EUROPEAN CENTRAL BANK
EUROSYSTEM

Working Paper Series

Katarzyna Budnik

How do economies with open labour markets work? The role of temporary migration in the European Union

No 3251

Abstract

This paper studies how temporary migration affects macroeconomic fluctuations and the conduct of stabilisation policies using a two-country DSGE model with search-and-matching frictions and endogenous cross-border labour mobility. The analysis shows that migration responds endogenously to both labour market conditions and exchange rate movements, making it an important channel of cross-country adjustment. Labour mobility alters the transmission of shocks in three main ways. First, it redistributes adjustment to productivity shocks across regions, smoothing output fluctuations in receiving economies while producing more nuanced effects in sending economies. Second, it favorably affects policy trade-offs: migration reduces the output costs of monetary tightening, and it mitigates the crowding-out effects of fiscal expansions. Third, it strengthens cross-country spillovers by transmitting labour market shocks across regions and reshaping their domestic propagation. Overall, temporary migration emerges as a powerful but non-neutral adjustment mechanism that affects both the effectiveness of stabilization policies and the distribution of macroeconomic outcomes across integrated economies.

JEL Classification: E20, E32, F16, F22, F41

Keywords: migration, business cycle, dynamic stochastic general equilibrium model, integration, labour market, EU enlargement

Non-technical summary

Labour mobility has become an increasingly important feature of integrated economic areas such as the European Union. Following the 2004 and 2007 enlargements, cross-border labour flows between the new Member States (NMS12) and the EU15 increased substantially. These developments have raised important questions about how migration interacts with macroeconomic fluctuations and economic policies. In particular, when workers can move across countries in response to economic conditions, migration may influence how economies adjust to shocks and how effective stabilization policies are.

This paper examines the macroeconomic role of temporary labour migration using a quantitative model of two interconnected economies. The framework captures key features of European labour markets, including unemployment, job creation by firms, and the possibility for workers to search for employment either at home or abroad. Migration decisions depend on expected wages, employment prospects, and migration costs. This allows labour flows to respond endogenously to economic conditions in both regions.

The analysis focuses on how labour mobility affects the response of economies to a range of shocks, including productivity changes, monetary policy interventions, fiscal expansions, and labour market disturbances. It compares two scenarios: one in which workers can move freely across borders, and one in which migration is effectively shut down. This comparison provides a clear benchmark for assessing the role of labour mobility as an adjustment mechanism.

The results show that migration is a key channel through which shocks are transmitted across countries. Labour flows respond jointly to changes in labour market conditions and exchange rates. When employment prospects improve or wages increase in one country, it attracts workers from abroad. At the same time, exchange rate movements affect the purchasing power of wages and can either reinforce or offset these incentives. This is the interaction that determines the direction and magnitude of migration flows.

Labour mobility affects economic adjustment in several important ways. First, it redistributes the impact of shocks across countries. In receiving economies, migration expands labour supply and supports production, which helps smooth fluctuations in output. In sending economies, the effects are more mixed and depend on the type of shock. For example, migration

tends to stabilize the economy following productivity improvements, but plays a more limited role when shocks operate primarily through investment demand.

Second, labour mobility changes how effective economic policies are. When monetary policy is tightened, migration can reduce the decline in output by increasing labour supply in some regions, but it may also lead to higher unemployment and weaker wage growth. Similarly, during fiscal expansions, migration can mitigate the reduction in private investment by supporting production and labour supply. These effects imply that labour mobility modifies the trade-offs faced by policymakers.

Third, migration strengthens economic linkages between countries. Shocks that originate in one economy are partly transmitted to others through labour flows. This is particularly important for labour market disturbances, such as changes in job creation or job destruction. Migration can absorb part of the impact of these shocks in the affected country, but at the same time shifts some of the adjustment burden to other economies.

Overall, the findings highlight that labour mobility is a powerful but non-neutral adjustment mechanism. While it can enhance economic flexibility and support production, it also redistributes the effects of shocks and can generate tensions in labour markets. As a result, policies that influence labour mobilityâ€"such as labour market regulations or migration costsâ€"can have important macroeconomic consequences.

The analysis also points to important considerations for economic policy in integrated areas such as the European Union. Since migration strengthens cross-country spillovers, national policies may have unintended effects on other economies. This underscores the importance of taking labour mobility into account when designing stabilization policies. Moreover, in environments where exchange rate adjustments are limited, such as in a monetary union, other mechanisms may need to play a larger role in facilitating adjustment.

1 Introduction

Labour mobility is a central adjustment mechanism in integrated economic areas. When workers can move across regions in response to economic conditions, migration alters labour supply, production, and income distribution, and thereby shapes the transmission of macroeconomic shocks (Blanchard et al., 1992). Despite its potential importance, labour mobility remains only imperfectly integrated into modern macroeconomic models used to analyse business cycle dynamics and stabilization policies.

This paper studies how temporary labour migration interacts with macroeconomic fluctuations and policy transmission. It develops a two-country New Keynesian dynamic stochastic general equilibrium (DSGE) model with search-and-matching frictions and endogenous migration decisions. In the model, unemployed workers choose whether to search domestically or abroad based on expected wages, unemployment risks, and migration costs. Firms post vacancies without targeting worker origin, and wages are determined through bargaining. Migration therefore affects both labour market tightness and firms' job creation incentives, creating a direct link between cross-border labour flows and macroeconomic outcomes.

The paper focuses on how labour mobility interacts with macroeconomic fluctuations and the conduct of stabilization policies. In particular, the model is used to analyze the transmission of productivity, labour market, monetary policy and fiscal shocks in economies with open labour markets. The key mechanism operates through the joint response of migration to labour market conditions and exchange rate movements. Migration reallocates labour across regions, thereby altering both domestic adjustment and cross-country spillovers.

The analysis is motivated by the European Union, where labour mobility increased markedly following the 2004 and 2007 enlargements. These developments coincided with declining transport and communication costs (Brücker et al., 2009), which lowered barriers to mobility and favoured temporary migration (Hatton and Williamson, 2006). Accordingly, a substantial share of post-accession migration from the new Member States (NMS12) to the EU15 has likely been temporary, with workers maintaining strong economic ties to their home countries. This feature is important, as return intentions influence consumption, savings, and labour supply decisions (Glytsos, 1988; Galor and Stark, 1990; Dustmann, 1993; 1997b;a; 1999; Sinning, 2011; Dustmann

and Glitz, 2011).

To capture these patterns, the model incorporates temporary migration in a stylised but comprehensive way. Migrants share preferences with native households, pool income with home-country members, and primarily invest in their country of origin, generating remittance flows consistent with constrained altruism (Lucas and Stark, 1985; Stark and Lucas, 1988; Rosenzweig and Stark, 1989). The two regions differ in productivity levels and labour market institutions, creating incentives for migration while abstracting from selection effects within regions.

The role of labour mobility is identified by comparing model dynamics under open and closed labour market regimes. In the open-border regime, migration costs are sufficiently low for cross-border job search to occur in equilibrium. In the closed-border regime, migration is effectively shut down. This comparison provides a clean benchmark for assessing how migration reshapes macroeconomic adjustment and allows me to isolate the macroeconomic role of migration as an adjustment margin.

The analysis yields four main findings. First, migration flows respond to differences in labour market conditions and exchange rate movements. This is the interaction of these forces that can amplify or dampen the transmission of shocks across countries. Second, labour mobility affects the cyclical properties of the economy asymmetrically across regions. It smooths fluctuations in receiving economies by relaxing labour supply constraints in response to productivity shocks, while its effects in sending economies are more nuanced and depend on the nature of the disturbance. In particular, migration plays a stabilizing role following TFP shocks, but less so in the case of investment productivity shocks.

Third, labour mobility alters the effectiveness of stabilization policies. It increases the potency of monetary and fiscal interventions, especially in the sending region, by reducing the output costs of monetary tightening and by mitigating the crowding-out of investment during fiscal expansions. Fourth, labour mobility substantially impacts the propagation of local labour market specific shocks by redistributing their effects across regions. Shocks are partly absorbed through migration and transmitted abroad. Especially, and regardless of their initial source, the effects of labour disutility, matching efficiency, and job destruction shocks on the sending economy become milder. In receiving economies, the role of migration margin differs by the nature of a shock, with local improvements in matching efficiency generating stronger expansions,

while local adverse job destruction shocks losing their edge.

Labour mobility is not merely an adjustment margin but a force that reshapes how economies respond to shocks. When workers move across borders in response to changing economic conditions, migration alters the transmission of macroeconomic disturbances, redistributes adjustment across regions, and modifies the trade-offs faced by policymakers. This paper shows that temporary migration can simultaneously stabilize output, amplify labour market fluctuations, and strengthen cross-country spillovers.

This paper builds on Budnik (2012), which develops a framework for analysing temporary migration and its role in short-run macroeconomic dynamics, with a focus on productivity shocks. This study extends this framework by incorporating a broader set of policy-relevant disturbances, and including monetary and fiscal shocks. More broadly, the paper contributes to the literature integrating labour mobility into DSGE models (Canova and Ravn, 1998; Chortareas et al., 2008; Binyamini and Razin, 2008; Engler, 2009). However, in contrast to this literature, it endogenises migration decisions and focuses on temporary rather than permanent migration. This distinction is important, as temporary migration gives rise to different behavioural responses and, consequently, different macroeconomic implications.

The paper also relates to the trade literature (Ramaswami, 1968; Saavedra-Rivano and Wooton, 1983; Kuhn and Wooton, 1987; Gould, 1994; Head and Ries, 1998; Rauch and Trindade, 2002; Dunlevy and Hutchinson, 1999; Blanes, 2005; White, 2007; Foad, 2009), which models migration as an endogenous outcome but typically abstracts from short-run dynamics and focuses on permanent migration. By contrast, this paper emphasises the role of temporary migration in shaping business cycle adjustment.

The findings further connect to the empirical literature on post-enlargement migration in Europe, which documents both the scale and distinctive features of recent migration flows (Brücker et al., 2009; Dustmann et al., 2010; Kahanec et al., 2010). While this literature provides rich evidence on labour market outcomes and the characteristics of intra-EU migration (Saleheen and Shadforth, 2006; Blanchflower et al., 2007; Blanchflower and Lawton, 2010; Lemos and Portes, 2008), less attention has been paid to the role of migration in shaping macroeconomic adjustment over the business cycle. This paper provides a framework to address this gap.

The remainder of the paper is structured as follows. Section 2 lays out the key elements of

the model. Section 3 discusses its calibration. Section 4 analyses the effects of labour mobility on macroeconomic dynamics. Section 5 examines robustness, and Section 6 concludes.

2 The Model

The New Keynesian dynamic general equilibrium model employed in this paper describes two regions. Its structure is presented in detail in Budnik (2012); here the exposition focuses only on the elements that are most relevant for the simulations conducted in this paper and is presented primarily from the perspective of the home country H. Annex A lists the full set of model equations.

Each economy is populated by households of workers, final- and intermediate-goods-producing firms, and monetary and fiscal authorities. Intermediate goods are produced by imperfectly competitive firms using capital and labour services. Labour input is a composite of the labour services of native and immigrant workers, which are close but imperfect substitutes. Intermediate goods are traded domestically and internationally. Final goods are produced from domestic and imported intermediate goods and are used for both consumption and investment.

Households accumulate physical capital and rent it to intermediate firms. They also own firms and receive their profits. In addition, households trade two types of financial assets: international bonds and domestic government bonds. Finally, households make consumption and investment decisions on behalf of their members.

Employed household members supply labour either in the domestic labour market or abroad. Unemployed workers may search for jobs in either labour market, but not in both simultaneously. Labour markets are characterized by search-and-matching frictions. Posting a vacancy is costly, and each labour market participant faces two types of externalities. A congestion externality implies that it becomes more difficult for a marginal worker to find a job, and for a marginal firm to find a worker, when more agents search on the same side of the labour market. A trade externality, in turn, makes it easier for a worker and a firm to match when more agents search on the opposite side of the market.

Following Pissarides (1992) and Ortega (2000), the model also features an additional labour-demand externality. A firm posts a vacancy that may be filled either by a native worker or by an

immigrant. The vacancy is filled by a native worker with a probability proportional to the share of natives searching for a job in the labour market. Labour turnover costs generate monopolistic rents on existing matches. The surplus from a job depends on labour market conditions, the productivity of the worker, and her fallback position, where the latter two may differ between natives and immigrants. During wage bargaining the firm observes the nationality of the worker and sets the wage according to the workerâ€™s expected productivity and reservation wage. Differences in productivity and wage aspirations between natives and immigrants therefore generate different expected returns from jobs filled by the two groups. As a result, the entry of immigrants into the labour market of the host country may either encourage or discourage firms from posting new vacancies.

2.1 Workers

A fraction ι of workers are born in the home country (labelled H) and a fraction $1-\iota$ in the foreign country (labelled F). Workers supply labour inelastically: they either work or remain out of employment. Each period there are n^H employed natives, and n^F employed immigrants in H. The number of the native unemployed in H after job recruitment has been completed is $\bar{u}^H$ and of unemployed immigrants, $\bar{u}^F$. Then, it holds that:

$$\bar{u}_t^H + \bar{u}^{H\star} = \iota - n_t^H - n_t^{H\star} \tag{1}$$

$$\bar{u}_t^{F\star} + \bar{u}^F = 1 - \iota - n_t^{F\star} - n_t^F \tag{2}$$

Unemployed workers who fail to find a job in a given period may either remain in the country or move abroad (emigrate or return home). The number of unemployed natives at the beginning of each period are u^H, and of immigrants, u^F. At the end of the period some jobs are destroyed, and workers who lose their jobs join the pool of unemployed workers in the local labour market. Consequently, the pool of unemployed workers in the next period includes workers who remained unmatched in the previous period and decided to stay in the country, as well as workers who have just lost their jobs:

$$u_t^H = \bar{u}_{t-1}^H + s_{t-1} n_{t-1}^H \tag{3}$$

$$u_t^F = \bar{u}_{t-1}^F + s_{t-1} n_{t-1}^F \tag{4}$$

The job destruction rate follows:

$$s_t = (1 - h_s)s + h_s s_{t-1} + \epsilon_{s,t} \tag{5}$$

where s is the steady-state job destruction rate, $\epsilon_{s,t}$ is an i.i.d. job-destruction shock, and h_s governs the persistence of the process.

The instantaneous utility function of a worker depends positively on consumption c, which is evaluated relative to the average consumption of natives $\bar{c}$, and negatively on labour supply with a disutility from working χ. Hence, the utility of worker j is therefore given by:

$$U_{j,t} = \frac{(c_{j,t} - h\bar{c}_{t-1})^{1-\sigma}}{1-\sigma} - \chi_t(n_{j,t}^H + n_{j,t}^{H\star}) - \upsilon(n_{j,t}^{H\star} + \bar{u}_{j,t}^{H\star}) \tag{6}$$

where the variables n_j^H, $n_j^{H\star}$, and $\bar{u}_j^{H\star}$ are indicator functions that take the value one if a worker born in H is employed at home, employed abroad, or unemployed abroad, respectively.

The disulity of exercising work evolves according to an autoregressive process:

$$\chi_t = (1 - h_\chi)\chi + h_\chi \chi_{t-1} + \epsilon_{\chi,t} \tag{7}$$

where $\chi \geq 0$ denotes the steady-state disutility of work for natives of H, $\epsilon_{\chi,t}$ is an i.i.d. shock, and h_χ governs the persistence of the process.

Worker utility also depends on the country of residence. Workers experience a period disutility from living abroad, normalized to $\upsilon \geq 0$ for workers born in H and $\upsilon^\star \geq 0$ for workers born in F.

2.2 Households

Before making consumption and saving decisions, workers pool their income within their native households. Together with the separability of consumption, labour supply, and home attachment in the utility function, this assumption implies that all workers born in H (and all workers born in F) share the same marginal utility of wealth and choose the same optimal level of consumption, regardless of their employment status.

Although workers may reside and supply labour in either country, they consume and invest only in their country of birth. The home bias in consumption and investment reflects the return intentions of temporary migrants. The assumption that migrants purchase consumption goods only in the source economy serves as a modelling shortcut.

The household maximization problem in per capita terms is:

$$V_t = \sum_{t=0}^{\infty} \beta^t \left(\frac{(c_t - h\bar{c}_{t-1})^{1-\sigma}}{1-\sigma} - \chi_t(n_t^H + n_t^{H\star}) - \upsilon_t(n_t^{H\star} + \bar{u}_t^{H\star}) \right) \tag{8}$$

where $\sigma \geq 1$ is the inverse of the elasticity of intertemporal substitution and β is the discount factor. The aggregate budget constraint of workers born in H takes the form:

$$c_t + i_t + \frac{b_t}{p_t} \leq \frac{W_t}{p_t} + r_t^K k_t + (1 + r_{t-1}) \frac{b_{t-1}}{p_t} + \frac{\Theta_t}{p_t} - \frac{\tau_t}{p_t} - \frac{X_t}{p_t} + e_t^r \frac{X_t^\star}{p_t^\star} \tag{9}$$

where i_t denotes per capita investment, e^r the real exchange rate, p the consumer price level in H, and $p^\star$ the consumer price level in F. The parameter t denotes the tax rate on wages in H, while $t^\star$ denotes the tax rate on wages in F. The variable τ_t represents the lump-sum tax paid by households in H to the domestic government.

Household income consists of labour income W, capital income $r^K k$ from renting capital to firms, and profits of domestic firms Θ. Households also hold domestic government bonds b, which are in zero net supply in the domestic economy and pay a nominal return r. These bonds are paid at the beginning of period t, although the return is known at $t-1$, and are therefore risk-free.

The term X denotes the total cost of movements of workers born in H between countries;

these costs are assumed to be transferred to foreign households. Conversely, $X^\star$ denotes the corresponding total migration costs of workers born in F, which are transferred to households in H.

Labour income of households born in H consists of wages of employed stayers w^H, wages of employed emigrants $w^{H\star}$, unemployment benefits of unemployed stayers ν^H, and unemployment benefits of unemployed emigrants $\nu^{H\star}$. Accordingly,

$$\frac{W_t}{p_t} = (1-t)\frac{w_t^H}{p_t}n_t^H + e_t^r(1-t^\star)\frac{w_t^{H\star}}{p_t^\star}n_t^{H\star} + \frac{\nu_t^H}{p_t}\bar{u}_t^H + e_t^r\frac{\nu_t^{H\star}}{p_t^\star}\bar{u}_t^{H\star} \tag{10}$$

The law of motion for capital owned by a household in H in per capita terms is:

$$k_{t+1} = (1-\delta)k_t + \Phi_t\left(1 - S\left(\frac{i_t}{i_{t-1}}\right)\right)i_t \tag{11}$$

where δ denotes the capital depreciation rate and $S(\cdot)$ represents capital adjustment costs:

$$S\left(\frac{i_t}{i_{t-1}} - 1\right) = \frac{\bar{S}}{2}\left(\frac{i_t}{i_{t-1}} - 1\right)^2 \tag{12}$$

with $\bar{S} > 0$.

The variable Φ represents investment-specific technological shocks affecting capital accumulation:

$$\Phi_t = h_\Phi\Phi_{t-1} + (1-h_\Phi)\Phi + \epsilon_{\Phi,t} \tag{13}$$

where ϵ_Φ is an investment productivity shock and h_Φ governs the persistence of the process.

The shadow price of consumption (the Lagrange multiplier associated with the household budget constraint in (9) is denoted by λ.

Domestic and foreign households trade a complete set of state-contingent securities that deliver one unit of the home and/or foreign currency in each state of nature. Bond holdings are subject to the standard no-Ponzi constraint. Under this market structure, the marginal utilities of consumption are proportional across countries (up to a wedge reflecting the initial

distribution of wealth) at all dates and states of nature.

2.3 Intermediate Goods Firms

An intermediate-goods firm employs labour and rents capital in order to produce a differentiated good i according to:

$$y_{i,t} = A_t n_{i,t}^{\alpha} k_{i,t}^{1-\alpha} \tag{14}$$

The aggregate total factor productivity index evolves according to:

$$A_t = (1 - h_A)A + h_A A_{t-1} + \epsilon_{A,t} \tag{15}$$

where A denotes the steady-state level of total factor productivity and ϵ_A is an exogenous i.i.d. productivity shock.

Firms may employ either natives or immigrants. The elasticity of substitution between the two types of labour input ρ is assumed to be high but finite. Immigrants may, however, be less productive than native-born workers in otherwise similar positions, which is captured by the parameter $\omega < 1$:

$$n_{i,t} = \left((n_{i,t}^{H})^{1-\rho} + \omega(n_{i,t}^{F})^{1-\rho}\right)^{\frac{1}{1-\rho}} \tag{16}$$

Intermediate goods are composites of differentiated varieties produced by intermediate-goods firms. The parameter ϵ denotes the elasticity of substitution across home-good varieties, while $\epsilon^{\star}$ denotes the corresponding elasticity across foreign-good varieties. The number of firms is normalized to ι in H and to $1 - \iota$ in F:

$$y_t^H = \left(\left(\frac{1}{\iota}\right)^{\frac{1}{\epsilon}} \int_0^{\iota} (y_{i,t}^H)^{\frac{\epsilon-1}{\epsilon}} di\right)^{\frac{\epsilon}{\epsilon-1}} \tag{17}$$

$$y_t^F = \left(\left(\frac{1}{1-\iota}\right)^{\frac{1}{\epsilon^{\star}}} \int_{\iota}^{1} (y_{i,t}^F)^{\frac{\epsilon^{\star}-1}{\epsilon^{\star}}} di\right)^{\frac{\epsilon^{\star}}{\epsilon^{\star}-1}} \tag{18}$$

An intermediate-goods firm sells its output in both domestic and foreign markets, so that $y_i = y_i^H + y_i^{H\star}$. Since firms operate under monopolistic competition, they set prices taking local demand conditions into account, which implies a deviation from the law of one price:

$$y_{i,t}^H = (\frac{1}{\iota})(\frac{p_{i,t}^H}{p_t^H})^{-\epsilon} y_t^H \tag{19}$$

$$y_{i,t}^{H\star} = (\frac{1}{1-\iota})(\frac{p_{i,t}^{H\star}}{p_t^{H\star}})^{-\epsilon} y_t^{H\star} \tag{20}$$

A firm faces quadratic price adjustment costs, following Rotemberg (1982), expressed as a fraction of revenues. These costs are country-specific:

$$\psi_{i,t}^H = \frac{\bar{\psi}}{2}(\frac{p_{i,t}^H}{p_{i,t-1}^H} - 1)^2 \tag{21}$$

$$\psi_{i,t}^{H\star} = \frac{\bar{\psi}^\star}{2}(\frac{p_{i,t}^{H\star}}{p_{i,t-1}^{H\star}} - 1)^2 \tag{22}$$

where the degree of nominal rigidity in H is governed by $\bar{\psi}$, and in F by $\bar{\psi}^\star$. Steady-state inflation is assumed to be zero in both countries.

To employ new workers, a firm must post vacancies v_i. The cost of posting a vacancy is expressed as a fraction $\bar{\kappa}$ of the firmâ€™s total revenues. The firm chooses $p_i^H, p_i^{H\star}, n_i^H, n_i^F, v_i$, and k_i so as to maximize:

$$E_0 \sum \tilde{\Lambda}_{t,0}(\frac{R_{i,t}^H}{p_t^H} + \frac{R_{i,t}^{H\star}}{p_t^H} - \frac{w_{i,t}^H}{p_t^H} n_{i,t}^H - \frac{w_{i,t}^F}{p_t^H} n_{i,t}^F - \psi_{i,t}^H \frac{R_{i,t}^H}{p_t^H} - \psi_{i,t}^{H\star} \frac{R_{i,t}^{H\star}}{p_t^H} - \bar{\kappa}_t v_{i,t} \frac{R_{i,t}}{p_t^H} - \frac{p_t}{p_t^H} r_t^K k_{i,t}) \tag{23}$$

subject to the demand constraints (19)–(19), the technological constraints (14)–(18), and the law of motion for employment.

The firm's discount factor is given by:

$$\tilde{\Lambda}_{t,s} = \beta^{t-s} \frac{\lambda_t}{\lambda_s} \frac{p_t^H}{p_s^H} (\frac{p_t}{p_s})^{-1} = \Lambda_{t,s} \frac{p_t^H}{p_s^H} (\frac{p_t}{p_s})^{-1} \tag{24}$$

2.4 Final Goods Firms

The final good Y is produced by a representative, perfectly competitive firm that aggregates intermediate goods according to:

$$Y_t = \left((a^{\frac{1}{\phi}}(y_t^H)^{\frac{\phi-1}{\phi}} + (1-a)^{\frac{1}{\phi}}(y_t^F)^{\frac{\phi-1}{\phi}}\right)^{\frac{\phi}{\phi-1}} \tag{25}$$

where ϕ is the elasticity of substitution between domestic goods y^H and imported goods y^F, and a captures the degree of home bias. The final good is used for private consumption c, investment i, and overnment consumption g:

$$Y_t = c_t + i_t + g_t \tag{26}$$

2.5 Labour Demand

Firms post vacancies but do not know whether a job offer will be accepted by a native or an immigrant worker. Consequently, the probability that a worker is matched with a job does not depend on her nationality but only on the total number of workers searching for employment and the number of vacancies posted in the local labour market. The number of newly created jobs is given by:

$$m(u_t, v_t) = \bar{m}_t (u_t^H + u_t^F)^{\varsigma} v_t^{1-\varsigma} \tag{27}$$

Matching efficiency may be subject to i.i.d. shocks $\epsilon_{m,t}$, with persistence governed by h_m:

$$\bar{m}_t = (1-h_m)\bar{m} + h_m \bar{m}_{t-1} + \epsilon_{m,t} \tag{28}$$

If $\theta = \frac{v}{u^H + u^F}$ denotes labour market tightness, firms meet unemployed workers at the rate

$$q(\theta_t) = \frac{m(u_t^H + u_t^F, v_t)}{v_t} \tag{29}$$

while unemployed workers find employment with probability $\theta q(\theta)$.

Although firms cannot target native or immigrant workers when posting vacancies, they observe the worker's status during the wage bargaining process. The ex post stream of profits from a newly created job depends on worker productivity and fallback options, and therefore also on nationality.

Let J^H denote the Lagrange multiplier on the law of motion of native employment and J^F the corresponding multiplier for foreign workers. The demand for workers by firm i is then given by:

$$J_{i,t}^H = \alpha mc_{i,t} \frac{y_{i,t}}{n_{i,t}} \left(\frac{n_{i,t}}{n_{i,t}^H}\right)^\rho - \frac{w_{i,t}^H}{p_t^H} + E_t\left(\tilde{\Lambda}_{t+1,t}(1-s_t) J_{i,t+1}^H\right) \tag{30}$$

$$J_{i,t}^F = \alpha\omega mc_{i,t} \frac{y_{i,t}}{n_{i,t}} \left(\frac{n_{i,t}}{n_{i,t}^F}\right)^\rho - \frac{w_{i,t}^F}{p_t^H} + E_t\left(\tilde{\Lambda}_{t+1,t}(1-s_t) J_{i,t+1}^F\right) \tag{31}$$

where mc_i denotes the Lagrange multiplier on the production function constraint (14).

