole economy and in lower welfare for risk averse agents.

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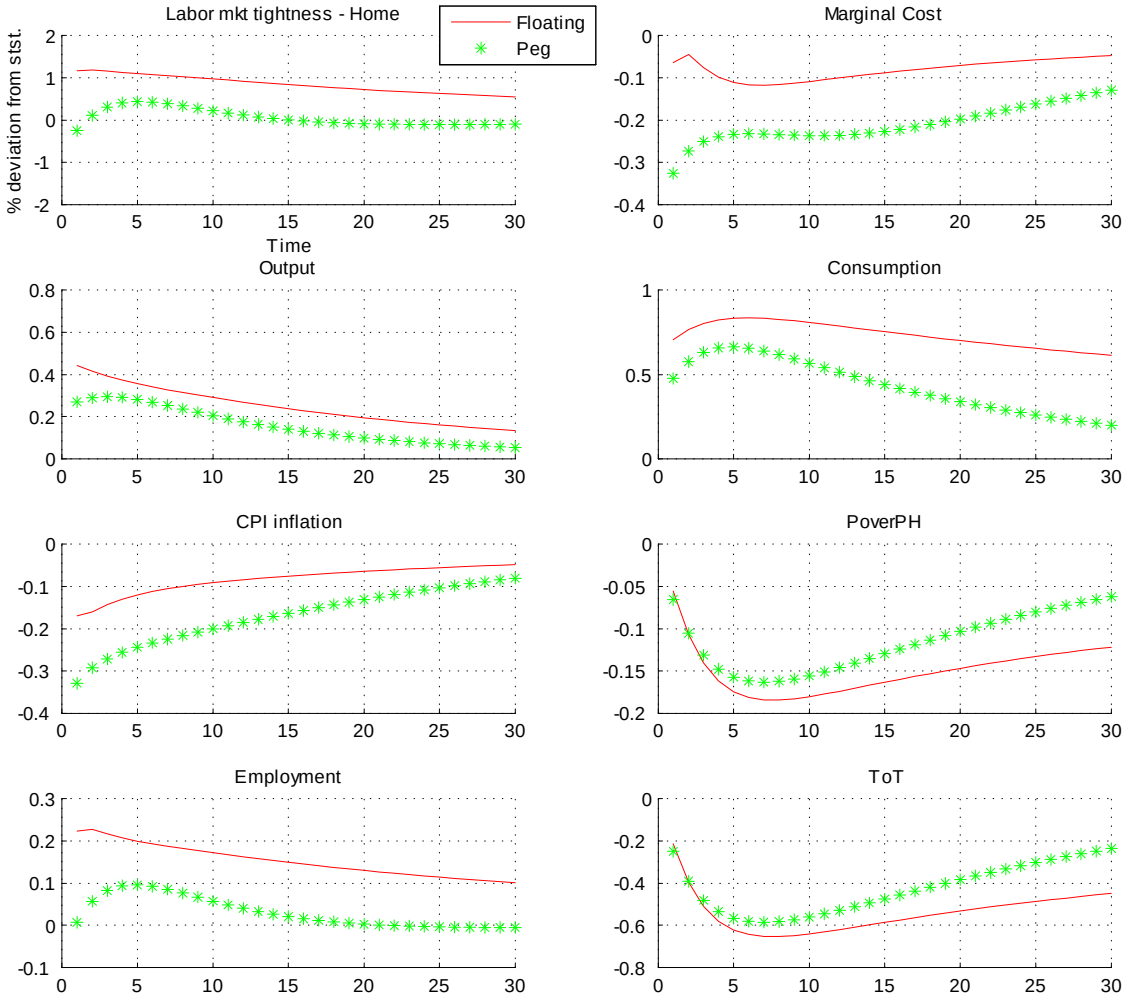


Figure 1: **Two-Country** Response of Home variables to a positive TFP shock in Foreign under two different exchange rate regimes: floating (solid line) and peg (dotted line).

