On the Design of a European Unemployment Insurance Mechanism*

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Abstract

European labour markets are subject to idiosyncratic shocks (and idiosyncratic responses to common shocks), resulting in countercyclical unemployment expenses difficult to accommodate under existing, fiscal compact, budget rules. These and other factors (solidarity, labour market integration) provide a rationale for European unemployment risk sharing. We study the potential benefits, and problems, of creating a European Unemployment Insurance Mechanism (EUIM). Following Krusell et al. (2015), we use a dynamic general equilibrium model with search frictions to analyze workers' flows (employment, unemployment and inactivity) and their cyclical properties, in order to assess the potential benefits of an EUIM under alternative common (and jointly financed) unemployment insurance (UI) policies. Our analysis shows that country-specific structural differences play a determinant role in explaining labour market differences, leaving limited space for welfare improvements with an EUIM with current policies. However, in spite of the differences, the welfare-maximizing mix of unemployment benefits financed by payroll taxes

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is very similar among all countries that have been analysed: *all countries prefer having unlimited unemployment benefits and relatively similar replacement rates* (close to 30%). The resulting tax differences across countries may be the best statistic of their structural labour market differences, in terms of job creation and destruction, providing incentives for reform. The result also shows the direction in which a – commonly accepted – welfare improving EUIM could be designed, subject to redistributional and incentive (moral hazard & free riding) constraints.

1 Introduction

The recent financial and sovereign debt crises have affected the European labour markets asymmetrically both in terms of duration and severity of unemployment. In particular, stressed countries - such as Greece, Portugal and Spain - have experienced high levels of unemployment, making it very difficult, if not impossible, to provide adequate insurance for the unemployed and, at the same time, to satisfy the low-deficit (Fiscal Compact) commitments. This has raised interest in proposals for Europe-wide, or Euro-Area-wide, Unemployment Insurance schemes[1].

Given the asymmetries and lack of perfect coordination of real business cycles across European countries[2], a European Unemployment Insurance Mechanism (EUIM) can efficiently provide risk-sharing across national labour markets and, at the same time, reduce the countercyclical impact of unemployment expenditures on national budgets. Furthermore, it can provide three additional important benefits for the participant states. First, it can reduce the lasting recessionary effects which follow severe crisis, as it has happened in the euro crisis and recession; second, it can develop a much needed solidarity across national labour markets and, third, it can improve labour mobility and market integrations, since unemployment benefits,

[1] In this paper we abstract from specific legal and institutional requirements; we will therefore refer to a European Unemployment Insurance Mechanism (EUIM) in reference to any possible transnational scheme that addresses the type of diversities which are present in the EU.

[2] For an overview on business cycles in the Euro Area see, for example, Böwer and Catherine (2006), Giannone et al. (2009) and Saiki and Kim (2014).

and the corresponding active policies of surveillance, do not need to be tied to a specific location.

However, the same asymmetries show that implementing a European Unemployment Insurance scheme may not be easy - or politically feasible - if it implies large and 'persistent transfers' across countries. In fact, these 'persistent transfers' are a good indicator of pending structural reforms; therefore, it is not just an issue of redistribution, it can also be a moral hazard problem: 'persistent transfers' may further delay costly, but needed, reforms.

Therefore, to assess the need, viability and possible design of an EUIM one needs to take into account its potential effects. First, the direct effect on agents' decisions to remain in their current employment situation – that is, employed, unemployed or inactive – or to move to a different state[3]. This individual effect, in turn, aggregates into a new distribution of employment within a country, meaning that it not only affects its unemployment level and duration (the main targets of a UI policy), but also the labour allocation (a side effect). Second, if there are borrowing limits to finance unemployment insurance, an EUIM can help to smooth taxes, which, in turn, may affect agents' employment and savings decisions. Third, transfers that are very persistent, or permanent, need to be limited by the commonly accepted *ex-post* levels of transnational redistribution. Fourth, a EUIM may change national labour and unemployment policies for good (complementing the EUIM) or for bad (free riding). Fifth, all these effects can be very different in countries with different processes of job creation, destruction and matching: an EUIM may even exacerbate the differences between these countries. In other words, one needs to address these non-independent effects in order to answer a basic question: which unemployment risks need and should – and, if so, how they should – be shared across European countries?

This is a conceptual question that requires a quantitative answer. Unfortunately, with the exception of the works of Dolls et al. (2015) and Beblacỳ and Maselli (2014), there is very little quantitative evaluation of European Unemployment Insurance

[3]In this paper, we only consider movements, within these three states within countries, not migration movements, which may also be affected by changes in employment policies.

schemes. In particular, there is no modelling framework to analyse the key trade-offs of such schemes. In this paper we develop and calibrate – to European countries – a dynamic model to study these effects and provide a first set of policy experiments.

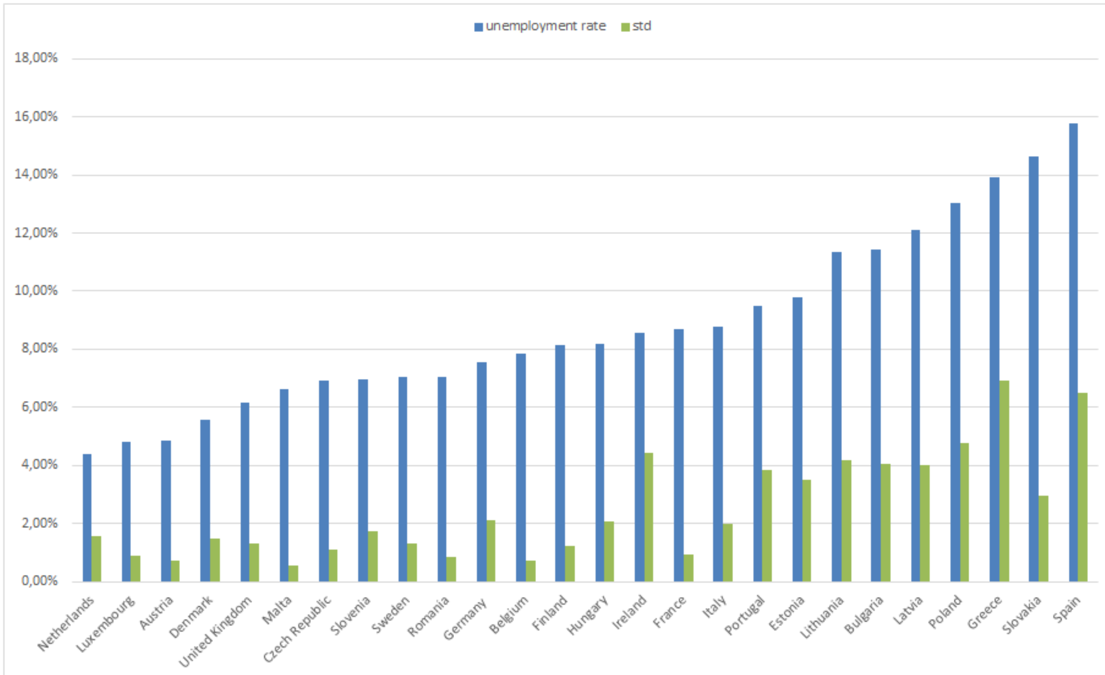

Figure 1: Average European Unemployment Rates: 2001-2014

Any model requires an adequate level of abstraction, in our case we need to effectively compare labour markets and unemployment policies of different countries. Regarding labour markets, Figure 1 ranks European countries using Eurostat data on average unemployment rates (and their variability) for different European countries (2001-2014). This is informative of the 'European labour market diversity' but it is too partial and crude an approximation to build a model just based on these statistics. Alternatively, a very detailed description of countries' labour markets and unemployment policies can be very informative but dilutes the main tradeoffs that should be at the core of a dynamic equilibrium model. Our approach is to study worker flows across the three states of employment, unemployment and inactivity. The corresponding transition matrices, and associated steady-state distributions, are the pictures that describe our different economies. For example, using Eurostat quarterly data on worker flows (2010Q2-2015Q4), Figure 2 shows similarities and differences in terms of 'persistency flows': Employment to Employment ("E to E", denoted E-E) versus Unemployment to Unemployment ("U to U", denoted U-U). With the exception of three countries (Spain, Portugal and Slovenia), these 'persistency flows' show a strong correlation among European labour markets, with more important differences on U-U. The corresponding ranking, across this E-E vs. U-U axis (of all but three countries), is not the same as the ranking of unemployment rates of Figure 1. In steady-state, the transition matrix of flows for a given country defines its stationary distribution of employment, and the corresponding Figures 1 and 2 are just two snapshots of European labour markets. Behind the scattered plots lie possible differences in preferences, technologies and market institutions, and labour policies. We will assume that across EU countries citizens share (almost) the same preferences and that labour mobility is relatively low across countries (we assume it is nil) but that EU countries still differ in the other aspects – mainly, market institutions and labour policies.

We build on the work of Krusell et al. (2011) and Krusell et al. (2015), who calibrate the U.S. three-states flows with a dynamic general equilibrium search-matching model, to analyse the diverse European labour markets. As in their calibration analysis, we generate worker-flows transition matrices and stationary distributions across the three states as the outcome of a stationary dynamic general equilibrium. This requires us to set a few parameters on preferences and technology, and calibrate others to match flows and stocks, consistently with observed time series and the existing unemployment policies of a country. More specifically, our model economies are characterised by three sets of parameters: (i) generic parameters of preferences and technologies common to all economies – agents' discount factors, idiosyncratic productivity shock, etc.; (ii) country-specific structural parameters of their economies - for example, the job-separation and job-finding rates, which in turn are a summary of different factors determining job creation, destruction and matching, and (iii) the country-specific unemployment insurance policies, summarized in two – plus one – parameters; the two are the replacement ratio (unemployment benefits to wages) and the duration of unemployment benefits; the third is the unemployment payroll

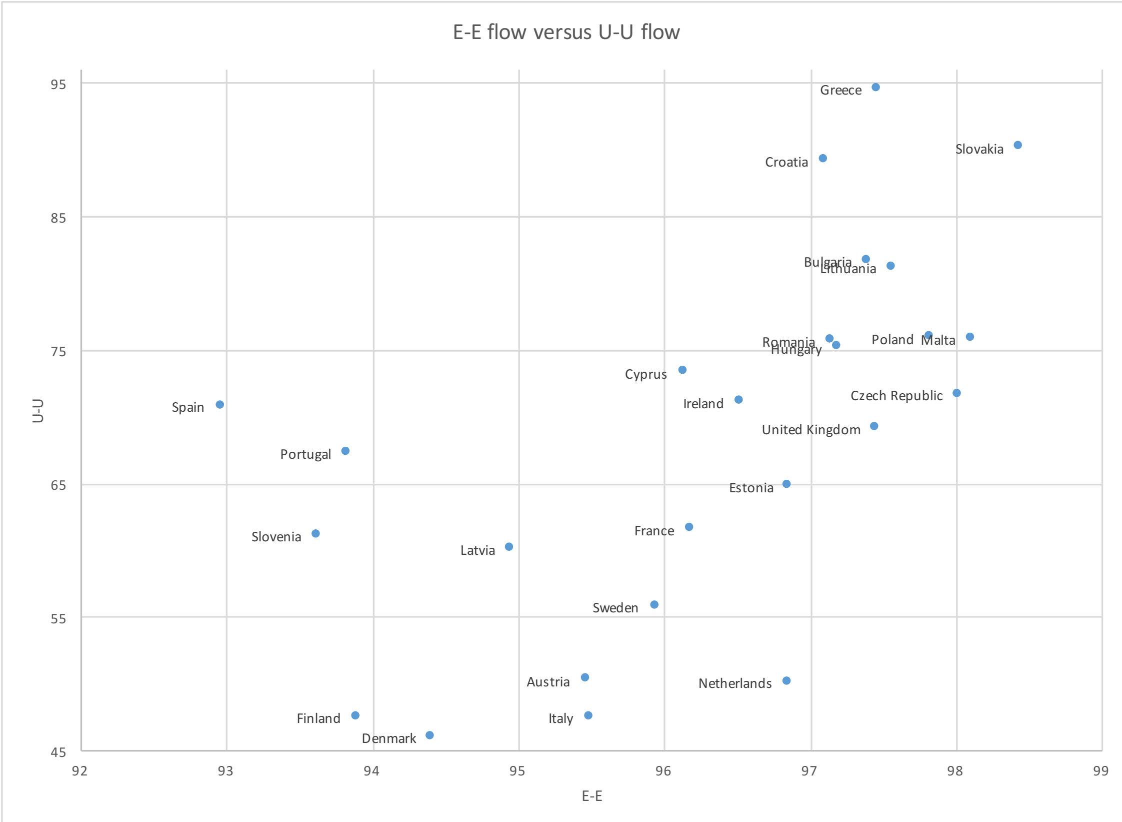

Figure 2: Persistence of Employment and Unemployment

tax rate needed to balance the budget within a period. Section 2 describes our model.