Firms observe the aggregate share of immigrant job seekers, $\eta = \frac{u^H}{u^H + u^F}$, so that the optimal number of posted vacancies satisfies:

$$\frac{\kappa_{i,t}}{q(\theta_t)} = \eta_t J_{i,t}^H + (1-\eta_t) J_{i,t}^F \tag{32}$$

The left-hand side represents the expected cost of posting one vacancy, while the right-hand side corresponds to the expected value of a filled job.

2.6 Labour Supply

The value function of being employed by a domestic firm i in H from the perspective of the representative household is:

$$\begin{aligned} W_{i,t}^H =& (1-t)\frac{w_{i,t}^H}{p_t} - \frac{\chi_t}{\lambda_t} + \\ & E_t\left(\Lambda_{t+1,t}\Big((1-s_t) W_{i,t+1}^H + s_t\big(1-\theta_{t+1} q(\theta_{t+1})\big) V_{t+1}^H + s_t \theta_{t+1} q(\theta_{t+1}) W_{t+1}^H\Big)\right) \end{aligned} \tag{33}$$

where V^H denotes the value function of an unemployed worker born in H who searches for a job in the home labour market:

$$V_t^H = \frac{\nu_t^H}{p_t} - \frac{x_t^H}{p_t} + E_t\Big(\Lambda_{t+1,t}\big(\theta_{t+1}q(\theta_{t+1})(W_{t+1}^H - V_{t+1}^H) + V_{t+1}^H\big)\Big) \tag{34}$$

and $\frac{x^H}{p}$ denotes the marginal migration cost for a household member and satisfies $\frac{x^H}{p} = \frac{\partial \frac{X}{p}}{\partial \bar{u}^H}$.

The value function of an H-born worker employed abroad has an analogous form to (33), except for the additional disutility associated with residing outside the home country:

$$\begin{aligned} W_{i,t}^{H\star} =& e_t^r(1-t^\star)\frac{w_{i,t}^{H\star}}{p_t^\star} - \frac{\chi_t}{\lambda_t} - \frac{\upsilon}{\lambda_t} + \\ & E_t\Bigg(\Lambda_{t+1,t}\Big((1-s_t^\star)W_{i,t+1}^{H\star} + s_t^\star\big(1-\theta_{t+1}^\star q(\theta_{t+1}^\star)\big)V_{t+1}^{H\star} + s_t^\star\theta_{t+1}^\star q(\theta_{t+1}^\star)W_{t+1}^{H\star}\Big)\Bigg) \end{aligned} \tag{35}$$

Finally, the value function of an unemployed H-born worker who searches for a job abroad is:

$$V_t^{H\star} = e_t^r\frac{\nu_t^{H\star}}{p_t^\star} - \frac{\upsilon}{\lambda_t} - \frac{x_t^{H\star}}{p_t} + E_t\Big(\Lambda_{t+1,t}\big(\theta_{t+1}^\star q(\theta_{t+1}^\star)(W_{t+1}^{H\star} - V_{t+1}^{H\star}) + V_{t+1}^{H\star}\big)\Big) \tag{36}$$

2.7 Wages

Workers and firms bargain over wages and share the job surplus according to a Nash bargaining scheme:

$$max(W_{i,t}^H - V_t)^\mu(\frac{p_t^H}{p_t}J_{i,t}^H)^{1-\mu} \tag{37}$$

where μ is a country-specific parameter capturing the relative bargaining power of workers. The negotiated real wage rate of H-born workers employed in H is given by:

$$\begin{aligned}\frac{\tilde{w}^H_{i,t}}{p_t} =&(1-\bar{\mu})(1-t)^{-1}(\frac{\nu^H_t}{p_t}+\frac{\chi_t}{\lambda_t}-\frac{x^H_t}{p_t})+\\ &\bar{\mu}\frac{p^H_t}{p_t}(mc_{i,t}\alpha\frac{y_{i,t}}{n_{i,t}}(\frac{n_{i,t}}{n^H_{i,t}})^{\rho}+\theta_{t+1}q(\theta_{t+1})(1-s_t)E_t(\tilde{\Lambda}_{t+1,t}J^H_{t+1}))\end{aligned} \tag{38}$$

where $\bar{\mu}=\mu((1-\mu)(1-t)+\mu)$.

Wages are assumed to be rigid and their persistence is introduced in an ad hoc manner following Blanchard and Gali (2007) and Duval and Vogel (2012). In particular, the actual wage level w^H is a weighted average of the Nash-bargained wage and the wage from the previous period:

$$\frac{w^H_{i,t}}{p_t}=\vartheta\frac{w^H_{i,t-1}}{p_{t-1}}+(1-\vartheta)\frac{\tilde{w}^H_{i,t}}{p_t} \tag{39}$$

2.8 Labour Migration

Labour migration in the model is defined as the presence of workers born in one country participating in the labour market of the other country. After job recruitment takes place there are $(1-\theta q(\theta))u^H$ unemployed natives and $(1-\theta q(\theta))u^F$ unemployed immigrants in H. Similarly, in F there are $(1-\theta^\star q(\theta^\star))u^{F\star}$ unemployed natives and $(1-\theta^\star q(\theta^\star))u^{H\star}$ unemployed immigrants.

Unemployed workers may move across borders in order to maximize their expected income stream. Migration arises in equilibrium if $V^H=V^{H\star}$ or $V^{F\star}=V^F$. If instead $V^H>V^{H\star}$ and $V^{F\star}>V^F$, no labour migration occurs. Conversely, if $V^H<V^{H\star}$ or $V^{F\star}<V^F$, workers from one country migrate to the other region.

Cross-border movements involve certain costs related, for example, to housing search, travel expenditures, or the translation of documents. These costs are introduced in an ad hoc way analogous to capital installation costs:

$$\frac{X_t}{p_t}=\frac{\bar{x}}{2}\left(\bar{u}^H_t-(1-\theta_t q(\theta_t))u^H_t\right)^2 e^r_t\frac{w^\star_t}{p^\star_t}=\frac{\bar{x}}{2}\left(\bar{u}^{H\star}_t-(1-\theta^\star_t q(\theta^\star_t))u^{H\star}_t\right)^2 e^r_t\frac{w^\star_t}{p^\star_t} \tag{40}$$

Hence, the larger the number of workers wishing to move abroad, the higher the marginal migration cost. The marginal cost satisfies:

$$\frac{x_t^H}{p_t} = -\frac{x_t^{H\star}}{p_t} = \bar{x}\big(\bar{u}_t^H - (1-\theta_t q(\theta_t))u_t^H\big)e_t^r \frac{w_t^\star}{p_t^\star} \tag{41}$$

The following equilibrium conditions hold:

$$\bar{u}_t^H + \bar{u}_t^{H\star} = \big(1-\theta_t q(\theta_t)\big)u_t^H + \big(1-\theta_t^\star q(\theta_t^\star)\big)u_t^{H\star} \tag{42}$$

$$\bar{u}_t^{F\star} + \bar{u}_t^F = \big(1-\theta_t^\star q(\theta_t^\star)\big)u_t^{F\star} + \big(1-\theta_t q(\theta_t)\big)u_t^F \tag{43}$$

The intensity of labour migration is measured by emigration and immigration rates in the source and host countries, respectively. The emigration rate is defined as the share of temporary emigrants in the total population of a country. For country H it equals:

$$\frac{n_t^{H\star} + u_t^{H\star}}{n_t^H + u_t^H + n_t^{H\star} + u_t^{H\star}} \tag{44}$$

The immigration rate is defined as the ratio of temporary immigrants in a country to the total number of residents in that country. For country H it is given by:

$$\frac{n_t^F + u_t^F}{n_t^H + u_t^H + n_t^F + u_t^F} \tag{45}$$

In the presence of labour migration, cross-country income transfers may arise, which are interpreted as remittances:

$$T = e_t^r(1-t^\star)\frac{w_t^{H\star}}{p_t^\star}n_t^{H\star} + e_t^r\frac{\nu_t^{H\star}}{p_t^\star}\bar{u}_t^{H\star} - (1-t)\frac{w_t^F}{p_t}n_t^F + \frac{\nu_t^F}{p_t}\bar{u}_t^F \tag{46}$$

2.9 Macroeconomic Policies

The monetary authority in H follows a Taylor rule of the form:

$$r_t = h_r r_{t-1} + (1-h_r)(r + h_\pi \pi_t) + \epsilon_{r,t} \tag{47}$$

where h_r controls the degree of interest rate smoothing, r is the steady-state nominal interest

rate, and $\epsilon_{r,t}$ is an i.i.d. monetary policy shock.

The government purchases final goods, transfers unemployment benefits to households, issues bonds, and levies income and lump-sum taxes. The period-by-period government budget constraint in H is:

$$g_t + \frac{\nu_t^H}{p_t}\bar{u}_t^H + \frac{\nu_t^F}{p_t}\bar{u}_t^F + \frac{b_{t-1}}{p_t}(1+r_t) = \frac{\tau_t}{p_t} + \frac{b_t}{p_t} + t(\frac{w_t^H}{p_t}n_t^H + \frac{w_t^F}{p_t}n_t^F) \tag{48}$$

Government consumption expenditures are generally proportional to aggregate demand but subject to shocks:

$$g_t = h_g g_{t-1} + (1-h_g)\bar{g}(c_t + i_t) + \epsilon_{g,t} \tag{49}$$

where $\bar{g}$ denotes the ratio of government consumption to aggregate demand, h_g governs expenditure smoothing, and $\epsilon_{g,t}$ is an i.i.d. fiscal shock.

Unemployment benefits are proportional to the average wage in the economy, $\bar{w}_t$, with potentially different replacement rates for natives and immigrants:

$$\nu_t^H = \bar{\nu}^H w_t \qquad \nu_t^F = \bar{\nu}^F w_t \tag{50}$$

Lump-sum taxes are set to stabilize public debt in the medium run:

$$\frac{\tau_t}{p_t} = h_\tau \frac{\tau_{t-1}}{p_{t-1}} + (1-h_\tau)(\frac{\tau}{p} + h_b \frac{b_{t-1}}{p_t}) \tag{51}$$

where h_b governs the speed at which government debt is adjusted toward its target level.

2.10 An Aggregate Equilibrium

In symmetric equilibrium all firms charge the same price and produce the same quantity of goods. In particular, $p_{i,t}^H = p_t^H$, $\frac{p_{i,t}^H}{p_{i,t-1}^H} = \frac{p_t^H}{p_{t-1}^H} = \pi_t + 1$, $\psi_{i,t}^H = \psi_t^H$ and $y_{i,t}^H = \iota^{-1} y_t^H$.

Consequently, firms employ the same number of workers (both native and foreign), $n_{i,t} =$

$\iota^{-1}n_t$, post the same number of vacancies $v_{i,t} = \iota^{-1}v_t$, and rent the same amount of capital $k_{i,t} = \iota^{-1}k_t$.

The cost of posting a vacancy therefore simplifies to:

$$\kappa_{i,t} = \kappa_t = \bar{\kappa}\iota^{-1}(y_t^H + e_t\frac{p_t^{H\star}}{p_t^H}y_t^{H\star}) \tag{52}$$

The aggregate supply of goods produced in H must satisfy the demand for these goods, while accounting for frictions in both goods and labour markets. The market-clearing conditions for goods take the following form:

$$a(\frac{p_t^H}{p_t})^{-\phi}(c_t + i_t + g_t) = y_t^H - \frac{\bar{\psi}}{2}(\pi_t^H)^2 y_t^H - \bar{\kappa}\iota^{-1}v_t y_t^H \tag{53}$$

$$(1-a^\star)(\frac{p_t^{H\star}}{p_t^\star})^{-\phi^\star}(c_t^\star + i_t^\star + g_t^\star) = y_t^{H\star} - \frac{\bar{\psi}^\star}{2}(\pi_t^{H\star})^2 y_t^{H\star} - \bar{\kappa}\iota^{-1}v_t y_t^{H\star} \tag{54}$$

and:

$$a^\star(\frac{p_t^{F\star}}{p_t^\star})^{-\phi^\star}(c_t^\star + i_t^\star + g_t^\star) = y_t^{F\star} - \frac{\bar{\psi}^\star}{2}(\pi_t^{F\star})^2 y_t^{F\star} - \bar{\kappa}^\star(1-\iota)^{-1}v_t^\star y_t^{F\star} \tag{55}$$

$$(1-a)(\frac{p_t^F}{p_t})^{-\phi}(c_t + i_t + g_t) = y_t^F - \frac{\bar{\psi}}{2}(\pi_t^F)^2 y_t^F - \bar{\kappa}^\star(1-\iota)^{-1}v_t^\star y_t^F \tag{56}$$

3 Calibration

3.1 Structural Parameters

The model is calibrated for the NMS12 as the H region and the EU15 as the F region. Structural parameters in the two versions of the model, corresponding to the closed- and open-border regimes, are identical except for the emigration preference parameters, which are scaled down in the open-border specification.

Periods are interpreted as quarters and the discount factor is set to 0.99. The share of NMS12 workers in the model is set to 21%, which corresponds to the share of NMS12 permanent residents

in the EU working-age population. Details of the calibration strategy are described in Budnik (2012), and Table 1 summarizes the parameter values.

The EU15 is substantially wealthier than the NMS12, with total factor productivity being approximately 63% higher in the former region. At the same time, the NMS12 economies are more open. The share of imports from the NMS12 in EU15 domestic demand is slightly above 1%, whereas the share of EU15 imports in NMS12 domestic demand is close to 10%.

To capture the fact that labour markets in the EU15 generally offer better employment opportunities, the disutility of labour supply is set so that, in the version without labour migration, the steady-state unemployment rate equals 7.9% in the EU15 and 12.1% in the NMS12. The corresponding probabilities of finding a job are 30% and 20%, respectively.

Labour markets in the NMS12 are assumed to be more flexible than those in the EU15. This is captured by a lower share of workers in job surplus in the NMS12 (0.4) than in the EU15 (0.5). The job destruction rate and the matching probability are set at 2.5% in the former region and 2.4% in the latter. The unemployment benefit replacement rate is also lower in the NMS12 (38%) than in the EU15 (42%).

Immigrants are assumed to receive unemployment benefits that are 50% lower than those of natives. Immigrant productivity and the disutility of residing abroad are calibrated so that the immigration rate in the EU15 equals 1.5%, while immigration to the NMS12 remains negligible. The calibration implies that immigrants earn wages roughly 26% lower than natives, while the average wage of NMS12 emigrants is approximately twice as high as the wage of the average worker remaining in the home country.

There are no substantial differences between the two regions in terms of labour taxation (40.5% in the EU15 and 41% in the NMS12), the ratio of government expenditure to private demand (6.3% versus 6.4%), price markups (20% in both regions), or the elasticities of substitution between goods (6 for domestic goods and 2 for domestic versus imported goods).

Turning to parameters governing short-run dynamics, price adjustment costs are set to 20 in both regions and the persistence of real wages is set to 0.7. The EU15 is assumed to face somewhat lower capital adjustment costs than the NMS12 (10 versus 12). Government spending persistence and the fiscal rule parameters are calibrated similarly in both regions. The degree

of interest rate smoothing and the response of interest rates to inflation are higher in the EU15 than in the NMS12 (0.9 versus 0.8, and 2.5 versus 2.3).

Finally, migration costs are calibrated such that if 1% of NMS12 workers move to the EU15, the marginal migration cost corresponds to roughly 10-15% of the EU15 quarterly real wage.

3.2 Steady-State

Table 2 reports the steady state of the model under the calibrated parameter values, for both the closed- and open-border regimes.

In the closed-border regime, real wages in the EU15 are around 90% higher than in the NMS12. In per capita terms, the gaps in output and consumption are of a similar magnitude.

Lower migration costs increase the immigration rate in the EU15 from 0 to 1.5%, which corresponds to an increase in the NMS12 emigration rate from 0 to 5.7%. The emergence of temporary migration reduces unemployment in both the sending and the receiving regions. As the decline is stronger in the NMS12, the unemployment rate gap between the two regions falls from 2.4 percentage points to 0.9 percentage points.

Average real wages in the EU15 decline by 0.6%, while in the NMS12 they increase by 1.5%. However, wages of native workers in the EU15 fall only modestly (around 0.2 percentage points). Most of the decline in the EU15 average wage reflects composition effects resulting from the larger share of lower-paid immigrant workers.

Importantly, the calibration ensures that in both regimes the value of employment exceeds the value of unemployment in each labour market. In the open-border regime, the value of employment abroad for NMS12 workers slightly exceeds both the employment and unemployment values at home.

The outflow of workers from the NMS12 reduces production capacity in the sending economy. Output declines by 3.1%, while investment and the capital stock fall by 2.1%. The mirror image of this process is an increase in EU15 output by 1.7% and in investment and capital by 1.5%.

Despite this reallocation of production, private consumption increases by roughly 1% in both regions. In the NMS12 this increase is financed by remittance inflows, with the remittance

balance reaching 1.3% of GDP.

3.3 Structural Shocks

The model includes several i.i.d. structural shocks: a total factor productivity shock ϵ_A, an investment productivity shock ϵ_Φ, a monetary policy shock ϵ_r, a government spending shock ϵ_g, and labour market shocks affecting labour supply ϵ_χ, matching efficiency $\epsilon_{\bar{m}}$, and job destruction ϵ_s.

The persistence and standard deviations of productivity and policy shocks for the EU15 are calibrated to match average estimates for the euro area reported in Smets and Wouters (2003; 2005), Pytlarczyk (2005), Adolfson et al. (2007), and Kolasa (2009). The persistence of labour supply shocks is set accordingly, while their standard deviations are chosen to replicate the average impact of labour supply shocks on employment found in these studies. This indirect calibration is necessary because the specification of labour disutility and labour market structure differs between the reference models and the model used in this paper.

For the NMS12, the persistence and volatility of shocks are set either equal to those in the EU15 or adjusted upward or downward based on estimates for Poland and Hungary reported in Jakab and Világi (2008), Kolasa (2009), and Jakab and Konya (2016).

Finally, matching efficiency and job destruction shocks are calibrated in an ad hoc manner and assumed to be identical in both regions. Table 3 summarizes the shock parameter values.

4 Results

This section presents the dynamic responses of the model to a range of shocks and evaluates how labour mobility shapes their propagation. We contrast open- and closed-border regimes using impulse responses and summary statistics on volatility, persistence, procyclicality and cross-country co-movement.

A central finding is that labour mobility systematically alters both the magnitude and the composition of macroeconomic adjustment. For productivity shocks, migration amplifies fluctuations in the receiving economy while weakening cross-country synchronization. For policy

shocks, it redistributes adjustment across regions and modifies the outputâ€“unemployment trade-off. For labour market shocks, migration most often smooths domestic adjustment but strengthens cross-border spillovers.

Taken together, the results show that endogenous migration is not a passive margin of adjustment. Rather, it actively reshapes transmission mechanisms, persistence, and international linkages in response to macroeconomic disturbances.

4.1 Productivity Shocks

Figures 3 and 4 present impulse response functions to a positive investment productivity shock in the EU15 and the NMS12, respectively. Dotted lines correspond to the closed-border regime, while solid lines represent the open-border regime. For comparison, Figures 1 and 2 show the effects of a temporary increase in total factor productivity (TFP), replicating the experiment in Budnik (2012).

Irrespective of the migration regime, higher investment productivity induces households to expand the capital stock. The resulting increase in domestic demand stimulates production and puts upward pressure on prices. Labour demand rises, leading to lower unemployment and higher real wages.

As capital accumulates, firms' production capacity gradually expands. After several quarters, supply adjusts to the initial demand impulse. Marginal costs decline, moderating inflation, while the increased supply of tradable goods leads to a real depreciation of the domestic currency. Labour demand remains robust and real wages continue to increase.

The key difference between investment productivity and TFP shocks lies in the timing of adjustment. TFP shocks immediately reduce marginal costs, triggering a rapid expansion of output and an early depreciation of the exchange rate. In contrast, investment productivity shocks operate initially through demand, leading to an earlier improvement in labour market conditions, while currency depreciation materialises only with a lag.

Moreover, because capital accumulation is gradual, investment productivity shocks generate more persistent dynamics than TFP shocks. As shown in columns 1 and 3 of Table 9, and columns 2 and 4 of Table 11, labour market variables, marginal costs, and inflation display

substantially stronger persistence following investment productivity shocks.

Under open borders, the response of the EU15 economy is amplified. Improved labour market conditions attract temporary migrants from the NMS12, enabling further expansion of production. The resulting increase in employment strengthens domestic demand and raises profits. As shown in column 4 of Table 5, the volatility of output, investment and consumption increases by around 20%, while employment volatility rises by about 30%. This is accompanied by higher persistence and stronger procyclicality of employment, vacancies, and job finding rates, whereas real wages remain largely unaffected. Overall, labour mobility reinforces the propagation of investment productivity shocks in a manner qualitatively similar - though somewhat weaker - than for TFP shocks.

In the case of asymmetric productivity shocks in the EU15, migration weakens the co-movement of output, investment and employment across regions. Nevertheless, households in both regions benefit through higher consumption, as documented in Tables 16 - 17.

In contrast, migration plays a limited role in the adjustment of the NMS12 to an investment productivity shock. The initial improvement in labour market conditions reduces incentives to emigrate, and although subsequent currency depreciation partly reverses this effect, migration flows remain modest throughout. As a result, the dynamics under open- and closed-border regimes are nearly identical. This contrasts with TFP shocks, where early exchange rate depreciation induces outward migration before labour market conditions improve, thereby moderating the expansion in output.

4.2 Economic Policy Shocks

4.2.1 A Monetary Policy Shock

Figures 5 and 6 show the effects of a monetary tightening in the EU15 and the NMS12. Higher interest rates induce households to postpone consumption and lead to an appreciation of the domestic currency. Both domestic and external demand decline, putting downward pressure on prices and production. Firms reduce vacancies and employment, while rising unemployment and falling wages further dampen demand and inflation.

Monetary tightening generates two opposing incentives for migration. The deterioration in labour market conditions encourages outflows, while currency appreciation increases the purchasing power of domestic wages and attracts workers. In the EU15, these effects largely offset each other: the exchange rate channel dominates initially, while the labour market channel prevails thereafter. As a result, migration flows - and hence aggregate dynamics - are only modestly affected.

However, return migration from the EU15 increases labour supply in the NMS12, where the relative impact is larger due to the smaller population. Consequently, unemployment rises more and real wages fall more than under closed borders.

When monetary policy tightens in the NMS12, the appreciation of the domestic currency induces return migration. The resulting increase in labour supply supports output and employment but also raises unemployment and depresses real wages, thereby containing inflation. As shown in Table 7 and Table 11, the volatility of output and employment declines by about 20% under open borders, while the variability and persistence of unemployment and wages increase by a similar magnitude. Overall, labour mobility reduces the sacrifice ratio when measured in terms of output.

Monetary tightening in the NMS12 also has stronger spillovers to the EU15 under open borders. Output and employment decline more than in the closed-border regime, while inflation increases slightly. Thus, labour mobility strengthens cross-country transmission of monetary policy shocks, regardless of where the tightening originates.

4.2.2 A Government Spending Shock

Figures 7 and 8 depict the effects of a fiscal expansion. Higher government spending raises domestic demand, leading firms to increase production, prices, and labour demand. Nominal wages rise, although real wage gains diminish over time as prices adjust.

To counter inflationary pressures, monetary policy tightens, while stronger domestic demand improves the terms of trade and appreciates the exchange rate. As fiscal consolidation unfolds, higher taxes and tighter policies crowd out private demand, and output gradually returns to steady state.

Under open borders, the initial dynamics are similar, but improved labour market conditions and currency appreciation attract temporary migrants. The resulting increase in labour supply supports employment and mitigates the decline in output as the fiscal impulse fades.

Migration also dampens the crowding-out of investment. Following a fiscal expansion in the receiving economy, investment declines more sharply but recovers faster than under closed borders. In the sending economy, the decline in investment is smaller and shorter-lived.

For the EU15, the migration margin mainly affects persistence rather than the magnitude of responses (see Table 9). In contrast, spillovers to the NMS12 are more pronounced, leading to a modest but more persistent reduction in output and investment.

Overall, the effects of migration are stronger in the sending region (see Table 7 and Table 11). In particular, part of the medium-term cost of fiscal expansion in the NMS12 is shifted abroad: return migration reduces labour supply in the EU15, lowering output and investment in the region that does not undertake fiscal expansion.

4.3 Labour Market Shocks

4.3.1 A Labour Supply Shock

Figures 9 and 10 illustrate the responses of the EU15 and NMS12 economies to a negative labour supply shock. In both open- and closed-border regimes, a decline in workers' willingness to supply labour - potentially reflecting an increase in the value of home production - induces firms to raise wages in order to attract workers. Higher labour costs, however, lead firms to reduce labour demand, resulting in a gradual decline in employment. Higher production costs also prompt firms to reduce output and increase prices.

The monetary authority responds to higher inflation by raising interest rates. This monetary tightening reinforces the appreciation of the domestic currency caused by the relative scarcity of domestically produced goods. The tighter monetary policy further dampens domestic demand and output.

In the open-border regime, the decline in labour demand and the reduced probability of finding employment following a negative labour supply shock in the EU15 encourage some tem-

porary migrants to return to their home countries. The resulting decline in the number of immigrants mitigates the reduction in employment among native workers. Because more EU15-born workers remain employed, domestic demand remains slightly higher than under migration restrictions. Nevertheless, the outflow of foreign workers is too small to substantially alter the aggregate response of the economy.

An increase in the value of leisure among NMS12 workers reduces their willingness to work both domestically and abroad. At the same time, the appreciation of the domestic currency following the labour supply shock reduces the purchasing power of emigrants' earnings abroad. As a result, some temporary migrants return from the EU15. This return migration partly offsets the decline in labour supply, moderating the fall in employment and the rise in real wages in the NMS12.

Consequently, the decline in output and domestic demand is smaller than in the closed-border regime. As shown in column 9 of Table 7, the variance of output falls by more than 50%, indicating that adjustment to a negative labour supply shock becomes considerably smoother and less costly.

However, when borders are open the negative effects of a labour supply shock originating in the NMS12 spill over more strongly to the EU15. In that region, output and employment decline more sharply than under the closed-border regime.

4.3.2 A Matching Efficiency Shock

The macroeconomic effects of a positive shock to job-worker matching efficiency are illustrated in Figures 11 for the EU15 and 12 for the NMS12. Improved matching efficiency immediately increases the probability that unemployed workers find jobs and that firms fill vacancies. The higher probability of filling vacancies reduces the expected cost of posting them and stimulates labour demand. This reinforces the expansion of employment and, consequently, output.

