Heterogeneity, Rigidity and Convergence of Labor Markets in the Euro Area

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Abstract

This paper investigates the welfare consequences of labor-market convergence reforms in a simple two-country monetary union DSGE model with search and matching frictions. The model features trade in consumption and investment goods, price stickiness and is calibrated to reflect the structural asymmetries of core and peripheral countries of the Euro Area in terms of size, productivity, fiscal variables and labor market variables. I study the welfare effects of two convergence reforms of labor market variables (replacement rates and labor market transition probabilities): a convergence to the average level of the Euro Area and a convergence towards the level of the most flexible region. Comparing across steady states, the former produces large structural and stabilization welfare gains while the latter produces only small gains (and losses for the most flexible country). Taking into account the transition path overturns these results: the reform brings sizable short-run welfare losses, especially for the most rigid country, that are not overturned by the long-run welfare gains except for a very slow transition to the most flexible level. As such, I conclude that convergence in labor markets can lead to substantial welfare gains, but only if implementation and convergence speed is carefully designed and if the reform is accompanied by short-run policies that alleviate the burden borne by rigid countries.

Keywords: Unemployment, Monetary Union, Labor Market Reform

JEL Classification: E32, F41, F45, J64

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1 Introduction

The Eurozone is a monetary union of nineteen countries with heterogeneous structural characteristics. Unlike in an optimal currency area (see Mundell, 1961; McKinnon, 1963), labor mobility is extremely limited, and risk-sharing mechanisms remain incomplete. The loss of monetary sovereignty by the countries of the Euro Area and the lack of cooperation and risk-sharing mechanisms to deal with asymmetric shocks has led the EMU to have had tremendous difficulties to face the Great Recession. Relying on several economic indicators, the Euro Area appears in worst shape ten years after the crisis than it was just before. For instance, as Figure 1 indicates, the unemployment rate was at 10% of the active population in 2016, that is 25% higher than in 2007. Besides, most of the other OECD countries had a much lower unemployment rate in 2016 than the Eurozone (it was only higher in Turkey). Finding means to cope efficiently with asymmetric shocks is thus of great interest for the Euro Area.

In this respect, I investigate welfare consequences of labor market convergence reforms in a simple two-country monetary union model with search and matching frictions where countries are asymmetric in terms of labor market variables. Indeed, Eurozone countries display important labor market differences, both in terms of labor market transition probabilities and unemployment insurance schemes. For instance, most countries have a net unemployment benefit replacement rate between 50% and 70% but there are huge differences between Malta, that has a net replacement rate of 20%, and Portugal, where the replacement rate is 92%. Moreover, the duration period of eligibility ranges from 28 weeks in Slovenia to an unlimited period in Belgium (Enner et al. 2013). In addition, labor-market flexibility is very heterogeneous between peripheral countries as Spain, Portugal, Italy or Greece and core countries of the Euro Area (Germany, the Netherlands, Austria, Finland, etc.), as a result of contrasting legislations. In core countries, firms make quicker and more efficient adjustments of their workforces. Employees have more flexible working time arrangements, the legislation protecting regular workers is close to the one protecting temporary workers, voluntary part-time work is higher. Moreover, overtime hours are more often observable and transition from temporary to permanent employment is higher (see Nardo and Rossetti, 2013). Higher labor market flexibility is considered by many authors as the main reasons explaining the lower unemployment rate in core countries of the Eurozone. While the unemployment rate was quite high in the Euro Area on average in 2016, Figure 2 shows great cross-country heterogeneity. Up to minor exceptions, core countries have a much lower unemployment rate (6.6%) than peripheral countries (14.7%).

My model features sticky prices, trade in consumption and investment goods, and home bias as in Pappa and Vassilatos (2007). Labor markets are frictional in the tradition of Pissarides (1979), Mortensen (1982) and Diamond (1982). The home country is meant to be the core of the EMU while the foreign country resembles the periphery. I calibrate the model carefully using Euro Area data. Countries are asymmetric in size, productivity, government policies (taxes and
Figure 1: Unemployment rate in OECD countries

Figure 2: Unemployment rate in the Eurozone in 2016
expenditure), and labor market variables. In particular, in the steady state, core countries have a lower unemployment rate but a higher net unemployment benefit replacement rate, as in the data. Fed with asymmetric productivity shocks, the model matches business cycle moments quite well. I then use the model to investigate the effects of labor market convergence reforms: labor market variables become identical in each country. Convergence is achieved by adjusting separation and the job-finding rates, as well as replacement rates. Two case are presented: convergence to the average level of the EMU and convergence to the level of the most flexible area (core countries). Two welfare comparison exercises are performed: a steady-state to steady-state welfare comparison, where structural and stabilization gains are computed, and an welfare analysis based on the full transition path from heterogeneous to homogeneous labor markets.

The steady-state to steady-state comparison shows that labor market convergence within the Euro Area brings welfare gains for the periphery and the monetary union as a whole. Under both levels of convergence, average and most flexible, peripheral countries witness a lower unemployment rate. As wage are higher than unemployment benefits, it leads to an increase in consumption (and welfare). The core loses welfare when convergence is implemented at the average level of the EMU, as its unemployment rate rises. However, welfare increases for the core when the convergence is made at the most flexible level, although its unemployment rate remains identical to its baseline level. This is due to the increase of the demand for their varieties of goods from the periphery. Generally speaking, convergence to the flexible labor market brings higher welfare than the convergence to the average level. Besides, the lower the unemployment rate, the lower the volatility in unemployment rate and consumption: higher market tightness stabilizes movements in matches, and therefore in unemployment rates. Again, as movements in unemployment imply movement in consumption and welfare, this lower volatility in the unemployment rate produces lower volatility in consumption and thus generates stabilization welfare gains.

However, those steady-state to steady-state welfare gains do not outlive an analysis of the full transition path. Indeed, along the transition, both the periphery and the Eurozone as a whole experience welfare losses, except in the long run for a very slow transition to the flexible level of convergence. This comes from short-term losses in the periphery. In those countries, convergence implies higher unemployment benefit replacement rates with negative effects on the unemployment rate in the short-run and with adverse welfare effects. A higher replacement rate decreases the value of working, lowers the number of matches and therefore increases the unemployment rate. Only after a few periods, the periphery gains welfare from the transition, as the unemployment rate eventually falls. However, those long-term gains do not overturn the short-term losses, except when the transition is very slow. An opposite mechanism takes place in core countries for a convergence to the average level. The decrease of the unemployment benefit replacement rate leads to a short-term decrease of the unemployment rate, producing welfare gains. For a convergence to the flexible level, the welfare in the core diminishes due to the decrease of demand for their varieties of goods coming from the periphery. Movements in the periphery being higher
than those in the core, the monetary union welfare changes follow the same pattern as those of the periphery but at a lower level. Those results point to relatively large welfare losses from the transition toward more homogeneous labor markets in most situations. Thus, the transition losses can been seen as a hurdle in terms of the political economy of such reforms. Such a transition would require fiscal adjustments to compensate the short-term welfare losses and sustain consumption in the periphery.

This paper relates to two different types of literature. The first one looks at better ways to cope with asymmetric shocks. Several authors have studied the stabilization role of fiscal and monetary policies in a monetary union. Beetsma and Jensen (2005) create a two-country model where, under commitment, monetary policy has for role to stabilize union-wide inflation and consumption while fiscal policies stabilize relative inflation. In this set up, it is optimal for authorities, in terms of welfare of the monetary union, to commit to monetary and fiscal contractions to stabilize (relative) inflation. However, they have incentives to diverge from commitment in the case of asymmetric shocks. Gali and Monacelli (2008) show that the best response to an asymmetric shock is for the monetary authority to commit to price stabilization and for fiscal authorities to exert a precise trade-off between the speed of return to zero of inflation on one side and of the output and fiscal gaps on the other side. Ferrero (2009) demonstrates that flexibility in terms of policy rule is always profitable. But a flexible fiscal rule brings much more welfare gains than a flexible monetary rule. Therefore, he advocates against the rigid rules of the Stability and Growth Pact.