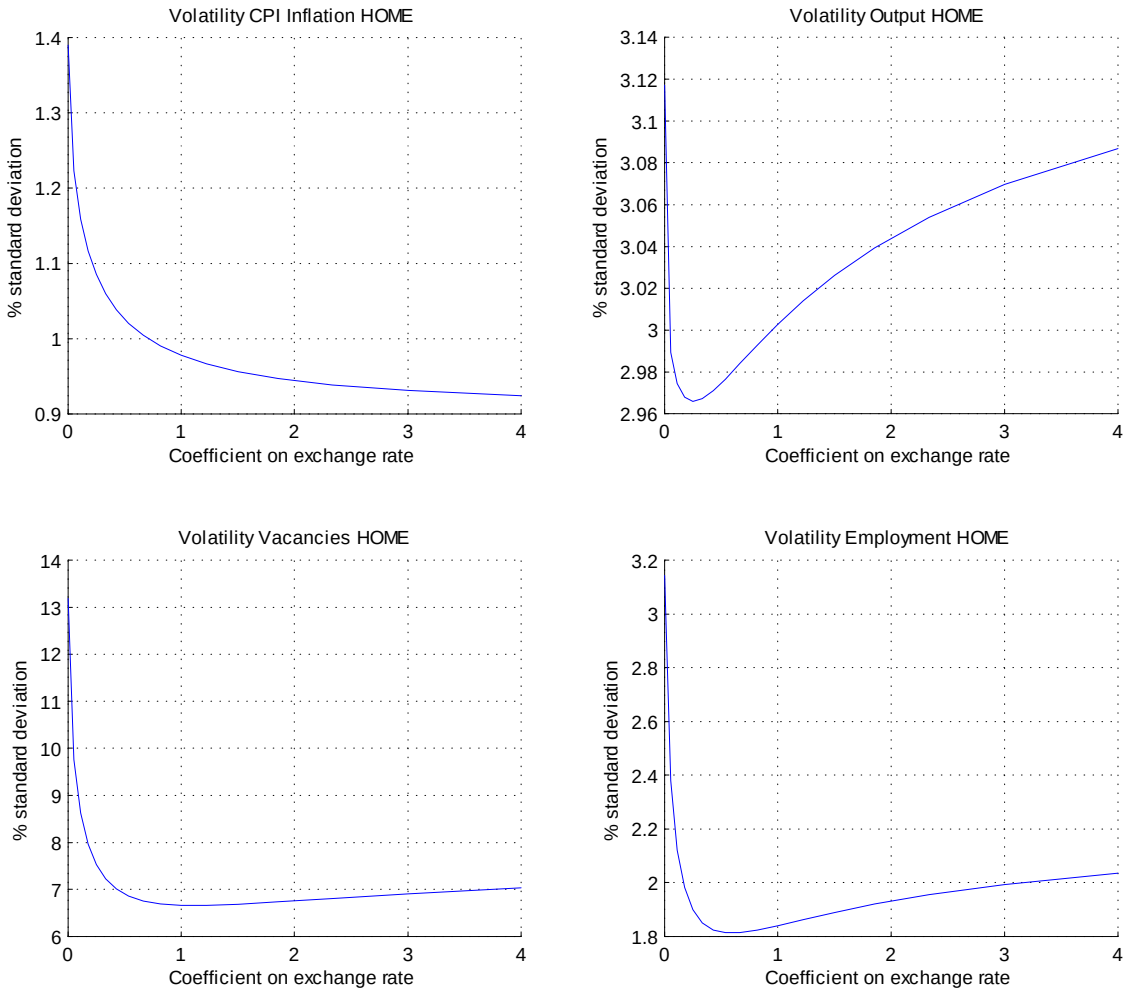


Figure 2: **Two-Country** Volatility of domestic variables for different values of b_e in the interest rate rule of HOME. All shocks are considered.