As output increases by less than employment, labour productivity declines slightly, which is reflected in relatively subdued real wages. At the same time, profitability improves due to lower labour turnover costs and stronger labour market conditions. Higher household income supports the recovery of domestic demand.

Lower labour turnover costs also create scope for price reductions. The resulting moderation in inflation induces the monetary authority to lower interest rates, which further supports the expansion of economic activity. The easing of monetary policy and the increased supply of domestically produced goods contribute to a depreciation of the currency.

When borders in the EU15 are open, the higher probability of finding employment following a positive matching efficiency shock attracts additional temporary migrants. However, the depreciation of the domestic currency partly offsets this effect, so that the increase in immigration remains moderate. The inflow of immigrants amplifies the gains in employment, output and domestic demand, increasing their post-shock volatility by around 10% relative to the closed-border regime. The corresponding standard deviations are reported in column 12 of Table 4 and Table 5.

When a similar shock affects the NMS12, the depreciation of the domestic currency is sufficiently strong to offset the increased incentive to remain in the region associated with the higher job finding probability. The expected relative income of emigrants therefore rises, triggering an outflow of workers abroad. As the emigration rate increases, labour supply in the domestic labour market declines accordingly. This dampens the positive response of employment and output to the shock. The post-shock volatility of these variables falls by around 40% (see column 11 in Table 7). By contrast, and consistent with the income-maximizing behaviour of workers, the response of private consumption is largely unaffected by the migration regime.

Nevertheless, a positive matching efficiency shock in the NMS12 generates noticeable gains in output in the EU15. In the closed-border regime the effects of the NMS12 shock on the EU15 economy are negligible, whereas in the open-border regime the resulting inflow of immigrants increases labour supply and employment, thereby stimulating investment and output.

4.3.3 A Job Destruction Shock

Figures 13 and 14 present the responses of key macroeconomic variables in the EU15 and the NMS12 to an unexpected temporary increase in the job destruction rate.

A higher job destruction rate implies that more jobs are eliminated, leading to an immediate decline in employment and an increase in the unemployment rate. Production costs rise due

to higher labour turnover costs, as firms must post more vacancies to maintain a given level of employment. Firms therefore raise prices and reduce both production and labour demand. The resulting contraction in domestic supply leads to an appreciation of the domestic currency, which is reinforced by the tightening of monetary policy in response to higher inflationary pressures.

At the same time, higher job turnover implies that the probability of finding employment remains relatively elevated, strengthening the bargaining position of unemployed workers and occasionally leading to a modest increase in real wages.

The response of the host economy to a job destruction shock differs substantially across immigration regimes. In the EU15, the appreciation of the domestic currency together with relatively high job finding probabilities attracts workers from the NMS12. Immigration increases labour supply and, because immigrants accept lower wages, moderates the decline in employment. Consequently, output falls by less than in the closed-border regime. The relatively stronger labour market conditions and improved profitability of firms result in a milder contraction of consumption and investment. Overall, the variability of output, employment and domestic demand declines by roughly 70% (see the last column of Table 5).

The spillover effects of a job destruction shock in the host economy to the sending region are significant. A marked increase in emigration reduces labour supply in the NMS12. The unemployment rate declines sharply and real wages increase. At the same time, output, consumption and investment decrease, with the decline in output and investment being even larger than in the EU15, which is directly affected by the negative shock.

When a job destruction shock occurs in the NMS12, higher labour turnover, together with the appreciation of the domestic currency, encourages temporary emigrants to return. In this sense, migration responses to the shock are symmetric: the country affected by the shock receives inflows of workers. Return migration mitigates the negative effects of the shock on output and investment. As shown in the penultimate column of Table 7, the volatility of these variables falls by roughly 50%. However, the decline in private consumption is similar under both open- and closed-border regimes.

The negative spillover effects of the shock on the neighboring economy - in this case the host country - remain substantial.

5 Robustness of Results

As shown in the related work by Budnik (2012), the magnitude of migration flows triggered by total factor productivity shocks depends on the level of one-off migration costs. This result generalizes to the response of migration flows to the other shocks considered in this paper. The higher the migration costs, the smaller the differences between the open-border and closed-border solutions of the model. Conversely, when migration costs are lower, the differences between the no-migration and free movement of labour equilibria become more pronounced.

Altering the pricing strategy of producers on foreign markets so that prices obey the law of one price reduces the volatility of the real exchange rate and the terms of trade, and weakens the co-movement between these two variables.

A modification of the model specification in which immigrants purchase consumption goods in the host country rather than in the source country also has meaningful implications for the results.[1] First, the modified model suggests that the open-border regime can influence the transmission of monetary policy not only in the host economy but also in the sending region. In this case, monetary authorities face higher output costs when reducing inflation. An increase in interest rates triggers a stronger outflow of temporary migrants from the affected region, both relative to the closed-border regime and to the benchmark model with endogenous migration and immigrants that purchase consumption goods only in the home country.

In the benchmark model, a tightening of monetary policy in the NMS12 has two immediate effects: an appreciation of the domestic currency and a deterioration in labour demand. These two channels have countervailing effects on the incentives to emigrate, so that emigration flows remain broadly unchanged. In the modified model, however, where emigrants purchase consumption goods abroad, the appreciation of the NMS12 currencies additionally reduces the cost of living of emigrants abroad when expressed in home-country currency. From the perspective of NMS12 households, sending workers abroad therefore becomes more attractive. The resulting increase in emigration leads to larger declines in employment, investment and ultimately output. Figure 16 compares the responses of NMS12 macroeconomic variables to a positive monetary policy shock under the two alternative assumptions regarding the location of emigrants' consumption.

[1] The modified specification of the model is presented in Budnik (2012).

A stronger reduction in temporary immigration following a monetary policy tightening in the EU15 in the modified model can also be traced to the implications of exchange rate movements. The appreciation of the EU15 currencies raises the price of consumption goods purchased by NMS12 emigrants when measured in NMS12 currency. Figure 15 presents the corresponding impulse response functions for the EU15 economy.

Second, when emigrants purchase consumption goods in the host country, the moderating effect of free labour mobility on the medium-term costs of expansionary fiscal policy becomes less pronounced. In the benchmark model, currency appreciation and improved labour market conditions in the country implementing expansionary fiscal policy attract inflows of workers. These migration flows strengthen the supply side of the economy and limit the crowding out of private investment. This mechanism can be particularly relevant for policymakers in the NMS12.

In the modified version of the model, however, migration flows are dampened because fiscal expansion increases the relative cost of living in the country experiencing the fiscal stimulus through currency appreciation and higher inflation. Figure 18 compares the impulse responses of NMS12 variables following a government spending shock under the two alternative specifications.

Third, the assumption that emigrants purchase consumption goods in their country of residence affects the response of host economies to labour market shocks. Following a negative labour supply shock, the immigration wave no longer moderates the adjustment of output, as observed in the benchmark model.[2] By contrast, after a matching efficiency shock the increase in immigration is stronger in the modified model. Currency depreciation reduces not only immigrants' earnings (as in the benchmark model) but also their cost of living. As a result, employment expands more strongly than in the benchmark model, and output rises accordingly.

For the remaining shocks the results are not substantially affected by the change in the assumption regarding where emigrants purchase consumption goods. This applies in particular to the responses to investment productivity shocks, job destruction shocks in both regions, and labour supply and matching efficiency shocks in the sending region. In these cases, the

[2]In the modified version of the model, higher immigration coincides with higher remittance outflows, which are absent in the benchmark specification. Higher remittances reduce domestic demand in the EU15, weakening labour demand and the income of EU15 natives. Consequently, the response of output becomes close to that observed in the absence of endogenous migration.

responses of the modified model are generally slightly closer to those of the closed-border model, but remain much closer to the benchmark specification with endogenous migration.

6 Conclusions

This paper shows that labour mobility is not a passive adjustment margin but a mechanism that fundamentally reshapes macroeconomic dynamics in integrated economies. Using a two-region DSGE model calibrated to key differences between the EU15 and NMS12, I demonstrate that allowing for temporary migration changes not only the magnitude, but also the composition, persistence and cross-country transmission of shocks.

At the core of the mechanism is the interaction between labour market conditions and exchange rate movements. Migration decisions respond to both, and the relative strength of these channels governs the direction and intensity of labour flows. This interaction generates adjustment patterns that are inherently nonlinear and, at times, counterintuitive.

A key contribution of the paper is to show that labour mobility alters the trade-offs faced by policymakers. For monetary policy, migration can reduce output losses associated with disinflation but at the cost of more pronounced labour market slack. For fiscal policy, it mitigates the crowding-out of private investment and redistributes the medium-term costs of expansion across regions. More generally, migration shifts adjustment away from prices and towards quantities, thereby changing the effective transmission of both policy and structural shocks.

These results also imply that open labour markets strengthen cross-country interdependence. Shocks are no longer primarily absorbed domestically but are partially exported through migration flows. As a result, economic fluctuations become more synchronised, yet the distribution of adjustment becomes more uneven across labour markets. This asymmetry is particularly relevant in environments characterised by large differences in country size, such as between the EU15 and the NMS12.

These considerations have direct policy implications. First, labour mobility should be explicitly incorporated into the design and evaluation of stabilisation policies, as it materially affects both domestic outcomes and cross-border spillovers. Second, policies that shape labour market functioning - including hiring costs, matching efficiency and mobility barriers - have international

consequences that go beyond their domestic objectives. Third, in highly integrated economies, migration cannot substitute for other adjustment mechanisms. Instead, it increases the need for complementary policies, including fiscal coordination and targeted labour market interventions, to manage the distributional effects of shocks.

In sum, labour mobility is a powerful but double-edged adjustment mechanism. It enhances flexibility and facilitates reallocation, but it also redistributes adjustment across regions and across labour markets. Understanding this dual role is essential for designing policies in increasingly integrated economic systems.

At the same time, the analysis abstracts from an important dimension: selection in migration. Workers are homogeneous within regions, and migration does not alter the composition of the labour force. In practice, migrants are likely to differ systematically from non-migrants along multiple dimensions, including skills, productivity and labour market attachment. This omission is not innocuous. Selection could amplify the supply-side effects identified in this paper, alter wage dynamics, and potentially reverse some of the distributional implications. Addressing endogenous selection is therefore a first-order priority for future research.

A second avenue for future research concerns the central role of the exchange rate. In the model, exchange rate movements are a key driver of migration incentives and a major channel of adjustment. This raises an immediate question about the relevance of the results for currency unions, where this channel is absent. In such environments, adjustment must rely more heavily on internal prices, wages, and fiscal mechanisms. Whether labour mobility becomes more stabilising or more destabilising in the absence of exchange rate flexibility is ultimately an empirical question that cannot be addressed within the current framework. Extending the analysis to a currency union setting is therefore a natural and necessary next step.

References

Adolfson, M., Laseen, S., Linde, J., and Villani, M. (2007). Bayesian estimation of an open economy DSGE model with incomplete pass-through. *Journal of International Economics*, 72(2):481–511.

Binyamini, A. and Razin, A. (2008). Inflation-output tradeoff as equilibrium outcome of globalization. NBER Working Papers 14379, National Bureau of Economic Research, Inc.

Blanchard, O. and Gali, J. (2007). Real wage rigidities and the new keynesian model. *Journal of Money, Credit and Banking*, 39(s1):35–65.

Blanchard, O. J., Katz, L. F., Hall, R. E., and Eichengreen, B. (1992). Regional evolutions. *Brookings Papers on Economic Activity*, 1992(1):pp. 1–75.

Blanchflower, D. G. and Lawton, H. (2010). *The impact of the recent expansion of the EU on the UK labor market*, pages 181–215. Springer Berlin Heidelberg, Berlin, Heidelberg.

Blanchflower, D. G., Saleheen, J., and Shadforth, C. (2007). The impact of the recent migration from Eastern Europe on the UK economy. IZA Discussion Papers 2615, Institute for the Study of Labor (IZA).

Blanes, J. V. (2005). Does immigration help to explain intra-industry trade? Evidence for spain. *Review of World Economics (Weltwirtschaftliches Archiv)*, 141(2):244–270.

Brücker, H., Baas, T., Beleva, I., Bertoli, S., Boeri, T., Damelang, A., Duval, L., Hauptmann, A., Fihel, A., Huber, P., Iara, A., Ivlevs, A., Jahn, E. J., Kaczmarczyk, P., Landesmann, M. E., Mackiewicz-Lyziak, J., Makovec, M., Monti, P., Nowotny, K., Okólski, M., Richter, S., Upward, R., Vidovic, H., Wolf, K., Wolfeil, N., Wright, P., Zaiga, K., and Zylicz, A. (2009). Labour mobility within the eu in the context of enlargement and the functioning of the transitional arrangements. Final report, European Integration Consortium.

Budnik, K. B. (2012). European temporary migration in a two country dsge model.

Canova, F. and Ravn, M. O. (1998). Crossing the Rio Grande: Migrations, business cycles and the welfare state. CEPR Discussion Papers 2040, C.E.P.R. Discussion Papers.

Chortareas, G., Katirtzidis, K., and Tsoukalas, J. (2008). Macroeconomic effects of immigration in a new keynesian model. Paper presented at the conference Migration, Labour Market and Economic Growth in Europe after Enlargement hosted by the National Bank of Poland, 8-9 December 2008.

Dunlevy, J. A. and Hutchinson, W. K. (1999). The impact of immigration on american import trade in the late nineteenth and early twentieth centuries. *The Journal of Economic History*, 59(04):1043–1062.

Dustmann, C. (1993). Earnings adjustment of temporary migrants. *Journal of Population Economics*, 6(2):153–68.

Dustmann, C. (1997a). Differences in the labor market behavior between temporary and permanent migrant women. *Labour Economics*, 4(1):29–46.

Dustmann, C. (1997b). Return migration, uncertainty and precautionary savings. *Journal of Development Economics*, 52(2):295–316.

Dustmann, C. (1999). Temporary migration, human capital, and language fluency of migrants. *Scandinavian Journal of Economics*, 101(2):297–314.

Dustmann, C., Frattini, T., and Halls, C. (2010). Assessing the fiscal costs and benefits of A8 migration to the UK. *Fiscal Studies*, 31(1):1–41.

Dustmann, C. and Glitz, A. (2011). Chapter 4 - migration and education. In Hanushek, E. A., Machin, S., and Woessmann, L., editors, *Handbook of The Economics of Education*, volume 4 of *Handbook of the Economics of Education*, pages 327–439. Elsevier.

Duval, R. and Vogel, L. (2012). How do nominal and real rigidities interact? a tale of the second best. *Journal of Money, Credit and Banking*, 44(7):1455–1474.

Engler, P. (2009). Gains from migration in a new-keynesian framework. unpublished manuscript.

Foad, H. S. (2009). Assimilation and Trade: Explaining the Migration-Trade Relationship with Middle Eastern Migration to Europe and North America. Working paper series, Department of Economics, San Diego State University.

Galor, O. and Stark, O. (1990). Migrants' savings, the probability of return migration and migrants' performance. *International Economic Review*, 31(2):463–467.

Glytsos, N. (1988). Remittances in temporary migration: A theoretical model and its testing with the

greek-german experience. *Review of World Economics*, 124(3):524–549.
Gould, D. M. (1994). Immigrant links to the home country: Empirical implications for u.s. bilateral trade flows. *The Review of Economics and Statistics*, 76(2):302–16.
Hatton, T. J. and Williamson, J. G. (2006). *Global Migration and the World Economy: Two Centuries of Policy and Performance,*, volume 1, chapter 5, pages 77–99. The MIT Press.
Head, K. and Ries, J. (1998). Immigration and trade creation: Econometric evidence from canada. *Canadian Journal of Economics*, 31(1):47–62.
Jakab, Z. and Konya, I. (2016). An open economy DSGE model with search-and-matching frictions: The case of hungary. *Emerging Markets Finance and Trade*, 52(7):1606–1626.
Jakab, Z. M. and Világi, B. (2008). An estimated DSGE model of the Hungarian economy. MNB Working Papers 2008/9, Magyar Nemzeti Bank.
Kahanec, M., Zaiceva, A., and Zimmermann, K. F. (2010). *Lessons from Migration after EU Enlargement*, pages 3–45. Springer Berlin Heidelberg, Berlin, Heidelberg.
Kolasa, M. (2009). Structural heterogeneity or asymmetric shocks? Poland and the euro area through the lens of a two-country DSGE model. *Economic Modelling*, 26(6):1245–1269.
Kuhn, P. and Wooton, I. (1987). International factor movements in the presence of a fixed factor. *Journal of International Economics*, 22(1-2):123–140.
Lemos, S. and Portes, J. (2008). New labour? The impact of migration from Central and Eastern European countries on the UK labour market. Discussion Papers in Economics 08/29, Department of Economics, University of Leicester.
Lucas, R. E. B. and Stark, O. (1985). Motivations to remit: Evidence from botswana. *Journal of Political Economy*, 93(5):901–18.
Ortega, J. (2000). Pareto-improving immigration in an economy with equilibrium unemployment. *Economic Journal*, 110(460):92–112.
Pissarides, C. A. (1992). Loss of skill during unemployment and the persistence of employment shocks. *The Quarterly Journal of Economics*, 107(4):1371–91.
Pytlarczyk, E. (2005). An estimated DSGE model for the german economy within the euro area. Discussion Paper Series 1: Economic Studies 2005/33, Deutsche Bundesbank, Research Centre.
Ramaswami, V. K. (1968). International factor movement and the national advantage. *Economica*, 35(139):309–310.
Rauch, J. E. and Trindade, V. (2002). Ethnic Chinese networks in international trade. *The Review of Economics and Statistics*, 84(1):116–130.
Rosenzweig, M. R. and Stark, O. (1989). Consumption smoothing, migration, and marriage: Evidence from rural india. *Journal of Political Economy*, 97(4):905–26.
Rotemberg, J. J. (1982). Monopolistic price adjustment and aggregate output. *Review of Economic Studies*, 49(4):517–31.
Saavedra-Rivano, N. and Wooton, I. (1983). The choice between international labour and capital mobility in a dynamic model of north-south trade. *Journal of International Economics*, 14(3-4):251–261.
Saleheen, J. and Shadforth, C. (2006). The Economic Characteristics of Immigrants and their Impact on Supply. Bank of England Quarterly Bulletin Q4, Bank of England.
Sinning, M. (2011). Determinants of savings and remittances: empirical evidence from immigrants to Germany. *Review of Economics of the Household*, 9(1):45–67.
Smets, F. and Wouters, R. (2003). An estimated dynamic stochastic general equilibrium model of the euro area. *Journal of the European Economic Association*, 1(5):1123–1175.
Smets, F. and Wouters, R. (2005). Comparing shocks and frictions in us and euro area business cycles: a bayesian DSGE approach. *Journal of Applied Econometrics*, 20(2):161–183.
Stark, O. and Lucas, R. E. B. (1988). Migration, remittances, and the family. *Economic Development and Cultural Change*, 36(3):465–81.
White, R. (2007). Immigrant-trade links, transplanted home bias and network effects. *Applied Economics*, 39(7):839–852.

Tables and Figures

Table 1: Model parameters

Parameter		Home	Foreign
ι	Population share	0.21	0.79
β	Discount factor	0.99	0.99
σ	Intertemporal elasticity of substitution	1.1	1.1
χ	Disutility of labour	0.612	0.395
υ	Disutility of emigration	0.290	0.189
h_c	Degree of external habit formation	0.70	0.65
a	Home bias	0.904	0.986
ϵ	Elasticity of substitution between intermediate goods	6	6
ϕ	Elasticity of substitution between domestic and imported goods	2	2
α	Output elasticity with respect to labour	0.67	0.69
A	Relative productivity level in F	1	1.63
ρ	Inverse elasticity of substitution between native and immigrant labour	0.03	0.03
ω	Relative productivity of immigrants	0.625	0.625
δ	Depreciation rate	0.025	0.025
s	Job destruction rate	0.025	0.024
μ	Workersâ€™ bargaining power	0.4	0.5
ϑ	Elasticity of matches with respect to unemployment	0.4	0.5
m	Matching elasticity	0.45	0.41
$\bar{\kappa}$	Vacancy posting cost	0.01	0.01
$\bar{g}$	Government consumption-to-private demand ratio	0.068	0.067
$\bar{\nu}^H/\bar{\nu}^{F\star}$	Unemployment benefit replacement rate (natives)	0.536	0.588
$\bar{\nu}^{H\star}/\bar{\nu}^F$	Unemployment benefit replacement rate (immigrants)	0.268	0.294
t	Income tax rate	0.41	0.405
$\bar{S}$	Capital adjustment cost parameter	12	10
ϑ	Degree of real wage rigidity	0.70	0.70
ψ	Price adjustment cost	20	20
$\bar{x}$	Migration cost (in terms of real wage abroad)	5	—
h_r	Interest rate smoothing parameter	0.80	0.90
h_π	Interest rate response to inflation	2.3	2.5
h_τ	Persistence of lump-sum taxation	0.80	0.80
h_b	Immediate adjustment of lump-sum taxes to public debt	0.40	0.40
h_g	Persistence of government spending	0.95	0.95

Table 2: Steady-state comparison

	EU15 (foreign country)		Difference	NMS12 (home country)		Difference
	No migration	Migration	in % or pp	Migration	No migration	in % or pp
Immigration rate* (%)	0.00	1.50				
Emigration rate** (%)				5.73	0.00	
Average real wage rate	2.86	2.84	-0.58%	1.54	1.56	1.47%
Average real wage rate of natives	2.86	2.85	-0.14%			
Employment level	0.73	0.75	2.14%	0.19	0.18	-3.57%
Employment level of natives	0.73	0.74	0.61%			
Unemployment rate (%)	7.48	6.92	-0.56 pp	9.87	7.81	-2.06 pp
Output	3.64	3.70	1.69%	0.52	0.51	-3.10%
Consumption	2.74	2.77	1.07%	0.39	0.39	0.94%
Investment	0.67	0.68	1.55%	0.10	0.10	-2.14%
Stock of capital	26.76	27.17	1.55%	4.09	4.00	-2.14%
Real exchange rate				0.99	0.91	-8.30%
Trade balance - output ratio (%)	0.00%	0.59%	0.59 pp	0.00	-1.58	-1.58 pp
Remittances balance - output ratio (%)				0.00%	1.27%	1.27 pp
Exports - output ratio (%)	1.39	1.81	0.42 pp	9.65	7.57	-2.09 pp
Share of imports in intermediate goods (%)	1.39	1.04	-0.35 pp	9.65	12.52	2.87 pp
Net contribution of immigrants to budget balance*** (%)	0.00	0.23	0.23 pp			

* Share of temporary immigrants in the local labour force. ** Share of population staying temporarily abroad. *** As a share of output. For the EU15, columns 2–4 compare the steady state without and with immigration. For the NMS12, columns 5–7 compare the steady state with and without emigration.

Table 3: Characterisation of shocks

		Home economy		Foreign economy	
Symbol	Description	Persistence	Std. dev.	Persistence	Std. dev.
ϵ_A	Total factor productivity shock	0.9	1.2%	0.9	0.6%
ϵ_Φ	Investment productivity shock	0.6	2.8%	0.8	1.4%
ϵ_r	Monetary policy shock	0	0.2 ppt	0	0.08 ppt
ϵ_g	Government spending shock	0	3%	0	0.75%
ϵ_χ	Labour disutility shock	0.85	5.5%	0.85	1.6%
ϵ_m	Matching efficiency shock	0.9	10%	0.9	10%
ϵ_s	Job destruction shock	0.9	1 ppt	0.9	1 ppt

Persistence refers to the AR(1) coefficient of the shock process.

Table 4: Standard deviations of EU15 variables (open-border regime)

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.03	0.20	0.00	0.07	0.00	0.01	0.01	0.00	0.02	0.02	0.01	0.08	0.03	0.05
Consumption	0.02	0.15	0.00	0.05	0.00	0.01	0.00	0.01	0.01	0.02	0.01	0.06	0.02	0.06
Investment	0.07	0.39	0.01	0.27	0.00	0.02	0.01	0.01	0.04	0.05	0.03	0.18	0.07	0.14
Gov. consumption	0.02	0.10	0.00	0.04	0.00	0.00	0.00	0.17	0.01	0.01	0.01	0.05	0.02	0.05
Labour market														
Employment	0.05	0.15	0.00	0.06	0.00	0.02	0.01	0.01	0.02	0.03	0.02	0.09	0.04	0.05
Real wage	0.01	0.07	0.00	0.03	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.04
Vacancies	0.63	4.79	0.05	0.99	0.08	0.75	0.08	0.34	0.23	0.43	0.15	2.06	0.39	11.58
Job finding prob.	0.09	0.60	0.01	0.17	0.01	0.09	0.01	0.04	0.04	0.08	0.02	0.27	0.07	1.06
Unemployment rate	0.03	0.11	0.00	0.05	0.00	0.02	0.00	0.01	0.01	0.02	0.01	0.08	0.02	0.12
Prices and monetary policy														
Inflation	0.00	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Marginal costs	0.02	0.11	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.04
Interest rate	0.00	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
External sector														
Net exports/output	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.05
Current account/output	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Real exchange rate	0.27	0.18	0.03	0.05	0.04	0.03	0.03	0.01	0.03	0.02	0.03	0.06	0.05	0.05
Terms of trade	0.21	0.16	0.03	0.05	0.03	0.02	0.02	0.01	0.03	0.02	0.02	0.06	0.05	0.05

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 5: Volatility ratios: open-border vs. closed-border regime (EU15)

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	16.52	1.22	5.33	1.25	5.04	1.11	22.97	1.20	32.72	0.99	35.58	1.11	37.50	0.28
Consumption	4.25	1.12	2.56	1.19	3.46	1.05	6.72	1.04	11.61	0.97	12.37	1.09	14.09	0.49
Investment	9.76	1.25	2.96	1.10	4.17	1.20	11.44	1.03	15.67	0.99	16.78	1.10	17.70	0.33
Gov. consumption	6.81	1.23	2.55	1.21	2.96	1.17	10.20	1.00	13.57	0.99	14.52	1.10	15.60	0.41
Labour market														
Employment	16.27	1.47	6.05	1.30	5.58	1.10	22.20	1.22	34.80	0.98	38.43	1.10	41.36	0.23
Real wage	4.82	0.86	1.65	0.99	5.86	1.01	5.99	1.27	8.84	0.98	9.23	1.11	10.12	0.64
Vacancies	5.97	1.07	4.49	1.16	1.58	1.02	7.35	1.00	12.67	0.99	13.18	0.94	14.72	1.13
Job finding prob.	6.93	1.16	4.17	1.27	1.78	1.09	9.19	1.08	15.94	1.07	16.82	1.20	18.58	1.22
Unemployment	9.73	1.21	3.64	1.13	3.69	1.00	11.92	1.11	18.75	0.95	20.04	1.07	21.65	0.63
Prices and monetary policy														
Inflation	2.22	0.88	2.40	1.24	6.65	0.99	3.36	1.03	16.53	0.91	12.86	1.04	12.90	0.72
Marginal costs	11.51	0.85	3.76	1.42	4.35	1.12	16.86	0.97	13.14	0.95	16.68	0.91	9.44	0.61
Interest rate	2.66	0.97	4.02	1.18	5.49	0.99	3.35	1.16	14.92	0.93	14.04	1.09	23.62	0.86
External sector														
Net exports/output	1.95	3.06	1.66	3.83	1.40	1.89	2.18	2.15	5.31	1.45	5.82	1.27	6.80	14.73
Current account/output	1.42	1.44	1.32	1.90	1.17	1.22	1.62	1.47	2.97	0.74	3.32	0.73	3.81	7.68
Real exchange rate	0.91	1.19	0.90	1.15	0.97	1.03	0.96	1.02	0.69	1.00	0.88	1.11	0.81	0.40
Terms of trade	0.91	1.21	0.91	1.17	1.02	1.00	0.95	1.00	0.65	1.01	0.84	1.13	0.79	0.40

Entries above one indicate amplification of volatility under open borders, while values below one indicate dampening. Bold values highlight the strongest amplification effects.

