Reforming the Liberal Welfare State
International Shocks, Unemployment and Income Shares

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Abstract: We examine the aggregate and labour market effects of labour market and welfare state reforms in the presence of international fragmentation of production and investigate the dynamic behaviour of the economy in response to international shocks is affected by the reforms. The behaviour of shares of different income sources in household income sheds light on the distributional impact of policy reforms and shocks. Reform packages exist that can improve upon the labour market outcomes of a *liberal* welfare state system. Even when reducing labour market flexibility relative to a liberal welfare state regime and resulting in lower steady-state unemployment, *flexicurity* reforms appear to lead to a higher volatility in employment and GDP in response to exogenous foreign shocks.

Keywords: *Flexicurity*; Welfare State Reforms; Labour Market Matching

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1. INTRODUCTION

The aim of this paper is to examine how labour market and welfare state reforms affect aggregate and labour market outcomes in the presence of international fragmentation of production, and to investigate how the dynamic behaviour of the economy in response to international shocks is shaped by different policy regimes. In addition, we analyse the behaviour of shares of different income sources in household income, thus shedding some light on the distributional impact of policy reforms and shocks.

Rising concerns about unemployment and low job creation, increasingly entwined with disquiet about the growing divergence between the shares of aggregate income accrued to labour vis-à-vis those accruing to capital and profits, have come to the fore of public and policy debates since the beginning of the new millennium. These trends are often ascribed to the globalisation of the world economy and to the deepening of the international division of labour which is reflected in the rise of the vertical fragmentation of production across national boundaries. By resulting in a greater exposure of national economies to international shocks, greater mobility of factors of production, and increasing competition from low wage countries, globalisation is perceived as requiring a deregulation of labour markets and a decrease in the size of the state as means to safe-guarding firms' international competitiveness. Interest in the functioning of the labour market as a central determinant of unemployment dynamics has been heightened by, but well precedes, the Great Recession. On the one hand, since the 1980s, the relatively rigid nature of its labour markets has been held responsible for Europe's relatively high unemployment rates vis-à-vis the US.[1] On the other hand, the sense of insecurity resulting from globalisation and the liberalisation of labour markets that characterises in particular *liberal* welfare state regimes are likely to have contributed to growing discontents towards globalisation.

The notion of *flexicurity* has been widely embraced as a guideline to reform labour markets and welfare states[2] capable of addressing both of these sets of concerns. At its core lies the idea that insurance for the unemployed and protection of employment (rather than jobs) via active labour market policies (ALMPs) that support and enhance employability can be combined with reductions of labour market rigidities so as to allow firms to respond flexibly to changes in demand and competitive conditions – thus resulting in the greater efficiency required to meet the challenges of globalisation. However, despite an emerging consensus around a 'recalibration' agenda of welfare state and labour market reforms towards a '*flexicurity* model',[3] considerable heterogeneity persists within Europe in labour market institutions and *flexicurity* is in reality a broad concept whose adoption has taken different shades in different countries. In essence, the country-specific nature of labour market policy configurations results in complex interactions within diverse and multifaceted welfare state and industrial relations systems.

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[1] Conventional wisdom holds that 'rigid' labour markets (e.g. ones with stringent employment protection) limit the flexibility required by firms to adjust to changes in the economy (Blanchard, 2000), and hence can hinder the effectiveness of countercyclical policies. The weaker employment performance of Europe relative to the US (often referred to as *Eurosclerosis*) is typically ascribed by many to its unfavourably rigid labour markets (see Blanchard and Wolfers, 2000; Blanchard, 2003; Nickell, et al., 2005 and Wesselbaum 2010, among others).

[2] These policies are central to the "European Employment Strategy" to address structural unemployment and to increase labour participation and are a cornerstone of the Social Investment model of the welfare state (see European Commission, 2013 for details). See Andersen and Svarer (2012) for a discussion of the Danish case. The 2013 EU Annual Growth survey, available at http://ec.europa.eu/europe2020/making-it-happen/annual-growth-surveys/index_en.htm, encourages the member states to step up ALMPs.

[3] The *flexicurity* model has been endorsed by the European Commission (2007) as a means to reconciling the labour market flexibility required to sustain firms' competitiveness with demands for equity and social protection.

In this paper we argue that an assessment of the effects of *flexicurity* policy on labour market outcomes and their role in offsetting the effects of shocks on aggregate employment requires capturing (at least some of) the complexity of these policy interactions. To this end, we construct a model that characterises a small open economy with goods and labour market imperfections (by allowing for imperfect competition in the goods market and search and matching frictions in the labour market) and use it to examine the effects of different labour market policy reform configurations, encompassing both ALMPs and passive labour market policies (PLMPs). The model is dynamic and focusses on the real side of the economy akin to the real business cycle models, and enables us to analyse the propagation of shocks within a dynamic stochastic general equilibrium setting. In particular, starting from a *liberal* welfare system (such as the UK's) characterised by high flexibility and low unemployment insurance, we examine a range of reforms in the direction of a *flexicurity* system characterised by relatively high flexibility, high unemployment insurance and ALMPs, shedding some light on how such reforms affect labour market outcomes and shares of income from labour and non-labour sources. To start with, we shall assess the role of such reforms in reshaping the long-run equilibrium of the economy. Then we shall investigate the extent to which they alter the dynamic response of the economy to international shocks – specifically to trade and external demand). We illustrate this by comparing the impulse responses of key variables to stochastic shocks introduced to pre- and post-reform calibrations of the model under different policy regimes.

Our results suggests that reform packages exist that can improve upon the labour market outcomes of a *liberal* welfare state system. In addition, we show that all reform packages will also have redistributive effects which change the income shares. Specifically, we find that if accompanied by ALMPs that foster employability and job creation, more generous PLMPs that offer higher protection to the unemployed can still reduce unemployment and increase the level of economic activity. Perhaps counterintuitively, we also find that these reforms – by increasing productivity and reducing outsourcing – tend to change household income shares away from labour and towards capital and profit income. Furthermore, the dynamic adjustments of the economy following once-and-for-all negative external shocks (that reduce vacancy creation and increase aggregate unemployment) are found to have different impacts pre- and post-reform. Even when they may reduce the flexibility of the labour market relative to a liberal welfare state regime and result in lower steady state unemployment levels, reforms in the direction of *flexicurity* appear to lead to a higher volatility in employment and GDP in response to exogenous foreign shocks.

The rest of the paper is organised as follows. Section 2 provides a brief context for the paper within the relevant literature, Section 3 outlines the model and Section 4 carries out the analysis of policy reforms and of the dynamic effects of exogenous shocks in the different policy regimes. Section 5 concludes the paper.

2. THEORETICAL FRAMEWORK AND RELATED LITERATURE

The model developed in this paper consists of a small open economy, a setting that allows for an easy characterisation of exogenous international shocks. The production process is characterised by vertical linkages, with a non-traded final good being produced competitively by aggregating domestically produced and imported varieties of an intermediate input. The domestic varieties of the input, which are also exported, are produced by a monopolistically competitive sector using capital and labour, which are assumed to be internationally mobile and immobile, respectively. Labour supply is endogenous. The input-output nature of the

production structure together with the tradability of the intermediate input can be taken to reflect the vertical fragmentation of production both domestically and across national borders. Thus, the model enables us to analyse how policy reforms and international shocks affect a country's outsourcing activity and how the latter, in turns, shapes labour market outcomes.

The basic structure of the labour market follows Mortensen and Pissaridis (1994), with endogenous job creation and exogenous job destruction within a search and matching framework. A key difference, as in Christoffel and Kuester (2008) and De Walque *et al.* (2009), is the presence of an employment agency that acts as an intermediary between members of household on the supply side and firms in the intermediate input producing sector on the demand side of the labour market. The agency hires the unemployed workers, trains all the workers and then sells the trained man-hours to the intermediate input producers. We assume that the agency is owned by the government and this enables us to easily capture the role of ALMPs aimed at increasing employability and in facilitating the working of the labour market. In particular, an innovative feature of the model is to assume that the training expenditure is not only a source of cost for the agency but also a means to increase the productivity of training and thus the employability of the workforce. The representative household receives income from all sources in the economy and offers full consumption insurance to its members regardless of their employment status. Despite the representative agent framework, in which there is no ex-post heterogeneity across individuals in the household, the analysis enables us to shed light on distributional impacts of policy reforms and stochastic shocks by tracing changes in shares of household income from different sources (labour, capital and profits).

A strand of the literature to which our paper is related focuses on the effects of labour market reforms on labour market outcomes. In a seminal paper, Blanchard and Giavazzi (2003) focus on the long-run implications of product and labour market reforms. Arguing that real world labour markets reflect a tight link in the use of different policies, Blanchard and Tirole (2008) stress the importance of considering policy combinations and study the joint determination of employment protection and unemployment benefits. More recently, a number of papers capture the interaction between the key pillars of the *flexicurity* system. Brown *et al.* (2009) develop a Markov model of the labour market with search; starting from a calibration on Germany, a transition to the Danish *flexicurity* system is shown to have the potential to reduce unemployment and earning inequalities in Germany. Davoine *et al.* (2015) consider the effects of *flexicurity* policies on the reallocation of jobs from declining to expanding sectors and derive optimal welfare state policies that combine the three pillars of *flexicurity*. Within a similar framework, Davoine's (2015) provides a theoretical rationale for *flexicurity* based on education which can act as a self-insurance device. Dabusinskas, Konya and Millard (2015) examine how differences in labour market institutions affect the dynamic adjustment of labour market outcomes. These contributions typically do not consider the interaction between labour markets and international openness.