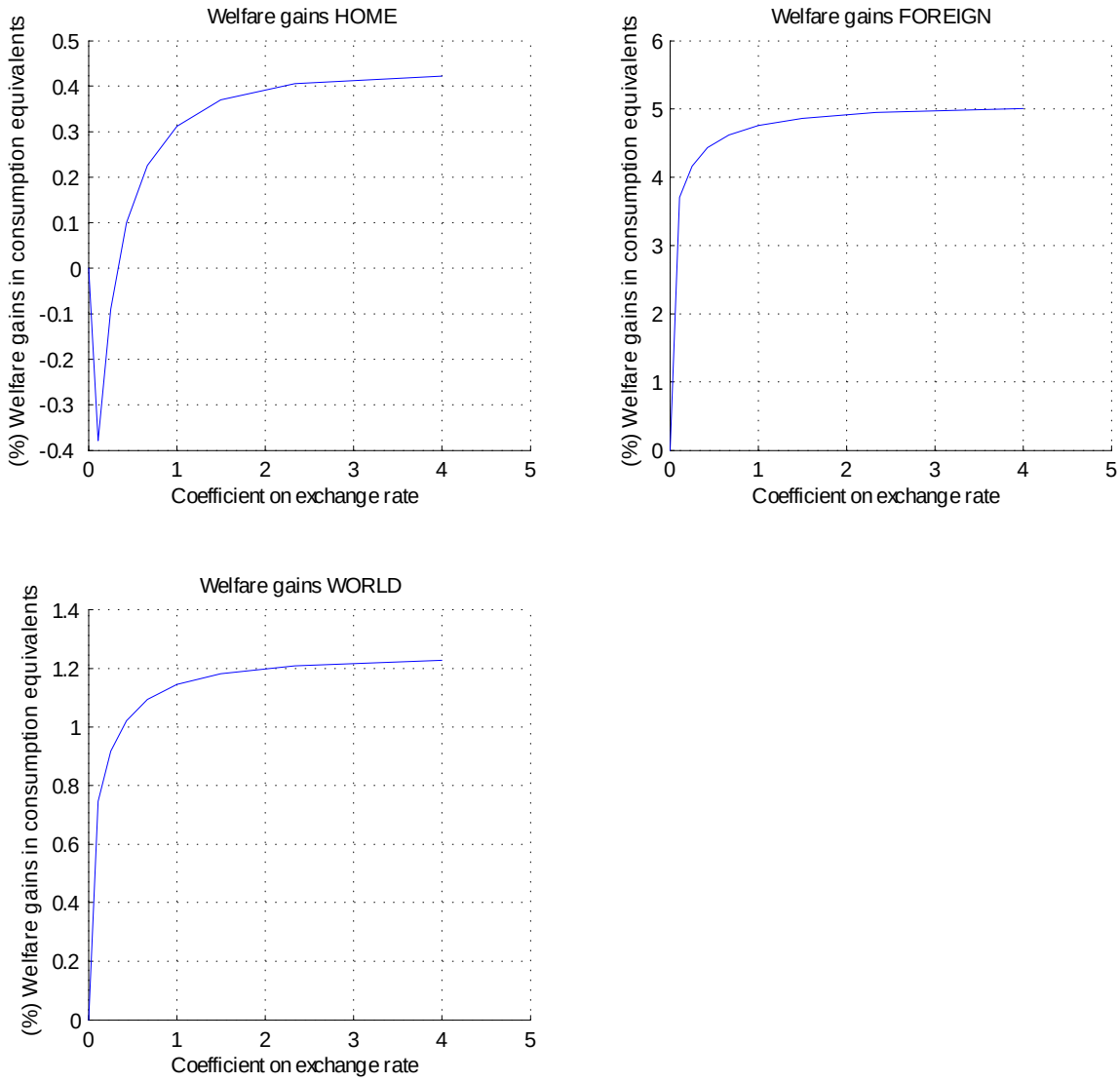


Figure 3: **Two-Country** Conditional welfare for Home, Foreign and the World economy for different values of b_e in the interest rate rule of HOME. All shocks are considered.