Table 6: Standard deviations of NMS12 variables (open-border regime)

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.23	0.06	0.04	0.03	0.01	0.00	0.03	0.00	0.03	0.00	0.02	0.01	0.04	0.22
Private consumption	0.21	0.02	0.03	0.01	0.02	0.00	0.02	0.00	0.03	0.00	0.03	0.01	0.06	0.04
Investment	0.44	0.06	0.17	0.05	0.01	0.00	0.01	0.01	0.07	0.01	0.06	0.02	0.12	0.29
Gov. consumption	0.13	0.02	0.02	0.01	0.00	0.00	0.67	0.00	0.03	0.00	0.02	0.01	0.05	0.05
Labour market														
Employment	0.11	0.09	0.04	0.04	0.02	0.00	0.05	0.00	0.04	0.00	0.03	0.01	0.05	0.30
Real wage	0.15	0.05	0.03	0.01	0.01	0.00	0.01	0.00	0.02	0.00	0.01	0.01	0.02	0.10
Vacancies	7.55	1.13	0.74	0.40	0.59	0.16	1.36	0.05	0.61	0.05	2.48	0.14	9.78	3.24
Job finding prob.	1.03	0.19	0.12	0.09	0.08	0.02	0.19	0.01	0.17	0.01	0.13	0.03	1.03	0.56
Unemployment rate	0.15	0.05	0.03	0.02	0.02	0.01	0.03	0.00	0.07	0.00	0.05	0.01	0.12	0.12
Prices and monetary policy														
Inflation	0.06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Marginal costs	0.20	0.01	0.01	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.04	0.01
Interest rate	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
External sector														
Net exports to product	0.11	0.09	0.01	0.04	0.01	0.01	0.02	0.01	0.04	0.00	0.03	0.01	0.08	0.32
Current account/output	0.08	0.04	0.01	0.02	0.00	0.00	0.02	0.00	0.02	0.00	0.02	0.01	0.04	0.16
Real exchange rate	0.27	0.18	0.03	0.05	0.04	0.03	0.03	0.01	0.03	0.02	0.03	0.06	0.05	0.05
Terms of trade	0.21	0.16	0.03	0.05	0.03	0.02	0.02	0.01	0.03	0.02	0.02	0.06	0.05	0.05

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 7: Volatility ratios: open-border vs. closed-border regime (NMS12)

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.84	10.45	0.89	5.78	0.80	1.95	1.25	8.72	0.44	2.77	0.58	2.59	0.48	18.67
Consumption	0.95	0.89	0.93	1.67	0.96	0.76	1.02	1.38	0.84	0.87	1.04	1.02	1.03	2.40
Investment	0.95	2.37	0.94	2.41	0.71	1.11	0.49	4.14	0.57	0.98	0.71	1.04	0.66	5.57
Gov. consumption	0.98	1.80	0.88	1.97	0.99	0.55	1.00	2.67	0.74	0.92	0.92	1.06	0.89	2.86
Labour market														
Employment	0.73	9.40	0.92	6.00	0.81	1.90	1.21	7.14	0.47	2.77	0.61	2.57	0.50	20.92
Real wage	1.09	4.45	0.99	2.03	1.22	4.36	1.20	1.41	0.61	1.43	0.66	1.46	0.62	5.64
Vacancies	1.00	4.84	0.99	7.59	0.86	0.89	1.05	3.39	0.73	1.48	1.02	1.43	0.99	11.90
Job finding prob.	1.26	6.89	1.21	8.85	1.09	0.96	1.29	6.13	1.24	2.46	1.53	2.55	1.15	16.25
Unemployment rate	1.10	6.27	0.88	4.63	1.15	2.42	0.88	5.03	1.04	2.07	1.26	2.30	1.29	9.34
Prices and monetary policy														
Inflation	0.95	0.40	0.94	1.63	1.03	1.88	0.98	0.62	0.75	1.08	0.98	0.93	1.03	4.70
Marginal costs	1.02	1.77	0.99	2.02	1.07	1.39	1.06	2.01	0.96	1.11	1.13	1.50	1.04	2.49
Interest rate	0.91	0.28	0.92	1.75	0.97	1.42	0.93	0.61	0.76	1.04	0.95	1.00	1.00	9.07
External sector														
Net exports/output	1.89	3.01	1.65	3.80	1.48	1.87	2.22	2.15	5.11	1.45	5.61	1.28	6.56	14.26
Current account/output	1.35	1.37	1.26	1.81	1.11	1.17	1.54	1.40	2.83	0.71	3.16	0.69	3.63	7.31
Real exchange rate	0.91	1.19	0.90	1.15	0.97	1.03	0.96	1.02	0.69	1.00	0.88	1.11	0.81	0.40
Terms of trade	0.91	1.21	0.91	1.17	1.02	1.00	0.95	1.00	0.65	1.01	0.84	1.13	0.79	0.40

Entries above one indicate amplification of volatility under open borders, while values below one indicate dampening. Bold values highlight the strongest amplification effects.

Table 8: AR(1) coefficients of EU15 variables under the open-border regime

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.99	0.98	0.99	1.00	0.95	0.87	1.00	0.76	1.00	1.00	1.00	1.00	1.00	0.99
Consumption	0.99	0.97	0.99	0.99	0.95	0.85	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99
Investment	0.99	0.99	1.00	0.99	0.98	0.97	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99
Gov. consumption	1.00	1.00	1.00	1.00	0.99	0.98	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Labour market														
Employment	0.99	0.92	0.99	0.99	0.95	0.86	1.00	0.83	1.00	0.99	1.00	0.99	1.00	0.96
Real wage	0.96	0.98	0.99	1.00	0.78	0.92	0.98	0.95	0.99	0.99	0.99	0.99	0.99	0.98
Vacancies	0.91	0.18	0.98	0.76	0.18	0.38	0.94	-0.16	0.98	0.90	0.98	0.90	0.98	0.85
Job finding prob.	0.93	0.32	0.99	0.89	0.21	0.45	0.96	-0.05	0.99	0.96	0.99	0.96	0.99	0.82
Unemployment rate	0.98	0.88	0.99	0.99	0.93	0.87	0.99	0.77	0.99	0.99	0.99	0.99	0.99	0.99
Prices and monetary policy														
Inflation	0.57	0.30	0.90	0.61	0.24	0.64	0.43	0.18	0.58	0.90	0.51	0.60	0.57	0.45
Marginal costs	0.51	0.27	0.67	0.61	0.13	0.66	0.49	0.14	0.65	0.91	0.58	0.53	0.68	-0.27
Interest rate	0.92	0.92	0.98	0.96	0.80	0.54	0.88	0.92	0.95	0.99	0.94	0.99	0.95	0.91
External sector														
Net exports/output	0.95	0.98	0.99	0.99	0.56	0.90	0.98	1.00	1.00	0.99	1.00	0.98	1.00	1.00
Current account/output	0.92	0.93	0.98	0.99	0.44	0.76	0.97	0.98	1.00	0.97	1.00	0.96	1.00	1.00
Real exchange rate	0.84	0.90	0.99	0.99	0.41	0.53	0.87	0.91	0.96	0.98	0.94	0.98	0.99	0.99
Terms of trade	0.95	0.97	0.99	0.99	0.54	0.61	0.97	0.98	0.97	0.98	0.98	0.99	0.96	0.99

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 9: AR(1) coefficient differences of EU15 variables: open- vs. closed-border regimes

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.09	0.01	0.00	0.00	0.52	0.03	0.06	0.13	0.02	0.00	0.02	0.00	0.02	-0.01
Consumption	0.04	0.01	0.00	0.00	-0.02	0.02	0.03	0.00	0.01	0.00	0.01	0.00	0.00	-0.01
Investment	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gov. consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour market														
Employment	0.09	0.07	0.00	0.01	0.56	0.03	0.07	0.09	0.04	0.00	0.04	0.00	0.04	-0.03
Real wage	-0.03	0.01	-0.01	0.00	0.08	-0.02	-0.02	0.03	-0.01	0.00	-0.01	0.00	-0.01	0.01
Vacancies	0.78	0.13	0.29	0.09	0.46	0.03	0.76	0.03	0.80	0.01	0.83	0.00	0.88	0.04
Job finding prob.	0.64	0.15	0.12	0.05	0.46	0.03	0.58	0.05	0.54	0.00	0.56	0.00	0.58	0.08
Unemployment rate	0.08	0.03	0.00	0.00	0.54	0.03	0.06	0.03	0.04	0.00	0.04	0.00	0.04	-0.01
Prices and monetary policy														
Inflation	0.08	0.02	0.45	-0.05	0.34	-0.05	0.01	0.05	-0.20	0.01	-0.16	0.05	0.57	0.55
Marginal costs	0.20	-0.04	0.12	-0.09	0.23	-0.13	0.39	0.00	0.73	-0.04	0.74	0.04	0.61	-0.21
Interest rate	0.02	0.02	0.06	0.00	-0.08	0.03	-0.02	0.02	-0.02	0.00	0.00	0.00	0.13	0.07
External sector														
Net exports/output	0.08	0.09	0.01	0.01	0.08	0.33	0.05	0.06	0.02	0.00	0.03	0.00	0.01	0.00
Current account/output	0.05	0.04	0.00	0.01	-0.04	0.19	0.04	0.04	0.02	-0.02	0.03	-0.03	0.01	0.00
Real exchange rate	-0.01	0.01	0.00	0.00	-0.03	0.04	-0.01	-0.01	-0.02	0.00	-0.02	0.00	-0.01	-0.01
Terms of trade	0.00	0.00	0.00	0.00	0.04	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.02

Entries above one indicate amplification of volatility under open borders, while values below one indicate dampening.

Table 10: AR(1) coefficients of NMS12 variables under the open-border regime

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.98	0.99	0.99	0.99	0.84	0.84	0.91	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Consumption	0.97	1.00	1.00	0.99	0.82	0.93	0.98	0.99	1.00	0.99	1.00	1.00	1.00	0.97
Investment	0.99	0.99	0.97	0.99	0.89	0.99	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.99
Gov. consumption	1.00	1.00	1.00	1.00	0.98	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Labour market														
Employment	0.45	0.98	0.96	0.99	0.84	0.82	0.91	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Real wage	0.99	0.96	1.00	1.00	0.92	0.80	0.98	0.94	0.98	1.00	0.99	1.00	0.95	0.98
Vacancies	-0.18	0.86	0.34	0.92	0.51	-0.06	-0.13	0.91	0.92	0.69	0.89	0.62	0.87	0.82
Job finding prob.	-0.06	0.91	0.57	0.97	0.60	0.02	0.02	0.97	0.98	0.90	0.98	0.90	0.84	0.87
Unemployment rate	0.74	0.96	0.96	1.00	0.85	0.57	0.83	0.96	0.99	0.99	0.99	0.99	1.00	1.00
Prices and monetary policy														
Inflation	0.28	0.16	0.48	0.67	0.69	0.24	0.13	0.18	0.95	0.79	0.47	0.69	-0.16	0.79
Marginal costs	0.31	0.73	0.45	0.80	0.86	0.20	0.15	0.54	0.65	-0.01	0.39	0.07	-0.09	0.86
Interest rate	0.87	0.71	0.92	0.96	0.46	0.82	0.85	0.87	0.99	0.95	0.96	0.95	0.66	0.95
External sector														
Net exports/output	0.94	0.98	0.98	0.99	0.52	0.87	0.98	1.00	1.00	0.99	1.00	0.98	1.00	1.00
Current account/output	0.92	0.93	0.98	0.99	0.44	0.76	0.97	0.98	1.00	0.97	1.00	0.96	1.00	1.00
Real exchange rate	0.84	0.90	0.99	0.99	0.41	0.53	0.87	0.91	0.96	0.98	0.94	0.98	0.99	0.99
Terms of trade	0.95	0.97	0.99	0.99	0.54	0.61	0.97	0.98	0.97	0.98	0.98	0.99	0.96	0.99

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 11: AR(1) coefficient differences of EU15 variables: open- vs. closed-border regimes

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.09	0.01	0.00	0.00	0.52	0.03	0.06	0.13	0.02	0.00	0.02	0.00	0.02	-0.01
Consumption	0.04	0.01	0.00	0.00	-0.02	0.02	0.03	0.00	0.01	0.00	0.01	0.00	0.00	-0.01
Investment	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gov. consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour market														
Employment	0.09	0.07	0.00	0.01	0.56	0.03	0.07	0.09	0.04	0.00	0.04	0.00	0.04	-0.03
Real wage	-0.03	0.01	-0.01	0.00	0.08	-0.02	-0.02	0.03	-0.01	0.00	-0.01	0.00	-0.01	0.01
Vacancies	0.78	0.13	0.29	0.09	0.46	0.03	0.76	0.03	0.80	0.01	0.83	0.00	0.88	0.04
Job finding prob.	0.64	0.15	0.12	0.05	0.46	0.03	0.58	0.05	0.54	0.00	0.56	0.00	0.58	0.08
Unemployment rate	0.08	0.03	0.00	0.00	0.54	0.03	0.06	0.03	0.04	0.00	0.04	0.00	0.04	-0.01
Prices and monetary policy														
Inflation	0.08	0.02	0.45	-0.05	0.34	-0.05	0.01	0.05	-0.20	0.01	-0.16	0.05	0.57	0.55
Marginal costs	0.20	-0.04	0.12	-0.09	0.23	-0.13	0.39	0.00	0.73	-0.04	0.74	0.04	0.61	-0.21
Interest rate	0.02	0.02	0.06	0.00	-0.08	0.03	-0.02	0.02	-0.02	0.00	0.00	0.00	0.13	0.07
External sector														
Net exports/output	0.08	0.09	0.01	0.01	0.08	0.33	0.05	0.06	0.02	0.00	0.03	0.00	0.01	0.00
Current account/output	0.05	0.04	0.00	0.01	-0.04	0.19	0.04	0.04	0.02	-0.02	0.03	-0.03	0.01	0.00
Real exchange rate	-0.01	0.01	0.00	0.00	-0.03	0.04	-0.01	-0.01	-0.02	0.00	-0.02	0.00	-0.01	-0.01
Terms of trade	0.00	0.00	0.00	0.00	0.04	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.02

Entries above zero indicate an increase in positive autocorrelation (or a decrease in negative autocorrelation) under open borders.

Table 12: Correlations of EU15 variables with output under the open-border regime

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption	0.98	0.98	0.96	0.67	0.90	0.98	0.97	-0.46	0.96	0.98	0.96	0.98	0.96	0.99
Investment	0.97	0.95	0.94	0.81	0.89	0.76	0.94	-0.09	0.94	0.95	0.94	0.95	0.94	0.92
Gov. consumption	0.57	0.59	0.66	0.68	0.47	0.37	0.70	0.65	0.71	0.69	0.73	0.70	0.72	0.65
Labour market														
Employment	0.98	0.87	0.97	0.85	0.99	0.99	0.98	0.98	0.98	0.96	0.98	0.96	0.98	0.74
Real wage	-0.74	0.65	-0.48	0.43	-0.53	0.55	-0.76	-0.44	-0.76	-0.63	-0.76	-0.45	-0.76	0.42
Vacancies	0.51	0.39	0.55	0.43	0.42	0.48	0.56	0.55	0.61	0.67	0.61	-0.68	0.62	-0.83
Job finding prob.	0.76	0.55	0.77	0.62	0.60	0.65	0.77	0.69	0.79	0.84	0.79	0.85	0.79	-0.78
Unemployment rate	-0.93	-0.79	-0.93	-0.81	-0.86	-0.99	-0.92	-0.99	-0.93	-0.96	-0.93	-0.96	-0.93	-0.96
Prices and monetary policy														
Inflation	-0.30	-0.09	-0.45	-0.17	-0.14	0.79	-0.22	0.65	-0.28	-0.59	-0.25	-0.35	-0.27	-0.13
Marginal costs	-0.08	-0.22	-0.13	0.13	0.08	0.79	-0.07	0.63	-0.10	-0.55	-0.09	-0.04	-0.11	-0.04
Interest rate	-0.80	-0.84	-0.50	0.19	-0.65	-0.78	-0.48	0.54	-0.33	-0.92	-0.29	-0.86	-0.28	-0.79
External sector														
Net exports/output	0.81	0.83	0.91	0.96	0.52	0.68	0.89	0.80	0.97	0.53	0.97	0.51	0.98	-0.89
Current account/output	0.69	0.56	0.87	0.85	0.20	0.29	0.83	0.82	0.95	-0.10	0.94	-0.26	0.96	-0.89
Real exchange rate	-0.45	0.86	-0.62	0.83	-0.19	0.78	-0.50	-0.56	-0.58	0.96	-0.59	0.95	-0.67	0.73
Terms of trade	0.70	-0.97	0.69	-0.78	-0.58	0.53	0.74	0.37	0.74	-0.98	0.76	-0.98	0.79	-0.71

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 13: Differences in the correlations of EU15 variables with output between the open- and closed-border regimes

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption	0.03	0.00	0.02	0.09	0.51	0.00	0.01	0.16	0.01	0.00	0.01	0.00	0.03	0.01
Investment	0.13	0.01	-0.02	0.01	0.40	0.02	0.05	0.36	0.01	0.00	0.01	0.00	0.00	-0.03
Gov. consumption	0.33	0.03	0.04	0.00	0.06	0.02	0.28	-0.12	0.13	0.01	0.12	0.01	0.12	-0.06
Labour market														
Employment	0.05	0.12	0.17	0.08	0.01	0.00	0.10	0.03	0.18	0.00	0.19	0.00	0.20	-0.22
Real wage	-1.30	0.00	-1.22	-0.14	-1.24	0.02	-1.43	-0.48	-1.52	-0.02	-1.53	-0.04	-1.53	0.81
Vacancies	0.06	0.06	0.09	0.08	-0.19	-0.01	0.15	-0.05	0.23	0.01	0.25	0.02	0.25	-0.21
Job finding prob.	0.12	0.08	0.12	0.06	-0.09	0.00	0.16	-0.02	0.22	0.00	0.23	0.00	0.24	-0.34
Unemployment rate	0.00	-0.04	-0.13	-0.04	0.12	0.00	-0.04	-0.04	-0.13	0.01	-0.14	0.00	-0.15	-0.01
Prices and monetary policy														
Inflation	0.02	-0.02	-0.26	-0.06	-0.88	-0.06	0.03	-0.14	0.09	-0.01	0.01	-0.01	-0.15	0.10
Marginal costs	0.32	0.03	-0.31	-0.08	-0.70	-0.06	0.13	-0.19	-0.32	0.02	-0.26	-0.01	-0.34	-0.04
Interest rate	0.13	0.00	-0.20	-0.12	-0.59	0.02	0.40	-0.30	0.49	0.02	0.46	0.02	0.30	-0.09
External sector														
Net exports/output	-0.12	1.67	0.12	1.24	-0.46	1.16	-0.06	0.00	0.01	1.46	0.01	1.44	0.04	0.06
Current account/output	-0.24	1.39	0.08	1.13	-0.77	0.77	-0.12	0.03	-0.02	0.83	-0.02	0.67	0.02	0.06
Real exchange rate	0.47	-0.02	0.34	0.17	0.64	-0.01	0.45	0.27	0.41	0.01	0.38	0.00	0.30	-0.24
Terms of trade	-0.13	0.01	-0.24	-0.16	-0.10	-0.10	-0.16	-0.20	-0.16	-0.01	-0.15	-0.01	-0.09	0.26

Entries above zero indicate an increase in positive correlation/procyclicality (or a decrease in negative correlation) under open borders.

Table 14: Correlations of NMS12 variables with output under the open-border regime

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption	0.99	-0.40	0.58	0.39	0.97	0.52	-0.93	0.79	0.96	-0.21	0.97	-0.20	0.97	0.69
Investment	0.92	0.42	0.83	0.53	0.88	0.61	-0.46	0.80	0.93	0.30	0.94	0.20	0.95	0.92
Gov. consumption	0.60	0.36	0.62	0.81	0.23	0.30	0.98	0.96	0.51	0.35	0.56	0.37	0.59	0.86
Labour market														
Employment	0.17	0.99	0.72	0.99	1.00	1.00	1.00	0.98	0.93	0.98	0.93	0.97	0.91	0.99
Real wage	0.90	-0.89	0.49	-0.76	0.78	-0.51	-0.79	-0.14	-0.67	-0.74	-0.27	-0.63	-0.20	-0.83
Vacancies	0.23	-0.10	0.18	-0.08	0.52	0.23	0.41	-0.05	0.85	-0.10	-0.77	-0.13	-0.71	-0.07
Job finding prob.	0.34	-0.46	0.47	-0.27	0.77	0.03	0.58	-0.19	0.98	-0.36	0.98	-0.39	-0.60	-0.32
Unemployment rate	-0.65	0.73	-0.81	0.46	-0.99	0.09	-0.98	0.27	-0.98	0.53	-0.99	0.52	-0.99	0.67
Prices and monetary policy														
Inflation	-0.18	-0.20	0.07	-0.30	0.89	0.17	0.48	-0.06	-0.89	-0.26	-0.40	-0.21	-0.24	-0.19
Marginal costs	-0.24	-0.33	0.27	-0.45	0.94	0.13	0.44	-0.12	-0.51	0.02	-0.02	0.02	0.00	-0.33
Interest rate	-0.77	-0.19	0.42	-0.71	-0.73	-0.43	0.85	-0.27	-0.97	-0.19	-0.89	-0.16	-0.57	-0.61
External sector														
Net exports/output	-0.96	0.85	-0.19	0.94	-0.74	0.75	0.98	0.96	-0.86	0.85	-0.89	0.84	-0.92	0.96
Current account/output	-0.93	0.64	-0.27	0.98	-0.61	0.56	0.99	0.88	-0.90	0.49	-0.92	0.37	-0.94	0.96
Real exchange rate	0.79	0.75	0.73	0.43	0.65	0.14	-0.91	-0.28	0.93	0.61	0.91	0.58	0.94	-0.72
Terms of trade	-0.97	-0.91	-0.63	-0.35	0.69	-0.16	0.88	0.42	-0.99	-0.69	-0.99	-0.64	-0.98	0.67

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 15: Differences in the correlations of NMS12 variables with output between the open- and closed-border regimes

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption	0.01	-1.37	-0.09	-0.54	0.00	0.38	-0.08	-0.19	-0.02	-1.17	-0.01	-1.17	-0.01	-0.25
Investment	-0.02	-0.42	0.02	-0.43	0.09	0.39	-0.10	-0.11	-0.03	-0.63	-0.01	-0.74	0.00	-0.01
Gov. consumption	0.03	0.04	-0.05	0.15	-0.06	0.01	0.03	0.36	-0.17	-0.30	-0.14	-0.31	-0.13	0.19
Labour market														
Employment	-0.40	0.09	-0.05	0.19	0.00	0.01	0.00	0.18	-0.04	0.21	-0.03	0.22	-0.06	0.23
Real wage	0.12	-1.55	-0.01	-1.50	0.12	-1.13	-0.14	-0.96	0.05	-1.55	0.31	-1.46	0.36	-1.63
Vacancies	0.01	-0.45	0.01	-0.45	0.09	-0.38	-0.04	-0.34	0.31	-0.37	-0.06	-0.39	-0.06	-0.33
Job finding prob.	0.05	-1.03	0.04	-0.89	0.17	-0.66	-0.05	-0.69	0.17	-0.85	0.17	-0.87	-0.01	-0.80
Unemployment rate	-0.08	1.64	-0.04	1.25	0.00	1.07	0.02	1.07	-0.01	1.30	-0.02	1.27	-0.02	1.43
Prices and monetary policy														
Inflation	0.01	0.15	0.06	-0.09	0.02	-0.62	-0.09	0.18	-0.12	0.21	-0.03	0.12	-0.01	-0.06
Marginal costs	0.02	0.37	0.02	-0.60	0.02	-0.75	-0.09	0.29	-0.06	-0.23	-0.03	-0.17	0.00	-0.57
Interest rate	0.01	0.71	0.11	-0.53	-0.02	-0.60	0.00	0.44	-0.03	0.54	-0.07	0.47	0.04	-0.16
External sector														
Net exports/output	-0.17	-0.09	0.24	0.16	-0.38	-0.18	0.03	-0.01	0.05	-0.13	0.00	-0.13	0.01	0.01
Current account/output	-0.14	-0.30	0.17	0.20	-0.25	-0.37	0.04	-0.09	0.01	-0.49	-0.03	-0.60	-0.01	0.01
Real exchange rate	-0.02	1.68	-0.05	1.39	-0.01	1.09	-0.01	0.67	0.00	1.59	-0.01	1.55	-0.01	0.26
Terms of trade	0.00	-1.80	0.06	-1.30	0.06	0.46	0.09	-0.54	-0.01	-1.62	-0.01	-1.58	-0.01	-0.23

Table 16: Cross-country correlations of EU15 and NMS12 variables under the open-border regime