Within a strand of the literature that examines the business cycle implications of international economic integration, Cacciatore *et al.* (2016b) study how business cycle conditions affect the dynamic impacts of labour and product market reforms in a two country model with labour market frictions. One key difference with our framework is that, given their aim to capture the effects of product market deregulation (in the form of reductions in market entry restrictions) for non-traded services and professions, they assume that the monopolistic

good is non-traded[4] and the sector producing the good is characterised by free-entry hence eliminating profit income from the analysis. Within a similar framework, Cacciatore (2014) examines how intercountry differences in labour market frictions affect the consequences of trade liberalisation. Although these papers analyse some policy combinations, they do not focus on the complexity of *flexicurity*. In general, when analysing the effects of international openness, the literature tends to use symmetric two-country models and to focus on the effects of labour market rigidities on macroeconomic dynamics, restricting the policy menu to a subset of the institutional variables characterising *flexicurity* reforms.

The fact that international shocks and welfare-based tax-and-benefit policies are not distributionally neutral is receiving increasing recognition, particularly following the Great Recession. A number of papers focus on the effects of international trade on wage distribution within and/or across groups and firms.[5] A strand of this literature studies the effects of labour market frictions in determining the distributional effects of trade liberalisation within general equilibrium frameworks. Felbermayr *et al.* (2016) incorporate directed job search into a dynamic model of international trade with firm heterogeneity to study how labour and product market reforms affect wage dispersion across and within firms. Coşar *et al.* (2016) examine the interaction between trade and labour market liberalisation on firm dynamics, job turnover and wage distribution. The focus of these papers is on the effects of trade liberalisation on firm dynamics and on wage inequality.[6] Another strand of the literature, has focussed on the effects of welfare state policies on income distribution. De Agostini *et al.* (2016) examine effects of direct tax and cash benefits on income distribution over the period 2008-2015 in a number of EU countries finding broadly progressive effects. Bargain *et al.* (2016) study the impact of the economic crisis and the policy reaction on income inequality and relative policy and document the stabilising effects of policy. These papers are concerned with income *distribution* and not with the effects of policies on *shares* of income types as stressed in this paper. A recent body of work addresses long-run (secular) trends in inequality and highlights the role of technology. Karabarbounis and Neiman (2014a) document declining "gross labour shares" resulting in capital/labour substitution due to falling investment prices. Piketty and Zucman (2014) show that "net labour shares" of wealth have declined as a result of increases in capital-output ratio. They argue that net-shares, which exclude depreciation since it is not consumed, are a better approximation of inequality between workers and capitalists. Summers (2014) and Rognlie (2014) show that net labour share is likely to increase even if gross share decreases: if capital and labour are sufficiently substitutable in gross production, a fall in return to capital causes a large enough increase in the real capital/labour ratio to reduce the gross labour share. Karabarbounis and Neiman (2014b) provide empirical evidence that countries experienced highly similar declines in both net and gross labour shares. The underlying theory is that in response to reductions in the price of capital, the gross and net labour shares will always move together because, unlike shocks to the real interest rate, reductions in the price of capital not only reduce the gross return to capital but also simultaneously reduce the value of depreciation.[7]

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[4] The tradability of the intermediate goods in a similar framework is assumed instead in Cacciatore *et al* (2016a) and in Cacciatore et al (2016), who however focus on the effects of market deregulation for monetary policy in a small economy and in Monetary Union, respectively.

[5] See, e.g., Egger and Kreikemeir (2012, JIE), Montagna and Nocco (2013, CJE), Helpman et al (2015, REStud, forthcoming).

[6] Ferlbermayr *et al* (2013) develop a two country asymmetric model of international trade to analyse the international spillover effects labour market institutions and show that labour market rigidities that increase unemployment in one country also do so in the trading partner.

[7] A second strand of the literature focuses on the short-run volatility of income shares over the business cycle and examine the role of external and policy shocks. Guvenen et al (2014) study the effects of business cycle on

However, in this strands of the literature, very little attention has been devoted to the effects of international shocks and policy reforms on the shares of income types in household income.

3. THE MODEL

The economy consists of two vertically integrated production sectors. The upstream sector produces varieties of an intermediate inputs using two primary inputs, labour and capital, to produce varieties of a horizontally differentiated product. We assume the economy to be open to trade in these varieties as well as in physical capital, but to be 'small' in the sense that it cannot affect the total aggregate demand for its exports, the price of the varieties it imports, and the world rate of return on capital. A downstream sector produces a homogenous final good by assembling domestically produced and imported varieties of the intermediate input. The final good is used for public and private consumption as well as investment and is not traded internationally. Households use capital accumulation to build their wealth and supply capital and labour to the intermediate good sector. In the labour market, a hiring agency acts as an intermediary between labour demand and supply by creating and filling job vacancies and training the workers. This agency is owned by the government which uses revenue accrued from the agency's operation and from taxing households to finance unemployment benefit payments, employment creation, training expenditure as well as government consumption (which is assumed to consist of a 'non-useful' aggregate demand boosting type of public consumption as in standard macro-models).

3.1. The household sector

The representative household consists of a continuum of members whose measure is normalised to unity. At any time t, the household members are either employed or unemployed. The employed members, denoted by $N_t \in [0,1]$, are trained by hiring agency and negotiate with it their hours of work and the hourly wage rate denoted by h_t^n and w_t^n respectively. The unemployed, $1-N_t$, receive an unemployment benefit b_t and search for jobs available in the form of vacancies posted by the agency; unemployed workers are matched to jobs according to a standard matching technology. We assume that members of the household completely insure each other against any income uncertainties by sharing all income and by collectively using physical capital to store household's wealth.[8]

At any time t, the household faces the following intertemporal budget constraint for all $s \geq 0$,

$$C_{t+s} + I_{t+s} + T_{t+s} = N_{t+s} w_{t+s}^n h_{t+s}^n + (1-N_{t+s}) b_{t+s} + \Pi_{t+s}$$
$$+ r_{t+s} \int_{i \in M_{t+s}} k_{it+s} di + r_{t+s}^* \left(K_{t+s} - \int_{i \in M_{t+s}} k_{it+s} di \right), \quad (1)$$

where C, I, K, Π and T are measured in terms of the final good (see below) and respectively represent the real values of consumption, investment, capital stock, profit income[9] and a lump sum tax paid to the government. r is the domestic gross rates of return on capital while r^*

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[8] See, for example, Andolfatto (1996) and Merz (1995).
[9] Profits are accrued to households via the ownership of the corresponding firms.

denotes its foreign equivalent. The household is assumed to provide the producers of differentiated good with their capital requirement and thus receives the capital income of $r_{t+s} \int_{i \in M_{t+s}} k_{it+s} di$ where M and k_i are the mass of firms (which are indexed by i) and firm i's capital requirement, respectively. The budget constraint above also reflects the economy's international borrowing/lending of capital at the world rate of return to capital r^*, with an inflow (outflow) of capital corresponding to $K_{t+s} - \int_{i \in M_{t+s}} k_{it+s} di > 0 (< 0)$. We further assume that the interest rate differential is determined by the extent of capital mobility and invoke

$$r_{t+s} - r_{t+s}^* = \kappa \left(\int_{i \in M_{t+s}} k_{it+s} di - K_{t+s} \right), \tag{2}$$

where $\frac{1}{\kappa} \geq 0$ is an exogenously fixed measure of capital mobility. Thus, for any given κ, a rise in excess demand for capital increases the right-hand-side of (2) which raises r above r^*; $\kappa = 0$ implies perfect mobility where $r = r^*$ always holds while $\kappa \to \infty$ implies no mobility and $\int_{i \in M} k_i di = K$ ought to hold for any r and r^*. The stock of capital is assumed to depreciate at the constant rate δ leading to the capital accumulation process

$$K_{t+s+1} = I_{t+s} + (1 - \delta) K_{t+s}. \tag{3}$$

The household, which is assumed to have an infinite life span, maximises the present value of lifetime utility

$$E_t \sum_{s=0}^{\infty} \beta^s \left(\frac{(C_{t+s})^{1-\alpha_c}}{1-\alpha_c} - \frac{\xi_h N_{t+s} \left(h_{t+s}^n \right)^{1+\alpha_h}}{1+\alpha_h} \right), \tag{4}$$

where E_t is the conditional expectations operator and: $\beta \in (0,1)$ is the subjective time preference discount factor; ξ_h capture the relative weight of disutility of work; $0 < \alpha_c \leq 1$ and $\alpha_h > 0$ determines the elasticity of labour supply. The household's optimization problem at this stage therefore is to choose the paths of consumption and capital stock, $\{C_{t+s}, K_{t+s+1}\}_{s=0}^{\infty}$, which maximise (4) subject to (1), (2) and (3) while taking K_t and $\{w_{t+s}^n, h_{t+s}^n, N_{t+s}, M_{t+s}, k_{it+s}, \Pi_{t+s}, r_{t+s}, r_{t+s}^*, T_{t+s}, b_{t+s}\}_{s=0}^{\infty}$ as given. Denoting the Lagrange multiplier associated with the optimisation by Λ_{t+s}, the first order conditions are

$$E_t \left[\beta^s (C_{t+s})^{-\alpha_c} - \Lambda_{t+s} \right] = 0, \tag{5}$$

$$E_t \left[\Lambda_{t+s} - \Lambda_{t+s+1} (1 + r_{t+s+1} - \delta) \right] = 0. \tag{6}$$

Rewriting (6) as $E_t \left[\frac{\Lambda_{t+j}}{\Lambda_{t+j-1}} (1 + r_{t+j} - \delta) \right] = 1$, we define, for later use,

$$\varsigma_{t+s} = \prod_{j=1}^{s} \left(1 + r_{t+j} - \delta\right)^{-1} = \left(\frac{\Lambda_{t+s}}{\Lambda_t}\right) \tag{7}$$

as the stochastic real discount factor used in discounting the future values of the variables when appropriate.