Our calibration is a contribution in itself: it provides a novel diagnosis of the European labour markets, since it reveals the key parameters that explain their different performance – in terms of unemployment (or employment) and its persistence. Country-specific structural parameters – in particular, job-separation and job-finding rates – and not UI policy parameters, are the key parameters. Not surprisingly, the job-finding rates for unemployed and for inactive are aligned, but their ranking, while very significant to explain persistence, provides a partial picture of labour market performance: one needs to account for the job-separation rate – for example, the very high job-separation rate of Spain – to get a more accurate one. In contrast, the 'technological' dimension in which we allow countries to differ – the total factor productivity – is not a key parameter to account for labour market differences, it mostly accounts for average wage differences. The fact that differences in UI policy parameters do not correspond to differences in labour market performance does not mean they are not relevant: they are, for two related reasons. First, because they show interesting patterns: for example, countries with high unemployment rates –say, Spain, Portugal, Greece and Slovakia – have low replacement rates but, among them, only those with high job-separation rates have long average duration of unemployment benefits (Spain and Portugal), while long average duration of unemployment benefits and high job-separation rates are also characteristic of countries with low unemployment rates (Denmark and Finland). Second, they are relevant because different UI policies – and/or different distributions of employment – result in different payroll taxes, since in our calibration all national budgets balance. These tax differences also determine the desirability of UI policy changes, at the national or at the EU – or some other – level. It should be noted that our UI policy parameters are related, but not on a one-to-one basis, with reported replacement and duration rates. We account for the reported eligibility rates, but then we let the reported benefits and the existing unemployment rates and flows determine our calibrated UI parameters. Section 3 provides a more detailed description of our calibration procedures and results.

Our model and its calibration provide the framework for our policy experiments, the main goal and contribution of this paper. Before we move to European unemployment insurance experiments, we perform a simple risk-sharing experiment within our calibrated European countries as a benchmark. We consider an economy in steady-state, subject to a severe unexpected negative – or a symmetric, positive – shock and after the one-period shock the subsequent sequence of shocks follows exogenous stochastic process. The country can either be in autarky and, therefore, finance its (calibrated) UI policy with a balanced budget in good or bad times or, alternatively, be able to risk-share across both extreme scenarios with constant payroll takes that balance the budget in expected terms. This is a basic example of 'the benefits of risk-sharing' and the common wisdom is that ex-ante the risk-sharing policy will Pareto dominate. However, our (robust) results show that it is more complicated than is usually assumed. There is an allocation effect of the risk-sharing policy, and the welfare gains – and the approval rates – differ across groups within countries and, as a result, the welfare gains are very small and not all groups within countries benefit. In sum, the risk-sharing policy does not Pareto dominate autarky. We also perform the same experiment for the asymmetric case in which the negative shock is less likely to occur and, therefore, can be financed with constant taxes without much employment distortion in the more likely good state. Welfare gains are larger than in the symmetric case, but still small and not Pareto improving.

We then perform a first round of European unemployment insurance experiments, analysing their different allocation effects, welfare gains and approval rates. We start by maintaining the current unemployment benefits (UB) policies of the countries but having a common budget with a constant payroll tax rate across countries. Not surprisingly, this policy of financial risk-sharing results in permanent transfers across countries, but not necessarily from low-unemployment to high-unemployment countries. Nevertheless, these transfers provide a benchmark indicator of the limits of risk-sharing with current national UI policies. We then experiment with a common ('average') UI policy with financial risk-sharing. Again, there are steady-state transfers across countries, and winners and losers within countries, but all these effects are substantially (quantitatively) different than in the experiment with only financial risk-sharing. Furthermore, it is possible to change the constant payroll taxes in every country, so as to cancel all the transfers and then reestimate the welfare and approval results. Section 4 presents in greater detail these experiments on single-country and multi European country risk-sharing; in particular, discusses how different welfare and approval rate measures are calculated, as well as the different allocation effects underlying these welfare results[4].

Our first set of experiments show the complexity of our query regarding the design of an European Unemployment Insurance Mechanism (EUIM), but they also suggest a way to move forward. First, our UI policies are parameterised by the unemployment benefits (UB) replacement rate and duration, which with a balanced

[4]More 'union' experiments have been performed for sets of countries with previous calibrations and will be covered in a future version with the current calibration and a broader set of countries.

budget (at the country or union level) result in a payroll tax-rate. Second, our calibration allows us to trace country differences to a few structural parameters, therefore if we constrain UI policies to take our parameterised form and we define welfare (or voting) criteria, we can obtain the UI policy which maximises welfare (or has higher acceptance) in each country. The result of this exercise (at this point with eight EU countries) is remarkable: in spite of the differences across countries, the welfare-maximizing UB mix is very similar: unlimited duration and close to 30% replacement rates. The resulting country-specific 'optimal policies' represent an important change from the existing UB policies for many countries and, therefore, in payroll taxes, and also in employment (higher) and individual saving behaviour (lower). The resulting tax differences across countries possibly provide the best indicator of the cost of having bad labour market institutions, in terms of job creation and destruction. Our analysis could stop here: a proposal for national reforms of existing UI policies. But it is worth taking the enquire a step further, since this result also means that a minimum welfare-improving commonly accepted UB policy – possibly with differential constant payroll taxes to avoid unwanted transfers (and create incentives for structural reforms) – is possible, which will provide tax smoothing across participating countries, and a common EUIM scheme for a more integrated labour market, which can also help mobility. National policies can then be complementary to the common policy, if needed. Section 5 provides the existing results on country specific 'optimal policies'.

Finally, Section 7 provides provisional conclusions on this work in progress. An Appendix includes more details on our calibration procedures, as well as complementary data on our experiments.

2 A Macroeconomic Model of Employment, Unemployment and Inactivity

Our model is based on Krusell et al. (2011) and Krusell et al. (2015) and captures key economic decisions of agents regarding their labour market behavior. In particular, in the model, given labour income taxes and unemployment benefits, agents with an opportunity to work are able to choose whether or not they work and agents currently not employed are able to choose whether or not to actively search for a job.

Our model economy consists of a union of $I \in \mathbb{N}$ areas.[5] Any area $i \in \{1, ..., I\}$ is itself a small open economy. In particular, we assume that within each area the wage rate adjusts such that the market for labour clears, and the international rental price for capital is fixed and common to all areas.

In the remainder of this section, we consider one particular country i. For ease of notation, we suppress superscript i in all variables. In the economy, agents are heterogeneous with respect to their labour market status, productivity and asset holdings (which determine each agent's state in every period). For the same reason, we also suppress the dependence of any variable in the state vector. In section 3 we describe the calibration procedure of the multi-area model in detail, and present its result. In section 4 we will introduce several versions of common unemployment insurance schemes, at the country level and country union level, and analyze the resulting dynamics.

Timing and Preferences. Time $t \in \{0, 1, 2, ...\}$ is discrete. Each area is populated by continuum of agents of measure one. Preferences over consumption, labour supply and job search are given by

$$\mathbb{E}_t \sum_{t=0}^{\infty} \beta^t \Big[\log(c_t) - \alpha w_t - \gamma_t s_t \Big]. \tag{1}$$

Agents derive utility from consumption c_t and disutility from employment w_t and job search s_t. The parameter α and the shock γ_t denote the utility cost of labour supply and active job search, respectively. The shock γ_t is i.i.d. across agents and over time. The discount factor is $\beta \in (0, 1)$. Workers can only choose to supply labor on the extensive margin, i.e. $w_t \in \{0, 1\}$. Additionally, the search decision is also discrete: $s_t \in \{0, 1\}$.

[5] In the remainder of the current version of the paper we use the notions *area* and *country* interchangeably. However, we want to keep the flexibility to group several countries (eventually, according to similarities with respect to their labour markets) into *areas*.

Markets and Technology. The production sector is competitive. Firms, who produce according to a constant returns to scale technology, hire labour in the domestic labour market at a wage rate which equals the marginal product of labour. They rent capital from the international capital market at a price r^* and pay for the depreciation of capital; the total rental price equals the marginal product of capital employed in production. Workers supply labour in the domestic market. This market is characterized by frictions that affect workers' separations from jobs, and workers' access to a job opportunity. In what follows, these frictions are described in detail.

In the beginning of every period, agents who were employed in the previous period can loose their job with probability σ. The job separation shock is denoted by $\chi_t \in \{0, 1\}$, with $\text{Prob}(\chi_t = 1) = \sigma$. The probability of finding a job while not employed depends on the search effort. An agent who is actively searching during period t finds an employment opportunity for period $t+1$ with probability λ_u; an agent who is not actively searching, with probability $\lambda_n < \lambda_u$. After loosing a job, agents who search may be eligible for unemployment benefits. Eligibility is denoted by the indicator $I_t^B \in \{0, 1\}$. The process that determines eligibility for unemployment benefits is described below.

Agents are heterogeneous with respect to their labour productivity, denoted by z_t. Specifically, idiosyncratic productivity follows the AR(1) process

$$\log z_{t+1} = \rho_z \log z_t + \epsilon_{t+1}, \tag{2}$$

where the innovations ϵ_t are i.i.d. according to the Normal distribution with mean zero and standard deviation σ_ϵ.

Agents cannot insure themselves against the idiosyncratic productivity risk, however they can save using a risk-free bond. The risk-free return is given by the international real interest rate r^*. We denote an agent's savings by a_t.

Unemployment Benefits and Budget Sets. There is an exogenous and an endogenous component which determines eligibility for unemployment benefits. The exogenous component is a stochastic process that, conditional on the unemployed agent actively searching for a job, determines eligibility. Denote the labour market status of an agent in period t by x_t; $x_t \in \{e, u, n\}$ for employed e, unemployed u and inactive n. In the first period of unemployment, agent are eligible for unemployment benefits with probability 1. From the first period of unemployment onward, an unemployed agent looses eligibility with probability μ. The exogenous process is denoted ι_t and satisfies:

$$\begin{aligned}
&\text{Prob}(\iota_t = 1 | x_{t-1} = e, \chi_t = 1) = 1, \\
&\text{Prob}(\iota_t = 1 | \iota_{t-1} = 1) = 1 - \mu, \quad \text{Prob}(\iota_t = 0 | \iota_{t-1} = 1) = \mu, \\
&\text{and Prob}(\iota_t = 1 | \iota_{t-1} = 0) = 0.
\end{aligned}$$

The endogenous part of eligibility is given by the search decision of the agent: only actively searching agents ($s_t = 1$) are eligible for benefits when $\iota_t = 1$. Accordingly, eligibility is denoted by the indicator variable:

$$I_t^B = \iota_t s_t, \tag{3}$$

which by construction takes the value one when the agent is eligible for benefits and searches and zero otherwise.

An eligible unemployed agent receives unemployment benefits $b(z)$ according to

$$b(z_t) = b_0 \omega_t z_t \tag{4}$$

where b_0 is a replacement rate, ω_t is the wage rate and z_t is the agent's current productivity level. The formula in (4) implies that an agent receives unemployment benefits according to his current labor market productivity. A more realistic assumption would be to have unemployment benefits depend on past labour earnings. We choose (4) to economize in the dimension of the state space of the model (avoiding the need to keep track of past productivity of currently unemployed agents), and because the process z_t is persistent, implying that current productivity is a good proxy for previous labor earnings.

In every period, each agent faces a budget constraint denoted $\mathcal{B}_t^x$, that takes different forms depending on the labour market status x_t. The feasible pair of consumption and savings for an agent who is employed ($x_t = e$) in period t is:

$$\mathcal{B}_t^e = \Big\{ (c_t, a_{t+1}) : c_t \geq 0, a_{t+1} \geq 0, (1 + r^*) a_t + (1 - \tau) \omega_t z_t \geq c_t + a_{t+1} \Big\}. \tag{5}$$

An employed agent finances consumption c_t and savings a_{t+1} with current period's asset a_t inclusive of interest income $r^* a_t$ and income from work, net of tax τ. An unemployed agent has no labour income but may receive unemployment benefits:

$$\mathcal{B}_t^u = \Big\{(c_t, a_{t+1}) : c_t \geq 0, a_{t+1} \geq 0, (1 + r^*)a_t + I_t^B b(z_t) \geq c_t + a_{t+1}\Big\}. \tag{6}$$

Finally, a non-active agent finances consumption and savings exclusively with income from asset holdings:

$$\mathcal{B}_t^n = \Big\{(c_t, a_{t+1}) : c_t \geq 0, a_{t+1} \geq 0, (1 + r^*)a_t \geq c_t + a_{t+1}\Big\}. \tag{7}$$

Note that, in order to be employed, the agent needs to have an employment opportunity, which arrive and disappear via *exogenous* shocks, and needs to be willing to work, which is an *endogenous* decision of the agent. If the agent is not employed but is eligible for unemployment benefits ($I_t^B = 1$), she obtains unemployment benefits. Again, whether or not the agent obtains benefits depends on exogenous (she can loose eligibility with probability μ) and endogenous (she can decide whether to search or not) forces. Finally, an agent who is not employed and his not eligible for unemployment benefit or not searching, consumes and saves exclusively out of the income from past savings.

Production is given by the Cobb-Douglas technology:

$$F(K_t, N_t) = A_t K_t^\theta N_t^{1-\theta}, \tag{8}$$

where A_t denotes total factor productivity, K_t the aggregate capital stock and θ the capital share of output. N_t is aggregate labour, measured in efficiency units. In what follows, we assume no aggregate shocks: $A_t = A$. This implies that in each country, at the aggregate level, all variables are constant over time: $K_t = K, N_t = N$.

Labor Market decisions and Value functions. We have now all the model ingredients to describe agents' decisions and value functions. Denote the state variable by the vector $\xi \equiv (a, z, \gamma, \iota)$, and the value of not having a job (being "jobless") in state ξ by J(ξ). The value at state ξ with a job opportunity is denoted by V(ξ).

Given $\mathrm{J}(\xi)$ and $\mathrm{V}(\xi)$, the value function for an employed worker satisfies the following Bellman equation:

$$\mathrm{W}(\xi) = \max_{(c,a')\in\mathcal{B}^e(\xi)} \left\{ \log(c) - \alpha + \beta\mathbb{E}_\xi \Big[(1-\sigma)\mathrm{V}(\xi') + \sigma\Big(\lambda_u \mathrm{V}(\xi') + (1-\lambda_u)\mathrm{J}(\xi')\Big)\Big] \right\}. \tag{9}$$

The Bellman equation reflects the dynamics of the labour market. In state ξ, an employed agent derives utility from consumption net of the utility cost of labour services. The continuation value takes into account that, with probability $1-\sigma$, the agent will have an employment opportunity next period. With probability σ, the agent is exogenously separated from the current job. If the separation shock happens, an agent can immediately draw a new job offer with probability λ_u, or arrive at state ξ' without a job with probability $1-\lambda_u$.

