Euro area unemployment insurance at the time of zero nominal interest rates

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Abstract

The discussion about a fiscal stabilisation capacity as a way of providing more fiscal integration in the euro area has strengthened in the aftermath of the European sovereign debt crisis. Among the instruments that can be used for temporary macroeconomic stabilisation in the presence of both asymmetric and area-wide shocks, a euro area unemployment insurance scheme has attracted increased attention. We build a two-region DSGE model with supply, demand and labour market frictions as well as a zero lower bound contraint on monetary policy, and introduce in it an area-wide unemployment insurance scheme that is entitled to borrow in financial markets. The model is calibrated to the euro area core and periphery data. For a country-specific negative demand shock hitting the periphery, we find the scheme to reduce the drop in Periphery and union output by about one fifth. Output variability is also reduced, but the results depend crucially on the share of households who are cut from financial markets.

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1 Introduction

The euro area sovereign debt crisis has exposed important gaps in the architecture of the Economic and Monetary Union. The introduction of the euro did not lead to moderation of country-specific shocks and national fiscal policies in many countries remained excessively pro-cyclical, not providing sufficient fiscal buffers against country-specific shocks. In addition, the doom loop between banks and their sovereigns, together with strong financial linkages across countries, allowed country-specific shocks to turn into systemic ones. Considerable cross-country spillovers and contagion from country-specific shocks and policies underlined the lack of sufficient risk-sharing mechanisms, both private and public, in the euro area.

In a monetary union where member countries give up independent monetary policy and irrevocably fix the nominal exchange rates vis-à-vis the other members, macroeconomic adjustment toolkit shrinks and other channels to mitigate crises become necessary to replace the missing policy instruments. Since the cross-border labour mobility remains low, private risk sharing in Europe usually takes place through cross-border flows of capital and credit. International capital flows lead to more geographically diversified portfolios that are less correlated with domestic income, while cross-border credit flows facilitate consumption smoothing in the aftermath of a country-specific shock. Despite recent progress with the banking and capital markets unions, financial intermediation in Europe is primarily bank based and financial markets remain fragmented along national lines. As a result of this fragmentation, the level of private risk-sharing compared to federations like the United States, Canada or Germany tends to be considerably lower and biased towards domestic credit, rather than capital flows (Allard et al., 2013). Moreover, the risk sharing through the bank lending channel tends to break down in period of crisis, exactly when needed the most (Furceri and Zdzienicka, 2015).

Public risk sharing, which usually takes place through taxes and transfers, is virtually non-existent at the euro area and the EU level. Federal states typically allocate significant resources at the federal level, with regional spending just below 50% of the total (and some 75% in Canada). In comparison, the EU budget represents some 2% of member states total

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expenditure, while the ESM's lending capacity of EUR 500 billion represents about 10% of the euro area countries' combined budgets. These tools are much smaller than usual in federations and neither of them is specifically meant for macroeconomic stabilisation.

At the European level, a common fiscal stabilisation capacity may address both asymmetric and area-wide shocks. For country-specific shocks, the national budget stabilisers may be constrained by the lack of fiscal space or high marginal borrowing costs. Although area-wide shocks could, in principle, be stabilised through a more accommodative monetary policy stance, monetary policy can usefully be complemented by fiscal policy, especially at the zero-lower bound. Moreover, weak economic growth in the euro area and especially the weak inflation suggests that nominal interest rates may stay close to zero for a prolonged period of time. Similarly, the global neutral rate may remain low, perhaps around 1%, in the medium to long term, reflecting wide-ranging shifts in saving and investment preferences, and making monetary policy more frequently constrained by the zero lower bound (Rachel and Smith, 2017).

The idea of complementing the monetary union in Europe with some form of fiscal federalism can be traced back to the MacDougall Report suggesting a community budget of 2-2.5% of GDP and other measures, including a common unemployment fund going a small part of the way towards creating a situation, in which monetary union could be sustained (MacDougall (1977), p.13). More recently, the Five Presidents Report highlighted the key characteristics for such a scheme: it should not lead to permanent transfers between countries, it should not undermine the incentives for sound fiscal policy-making at the national level, it should be consistent with the existing EU fiscal framework and it should not be an instrument for crisis management.[1] The fiscal stabilisation instrument would help increase the resilience of the euro area and make future interventions by the ESM less likely.

Our paper contributes to the literature by explicitly modeling the stabilisation gains from a euro area unemployment insurance scheme when nominal interest rates are at zero. In normal times, the European Central Bank reacts to the area-wide inflation rate, so its

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[1]See Juncker et al. (2015).

reaction is not strong enough to fully offset an asymmetric demand shock in a given country. At the zero lower bound, the amount of stabilisation that monetary policy can deliver is reduced further, as the central bank cannot decrease the area-wide nominal interest rate below zero. With constrained monetary policy, additional fiscal integration is likely to improve macroeconomic outcomes.

More specifically, the present paper assesses whether a euro area unemployment insurance scheme can improve stabilisation in the presence of asymmetric shocks. We build a two-country general equilibrium model (Core and Periphery) with job market frictions along the lines of Claveres and Clemens (2017) and calibrate it to match the most important macroeconomic characteristics of the euro area. We then simulate three scenarios: one without the constraint on monetary policy and without transfers, a second one where we introduce the ZLB constraint, and finally a third where we implement both the ZLB and the transfers. Our results suggest that the unemployment insurance could mitigate about a fifth of the crisis in the Periphery: for a shock that would bring its GDP down by -1.85% compared to the steady-state, at the ZLB, transfers would limit the recession to -1.65% only. When the shock hits, transfers received would amount to about 1.2% of GDP. Combined with stabilization also happening in the Core, the fall in union output would be reduced from -0.54% to -0.35% of GDP. Since the model incorporates considerable Ricardian equivalence effects, as only a small fraction of Periphery households are cut from financial markets, the effectiveness of the unemployment benefit transfers is reduced, raising the issue of interaction between the unemployment insurance scheme and policies aimed at reducing financial frictions.

The rest of the paper is structured as follows: Section 2 reviews the literature on risk sharing in a monetary union, the propagation of macroeconomic shocks at the zero lower bound and on unemployment insurance. Section 3 gives a summary of the main building blocks of the model and Section 4 discusses models calibration. Section 5 provides the results of model simulations and discusses the stabilisation gains from the common unemployment benefits scheme. Section 6 outlines several avenues for future work and concludes.