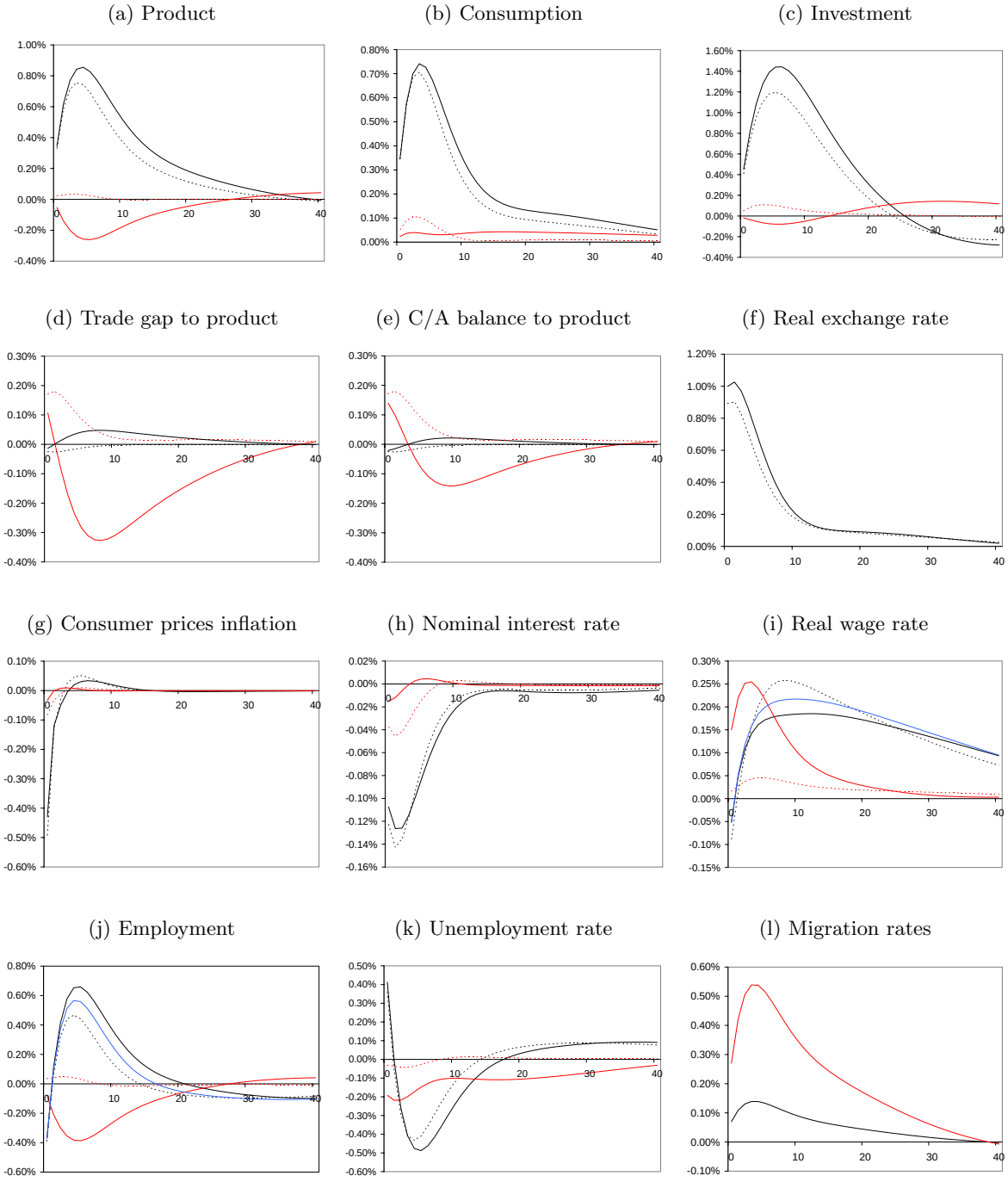
	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.83	-0.96	0.12	-0.81	0.44	-0.69	-0.80	-0.67	0.73	-0.76	0.76	-0.72	0.81	0.92
Consumption	0.81	0.62	0.78	0.82	0.22	-0.81	0.75	0.91	0.82	0.88	0.82	0.91	0.86	0.73
Investment	0.95	-0.43	-0.14	-0.53	0.59	-0.73	0.19	0.65	0.93	-0.18	0.93	0.04	0.95	0.89
Gov. consumption	0.95	0.40	0.58	0.28	0.59	-0.04	-0.37	-0.46	0.96	0.61	0.96	0.70	0.97	0.79
Labour market														
Employment	0.36	-0.94	-0.39	-0.99	0.42	-0.69	-0.81	-0.77	0.60	-0.78	0.63	-0.79	0.67	0.70
Real wage rate	-0.32	0.50	-0.08	0.36	-0.09	0.31	-0.75	-0.29	0.45	-0.50	0.36	-0.30	0.44	0.12
Vacancies	0.01	-0.41	-0.16	-0.55	0.39	0.05	-0.29	-0.23	0.69	-0.16	-0.71	-0.03	-0.65	-0.34
Job finding prob.	0.15	-0.01	-0.12	-0.11	0.46	0.15	-0.39	-0.07	0.87	0.14	0.86	0.32	-0.41	-0.16
Unemployment rate	0.66	0.40	-0.17	0.45	0.07	0.74	-0.53	-0.05	0.77	0.60	0.77	0.68	0.82	-0.62
Prices and monetary policy														
Inflation	-0.64	0.84	0.10	0.93	-0.05	0.78	-0.86	0.98	-0.24	0.80	-0.82	0.92	0.57	0.76
Marginal costs	-0.96	-0.82	-0.83	0.93	0.23	0.83	-0.93	-0.89	-0.92	0.00	-0.96	-0.89	0.65	0.35
Interest rate	-0.04	0.36	0.54	0.90	-0.39	-0.88	-0.56	0.95	-0.14	0.49	-0.43	0.63	0.41	0.91

A = TFP shock, Φ = investment productivity shock, r = monetary policy shock, g = government spending shock, χ = labour supply shock, m = matching efficiency shock, s = job destruction shock. Asterisk ($\star$) denotes foreign shocks.

Table 17: Differences in cross-country correlations between EU15 and NMS12 variables under the open- and closed-border regimes

	A	$A^\star$	Φ	$\Phi^\star$	r	$r^\star$	g	$g^\star$	χ	$\chi^\star$	m	$m^\star$	s	$s^\star$
Real activity														
Output	0.03	-1.79	-0.75	-1.61	0.14	-1.31	0.01	0.00	-0.21	-1.70	-0.18	-1.67	-0.12	-0.03
Consumption	-0.15	-0.35	-0.20	-0.16	0.77	-0.41	-0.21	-0.07	-0.16	-0.10	-0.17	-0.07	-0.12	-0.25
Investment	0.01	-1.37	-0.60	-0.92	0.30	-1.26	-0.62	-0.32	-0.05	-1.14	-0.06	-0.93	-0.04	-0.08
Gov. consumption	-0.03	-0.58	-0.27	-0.55	0.99	-0.18	0.33	0.11	-0.03	-0.38	-0.03	-0.29	-0.02	-0.20
Labour market														
Employment	0.04	-1.52	-1.18	-1.67	0.15	-1.27	-0.33	-0.33	-0.22	-1.65	-0.18	-1.67	-0.13	-0.15
Real wage	-1.28	-0.40	-1.07	-0.58	-0.43	0.51	-1.68	-1.07	0.69	-0.47	0.38	-0.51	0.45	-0.11
Vacancies	0.58	-0.19	-0.86	-1.11	0.00	-0.61	0.55	0.47	0.02	-0.78	-0.09	0.54	-0.45	-0.31
Job finding prob.	0.59	0.06	-0.84	-0.75	0.07	-0.48	0.37	0.57	0.15	-0.56	0.15	-0.39	0.02	0.06
Unemployment rate	0.34	-0.18	-0.96	-0.23	-0.19	0.16	-0.05	0.39	-0.04	-0.27	-0.04	-0.19	0.02	-1.47
Prices and monetary policy														
Inflation	-1.60	-0.15	-0.83	-0.06	-0.73	-0.09	-1.80	0.01	-0.82	-0.09	-1.68	-0.04	-0.33	-0.20
Marginal costs	-0.99	-1.49	-1.82	-0.02	-0.07	0.29	-0.63	-1.37	-0.31	0.17	-0.23	-0.17	-0.33	-0.63
Interest rate	-1.02	-0.60	-0.41	-0.05	0.17	-0.35	-1.53	0.01	-0.98	-0.26	-1.35	-0.14	-0.37	0.15

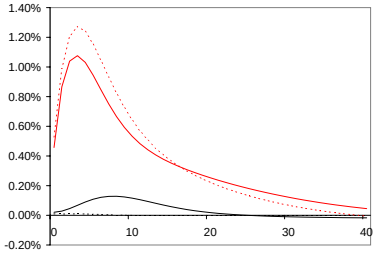
Figure 1: Impulse responses to a positive TFP shock in the EU15 (foreign country)



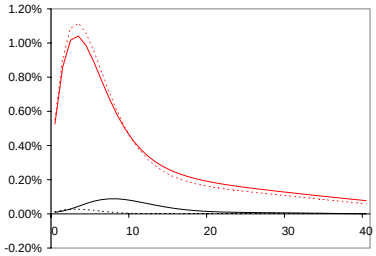
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 2: Impulse responses to a positive TFP shock in the NMS12 (home country)

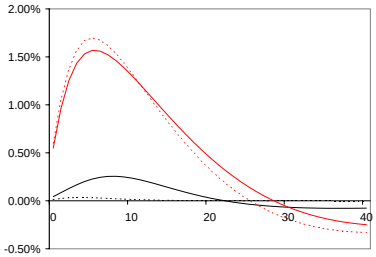
(a) Product



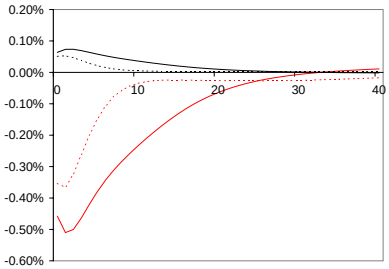
(b) Consumption



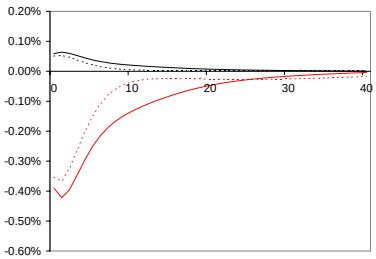
(c) Investment



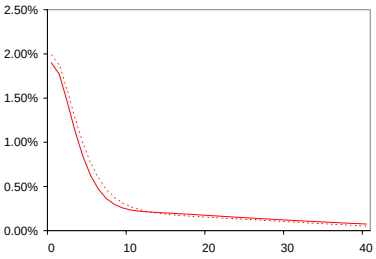
(d) Trade gap to product



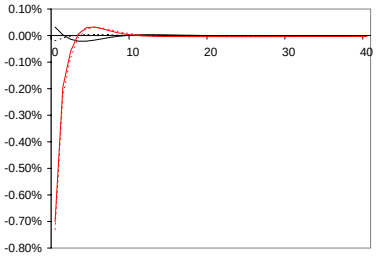
(e) C/A balance to product



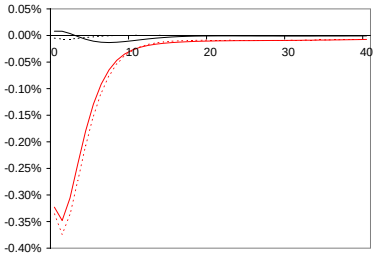
(f) Real exchange rate



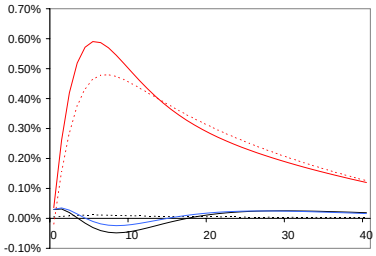
(g) Consumer prices inflation



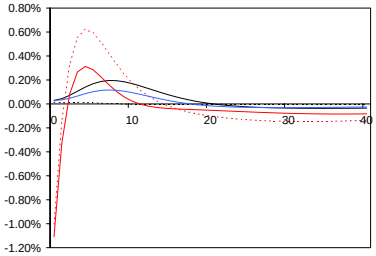
(h) Nominal interest rate



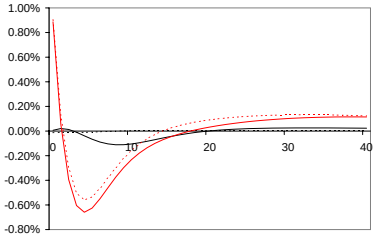
(i) Real wage rate



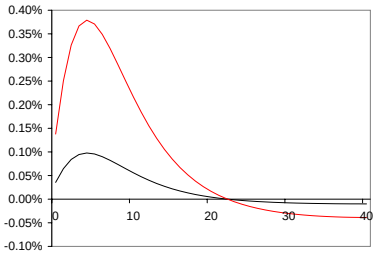
(j) Employment



(k) Unemployment rate

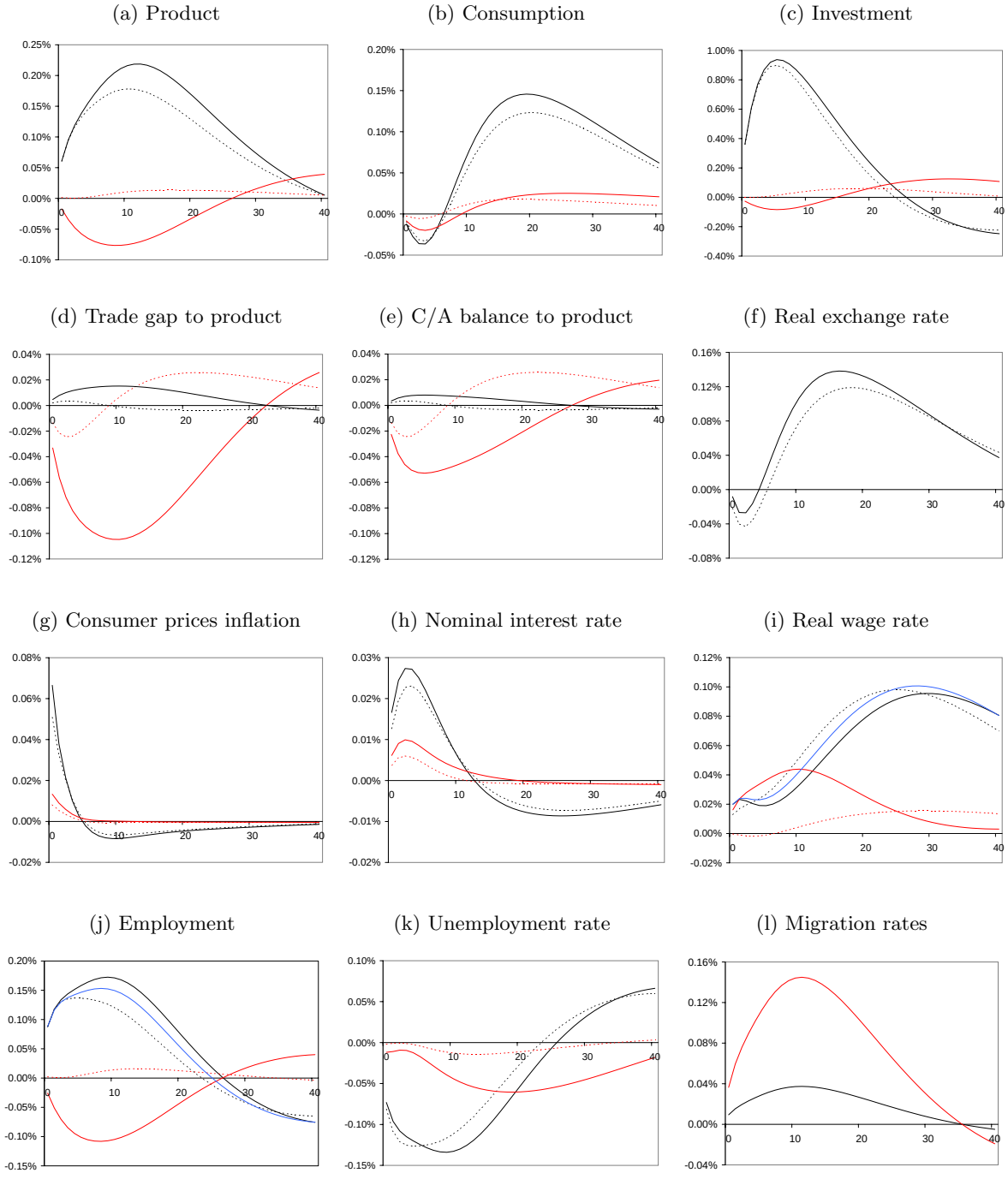


(l) Migration rates



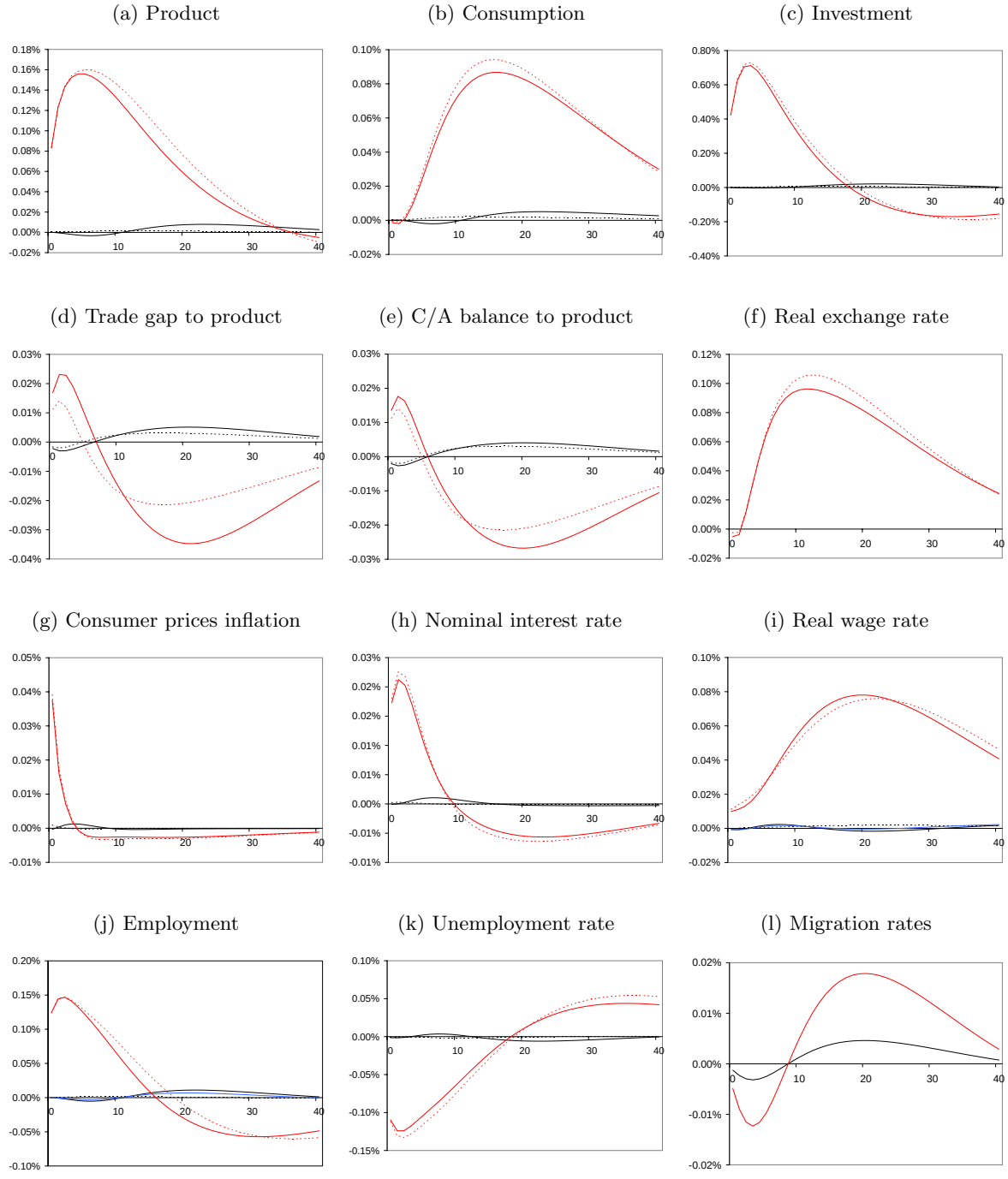
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 3: Impulse responses to a positive investment productivity shock in the EU15 (foreign country)



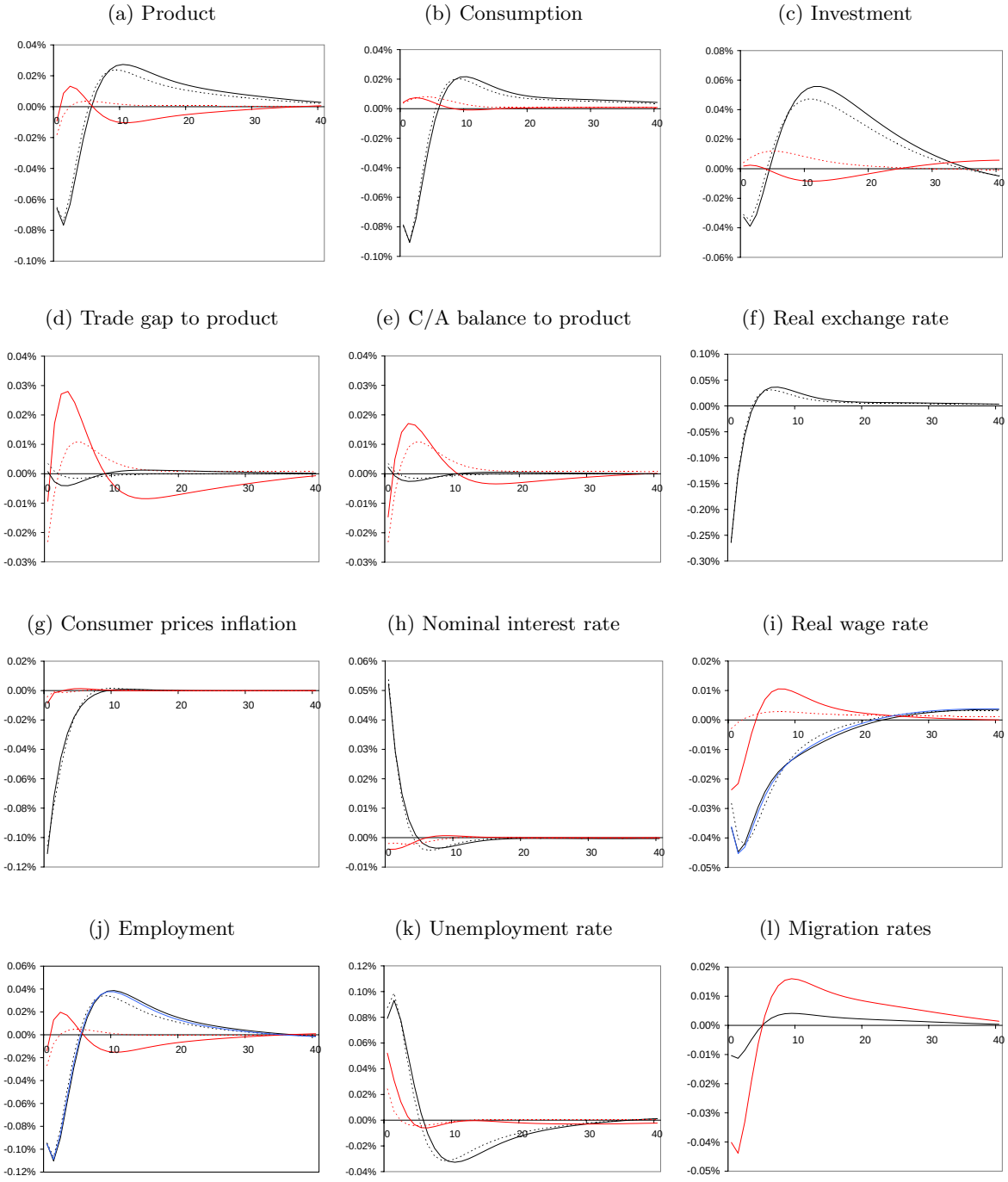
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 4: Impulse responses to a positive investment productivity shock in the NMS12 (home country)



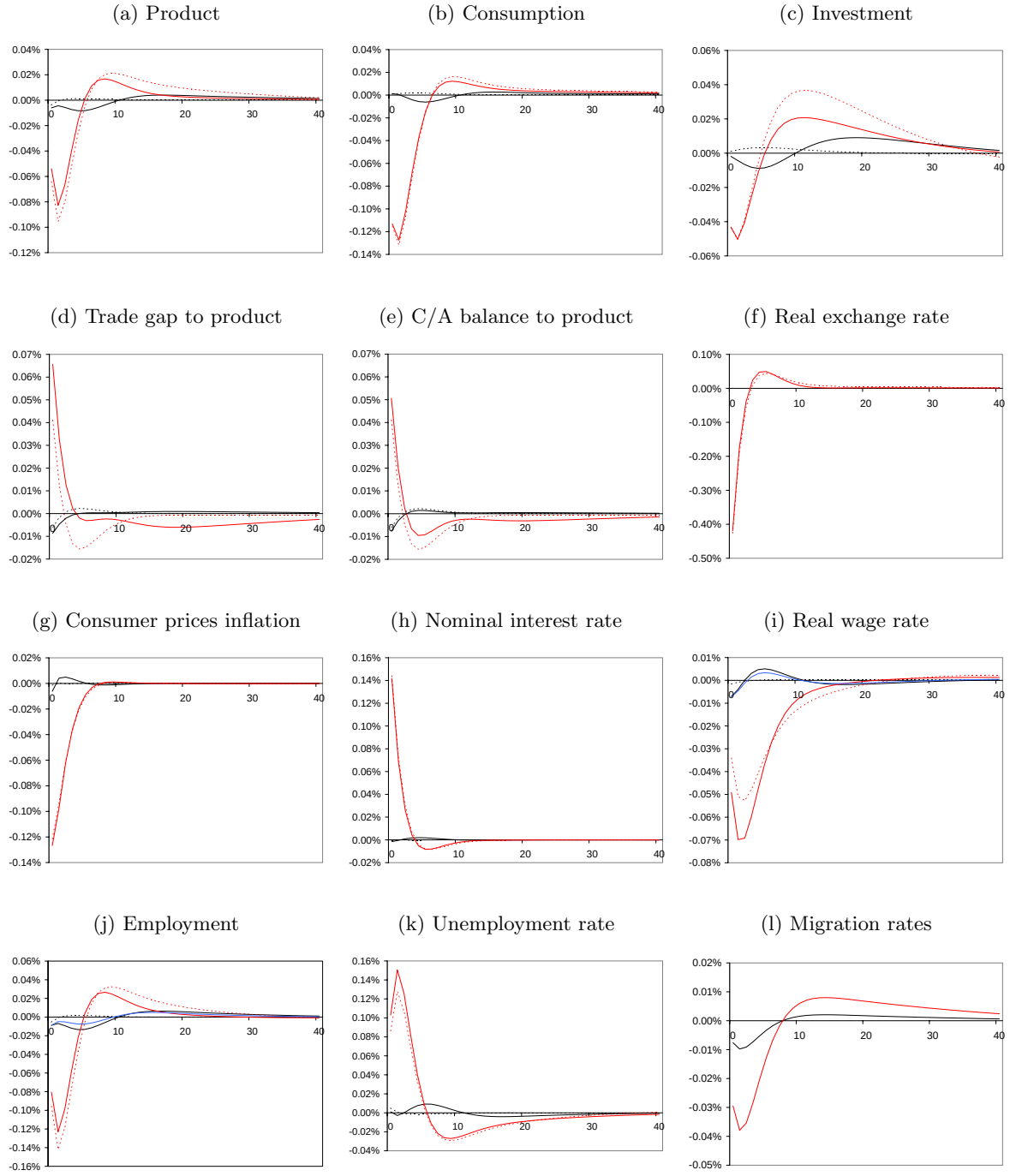
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 5: Impulse responses to a positive monetary policy shock in the EU15 (foreign country)