Following the seminal work of Kenen (1969), several authors advocate in favor of a greater fiscal integration, mainly with fiscal transfers. Indeed, when two countries are at different moments of their business cycle, transferring money from the country above the trend to the country below the trend should mitigate the consequences of an asymmetric shock. For instance, Evers (2012) looks at different federal fiscal transfer schemes and determines that the transfer mechanism that targets labor income divergences is the one that generates the highest welfare despite also producing the highest volatility in GDP and consumption. Farhi and Werning (2017) point out that in a monetary union, government should play a role of organiser of a macro insurance scheme through fiscal transfers whether financial markets are complete or not. When asymmetric shocks are large, persistent and the countries of the monetary union little open, the positive consequences of this macro insurance scheme are larger. A different result is produced by Verstegen and Meijdam (2016). They implement a specific transfer and apply it to the Great Recession. They show that it would have increased the welfare of peripheral countries but have slightly decreased the one of the monetary union as a whole. Finally, Engler and Voigts (2013) and Moyen, Stahler and Winkler (2016) implement a Eurozone unemployment insurance system. Both papers show that such a fiscal transfer brings higher welfare than national stabilizing policies. Indeed, government debt has to be repaid while fiscal transfers must only be averaged out in expectation over time. Engler and Voigts single themselves out by showing that a deepened integration of the markets of goods generates an even higher welfare. Therefore, they consider the transfer scheme as a
momentary mitigating mechanism unnecessary in the event of a more integrated Euro Area.

While those works have great implications for the future of the Eurozone, the purpose of the mechanisms they propose is to weaken the consequences of large asymmetric shocks after they occur. This paper differs from previous works by looking at the consequences in terms of welfare of decreasing the asymmetries in the first place in order to diminish the strength and the occurrence of asymmetrical shocks.

Second, this work relates to papers that try to determine the consequences, especially in terms of unemployment rate, of a higher labor market flexibility in Eurozone countries. Several studies have been conducted and have exhibited evidence in favor of more flexibility. For example, using a panel of seventeen European countries, Agnello et al. (2014) find that youth unemployment decreases by 0.6-0.7 percentage point when the labor market flexibility index they use increases by one point. Besides, long term unemployment decreases by around 2 points. Gomes et al. (2013) show that a decrease in labor markets’ markup in Germany or Portugal would strongly increase output in each country and the rest of the monetary union. Furthermore, if the fall in labor markets’ markup is made in cooperation between Eurozone countries, the effects are stronger and more homogeneous between countries. Finally, Cacciatore et al. (2016) find that the adverse effects coming from a reduction of firing costs are much lower in a boom or in normal times than in a recession. On the contrary, output and employment increase more after a fall of unemployment benefits in the case of a recession than in normal times.

The remainder of the model is organized in the following way. Section 2 presents the Dynamic Stochastic General Equilibrium model. Section 3 discusses the parametrization and looks at the fit of the model to the data. Section 4 examines the main results. Section 5 concludes.

2 Model

The world economy consists of two countries in a monetary union: a home country of size $n \in (0, 1)$ representing core countries of the Euro Area and a foreign country of size $(1 - n)$ representing peripheral countries. A central bank sets the nominal interest rate that prevails in the monetary union, while each government has an independent fiscal policy, that consists in setting the tax rates and the unemployment insurance (UI hereafter) benefit scheme. Each government buys local varieties of goods and finances expenditure through labor and capital income taxes and one-period nominal bonds. Individuals have preferences over a bundle of domestic and foreign goods with home bias, supply labor and accumulate capital. Capital goods feature the same structure as consumption goods, with home bias. Firms in each country produce internationally-traded varieties of goods using labor and capital. They face sticky prices à la Rotemberg while labor markets are subject to search and matching frictions. The real wage is Nash-bargained as usual in this literature. Individuals have access to two types of bonds: local government one-period
nominal bonds and international nominal bonds. Union-wide financial markets are incomplete and households face a portfolio adjustment cost that ensures the model’s stationarity.

Countries are symmetric in structure but heterogeneous in terms of calibration. Therefore, this section only presents details of the model from the perspective of the home country. If needed, foreign variables are denoted by an asterisk. Quantity variables are expressed per capita, unless specified otherwise.\(^1\)

### 2.1 Households

In the home country, there is a large family made of a continuum of \(n\) individuals (Merz, 1995).\(^2\) A fraction \(N_t = 1 - U_t\) is employed while the remaining portion \(U_t\) is unemployed and searching for jobs. Family members are insured against unemployment risk: members pool their income to achieve the same level of individual consumption. Family members derive utility from consumption \(C_t\) and from home production \(h\) when unemployed.\(^3\) The family head thus maximizes its utility \(u(C_t)\):

\[
\max_{C_t} E_t \left[ \sum_{t=0}^{\infty} \beta^t \left( \frac{C_t + hU_t}{1 - \gamma} \right)^{1-\gamma} \right] \tag{1}
\]

subject to the budget constraint

\[
P_tC_t + P_tI_t + B_{t+1} + B_{MU,t+1} + P_t AC_t \\
= R_tB_t + R_{MU,t}B_{MU_t} + Div_t + (1 - \tau^W_t)(\chi_t U_t + W_t N_t) + (1 - \tau^K_t)R_{k,t}K_t + P_t\tau^K_t \delta K_t \tag{2}
\]

and subject to the capital accumulation constraint

\[
K_{t+1} = (1 - \delta)K_t + I_t \tag{3}
\]

In the utility function, \(\gamma\) denotes the degree of relative risk aversion.\(^4\) On the LHS of the budget constraint, \(P_t\) is the consumption price index, \(K_{t+1}\) the stock of physical capital at the end of period \(t\), \(\delta\) the depreciation rate. The last term \(AC_t = \frac{1}{2} \left( \frac{B_{MU,t+1}}{P_t} - \frac{B_{MU}}{P} \right)^2 \) denotes the portfolio adjustment costs paid on union-wide bonds, where \(B_{MU}\) is the steady-state level of foreign assets.\(^5\) On the RHS of the budget constraint, \(B_t\) is the amount of one-period government nominal bonds paying \(R_t\) between \(t - 1\) and \(t\). Identically, \(B_{MU,t}\) is the amount of union-wide bonds paying \(R_{MU,t}\) between \(t - 1\) and \(t\). \(Div_t\) is the profit of the monopolistic firms indexed in \(\omega\) with \(Div_t = \frac{1}{n} \int_0^n Div_t(\omega)\), \(W_t\) is the pre-tax nominal wage received by workers, \(\tau^W_t\) is the tax rate on labor income, and \(\chi_t\) is the UI benefit. Finally, \(R_{k,t}\) the pre-tax rate of return on capital,
\( \tau_{t}^{K} \) is the capital income tax, that comes with a deduction on depreciated capital. First-order conditions imply:

\[
\beta E_t \left\{ \left( \frac{C_t + hU_t}{C_{t+1} + hU_{t+1}} \right)^{\gamma} \left[ 1 + (1 - \tau_{t+1}^{K}) \left( \frac{R_{k,t+1}}{P_{t+1}} - \delta \right) \right] \right\} = 1 \tag{4}
\]

\[
\beta E_t \left[ \frac{P_t (C_t + hU_t)^{\gamma}}{P_{t+1} (C_{t+1} + hU_{t+1})^{\gamma}} R_{t+1} \right] = 1 \tag{5}
\]