Similarly, the value function of an unemployed agent satisfies:

$$\mathrm{U}(\xi) = \max_{(c,a')\in\mathcal{B}^u(\xi)} \left\{ \log(c) - \gamma + \beta\mathbb{E}_\xi \Big[\lambda_u \mathrm{V}(\xi') + (1-\lambda_u)\mathrm{J}(\xi')\Big] \right\}. \tag{10}$$

An unemployed agent incurs a utility cost of searching, γ. While searching, a job offer for next period arrives with probability λ_u, or does not materialize with probability $1-\lambda_u$. The value function for non-active (i.e. not actively searching) agents is given by:

$$\mathrm{N}(\xi) = \max_{(c,a')\in\mathcal{B}^n(\xi)} \left\{ \log(c) + \beta\mathbb{E}_\xi \Big[\lambda_n \mathrm{V}(\xi') + (1-\lambda_n)\mathrm{J}(\xi')\Big] \right\}. \tag{11}$$

A non-active agent, who is not actively searching for a job, derives a flow utility of consumption and no search cost, and his continuation value reflects a lower probability of a job offer, λ_n.

An agent without a job offer at hand decides whether or not to search according to:

$$\mathrm{s}(\xi) = \arg\max_{s\in\{0,1\}} \Big\{ s\cdot \mathrm{U}(\xi) + (1-s)\cdot \mathrm{N}(\xi) \Big\}. \tag{12}$$

Accordingly, the value of being jobless in state ξ, $\mathrm{J}(\xi)$, is:

$$\mathrm{J}(\xi) = \mathrm{s}(\xi)\cdot \mathrm{U}(\xi) + (1-\mathrm{s}(\xi))\cdot \mathrm{N}(\xi). \tag{13}$$

An agent with an employment opportunity decides whether or not to work according to:

$$\mathrm{w}(\xi) = \arg\max_{w\in\{0,1\}} \Big\{ w\cdot \mathrm{W}(\xi) + (1-w)\cdot \mathrm{J}(\xi) \Big\}, \tag{14}$$

and the value of a job opportunity is:

$$\mathrm{V}(\xi) = \mathrm{w}(\xi) \cdot \mathrm{W}(\xi) + (1 - \mathrm{w}(\xi)) \cdot \mathrm{J}(\xi). \tag{15}$$

Stationary Equilibrium. A stationary equilibrium in this economy is given by a wage rate ω, a policy (τ, b_0, μ), aggregate production inputs (K, N), decision rules for consumption $\mathrm{c}^x(\xi)$, savings $\mathrm{a'}^x(\xi)$ for $x \in \{e, u, n\}$; work $\mathrm{w}(\xi)$ and search $\mathrm{s}(\xi)$ decisions, and a probability distribution ζ over states (ξ, x), such that:

1. Given prices (r^*, ω), the representative firm maximizes profit: $r^* = F_K(K, N) - \delta$, $\omega = F_N(K, N)$.

2. Given prices and policy parameters (τ, b_0, μ), agents behave optimally. In particular $\mathrm{c}(\xi)$, $\mathrm{a'}(\xi)$, $\mathrm{w}(\xi)$ and $\mathrm{s}(\xi)$ solve the problems characterized by (9) to (15).

3. The labour market clears:
$$N = \int z d\zeta(\xi, x = e)$$

4. ζ is a stationary probability distribution.

5. The government budget clears:
$$\tau \omega N = \int b(z) I^B(\xi) d\zeta(\xi, x = u)$$

The last condition (government budget clearing) only holds in the baseline model. In the policy experiments of section 4, we substitute this condition by a multi-country budget constraint when we consider joint unemployment insurance mechanisms.

3 Calibration Procedure

The model presented in the previous section has 16 parameters, summarized in Table 1. Each of these parameters can be assigned to one of three groups, which are represented by the three panels of the table. The upper panel describes parameters related to the aggregate technology (θ, δ), the idiosyncratic productivity process (ρ_z, σ_z), preferences (β, α, $\bar{\gamma}$) and the exogenous interest rate r. These parameters are kept *constant* across all countries.

Parameter	Definition
θ	Capital share of output
δ	Capital depreciation rate
β	Discount factor
ρ_z	Persistence of productivity
σ_z^2	Variance of prod. shock
α	Utility cost of labor
$\bar{\gamma}$	Average Utility cost of search
r	Exogenous Interest rate
A	Total factor productivity
σ_γ	St. deviation of search cost
σ	Job separation rate
λ_u	Job finding rate for unemployed
λ_n	Job finding rate for inactive
μ	Prob. of loosing UB eligibility
b_0	UB replacement rate
τ	Labor income tax rate

Table 1: Model parameters.

The other two panels display parameters that are *heterogeneous* across countries. The middle panel includes parameters that capture - in a reduced form - different labour market institutions. These are total factor productivity A (which determines wage differences across countries), the job separation rate σ, the job arrival rates λ_u and λ_n as well as the standard deviation of the search cost shock σ_γ. The lower panel contains parameters that determine tax and subsidy policies (μ, b_0, τ) related to labour markets. These parameters will be the instruments of the policy experiments (Section 4).

A central aspect of our analysis, visible in the construction of the theoretical model of the preceding section, are the transitions between the states employment, unemployment and inactivity. Flow statistics are a useful measure since they quantify the aggregate transitions between labour market states in the data. In order to calibrate our model we therefore use Eurostat data on labour market transitions. These flows are available since 2010 on a quarterly basis for all European Union countries except Belgium, Germany and the United Kingdom. This data, however, has one important shortcoming. It is composed of all individuals aged 15 to 64 and as inactive counts everyone who is not employed and not searching for a job. Hence, in particular many individuals who are still in education fall in this category. As a consequence the stock of inactive people in the model does not correspond to its data equivalent. We take this shortcoming into account(see following section).

3.1 Calibration strategy

We now describe in detail how each model parameter is calibrated. We want to impose some discipline on our choices. First, we fix the techonological parameters θ, δ, ρ_z and σ_z to the quarterly counterparts of the values in Krusell et al. (2015), who use monthly data for the US. As Krusell et al. (2015) we discretize the individual productivity process by 20 different productivity states using the Tauchen method. We fix the real interest rate r to match a long term average of 0.8% per year, i.e. 0.2% per quarter.

Second, we impose that preferences are equalized across countries. In particular, β, α and $\bar{\gamma}$ are the same for all countries. The time discount factor β we again set to the quarterly analogue of Krusell et al. (2015). We further require the utility cost of work α to be not less than the utility cost of search γ.

The parameter μ is the inverse of the duration of unemployment benefits. This parameter we obtain directly from the data for each country. The parameters α and $\bar{\gamma}$ are calibrated together with the other - country specific - parameters in two interdependent stages. In a first step the preference parameters α and $\bar{\gamma}$ are fixed. We allow only two realizations of $\gamma \in \{\gamma_h, \gamma_l\}$, where $\gamma_h = (1+\sigma_\gamma)\bar{\gamma}$ and $\gamma_l = (1-\sigma_\gamma)\bar{\gamma}$. The search utility loss is required to be always non-negative and not higher than the work utility cost α restricting the parameter space to $\sigma_\gamma \in [0, 1]$ and $\bar{\gamma} \in (0, \alpha/2]$. In the second step all other parameters are calibrated in order to match a set of data moments in each country. Taken into account our imposed restrictions we iterate on the choice of $(\alpha, \bar{\gamma})$ until these moments are matched for a maximum of countries and the model implied stock of inactive people is less than the one in the data in all countries.

Our calibration targets are the average wage, the unemployment rate, the transitions from employment to unemployment and vice versa, the persistence of unemployment as well as government expenditures on unemployment benefits as a fraction of GDP. This gives us a total of six targets for six country specific parameters $(A, b_0, \sigma_\gamma, \sigma, \lambda_u, \lambda_n)$.

Table 2: Common Parameters

Parameter	θ	δ	β	ρ_z	σ_z^2	α	$\bar{\gamma}$	r
	0.3	0.01/4	0.98	0.991	0.16	1.40	0.70	0.002

Table 2 summarizes the common parameters, while table 3 summarizes the country specific parameters for all calibrated European countries. Absent data for Germany, we picked the second biggest country in the European Union, France, as our reference country. I.e. we normalized TFP in France to one and calibrated A for each country in order to match its average wage relative to France. Finally, in the benchmark calibration the tax rate τ is chosen in a way such that the budget in each country clears.

3.2 Quality of the Fit

In this section we want to investigate how well the model fits the data along dimensions we do and do not target. Figure 3 shows the unemployment rate implied by the transitions in the data (2010-2015) in blue. With our strategy we are able to match this target in all countries but one, Romania, in which the model predicts a slightly lower unemployment rate than observed in the data.

As discussed above the Eurostat data set we are using is composed of all individuals aged 15-64 and it classifies any individual in this age group, who is neither employed nor searching for a job, as inactive. This includes a substantial share of young people who are still in education. We hence do not expect - nor want - our

Table 3: Country Specific Parameters

Country	A	σ_γ	σ	λ_u	λ_n	μ	b_0
Bulgaria	0.37	0.00	0.02	0.09	0.05	0.34	0.17
Czech Republic	0.62	0.40	0.01	0.17	0.07	0.51	0.27
Denmark	1.21	0.82	0.03	0.42	0.32	0.13	0.44
Estonia	0.62	0.17	0.04	0.20	0.12	0.26	0.17
Ireland	0.93	0.32	0.02	0.11	0.06	0.25	0.41
Greece	0.73	0.00	0.05	0.05	0.03	0.25	0.11
Spain	0.89	0.25	0.09	0.16	0.08	0.13	0.18
France	1.00	0.58	0.03	0.21	0.14	0.13	0.33
Italy	0.91	0.80	0.03	0.16	0.11	0.39	0.41
Latvia	0.39	0.35	0.05	0.19	0.10	0.34	0.14
Lithuania	0.48	0.05	0.03	0.12	0.06	0.63	0.18
Luxembourg	1.24	0.90	0.01	0.19	0.15	0.25	0.56
Hungary	0.59	0.02	0.02	0.16	0.08	0.34	0.22
Malta	0.78	0.10	0.01	0.15	0.10	0.51	0.35
Netherlands	1.21	0.85	0.02	0.27	0.19	0.31	0.72
Austria	1.10	0.40	0.02	0.31	0.20	0.44	0.62
Poland	0.60	0.00	0.02	0.13	0.07	0.51	0.17
Portugal	0.73	0.30	0.05	0.17	0.10	0.17	0.21
Romania	0.44	1.00	0.01	0.10	0.00	0.51	0.55
Slovenia	0.82	0.20	0.04	0.19	0.12	0.51	0.26
Slovakia	0.60	0.20	0.01	0.08	0.00	0.51	0.18
Finland	1.02	0.88	0.02	0.28	0.22	0.13	0.44
Sweden	1.02	0.70	0.02	0.26	0.14	0.22	0.38

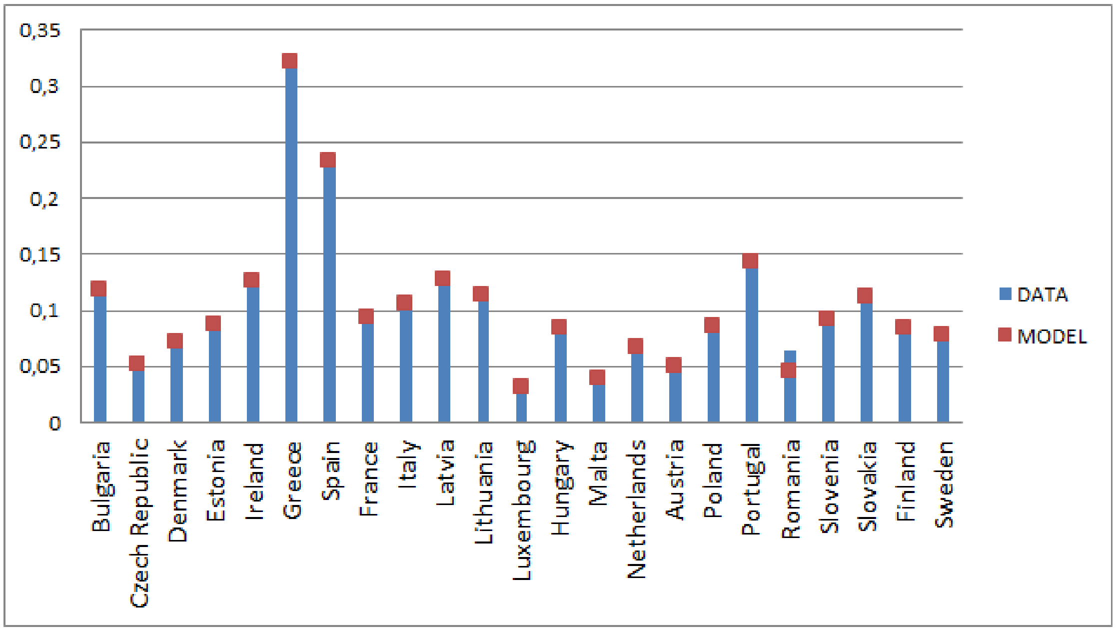

Figure 3: Unemployment Rate

model to predict this share well. In fact we make it part of our calibration requirements that the model underpredicts inactivity in all the countries. This can be seen in figure 4.