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2 Related literature

Joining a monetary union brings both benefits, such as reduction in trade costs and elimination of exchange rate risk, and costs, mainly in terms of imperfect macroeconomic stabilisation (Mundell, 1961; Kenen, 1969), while the cost-benefit assessment of a shared currency may be endogenous to the past steps toward economic integration (Frankel and Rose, 1998). Although the degree of business cycle synchronisation may increase as the track record of economic integration lengthens, the loss of independent monetary policy and nominal exchange rate flexibility is likely to be costly even after a long period of trade integration, especially if not accompanied by increased labour mobility and other risk sharing mechanisms (Bayoumi et al., 1994).

The literature on risk sharing usually distinguishes between public risk sharing in the form of taxes and transfers, and private risk sharing, either in the form of cross-border borrowing and lending (savings channel) or international portfolio diversification (capital market channel). The empirical studies of the risk sharing channels in federal systems show important heterogeneity among countries. For the United States, Asdrubali et al. (1996) find that between 1963 and 1990 some 75% of the shocks to per capita state gross product are smoothed, mainly through capital and credit markets, at 39% and 23% respectively, while fiscal transfers from the federal budget only smooth out 13% of the output shocks. In Europe, less than a half of the GDP shocks between 1966 and 1990 were smoothed, roughly one half by fiscal transfers and another half by private savings (Sørensen and Yosha, 1998). Further studies of European Union countries confirmed that only 30% to 40% of GDP shocks are smoothed, mainly by social benefits (Afonso and Furceri, 2008). If anything, risk sharing in the euro area seems to have deteriorated in the aftermath of the financial crisis when more than 70% of shocks remained unsmoothed (Milano and Reichlin, 2017; ECB, 2017). On the other hand, the financial assistance instruments introduced during the European sovereign debt crisis probably increased the euro areas risk sharing capacity (Cimadomo et al., 2017).

The importance of public risk sharing channels, such as a common fiscal stabilisation function, is still being disputed but the arguments in support seem stronger in a monetary

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union. Private risk sharing may not be sufficient when agents insufficiently internalise the social benefits from international risk sharing, while the reality of incomplete financial markets makes the case for public risk sharing arrangement even stronger (Farhi and Werning, 2017). A similar rationale for a common fiscal instrument is the existence of spill-overs from fiscal policy in one country to other countries in a monetary union (Alcidi et al., 2016).

European unemployment insurance system as a cross-country temporary transfer scheme has been given increased attention (Dullien, 2014; Beblavỳ et al., 2017). Unemployment benefits can be effective at upholding consumption as they quickly replace lost income and react shiftly to the cycle, and they also target households with a high propensity to consume. In the case of asymmetric shocks, governments may become liquidity constrained or face spiking marginal borrowing costs in times of sovereign stress. Furthermore, the current system of European fiscal rules does not provide strong incentives to cut deficits or, as in case of Ireland and Spain, to sustain large surpluses in good times (Dullien, 2017). According to Allard et al. (2013), with pay-outs limited to asymmetric temporary shocks to GDP, a euro area rainy-day stabilisation fund created in 1999 could have raised the overall level of income shock smoothing to 80% (roughly, the level in Germany), at the cost of annual contributions ranging from 1.5 to 2.5% of GNP. Moreover, in the case of common negative shocks, the stabilisation properties of the unemployment insurance scheme may usefully be enhanced by the ability to issue debt. An unemployment insurance scheme with borrowing capacity and annual average total payments of 0.1% of euro area GDP can provide smoothing of shocks comparable to that provided by federal budgets (Carnot et al., 2017).

As far as they have implications for price stability, common shocks in a monetary union would normally, be stabilised by monetary policy. However, in periods when it is constrained by the zero lower bound, coordinated fiscal support may be an important part of the policy mix. Even if unconventional monetary policy provides additional accommodation, the effectiveness of unconventional measures may be limited and have distributional consequences (Orphanides, 2017). Fiscal policy measures that stimulate aggregate demand, such as a temporary increase in government spending, are associated with higher multipliers

in recession and at the zero lower bound (Auerbach and Gorodnichenko, 2012; Eggertsson, 2011), although the magnitude of the effect seems to be reduced when the expectations about monetary policy are more forward-looking (Swanson and Williams, 2014; Hills and Nakata, 2014).

In general, the unemployment scheme faces a trade-off between the provision of insurance and negative effects on incentives. In a dynamic setting, benefits should be decreasing with the length of the unemployment spell (Hopenhayn and Nicolini, 2009) and be countercyclical, as the moral hazard costs of insurance tend to be lower in times of high unemployment (Kroft and Notowidigdo, 2011). With direct relevance for our paper, the presence of the zero lower bound constraint seems to modify the labour market dynamics (Albertini and Poirier, 2015). The inflationary pressure induced by the extension of unemployment benefits in the U.S. in 2008 when nominal interest rates were close to zero, has reduced the real interest rate and partly offset the negative job search and matching effects from higher wages, resulting in reduced unemployment rate. Outside the ZLB, extending the ZLB has an adverse effect on unemployment.

3   Model

The model for quantitative analysis is built as a simple general equilibrium set-up with price and labour market frictions. The economy consists in a two-country monetary union: we label the first country the Core and the second the Periphery. Both countries have the same structure and only differ by the value of their parameters, so we only derive equations for the Core economy and label Periphery variables or parameters with a star when needed. Each is inhabited by a continuum of households with some having access to financial markets and others not, by final and intermediate-sector firms, and by a government in the form of an unemployment agency. Monetary policy is set by a common central bank, with a zero lower bound constraint. We add to this standard modelization a supra-national entity in the form of a European unemployment insurance scheme. Variables related to the supranational layer are labelled with an e.

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3.1 Labor markets

Workers flow in and out of unemployment, with labour markets being subject to search and matching frictions à la Mortensen and Pissarides (1999). As both household types, defined below, face the same probability of being hired (firms do not discriminate across household types), we do not need to specify household-specific labour market variables. In period t, firms post vacancies v_t at a cost and all workers who ended the last period unemployed u_{t-1} search for a job. Firms and searching workers are matched according to the following Cobb-Douglas matching function:

$$m_t = \kappa^m \, u_{t-1}^{\eta} \, (v_t)^{1-\eta} \tag{1}$$

where $0 < \kappa^m < 1$ represents the matching efficiency and $0 < \eta < 1$ denotes the matching elasticity with respect to unemployment.