\[
\beta E_t \left[ \frac{P_t (C_t + hU_t)^{\gamma}}{P_{t+1} (C_{t+1} + hU_{t+1})^{\gamma}} \frac{R_{MU,t+1}}{\Gamma \left( \frac{B_{MU,t+1}}{R} - \frac{B_{MU}}{P} \right)} \right] = 1 \tag{6}
\]

where \( \pi = P_t/P_{t-1} \) is the CPI inflation rate. Per-capita consumption, investment and adjustment costs are defined as Armington bundles of home and foreign goods:

\[
\nu_t = \left[ \alpha^{1/\phi} (\nu_{H,t})^{\phi-1/\phi} + (1 - \alpha) \frac{1}{\phi} (\nu_{F,t})^{\phi-1/\phi} \right]^{\phi-1} \tag{7}
\]

for \( \nu = \{C, I, AC\} \). Variables \( \nu_H \) and \( \nu_F \) respectively stand for the quantities of Home and Foreign goods in the bundles, \( \phi \) is the trade elasticity and \( \alpha \in [0.5, 1] \) expresses the preference for Home goods.\(^6\) Per-capita quantities of Home and Foreign goods are defined by the following bundles of varieties:

\[
\nu_{H,t} = \left[ \left( \frac{1}{n} \right)^{1/\psi} \int_0^n \nu_{h,t}(\omega) \frac{1}{\psi} d\omega \right]^{\psi} \tag{8}
\]

\[
\nu_{F,t} = \left[ \left( \frac{1}{1-n} \right)^{1/\psi} \int_1^n \nu_{f,t}(\omega) \frac{1}{\psi} d\omega \right]^{\psi} \tag{9}
\]

where \( \nu_{h,t}(\omega) \) and \( \nu_{f,t}(\omega) \) denote differentiated varieties of Home and Foreign goods, and \( \psi \) is the elasticity of substitution among varieties. We assume that the law of one price holds. Since countries have a common currency, the Home consumption price index is:

\[
P_t = \left[ \alpha (P_{H,t})^{1-\phi} + (1 - \alpha) (P_{F,t})^{1-\phi} \right]^{1/\phi} \tag{10}
\]

where \( P_{H,t} \) and \( P_{F,t} \) are given by

\[
P_{H,t} = \left[ \left( \frac{1}{n} \right) \int_0^n (P_{h,t}(\omega))^{1-\psi} d\omega \right]^{1/(1-\psi)} \tag{11}
\]

\[
P_{F,t} = \left[ \left( \frac{1}{1-n} \right) \int_1^n (P_{f,t}(\omega))^{1-\psi} d\omega \right]^{1/\psi} \tag{12}
\]

\(^6\)Parameters \( \alpha \) and \( \alpha^* \) are defined according to the intra-EMU degree of openness of the monetary union \((1-\tilde{\alpha})\) in the following way \((1-\alpha) = (1-n)(1-\tilde{\alpha}) \) and \((1-\alpha^*) = n(1-\tilde{\alpha})\).
where $P_{h,t}(\omega)$ and $P_{f,t}(\omega)$ are respectively the price of Home and Foreign varieties. Optimization yields the following variety demands:

$$

\nu_{h,t}(\omega) = \frac{\alpha}{n} \left( \frac{P_{H,t}}{P_t} \right)^{-\phi} \left( \frac{P_{h,t}(\omega)}{P_{H,t}} \right)^{-\psi} (n \nu_t) \quad (13)

\nu_{h,t}^*(\omega) = \frac{1 - \alpha^a}{n} \left( \frac{P_{H,t}}{P_t^*} \right)^{-\phi} \left( \frac{P_{h,t}(\omega)}{P_{H,t}} \right)^{-\psi} (1 - n) \nu_t^* \quad (14)

\nu_{f,t}(\omega) = \frac{1 - \alpha}{1 - n} \left( \frac{P_{f,t}}{P_t} \right)^{-\phi} \left( \frac{P_{f,t}(\omega)}{P_{f,t}} \right)^{-\psi} (n \nu_t) \quad (15)

\nu_{f,t}^*(\omega) = \frac{\alpha^*}{1 - n} \left( \frac{P_{f,t}}{P_t^*} \right)^{-\phi} \left( \frac{P_{f,t}(\omega)}{P_{f,t}} \right)^{-\psi} (1 - n) \nu_t^* \quad (16)

2.2 Firms

In the Home country, a continuum of monopolistic firms indexed by $n$ combine labor and capital to produce varieties of the local good using the same Cobb-Douglas production function:

$$

Y_t(\omega) = A_t(N_t(\omega))^{1-\zeta}(K_t(\omega))^\zeta \quad (17)

$$

where $A_t$ is an exogenous productivity measure defined as $A_t = A^0_{t-1} \tilde{\eta}^{1-\eta} \epsilon_{a,t}$, where $\epsilon_{a,t}$ is an iid shock. Firms take into account the demands for local varieties expressed by individuals and governments when setting their prices $P_{h,t}(\omega)$. Their objective is to maximize the profits they rebate to households through dividends:

$$

E_a \sum_{s=t}^{\infty} Q_{t+s} \left[ \left( \frac{P_{h,t+s}(\omega)}{P_{H,t+s}} - \frac{\kappa_p}{2} \frac{P_{h,t+s}(\omega)}{P_{H,t+s} N_{t+s}(\omega)} - 1 \right)^2 \right] Y_{t+s}(\omega) - \frac{W_{t+s}}{P_{H,t+s}} N_{t+s}(\omega) - \frac{R_{h,t+s}}{P_{H,t+s}} K_{t+s}(\omega) - \kappa V_t(\omega)

= E_a \sum_{s=t}^{\infty} Q_{t+s} \left[ \left( \frac{P_{h,t+s}(\omega)}{P_{H,t+s}} - MC_{t+s} - \frac{\kappa_p}{2} \frac{P_{h,t+s}(\omega)}{P_{H,t+s} N_{t+s}(\omega)} - 1 \right)^2 \right] Y_{t+s}(\omega) - \kappa V_t(\omega) \quad (18)

$$

where we have defined $MC_t = \frac{W_t}{P_{H,t}} N_t(\omega) + \frac{R_{h,t+1}}{P_{H,t}} K_t(\omega)$ as the real marginal cost – common to all firms, and $Q_{t+s} = \beta \left( \frac{c_{t+s} + h_{t+s}}{c_{t+s}} \right)$ as the stochastic discount factor. In addition, $V_t(\omega)$ is the number of vacancies, $\kappa$ the cost of a vacancy, and $\kappa_p > 0$ a measure of price stickiness. Using the first formulation of dividends allows to derive the first-order condition on the stock of capital:

$$

\zeta MC_t Y_t(\omega) = \frac{R_{h,t}}{P_{H,t}} K_t(\omega) \quad (19)

$$

This condition, combined with the marginal value of a job filled (to be detailed below), determines the real marginal cost $MC_t$. Further, the optimal choice of $P_{h,t}(\omega)$ maximizes the expected stream of dividends subject to

\( ^7 \text{A similar expression holds for the Foreign firm.} \)
\[
\left[1 - \frac{\kappa_p}{2} \left( \frac{P_{h,t}(\omega)}{P_{h,t-1}(\omega)} - 1 \right) \right]^2 Y_t(\omega) = \left( \frac{P_{h,t}(\omega)}{P_{H,t}} \right)^{-\psi} \left[ \alpha \left( \frac{P_{H,t}}{P_t} \right)^{-\phi} (C_t + I_t + AC_t) \right.
\]
\[
+ \frac{1 - n}{n} (1 - \alpha^*) \left( \frac{P_{H,t}}{P^*_t} \right)^{-\phi} (C^*_t + I^*_t + AC^*_t) + G_t + \kappa V_t \right]
\]

where \( V_t = \frac{1}{n} \int_0^n V_t(\omega) d\omega \) is the per-capita number of vacancies. As every firm sets the same new price in equilibrium, we have \( P_{h,t}(\omega) = P_{H,t} \). This allows us to obtain the following New Keynesian Phillips curve, that determines the evolution of the producer price index inflation \( \pi_{H,t} \):

\[
(1 - \psi) + \psi MC_t + E_t Q_t \kappa_p (\pi_{H,t+1} - 1) \pi_{H,t+1} Y_{t+1} / Y_t = \kappa_p (\pi_{H,t} - 1) \pi_{H,t}
\]