As a consequence our model overpredicts the share of population in employment (see figure 5). This is simply the mirror image of inactivity. The same data problem also results in an overprediction of the flows *out of* inactivity. However, our model is able to match the flows *into* inactivity well. It does so mechanically for flows out of unemployment. Since we target the flows from unemployment to employment as well as the persistence of unemployment, by construction also the flow from unemployment to inactivity is matched. The persistence of unemployment is shown in figure 6. We are able to exactly match this flow for all but two countries, Greece and Romania. In these two countries we are reaching the boundaries of the parameter restrictions we imposed ($\sigma_\gamma = 0$ for Greece, $\sigma_\gamma = 1$ and $\lambda_n = 0$ for Romania).

The persistence of employment is shown in figure 7. This is an untargeted flow and our model is able to match it well. Only in five countries (Denmark, Estonia, Greece, Luxembourg and Romania), the difference between the data and the model

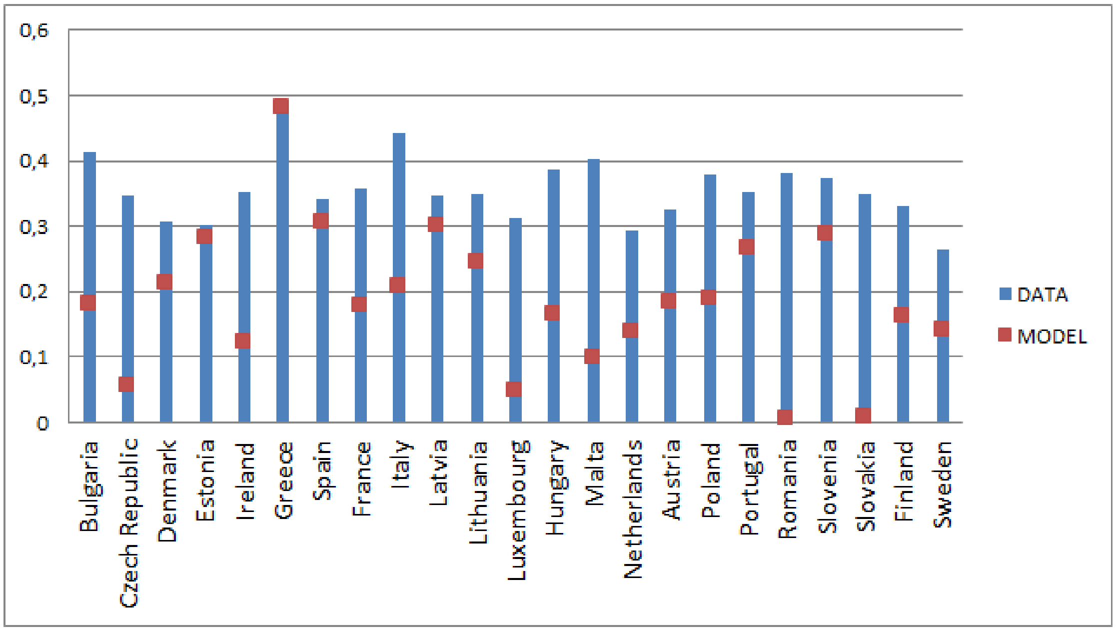

Figure 4: Share of Inactive Population

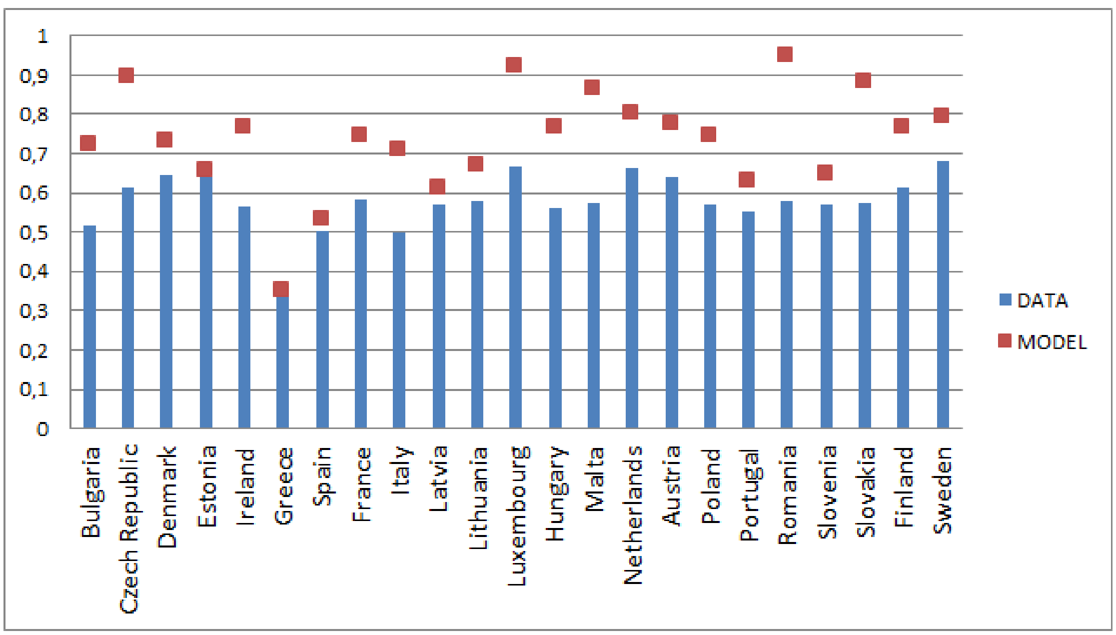

Figure 5: Share of Population in Employment

is above - but close to - two percentage points. As we are able to exactly match the (targeted) flow from unemployment to employment exactly in all countries, the

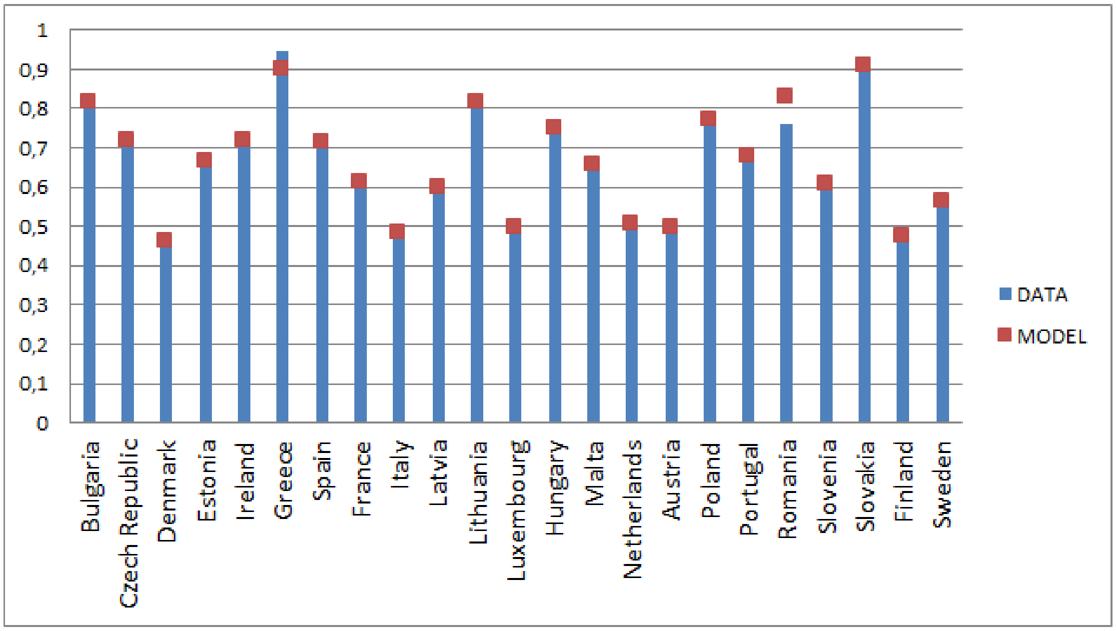

Figure 6: Persistence of Unemployment

flow from employment into inactivity is matched similarly well.

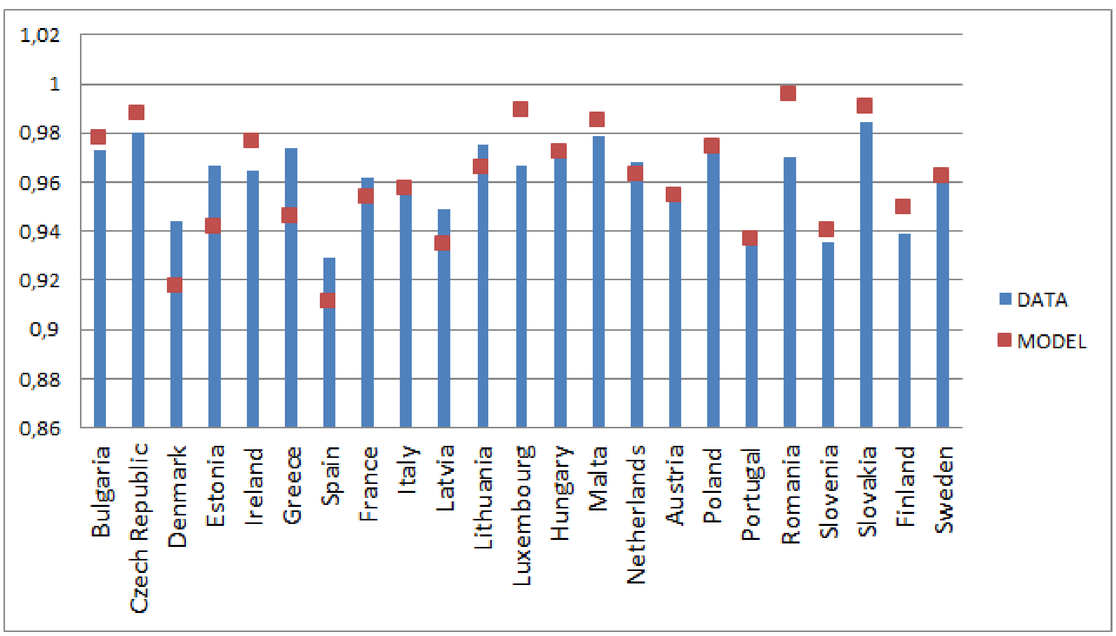

Figure 7: Persistence of Employment

3.3 Diversity of Labour Market Institutions

Our calibration makes apparent that labour market institutions vary substantially across countries. We visualize this in the figures 8 to 10. Figure 8 shows the job arrival rate for searchers (horizontal axis) and non-searchers (vertical axis) for each of the calibrated countries. We observe that these two rates are highly correlated but their values differ substantially across countries. For example, in the Scandinavian countries, the Netherlands and Austria the job finding rate for not actively searching individuals is higher than 15%, while in Greece, Slovakia, Romania and Bulgaria it is lower than 10% even for actively searching individuals.

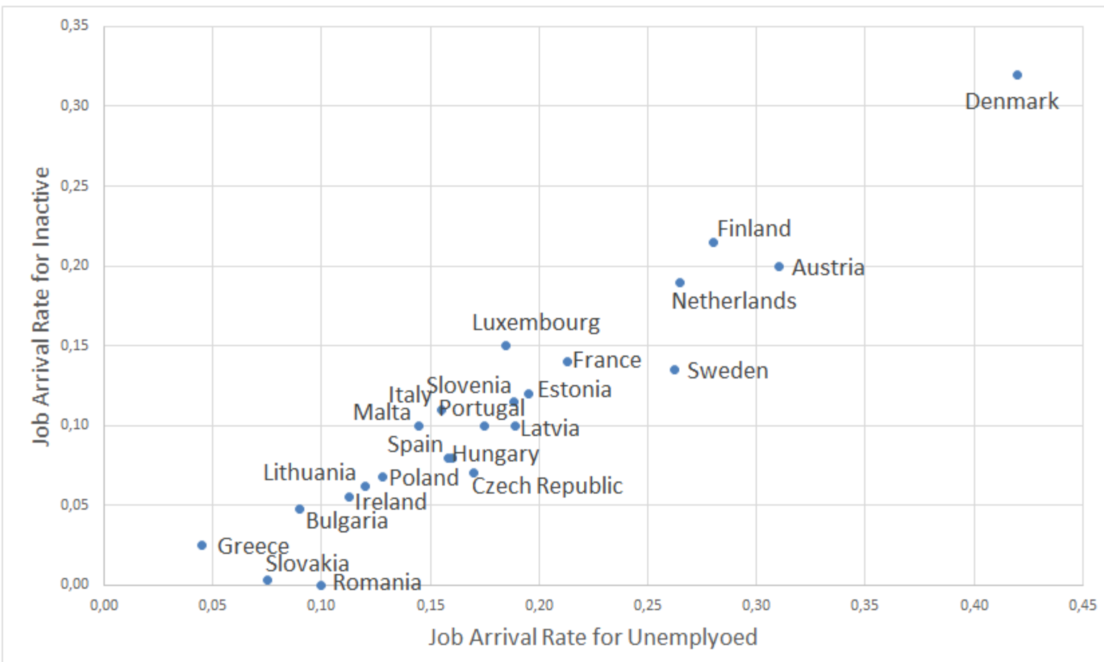

Figure 8: Job Arrival Rates

Figure 9 plots again the job finding rate for unemployed on the x-axis, but this time against the job separation rate on the y-axis. It hence gives an idea of the rigidity of the respective labour markets. Labour markets are less rigid, i.e. feature more fluctuations towards the northeast part of the graph. Countries in the southeast have the high job finding but low separation rates. We again see the cluster of the three Scandinavian countries, the Netherlands and Austria, all with job arrival rates above 25% but with separation rates below 3%. Eye-catching is also the extremely high separation rate in Spain, responsible for making it the European country with the second highest unemployment rate after Greece.