Normalizing total labour force to one, the employment rate at the end of period t is equal to $n_t = 1 - u_t$. We assume for simplicity constant search effort, fixed number of working hours and no discouraged workers. Defining labour market tightness as $\theta_t = \dfrac{v_t}{u_{t-1}}$, the job finding rate for workers writes $f_t = \dfrac{m_t}{u_{t-1}} = \kappa^m \theta_t^{1-\eta}$ and the vacancy filling rate for firms writes $q_t = \dfrac{m_t}{v_t} = \kappa^m \theta_t^{-\eta}$.

Finally, workers are separated each period at the exogenous rate $0 < s < 1$. It follows that the number of employed workers in period t is equal to those employed at the end of last period, minus those who are separated, plus the new matches for the current period. Hence the law of motion for employment writes:

$$n_t = (1 - s)n_{t-1} + m_t, \tag{2}$$

3.2 Households

The Core and the Periphery are inhabited by a mass ω and $1-\omega$ of households respectively, with $0 < \omega < 1$, so that the total size of the union is normalized to one.

Households derive utility from the consumption of a basket of domestic and foreign-produced goods with a degree of home bias. In line with the large family approach, each household is made of a continuum of members, either employed or unemployed, who pool their income to self-insure against unemployment risk. Following Galí et al. (2007), a fraction $\mu \in [0,1]$ of these households, labelled with an r for "Rule-of-thumb", is cut from financial markets and cannot trade in bonds to smooth consumption. The other fraction $(1-\mu) \in [0,1]$ is made of households able to save and borrow for consumption-smoothing purposes, labelled with an o for Optimizers. Hence, there exists some private risk-sharing between the two countries, through trade in goods and bonds.

Each optimizing household maximizes the following lifetime utility by choosing a sequence $\{c_t^o, H_t\}_{t=0}^{\infty}$, where c_t^o and H_t^o denote per optimizing household consumption and holdings of nominal bonds respectively:

$$E_0 \sum_{t=0}^{\infty} \left(\prod_{i=0}^{t} \beta_i \right) \frac{(c_t^o)^{1-\gamma}}{1-\gamma} \tag{3}$$

subject to the following budget constraint written in real terms:

$$c_t^o + \frac{H_t}{P_t} = (1 + i_{t-1}) \frac{H_{t-1}}{P_t} + w_t n_t + b u_t + \frac{Tr_t}{P_t} - \tau_t + \Delta_t^o \tag{4}$$

where β_i represents the discount factor, β in the steady-state, and E_0 the expectation operator at time t. i_t is the nominal union-wide interest rate set by the central bank, and P_t the Core consumer price index (CPI). Among the household members, n_t employed receive real wage w_t from their supply of labour in the production process while u_t unemployed at the end of t receive real unemployment benefits b. We only consider a constant benefit policy so thatreal per unemployed benefits are treated as a parameter. Moreover, optimizing households receive real profits Δ_t^o as they own the firms, and they also pay lump-sum taxes τ_t. Finally, they receive nominal transfers from the European unemployment insurance scheme, $Tr_t(u_t)$ defined below.

Members of Rule-of-thumb households also pool their income, but they do not have access to financial market to insure themselves against shocks. They just consumes their current disposable income, made of wage and unemployment benefits net of taxes, plus

transfers. Hence per RoT household consumption c_t^r follows the budget constraint:

$$c_t^r = w_t n_t + b u_t - \tau_t + T r_t \tag{5}$$

Consumption consists in a basket of final Core and Periphery-produced goods, taking the form of CES aggregate of imperfect substitutes:

$$c_t^i = \left[\Psi (c_t^{i,c})^\sigma + (1 - \Psi)(c_t^{i,p})^\sigma \right]^{\frac{1}{\sigma}} \tag{6}$$

with $i \in o, r$ where $(c_t^{i,c})$ and $(c_t^{i,p})$ denote consumption of final Core and Periphery goods respectively by Core households, $0 < \Psi < 1$ the degree of home bias (the relative valuation of Core products for the Core consumption basket) and $\sigma > 0$ the inverse elasticity of substitution between Core and Periphery goods. Expressions for CPI as well as consumption shares in the basket read:

$$P_t = \left[\Psi^{\frac{1}{1-\sigma}} (p_t^c)^{-\frac{\sigma}{1-\sigma}} + (1 - \Psi)^{\frac{1}{1-\sigma}} (p_t^p)^{-\frac{\sigma}{1-\sigma}} \right]^{-\frac{1-\sigma}{\sigma}} \tag{7}$$

$$\frac{c_t^{i,c}}{c_t} = \Psi^{\frac{1}{1-\sigma}} \left(\frac{p_t^c}{P_t} \right)^{-\frac{1}{1-\sigma}} \tag{8}$$

$$\frac{c_t^{i,p}}{c_t} = (1 - \Psi)^{\frac{1}{1-\sigma}} \left(\frac{p_t^p}{P_t} \right)^{-\frac{1}{1-\sigma}} \tag{9}$$

where p_t^c and p_t^p are the prices of the final Core and Periphery goods respectively.

At optimum, optimizing household consumption is determined by the following Euler equation:

$$\lambda_t^o = (1 + i_t) E_t \beta_{t+1} \frac{\lambda_{t+1}^o}{\Pi_{t+1}} \tag{10}$$

where $\Pi_{t+1} = \frac{P_t}{P_{t-1}}$ is the gross rate of CPI inflation and $\lambda_t^o = (c_t^o)^{-\sigma}$ the marginal utility for optimizing households. Similarly, marginal utility for RoT consumers writes $\lambda_t^r = (c_t^r)^{-\sigma}$.

Finally, we can write the marginal value of having an unemployed member turning employed (hence the marginal value of a match for the worker) in type-i household as:

$$W_t^i = w_t - b + E_t \beta_{t+1} \frac{\lambda_{t+1}^i}{\lambda_t^i} (1 - s - f_{t+1}) W_{t+1}^i \tag{11}$$

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which is the equivalent to the real wage net of unemployment benefits that this member is no longer eligible to, plus a continuation value (that same marginal value of a match discounted and corrected for s in case the match separates and for f_{t+1} since the same match cannot be formed next period).