2.2.1 The labor market

The labor market is subject to search and matching frictions. Households are divided between employed and unemployed. I consider that labor is immobile and that matches become productive at the end of the current period. We have the following relation tying employment with matches:

\[
N_t = (1 - \rho) N_{t-1} + M_t
\]

where \( N_t = \frac{1}{n} \int_0^n N_t(\omega) d\omega \) is the end-of-period employment, \( \rho \) is the separation rate, \( M_t \) is the number of matches formed during period \( t \). New matches are formed according to a standard Cobb-Douglas matching function:

\[
M_t = m \theta_t^{1 - \mu} U_t^\mu
\]

where \( m \) captures the efficiency of the matching process, and \( \mu \in [0,1] \) is the match elasticity. Defining \( \theta = V_t / U_t \) as labor market tightness, the hiring rate, defined as the ratio of total new hires to the number of vacancies is:

\[
q(\theta_t) \equiv \frac{M_t}{V_t} = m \theta_t^{-\mu}
\]

and the job-finding rate, defined as the ratio of total new hires to the number of unemployed individuals, is:

\[
p(\theta_t) \equiv \frac{M_t}{U_t} = m \theta_t^{1-\mu}
\]

The value of a filled job \( J_t \) is derived from the first-order derivative of Equation (18) with respect to \( N_t(\omega) \), and using price symmetry among firms:

\[
J_t = MC_t (1 - \zeta) \frac{Y_t}{N_t} - \frac{W_t}{P_{H,t}} + E_t Q_t \left[ (1 - \rho) J_{t+1} + \rho Y_{t+1} \right]
\]
This value corresponds to the marginal profit \( MC_t(1 - \zeta)\frac{Y_t}{N_t} - \frac{W_t}{P_{H,t}} \) that the firm derives from a filled job at period \( t \) plus the continuation value. The value of a vacancy \( V \) is defined as

\[
V_t = -\kappa_t + E_t Q_t \left[ q(\theta_t) J_{t+1} + [1 - q(\theta_t)] V_{t+1} \right]
\]

with \( \kappa \) the vacancy posting cost. In equilibrium, we assume free entry which implies \( V_t = 0 \). Therefore, we can rewrite the former equations as:

\[
J_t = MC_t(1 - \zeta)\frac{Y_t}{N_t} - \frac{W_t}{P_{H,t}} + E_t Q_t \left[ (1 - \rho) J_{t+1} \right]
\]

(27)

\[
\kappa_t = E_t Q_t \left[ q(\theta_t) J_{t+1} \right]
\]

(28)

Family members contribute marginally to the family surplus differently whether they are employed (\( W \)) or unemployed (\( U \)):

\[
W_t = (1 - \tau_t W) \frac{W_t}{P_{H,t}} + E_t Q_t \left[ (1 - \rho) W_{t+1} + \rho U_{t+1} \right]
\]

(29)

\[
U_t = (1 - \tau_t W) \frac{\chi_t}{P_{H,t}} + h + E_t Q_t \left[ p(\theta_t) U_{t+1} + [1 - p(\theta_t)] U_{t+1} \right]
\]

(30)

As it is common in the literature, the real wage is determined through a Nash-bargaining solution involving the maximization of total surplus. The latter is a geometric average of the net contribution of households and the contribution of firms, weighted by their relative bargaining power \( \sigma \in [0; 1] \):

\[
W_t = \frac{arg \max (W_t - U_t)\sigma (J_t - V_t)^{1-\sigma}}{P_{H,t}}
\]

(31)

The solution implies:

\[
\sigma (1 - \tau_t W) J_t = (1 - \sigma) (W_t - U_t)
\]

(32)

After simplifications, we obtain the determination of the real wage:

\[
\frac{W_t}{P_{H,t}} = \sigma \left( MC_t(1 - \zeta)\frac{Y_t}{N_t} + \theta_t \kappa \right) + (1 - \sigma) \left( \frac{\chi_t}{P_{H,t}} + \frac{h_t}{1 - \tau_t W} \right)
\]

(33)

As usual, the real wage settles somewhere between the marginal productivity of labor plus the rent of a position filled – the upper bound – and the outside option for workers – the lower bound – that depends on UI benefits and the home production term.

### 2.3 Governments

Government expenditure and UI benefits are funded through taxes on capital and labor, as well as public debt. The Home government consumes only local goods and government bond markets are fully segmented, i.e. purchased nationally. Therefore, the government has the following budget
constraint, expressed in real terms:

\[
G_t + (1 - \tau_W) \frac{\chi_t}{P_{H,t}} U_t + \frac{B_t}{P_{H,t}} \left( \left\{ \frac{R_{k,t}}{P_{H,t}} - \frac{P_t}{P_{H,t}} \delta \right\} K_t \tau_W^K + \frac{W_t}{P_{H,t}} N_t \tau_W + Q_{t+1} \frac{B_{t+1}}{P_{H,t}} \right)
\]

(34)

where \( G_t \) is government expenditure.\(^8\) As the government issues nominal debt, it needs a feedback rule in order to produce stationary dynamics. I assume that government spending follow a simple feedback rule:

\[
G_t = s_g Y - \phi^b (B_t - \bar{B})
\]

(35)

where \( s_g \) is the steady-state share of government spending in GDP, \( \phi^b \) determines the speed of debt stabilization, and \( \bar{B} \) is the steady-state level of debts.

### 2.4 Central Bank

We define the union-wide inflation rate as a geometric weighted average of national inflation rates:

\[
\pi^{MU}_t = \pi^i (\pi^i)^{1-n}
\]

(36)

The Central Bank has control over the nominal interest rate of the union-wide bond \( R^{MU} \). It is set according to the following Taylor-type rule, close to the actual European Central Bank objectives:

\[
\log \left( \frac{R^{MU,t}}{R^{MU}} \right) = \rho_i \log \left( \frac{R^{MU,t-1}}{R^{MU}} \right) + \phi_i \log (\pi^{MU}_t) + \epsilon_{i,t}
\]

(37)

where \( \rho_i \) expresses the persistence of the interest rate, \( \phi_i > 1 \) and \( \epsilon_{i,t} \) is an iid monetary shock.