3.2. The final good producing sector

The final good is a homogeneous product produced by a competitive sector using as inputs domestically produced and imported varieties of a differentiated product. The latter can be taken to reflect the country's international 'outsourcing' of the intermediate input. The production function is a CES aggregator of the form

$$Y_t = \left(M^{-\frac{1}{\sigma}} \int_{i \in M} \left(y_{it}^d\right)^{1-1/\sigma} di + M^{*-\frac{1}{\sigma}} \int_{i \in M^*} \left(y_{it}^*\right)^{1-1/\sigma} di \right)^{\frac{1}{1-1/\sigma}}, \tag{8}$$

where Y is the quantity of the final good, y_{it}^d and y_{it}^* are the quantities of the domestically produced and imported varieties of the differentiated product and M and M^* denote the respective mass of available varieties and $\sigma > 1$ is the elasticity of substitution between any two varieties. This sector's profit is

$$\Pi_{Yt} = P_t Y_t - \left(\int_{i \in M} p_{it}^d y_{it}^d di + \int_{i \in M^*} \phi_t p_{it}^* y_{it}^* di \right), \tag{9}$$

where P, p_i^d and p_i^* are the prices of final good and domestic and foreign input varieties, and $\phi \geq 1$ represents the per-unit iceberg trade cost incurred in importing.[10] Taking all prices and the trade cost as given and choosing y_{it}^d and y_{it}^* to maximise Π_{Yt} subject to (8), we derive the corresponding demand functions

$$y_{it}^d = \frac{Y_t}{M} \left(\frac{p_{it}^d}{P_t} \right)^{-\sigma}, \quad i \in M, \tag{10}$$

$$y_{it}^* = \frac{Y_t}{M^*} \left(\frac{\phi_t p_{it}^*}{P_t} \right)^{-\sigma}, \quad i \in M^*. \tag{11}$$

Invoking the zero profit condition implied by the perfect competition assumption and using (9), (10) and (11) we obtain the expression for the price index associated with the final good

$$P_t = \left(\frac{1}{M} \int_{i \in M} \left(p_{it}^d\right)^{1-\sigma} di + \frac{1}{M^*} \int_{i \in M^*} \left(\phi_t p_{it}^*\right)^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}, \tag{12}$$

which is the dual to (8), as required.

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[10] Thus, in order to use one unit of the foreign good a firm needs to ship $\phi \geq 1$ units.

3.3. The differentiated good producing sector

The differentiated sector consists of a mass M of monopolistically competitive firms each producing a single variety which they sell domestically as well as export. Equation (10) describes the domestic demand facing the firm that produces variety i. The foreign demand facing the firm is assumed to be

$$y_{it}^{x} = \frac{F_{t}^{*}}{M} \left(\phi_{t} p_{it}^{d} \right)^{-\sigma}, \quad i \in M_{t},$$ (13)

where y_{i}^{x} is the quantity demanded and F^{*} is an exogenous scale factor (a measure of the foreign expenditure on this good). For simplicity, we have assumed the same price elasticity for foreign demand and the same iceberg the trade cost.

Given the demand functions in (10) and (13), the total demand facing the firm producing variety i at period t is

$$z_{it} = y_{it}^{d} + y_{it}^{g} + \phi_{t} y_{it}^{x},$$ (14)

where y_{it}^{g} is government's demand which is explained later. Each variety is assumed to be produced using a composite input comprising two factors: capital, which is rented from the households at price r, and 'effective' labour man-hours, which is purchased from the hiring agency at price w_{t}. Let a_{it} be the quantity of the composite input and use k_{it} and l_{it} to denote the quantities of capital and labour man-hours, respectively. Using a Cobb-Douglas technology, we define the input basket as

$$a_{it} = \left(\frac{l_{it}}{\gamma} \right)^{\gamma} \left(\frac{k_{it}}{1-\gamma} \right)^{1-\gamma}; \quad 0 \leq \gamma \leq 1 .$$ (15)

The production function of the representative firm is then described by its composite input requirement, which we assume to be linear and given by

$$z_{it} = \rho a_{it},$$ (16)

where $\rho > 0$ is the total factor productivity that is assumed to be common to all firms. We write a firm's total cost as

$$p_{t}^{a} a_{it} = w_{t} l_{it} + r_{t} k_{it},$$ (17)

where p_{t}^{a} denotes the unit cost of production. Taking the latter as given, (15) and (17) imply that the optimal unit cost facing a firm is

$$p_{t}^{a} = w_{t}^{\gamma} r_{t}^{1-\gamma}.$$ (18)

The input demands for firm i are then obtained by applying Shephard's lemma to $p_{t}^{a} a_{it}$ and imply,

$$w_{t} l_{it} = \gamma p_{t}^{a} a_{it},$$ (19)

$$r_{t} k_{it} = (1-\gamma) p_{t}^{a} a_{it},$$ (20)

Finally, the real profit of firm i in each period t is

$$\pi_{it} = \left(\frac{p_{it}^d}{P_t}\right) z_{it} - p_t^a a_{it}. \tag{21}$$

Given the environment in which the firm operates, and in the absence of price setting frictions, maximising the present value of the stream of current and future profits reduces to choosing p_{it}^d each period to maximise (21) subject to (10), (13) and (14). This leads to the mark-up equation

$$\frac{p_{it}^d}{P_t} = \frac{\sigma p_t^a}{(\sigma-1)\rho}. \tag{22}$$

3.4. The labour market

We assume that job losses occur at an exogenous constant rate[11] η, and denote the number of vacancies and new hires by V_t and $\mathfrak{M}_t$, respectively. Assuming that the number of job seekers in each period is given only by those who began the period without a job, i.e. $(1-N_t)$, we postulate the standard matching technology,

$$\mathfrak{M}_t = \chi(1-N_t)^\mu V_t^{1-\mu}, \tag{23}$$

where $\chi > 0$ and $\mu \in (0,1)$ denote matching efficiency elasticity with respect to unemployment and define the vacancy-filling and job-finding probabilities respectively by

$$q_t^V = \frac{\mathfrak{M}_t}{V_t}, \tag{24}$$

$$q_t^U = \frac{\mathfrak{M}_t}{1-N_t}. \tag{25}$$

Thus, $1/q_t^V$ and $1/q_t^U$ represent the mean durations of vacancy and unemployment spell.[12] We also assume that the new hires in a period start working at the beginning of the following period, hence the number of employed evolve according to[13]

$$N_t = (1-\eta)N_{t-1} + \mathfrak{M}_{t-1}. \tag{26}$$

Finally, we assume that each period the employment agency trains all the workers it has hired, using a concave training technology for each worker offering h hours,

$$h_t = \frac{e_t}{\varepsilon}(h_t^n)^\varepsilon, \quad 0 < \varepsilon < 1 \tag{27}$$

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[11] Hall (2005) documents that a large percentage of the variation of employment over the business cycle is explained by variations in vacancy creation rather than job separation rate. For simplicity, we therefore follow the literature in assuming that job separations are exogenous. See also Blanchard and Gali (2010) for further details.
[12] It is worth noting that these probabilities can be expressed in terms of 'degree of market tightness' defined by the ratio $V_t / (1-N_t)$.
[13] An alternative is to distinguish between the *unemployed* and the *effective job seekers* following, e.g., Blanchard and Gali (2010) who define these by $u_t = 1-N_t$ and $U_t = 1-(1-\eta)N_{t-1}$ respectively but assume that new hires start working in the period they are matched, so that $u_t = U_t - \mathfrak{M}_t$.

where $e_t > 0$ is a measure of productivity or effort.[14] This technology converts h_t^n man-hours supplied by a worker to h_t effective man-hours of labour services that are offered at the hourly rate w_t to the intermediate good producing firms. An innovative feature of the model is to assume that a higher expenditure on training raises the productivity of the training technology.[15] To reflect this we assume that e_t depends positively on the per capita expenditure on training (measured in units of the final good), x_t^T. In our analysis we use the specific functional form

$$e_t = e_0 + \left(\varepsilon - e_0 \right)\left(1 - \exp\left(-e_1 \left(\frac{x_t^T}{\bar{x}^T} - 1 \right) \right) \right), \quad 0 < e_0 < \varepsilon, \quad 0 < e_1 < 1, \quad \bar{x}^T > 0, \qquad (28)$$

where $\bar{x}^T$ is the base value of x_t^T. Thus, the per unit expenditure on training (x_t^T) is not only a source of cost for the agency, but can be thought of as an active labour market policy instrument influencing the employability of the workforce.

We model the determination of the combination of $\left(w_t^n, h_t^n \right)$ by specifying, within the framework described above, the interaction between workers and the hiring agency as follows. The agency's contemporaneous net revenue from hiring a worker is defined by $w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t$ where the government imposes a firing cost per job loss of f_t.

The value of a job to the agency, denoted by Ω_t^J, is therefore given by its current net revenue and the discounted future value of the job if it survives. This is expressed in the value function form as

$$\Omega_t^J = w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t + \left(1 - \eta \right) E_t \varsigma_{t+1} \Omega_{t+1}^J. \qquad (29)$$

Creating and posting a vacancy is assumed to cost x_t^V per unit (measured in units of the final good). The value of an open vacancy to the agency, denoted by Ω_t^V, is given by its current cost and its discounted future value, where the latter is equivalent to the expected gain arising from future matches. This is expressed in the value function form as

$$\Omega_t^V = -x_t^V + E_t \left[\varsigma_{t+1} \left(q_t^V \Omega_{t+1}^J + \left(1 - q_t^V \right) \Omega_{t+1}^V \right) \right] \qquad (30)$$

The condition that eliminates any incentives for other competing agencies to be set up is $\Omega_{t+s}^V = 0, \ \forall s \geq 0$ and holds if

$$x_t^V = q_t^V E_t \varsigma_{t+1} \Omega_{t+1}^J, \qquad (31)$$

which equates the current actual cost of creating a vacancy to the expected value of the corresponding hired worker's contribution. Equations (29) and (31) then imply that the value of a job to the hiring agency is

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[14] This is in line with Christoffel and Kuester (2008), De Walque et al. (2009) and Di Pace and Hertweck (2012). (27) ought to be sufficiently concave to generate $h_t < h_t^n$ at very low values of h.