3.3 Firms

The production side comprises an intermediate and a final good sector. A representative firm in the final good sector operates a frictionless technology by bundling a variety of intermediate products, so that final good production follows:

$$y_t = \left(\int_0^1 y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}} \tag{12}$$

where $y_t(j)$ represents the demand for intermediate input from firm j in the intermediate sector, and $\epsilon > 1$ the elasticity of substitution between these intermediate inputs. All input are domestic without trade in intermediate goods. The maximization problem of the final good firm yields the relative demand for input j as well as the final good price as functions of intermediate price Core input $p_t(j)$:

$$\frac{y_t(j)}{y_t} = \left(\frac{p_t(j)}{p_t^c} \right)^{-\epsilon} \tag{13}$$

$$p_t^c = \int_0^1 p_t(j)^{1-\epsilon} dj \tag{14}$$

Firms in the intermediate sector use labour as input for production with the same productivity a_t following:

$$y_t(j) = a_t n_t(j) \tag{15}$$

They face vacancy costs when they search for workers and quadratic price adjustment costs as in Rotemberg (1982), so that their profit function reads in real terms:

$$\Delta_t(j) = \frac{p_t(j)}{p_t^c} y_t(j) - w_t n_t(j) - \kappa^v v_t(j) - \Phi_t^\pi(j) \tag{16}$$

where $\Phi_t^\pi(j) = \frac{\kappa^\pi}{2} \left(\frac{p_t(j)}{p_{t-1}(j)-1} \right)^2 y_t(j)$ represents the real Rotemberg price costs, with $0 < \kappa^v < 1$ and $0 < \kappa^\pi < 1$ vacancy and price cost parameters. Intermediate firms choose employment, vacancies and prices so as to maximize their profits (16), taking into account the

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employment law of motion (2), the relative input demand function (13) and the production function (15). Maximization implies that at optimum firms post vacancies according to the following job creation condition:

$$\frac{\kappa^v}{q_t} = a_t mc_t - w_t + (1-s)E_t \beta_{t+1} \frac{\lambda^o_{t+1}}{\lambda^o_t} \frac{\kappa^v}{q_{t+1}} \qquad (17)$$

where mc_t denotes the Lagrange multiplier on equation (13) in the program, in other words the marginal costs of the firms. According to this condition, at equilibrium, firms post vacancies until the current marginal cost of a vacancy equals its marginal benefit, comprised of the marginal product net of wage, plus a continuation value (that same cost one period ahead, discounted, provided the match does not separate). We also obtain the following New-Keynesian Philipps curve which links current inflation to expectations of future inflation and output growth:

$$mc_t = \frac{\epsilon - 1}{\epsilon} + \frac{\kappa^\pi}{\epsilon} \pi^c_t (\pi^c_t - 1) - \frac{\kappa^\pi}{\epsilon} E_t \beta_{t+1} \frac{\lambda^o_{t+1}}{\lambda^o_t} \pi^c_{t+1} (\pi^c_{t+1} - 1) \frac{y_{t+1}}{y_t} \qquad (18)$$

where $\pi^c_t = \dfrac{p^c_t}{p^c_{t-1}}$ is the gross rate of inflation for Core product price. Note that we have dropped the j subscripts after the maximization as all intermediate firms are identical, and we can also write $n_t = \int_0^1 n_t(j)dj$ and $v_t = \int_0^1 v_t(j)dj$. Terms in last two equations stemming from the firms maximization problem are discounted with optimizing households marginal utility as they own the firms.

3.4   Wage

The equilibrium wage is determined through a Nash-bargaining process, in which workers and firms share the marginal surplus of a match depending on worker bargaining power $0 < \zeta < 1$. The optimal split yields the following wage schedule:

$$w_t = \zeta \left[a_t mc_t + (1-s)E_t \beta_{t+1} \frac{\lambda^o_{t+1}}{\lambda^o_t} \frac{\kappa^v}{q_{t+1}} \right] +$$
$$(1-\zeta) \left[b - E_t \beta_{t+1}(1-s-f_{t+1}) \left(\mu \frac{\lambda^r_{t+1}}{\lambda^r_t} W^r_{t+1} + (1-\mu) \frac{\lambda^o_{t+1}}{\lambda^o_t} W^o_{t+1} \right) \right] \qquad (19)$$

According to this rule, for the supply of labour, the worker obtains a share of the firms surplus from a match and a share of an outside option (unemployment benefits net of

the average marginal utility of becoming employed). However, following Hall (2003), we introduce some real wage rigidity to better reproduce cyclical variations in employment and vacancies, addressing a typical issue of search and matching models known as the Shimer puzzle (Shimer, 2005). Real wage in our model follows instead a weighted average of w_t and its steady-state value $\bar{w}$, with a wage rigidity parameter $0 < \upsilon < 1$:

$$\tilde{w}_t = \upsilon w_t + (1 - \upsilon)\bar{w} \tag{20}$$

3.5 Governments

In each country, a national government levies lump-sum taxes on households τ_t and issues nominal debt D_t to finance unemployment benefits. We assume that it does not incur other expenditure than these benefits b, and it also rebates price adjustment costs of the firms to neutralize their business cycle effects. Hence government budget constraint follows in real terms:

$$\tau_t + \frac{D_t}{P_t} = (1 + i_{t-1})\frac{D_{t-1}}{P_t} + bu_t - (1 - \mu)\Phi_t^\pi(j) \tag{21}$$

The national tax rule comprises a counter-cyclical and a debt stabilization component:

$$\tau_t - \bar{\tau} = \phi^y(y_t - \bar{y}) + \phi^d\left(\frac{D_t}{P_t} - \frac{\bar{D}}{\bar{P}}\right) \tag{22}$$

where variables with an upper bar denote steady-state levels and ϕ^y, ϕ^d are policy parameters.