### 2.5 Equilibrium

To close the model, we can start from the variety demand equation (20) and its foreign counterpart, and aggregate over varieties to get:

\[
(1 - \frac{\kappa_p}{2} (\pi_{H,t} - 1)^2) Y_t = \alpha \left( \frac{P_{H,t}}{P_t} \right)^{-\phi} (C_t + I_t + AC_t) + \frac{1}{n} \frac{n}{(1 - \alpha^*)} \left( \frac{P_{H,t}}{P_t} \right)^{-\phi} (C^*_t + I^*_t + AC^*_t) + G_t + \kappa V_t
\]

(38)

\[
(1 - \frac{\kappa_p}{2} (\pi_{F,t} - 1)^2) Y^*_t = \alpha^* \left( \frac{P_{F,t}}{P^*_t} \right)^{-\phi} (C^*_t + I^*_t + AC^*_t) + \frac{n}{1 - n} \frac{1}{(1 - \alpha)} \left( \frac{P_{F,t}}{P^*_t} \right)^{-\phi} (C + I + AC_t) + G^*_t + \kappa^* V^*_t
\]

(39)

\(^8\)The latter are defined as:

\[
G_t = \left[ \left( \frac{1}{n} \right)^{\frac{1}{\psi}} \int_0^n (G_t(\omega))^{\frac{\psi-1}{\psi}} d\omega \right]^{\frac{\psi}{\psi-1}}
\]

The corresponding variety demands are therefore

\[
G_t(\omega) = \frac{1}{n} \left( \frac{P_{H,t}(\omega)}{P_{H,t}} \right)^{-\psi} G_t
\]
The clearing condition on the union-wide bond market is

$$n \frac{B_{MU,t}}{P_t} + RER_t (1 - n) \frac{B^*_{MU,t}}{P^*_t} = 0 \quad (40)$$

where $RER_t$ is the real exchange rate defined as $RER_t = P^*_t / P_t$. Finally, aggregating all budget constraints yields the dynamics of foreign assets of the domestic economy:

$$\frac{B_{MU,t+1}}{P_t} - R_{MU,t} \frac{B_{MU,t}}{P_t} = \frac{P_{H,t}}{P_t} \left[ \left( 1 - \frac{\kappa_p}{2} (\pi_{H,t} - 1)^2 \right) Y_t - G_t - \kappa_t V_t \right] - C_t - I_t - AC_t \quad (41)$$

Finally, for future reference, I define the terms of trade as:

$$T_t = \frac{P_{F,t}}{P_{H,t}} \quad (42)$$

3 Calibration, solution, and business cycle moments

**Size and productivity.** The calibration is meant for the home country to be the core of the Eurozone (Germany, France, the Netherlands, Belgium, Austria and Finland) and for the foreign country to resemble the main countries of the periphery (Italy, Spain, Portugal, Ireland and Greece). The size of each country represents the labor force of each region of the Euro Area: $n = 0.61$. I also impose that the core country is more productive, that is $\bar{A} = 1.12$ and $\bar{A}^* = 1$.

**Preferences, trade and openness.** The period is a quarter, as our business cycle matching exercise will use quarterly data. Hence, $\beta$ is calibrated to 0.99, which implies an annualized steady-state nominal interest rate of 4%. I have assumed that inflation rates have no trends, therefore $\bar{\pi} = \bar{\pi}^* = \bar{\pi}_H = \bar{\pi}_F = \bar{\pi}^{MU} = 1$. Further, the value of $\bar{T}$ is undetermined in the steady state. I choose $\bar{T} = 1.15$, that is, above the relative productivity, to capture the fact that the core country has a lower production price level due to the relatively more flexible labor market. Risk aversion $\gamma$ is set at 2.5 as in Beetsma and Jensen (2005). I choose the same value as in Schmitt-Grohé and Uribe (2003) concerning portfolio intermediation cost: $\Gamma = 0.0007$ to imply an annual interest rate premium of 3%. Based on intra-EMU trade openness data, the intra-EMU import share is $(1 - \tilde{\alpha}) = 15\%$. It implies $\alpha = 0.9415$ and $\alpha^* = 0.9085$. The value of the trade elasticity remains debated in the literature, with very different values used in the DSGE literature and the literature on international trade. I choose a low value of $\phi = 2$ as in Backus, Kehoe and Kydland (1993).

**Production.** The depreciation rate of capital is $\delta = 0.025$ to match a 10% yearly depreciation. The capital share is set to $\zeta = 0.36$. The elasticity of substitution between varieties $\psi$ is set to 6 as in Brückner and Pappa (2011) in order to have a gross steady state markup of 20%. I choose $\kappa_p = 50$ which is plausible value considering the price markup as indicated in Ireland (2001), Keen and Wang (2007), or Born and Pfeifer (2016) among others.
**Labor market.** As in Mayer, Moyen and Stähler (2010), I set the elasticity of the matching function to $\mu = 0.5$. The bargaining power of workers $\sigma$ is set to 0.4 to better match second-order moments of the unemployment rate. I calibrate the vacancy costs to represent roughly 5% of the real wage, slightly higher than the values proposed by Hagedorn and Manovskii (2008) for the United States. I get $\kappa = 0.0979$ and $\kappa^* = 0.0825$. Then the value of home production is set to be consistent with the previous values: $h = 0.4143$ and $h^* = 0.4159$ (i.e. for the net replacement rates to match their targeted values given the vacancy cost). I calculate the separation rates using the data from Hobijn and Sahin (2007). I obtain $\rho = 0.032$ and $\rho^* = 0.036$. Then, I set up the steady-state values of the job-finding rates in order to get specific steady-state values of the unemployment rate. I set it equal to the average unemployment rate value weighted by the labor force in both areas of the Eurozone between the first quarter of 1995 and the last quarter of 2016. Those values are $\bar{U} = 7.89\%$ and $\bar{U}^* = 12.20\%$. To get them, I choose $\bar{\rho} = 0.379$ and $\bar{\rho}^* = 0.259$. Finally, I set up the steady-state hiring rates $\bar{q} = 0.7$ as in Christoffel, Kuester and Linzert (2009).

**Policy.** Using European data, the share of government consumption in GDP is $s_g$ to 0.19 and $s_g^*$ to 0.17. Moreover, $\phi^b$ is set to 0.1, which means that more than half of the deviation of debt to its steady-state value is closed in roughly two years. I follow Mayer, Moyen and Stähler (2010) for the monetary rule by setting the persistence at $\rho_i = 0.85$ and the response to inflation at $\phi_i = 2$. The steady-state tax rates on capital income are computed from Trabandt and Uhlig (2013). I use country-level tax rates to calculate GDP-weighted average rate tax rates for each zone. It obtain $\tau^K = 0.335$ and $\tau^*K = 0.351$. Proceeding similarly with the data of Esser et al. (2013), I find average net UI benefit replacement rates of $\chi_{W} = 64.13\%$ and $\chi_{W*}^* = 59.74\%$. Finally, I adjust the tax rates on labor income to obtain a steady-state debt-to-GDP ratio of 66% in country H and 83% in country F. These levels correspond to $\tau^W = 0.37$ and $\tau^*W = 0.36$.

**Shocks.** I set the persistence of productivity shocks at $\eta = \eta^* = 0.9$ and their volatility at $std(\epsilon_{a,t}) = std(\epsilon_{a,t}^*) = 0.8\%$ where the cross-country correlation of shocks is 0.7. The volatility of the monetary policy shock is adjusted to $std(\epsilon_i) = 0.25\%$ to match the average volatility of GDP in the area. Table 1 below summarizes my parameter values.

**Solution and second-order moments.** The model is solved using second-order perturbation methods. I first compare the implied second-order moments of important variables with those of the data to gauge the quality of the model. Empirical second-order moments were obtained using the OECD database. I use quarterly data from 1995Q1 to 2016Q4 for GDP, private consumption and investment, building GDP-weighted averages for each zone. Unemployment rate are labor force weighted average rates. The moments are computed on HP-filtered series taken in logs with a smoothing parameter of 1600.