[15] Typically, in the literature, the training expenditure is simply modelled as a cost to the firm/employment agency. This however fails to capture that increasing the amount of resources devoted to training does not only increase the cost of converting supplied man-hours into effective man-hours but is also likely to have an effect on the human capital of the workforce.

$$\Omega_t^J = w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t + \frac{(1-\eta)x_t^V}{q_t^V}$$

and that the vacancy posting activity evolves according to

$$\frac{x_t^V}{q_t^V} = E_t\left[\varsigma_{t+1}\left(w_{t+1}h_{t+1} - w_{t+1}^n h_{t+1}^n - x_{t+1}^T - \eta f_{t+1}\right)\right] + (1-\eta)E_t\left[\frac{\varsigma_{t+1}x_{t+1}^V}{q_{t+1}^V}\right], \tag{32}$$

which explains how the current activity is affected by the expected net return − given by the first term on the right-hand-side − and expectations of corresponding future activity − which is captured by the second term.

From the household's perspective, the net pay-off from employment of one of its members with the hiring agency, denoted by Ω_t^W, consists of the wage income $w_t^n h_t^n$ less the value of the outside option − comprising the unemployment benefit and the utility of leisure − and the continuation value of employment if the match lasts. This is expressed in the value function form as

$$\Omega_t^W = w_t^n h_t^n - \left(b_t + \frac{\xi_{ht}\left(h_t^n\right)^{1+\alpha_h}}{(1+\alpha_h)\Lambda_t}\right) + (1-q_t^U)E_t\left[\varsigma_{t+1}(1-\eta)\Omega_{t+1}^W\right], \tag{33}$$

We assume that w_t^n and h_t^n are determined by efficient Nash bargaining between the household and the hiring agency so as to maximise the joint surplus of each match defined by $\left(\Omega_t^W\right)^\omega \left(\Omega_t^J\right)^{1-\omega}$ subject to (29) to (33), where $\omega \in [0,1]$ denotes the relative bargaining power of workers. The first order condition of this maximization with respect w_t^n implies

$\frac{\omega}{\Omega_t^W}\frac{\partial\Omega_t^W}{\partial w_t^n} + \frac{1-\omega}{\Omega_t^J}\frac{\partial\Omega_t^J}{\partial w_t^n} = 0$ and yields the well-known match surplus sharing rule,

$$(1-\omega)\Omega_t^W = \omega\Omega_t^J. \tag{34}$$

The bargained wage bill of the agency (or wage income of the worker) is then obtained by substituting equations (29), (31) and (33) into (34) to eliminate terms involving $E_t\varsigma_{t+1}\Omega_{t+1}^J$, to yield

$$w_t^n h_t^n = \omega\left(w_t h_t - x_t^T - \eta f_t\right) + \omega(1-\eta)x_t^V\theta_t + (1-\omega)\left(b_t + \frac{\xi_{ht}\left(h_t^n\right)^{1+\alpha_h}}{(1+\alpha_h)\Lambda_t}\right) \tag{35}$$

Equation (35) is similar to the standard results obtained in the search and matching literature − see e.g., Pissarides (2000) or Di Pace and Faccini (2012) among others − and states that the bargained wage consists, for any given bargained h_t^n, of the weighted sum of the reservation earning of each party, where the weights reflect the respective bargaining powers.[16]

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[16] The reservation wage for the household is the outside option of each member while for the hiring sector it consists of what the agency gets from the intermediate good producing firms net of the training expenditure, taking account of the cost of replacing the worker (i.e. posting a vacancy adjusted for market tightness).

The first order condition for maximization of the joint surplus with respect h_t^n implies

$$\frac{\omega}{\Omega_t^W}\frac{\partial \Omega_t^W}{\partial h_t^n} + \frac{1-\omega}{\Omega_t^J}\frac{\partial \Omega_t^J}{\partial h_t^n} = 0 \text{ which, using } \frac{\partial \Omega_t^W}{\partial h_t^n} = w_t^n - \frac{\xi_{ht}\left(h_t^n\right)^{\alpha_h}}{\Lambda_t}, \quad \frac{\partial \Omega_t^J}{\partial h_t^n} = e_t w_t\left(h_t^n\right)^{\varepsilon-1} - w_t^n \text{ and}$$

(34) yields

$$\frac{\xi_{ht}\left(h_t^n\right)^{\alpha_h}}{\Lambda_t} = e_t w_t\left(h_t^n\right)^{\varepsilon-1}. \tag{36}$$

This is the familiar result in the literature which states that the bargained hours equalise a worker's marginal rate of substitution between leisure and consumption (on the left-hand-side) and the value of her marginal product to the hiring agency. Substituting (36) into (35) yields

$$w_t^n h_t^n = \omega\left(w_t h_t - x_t^T - \eta f_t\right) + \omega(1-\eta)x_t^V \theta_t + (1-\omega)\left(b_t + \frac{e_t w_t\left(h_t^n\right)^{\varepsilon}}{1+\alpha_h}\right). \tag{37}$$

Thus, the total rent from employment extracted by the household, *ceteris paribus*, is higher the larger is the profit of the employment agency, the tighter is the labour market, and the higher is the household reservation wage.

3.5. The government

The government revenue consists of lump-sum taxation T and the net revenue of the hiring agency[17] which is used to finance the expenditure on public consumption G and unemployment benefit rate b. The government maintains a balanced budget in each period which satisfies

$$(1-N_t)b_t + \frac{p_t^g G_t}{P_t} = T_t + N_t\left(w_t h_t - w_t^n h_t^n - x_t^T\right) - x_t^V V_t, \tag{38}$$

where p_t^g is the public good price index. We assume that public consumption G is of 'non-useful' aggregate demand boosting type and that G is produced by assembling varieties of the domestically produced intermediate good using the CES technology with variety

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[17] Given that the hiring agency is a 'public sector subsidiary', its contemporaneous net revenue accrues to the government and this ensures that the good market clearing condition holds. One might argue that the agency contemporaneous net revenue $N_t\left(w_t h_t - w_t^n h_t^n - x_t^T\right) - \eta f_t - x_t^V V_t$ should be zero, which implies $q_t^V\left(w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t\right) - \left(\frac{q_t^V V_t}{N_t}\right)x_t^V = 0$. However, given that in the steady-state equilibrium successful matches should be equal to job losses so as to sustain a constant employment rate, $q_t^V V = \eta N_t$ and hence $q_t^V\left(w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t\right) - \eta x_t^V = 0$ which results in negative expected net revenue, i.e. $q_t^V\left(w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t\right) - x_t^V < 0$. This would eliminate any incentive for such an agency to exist. A further implication of this is that the contemporaneous net revenue of the agency contributes to the financing of other labour market policies (e.g. unemployment benefits) and transfers. Although there is not a direct link between the government revenue raised via the agency and the government outlay of unemployment benefit, our framework is somewhat consistent with Blanchard and Tirole (2008)'s argument that unemployment benefits ought to be funded via firing taxes rather than other taxes.

$$G_t = \left(M_t^{-\frac{1}{\sigma}} \int_{i \in M} \left(y_{it}^g \right)^{1-1/\sigma} di \right)^{\frac{1}{1-1/\sigma}}. \tag{39}$$

The demand for a typical variety y_i^g satisfies $\int_{i \in M} p_t^d y_{it}^g di = p_t^g G_t$, where we assume the government pays the market price for each variety, and is given by

$$y_{it}^g = \frac{G_t}{M} \left(\frac{p_t^d}{p_t^g} \right)^{-\sigma}, \quad i \in M, \tag{40}$$

which implies that the public good price index satisfies the duality property,

$$p_t^g = \left(\frac{1}{M} \int_{i \in M} \left(p_{it}^d \right)^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}. \tag{41}$$

3.6. General equilibrium

The following additional equations are required to close the model. The labour market equilibrium requires that the total trained man-hours supplied and demanded at any point in time are equalised, hence,

$$N_t h_t = \int_{i \in M} l_{it} di \tag{42}$$

The balance of payments with the rest of the world requires that the trade balance is offset by the interest payments on net capital flow,

$$\int_{i \in M_t} \frac{\phi_t p_{it}^d y_{it}^x}{P_t} di - \int_{i \in M_t^*} \frac{\phi_t p_{it}^* y_{it}^*}{P_t} di = r_t^* \left(\int_{i \in M_t} k_{it} di - K_t \right). \tag{43}$$

Finally, we consider the symmetric equilibrium where firms in the intermediate good producing sector are assumed to be identical. Thus in what follows the firm/variety index i is dropped and the equations are expressed in terms of the values pertaining to the representative firm and/or variety, e.g. (43) will be written as $\frac{M \phi_t p_t^d y_t^x}{P_t} - \frac{M^* \phi_t p_t^* y_t^*}{P_t} = r_t^* \left(M k_t - K_t \right)$, etc. In addition, the real GDP from the supply and the demand sides are respectively defined as

$$GDP_t = \frac{M p_t^d \left(y_t^d + y_t^g + \phi_t y_t^x \right)}{P_t}, \tag{44}$$

and

$$GDP_t = \left(C_t + I_t \right) + \left(x^T N_t + x^V V_t + \frac{p_t^g G_t}{P_t} \right) + r_t^* \left(M k_t - K_t \right), \tag{45}$$

where the three terms in parentheses on the right-hand-side respectively measure private and public expenditure and net exports. The value of GDP from factor income side is given by

$$GDP_t = M \left(w_t l_t + r_t k_t + \pi_t \right). \tag{46}$$

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Finally, we note that

$$Y_t = C_t + I_t + x^T N_t + x^V V_t, \tag{47}$$

as, in addition to household's consumption and investment, the final good is used to meet the cost of vacancy posting and labour training by the hiring agency. Equation (47) can be obtained by using the definition of aggregate profits − $\Pi_{Yt} = 0$ and $\Pi_t = M\pi_t$ and equation (21) − together with the market clearing and budget constraints − equations (1), (9), (14), (17), (38), (42) and (43).