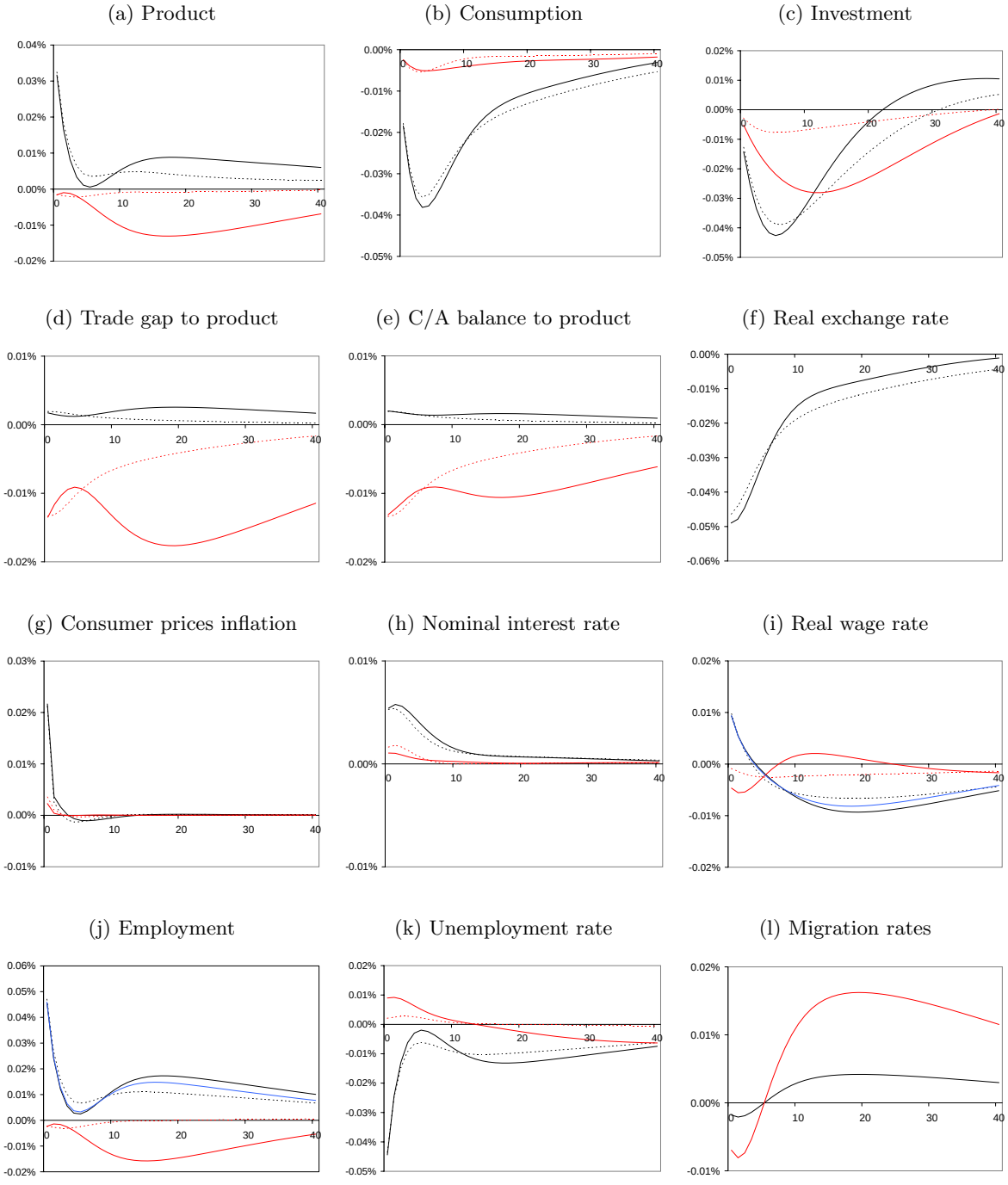
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 6: Impulse responses to a positive monetary policy shock in the NMS12 (home country)



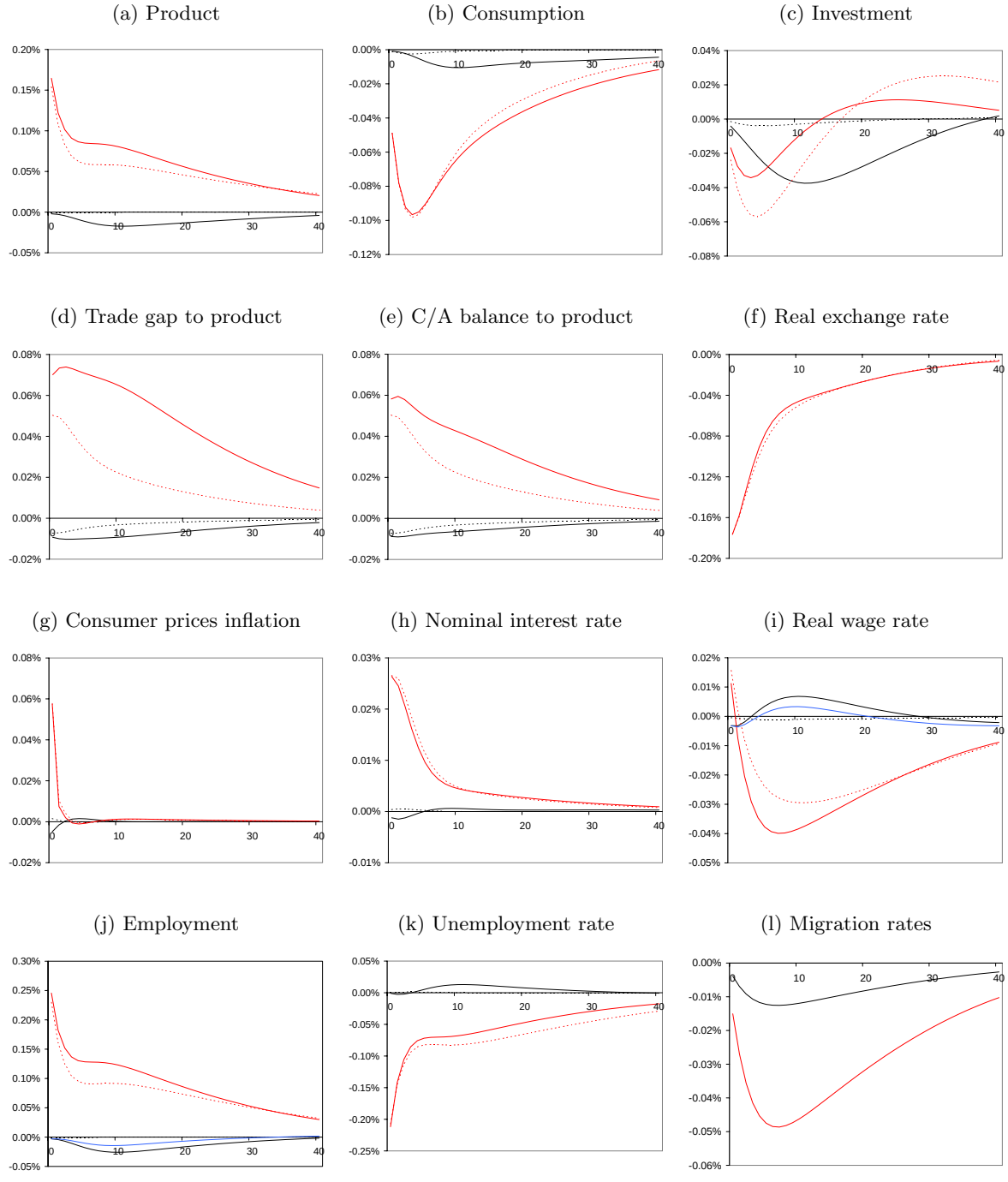
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 7: Impulse responses to a positive government expenditure shock in the EU15 (foreign country)



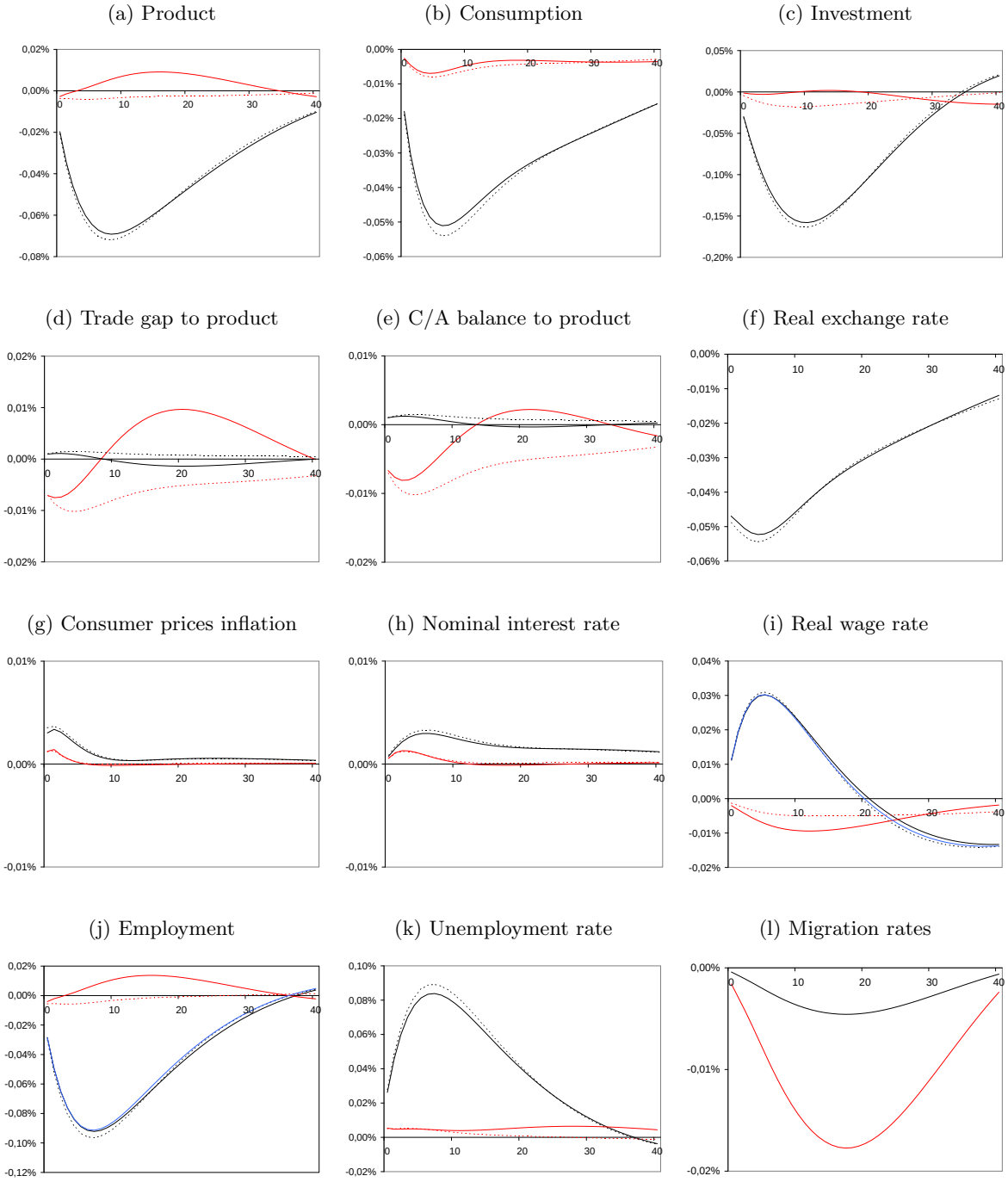
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 8: Impulse responses to a positive government expenditure shock in the NMS12 (home country)



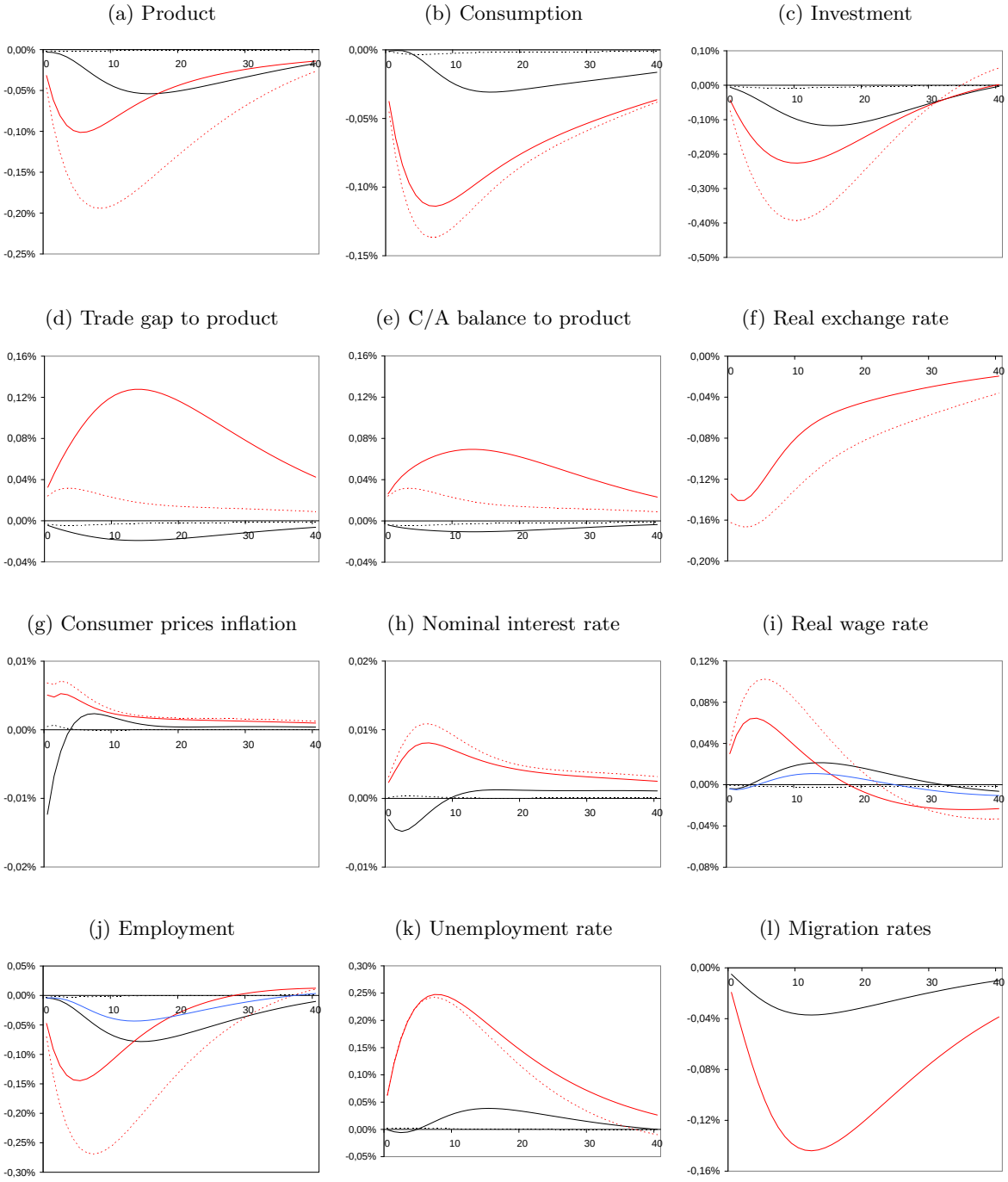
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 9: Impulse responses to a negative labour supply shock in the EU15 (foreign country)



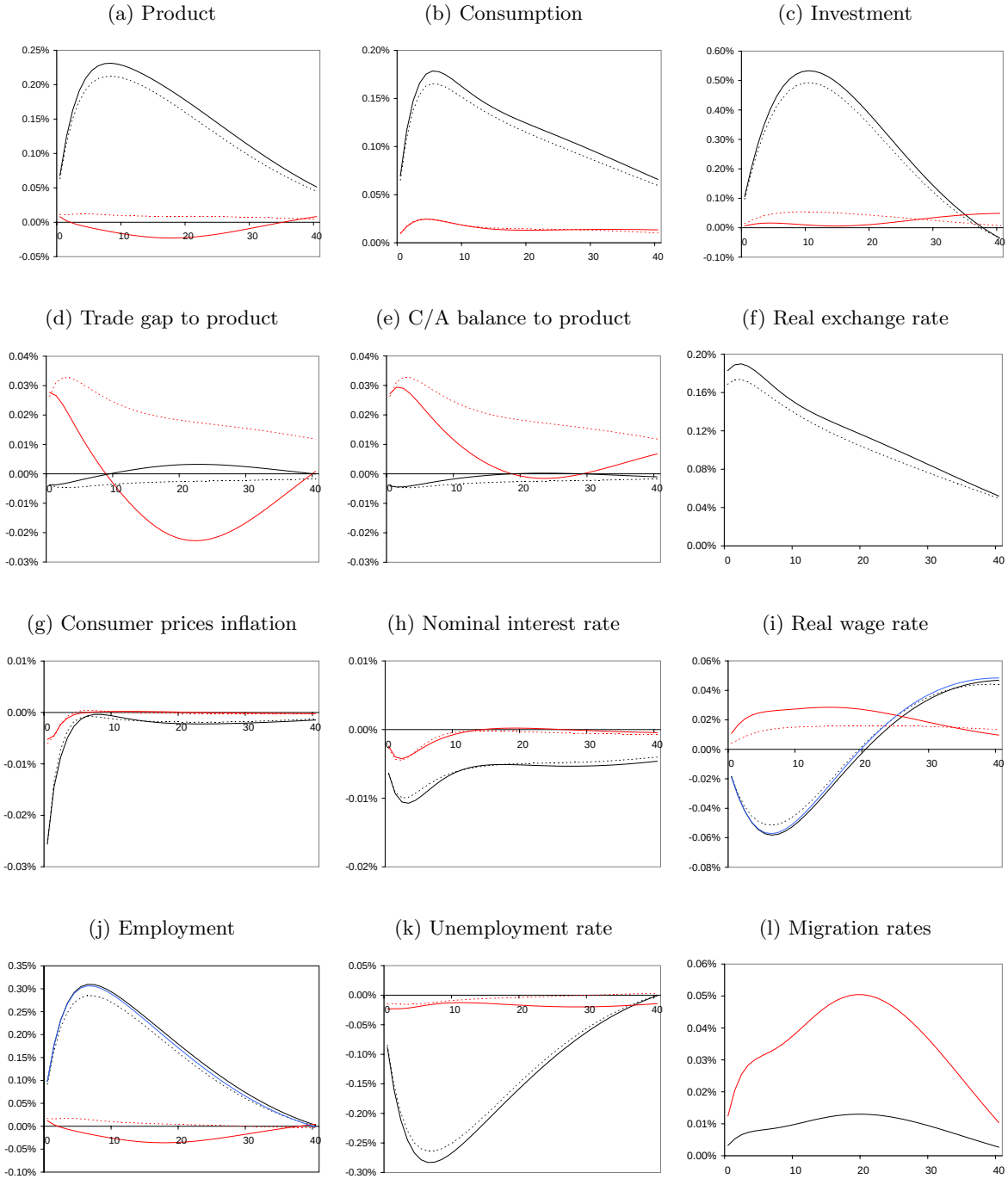
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 10: Impulse responses to a negative labour supply shock in the NMS12 (home country)



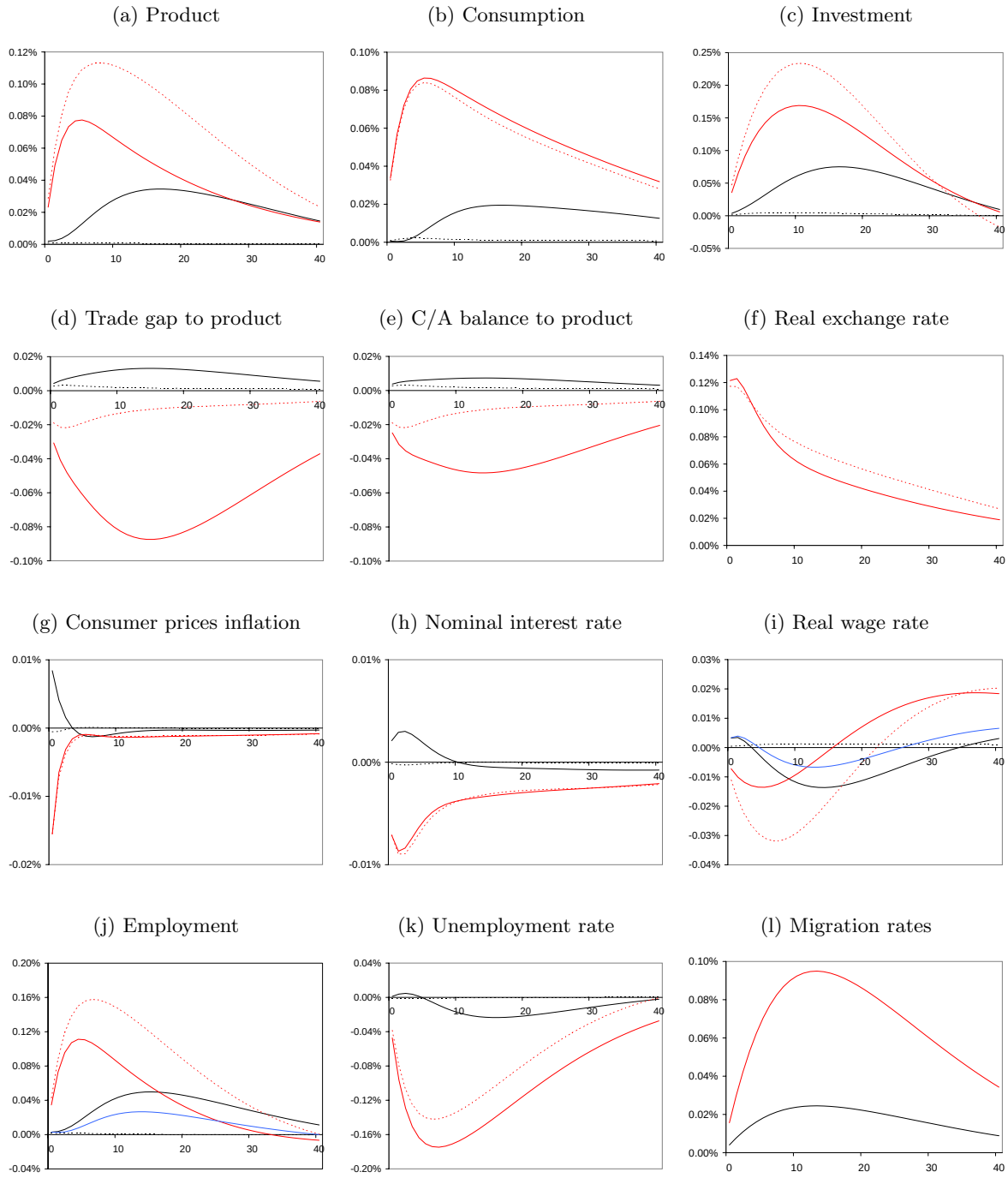
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 11: Impulse responses to a positive matching efficiency shock in the EU15 (foreign country)



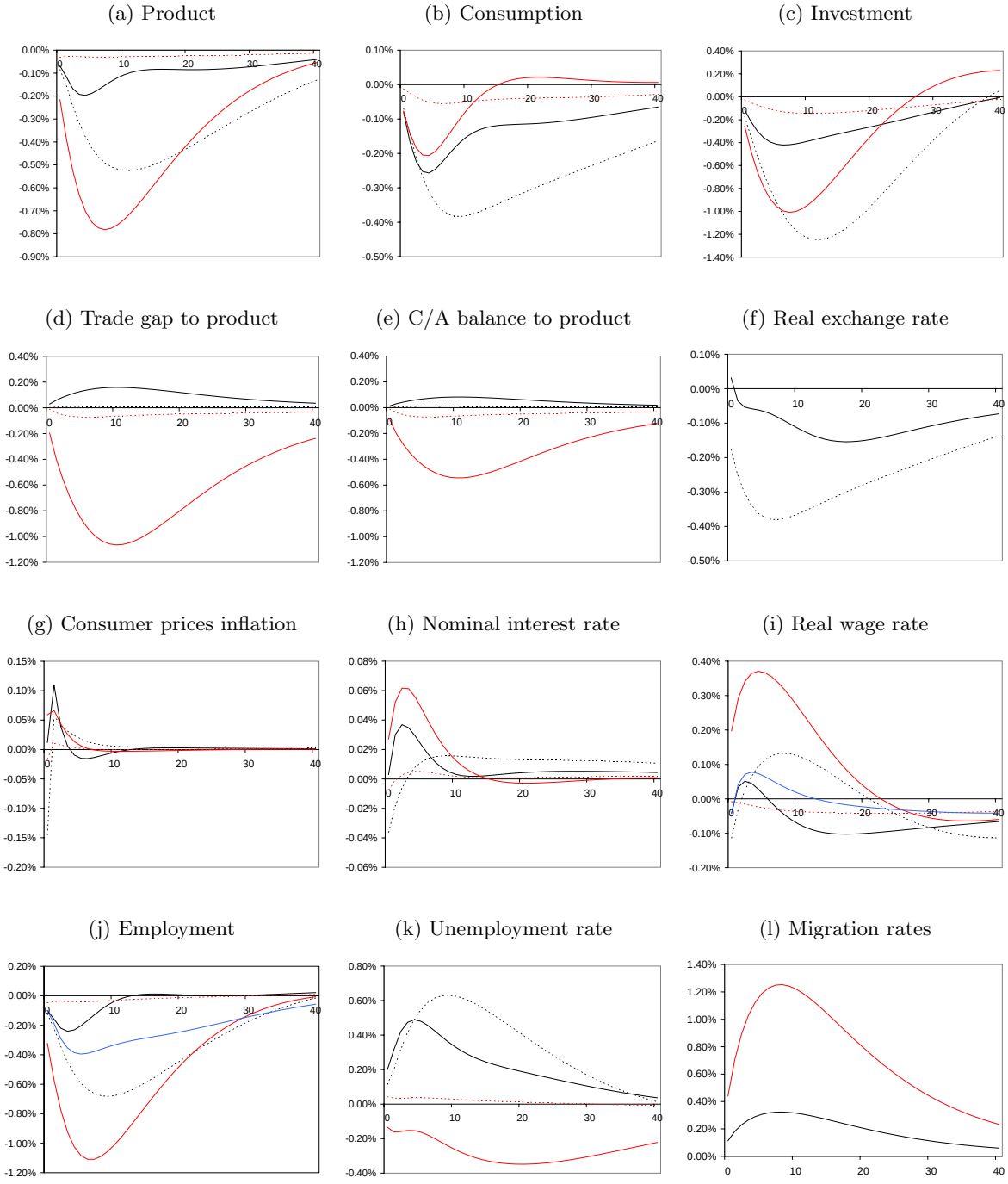
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 12: Impulse responses to a positive matching efficiency shock in the NMS12 (home country)