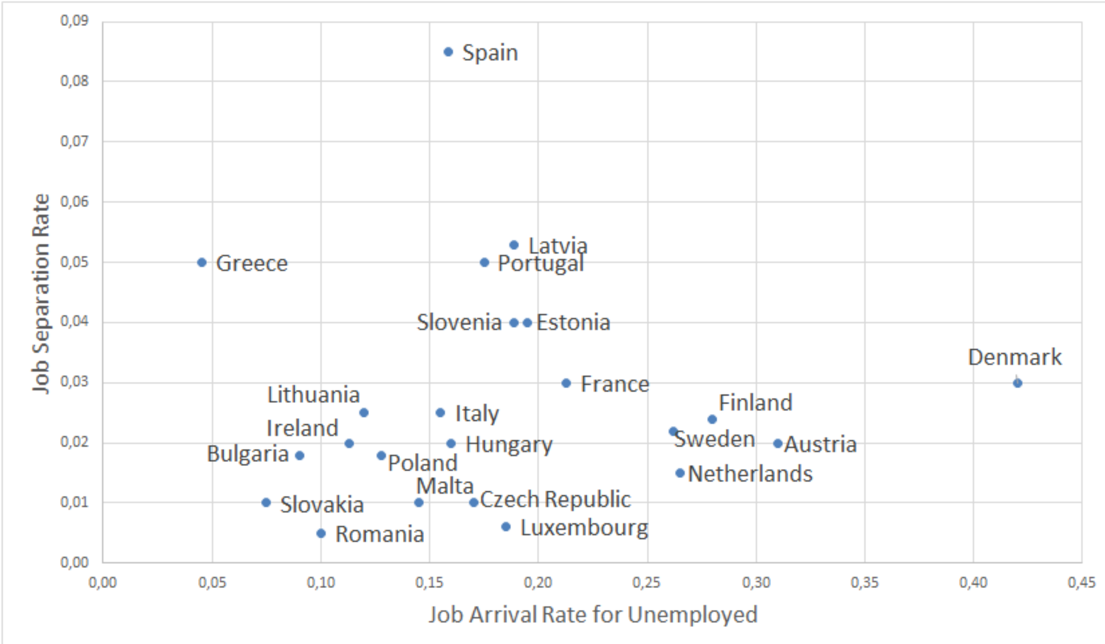

Figure 9: Labour Market Rigidity

Finally, figure 10 shows that the countries also differ substantially with respect to the generosity of their unemployment benefit system. It plots the replacement rate vs. the average duration for which unemployed are eligible to receive benefits.

Varying labour market institutions and -policies induce varying behaviour of households across countries. This is shown in figures 11 and 12. Figure 11 depicts the share of job separations that is due to voluntary quits of workers. We see that in the countries with high job arrival rates, i.e. the Scandinavian countries, the Netherlands and Austria, this share is between 55% and 80%, while in the countries with low job arrival rates, in particular Greece, Romania and Slovakia, it is below 15%. The reason is intuitive. In countries with high job arrival rates, agents know that when needed, they will find a job again relatively quickly. Hence, especially relatively rich agents sometimes decide to quit and live for some time on their savings until a better job offer arrives.

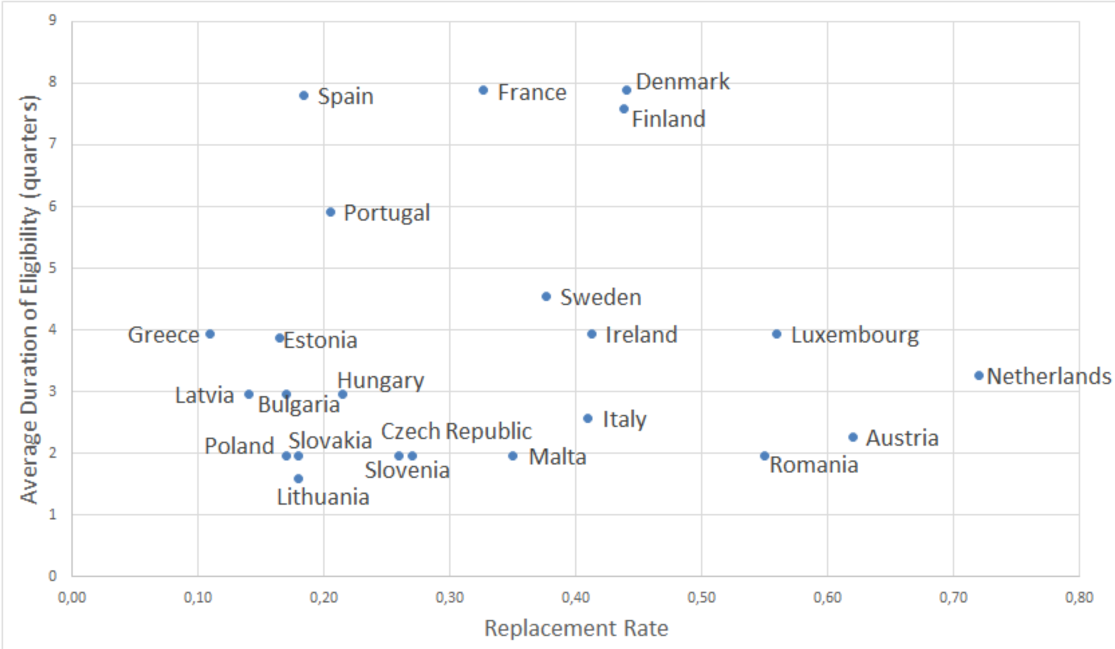

Figure 10: Generosity of the Benefit System

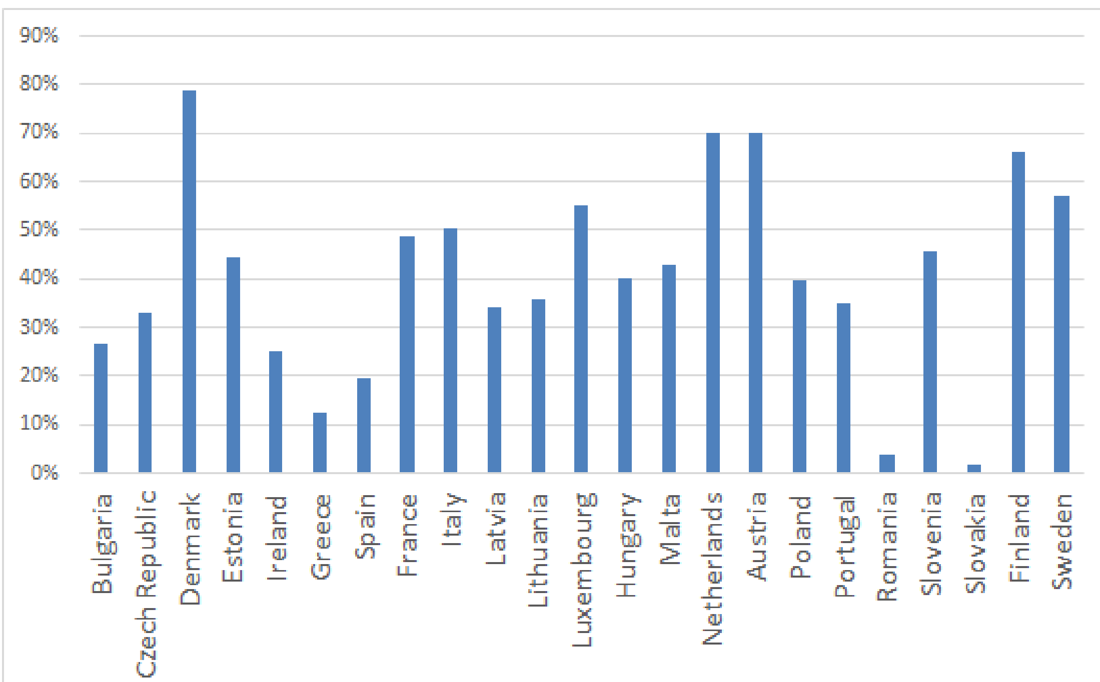

Figure 11: Share of Voluntary Separations

Finally, figure 12 shows the share of job offers that is rejected. It does so separately for unemployed (blue bars) and inactive (red bars). We again see substantial differences across countries. For example unemployed - i.e. actively searching - individuals in Ireland, Greece, Spain and Slovakia accept basically all offers, and the share of rejections among inactive is less than 15%. Contrary in Denmark and the Netherlands even actively searching reject more than 15% of the offers and the share of offer rejections of inactive is above 35%.

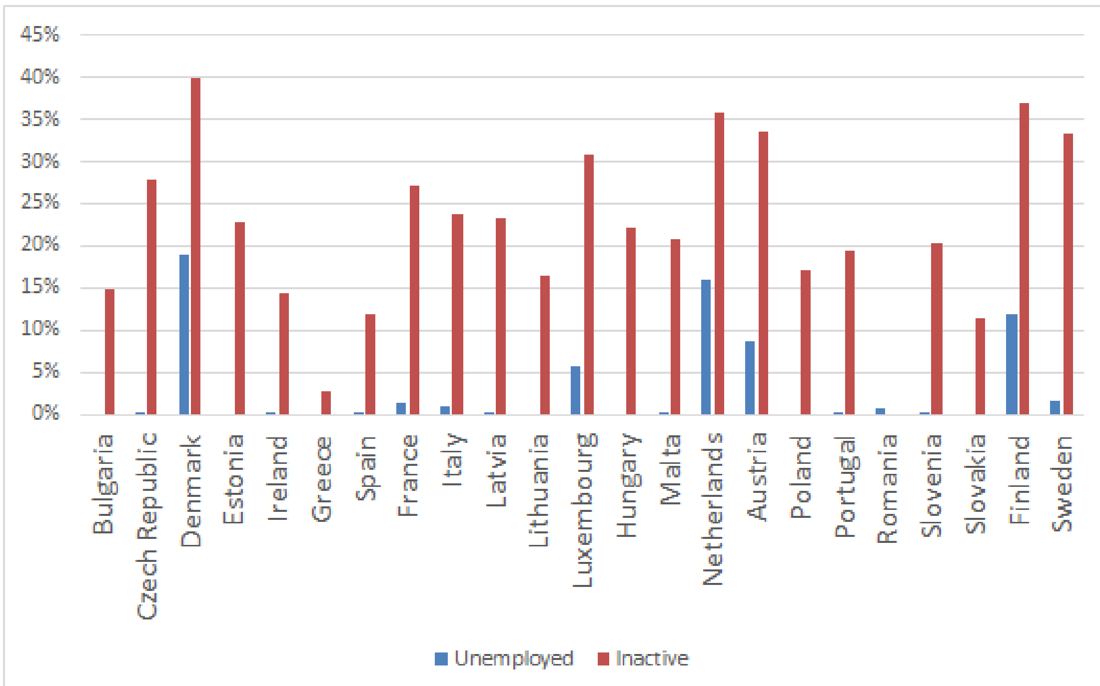

Figure 12: Share of Job Offer Rejections

4 European Unemployment Insurance: Some Policy Experiments

This section contains a preliminary investigation of how different configurations of a European unemployment insurance scheme influence labour markets and welfare in the participating countries as well as on the magnitudes and direction of (steady state) transfers necessary to finance such a system. As we pointed out earlier, a key motivation for a EUIM would be that it may provide insurance against country specific fluctuations in unemployment and, in particular, against fluctuations in the tax burden associated with its financing.

In Subsection 4.1, we directly study the pure insurance effects of such policy from the viewpoint of individual European countries. In this experiment, the EUIM only insures countries against country-specific fluctuations in unemployment. This scheme, by construction, does not involve transfers across countries. At the same, we will see that its welfare impacts are very limited as the insurance gains are partially offset by efficiency losses due to increased distortions.

In Subsection 4.2, we consider a larger scale reform, where members countries pool together resources through a common European unemployment tax, however they keep the unemployment insurance system (b_0 and μ) unchanged. This system will involve a significant amount of redistribution across member countries. The transfers are typically flowing from countries with low *unemployment budgets* to large *unemployment budgets* (this does not always imply that they flow from low *unemployment* countries to high *unemployment* countries). We will see that these transfers have a much stronger impact on welfare than the possible insurance gains. Consequently, hat the implied redistribution can be a significant hurdle for the implementation of this scheme. At the same time, in this case, still only taxes change at the national level, hence labor market variables are hardly affected (recall that we have only extensive margins of labor supply).

In the last subsection 4.3, we address this issue by considering a full EUIM, where the replacement rates, the durations and the unemployment taxes are unified across Europe. This reform again implies large transfers from countries with low post-reform unemployment to high post-reform unemployment. Given that, for some countries, the UI system changes significantly we see also larger changes in aggregate labor market outcomes. Nevertheless, we see very significant transfers across countries. This is due to the fact the labor market institutions (modelled as job offer arrival rates λ_u and λ_n and separation rates σ) are still different across countries implying very different "natural" rates of unemployment. For the same reason, different countries would prefer different unemployment insurance schemes and a unified EUIM obviously cannot be optimal for all countries. For this reason in Section 5, we study the optimal unemployment insurance at the level of individual countries.

4.1 Experiment 1: Insuring Country Level fluctuations

As we mentioned above the main argument for a EUIM can be that it may provide insurance against country level fluctuations in unemployment. This insurance might be very valuable as European countries (especially recently after the crisis) have hard time to finance the increasing fiscal burden of unemployment using debt because of tighter deficit requirements. In the following experiment we provide the "best chance" for these insurance benefits to realise as we assume that individual countries have no access to any debt or savings to smooth out unemployment fluctuations.