On top of national governments, a European fund organizes per-capita transfers (Tr_t, Tr_t^*) (which can be negative). Real transfers flowing from the European fund are pinned down to changes in unemployment:

$$\frac{Tr_t}{P_t y_t} = \phi^{stab}(u_t - \bar{u}) - \phi^{de}\left(\frac{D_t^e}{P_t} - \frac{\bar{D}^e}{\bar{P}}\right) \tag{23}$$

with $0 < \phi^{stab} < 1$ representing a policy parameter for the stabilization delivered by the scheme. The higher this parameter, the higher the transfers when unemployment deviates from its steady-state value. The rule above also comprises a debt stabilization component scaled by $0 < \phi^{de} < 1$ for the debt that the scheme issues D_t^e, to finance these transfers.

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The budget constraint for the European fund writes in nominal terms:

$$D_t^e = (1 + i_{t-1})D_{t-1}^e + \omega Tr_t + (1 - \omega)Tr_t^*$$ (24)

Finally, the central bank sets the interest rate according a standard Taylor rule, although bounded by the ZLB, to stabilize the average inflation rate of the union $\Pi_t^u = \omega\Pi_t + (1 - \omega)\Pi_t^*$. We have:

$$1 + i_t = \begin{cases} \frac{\bar{\Pi}}{\beta}\left(\frac{\Pi_t^u}{\bar{\Pi}}\right)^{\phi^{cb}} \\ 1 \end{cases}$$ (25)

where $\phi^{cb} > 1$ is the strength with which the central bank reacts to changes in union inflation and $\bar{Pi}$ is its target inflation rate.

3.6 Market clearing

To close the model, we need to perform aggregation $c_t = \mu c_t^r + (1 - \mu)c_t^o$, $c_t^c = \mu c_t^{r,c} + (1 - \mu)c_t^{o,c}$, $c_t^p = \mu c_t^{r,p} + (1 - \mu)c_t^{o,p}$ and $\Delta_t = (1 - \mu)\Delta_t^o$. The financial market equilibrium reads $\omega(1 - \mu)H_t + (1 - \omega)(1 - \mu^*)H_t^* = \omega(1 - \mu)D_t + (1 - \omega)(1 - \mu^*)D_t^*$. Finally, market clearing for the Core and Periphery goods read respectively:

$$\omega(y_t - \kappa^v v_t) = \frac{p_t}{P_t}[\omega c_t^c + (1 - \omega)c_t^{c*}]$$ (26)

$$(1 - \omega)(y_t^* - \kappa^{v*}v_t^*) = \frac{p_t^c}{P_t^*}[\omega c_t^p + (1 - \omega)c_t^{p*}]$$ (27)

4 Calibration

The calibration draws on standard parameter values from the DSGE and search and matching literature, as well as key data facts for the euro area.[2] The Core comprises Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands, while the Periphery includes Greece, Ireland, Italy, Portugal and Spain. The relative size of the Core is set to $\omega = 0.61$. The discount factor is equal to $\beta = 0.994$ and the central bank target for

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[2]We draw on the calibration from Galí (2008); Christoffel et al. (2009); Albertini and Fairise (2013); Moyen and Stähler (2014); Guerrieri and Iacoviello (2015); Mitman and Rabinovich (2015). Data from 1980 to 2008 is extracted from OECD Employment and Labor Market Statistics and AMECO databases.

inflation is $\bar{\Pi} = 1.005$ so that the annualized steady-state interest rate settles at 4.4%. The risk aversion coefficient is the same for both countries, $\gamma = \gamma^* = 1.5$, as is the elasticity of substitution between Core and Periphery goods $\sigma = \sigma^* = 0.904$. The degree of wage rigidity is set to $\upsilon = \upsilon^* = 0.6$ following Faia (2008). We set the share of RoT households in the Core and the Periphery to $\mu = \mu^* = 0.33$.[3]

Turning to labour market frictions, steady-state employment, job finding and vacancy filling probabilities are targeted to compute matching efficiency, vacancy cost and separation rate parameters, with $\bar{n} = 0.921$, $\bar{f} = 0.3$ and $\bar{q} = 0.71$ for the Core and $\bar{n}^* = 0.871$, $\bar{f}^* = 0.29$ and $\bar{q}^* = 0.73$ for the Periphery. This is consistent with labour markets being tighter at the steady state in the Core than in the Periphery (we have $\bar{\theta} > \bar{\theta}^*$), in the sense that the stead-state ratio of vacancies over unemployed workers is higher. Also, Core labor market are more efficient than Periphery labor market, with higher matching effiency ($\kappa^m = 0.4615$ against $\kappa^{m*} = 0.4601$), lower vacancy cost as a share of GDP ($\kappa^\upsilon \bar{\upsilon}/\bar{y} = 0.29\%$ against $\kappa^{\upsilon*} \bar{\upsilon}^*/\bar{y}^* = 0.42\%$) and lower separation rate ($s = 2.57\%$ against $s^* = 4.3\%$). The matching elasticity and the worker bargaining power are set equal in both countries, $\eta = \eta^* = 0.5$ and $\zeta = \zeta^* = 0.9$ respectively, so that the Hosios condition does not hold.[4] Finally, unemployment benefits are a bit higher in the Core than in the Periphery, $b = 0.61$ against $b^* = 0.58$.

Price adjustment cost parameter, as well as elasticities of substitution between intermediate inputs are equal to standard values $\kappa^\pi = \kappa^{\pi^*} = 6$ and $\epsilon = \epsilon^* = 10$, respectively. We normalize steady-state per capita output in the Core to $\bar{y} = 1$, while it is lower in the Periphery, equal to $\bar{y}^* = 0.85$. The relative valuation of Core goods is calibrated to $\Psi = 0.65$ and $\Psi^* = 0.45$ to mimic the degree of trade openness based on shares of domestic consumption to GDP. Finally, the coefficient on the Taylor rule for inflation stabilization is set to $\phi^{cb} = 1.5$. The coefficients on output and debt stabilization for the national tax rule are equal to, respectively, $\phi^y = \phi^{y*} = 0.8$ and $\phi^d = \phi^{d*} = 0.15$ and the coefficient on

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[3]The share of %30 is in the same order of magnitude although lower than Galí et al. (2007) or Campbell and Mankiw (1989).

[4]Hence frictions in the labor market arise due to the positive between-group and the negative within-group of searching workers and firms not balancing out.

debt stabilization for the transfer rule is $\phi^d = \phi^{d*} = 0.05$.