4. POLICY ANALYSIS

We use the model to examine the effects of different permanent reforms and transitory shocks on aggregate labour market outcomes such as unemployment and job creation. In addition, even though the technology adopted in the model implies constant factor income and profit shares in GDP, we analyse the behaviour of shares of different income sources in household income, thus shedding some light on the distributional impact of shocks.[18] This is of value since shares of components of household income − which are arguably a better reflection of the policy implications on welfare and/or on the purchasing power of different income groups in the economy − happen to be more volatile than factor income shares in GDP. To illustrate this point, Figure 1 below plots the wage income shares in household income and GDP for a selection of countries for the period 1991-2014. As can be seen from the figure, the variability over time of the wage income as share of household income is much higher than that of GDP shares. This follows from the fact that transfers which affect household income tend to be volatile as they are likely to respond to cyclical fluctuations.[19]

Fig 1 around here

In our model, the labour income share in household income (*HGI*) can be written as

$\dfrac{Nw^n h^n}{HGI} = \dfrac{Nwh}{GDP}\dfrac{Nw^n h^n}{Nwh}\dfrac{GDP}{HGI}$. While Nwh/GDP is constant in the model given the assumed

technology[20], the other two ratios on the right-hand-side vary. $w^n h^n / wh$ reflects the discrepancy between the gross wage income received by the worker and the gross wage paid by the firm which results from the labour market imperfections arising from search frictions and wage bargaining process. *GDP/HGI* reflects net exports as well as the net transfers. The

capital income share is $\dfrac{Mrk + r^*(K - Mk)}{HGI} = \dfrac{Mrk + r^*(K - Mk)}{HGI}\dfrac{HGI}{GDP}$ and the first ratio on the

right-hand-side is constant in the long-run when $r = r^*$ and, hence, $K = MK$ hold. The variation

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[18] Of course, a representative agent framework is not by definition the best suited to analyse issues of income distribution. However, models with consumer heterogeneity have been shown to give near equivalence results in terms of inequality with representative agent real business cycle models (see Krusell and Smith, 1998).

[19] Consistent with this is the growing attention given to the limitations of per-capita GDP as a measure of well-being. Median household income (that reflects the skewedness of the income distribution) or survey based household income measures are put forward as better measure to assess trends in living standards (e.g. Atkinson, 2013).

[20] It is straightforward to verify that the shares of labour, capital and profit to GDP in this model are, respectively, $\gamma(1-\sigma)/\sigma$, $(1-\gamma)(1-\sigma)/\sigma$, and $1/\sigma$.

in the ratio of capital income ratio is therefore determined by *GDP/HGI*. Finally, the profit income share usually is not addressed in the studies that are based on models in which firms' entry and/or exit eliminates profit. In our model with monopolistically competitive firms and no entry or exit, profit is not eliminated but its share of GDP is constant and is determined by the inverse of the elasticity of substitution between the varieties. Hence, the profit share approaches zero as the goods market structure tends to perfect competition. The share of profits over household income, however, varies and as with other income shares depends on the wedge between GDP and household income, since $\frac{M\pi}{HDI} = \frac{M\pi}{GDP} \frac{GDP}{HDI}$.

In what follows we shall consider 'reforms' that consist of changes in welfare state regime which aim at reforming labour markets in the direction of *flexicurity*. Specifically, we analyse the effect on the equilibrium solution of permanent changes in unemployment benefit, lay-off and vacancy creation costs, and the efficiency of workers' training. We then compare the impacts of stochastic international shocks on the main variables before and after reform.

4.1 Welfare state reforms

In this section we examine the effects of labour market reforms. To reflect current debates, we focus on reforms in the direction of *flexicurity* which is defined as a strategy that aims to strengthen both the security and the flexibility of labour markets by influencing both sides of the market. Specifically, a relatively high degree of flexibility is combined with more generous unemployment support together with the implementation of ALMPs aimed at increasing employability and improving the quality of matching in the labour market. To this end, starting from a benchmark scenario that could be thought of as representing a *liberal* welfare system (characterised by high flexibility and low unemployment insurance), we shall implement permanent shocks reflecting a move towards a system characterised by relatively high flexibility and unemployment insurance, and an emphasis on ALMPs.

We calibrate the steady-state 'pre-reform' benchmark version of the model using data-based stylised features of a typical country. As an example of a *liberal* European welfare system, we use the UK data to set wage and profit income ratios, the relative size of the public sector, trade openness, the unemployment rate, etc. For the freely determined parameters we use values that are commonly used in similar studies. We also assume a lump-sum tax only in order to avoid any distortions introduced by proportional taxation and assume that in the steady-state domestic and foreign interest rates are equal hence there is no capital flowing into or out of the country and the trade balance is satisfied. The Appendix provides the data used in our calibration. Then we define a reform as a permanent change in a set of exogenous variables and implement such a reform by introducing the required changes (e.g. an increase in unemployment benefit and lay-off cost) to the benchmark (i.e. pre-reform) version of the model in the steady-state to find the new steady-state solution representing the post-reform economy. In particular, using Denmark as an example of a *flexicurity* system, we discuss the effects of reforms based on the changes that would take the UK values of the policy and institutional variables closer to their Danish counterparts. Thus, we shall not contrast different welfare state regimes across countries – which would require different initial calibrations – but address the question of how reforms in a given economy (i.e. given its initial structural characteristics) would affect its performance. We shall consider a number of 'reform packages' consisting of different combinations of four policy ingredients that in our model can be thought of as capturing the key pillars of *flexicurity*:

(a) An increase in the unemployment replacement rate (*b/wh*), which increases *security* via the implementation of a PLMP;

(b)   An increase in per-capita training expenditure (x^T) which can be thought of as an ALMP aimed at increasing workers' employability;

(c)   An increase in the firing cost (f), which reduces labour market *flexibility*; and

(d)   A reduction in the vacancy creation cost share in GDP, via a reduction of the unit cost (x^V), which increases labour market *flexibility*.

The parameters are changed in the direction of and by a proportion consistent with taking the UK values closer to the corresponding Danish ones. Interestingly, the *flexicurity* system of Denmark is characterised by higher security (higher unemployment benefit rates), and higher labour market rigidity in terms of a higher firing cost, alongside a lower vacancy creation cost, and a higher training cost.

After examining the effects of each of the above policies in isolation, we shall then consider the following reform packages:

RP1: Reform Package 1, consisting of (a) & (b)
RP2: Reform Package 2, consisting of (a) & (c)
RP3: Reform Package 3, consisting of (a), (c) & (d)
RP4: Reform Package 4, consisting of (a), (b), (c) & (d)

The rationale behind these different combinations is twofold. First, despite an emerging consensus around a 'recalibration' agenda of welfare state and labour market reforms towards a '*flexicurity* model',[21] considerable heterogeneity persists within Europe in labour market institutions, with different countries placing different emphases on the individual elements of the system. Thus, a reform towards *flexicurity* can take different forms. Second, from a positive as well as normative perspective, there is value in understanding the labour market and re-distributive implications of different combinations of reform.

In order to identify the channels through which the ingredients of reform operate, we first examine the effects of the individual policy instruments. Table 1 summarises their effects showing how the benchmark values of crucial variables which represent our *liberal* welfare state system (based on UK data) are affected by each of the policies outlined in (a) to (d) above when each policy is implemented in isolation.

Table 1 around here

Comparison of columns labelled Benchmark and (a) in Table 1 reveals that an increase in unemployment benefit ratio increases unemployment, reduces vacancies and the number of labour market matches, and results in a lower GDP. Intuitively, an increase in the unemployment benefit rate, by raising workers' reservation wage, leads to a higher real wage – see equation (35). This in turn translates into a lower marginal gain from hiring (Ω^J) which induces the employment agency to reduce the number of vacancies it creates. The Beveridge curve equilibrium then requires that the resulting reduction in labour market tightness be accompanied by an increase in unemployment. In addition, the higher wage paid by firms reduces the marginal product of capital and leads to a reduction in the domestic interest rate. The negative interest rate differential ($r - r^*$) then results in a reduction in investment and capital stock which do not recover to their initial values when $r=r^*$ is restored in the long run. The transitional adverse interest rate differential together with the worsening of price

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[21] The *flexicurity* model has been endorsed by the European Commission (2013) as a means to reconciling the labour market flexibility required to sustain firms' competitiveness with demands for equity and social protection.

competitiveness evidenced by an increase in the (relative) price of the typical domestic variety, p^d, result in an increase in 'outsourcing' – captured by the larger share of the intermediate input basket that is imported – and in a fall in aggregate profits. Despite the higher unemployment, the policy reform results in a reallocation of the household sector gross as well as disposable income away from capital and profits towards labour income. This is due to the higher unemployment benefit, higher wages and lower profitability of firms. These results are pretty much in line with the conventional view that PLMPs (typically necessary to address market failures due to missing private insurance markets) are ultimately contractionary – even though they serve as a redistributive device.