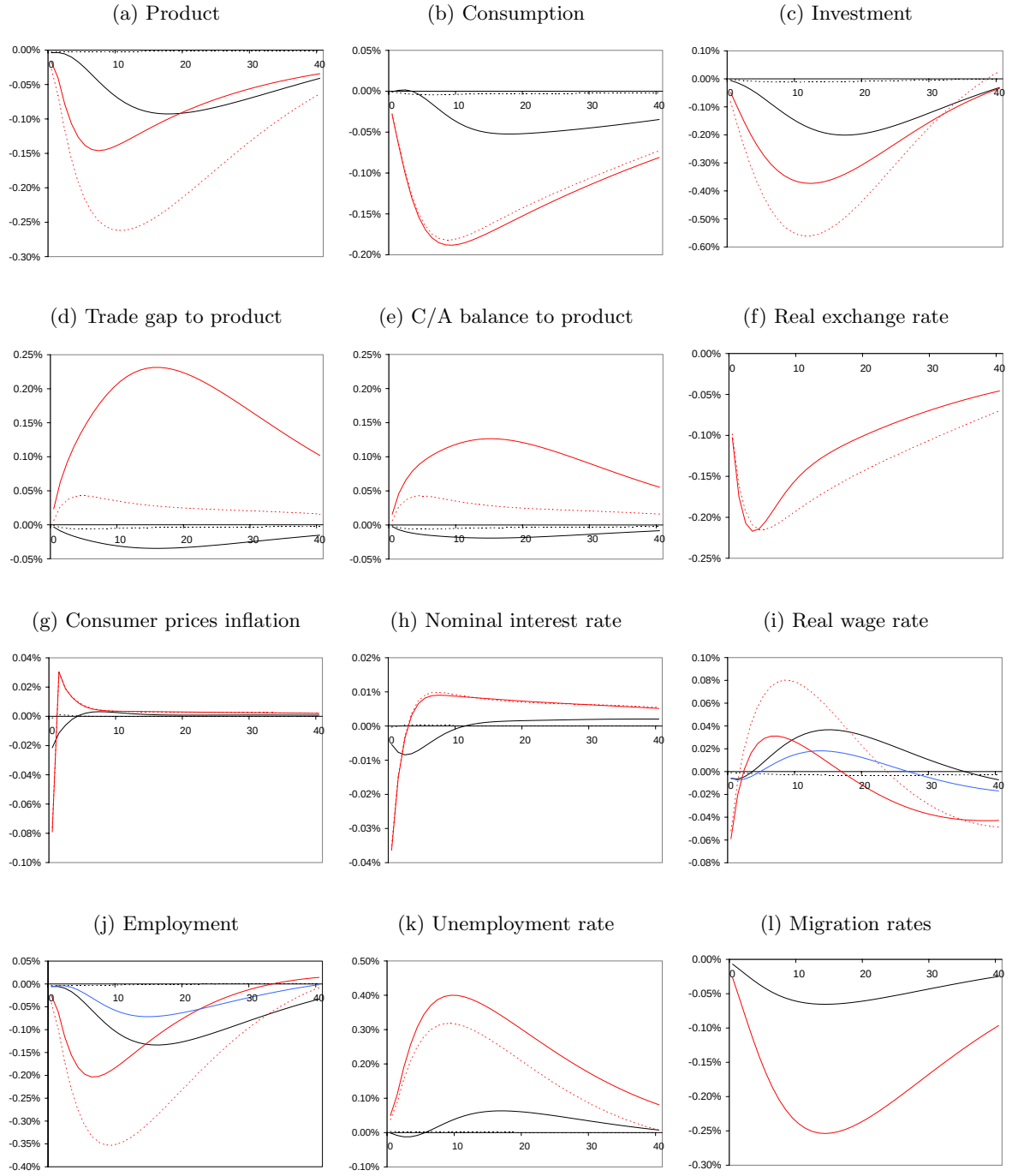
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 13: Impulse responses to a positive job destruction shock in the EU15 (foreign country)



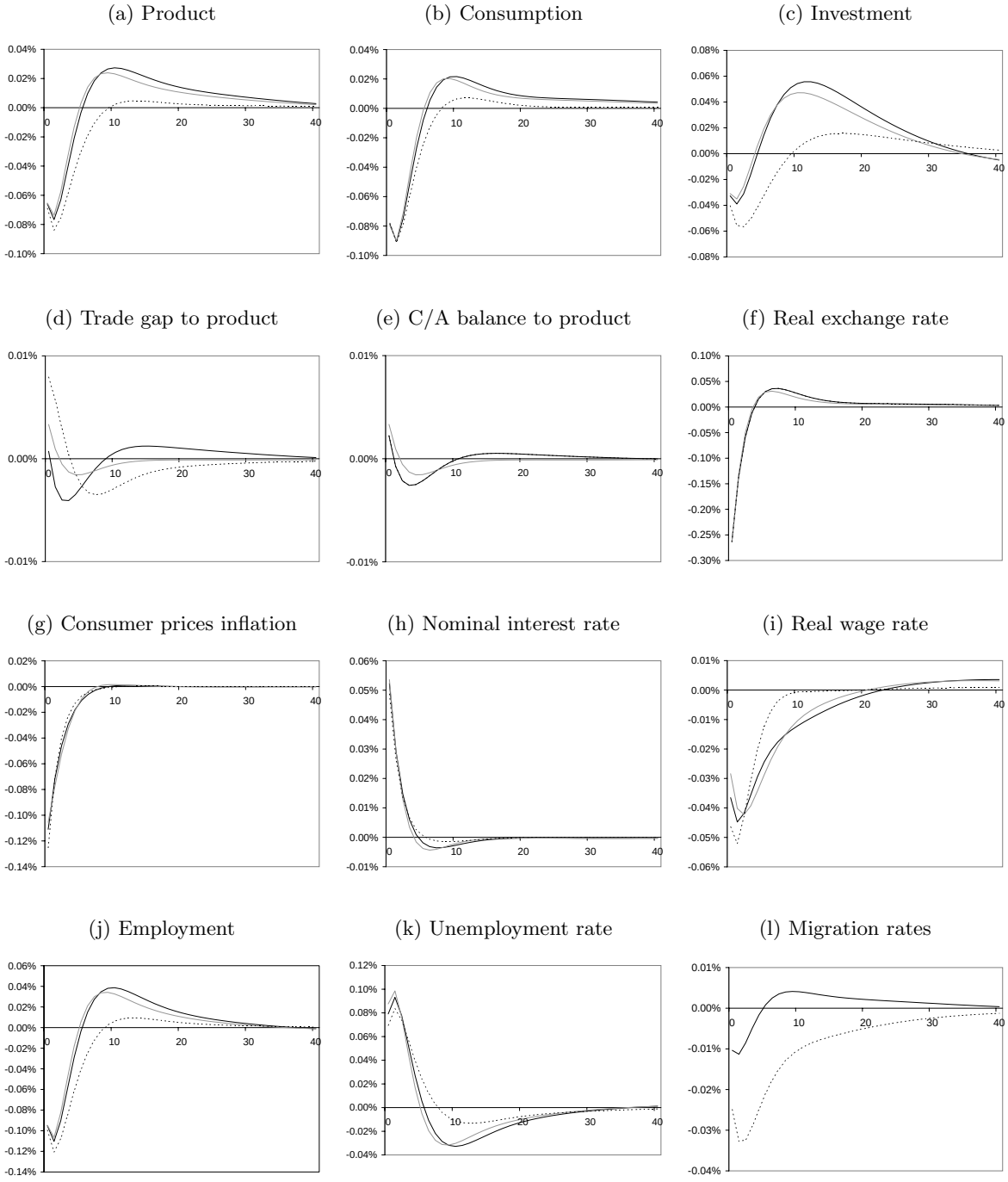
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 14: Impulse responses to a positive job destruction shock in the NMS12 (home country)



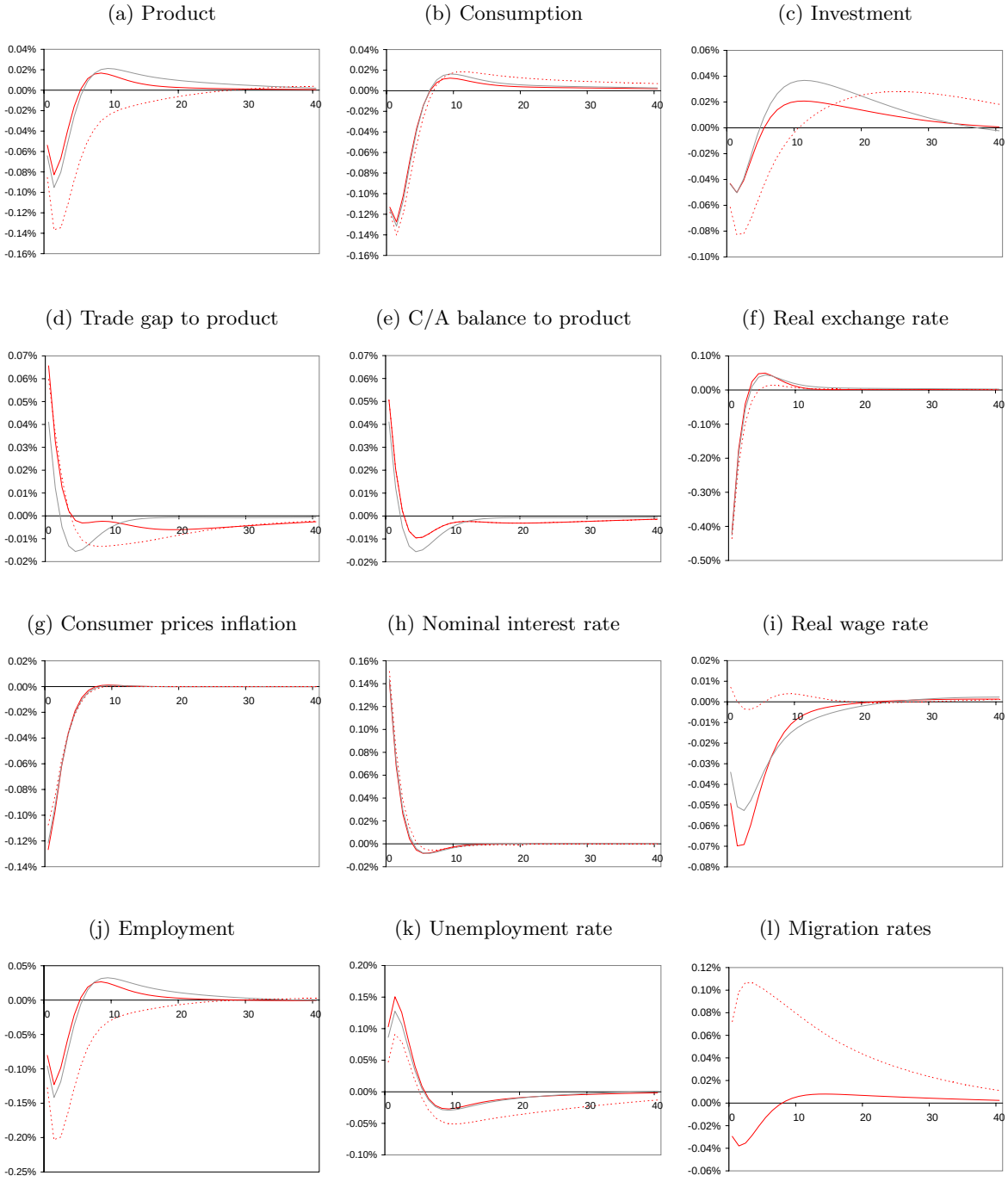
Black lines denote responses of EU15 variables, while red lines denote responses of NMS12 variables. Solid lines correspond to the open-border regime, whereas dotted lines represent the closed labour market regime. In the final panel, the black solid line shows the temporary immigration rate in the EU15, while the red solid line shows the temporary emigration rate of NMS12 workers. Blue lines distinguish the responses of variables for EU15 natives.

Figure 15: Positive monetary policy shock in the EU15: alternative modelling of home bias



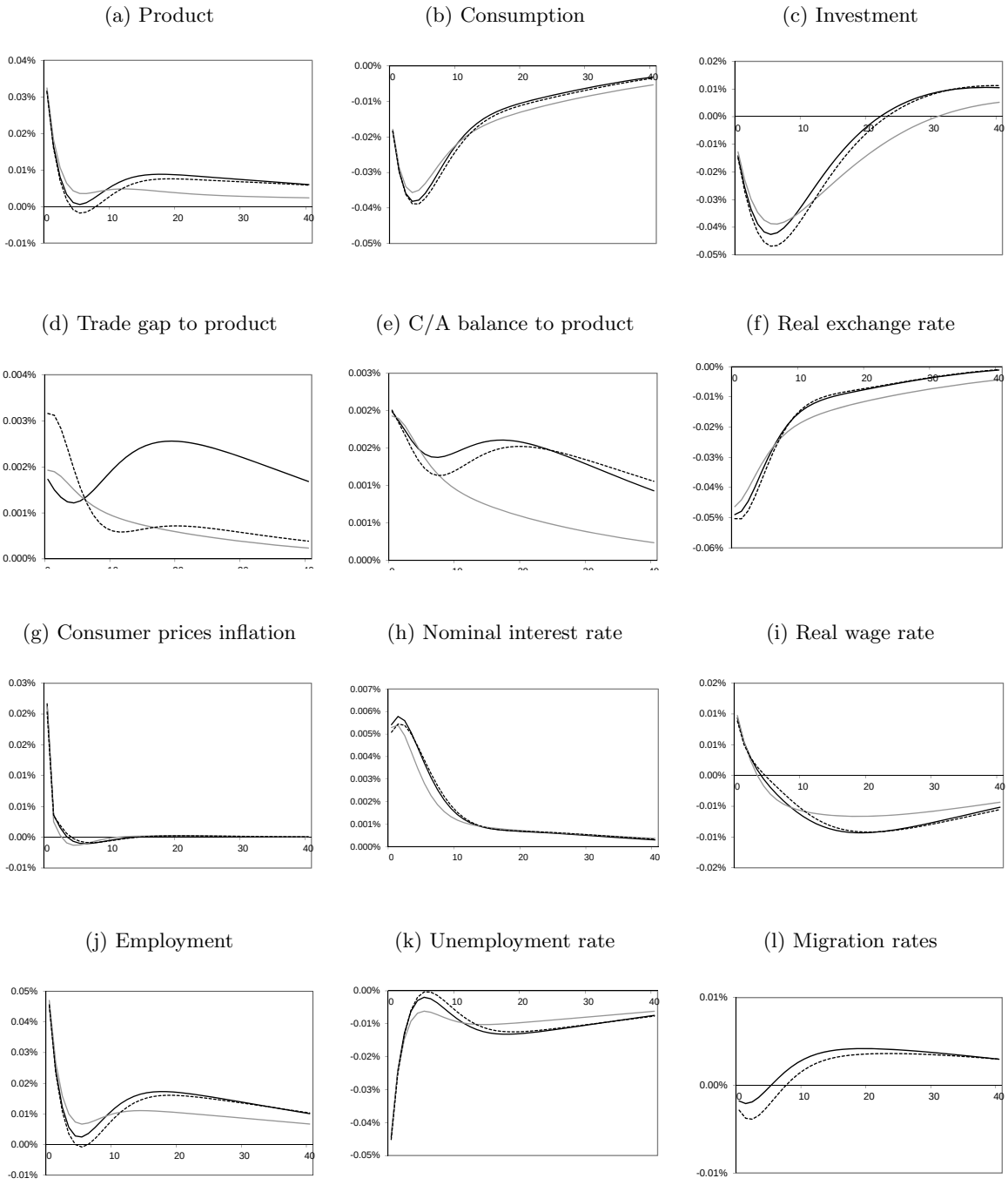
Black lines show the responses of EU15 variables under the open-border regime. Solid line represents the benchmark model, while dotted lines assumes that temporary migrants consume in their country of residence. Solid gray line shows the impulse responses under a closed labour market.

Figure 16: Positive monetary policy shock in the NMS12: alternative modelling of home bias



Red lines show the responses of NMS12 variables under the open-border regime. Solid line represents the benchmark model, while dotted lines assumes that temporary migrants consume in their country of residence. Solid gray line shows the impulse responses under a closed labour market.

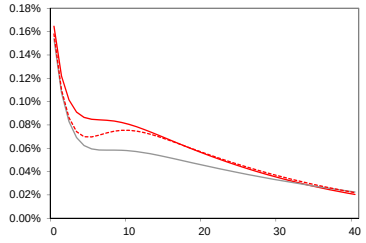
Figure 17: Positive government expenditure shock in the EU15: alternative modelling of home bias



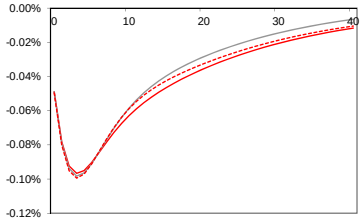
Black lines show the responses of EU15 variables under the open-border regime. Solid line represents the benchmark model, while dotted lines assumes that temporary migrants consume in their country of residence. Solid gray line shows the impulse responses under a closed labour market.

Figure 18: Positive government expenditure shock in the NMS12: alternative modelling of home bias

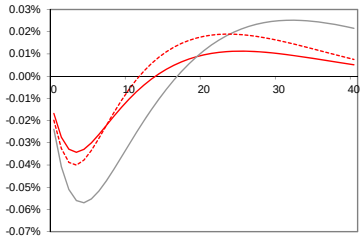
(a) Product



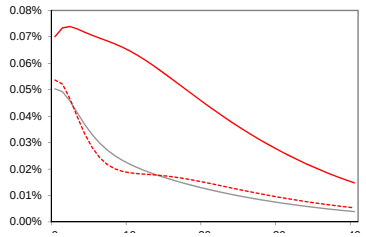
(b) Consumption



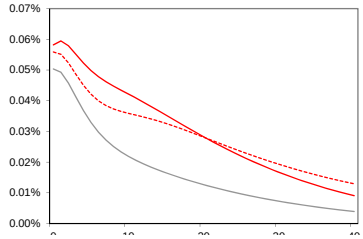
(c) Investment



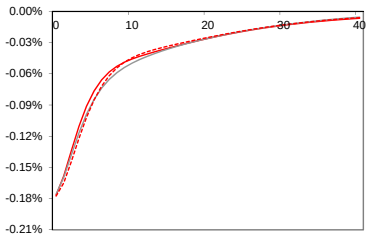
(d) Trade gap to product



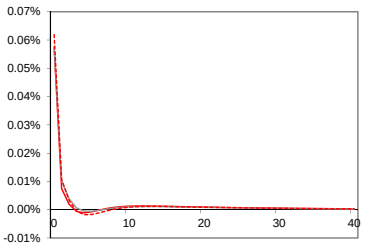
(e) C/A balance to product



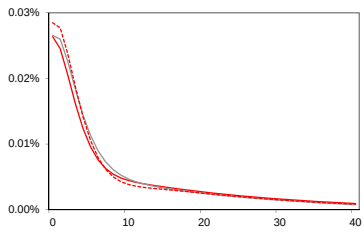
(f) Real exchange rate



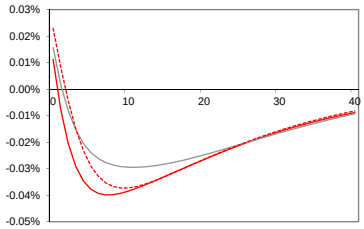
(g) Consumer prices inflation



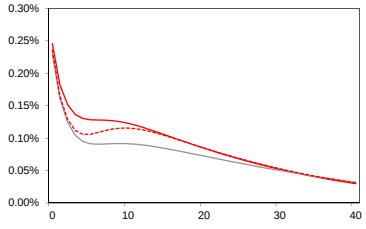
(h) Nominal interest rate



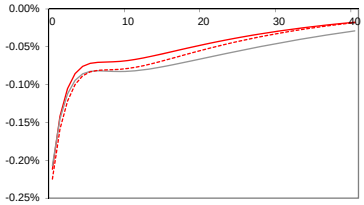
(i) Real wage rate



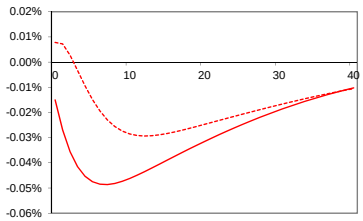
(j) Employment



(k) Unemployment rate



(l) Migration rates



Red lines show the responses of NMS12 variables under the open-border regime. Solid line represents the benchmark model, while dotted lines assumes that temporary migrants consume in their country of residence. Solid gray line shows the impulse responses under a closed labour market.

A Annex - Symmetric equilibrium

The shadow price of consumption:

$$\lambda_t = ((c_t - h_c c_{t-1})/\iota)^{-\sigma} \tag{A.1}$$
$$\lambda_t^\star = ((c_t^\star - h_c^\star c_{t-1}^\star)/(1-\iota))^{-\sigma} \tag{A.2}$$

Household discount factor:

$$E_t \Lambda_{t+1,t} = \beta E_t \frac{\lambda_{t+1}}{\lambda_t} \tag{A.3}$$
$$E_t \Lambda_{t+1,t}^\star = \beta E_t \frac{\lambda_{t+1}^\star}{\lambda_t^\star} \tag{A.4}$$

The Euler's equation:

$$1 = E_t \Lambda_{t+1,t}(1 + r_t)\frac{p_t}{p_{t+1}} \tag{A.5}$$
$$1 = E_t \Lambda_{t+1,t}^\star(1 + r_t^\star)\frac{p_t^\star}{p_{t+1}^\star} \tag{A.6}$$

International financial market:

$$e_t^r = \bar{\xi}\frac{\lambda_t^\star}{\lambda_t} \tag{A.7}$$

Household budget constraints:

$$\begin{aligned} c_t + i_t + \frac{b_t}{p_t} = (1-t)\frac{w_t^H}{p_t} n_t^H + e_t^r(1-t^\star)\frac{w_t^{H\star}}{p_t^\star} n_t^{H\star} + \frac{\nu_t^H}{p_t}\bar{u}_t^H + e_t^r\frac{\nu_t^{H\star}}{p_t^\star}\bar{u}_t^{H\star} + \\ + r_t^K k_{t-1} + (1 + r_{t-1})\frac{b_{t-1}}{p_t} + \frac{\Theta_t}{p_t} - \frac{\tau_t}{p_t} - \frac{X_t}{p_t} + e_t^r\frac{X_t^\star}{p_t^\star} \end{aligned} \tag{A.8}$$

$$\begin{aligned} c_t^\star + i_t^\star + \frac{b_t^\star}{p_t^\star} = (1-t^\star)\frac{w_t^{F\star}}{p_t^\star} n_t^{F\star} + (e_t^r)^{-1}(1-t)\frac{w_t^F}{p_t} n_t^F + \frac{\nu_t^{F\star}}{p_t^\star}\bar{u}_t^{F\star} + (e_t^r)^{-1}\frac{\nu_t^F}{p_t}\bar{u}_t^F + \\ + r_t^{K\star} k_{t-1}^\star + (1 + r_{t-1}^\star)\frac{b_{t-1}^\star}{p_t^\star} + (1 + r_{t-1}^\star) + \frac{\Theta_t^\star}{p_t} - \frac{\tau_t^\star}{p_t} - \frac{X_t^\star}{p_t^\star} + (e_t^r)^{-1}\frac{X_t}{p_t} \end{aligned} \tag{A.9}$$

Capital accumulation:

$$k_{t+1} = (1-\delta)k_t + \Phi_t\big(1 - S(\frac{i_t}{i_{t-1}})\big)i_t \tag{11}$$
$$k_{t+1}^\star = (1-\delta^\star)k_t^\star + \Phi_t^\star\big(1 - S^\star(\frac{i_t^\star}{i_{t-1}^\star})\big)i_t^\star \tag{A.10}$$

Capital adjustment costs:

$$S(\frac{i_t}{i_{t-1}}-1) = \frac{\bar{S}}{2}(\frac{i_t}{i_{t-1}}-1)^2 \tag{12}$$

$$S^{\star}(\frac{i_t^{\star}}{i_{t-1}^{\star}}) = \frac{\bar{S}^{\star}}{2}(\frac{i_t^{\star}}{i_{t-1}^{\star}}-1)^2 \tag{A.11}$$

The Tobin-Q:

$$Q_t = \frac{\lambda_t^K}{\lambda_t} \tag{A.12}$$

$$Q_t^{\star} = \frac{\lambda_t^{K\star}}{\lambda_t^{\star}} \tag{A.13}$$

The value of installed capital:

$$Q_t = E_t\Lambda_{t+1,t}\big(r_{t+1}^K + (1-\delta)Q_{t+1}\big) \tag{A.14}$$

$$Q_t^{\star} = E_t\Lambda_{t+1,t}^{\star}\big(r_{t+1}^{K\star} + (1-\delta^{\star})Q_{t+1}^{\star}\big) \tag{A.15}$$

Investment demand:

$$Q_t\Phi_t\Big(\big(1-S(\frac{i_t}{i_{t-1}})\big) - S'(\frac{i_t}{i_{t-1}})\frac{i_t}{i_{t-1}}\Big) = 1 - E_t\big(\Lambda_{t+1,t}Q_{t+1}\Phi_{t+1}S'(\frac{i_{t+1}}{i_t})(\frac{i_{t+1}}{i_t})^2\big) \tag{A.16}$$

$$Q_t^{\star}\Phi_t^{\star}\Big(\big(1-S^{\star}(\frac{i_t^{\star}}{i_{t-1}^{\star}})\big) - S^{\star'}(\frac{i_t^{\star}}{i_{t-1}^{\star}})\frac{i_t^{\star}}{i_{t-1}^{\star}}\Big) = 1 - E_t\big(\Lambda_{t+1,t}^{\star}Q_{t,t+1}^{\star}\Phi_{t+1}^{\star}S^{\star'}(\frac{i_{t+1}^{\star}}{i_t^{\star}})(\frac{i_{t+1}^{\star}}{i_t^{\star}})^2\big) \tag{A.17}$$

Production function:

$$y_t = A_t n_t^{\alpha} k_t^{1-\alpha} \tag{A.18}$$

$$y_t^{\star} = A_t^{\star}(n_t^{\star})^{\alpha^{\star}}(k_t^{\star})^{1-\alpha^{\star}} \tag{A.19}$$