5 Simulations

We simulate the behaviour of the calibrated economy in response to an asymmetric demand shock, in the form of a discount factor increase in the Periphery. Discount factor hikes have been used in the DSGE literature to mimic negative demand shocks which depress consumption and output. In our simulations, an unexpected increase in β in period 6 in the Periphery brings the discount factor from 0.994 to 1.024, with 0.8 shock persistence. To solve for the non-linear dynamic model, we use the OccBin toolkit described in Guerrieri and Iacoviello (2015). Results for Periphery, Core and union-wide variables are reported in Figure 1, 2 and 3, respectively.

Scenario 0 - Asymmetric negative shock without the ZLB

We first analyse a hypothetical case in which the central bank is not constrained by the ZLB and can set its nominal interest rate below 0. The corresponding results are depicted with dashed-dotted black lines in the figures.

In the short run, the increase in the discount factor in the Periphery depresses Periphery consumption by 1.4% compared to steady-state level. Output and employment decrease in response to the falling demand by 1% while inflation drops by 37%, compared to steady-state. The shock results in union inflation decreasing by around 5.7%, to which the central bank reacts by cutting its union-wide annualized interest rate from 4.4% to -4.2%. As it reacts to the union inflation rate, averaged over both countries, this reaction is not enough to fully offset the demand shock in the Periphery. On the contrary, the interest rate cut triggers a decrease in the real interest rate in the Core. Although the demand for Core goods drops in the Periphery, the expansionary monetary policy translates into an increase in Core consumption, as well as slight increases in Core output and employment.

As in Engler and Voigts (2013), the fact that the central bank cannot discriminate its policy between countries with its interest rate makes the demand shock asymmetric.

Consumption falls in the Periphery, while it increases in the Core. Were countries not in a monetary union, each respective central bank could set country-specific interest rates to tailor monetary policy response delivering stronger stabilization. In the end, at the scale of the union, there are small decreases in aggregate consumption and output, about -0.1%.

Scenario 1 - Asymmetric negative shock with a ZLB

The Periphery negative shock brings the economy to the ZLB for 5 periods. During that time, the central bank cannot decrease the union-wide nominal interest below 0, reducing the amount of stabilization it can deliver. Results for this scenario are reported with solid lines.

As the interest rate hits the ZLB, drop in Periphery consumption is greater (-1.85%). Hence, the Periphery experiences a more severe recession with a bigger fall in output and employment (-1.6%). Also, there is now stronger deflation in the Periphery.

In the Core, the decrease in demand for Core goods from the Periphery is stronger than in the previous scenario, combined to a lower cut in the nominal interest rate due to the ZLB. Hence the rise in Core output and employment virtually disappear. Thus, the negative demand shock spreads to Core countries, where consumption is lower. Compared to the previous scenario where the interest rate cut allowed an expansion in the Core to offset the negative demand shock in the Periphery, so that at the scale of the union the contraction would be limited, at the ZLB the muted response of the central bank to the demand shock produces a larger recession in the Periphery, not compensated by an expansion in the Core. In the end, union output, consumption and employment fall by more in scenario 1 than in scenario 0.

Scenario 2 - Asymmetric negative shock with a ZLB and the EUBS

We now study the same Periphery negative shock, with the ZLB, activating the supranational scheme. We set $\phi^{stab} = 1$. Results are plotted with crossed lines.

The fall in employment in the Periphery triggers transfers in the size of 1.2% of GDP

at the height of the crisis in period 6. These transfers flow from the European scheme, which issues debt to finance them. Transfers uphold Periphery consumption, which falls by -1.65% compared to steady-state against -1.85% in the previous scenario without transfers. The supported consumption translates both into higher Periphery output (which falls only by -1.35%), and Core output (which increases by 0.2%) as demand for both Periphery and Core goods from the Periphery households improves compared to a setting without transfers. In the end, at the scale of the union, transfers mitigate the crisis, with aggregate output and consumption falling by -0.35% and -0.3% respectively, against -0.54% and -0.44% in the preivous scenario.

The stabilization power of the scheme depends on the presence of non-Ricardian households who are cut from financial markets in the Periphery. Indeed, when distributed to Ricardian households, these transfers are regarded as temporary and saved in expectation of higher taxes to consolidate debt. In other words, through Ricardian equivalence effects, transfers do not change the inter-temporal revenue of these households, having no impact of their consumption. In a case (not shown) without any rule of thumb households in the Periphery, the transfers would have no stabilization effect at all, including in the Core, so that scenarios 1 and 2 would be identical.

Transfers are effective at upholding consumption. Because they account for only 33% of the Periphery population, a 1.2% of GDP transfer amount translates into stabilization of Periphery output from -0.54% in scenario 1 to only -0.35% in scenario 2 compared to steady-state. Together with stabilization in the Core, the fall in union output is dampened.

Hence, the scheme partially offset the presence of the ZLB and the central banks inability to mitigate the shock. It provides counter-cyclical fiscal policy in the form of European stabilizers, to the extent that there are rule of thumb consumers or other financial market imperfections.

6   Conclusion

In order to assess potential gains from a euro area unemployment insurance scheme, we have calibrated a two-region DSGE model with supply, demand and labour market frictions and common unemployment insurance to simulate the effects of a country-specific negative demand shock in the absence and presence of zero nominal interest rates. The introduction of a zero lower bound adds an additional layer of stabilisation losses to the standard one-size-fits-all monetary policy stabilisation in a monetary union. The results from the simulation of a negative country-specific demand shock to the periphery suggest that the existence of common unemployment insurance expands the set of policy options, in particular the mix of fiscal and monetary policy at the union level, and improves the macroeconomic stabilisation: transfers associated with the unemployment insurance scheme reduce the drop in Periphery and union output.