---

9I use the Dynare setup (Adjemian et al., 2011) with pruning.
Table 1: Calibration for the baseline model

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Symbol</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount factor</td>
<td>$\beta$</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>Degree of risk aversion</td>
<td>$\gamma$</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Depreciation rate of capital</td>
<td>$\delta$</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>Portfolio intermediation costs</td>
<td>$\Gamma$</td>
<td>0.0007</td>
<td></td>
</tr>
<tr>
<td>Elasticity of substitution between varieties</td>
<td>$\psi$</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Trade elasticity</td>
<td>$\phi$</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Parameter of the production function</td>
<td>$\zeta$</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Persistence of the productivity shocks</td>
<td>$\eta$</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>Rotemberg cost parameter</td>
<td>$\kappa_p$</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Country size</td>
<td>$n$</td>
<td>0.61</td>
<td>0.39</td>
</tr>
<tr>
<td>Home bias</td>
<td>$\alpha$</td>
<td>0.9415</td>
<td>0.9085</td>
</tr>
<tr>
<td>Tax rate on capital</td>
<td>$\tau^K$</td>
<td>0.335</td>
<td>0.351</td>
</tr>
<tr>
<td>Tax rate on labor</td>
<td>$\tau^W$</td>
<td>0.37</td>
<td>0.36</td>
</tr>
<tr>
<td>Share of government consumption</td>
<td>$\upsilon$</td>
<td>0.19</td>
<td>0.17</td>
</tr>
<tr>
<td>Separation rate</td>
<td>$\rho$</td>
<td>0.032</td>
<td>0.036</td>
</tr>
<tr>
<td>Vacancy cost</td>
<td>$\kappa$</td>
<td>0.0979</td>
<td>0.0825</td>
</tr>
<tr>
<td>Value of home production</td>
<td>$h$</td>
<td>0.4143</td>
<td>0.4159</td>
</tr>
<tr>
<td>Match elasticity</td>
<td>$\mu$</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Bargaining power of workers</td>
<td>$\sigma$</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Persistence of the interest rate</td>
<td>$\rho_i$</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Parameter associated with $\pi^{MU}$</td>
<td>$\phi_i$</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Policy parameter</td>
<td>$\phi_b$</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labor market variables</th>
<th>Symbol</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady-state unemployment rate</td>
<td>$U$</td>
<td>0.0779</td>
<td>0.1220</td>
</tr>
<tr>
<td>Unemployment benefit replacement rate</td>
<td>$\chi^U$</td>
<td>0.6413</td>
<td>0.5974</td>
</tr>
<tr>
<td>Steady-state job-finding rate</td>
<td>$\bar{p}(\theta)$</td>
<td>0.379</td>
<td>0.259</td>
</tr>
<tr>
<td>Steady-state job-filling rate</td>
<td>$\bar{q}(\theta)$</td>
<td>0.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows that the moments of the model match fairly well those of the data. Although the volatility of consumption is lower in the model, relative standard deviations are well reproduced. Consumption and investment are strongly pro-cyclical both in the model and the data while unemployment is strongly countercyclical. Cross-country correlations are around 0.7 for all variables in the data and in the model, although most of this cross-country correlation stems from the cross-country correlation of shocks. Finally, the large persistence observed in the data is relatively well replicated by the model, especially for private consumption and unemployment. Appendix A presents the Impulse Response Functions produced after technology shocks and provides more details on the transmission mechanisms that generate those second-order moments. Overall the model reproduces most features of the European business cycle and is therefore a reliable representation of the European economy.
Table 2: Comparison of the second moments of specific variables in the model and the data

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\sigma_Z/\sigma_Y$</th>
<th>$\text{Corr}(Z; Y)$</th>
<th>$\text{Corr}(Z_t; Z_{t-1})$</th>
<th>$\text{Corr}(Z; Z^*)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model</td>
<td>Data</td>
<td>Model</td>
<td>Data</td>
</tr>
<tr>
<td>$Y$</td>
<td>-</td>
<td>-</td>
<td>0.78 (0.90)</td>
<td>0.71 (0.76)</td>
</tr>
<tr>
<td>$Y^*$</td>
<td>-</td>
<td>-</td>
<td>0.80 (0.92)</td>
<td>0.7 (0.73)</td>
</tr>
<tr>
<td>$C$</td>
<td>0.34 (0.60)</td>
<td>0.98 (0.88)</td>
<td>0.81 (0.86)</td>
<td>0.7 (0.73)</td>
</tr>
<tr>
<td>$C^*$</td>
<td>0.37 (0.92)</td>
<td>0.99 (0.93)</td>
<td>0.82 (0.90)</td>
<td>0.7 (0.73)</td>
</tr>
<tr>
<td>$I$</td>
<td>4.19 (2.45)</td>
<td>0.98 (0.90)</td>
<td>0.76 (0.91)</td>
<td>0.62 (0.69)</td>
</tr>
<tr>
<td>$I^*$</td>
<td>4.28 (2.80)</td>
<td>0.97 (0.91)</td>
<td>0.81 (0.87)</td>
<td>0.62 (0.69)</td>
</tr>
<tr>
<td>$U$</td>
<td>6.10 (4.48)</td>
<td>-0.91 (-0.71)</td>
<td>0.91 (0.94)</td>
<td>0.73 (0.64)</td>
</tr>
<tr>
<td>$U^*$</td>
<td>4.69 (5.07)</td>
<td>-0.92 (-0.89)</td>
<td>0.92 (0.95)</td>
<td>0.73 (0.64)</td>
</tr>
</tbody>
</table>

4 Labor markets convergence in the Euro Area

My ultimate objective in this section is to investigate the steady-state and business cycle implications of labor market convergence within the Euro Area. Labor market convergence is achieved by smoothly adjusting the separation rate and the job-finding rate in each country to either the level of the most flexible country (country H), or to the average level within the Eurozone. This calibration involves a common unemployment rate. The home production calibration is also modified to imply a convergence in unemployment benefit replacement rates. Finally, convergence in labor markets also requires a steady-state adjustment of the terms of trade toward the value of relative productivities.

First, I contrast the business cycle implications of the two convergence experiments. More precisely I compute the welfare losses from business cycles around the initial and final steady-state. Second, I also look at the structural welfare effects, comparing welfare in each steady state. Both analyses suggest that the welfare gains from labor market convergence are potentially important. However, this is merely an illusion of the steady-state to steady-state comparison. Indeed, when I compute the welfare gains on the full transition path, I show that the short-run welfare losses overturn the long-run welfare gains in most situations, suggesting that the pain to actually achieve labor market convergence is quite substantial.

4.1 Steady-state to steady-state analysis

I calibrate the model so that labor markets are identical in both countries to conduct a welfare comparison with the baseline calibration. I investigate two steady-state calibrations: one where labor market parameters that differ in the baseline calibration (separation rate and job-finding rate) converge towards their average values and one where those parameters converge to the value of the most flexible country. I refer to the first case as the convergence to the average level or CAL, and refer to the second case as the convergence to the flexible level or CFL.

Each case is compared to the baseline steady state both in terms of the welfare losses from fluctuat-
ations they imply (stabilization welfare gains/losses), and in terms of expected utility (structural welfare gains/losses). I look at aggregate and country-level welfare gains/losses. More precisely, let

\[ \Omega_t^{MU} = n \frac{(C_t + hU_t)^{1-\gamma}}{1 - \gamma} + (1 - n) \frac{(C_t^* + h^*U_t^*)^{1-\gamma}}{1 - \gamma} + \beta \Omega_{t+1} \]

\[ \Omega_t = \frac{(C_t + hU_t)^{1-\gamma}}{1 - \gamma} + \beta \Omega_{t+1} \]

\[ \Omega_t^* = \frac{(C_t^* + h^*U_t^*)^{1-\gamma}}{1 - \gamma} + \beta \Omega_{t+1}^* \]

respectively denote the aggregate, Home and Foreign welfare measures. Our two types of welfare gains/losses, structural and stabilization, are respectively defined as:

\[ \Delta_{i,Str} = \frac{E_t(\Omega_C^i) - E_t(\Omega_B^i)}{E_t(C_B^i)} \]

\[ \Delta_{i,Sta} = \frac{E_t(\Omega_C^i) - \bar{\Omega}_C^i - (E_t(\Omega_B^i) - \bar{\Omega}_B)}{E_t(C_B^i)} \]

for \( i = MU, H, F \), where \( C^{MU} = nE_t(C) + (1 - n)E_t(C^*) \). The subscripts \( C \) and \( B \) respectively stand for convergence calibration (\( C \)) and baseline calibration (\( B \)). Structural welfare gains mean a higher expected utility. Stabilization welfare gains indicate lower second-order fluctuations at the business cycle frequency. In this case, the expected average welfare becomes closer to its steady-state level. For stabilization gains, I also compare the baseline model to a model with complete financial markets. This will give a sense of how large the stabilization gains from integrating labor markets compared to the stabilization gains from completing asset markets.\(^\text{10}\) The results are reported in Table 3 below.