Employment composite:

$$n_t = \big((n_t^H)^{1-\rho} + \omega(n_t^F)^{1-\rho}\big)^{\frac{1}{1-\rho}} \tag{A.20}$$

$$n_t^{\star} = \big((n_t^{F\star})^{1-\rho^{\star}} + \omega^{\star}(n_t^{H\star})^{1-\rho^{\star}}\big)^{\frac{1}{1-\rho^{\star}}} \tag{A.21}$$

The real cost of capital:

$$(1-\alpha)mc_t\frac{y_t}{k_t} = \frac{p_t}{p_t^H}r_t^K \tag{A.22}$$

$$(1-\alpha^{\star})mc_t^{\star}\frac{y_t^{\star}}{k_t^{\star}} = \frac{p_t^{\star}}{p_t^{F\star}}r_t^{K\star} \tag{A.23}$$

Profits:

$$\frac{\Theta_t}{p_t} = \frac{p_t^H}{p_t}\Big(\big(1-\frac{\psi}{2}(\pi_t^H)^2-\frac{\bar{\kappa}v_t}{\iota}\big)y_t^H + e_t^r\frac{p_t^{H\star}}{p_t^\star}(\frac{p_t^H}{p_t})^{-1}\big(1-\frac{\psi^\star}{2}(\pi_t^{H\star})^2-\frac{\bar{\kappa}v_t}{\iota}\big)y_t^{H\star} - n_t^H\frac{w_t^H}{p_t^H} - n_t^F\frac{w_t^F}{p_t^H} - \frac{p_t}{p_t^H}r_t^K k_{t-1}\Big) \tag{A.24}$$

$$\frac{\Theta_t^\star}{p_t^\star} = \frac{p_t^{F\star}}{p_t^\star}\Big(\big(1-\frac{\psi^\star}{2}(\pi_t^{F\star})^2-\frac{\bar{\kappa}^\star v_t^\star}{(1-\iota)}v_t^\star\big)y_t^{F\star} + (e_t^r)^{-1}\frac{p_t^F}{p_t}(\frac{p_t^{F\star}}{p_t^\star})^{-1}\big(1-\frac{\psi}{2}(\pi_t^F)^2-\frac{\bar{\kappa}^\star v_t^\star}{(1-\iota)}\big)y_t^F - n_t^{F\star}\frac{w_t^{F\star}}{p_t^{F\star}} - n_t^{H\star}\frac{w_t^{H\star}}{p_t^{F\star}} - \frac{p_t^\star}{p_t^{F\star}}r_t^{K\star}k_{t-1}^\star\Big) \tag{A.25}$$

Vacancy costs:

$$\kappa_t = \bar{\kappa}\iota^{-1}\big(y_t^H + e_t^r(\frac{p_t^{H\star}}{p_t^\star})(\frac{p_t^H}{p_t})^{-1}y_t^{H\star}\big) \tag{A.26}$$

$$\kappa_t^\star = \bar{\kappa}^\star(1-\iota)^{-1}\big(y_t^{F\star} + (e_t^r)^{-1}(\frac{p_t^{F\star}}{p_t^\star})^{-1}(\frac{p_t^F}{p_t})y_t^F\big) \tag{A.27}$$

Firm discount factor:

$$E_t\tilde{\Lambda}_{t+1,t} = E_t\Lambda_{t+1,t}\frac{p_{t+1}^H}{p_t^H}(\frac{p_{t+1}}{p_t})^{-1} \tag{A.28}$$

$$E_t\tilde{\Lambda}_{t+1,t}^\star = E_t\Lambda_{t+1,t}^\star\frac{p_{t+1}^{F\star}}{p_t^{F\star}}(\frac{p_{t+1}^\star}{p_t^\star})^{-1} \tag{A.29}$$

The value of a job:

$$J_t^H = mc_t\alpha\frac{y_t}{n_t}(\frac{n_t}{n_t^H})^\rho - \frac{w_t^H}{p_t^H} + E_t\big(\tilde{\Lambda}_{t+1,t}(1-s_t)J_{t+1}^H\big) \tag{A.30}$$

$$J_t^F = \omega mc_t\alpha\frac{y_{i,t}}{n_t}(\frac{n_t}{n_t^F})^\rho - \frac{w_t^F}{p_t^H} + E_t\big(\tilde{\Lambda}_{t+1,t}(1-s_t)J_{t+1}^F\big) \tag{A.31}$$

$$J_t^{F\star} = mc_t^\star\alpha^\star\frac{y_{i,t}^\star}{n_t^\star}(\frac{n_t^\star}{n_t^{F\star}})^{\rho^\star} - \frac{w_t^{F\star}}{p_t^{F\star}} + E_t\big(\tilde{\Lambda}_{t+1,t}^\star(1-s_t^\star)J_{t+1}^{F\star}\big) \tag{A.32}$$

$$J_t^{H\star} = \omega^\star mc_t^\star\alpha^\star\frac{y_t^\star}{n_t^\star}(\frac{n_t^\star}{n_t^{H\star}})^{\rho^\star} - \frac{w_t^{H\star}}{p_t^{F\star}} + E_t\big(\tilde{\Lambda}_{t+1,t}^\star(1-s_t^\star)J_{t+1}^{H\star}\big) \tag{A.33}$$

Job creation condition:

$$\frac{\kappa_t}{q(\theta_t)} = \eta_t J_t^H + (1-\eta_t)J_t^F \tag{A.34}$$

$$\frac{\kappa_t^\star}{q(\theta_t^\star)} = \eta_t^\star J_t^{F\star} + (1-\eta_t^\star)J_t^{H\star} \tag{A.35}$$

Producer price inflation:

$$\pi_t^H = \frac{p_t^H}{p_{t-1}^H} - 1 \qquad \pi_t^F = \frac{p_t^F}{p_{t-1}^F} - 1 \tag{A.36}$$

$$\pi_t^{H\star} = \frac{p_t^{H\star}}{p_{t-1}^{H\star}} - 1 \qquad \pi_t^{F\star} = \frac{p_t^{F\star}}{p_{t-1}^{F\star}} - 1 \tag{A.37}$$

Pricing:

$$\begin{aligned}\Big((1-\epsilon)\big(1-\frac{\psi}{2}(\pi_t^H)^2-\bar{\kappa}\iota^{-1}v_t\big)+\epsilon mc_t\Big)-\psi(1+\pi_t^H)\pi_t^H+\\ E_t\tilde{\Lambda}_{t,t+1}\psi(1+\pi_{t+1}^H)\pi_{t+1}^H\frac{y_{t+1}^H}{y_t^H}=0\end{aligned} \tag{A.38}$$

$$\begin{aligned}\Big((1-\epsilon)\big(1-\frac{\psi^\star}{2}(\pi_t^{H\star})^2-\bar{\kappa}\iota^{-1}v_t\big)+\epsilon mc_t(e_t^r\frac{p_t^{H\star}}{p_t^\star}\frac{p_t}{p_t^H})^{-1}\Big)-\psi^\star(1+\pi_t^{H\star})\pi_t^{H\star}+\\ E_t\tilde{\Lambda}_{t,t+1}\frac{e_{t+1}^r}{e_t^r}\frac{p_{t+1}^{H\star}}{p_{t+1}^\star}(\frac{p_{t+1}^H}{p_{t+1}})^{-1}(\frac{p_t^{H\star}}{p_t^\star})^{-1}\frac{p_t^H}{p_t}\psi^\star(1+\pi_t^{H\star})\pi_t^{H\star}\frac{y_{t+1}^{H\star}}{y_t^{H\star}}=0\end{aligned} \tag{A.39}$$

$$\begin{aligned}\Big((1-\epsilon^\star)\big(1-\frac{\psi^\star}{2}(\pi_t^{F\star})^2-\bar{\kappa}^\star(1-\iota)^{-1}v_t^\star\big)+\epsilon^\star mc_t^\star\Big)-\psi^\star(1+\pi_t^{F\star})\pi_t^{F\star}+\\ E_t\tilde{\Lambda}_{t,t+1}^\star\psi^\star(1+\pi_{t+1}^{F\star})\pi_{t+1}^{F\star}\frac{y_{t+1}^{F\star}}{y_t^{F\star}}=0\end{aligned} \tag{A.40}$$

$$\begin{aligned}\Big((1-\epsilon^\star)\big(1-\frac{\psi}{2}(\pi_t^F)^2-\bar{\kappa}^\star(1-\iota)^{-1}v_t^\star\big)+\epsilon mc_t^\star e_t^r\frac{p_t^{F\star}}{p_t^\star}\frac{p_t}{p_t^F}\Big)-\psi(1+\pi_t^F)\pi_t^F+\\ E_t\tilde{\Lambda}_{t,t+1}^\star(\frac{e_{t+1}^r}{e_t^r})^{-1}(\frac{p_{t+1}^{F\star}}{p_{t+1}^\star})^{-1}\frac{p_{t+1}^F}{p_{t+1}}\frac{p_t^{F\star}}{p_t^\star}(\frac{p_t^F}{p_t})^{-1}\psi(1+\pi_{t+1}^F)\pi_{t+1}^F\frac{y_{t+1}^F}{y_t^F}=0\end{aligned} \tag{A.41}$$

Product markets clearing:

$$a(\frac{p_t^H}{p_t})^{-\phi}(c_t+i_t+g_t)=y_t^H-\frac{\bar{\psi}}{2}(\pi_t^H)^2y_t^H-\bar{\kappa}\iota^{-1}v_ty_t^H \tag{53}$$

$$(1-a^\star)(\frac{p_t^{H\star}}{p_t^\star})^{-\phi^\star}(c_t^\star+i_t^\star+g_t^\star)=y_t^{H\star}-\frac{\bar{\psi}^\star}{2}(\pi_t^{H\star})^2y_t^{H\star}-\bar{\kappa}\iota^{-1}v_ty_t^{H\star} \tag{54}$$

$$a^\star(\frac{p_t^{F\star}}{p_t^\star})^{-\phi^\star}(c_t^\star+i_t^\star+g_t^\star)=y_t^{F\star}-\frac{\bar{\psi}^\star}{2}(\pi_t^{F\star})^2y_t^{F\star}-\bar{\kappa}^\star(1-\iota)^{-1}v_t^\star y_t^{F\star} \tag{55}$$

$$(1-a)(\frac{p_t^F}{p_t})^{-\phi}(c_t+i_t+g_t)=y_t^F-\frac{\bar{\psi}}{2}(\pi_t^F)^2y_t^F-\bar{\kappa}^\star(1-\iota)^{-1}v_t^\star y_t^F \tag{56}$$

Consumer price index:

$$p_t=\big(a(p_t^H)^{1-\phi}+(1-a)(p_t^F)^{1-\phi}\big)^{\frac{1}{1-\phi}} \tag{A.42}$$

$$p_t^\star=\big(a^\star(p_t^{F\star})^{1-\phi^\star}+(1-a^\star)(p_t^{H\star})^{1-\phi^\star}\big)^{\frac{1}{1-\phi^\star}} \tag{A.43}$$

Consumer price inflation:

$$\pi_t = \frac{p_t}{p_{t-1}} - 1 \tag{A.44}$$

$$\pi_t^\star = \frac{p_t^\star}{p_{t-1}^\star} - 1 \tag{A.45}$$

Labour market tightness:

$$\theta_t = \frac{v_t}{u_t} \tag{A.46}$$

$$\theta_t^\star = \frac{v_t^\star}{u_t^\star} \tag{A.47}$$

The probability of finding a worker:

$$q(\theta_t) = \bar{m}_t(\theta_t)^{-\varsigma} \tag{A.48}$$

$$q(\theta_t^\star) = \bar{m}_t^\star(\theta_t^\star)^{-\varsigma^\star} \tag{A.49}$$

The aggregate unemployment level at beginning of a period :

$$u_t = u_t^H + u_t^F \tag{A.50}$$

$$u_t^\star = u_t^{F\star} + u_t^{H\star} \tag{A.51}$$

The unemployment level at the beginning of a period:

$$u_t^H = \bar{u}_{t-1}^H + s_{t-1} n_{t-1}^H \tag{3}$$

$$u_t^F = \bar{u}_{t-1}^F + s_{t-1} n_{t-1}^F \tag{4}$$

$$u_t^{F\star} = \bar{u}_{t-1}^{F\star} + s_{t-1}^\star n_{t-1}^{F\star} \tag{A.52}$$

$$u_t^{H\star} = \bar{u}_{t-1}^{H\star} + s_{t-1}^\star n_{t-1}^{H\star} \tag{A.53}$$

The share of natives in unemployment:

$$\eta_t = \frac{u_t^H}{u_t^H + u_t^F} \tag{A.54}$$

$$\eta_t^\star = \frac{u_t^{F\star}}{u_t^{F\star} + u_t^{H\star}} \tag{A.55}$$

The evolution of employment:

$$n_t^H = (1 - s_{t-1}) n_{t-1}^H + \theta_t q(\theta_t) u_t^H \tag{A.56}$$

$$n_t^F = (1 - s_{t-1}) n_{t-1}^F + \theta_t q(\theta_t) u_t^F \tag{A.57}$$

$$n_t^{F\star} = (1 - s_{t-1}^\star) n_{t-1}^{F\star} + \theta_t^\star q^\star(\theta_t^\star) u_t^{F\star} \tag{A.58}$$

$$n_t^{H\star} = (1 - s_{t-1}^\star) n_{t-1}^{H\star} + \theta_t^\star q^\star(\theta_t^\star) u_t^{H\star} \tag{A.59}$$

Labour market equilibrium:

$$\bar{u}_t^H + \bar{u}_t^{H\star} = \iota - n_t^H - n_t^{H\star} \tag{1}$$
$$\bar{u}_t^F + \bar{u}_t^{F\star} = 1 - \iota - n_t^F - n_t^{F\star} \tag{2}$$

Migration flows:

$$\bar{u}_t^H + \bar{u}_t^{H\star} = u_t^H\big(1 - \theta_t q(\theta_t)\big) + u_t^{H\star}\big(1 - \theta_t^\star q(\theta_t^\star)\big) \tag{42}$$
$$\bar{u}_t^{F\star} + \bar{u}_t^F = u_t^{F\star}\big(1 - \theta_t^\star q(\theta_t^\star)\big) + u_t^F\big(1 - \theta_t q(\theta_t)\big) \tag{43}$$

Migration cost:

$$\frac{X_t}{p_t} = \frac{\bar{x}}{2}\Big(\bar{u}_t^H - \big(1 - \theta_t q(\theta_t)\big)u_t^H\Big)^2 e_t^r \frac{w_t^\star}{p_t^\star} \tag{40}$$
$$\frac{X_t^\star}{p_t^\star} = \frac{\bar{x^\star}}{2}\Big(\bar{u}_t^{F\star} - \big(1 - \theta_t^\star q(\theta_t^\star)\big)u_t^{F\star}\Big)^2 (e_t^r)^{-1}\frac{w_t}{p_t} \tag{A.60}$$

The marginal cost of migration:

$$\frac{x_t^H}{p_t} = -\frac{x_t^{H\star}}{p_t} = \bar{x}(\bar{u}_t^H - \big(1 - \theta_t q(\theta_t)\big)u_t^H\Big)e_t^r \frac{w_t^\star}{p_t^\star} \tag{41}$$
$$\frac{x_t^{F\star}}{p_t^\star} = -\frac{x_t^F}{p_t^\star} = \bar{x}^\star\Big(\bar{u}_t^{F\star} - \big(1 - \theta_t^\star q(\theta_t^\star)\big)u_t^{F\star}\Big)(e_t^r)^{-1}\frac{w_t}{p_t} \tag{A.61}$$

Migration condition:

$$\begin{aligned}\frac{\nu_t^H}{p_t} - \frac{x_t^H}{p_t} + \frac{\mu}{1-\mu}\theta_{t+1}q(\theta_{t+1})\frac{p_t^H}{p_t}E_t\tilde{\Lambda}_{t+1,t}J_{t+1}^H = \\ e_t^r\frac{\nu_t^{H\star}}{p_t^\star} - \frac{\upsilon_t}{\lambda_t} - \frac{x_t^{H\star}}{p_t} + \frac{\mu^\star}{1-\mu^\star}\theta_{t+1}^\star q(\theta_{t+1}^\star)e_t^r\frac{p_t^{F\star}}{p_t^\star}E_t\tilde{\Lambda}_{t+1,t}^\star J_{t+1}^{H\star}\end{aligned} \tag{A.62}$$

$$\begin{aligned}\frac{\nu_t^{F\star}}{p_t^\star} - \frac{x_t^{F\star}}{p_t^\star} + \frac{\mu^\star}{1-\mu^\star}\theta_{t+1}^\star q(\theta_{t+1}^\star)\frac{p_t^{F\star}}{p_t^\star}E_t\tilde{\Lambda}_{t+1,t}^\star J_{t+1}^{F\star} = \\ (e_t^r)^{-1}\frac{\nu_t^F}{p_t} - \frac{\upsilon_t^\star}{\lambda_t^\star} - \frac{x_t^F}{p_t^\star} + \frac{\mu}{1-\mu}\theta_{t+1}q(\theta_{t+1})(e_t^r)^{-1}\frac{p_t^H}{p_t}E_t\tilde{\Lambda}_{t+1,t}J_{t+1}^F\end{aligned} \tag{A.63}$$

The Nash bargained wage:

$$\begin{aligned}\frac{\tilde{w}_t^H}{p_t} =&(1-\bar{\mu})(1-t)^{-1}(\frac{\nu_t^H}{p_t}+\frac{\chi_t}{\lambda_t}-\frac{x_t^H}{p_t})+\\ &\bar{\mu}\frac{p_t^H}{p_t}(mc_t\alpha\frac{y_t}{n_t}(\frac{n_t}{n_t^H})^{\rho}+\theta_{t+1}q(\theta_{t+1})(1-s_t)E_t(\tilde{\Lambda}_{t+1,t}J_{t+1}^H))\end{aligned} \tag{38}$$

$$\begin{aligned}\frac{\tilde{w}_t^F}{p_t} =&(1-\bar{\mu})(1-t)^{-1}(\frac{\nu_t^F}{p_t}+e_t^r\frac{\chi_t^\star}{\lambda_t^\star}-e_t^r\frac{\upsilon_t^\star}{\lambda_t^\star}-e_t^r\frac{x_t^F}{p_t^\star})+\\ &\bar{\mu}\frac{p_t^H}{p_t}(\omega mc_t\alpha\frac{y_{i,t}}{n_{i,t}}(\frac{n_{i,t}}{n_{i,t}^F})^{\rho}+\theta_{t+1}q(\theta_{t+1})(1-s_t)E_t(\tilde{\Lambda}_{t+1,t}J_{t+1}^F))\end{aligned} \tag{A.64}$$

$$\begin{aligned}\frac{\tilde{w}_t^{F\star}}{p_t^\star} =&(1-\bar{\mu}^\star)(1-t)^{-1}(\frac{\nu_t^{F\star}}{p_t^\star}+\frac{\chi_t^\star}{\lambda_t^\star}-\frac{x_t^{F\star}}{p_t^\star})+\\ &\bar{\mu}^\star\frac{p_t^{F\star}}{p_t^\star}(mc_t^\star\alpha^\star\frac{y_t^\star}{n_t^\star}(\frac{n_t^\star}{n_t^{F\star}})^{\rho^\star}+\theta_{t+1}^\star q(\theta_{t+1}^\star)(1-s_t^\star)E_t(\tilde{\Lambda}_{t+1,t}^\star J_{t+1}^{F\star}))\end{aligned} \tag{A.65}$$

$$\begin{aligned}\frac{\tilde{w}_t^{H\star}}{p_t^\star} =&(1-\bar{\mu}^\star)(1-t)^{-1}(\frac{\nu_t^{H\star}}{p_t^\star}+(e_t^r)^{-1}\frac{\chi_t}{\lambda_t}-(e_t^r)^{-1}\frac{\upsilon_t}{\lambda_t}-(e_t^r)^{-1}\frac{x_t^{H\star}}{p_t})+\\ &\bar{\mu}^\star\frac{p_t^{F\star}}{p_t^\star}(\omega^\star mc_t^\star\alpha^\star\frac{y_t^\star}{n_t^\star}(\frac{n_t^\star}{n_t^{H\star}})^{\rho^\star}+\theta_{t+1}^\star q(\theta_{t+1}^\star)(1-s_t^\star)E_t(\tilde{\Lambda}_{t+1,t}^\star J_{t+1}^{H\star}))\end{aligned} \tag{A.66}$$

$$\bar{\mu} =\mu\big((1-\mu)(1-t)+\mu\big)^{-1} \tag{A.67}$$

$$\bar{\mu}^\star =\mu\big((1-\mu^\star)(1-t)+\mu^\star\big)^{-1} \tag{A.68}$$

Wages:

$$\frac{w_t^H}{p_t} =\vartheta\frac{\tilde{w}_t^H}{p_t}+(1-\vartheta)\frac{\tilde{w}^H}{p} \tag{A.69}$$

$$\frac{w_t^F}{p_t} =\vartheta\frac{\tilde{w}_t^F}{p_t}+(1-\vartheta)\frac{\tilde{w}^F}{p} \tag{A.70}$$

$$\frac{w_t^{F\star}}{p_t} =\vartheta^\star\frac{\tilde{w}_t^{F\star}}{p_t}+(1-\vartheta^\star)\frac{\tilde{w}^{F\star}}{p} \tag{A.71}$$

$$\frac{w_t^{H\star}}{p_t} =\vartheta^\star\frac{\tilde{w}_t^{H\star}}{p_t}+(1-\vartheta^\star)\frac{\tilde{w}^{H\star}}{p} \tag{A.72}$$

The average wage:

$$w_t =\frac{n_t^H w_t^H+n_t^F w_t^F}{n_t^H+n_t^F} \tag{A.73}$$

$$w_t^\star =\frac{n_t^{F\star}w_t^{F\star}+n_t^{H\star}w_t^{H\star}}{n_t^{F\star}+n_t^{H\star}} \tag{A.74}$$

Monetary policy:

$$r_t =h_r r_{t-1}+(1-h_r)(r+h_\pi\pi_t)+\epsilon_{r,t} \tag{47}$$

$$r_t^\star =h_r^\star r_{t-1}^\star+(1-h_r^\star)(r^\star+h_\pi^\star\pi_t^\star)+\epsilon_{r,t}^\star \tag{A.75}$$

Government policy:

$$g_t + \frac{\nu_t^H}{p_t} u_t^H + \frac{\nu_t^F}{p_t} u_t^F + \frac{b_{t-1}}{p_t}(1+r_t) = \frac{\tau_t}{p_t} + \frac{b_t}{p_t} + t(\frac{w_t^H}{p_t} n_t^H + \frac{w_t^F}{p_t} n_t^F) \tag{48}$$

$$g_t^\star + \frac{\nu_t^{F\star}}{p_t^\star} u_t^{F\star} + \frac{\nu_t^{H\star}}{p_t^\star} u_t^{H\star} + \frac{b_{t-1}^\star}{p^\star}(1+r_t^\star) = \frac{\tau_t^\star}{p_t^\star} + \frac{b_t^\star}{p^\star} + t^\star(\frac{w_t^{F\star}}{p_t^\star} n_t^{F\star} + \frac{w_t^{H\star}}{p_t^\star} n_t^{H\star}) \tag{A.76}$$

Budget adjustment rule:

$$\frac{\tau_t}{p_t} = h_\tau \frac{\tau_{t-1}}{p_{t-1}} + (1-h_\tau)(\frac{\tau}{p} + h_b \frac{b_{t-1}}{p_t}) \tag{51}$$

$$\frac{\tau_t^\star}{p_t^\star} = h_\tau^\star \frac{\tau_{t-1}^\star}{p_{t-1}^\star} + (1-h_\tau^\star)(\frac{\tau^\star}{p^\star} + h_b^\star \frac{b_{t-1}^\star}{p_t^\star}) \tag{A.77}$$

Government spending:

$$g_t = (1-h_g)\bar{g}(c_t + i_t) + h_g g_{t-1} + \epsilon_{g,t} \tag{49}$$

$$g_t^\star = (1-h_g^\star)\bar{g}^\star(c_t^\star + i_t^\star) + h_g g_{t-1}^\star + \epsilon_{g,t}^\star \tag{A.78}$$

Unemployment benefits:

$$\nu_t^H = \bar{\nu}^H w_t \qquad \nu_t^F = \bar{\nu}^F w_t \tag{50}$$

$$\nu_t^{F\star} = \bar{\nu}^{F\star} w_t^\star \qquad \nu_t^{H\star} = \bar{\nu}^{H\star} w_t^\star \tag{A.79}$$

Total factor productivity:

$$A_t = h_A A_{t-1} + (1-h_A)A + \epsilon_{A,t} \tag{15}$$

$$A_t^\star = h_A^\star A_{t-1}^\star + (1-h_A^\star)A^\star + \epsilon_{A,t}^\star \tag{A.80}$$

Investment productivity shocks:

$$\Phi_t = h_\Phi \Phi_{t-1} + (1-h_\Phi)\Phi + \epsilon_{\Phi,t} \tag{A.81}$$

$$\Phi_t^\star = h_\Phi^\star \Phi_{t-1}^\star + (1-h_\Phi^\star)\Phi^\star + \epsilon_{\Phi,t}^\star \tag{A.82}$$

Labour supply shocks:

$$\chi_t = (1-h_\chi)\chi + h_\chi \chi_{t-1} + \epsilon_{\chi,t} \tag{7}$$

$$\chi_t^\star = (1-h_\chi^\star)\chi^\star + h_\chi^\star \chi_{t-1}^\star + \epsilon_{\chi,t}^\star \tag{A.83}$$

Matching efficiency shocks:

$$\bar{m}_t = (1-h_m)\bar{m} + h_m \bar{m}_{t-1} + \epsilon_{m,t} \tag{28}$$

$$\bar{m}_t^\star = (1-h_m^\star)\bar{m}^\star + h_m^\star \bar{m}_{t-1}^\star + \epsilon_{m,t}^\star \tag{A.84}$$

Job destruction shocks:

$$s_t = (1-h_s)s + h_s s_{t-1} + \epsilon_{s,t} \tag{7}$$

$$s_t^\star = (1-h_s^\star)s^\star + h_s^\star s_{t-1}^\star + \epsilon_{s,t}^\star \tag{A.85}$$

Acknowledgements

The author would like to thank for comments to Maciej Bukowski, Heinz Herrmann, Zbigniew Hockuba, Mathias Hoffmann, Michael Krause, Piotr Mechocki, Stéphane Moyen, Wolfgang Pointner, and Nikolai Stähler.

Katarzyna Budnik
European Central Bank, Frankfurt am Main, Germany; email: katarzyna.budnik@ecb.europa.eu

PDF ISBN 978-92-899-7936-8 ISSN 1725-2806 doi:10.2866/0415534 QB-01-26-172-EN-N