Comparing the columns labelled Benchmark and (c) shows that a rise in the firing costs, which reduces the degree of labour market flexibility, has mild effects on the long run equilibrium values. They are however in the direction of increasing unemployment and reducing GDP and result in a mild redistribution away from labour income. Intuitively, a higher firing cost reduces labour market flexibility and results in a fall in the number of job separations and in a lower flow into unemployment. The higher expected cost of firing also result in a lower vacancy creation as the employment agency, whose net revenue falls, faces a lower value of a job (Ω^J). This effect dominates and leads to higher unemployment (corresponding to a downward movement along the Beveridge curve), as well in a mild redistribution away from labour income.[22]

The impacts of an increase in training expenditure per worker (x^T) and a reduction in the unit cost of vacancy creation (x^V) reported in columns (b) and (d), respectively, are quantitatively more substantial. Both policies increase vacancy creation and reduce unemployment in the labour market and represent an upward movement along the Beveridge curve which is expansionary and results in an increase in GDP. These effects are relatively stronger for the increase in x^T. In terms of their impact on income shares, however, whilst a reduction in x^V changes in favour of labour, an increase in x^T (that raises the productivity of training) does the opposite. Note that, other things equal, the immediate effect of a higher x^T is to increase the cost of a match, and this reduces the value of a filled vacancy (Ω^J) to the agency. This works towards a reduction in the number of vacancies and hence towards an increase in unemployment. However, the positive impact on the 'productivity of training' of a higher x^T results in a higher h/h^n and this works towards an increase in Ω^J and in higher vacancy creation. The higher productivity of training also leads to a rise in the marginal product of capital that results in an incipient positive interest rate differential. The ensuing increase in investment and capital stock do not fall to their initial values when interest parity condition is restored in the long run. This, together with a substantial reduction in the price of the typical domestically produced intermediate variety, results in a fall in outsourcing, a very large increase in firm-level and total profits, and in an increase in profit income share. A reduction in x^V has qualitatively similar effects on vacancy creation, unemployment, price competitiveness, outsourcing and profitability. However, these are less pronounced and do not result in a redistribution towards profit and capital income – a redistribution that is driven here by the increase in wages that dominate the increase in profits. To understand the different redistributive effects of the two policy instruments, consider the implications of equation (37):

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[22] The small impact of the rise in firing cost we find in the paper is consistent with the empirical evidence that tends to show employment protection to have small and ambiguous *net* effects on employment (despite a fall in both inward and outward flows into unemployment as predicted by the theory).

for a given bargaining power of workers, ω, the total rent from employment extracted by an employed member of the household, i.e. $w_t^n h_t^n$, is higher (i) the larger is the agency's contemporaneous net revenue from hiring a worker $(w_t h_t - x_t^T - \eta f_t)$, (ii) the higher are the vacancy creation cost per unemployed $(1-\eta) x_t^V \theta_t$, and (iii) the higher is the reservation wage

$$\left(b_t + \frac{e_t w_t \left(h_t^n \right)^{\varepsilon}}{1+\alpha_h} \right).$$ Hence, whereas an increase in x^T increases the total rent extracted by the

workers (since it can be verified that $\partial(w_t h_t - x_t^T - \eta f_t)/\partial x_t^T > 0$), a *reduction* in x^V directly reduces it. As a result, an increase in x^T redistributes income towards wage earners, whilst a reduction in x^V does the opposite.

Having examined the impact of individual policies in isolation, we now consider how the reform packages 1 to 4 specified above affect the economy. Table 2 reports the results.

Table 2 around here

RP1 combines an increase in unemployment benefit b (a PLMP) with an increase in the training expenditure per worker x^T (an ALMP) and can be thought of as putting the emphasis on providing security to the unemployed while increasing employability. This reform results in an upward move along the Beveridge curve – i.e. in a reduction in unemployment and in an increase in vacancy creation – and its expansionary nature leads to a substantial increase in GDP since the positive employment effect induced by the increase in x^T dominates the negative effect of the rise in b. So, when combined with greater investment in workers' productivity (effective units of labour), an increase in unemployment protection increases the productivity in the intermediate sector, reduces outsourcing, and raises the level of economic activity. It reduces however the wage share of household disposable income.

Combining increases in unemployment benefits (b) in RP2 with increases in firing costs f that would be required to take the system in the 'direction' of the Danish model results in a redistribution of income towards wages. However, the share of imported varieties increases and so does unemployment – consistent with the effects of the individual policy instruments – and the resulting contractionary downward move along the Beveridge curve reduces GDP.

By augmenting RP2 with a reduction in the vacancy creation costs (x^V), RP3 reverses the contractionary outcome of implementing the former reform package: vacancies rise, unemployment reduces and GDP recovers while income share changes in favour of wage earners. Finally, RP4 which combines all the policies is the most successful in terms of unemployment reduction and economy wide expansion, but it reduces the share of wages income.

The above results suggest that there exist reform packages which consist of specific combination of PLMPs and ALMPs that can improve upon the labour market outcomes of a *liberal* welfare state system. In addition, such reform packages will, inevitably, have redistributive effects that alter the share of income sources in total household income. In particular, we find that when accompanied by specific ALMPs that foster employability and job creation, more generous PLMPs that offer protection to the unemployed can in fact reduce unemployment and increase the level of economic activity. Our results show, perhaps counterintuitively, that these reforms also tend to reduce the share of labour income and raise that of capital and profit income, as a result of higher productivity and lower outsourcing.

4.2 Impact of international shocks

We now compare the impact of international shocks on the economy before and after the implementation of the different reform packages discussed above. Specifically, we examine the immediate response of endogenous variables to, and the pattern of adjustment that follows, exogenous international shocks, shedding light on how the reforms alter the short-run behaviour of the economy.

In order to compare the impact of a stochastic exogenous shock before and after a reform, we augment the log-linearised version of our dynamic model with an appropriate autoregressive process that generates the underlying exogenous variable that is subjected to the shock and trace the impact of a once-and-for-all shock to the process on the endogenous variables. More specifically, using $\bar{x}$ to denote the steady-state value of a typical endogenous variable $x_{t\pm s}$, the log-linearised version of the model is obtained using the first order approximation of the equations that enables us to replace all $x_{t\pm s}$ with percentage deviations from their steady-state, $\hat{x}_{t\pm s} = \log \frac{x_{t\pm s}}{\bar{x}}$. When introducing stochastic shocks we assume that the percentage deviation from the steady-state of the exogenous variable in question, e.g. the foreign demand scale factor $z_t \equiv F_t^*$, follows an AR(1) path, namely $\hat{z}_t = a\hat{z}_t + v_t$, $|a| < 1$, $v_t \sim wn\left(0, \sigma_v^2\right)$. In the absence of shocks, $\hat{z}_{t\pm s} = 0$ and $z_{t\pm s} = \bar{z} \Rightarrow x_{t\pm s} = \bar{x}$. When a shock is introduced, that is when we set $v_t \neq 0$ at t but keep $v_{t+s} = 0$ $\forall s > 0$, we generate a non-zero path for $\hat{z}_{t+s}$ which decays based on the value of a and this affects all the endogenous variables, generating a path for each $\hat{x}_{t+s}$. With a stable steady-state equilibrium all $\hat{x}_{t+s} \to 0$ as s rises. The path of a variable $\hat{x}_{t+s}$ is used to construct its impulse response graph which we illustrate in our discussions below when comparing impacts pre-and post-reform stochastic shocks.

4.3.1 Shock propagation in the benchmark model

Figure 2 displays the impulse responses of key endogenous variables in the model to exogenous negative shocks to foreign demand (i.e. a once-and-for-all fall in F^*) and to trade (i.e. a once-and-for-all increase in trade cost ϕ), in the first and second columns respectively.[23] Both shocks have the same qualitative effects on labour market outcomes: unemployment increases while the number of vacancies, labour market tightness and the probability of finding a job fall. Also in both cases, household consumption and investment, the final good output and GDP all fall. However, quantitatively, the impact of the shock to ϕ is much more enhanced than that of the shock to F^*. Key to the intuition behind these results is the different channels through which the two shocks affect the economy. Whilst a negative foreign demand shock directly reduces demand for the exported varieties, an increase in ϕ directly raises the variety prices at the point of delivery of both exported and imported varieties and thus leads to a fall in the demand for both exports and imports, y^x and y^*, and a raise in the price index P. In both cases, the fall in y^x reduces the firm-level demand for production factors, output and profit and leads to a smaller vacancy creation and firm-level wage. The latter works towards a lower real marginal production cost in the intermediate sector that translates into a lower price for domestic intermediate varieties and, other things equal, a lower price level, P. In the case of a negative trade shock, however, this effect on P is insufficient to offset the initial consequences on the

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[23] The complete set of IRFs are available in an online Appendix.

unit cost of delivering a variety of the increase in trade cost – this effect being compounded by the fact that the higher P reduces the competitive pressure on domestic variety producers who push up their price p^d via their markup pricing rule in (22). Thus, whilst the price index falls after a negative foreign demand shock, it increases following a trade shock. Given the vertical linkages in the economy, this has a negative pecuniary externality and results in lower final good output. Ultimately, despite the different effects on the price index, variety prices fall in both cases. Thus, whilst the country's terms of trade fall as a result of both shocks, a negative trade shock has a much larger negative impact on the country's terms of trade which, together with its additional impacts on y^* and P, leads to a larger negative effect on productivity, aggregate output, vacancy creation and unemployment. This occurs despite the fact that a negative trade shock leads to a larger increase in the demand for domestic upstream producers by triggering a substitution away from foreign and towards domestic varieties of the intermediate goods. In both cases, the fall in firm profits together with the reduction in labour income explains the smaller household disposable income (HDI), consumption and investment. The way these two shocks affect the interest rate differential and lead to capital flow can also shed light on the larger quantitative impact of the shock to ϕ: whilst both shocks immediately generate a trade deficit that leads a reduction in r relative to r^* via the corresponding capital flow that is required to clear the balance of payments, the initial impact of the shock to F^* is much milder than that caused by the shock to ϕ. This large discrepancy in the effects is later mitigated by the fact that unlike in the former case, where r monotonically rises towards r^*, in the latter case r rises quickly and substantially above r^* and then declines back monotonically.