As indicated in Table 3, a convergence of the labor markets brings structural welfare gains for the monetary union as a whole and for the periphery under both configuration (CAL and CFL). The core of the monetary union only gains welfare when the convergence of the labor markets is made at the more flexible level (CFL case). It loses welfare in CAL because its labor market becomes less flexible, producing a higher level of unemployment compared to the initial steady state. Overall, CFL brings higher welfare gains because the unemployment rate is lower at the level of the monetary union, which implies higher per-capita consumption and thus higher GDP in both countries as specified in Table 4. The core takes advantage of the increased demand for their

\(^{10}\) For instance, Mundell (1973) argued that complete asset markets could provide enough insurance to economies that belong to a monetary union for other dimensions (as labor market integration or perfect labor mobility) to be disregarded as criteria of optimal currency areas. With complete financial markets, the value of the terms of trade is no longer indeterminate. It is actually pinned down by a risk-sharing condition that derives from the existence of a complete menu of Arrow-Debreu securities allowing households in each country to exactly equate their shadow values of consumption. Therefore, comparison is made with a different steady state.
Table 3: Welfare analysis

<table>
<thead>
<tr>
<th>Structural welfare gains</th>
<th>Monetary Union</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL</td>
<td>0.0413</td>
<td>-0.1639</td>
<td>0.4058</td>
</tr>
<tr>
<td>CFL</td>
<td>0.3090</td>
<td>0.0782</td>
<td>0.7191</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stabilization welfare gains</th>
<th>Monetary Union</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL</td>
<td>0.0087</td>
<td>-0.0307</td>
<td>0.0788</td>
</tr>
<tr>
<td>CFL</td>
<td>0.0477</td>
<td>0.0057</td>
<td>0.1223</td>
</tr>
<tr>
<td>Complete markets</td>
<td>0.0043</td>
<td>-0.0123</td>
<td>0.0340</td>
</tr>
</tbody>
</table>

Results are expressed in percentage of the permanent consumption in the baseline calibration.

Table 4: Steady state levels of key variables

<table>
<thead>
<tr>
<th>Output</th>
<th>Monetary Union</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>3.1346</td>
<td>3.3955</td>
<td>2.7265</td>
</tr>
<tr>
<td>CAL</td>
<td>3.1333</td>
<td>3.3398</td>
<td>2.8103</td>
</tr>
<tr>
<td>CFL</td>
<td>3.1880</td>
<td>3.3981</td>
<td>2.8594</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Monetary Union</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>1.9702</td>
<td>2.0592</td>
<td>1.8309</td>
</tr>
<tr>
<td>CAL</td>
<td>1.97105</td>
<td>2.0329</td>
<td>1.8744</td>
</tr>
<tr>
<td>CFL</td>
<td>2.0057</td>
<td>2.0686</td>
<td>1.9073</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unemployment rate</th>
<th>Monetary Union</th>
<th>Core</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>9.5087</td>
<td>7.7859</td>
<td>12.2034</td>
</tr>
<tr>
<td>CAL</td>
<td>9.3664</td>
<td>9.3664</td>
<td>9.3664</td>
</tr>
<tr>
<td>CFL</td>
<td>7.7859</td>
<td>7.7859</td>
<td>7.7859</td>
</tr>
</tbody>
</table>

Results are expressed in per-capita. Unemployment rates are indicated in percentages.

varieties of goods coming from the periphery. This way, their consumption and their output is higher in the flexible case although their unemployment rate is the same as initially. Furthermore, even if both countries possess homogeneous labor markets, the core has per-capita consumption and output higher than the periphery because of their difference in their productivity levels.

Now focusing on stabilization gains, a similar pattern emerges: large aggregate gains and positive welfare effects for both countries under CLF, small aggregate gains and losses for the core under CAL. As pinpointed by the Impulse Response Functions in Appendix A, the volatility of unemployment is lower when the unemployment rate is lower. Indeed, in this case, labor market tightness ($\theta_t$) is higher, which means that unemployment movements are lower. The per-capita consumption depends directly on the relative number of employed individuals (paid the country’s wage) to unemployed individuals (earning the country’s UI benefit). Therefore the volatility of
consumption – and of welfare – is the lowest when the unemployment volatility is the lowest, i.e. in the flexible case.

Finally, a model with complete financial markets features stabilization gains. Their size is comparable to those found in the literature (See Auray and Eyquem (2014) or Benigno (2009)), around 0.0043% of permanent consumption. Those gains are higher than in the CAL case but lower than for a CFL. Thus, those results seem to indicate that a convergence of labor markets can potentially lead to a large increase of the level of welfare, but only if convergence to the level of the most flexible country is achieved. Convergence to the average level of labor market flexibility generates very small gains, and even brings losses for the core country.

The above analysis shows that there are potential gains from convergence in labor markets within a monetary union. An important limitation is that those welfare numbers are computed in a static way, comparing steady state to steady state. However, if a reform aiming at achieving convergence on European labor markets was implemented, the latter would not lead to jump directly to the new steady state. It would most certainly be a slow moving reform with a long transition period, that would progressively make labor market’s variables converge. Along this transition, it is possible that the reform generates negative effects on consumption and/or other variables. So, even if convergence brings theoretical welfare gains when comparing steady states, the transition process is essential in assessing its desirability from the perspective of welfare.

### 4.1.1 Transitional analysis

To determine the consequences of a transition in terms of welfare, I calculate the Hicksian-equivalent consumption change implied by the transition process. The latter measures the percentage of permanent consumption that families would have to lose – or gain – to be indifferent between the situation where labor markets are heterogeneous and the one where a legislation modifies labor markets until they become homogeneous in the whole Euro Area:

\[
E_0 \sum_{t=0}^{T} \beta^t \left[ u \left( (1 - \xi) C^f_t \right) \right] = \sum_{t=0}^{T} \beta^t \left[ u(C_0) \right]
\]  

(43)

In this experiment, I use a perfect-foresight non-linear solution of the model.\(^{11}\) The UI benefit switches from its baseline level to the desired convergence level and converges according to the following process:

\[
\Lambda_t = (1 - \rho_\Lambda) Z_t + \rho_\Lambda \Lambda_{t-1}
\]  

(44)

\[
\log(\chi_t) = \Lambda_t \log(\bar{\chi}_I) + (1 - \Lambda_t) \log(\bar{\chi}_F)
\]  

(45)

\(^{11}\)The algorithm is taken from Dynare and based on a Newton-type algorithm that solves a set of non-linear equations at each period using the special structure of the Jacobian matrix. See Juillard (1996) for details about the algorithm.
where $\bar{\chi}_I$ and $\bar{\chi}_F$ are respectively the initial and final steady-state levels of the UI benefit. In period 0, $Z_t$ switches from 1 to 0, which triggers a convergence process in UI benefits. Its speed is governed by $\rho_\Lambda$, the persistence of $\Lambda_t$.