Note that, in Section 2, we have only considered a stationary distribution where all aggregate variables are constant. In oder to consider fluctuations, we need to abandon this assumption. We do this in a parsimonious way, by assuming that at time $t = 0$, the country is in its steady state. At the end of his period when all decisions are already made, it becomes aware, that at $t = 1$, it is either hit by a positive shock or by a negative shock. After the shock hits the country returns back to its steady state in a deterministic and gradual way.

Similarly to Krusell et al. (2015), we model shocks as hitting simultaneously TFP (A) and exogenous labor market flows (σ, λ_u and λ_n). In particular, a boom (crisis) will be modelled as a rise (drop) in TFP and job arrival rates and a drop (rise) in the separation rate. We model economic fluctuations in this way, because it is well-known that fluctuations of TFP alone are not able to generate large enough fluctuations of unemployment if output fluctuations are reasonable. This issue is amplified in our framework by the fact that job creation and job destruction are not modelled endogenously.

Given all these assumptions, note that after the shock is realised the economy is following a deterministic pattern and eventually converges back to its steady state. Hence, after the realisation of the shock agents have perfect foresight when solving their dynamic optimisation problems. We consider two cases: financial autarky and insurance through the EUIM. In financial autarky, along the transition the tax rate needs to adjust to balance the government budget constraint every period. In the case of EUIM, we assume that countries can get full insurance against the fluctuation unemployment expenditure. Further more, we assume that this insurance is actuarially fair, that is (ex ante or in expectation) the government's intertemporal budget constraint is satisfied by equality.[6]

We can calculate the welfare effect of the introduction of this EUIM by comparing the (ex ante) welfare of autarky and the EUIM of an individual at a given state ξ after learning that shocks will occur next period but before knowing the realisation of the shock.

We consider two environments. In the first one there is the possibility of a good and a bad shocks both of which occur with equal probability. In the second case we assume that only a bad shock can occur with some positive probability, while with the complementary probability the economy remains at its steady state.

4.1.1 Symmetric Shocks

Assume first that the country learns in $t = 0$ that it will be hit next period by either a good or a bad shock and both shocks occur with probability one half.

We are presenting graphically this policy experiment for France in Figures 13 to 16. The first row of Figure 13 shows the evolution of the 'stochastic ' variable for the boom and for the crisis. The magnitude of the shocks to these variables was chosen such that they generate a deep crisis of an output drop of around 11 percent, a drop in consumption of 4 percent and increase in unemployment of around 4 percentage points. It is also clear that in autarky the tax rate need to vary substantially to finance the increase in (eligible) unemployment. In particular the tax rate increases from around 2.0 percent to roughly 4.2 percent at beginning of the crisis to be able to finance the sudden rise pf eligible unemployed. These are the fluctuation the EUIM can insure. In fact, in Figure 14, we show the same transitions for the case when the EUIM provides insurance for these fluctuations. The only noticeable difference

[6] This assumption can be justified by the assumption that this country is small and country shocks are uncorrelated or by the fact that the EUIM can finance itself at the risk free rate.

is in terms of the tax rates, that are constant in this formulation. The fact that the existence of this insurance have practically no visible effect on consumption already indicates the small magnitude of the welfare effects of this policy.

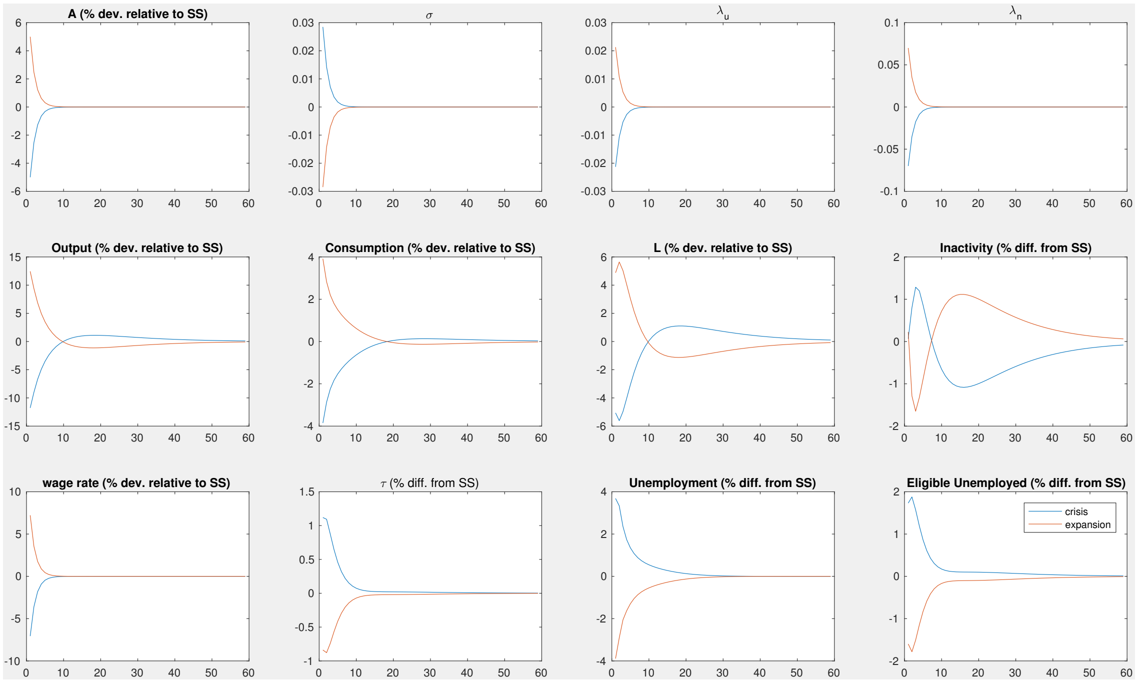

Figure 13: Transition Dynamics in Autarky

To highlight some important differences between the two cases we show how aggregate (average) consumption evolves during the crisis and boom simulation across the two scenarios on Figure 15. The figure clearly shows the insurance benefits of EUIM. Aggregate consumption shows lower variation across the two shocks because the taxes are higher in this scenario in the boom periods and lower during the crisis period.

However, this tax dynamics also have negative consequences. It implies that net wages are increasing less in booms. This will imply that the increase of labor is lower under the EUIM during boom and the drop of labor is reduced during the crisis. Figure 16 shows this pattern clearly, although the quantitative effect is small. These changes imply a reallocation of labor across states that diminishes aggregate production and hence consumption as shown on Figure 17. This implies that introducing the EUIM is beneficial as it increases insurance but it is also costly

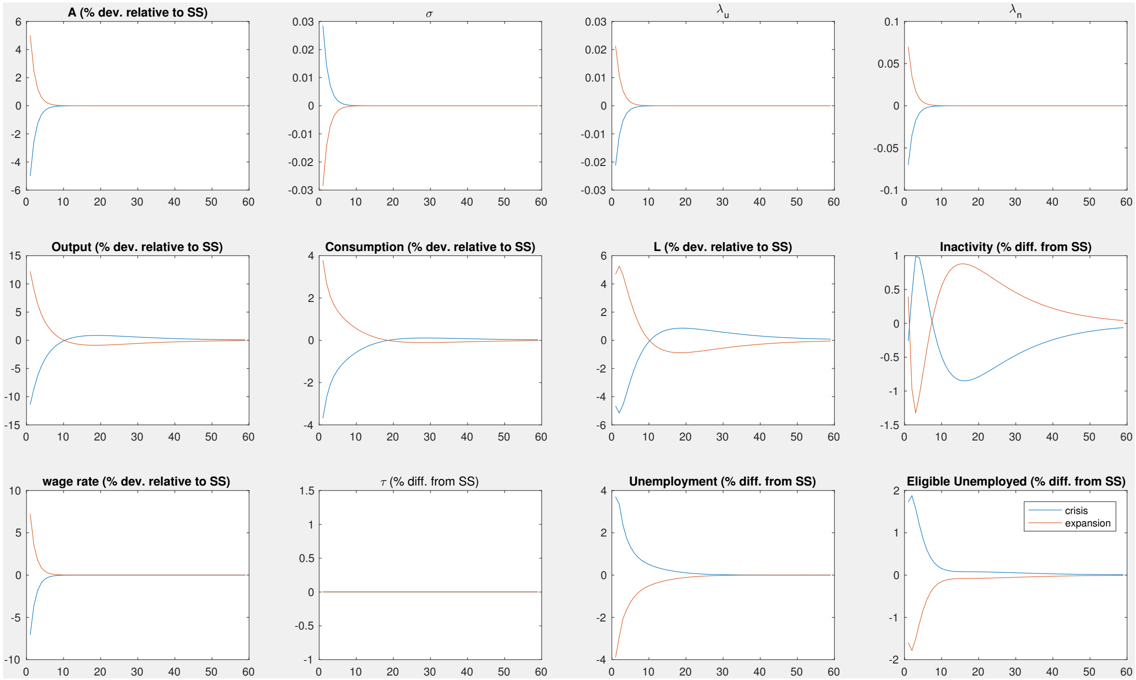

Figure 14: Transition Dynamics with the EUIM

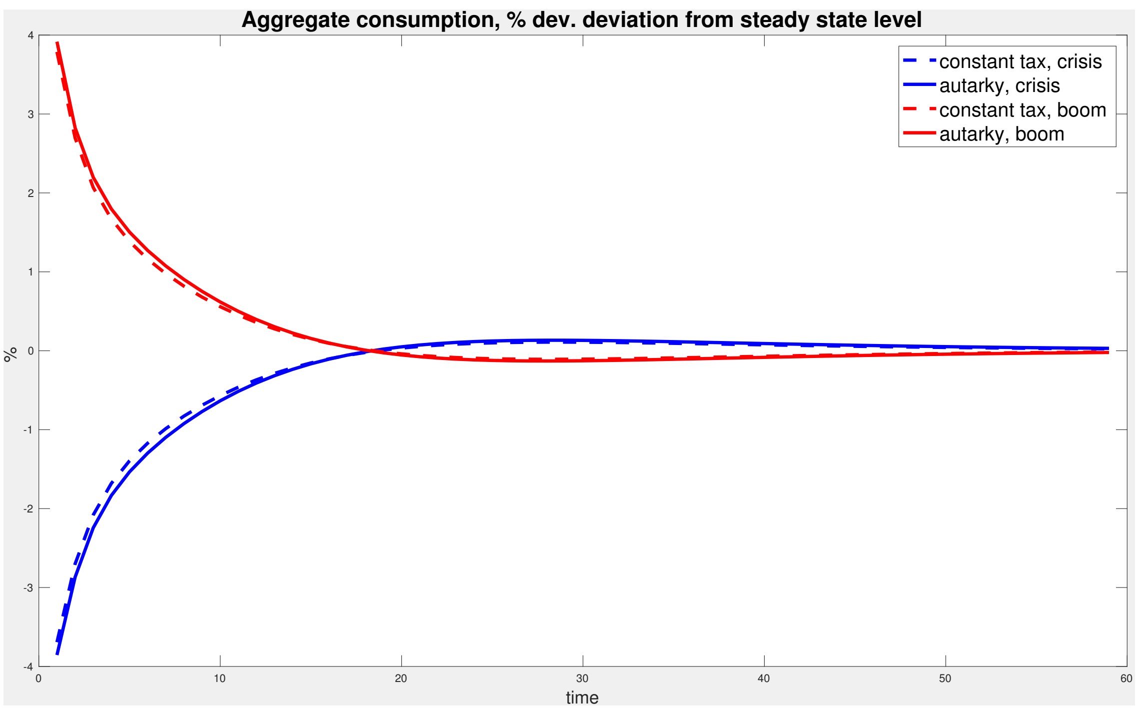

Figure 15: Aggregate Consumption Dynamics in Crisis and Boom

as it reduces expected consumption. The overall quantitative effects depends on the relative magnitude of the two effects.

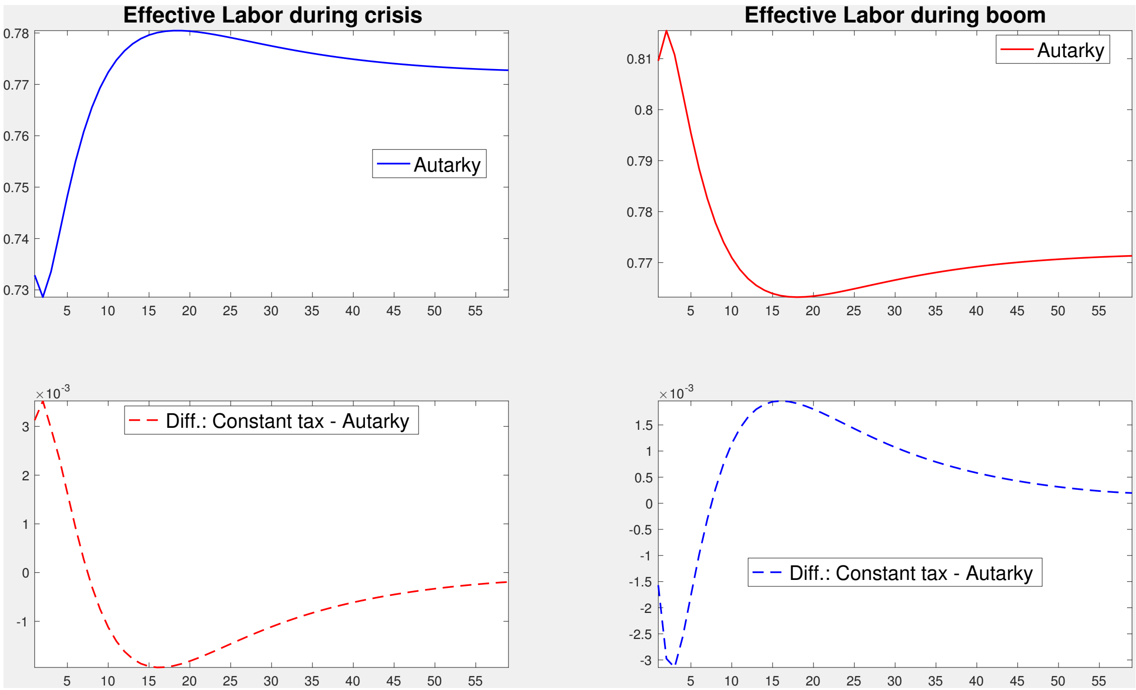

Figure 16: Aggregate Labour Dynamics in Crisis and Boom

Table 4 below provides the welfare calculation regarding the attractiveness of this limited version of EUIM for a number of countries.[7] We use two 'measures of welfare ': the average (utilitarian) consumption equivalent measure and the share of the population who gains by the introduction of the EUIM. Both measure shows that the introduction of the EUIM is welfare enhancing, that is the insurance gains are higher than the output losses.[8] at the same time, this reform would not be Pareto optimal in the sense that a (minority) fraction of population would prefer to stay in autarky. It is also clear from the Table 4 that the key beneficiary of this reform for most countries is the employed group as they are the ones who directly

[7]The set of countries chosen are well-covering the space of parameters described in Figures yy1 to YY2 in Section 3.3

[8]Note that this does not always hold. Under a previous calibration of the model, for some countries, the introduction of EUIM resulted in welfare losses as the insurance gains were dominated by the output losses.