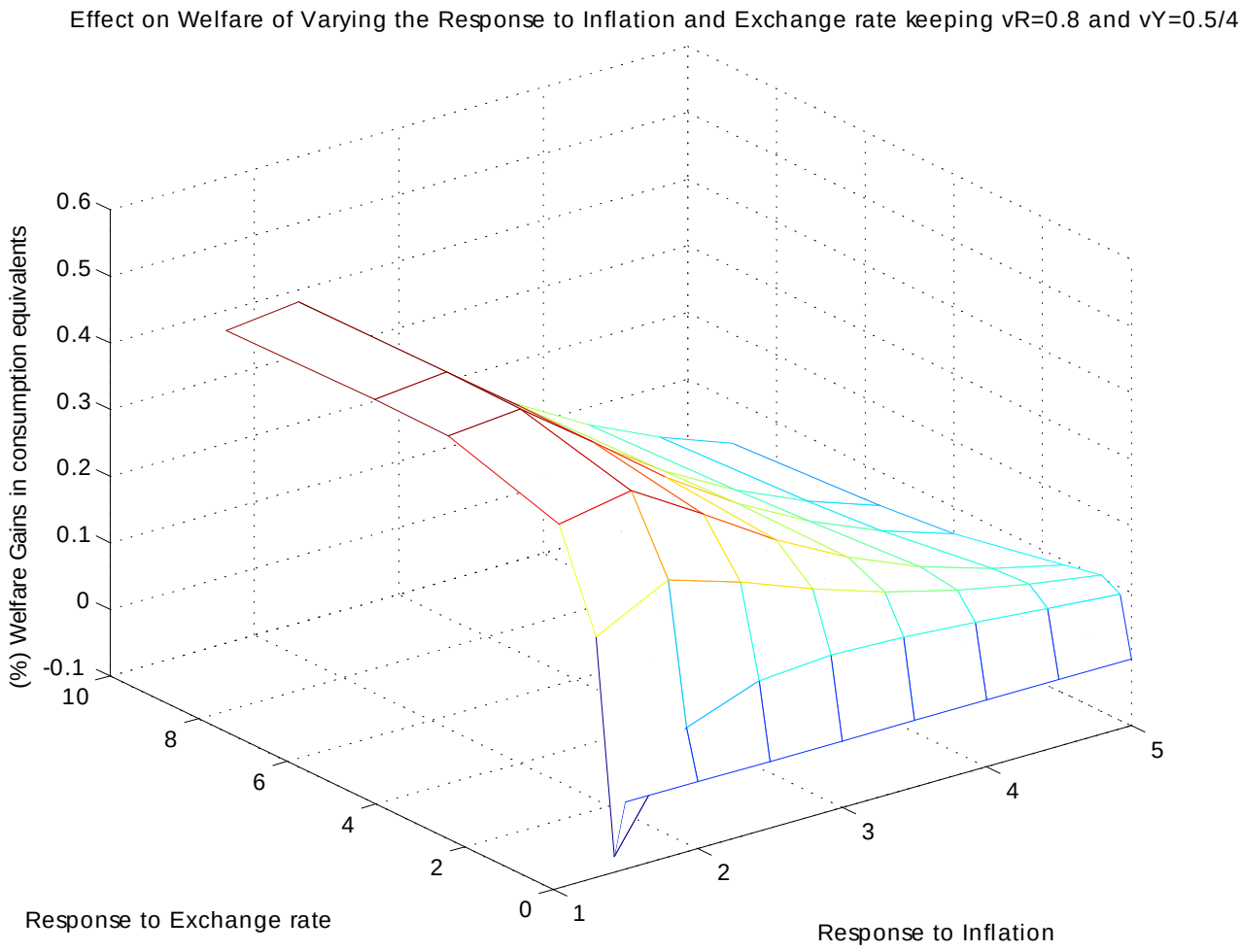


Figure 4: **Two-Country** (%) Welfare gains/losses from the case $b_e = 0$ for HOME. Welfare gains/losses are expressed in terms of consumption equivalents. All shocks are considered.