Tables 4 and 5 show that the periphery and the monetary union as a whole lose in terms of welfare in every situation except when for a convergence to the flexible level and a really high persistence $\rho_\Lambda$. This is caused by the strong transition costs that the periphery bears before benefiting from having a flexible labor market. The transition is implemented through a progressive change of the net UI benefit replacement rate. With the homogenization of labor markets, the net UI benefit replacement rate increases in the periphery (from 59.14% to 61.93% in CAL and to 64.13% in CFL). This change has a negative short-run effect on unemployment, that dominates the long-term gains from the homogenization and more labor-market flexibility. Indeed, this relative increase of $\chi$ means that $\mathcal{W}$ rises too. This diminishes the workers surplus and therefore the number of matches, which raises the unemployment rate. As a consequence, consumption and welfare drop significantly in the short run. Only after a few years, the benefits of the labor-market reforms are felt. Due to the discount factor, the future welfare gains do not overturn the first periods’ losses, except for a very slow transition towards the most flexible level of convergence (if $\rho_\Lambda > 0.99$), in which case the negative short-run effects are attenuated.

The opposite mechanism takes place in the core in the case of CAL. As its net UI benefit replacement rate falls from 64.13% to 61.93%, $\mathcal{W}$ rises, which decreases the worker surplus. This leads to more matches and a lower unemployment rate in the short run. As a consequence, a transition towards the average level of convergence generates welfare gains for the core for more than ten years, whatever the speed of convergence. However, it experiences welfare losses from any transition in the long run. For CFL, the labor market of the core does not change. The slight welfare loss in the short run is simply due to the decrease of the demand for their varieties of goods coming from the periphery, as the latter experiences a temporary loss of income due to higher unemployment in the first periods of the transition.

The monetary union as a whole follows the pattern of the periphery, gaining welfare only in the convergence to the flexible labor market when the persistence is high. For CAL, short-term welfare losses in the periphery are indeed much higher than the short-run gains in core countries. Generally speaking, the quicker the transition, the larger the pain. Besides, losses are maximal four to five years after the beginning of the reform, which matches the length of most public office terms. Thus, it makes this type of reform potentially difficult to implement given that politicians carrying it out would experience large welfare losses at the end of their terms. A transition from heterogeneous to homogeneous labor markets would need to be made along with a fiscal policy that attenuates the short-run losses, especially for the peripheral countries, for them to have an interest in actually making the reform.
### Table 5: Welfare gains for a transition towards the average level of convergence

<table>
<thead>
<tr>
<th></th>
<th>ρ_Λ</th>
<th>1 year</th>
<th>4 years</th>
<th>10 years</th>
<th>25 years</th>
<th>100 years</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>0.99</td>
<td>-0.7084</td>
<td>-0.8382</td>
<td>-0.7681</td>
<td>-0.5960</td>
<td>-0.3989</td>
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<tr>
<td>0.9</td>
<td>-0.7656</td>
<td>-0.9091</td>
<td>-0.8636</td>
<td>-0.7157</td>
<td>-0.4753</td>
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<td>-0.9855</td>
<td>-0.9551</td>
<td>-0.8110</td>
<td>-0.5500</td>
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<td><strong>Core Countries</strong></td>
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<td></td>
</tr>
<tr>
<td>0.99</td>
<td>0.4709</td>
<td>0.4133</td>
<td>0.1092</td>
<td>-0.3091</td>
<td>-0.5607</td>
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<tr>
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<td>0.6477</td>
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<td>0.5148</td>
<td>0.1587</td>
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<td></td>
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</tr>
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<td>-0.9782</td>
<td>-0.1830</td>
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<tr>
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<td>-1.8182</td>
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</tr>
<tr>
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<td>-2.9357</td>
<td>-2.1201</td>
<td>-1.1223</td>
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</table>

Results are given in percentage of permanent consumption. A positive number indicates a gain from a convergence of labor markets.

### Table 6: Welfare gains for a transition towards the flexible level of convergence

<table>
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<th>ρ_Λ</th>
<th>1 year</th>
<th>4 years</th>
<th>10 years</th>
<th>25 years</th>
<th>100 years</th>
</tr>
</thead>
<tbody>
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<td>-2.3547</td>
<td>-1.8511</td>
<td>-0.9812</td>
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</tr>
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<td>-0.3946</td>
<td>-0.1894</td>
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<td><strong>Peripheral Countries</strong></td>
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<td></td>
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<tr>
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<td>-3.4516</td>
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<tr>
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<td>-5.3820</td>
<td>-4.9933</td>
<td>-3.8303</td>
<td>-2.0540</td>
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</table>

Results are given in percentage of permanent consumption. A positive number indicates a gain from a convergence of labor markets.
5 Conclusion

In this paper, I studied the consequences of labor markets convergence in the Euro Area. I used a DSGE model with two-countries in a monetary union with Rotemberg adjustment costs, trade in consumption and investment goods, and search and matching frictions on the labor market. Comparing steady-state outcomes, the results indicate that an homogeneous and more flexible labor market brings a higher utility at least to the Euro Area and the periphery. However, transiting from heterogeneous to homogeneous labor markets involves high short-term transition costs that are not compensated by the long-term gains in most configurations that were explored. Therefore, to be implemented, a convergence of the labor markets should come along with a fiscal policy aimed at sustaining consumption in the periphery in the first periods of the transition.

References


A Impulse responses

Responses to local technology shocks. Graph 3 depicts local responses of key variables to the positive technology shocks in the core (solid line) and in the periphery (dashed line). Notice that the cross-country correlation of shocks has been set to zero to disentangle the effects of a purely asymmetric shock. As usual in RBC models, the productivity shock raises wages and rental rates, but less than the rise in productivity, which makes marginal production costs fall. Firms can produce more with the same amount of inputs and expand production, raising the capital stock, vacancies and then hires. Local prices drop, therefore raising local and foreign demand for local varieties of goods, consistently with the increase in output. the family experiences a rise in its income through capital and labor, and uses it to smoothly rise its level of consumption. This consumption smoothing is achieved by raising investment in capital. Quantities rise more in the periphery: the high level of unemployment leads to a looser labor market in the periphery ($\theta^*_t < \theta_t$), which makes vacancies easier to fill and therefore amplifies movements in employment after productivity shocks. As a consequence, the response of most macroeconomic aggregates (consumption in particular) are also amplified. Finally, notice that the dynamics of real wages is quite different in both countries. this is also due to relative labor market tightness. As the latter is higher in the core country, larger movements in the real wage are needed to actually fill vacancies.

Responses to an external technology shock. Graph 4 presents the response of key variables to a technology shock hitting the other country of the Euro Area. In other words Graph 4 shows the international transmission of productivity shocks. Here too, the shock is a purely asymmetric shock. An external productivity shock raises the relative price of the production good, which lowers the purchasing power of households and raises the price of production factors. As such, it increases the marginal production cost, leading inflation to jump. This raises the real interest rate, undermining consumption and causing an increase of the cost of capital and in fine a fall in investment. As the latter decreases, the stock of capital diminishes, forcing firms to hire more workers to maintain production. Therefore employment, wages and vacancies increase. As wages and employment rise in both countries, the demand for goods in the country where the shock does not take place also increases during the first periods following the positive shock. As the effects of the shock fade, demand ends up falling. When the shock occurs in the periphery, the demand for the goods of the core even goes below the equilibrium level. Unemployment also exceeds its steady state level after roughly ten periods in the core due to this decrease in demand. In general, when the shock happens in the other country, the periphery responds more dynamically (higher consumption and output, lower decrease of investment and of the stock of capital). This is mainly due to the relative size of countries. Indeed, a higher number of firms benefit from the technology shock when it occurs in the core countries. Positive spillover effects to the periphery are thus higher.

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12 Results are given in percent deviation from the steady-state level.
Figure 3: Impulse response functions after a local technology shock

Figure 4: Impulse response functions after an external technology shock