Fig. 2 around here

The redistributive effects of the shocks discussed above are shown in Figure 3 which suggests that they have opposite impacts on the relative shares of different income types: the negative trade shock redistributes income towards wages and capital (i.e. towards the primary factors of production) and away from profits whereas the negative foreign demand shock does the opposite. As with the labour market implications of the shocks, the redistributive effects of a negative trade shock are considerably larger. These results too can be explained using the different mechanisms we outlined when discussing the results in Figure 2. In particular, the negative trade shock increases the price index P and has a larger 'depressive' effect on aggregate productivity and employment; this results in a larger fall in household consumption and investment but stimulates a relatively large increase in the return to capital. These effects are reversed in the case of a negative foreign demand shock that reduces both P and r.

A clear implication of our findings is that negative international shocks which originate from different sources are likely to trigger different adjustment mechanisms. As a result, they will have different short-run consequences for labour market outcomes as well as leading to very different redistributive effects. If the economy is characterised by vertical linkages (that generate aggregate scale economies) a shock that reduces trade in intermediate inputs can have stronger aggregate effects than a demand shock. In the next section we examine how labour market and welfare state reforms affects these outcomes.

Figure 3 around here

4.3.2 Welfare state reforms and shock propagation

To examine the effects of reforms on shock propagation, we compare the impacts of the negative foreign demand and trade shocks on the main aggregate measures in post-reform economy with their pre-reform counterparts discussed above. The impulse response functions for unemployment, GDP, the price index and the labour income share in household income are displayed in Figure 4 and provide an indication of how these reforms alter the propagation shocks in the economy.

<div align="center">Figure 4 around here</div>

At a first glance, the effects of the two types of shocks in both pre- and post-reform states are very close and all follow very similar patterns to those observed in the benchmark case: unemployment, GDP and the price index exhibit the same qualitative responses but the shocks affects the share of labour income differently. However, a closer inspection of the graphs reveals that welfare state reforms tend to have different quantitative impacts on the propagation of shocks. Specifically, we find that when a *liberal* welfare state regime is reformed in the direction of *flexicurity* (which is characterised by *lower* flexibility and a higher employment protection), the economy tends to become more volatile in response to shocks – even when a reform package has taken the economy to a steady-state characterised by lower unemployment. Thus, as can be more clearly seen from the enlarged sections of the graphs, post-reform unemployment and GDP responses are larger than pre-reform ones under all reform packages. The highest volatility in terms of unemployment is post-RP3, whilst the lowest is post-RP1. This might appear as counterintuitive since the latter is the only reform combination that does not include an increase in firing cost, f. However, the results are dominated by the fact that the post-reform economy is characterised by a higher unemployment benefit. As is standards in these models, higher unemployment benefit results in workers appropriating a higher share of the bargained match surplus and this results in a much larger percentage decrease in vacancy creation, leading to a higher response in terms of unemployment. In post-RP1 (the regime with the lowest unemployment response after the pre-reform situation), the negative effect of the higher unemployment benefit is offset by the higher per capita training expenditure which is associated with a higher efficiency of training. Following RP2, which is characterised by a higher firing cost that reduces labour market flexibility and hence the ability of firms to adjust employment quickly in response to the shock, the increase in unemployment is initially lower than post-RP4, but the ranking between the two is altered later in the dynamic adjustment path – with unemployment growth peaking earlier than post-RP2, due to the compensating effect of the higher training expenditure per worker and also the lower vacancy creation cost. The higher training expenditure is key in offsetting the negative effect of a higher unemployment replacement rate; this is confirmed by the fact that the largest increase in unemployment occurs post-RP3, which is characterised by a higher degree of unemployment income support and a higher firing cost. Turning our attention to the redistributive effects of these shocks we see that in general they are most (least) pronounced post-RP2 (post-RP4), and that a trade shock has a more distinct quantitative impact that separates the benchmark, post-RP2 and post-RP3 from post-RP1 post-RP4.

In sum, although the qualitative responses under all post-reform regimes are similar and quantitatively very close, the small quantitative differences that we observe in the responses suggest that in general the proposed reforms are likely to increase volatility to shocks and, contrary to conventional wisdom, a higher firing cost and greater unemployment protection do not effectively contribute to shielding the economy from negative exogenous shocks.

Overall, the results discussed in this section suggest that reforming a liberal welfare state in the direction of *flexicurity* that combines generous unemployment support with ALMPs can improve labour market outcomes and increase the level of economic activity in the long-run. Somewhat counterintuitively, these reforms appear however to result in a higher volatility in unemployment and GDP response to exogenous foreign shocks in the short-run. These findings germinate clear hypotheses that can be tested empirically – a task that lies beyond the scope of this paper. However, the crude evidence in Figure 5 which compares the volatility of unemployment and GDP in Denmark and the UK suggests that our theoretical results are not at odds with empirical stylised facts. The graphs show that, consistent with our analysis, whilst the unemployment rate in the UK is higher than in Denmark (with the exception of the 2014-2016 interval), the volatility of unemployment is higher in Denmark. Similarly, Danish GDP is characterised by a higher volatility than the UK's. This evidence ought to be interpreted with caution. It is important to reiterate that our theoretical exercise is not an 'inter-country' comparison between different welfare state regimes – which would entail comparing economies characterised by different initial calibrations. Rather, we ask how an economy – given its initial structural characteristics – would perform were it to introduce reforms in a certain direction. In addition, the stylised nature of our model implies that it cannot fully capture the differences between the two economies' welfare and labour market systems. For instance, the model does not reflect the different nature of job creation in the two countries, with the UK's employment performance having been underpinned by a greater reliance of on temporary or zero-hour contracts jobs.[24]

Figure 5 around here

5. CONCLUSIONS

This paper developed a small open economy model with imperfectly competitive good and labour markets. We studied the steady state implications of welfare state reforms and how the dynamic responses to shocks vary pre- and post-reforms.

Our results suggest that reforms to the liberal welfare system in the direction of *flexicurity* that combine greater income support for the unemployed and *stronger firing restrictions* with active labour market policies that enhance employability and job creation can improve labour market outcomes and increase the level of economic activity. Somewhat counterintuitively, however, these reforms – by increasing productivity and reducing outsourcing – will tend to redistribute household income away from labour and towards capital and profit income.

As expected, negative international shocks reduce vacancy creation and increase aggregate unemployment and are also not distributionally neutral. The dynamic adjustments of the economy following once-and-for-all external shocks differs pre- and post-reform. Even when they result in lower steady state unemployment levels, reforms in the direction of *flexicurity* appear however to lead to a higher volatility in employment and GDP in response to exogenous foreign shocks despite the fact that they may reduce the flexibility of the labour market relative to a liberal welfare state regime.

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[24] As an indicator, the share of involuntary temporary as a percentage of all temporary workers in the UK is higher than in Denmark (European Commission, 2013).

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Appendix – Calibration Values

Notation		Definition	Value
α_c		exponent of consumption in the utility function	0.8
α_h		exponent of (disutility of) work in the utility function	2.0
β		subjective rate of time preference	0.99
δ		depreciation rate	0.025
σ	(1)	elasticity of substitution between intermediate varieties	5.0
κ		capital (im)mobility coefficient	0.001
γ	(2)	elasticity of labour in the C-D composite input	0.709
ρ		autonomous TFP	1.0
ω	(4)	worker's bargaining power	0.246
μ	(5)	worker-vacancy matching elasticity	0.754
χ		worker-vacancy matching efficiency	0.535
η	(6)	job destruction rate	0.038
e_0		efficiency of worker training technology	0.70
e_1		effect of training expenditure growth on training efficiency	0.75
ε		elasticity of worker training technology	0.995
x^T	(7)	training expenditure per worker	0.113
$\bar{x}^T$		base value of x^T	0.113
x^V	(7)	vacancy creation unit cost	0.876
q^V	(8)	vacancy-filling probability	0.700
q^U	(8)	job-finding probability	0.490
U	(9)	employment (rate)	0.072
b	(10)	unemployment benefit rate	0.124
f	(11)	worker firing fine	0.034
G	(12)	general public good	0.186
T		Tax paid by households (lump-sum)	0.205
I	(13)	private investment (by households)	0.166
C		private consumption (by households)	0.570
M/M^* (14)		mass of domestic varieties relative to ROW	0.0465
p^d/p^* (15)		relative price of domestic and foreign varieties (terms of trade)	1.093/1.236
ϕ		ice-berg trade cost	1.0
F^*	(15)	scale factor in foreign demand for domestic varieties	0.415
r^*		foreign real interest rate	0.035

Note: numbers in parentheses correspond to the notes below. When there is no note, the value is determined freely.

(1) Is set s.t. $1/\sigma$ = profit share in GDP of 0.2 (average over 2008-2014). Figures are based on business profit shares. Sources: http://ec.europa.eu/eurostat/web/sector-accounts/data/ annual-data.

(2) Is set s.t. $\gamma(\sigma$-1$)/\sigma$ = labour income share in GDP of 0.5 (average over 2008-2009). Source: http://stats.oecd.org/index.aspx?queryid=345.

(3) Is set relative to the US total factor productivity normalised to unity (average over 2009-2014). Source: https://fred.stlouisfed.org/series/CTFPPPGBA669NRUG.

(4) Is set using the weighted average of collective bargaining and union density indices for 2013. Source: http://www.oecd.org/employment/emp/43116624.pdf. and https://stats.oecd.org/Index.aspx?DataSetCode= UN_DEN.

(5) Is set to satisfy the consistency condition, $\mu + \omega = 1$.

(6) Is set based on empirical evidence on job separation rate provided by Hobijn and Sahin (2009), http://www.sciencedirect.com/science/article/pii/S0165176509001359. Following Faccini, Millard and Zanetti (2011), we normalise the UK figure to 0.38. For further details, see http://www.bankofengland.co.uk/research/Documents/workingpapers/2011/wp408.pdf.

(7) The values are based on simulations of the steady-state equilibrium version of the model calibrated for the UK.