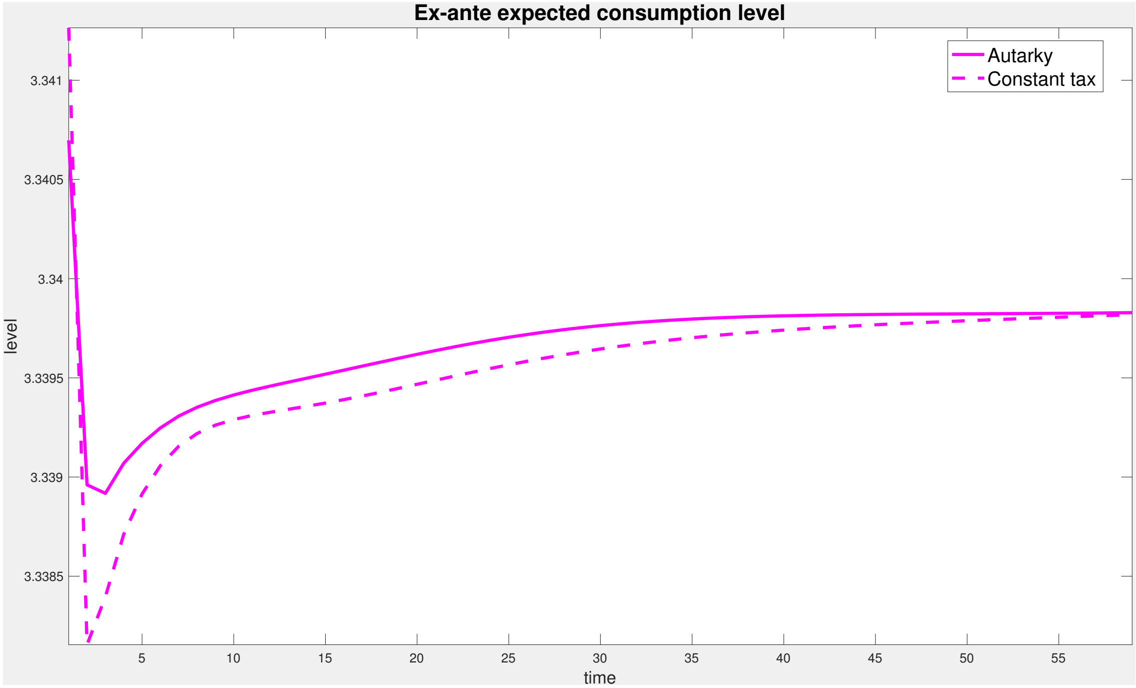

Figure 17: Expecetd Consumption Dynamics

benefit from the smoother taxes. In most countries, the unemployed and inactive are not in favour of the reform as it decreases the gains of getting a job in the boom through lower net wages although it increases the benefits of finding a job in a recession. In most cases, the first effect dominates as it is much more likely to find a job in the boom.

One obvious feature of these results is the very small magnitude of the average welfare gains. This is due to the fact that most welfare gains come from the small improvement of consumption smoothing for the employed. These small welfare gains imply that, if the introduction of this policy has some non-negligible costs, then it would not be socially optimal to introduce it.

4.1.2 Asymmetric Shocks

Consider now the case where the country learns that with probability p it will be hit by a negative shock, while with the remaining probability $1 - p$ it will stay in steady state. We again calculate the welfare gains and approval rates of entering a EUIM that insures against this shock in the sense that taxes can stay constant at a

Experiment 1: National level UB policy, fixed national tax during transition.

	Welfare gain**	Approval E*	Approval Ue*	Approval Une*	Approval I*	Approval Total*
Denmark	0,003%	88%	30%	20%	0%	62%
Spain	0,003%	93%	92%	100%	5%	64%
France	0,002%	91%	2%	39%	0%	64%
Italy	0,001%	90%	0%	9%	0%	61%
Netherlands	0,001%	87%	12%	6%	4%	66%
Poland	0,001%	98%	5%	51%	0%	72%
Portugal	0,002%	95%	29%	86%	0%	62%
Finland	0,002%	89%	2%	4%	0%	63%

** consumption equivalent, % of autarky consumption

* % population group/Total

Table 4: Welfare comparison and approval rates for EUIM, symmetric shocks

level such that in expectation the government budget clears.

Table 5 summarizes the welfare gains for the case of $p = 0.1$ for the same set of countries. By and large the same picture as with symmetric shocks emerges. In most countries approval and welfare gains tend to be slightly higher than with symmetric shocks. However, the gains are small even in this specification.

p=.10	Welfare gain**	Approval E*	Approval Ue*	Approval Une*	Approval I*	Approval Total*
Denmark	0,002%	100%	65%	79%	0%	70%
Spain	0,004%	100%	99%	100%	11%	66%
France	0,004%	100%	85%	100%	3%	73%
Italy	0,005%	100%	50%	99%	3%	70%
Netherlands	0,004%	100%	18%	19%	0%	76%
Poland	0,004%	100%	0%	0%	0%	78%
Portugal	0,004%	100%	100%	100%	16%	72%
Finland	0,002%	100%	4%	1%	0%	70%

** consumption equivalent, % of autarky consumption

* % population group/Total

Table 5: Welfare comparison and approval rates for EUIM, asymmetric shocks

4.2 Experiment 2: Common European Unemployment Taxes

In the second experiment, we consider a larger scale of the EUIM where the unemployment budget is joint in the sense that all member countries charge a constant European unemployment tax, τ^{EU}. At the same time, the parameters of the unemployment benefits remain at their country specific level. The transnational budget constraint that replaces the national budget constraints is given by

$$\tau^{EU} \sum_i P_i \omega_i \int z d\zeta_i(\xi, x = e) = \sum_i P_i \int b_i(z) I^B(\xi) d\zeta_i(\xi, x = u),$$

where i refers to a country i and P_i is the population of country i.

In practical terms, for this experiment, we need to solve for all countries simultaneously for a given tax rate and then iterate on the tax rate until the transnational budget constraint is satisfied. For this reason, we have only included a small set of countries that is contained in Table 6 at this point. In any case, we expect the same qualitative picture to emerge when all countries are included.

Table 6 contains the result for this reform. The first observation is that the European tax rate should be around 1.8 percent for this set of countries. The third column of the table contains the permanent transfers this reform would imply across countries. Note that the direction of transfers are determined by the size of the the unemployment budget. In particular, countries such that the European tax is higher than the tax under the national system will become the net financiers of the system, while countries for which the taxes decrease under the new system become net beneficiaries.

However, lower tax rates do not necessarily mean low unemployment: it can be also the signal of the low generosity of the unemployment system. For example, Poland is not a particularly low unemployment country but it has a very low replacement rate and expected duration, hence it is a net contributor to the joint budget. At the same time, Denmark and the Netherlands have low unemployment but a very generous system. For the latter reason, they become net beneficiaries of this reform. As we have noted in the previous subsection, (small) tax changes only have a limited effect on individual and aggregate behaviour. This implies that the welfare effects of these policies go hand in hand with the transfers: those countries

Experiment 2: National UB policy, common tax (joint budget): τ*U*

	τ (%)	τU (%)	Transfer (% gdp)	Welfare gain**	Approval Total*
Denmark	2.0%	1.8%	-0.11	0.12	100.0
Spain	2.9%	1.8%	-0.75	0.85	100.0
France	2.0%	1.8%	-0.13	0.16	100.0
Italy	1.3%	1.8%	0.33	-0.40	0.0
Netherlands	2.2%	1.8%	-0.29	0.36	100.0
Poland	0.3%	1.8%	1.05	-1.23	0.0
Portugal	1.6%	1.8%	0.16	-0.19	0.0
Finland	2.0%	1.8%	-0.11	0.15	100.0

**consumption equivalent, % of autarky consumption.

* % population group/Total

National policy

Policy reform

Table 6: Common EU tax financing national UI policies.

that receive net permanent transfers prefer this reform, while those who received negative permanent transfers are against it.

Here it is useful to note that we have computed welfare gains by comparing the steady state value functions, but using the autarchic distribution of agents. This is not an innocuous assumption as the distribution of agents across states may change after the reform. Using the initial distribution as the base of our welfare calculation is a way to minimise this potential bias. For future versions of the paper, we will compute the welfare gains to take into account the transitional dynamics between the two steady states.

Also notice that the size of the welfare effects is at a least magnitude higher than in the previous experiment and it is considerable. This implies that the welfare effects of these transfers will necessarily offset gains coming from insurance.[9]

Finally note that this reform does not only raises issues regarding redistribution

[9]Results available on request show that when we combine the two reforms, the transfer effect always dominates.

but also in terms of moral hazard and the country level. Given this policy, all countries would have incentives to raise the generosity of their UI system and try free-ride on financing coming from outside.

4.3 Experiment 3: Common European Unemployment Insurance Scheme

Our final experiment considers a fully integrated EUIM where not only the budget is common across the member countries, but also the replacement rate and the average duration. This implies the following transnational budget constraints.

$$\tau^{EU} \sum_i P_i \omega_i \int z d\zeta_i(\xi, x = e) = \sum_i P_i \int b(z) I^B(\xi) d\zeta_i(\xi, x = u).$$

This policy has a much stronger impact as it changes individual incentives for searching significantly. Moreover, and equally importantly for welfare calculations, the amount insurance agents receive for unemployment shocks changes also significantly. Table 7 contains the results regarding this experiment. The top panel of Table 7 contains the steady state proportion of agents in the different employment states, the tax rate and the replacement rates together with the expected duration of eligibility $(1/(1-\mu)$ for the same group of countries under autarky. The lower panel contains the same information for the EUIM scheme together with welfare comparisons.

First note, that as common policy we have used a relatively generous unemployment insurance scheme with $b_0 = 0.4$ and average duration of 6 quarters. This implies a European unemployment tax rate of 2.6 percent, that is higher than any national tax rate apart from the one in Spain. This does not imply negative transfers for all other countries, though. Portugal, even with the much higher tax, is a net beneficiary of the system. This is for two reasons. First, the unemployment benefit system becomes more generous; second, the unemployment rate increases in Portugal after the reform.

Another key feature of these comparisons is that, as opposed to the previous reforms, individual and aggregate behaviour changes significantly across countries. Most importantly, a more generous UI system increases the relative value of search

Experiment 3: Commom level UB policy, common tax (joint budget)

	E	U	I	τ (%)	b0	d
Denmark	73%	6%	21%	2.0%	0.44	7.9
Spain	53%	16%	31%	2.9%	0.18	7.8
France	74%	8%	18%	2.0%	0.33	7.9
Italy	71%	8%	21%	1.3%	0.41	2.6
Netherlands	80%	6%	14%	2.2%	0.72	3.3
Poland	74%	7%	19%	0.3%	0.17	2.0
Portugal	63%	10%	27%	1.6%	0.21	5.9
Finland	77%	7%	16%	2.0%	0.44	7.6

	E	U	I	τ U (%)	b0 U	d U	Transfer***	Welfare gain**
Denmark	72%	5%	23%	2.6%	0.36	5.6	1.08	-1.12
Spain	55%	19%	27%	2.6%	0.36	5.6	-3.28	3.51
France	73%	7%	19%	2.6%	0.36	5.6	0.44	-0.68
Italy	73%	9%	17%	2.6%	0.36	5.6	0.44	-0.42
Netherlands	80%	5%	15%	2.6%	0.36	5.6	1.24	-1.36
Poland	82%	9%	9%	2.6%	0.36	5.6	0.45	1.01
Portugal	65%	13%	22%	2.6%	0.36	5.6	-0.98	1.31
Finland	75%	6%	19%	2.6%	0.36	5.6	1.02	-1.26

*** % gdp

**consumption equivalent, % of autarky consumption.

Table 7: Labour markets and welfare consequences of UI policy reform.

increases compared to inactivity among those who are eligible. The increased duration also prolongs eligibility which on the one hand, increases the fiscal burden of unemployment insurance, but on the other hand increasing the probability of finding a job as $\lambda_u > \lambda_n$. Hence, for countries (Poland, Portugal, Spain, Italy) where generosity increases significantly we see more employment and less inactivity in the long run. Depending on the relative strength of these forces, we can have an increase or drop in unemployment. In none of these countries the push towards employment is powerful enough, hence both unemployment and employment rise. The opposite happens (to a less extent) for those countries where the UI system becomes less generous in at least one dimension.