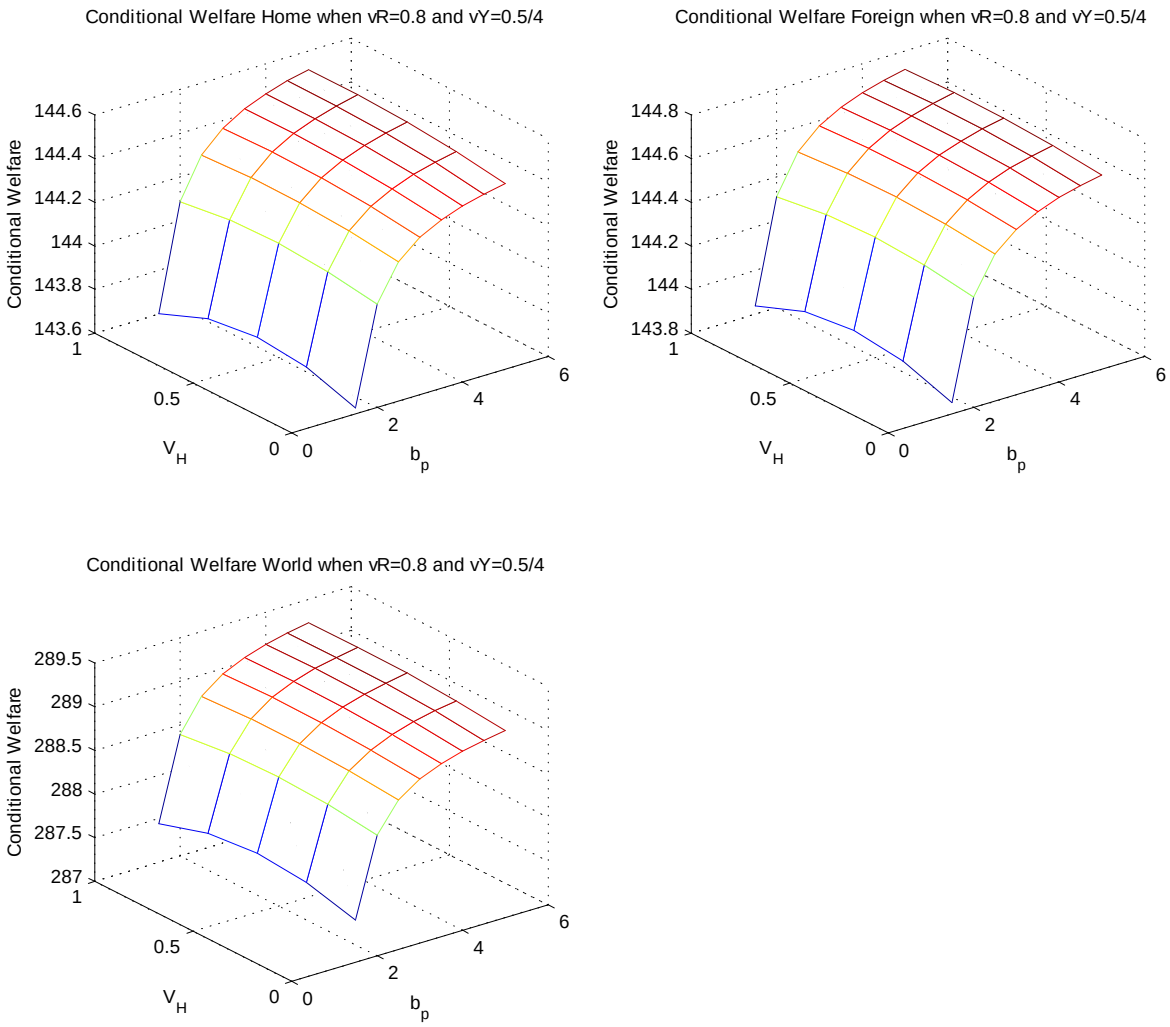
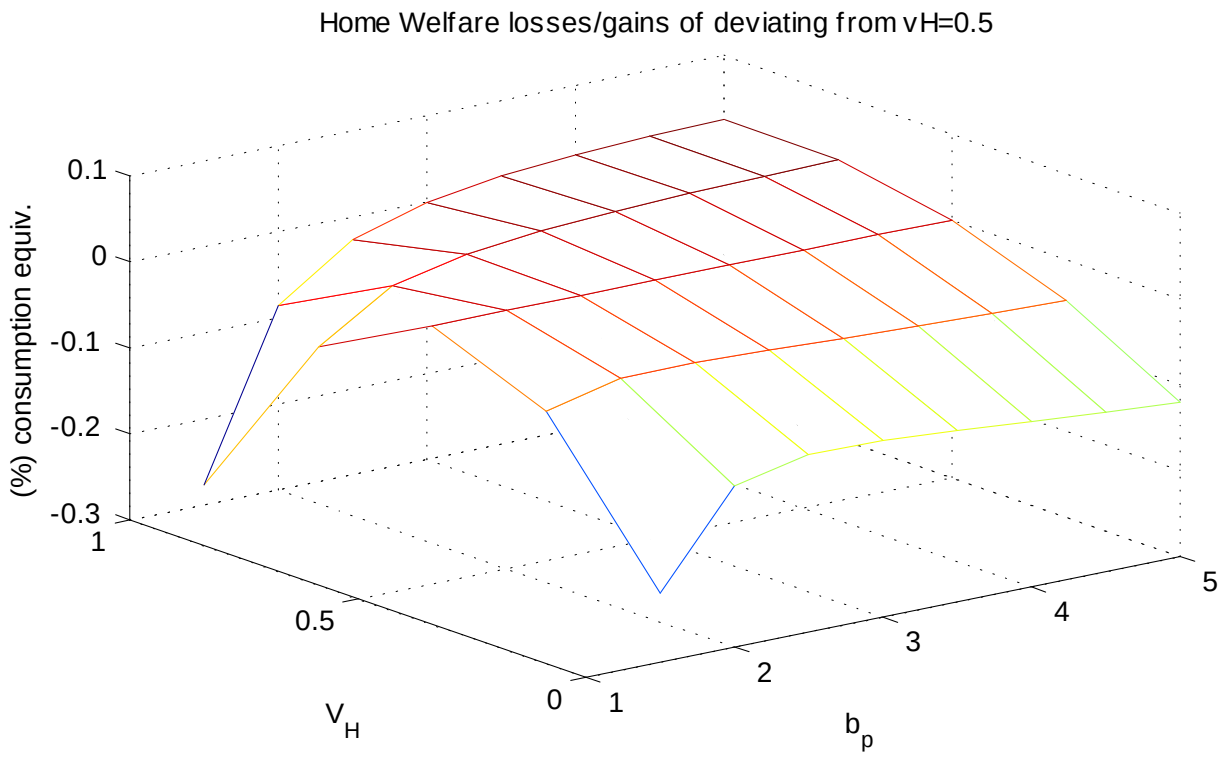