In conclusion, we briefly review two potential avenues for future work. First, our analysis could be extended to model a trigger for reinsurance in the form of a second non-linearity. Transfers would only flow if unemployment rises above a given threshold, introducing a second occasional binding constraint to the model. This would allow to refine further the modelling of the European unemployment scheme as one of reinsurance which only steps in in cases of extreme shocks. Second, strategic interactions between the national and supranational layers of government could be included. Hence, through moral hazard effects, the impact of introducing a European unemployment insurance in terms of how governments insure their workers or carry out reforms to reduce unemployment and improve labor market efficiency could be studied.
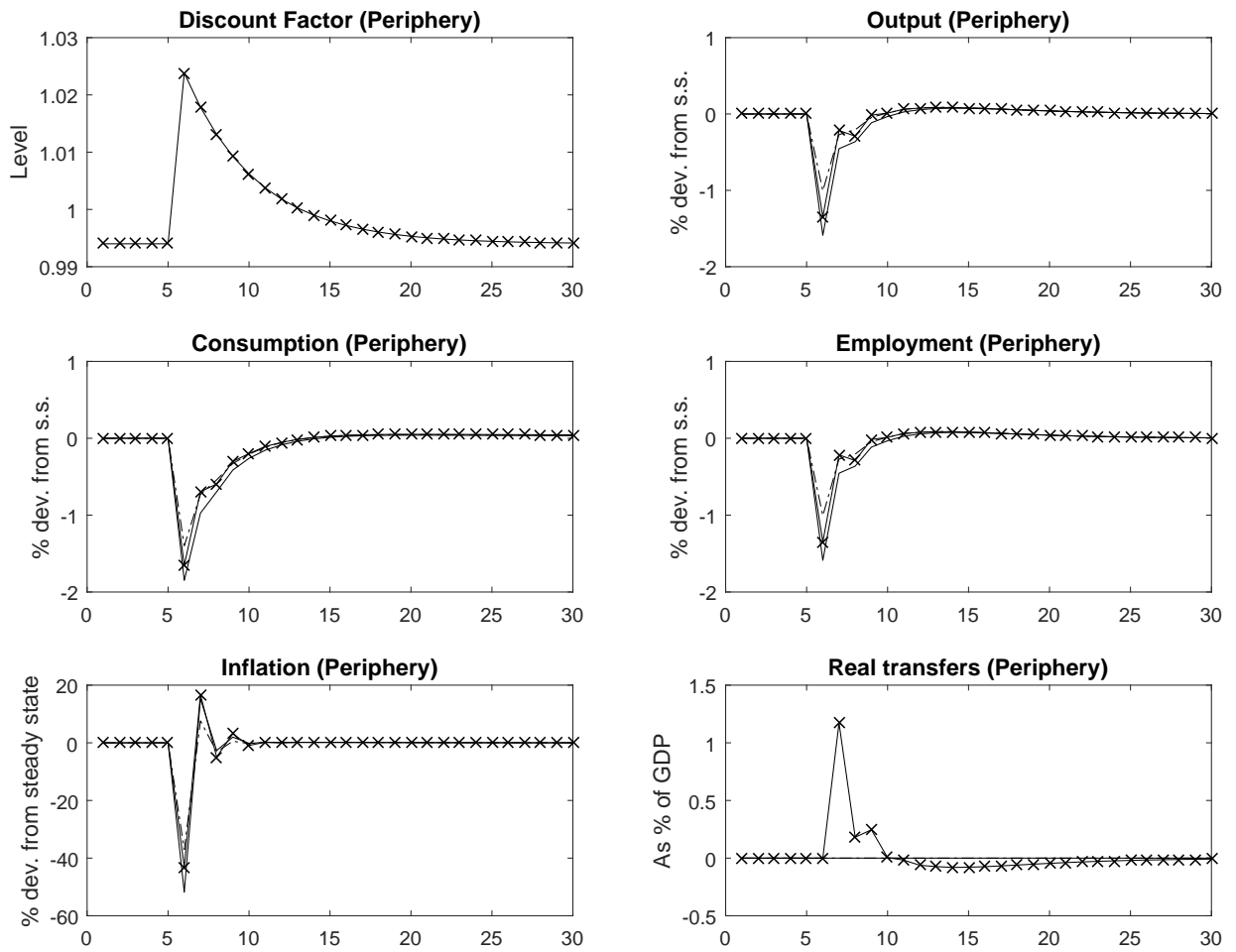
Figure 1: Periphery variables

Discount Factor (Periphery)

Output (Periphery)

Consumption (Periphery)

Employment (Periphery)

Inflation (Periphery)

Real transfers (Periphery)

20

Negative demand shock in the Periphery. Dashed-dotted lines refer to the unconstrained model without transfers (scenario 0), solid lines to the constrained model without transfers (scenario 1) and crossed lines to the constrained with transfers model (scenario 2).

Figure 2: Core variables

Discount Factor (Core)

Output (Core)

Consumption (Core)

Employment (Core)

Inflation (Core)