All this implies that, now the transfers and the welfare gains do not necessarily have the same sign. In the current set of countries, it only happens for Poland. Poland turns out to be a net contributor to the new system, but still the utilitarian welfare gains are positive. The reason for this is that Poland manages to increase employment significantly with the reform. This does not only increase overall production and tax revenue but also increases welfare. At the same time, the reform increased the insurance against unemployment shocks as it made unemployment consumption higher. These forces are strong enough the counteract the negative transfer Poland has to contribute to the joint budget.

Table 8, shows the composition of the support for the reform in the different countries. In most countries, the whole population agrees on this issue. Two notable exceptions are Poland and Italy. In Poland, the generosity of the UI system increased significantly hence all eligible unemployed are in favour of the reform. Moreover ineligible unemployed and inactive agents are only affected directly through the better future insurance. As we pointed out Poland suffers an outflow of resources represented by a significant increase of taxes. It is going to hurt the employed as they pay the higher taxes. At the same time, they also benefit from the higher insurance in the future. Whether the first or second effect dominates depends on the disposable wealth of the agents. The other complex case is Italy, where the reform increases significantly the expected duration of eligibility. This provides much better insurance for unemployment and eligible unemployed agents will be in favour of this reform even if employment become less attractive because of increased taxes.

	Approval E*	Approval Ue*	Approval Une*	Approval I*	Approval Total*
Denmark	0.0	0.0	0.0	0.0	0.0
Spain	100.0	100.0	100.0	100.0	100.0
France	0.0	0.0	0.0	0.0	0.0
Italy	3.2	60.5	28.8	4.7	6.4
Netherlands	0.0	0.0	0.0	0.0	0.0
Poland	79.3	100.0	100.0	100.0	84.6
Portugal	100.0	100.0	100.0	100.0	100.0
Finland	0.0	0.0	0.0	0.0	0.0

* % population group/Total

Table 8: Approval rates.

Apart from this, countries with high ex post unemployment seem to benefit from this system and countries with low ex post unemployment (except Poland) will suffer from this system. Hence the transfer component is a key but not unique determinant of welfare gains. Moreover, in this case, welfare gains and losses are even larger than the previous case. This has two implications. First, in many countries the existing UI scheme may be far from being welfare-maximising and hence there is a scope of a reform at the country level. These reforms may deliver very different optimal policies as labor market institutions differ significantly across these countries. For the same reason, a common policy of this type leads to even higher transfers across countries than in the case of experiment 2. We study these issues in more detail in the next section.

5 Country specific 'optimal UI policies'

The previous sections illustrate the role of labour market institutions in shaping the economic implications of alternative UI policies in each countries. In this section, we characterise how an optimal UI policy (according to a precise definition presented below) depends on each countrys institutions, that influence average shares of employment and unemployment. In contrast to the small welfare effects of a risk sharing mechanism, as the one studied in section 4, national UI reforms can increase average consumption at the country level 2 or 3 order of magnitude higher compared to the gains associated with a EUIM calculated above.

As a first step, we provide the answer to the following question: what is the country level policy (parametrised by b_0, μ and τ) that maximizes an utilitarian welfare measure at the new steady state, relative to the status quo national policy? In the preliminar analysis presented here, we abstract from the welfare effects associated with the transition between the baseline policy and the new policy after the reform, comparing only aggregate utility across the two different steady states.[10] We follow the same criteria as in the previous Section, and weighted aggregate welfare according to the stationary distribution under the baseline scenario.

We solve the model for a (large) set of candidate reforms given by b_0 and μ,

[10]The analysis taking into account the effects of the transition between the two states is work in progress and will be included soon.

each implying a tax rate τ that balances the government budget. To each policy corresponds a stationary distribution over the state space of the model, and a utility value associated with each state. We compute the aggregate (average) value associated with each policy, using the utility function of each policy reform and stationary distribution implied by the baseline policy, and compare it with the equivalent measure given by the countrys baseline policy. Table 9 shows the difference between the two values (welfare gain, expressed in units of consumption), as well as the corresponding UI policies before and after the reform, and the implied changes in labour market outcomes for the group of countries under analysis. The result is remarkable: *all countries prefer having unlimited unemployment benefits and relatively similar replacement rates!*

Experiment 4: UB policy reform, country level.

	τ (%)	τ' (%)	b0	b0	d	d	Welfare gain* (%)
Denmark	1.7%	0.7%	0.44	0.35	7.9	∞	0.06%
Spain	2.3%	14.0%	0.18	0.30	7.8	∞	1.72%
France	1.7%	4.1%	0.33	0.35	7.9	∞	1.03%
Italy	1.2%	5.0%	0.41	0.35	2.6	∞	1.44%
Netherlands	2.4%	2.2%	0.72	0.40	3.3	∞	0.64%
Poland	0.2%	5.1%	0.17	0.40	2.0	∞	6.72%
Portugal	1.2%	7.0%	0.21	0.30	5.9	∞	1.56%
Finland	1.7%	1.0%	0.44	0.25	7.6	∞	0.02%

* consumption equivalent, % of autarky consumption.

National policy

Policy reform

Table 9: Optimal country level policy.

5.1 Analysis of Welfare Gains: France

We now want to analyse the sources of the welfare gains when moving from the current to the optimal policy. We illustrate these gains by the example of France.

Table 10 summarizes the benchmark policy and the optimal policy. The replacement rate is similar (33% and 30%) but the duration increases from around two years (8 quarters) to infinity.

	Tax Rate	Replacement Rate	Duration
Baseline	1.7%	33%	8
Reform	3.1%	30%	Inf

Table 10: UI Policies

The increase in the generousity of the system needs to be financed by higher taxes. The tax rate that finances unemployment benefits increases from 1.7% to 3.1%. One concern about unlimited duration of eligibility may be that it induces moral hazard regarding the acceptance of job offers. Indeed we observe that more job offers are rejected after the reform (see table 11). However the increase in the share of rejected offers is only minor.

Job Offer Rejections	Unemployed	Inactive
Baseline	1,94%	21,44%
Reform	2,17%	25,63%

Table 11: Job Offer Rejections

On the other hand the share of voluntary separations reduces substantially by over 20%. Quitting a job is less attractive as eligibility is more valuable when duration is unlimited.

	Voluntary Separations
baseline	59,74%
reform	37,32%

Table 12: Voluntary Separations

So what does the new policy imply in terms of how agents are distributed over the labour market states. In table 13 we see that unemployment increases only by a bit more than one percentage point while employment increases by more than 11 percentage points. The reason comes from a sharp decline in inactivity. Unlimited duration of eligibility induces more agents to actively search for a job and eventually find a job. The share of non eligible unemployed becomes negligible. It consists only of agents, who, after some time of inactivity, decide to start searching.

	Employed	Unemployed Eligible	Unemployed Non-Eligible	Inactive
Baseline	69,0%	3,7%	3,4%	23,9%
Reform	80,1%	8,3%	0,1%	10,5%

Table 13: Employment States

It turns out that after the reform the average productivity of employed is lower. While employment increases by around 16%, effective labour increases only by around 14%. This is natural as the agents who are at the margin between employment and non-employment are not the most productive ones.

Naturally the average duration of unemployment spell increases. On average agents are unemployed for a bit more than 2 quarters in the benchmark, while it is almost 4 quarters after the reform. This has two reasons. On the negative side less offers are accepted, on the positive one fewer agents transit into inactivity.

Finally savings decrease by almost half. The reason is simply that in the benchmark savings partially serve as insurance against the risk of losing eligibility while with unlimited duration this becomes unnecessary.

6 The quest for an optimal EUIM

Our 'quest for an optimal EUIM' is work in progress. We ask a similar question as in the previous section, regarding a common UI scheme (b_0, μ) and a country specific τ that maximizes welfare across all countries. In this setting, different tax rates reflect how costly it is in a given country to finance the "UI-optimal" system, and are influenced by country specific labour market institutions (given common preferences and technology parameters). As a first step, motivated by the remarkably similar national optimal UI policies, we compute the welfare gains associated with the implementation of a UI policy that is a simple average of the optimal national policies (in terms of replacement rates and average duration). The result is displayed in the table 14. Three remarks are in order. First, that an optimisation - which is work in progress - over the set of combinations b_0, μ may deliver weakly higher welfare gains relative to those contained in the table 14; second, that as it has already mentioned in the Introduction, our welfare measures may change when we will account for transitional dynamics and compute endogenous interest rates, and third, than even if we report welfare gains (i.e. the average utilitarian consumption-equivalent value) and acceptance rates, other values may also be relevant (for example that the Spanish approval is not supported by the employed who face a very high payroll tax with the reform).

Experiment 5: common UB policy reform, country level.

	τ (%)	τ' (%)	b0	b0	d	d	Welfare gain* (%)
Denmark	1.93%	**1.33%**	0.44	**0.33**	7.88	∞	**-0.08%**
Spain	2.89%	**17.01%**	0.18	**0.33**	7.80	∞	**0.88%**
France	1.96%	**3.47%**	0.33	**0.33**	7.88	∞	**1.00%**
Italy	1.32%	**4.37%**	0.41	**0.33**	2.58	∞	**1.37%**
Netherlands	2.21%	**1.18%**	0.72	**0.33**	3.26	∞	**0.14%**
Poland	0.29%	**4.06%**	0.17	**0.33**	1.97	∞	**5.51%**
Portugal	1.57%	**8.01%**	0.21	**0.33**	5.91	∞	**1.47%**
Finland	1.96%	**1.71%**	0.44	**0.33**	7.58	∞	**0.47%**

Baseline policy
Better EU policy
* consumption equivalent, % of autarky consumption.

Table 14: Welfare improving EU-UI policy.

	Approval E*	Approval Ue*	Approval Une*	Approval I*	Approval Total*
Denmark	21.5	36.8	22.9	3.4	17.6
Spain	38.2	99.0	98.5	72.4	58.6
France	97.3	100.0	100.0	100.0	98.1
Italy	74.4	99.4	99.9	99.9	82.8
Netherlands	57.0	39.1	73.5	40.4	54.2
Poland	100.0	100.0	100.0	100.0	100.0
Portugal	52.7	100.0	100.0	94.6	70.1
Finland	100.0	76.9	100.0	100.0	99.3

* % population group/Total

Table 15: Approval rates.

7 Conclusions on work in progress

This is the first paper of a larger research project aimed at assessing the value of an European Unemployment Insurance Mechanism (EUIM) and, in particular, how it should be designed as a constrained efficient mechanism. We take as a constraint the current labour market institutions (contacts, regulations, etc.) which determine differences in job creation and destruction, as well as offers received by the unemployed (searching for a job) and the inactive (not actively searching). Nevertheless, our work provides a quantitative proof of the potential gains that market reforms – not just labour market reforms – can achieve in many European countries. In fact, the first contribution of this paper is to provide a novel diagnosis of European labour markets. The second, which is almost a corollary of the first, is to show quantitatively that country-specific structural parameters play a determinant role in explaining the different performance of labour markets across the EU and, as a result, the relative benefits of joining an EU-based Unemployment Insurance scheme.

We only consider – for the moment – a basic design that an EUIM can take. As with most existing UI systems, we design it as a universal system for the participating country, or countries, (i.e. as rights for the eligible unemployed and tax duties for the employed), and as a system that is suitable for parameterisation by the unemployment replacement rate and the expected duration of the unemployment benefits. We also consider that UI systems must be balanced, which is the right assumption at the steady state but may be relaxed when analysing transitional dynamics.

Our third contribution is a first set of experiments (the result of a long process of calibration and trial experiments) which already shed light in our enquire. First, once equilibrium effects, with a balanced budget, are taken into account, the gains from pure risk-sharing (i.e. absent transnational transfers or UI reforms) are very limited and, in general (i.e. always in our experiments) do not represent a Pareto improvement; that is, they do not represent an *ex-ante* improvement for all, the reason being that insurance gains typically result in output losses. Second, if countries share risks but maintain their UI policies, the benefits (and losses) are mostly due to positive (negative) transnational transfers, not necessarily from low to high unemployment countries. These transfers could be corrected by having differential fixed tax rates, but then there will not be any gain at the steady state and, as we have seen, minimal gains, if any, in transitional periods. A more substantial reform, also involving a common Unemployment Benefit system, produces higher gains and losses, but interestingly is not associated one-to-one with positive, and negative, transfers.

The final contribution of this paper is to show that substantial welfare gains can be achieved by reforming the existing UI systems within European countries. Even if, as we document, labour markets are very different, almost surprisingly the (parameterised) UI systems that maximise welfare – and have higher approval rates – taking the original steady-state distributions as the reference populations of the countries, are very similar: unemployment benefits duration should be unlimited and replacement rates more similar across countries than what they are now (close to 30%). These similar policies result in higher employment and lower private savings, since with unlimited unemployment benefits there is less need for precautionary savings. As a first exercise on our 'quest for an optimal EUIM' we have seen that an EUIM with unlimited unemployment benefits and an average replacement rate (among a set of eight EU countries: 33%) will be supported by all but one (Denmark!). These results must be taken with a grain of salt, since we need to estimate the transitional dynamics and also compute an endogenous interest rate (i.e. the EU as a closed economy) as a benchmark, but they point out in which direction a EUIM should be designed to be constrained efficient. Furthermore, we can also use our calibrated economies to study EUIM alternatives which remove some of the self-imposed UI design constraints. It is, in this sense, that ours is work in progress...

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