Figure 5: **Currency Area** Conditional welfare for Home, Foreign and the World economy for different values of b_p and V_H. The model is solved under the assumption that $\chi = 0.8$ and $b_y = 0.5/4$. All shocks are considered.



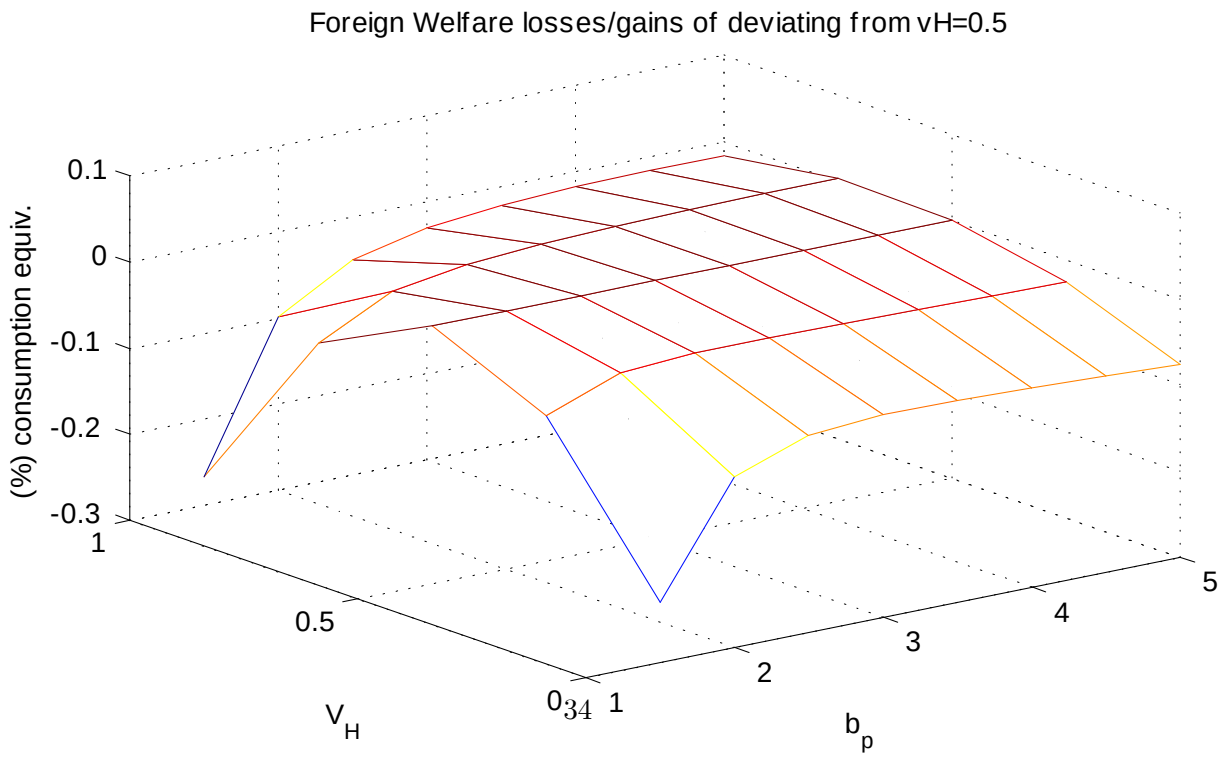


Figure 6: **Currency Area** (%) Welfare gains/losses from the case $V_H = 0.5$ for HOME and Foreign and for different values of b_p. The model is solved under the assumption that $\chi = 0.8$ and $b_p = 0.5/4$. Welfare gains/losses are expressed in terms of consumption equivalents. All shocks are