Real transfers (Core)
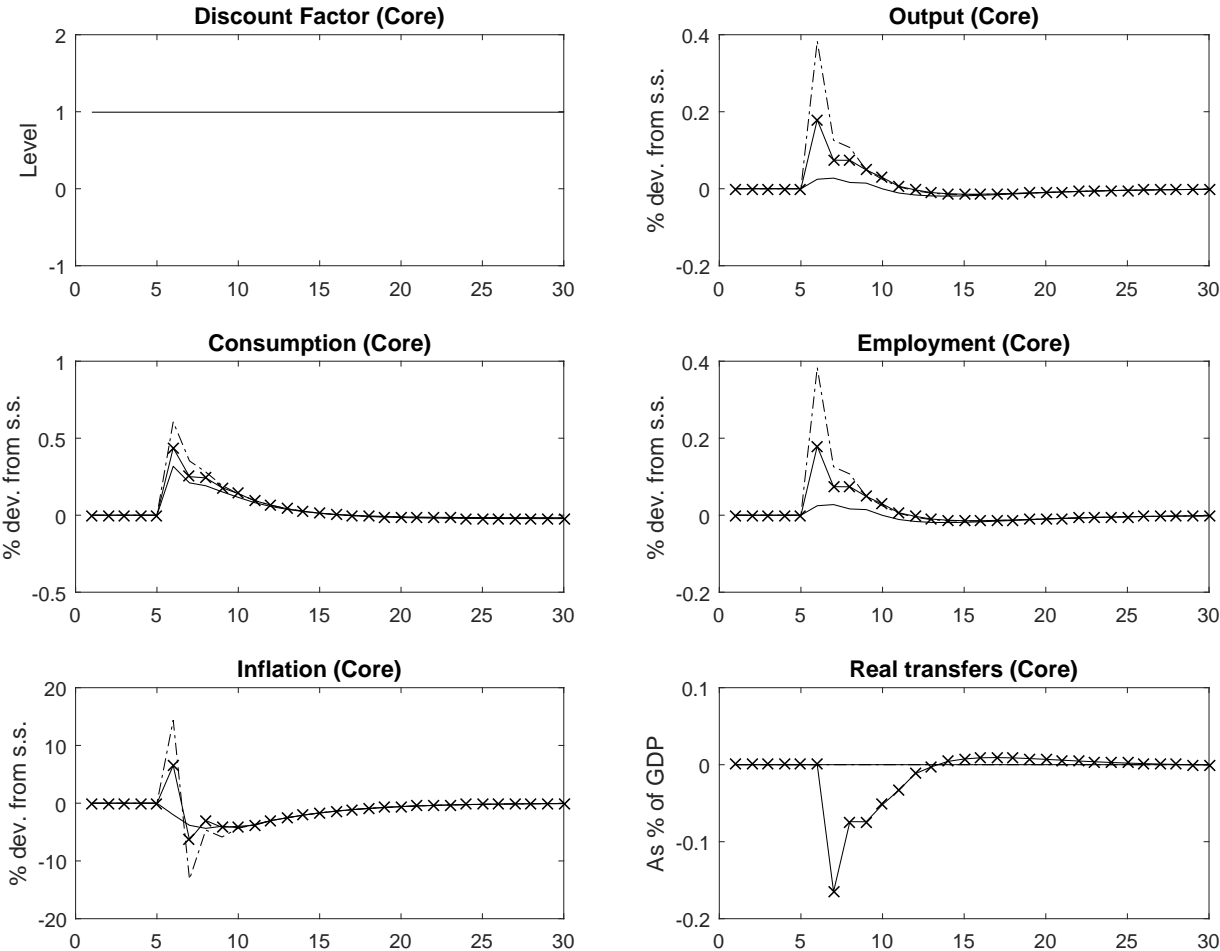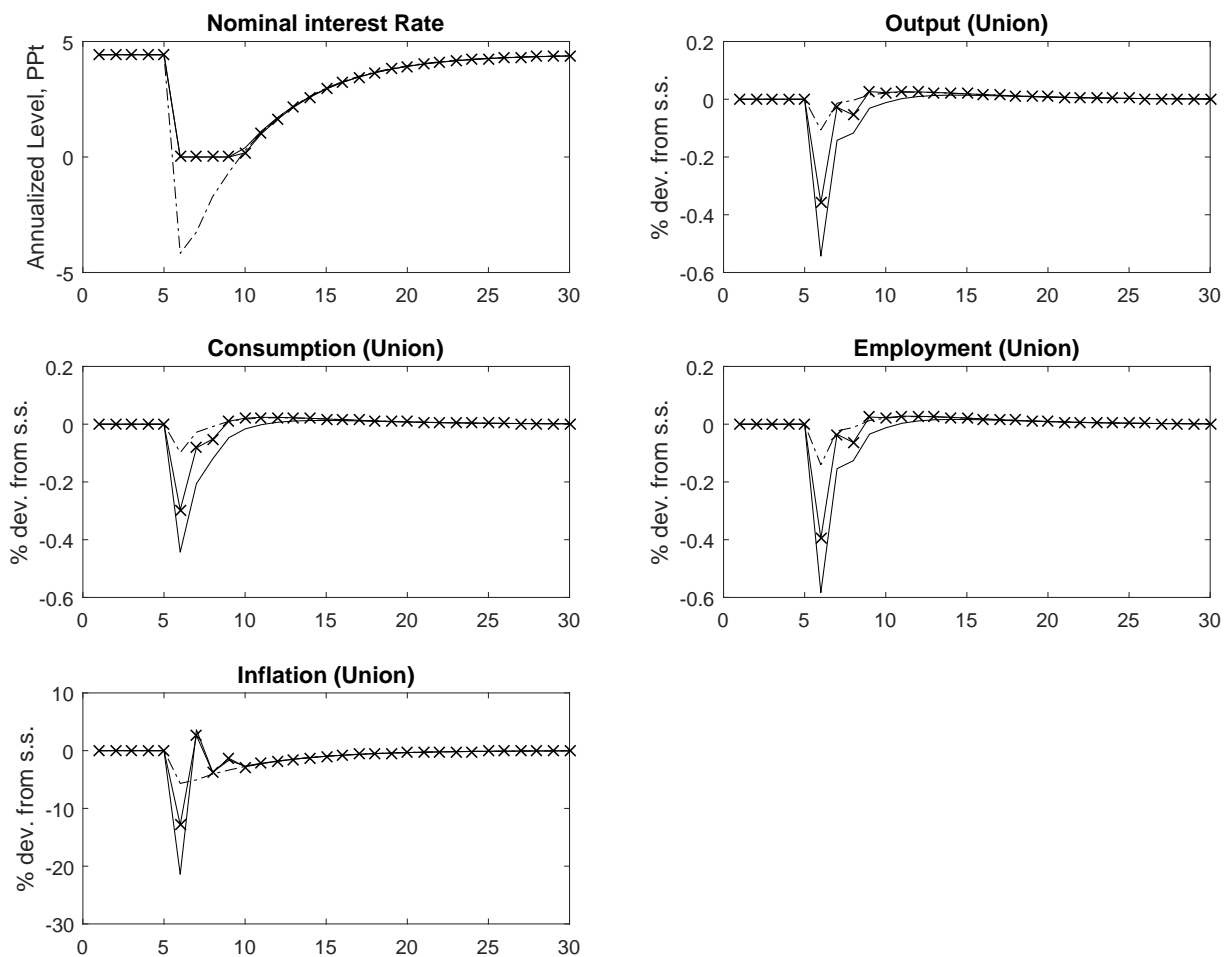
Negative demand shock in the Periphery. Dashed-dotted lines refer to the unconstrained model without transfers (scenario 0), solid lines to the constrained model without transfers (scenario 1) and crossed lines to the constrained with transfers model (scenario 2).

Nominal interest Rate

Output (Union)

Consumption (Union)

Employment (Union)

Inflation (Union)

22

Negative demand shock in the Periphery. Dashed-dotted lines refer to the unconstrained model without transfers (scenario 0), solid lines to the constrained model without transfers (scenario 1) and crossed lines to the constrained with transfers model (scenario 2).

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