(8) In the absence of any empirical estimate or data for vacancy filling success rate we use the EURO Area average as in Christoffel, Kuester and Linzert (2009). We use the EURO Area averages of Job Vacancy Rate for 2012; ec.europa.eu/social/BlobServlet?docId= 13403&langId=en.

(9) Source: http://stats.oecd.org/index.aspx?queryid=36324. Values are based on quarterly harmonised unemployment rate (average over 2009-2015).

(10) Is set s.t. average benefit paid as ratio of the average earning is 0.23 on average. Source: Nunziata and Ochel (2005) https://www.jstor.org/stable/3590502?seq=1#page_scan_tab_contents and Vliet and Caminada (2012) http://media.leidenuniv.nl/legacy/neujobs-vanvliet-%26-caminada-24-01-2012.pdf. The values for 'replacement rates' reported in the literature do not seem to change often, as evidenced in Nickell, Nunziata, and Ochel (2005) whose report covers the period 1960-1999.

(11) Is set s.t. the firing cost as ratio of average earning is 0.063, based on the strictness of employment protection, OECD, 2013. Source: http://ec.europa.eu/europe2020/pdf/themes/23_employment_protection_legislation.pdf.

(12) Is set s.t. share of government consumption in GDP is 0.209 (average over 2008-2014). Source: http://data.worldbank.org/indicator/NE. CON.GOVT.ZS.

(13) Is set share of investment in GDP is 0.1661 (average over 2008-2014). Sources: http://ec.europa.eu/eurostat/web/sector-accounts/data/ annual-data.

(14) Is set to ratio of UK GDP to world GDP (average over 2008-2014). Source: https://knoema.com/mhrzolg/gdp-statistics-from-the-world-bank.

(15) Is set consistently with the trade openness ratio and share of export to GDP (average over 2008-2014).

**Table 1. Effects of permanent changes in individual policy instruments
on a selected set of endogenous variables**

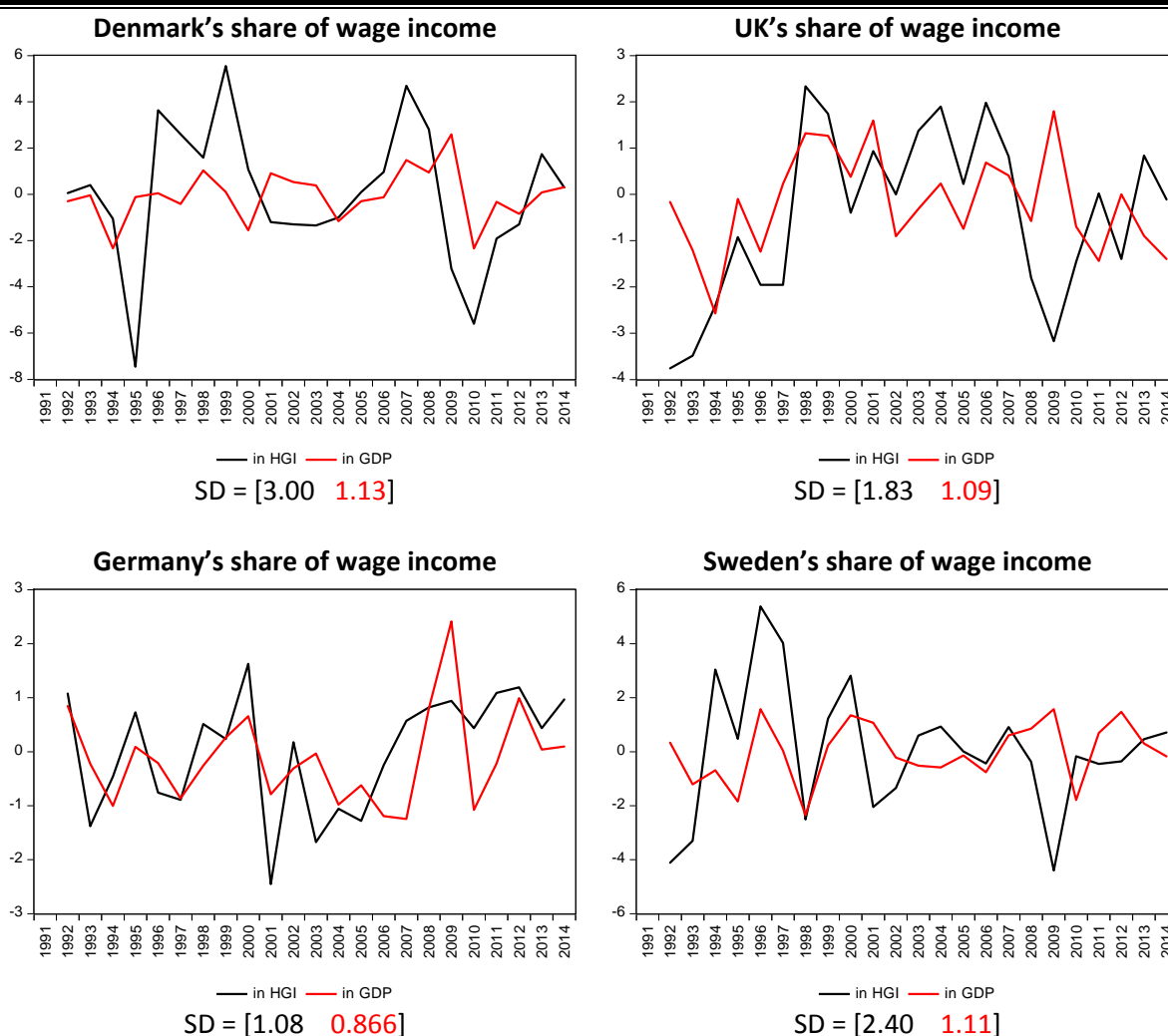| Variables	Benchmark	(a)	(b)	(c)	(d)
GDP	1	0.9936	1.3795	0.9999	1.0048
Unemployment	0.0720	0.0768	0.0665	0.0720	0.0609
Job Value to agency	1.2645	1.0226	1.6450	1.2624	1.0978
Vacancies	0.0504	0.0405	0.0659	0.0503	0.0885
Price Index	0.9700	0.9707	0.9363	0.9700	0.9695
Matches	0.0353	0.0351	0.0357	0.0353	0.0357
Price of an Intermediate Variety	1.0928	1.0941	1.0347	1.0928	1.0919
Import Share of Intermediates in Input	0.0176	0.0177	0.0153	0.0176	0.0176
Household Income (HGI)	0.9415	0.9513	1.2587	0.9410	0.9515
Wage & Benefit Income of HH / HGI	0.5406	0.5483	0.5260	0.5404	0.5432
Profit Income of HH / HGI	0.2124	0.2089	0.2192	0.2125	0.2112
Capital Income of HH / HGI	0.2467	0.2429	0.2549	0.2471	0.2456
Tax paid by HH / HGI	0.2179	0.2237	0.1564	0.2174	0.2155
Wage Income of / HDI	0.6790	0.6869	0.6157	0.6784	0.6824
Wage & Benefit Income of HH / HDI	0.6911	0.7063	0.6234	0.6905	0.6925
Capital Income of HH / HDI	0.3158	0.3129	0.3021	0.3158	0.3130
Profit Income of / HDI	0.2716	0.2691	0.2598	0.2716	0.2692
Investment / HDI	0.2256	0.2235	0.2158	0.2256	0.2236
Investment / GDP	0.1661	0.1661	0.1661	0.1661	0.1661
Consumption / HDI	0.7744	0.7765	0.7856	0.7766	0.7764
Consumption / GDP	0.5703	0.5772	0.637	0.5773	0.5768

The Benchmark calibration is based on the UK data and columns (a) to (d) correspond to the list of policies, i.e. "key pillars of *flexicurity*" identified above which respectively incorporate changes in unemployment benefit rate, per-capita training expenditure, firing cost and vacancy creation unit cost that are chosen on the basis of Danish data and are all in the magnitudes of 50% change relative to the Benchmark column except for column (b) which involves 250% change.

Table 2. Effects of permanent reform packages

| Variables	Bench-mark	RP1 (a) & (b)	RP2 (a) & (c)	RP3 (a), (c) & (d)	RP4 (a), (b), (c) & (d)
GDP	1	1.3736	0.9935	0.9992	1.3809
Unemployment	0.0720	0.0695	0.0768	0.0609	0.0588
Job Value to agency	1.2645	1.4199	1.0203	0.8855	1.2294
Vacancies	0.0504	0.0567	0.0404	0.0712	0.0994
Price Index	0.9700	0.9368	0.9707	0.9701	0.9362
Matches	0.0353	0.0354	0.0351	0.0356	0.0358
Price of an Intermediate Variety	1.0928	1.0354	1.0941	1.0930	1.0345
Import Share of Intermediates in Input	0.0176	0.0153	0.0177	0.0176	0.0153
Household Income (HGI)	0.9415	1.2678	0.9509	0.9596	1.2798
Wage & Benefit Income of HH / HGI	0.5406	0.5314	0.5481	0.5496	0.5333
Profit Income of HH / HGI	0.2124	0.2167	0.2090	0.2082	0.2158
Capital Income of HH / HGI	0.2467	0.2519	0.2430	0.2421	0.2509
Tax paid by HH / HGI	0.2179	0.1607	0.2233	0.2201	0.1584
Wage Income of / HDI	0.6790	0.6210	0.6863	0.6886	0.6235
Wage & Benefit Income of HH / HDI	0.6911	0.6331	0.7056	0.6925	0.6337
Capital Income of HH / HDI	0.3158	0.3002	0.3128	0.3130	0.2981
Profit Income of / HDI	0.2716	0.2582	0.2690	0.2692	0.2564
Investment / HDI	0.2256	0.2144	0.2234	0.2236	0.2129
Investment / GDP	0.1661	0.1661	0.1661	0.1661	0.1661
Consumption / HDI	0.7744	0.7856	0.7766	0.7783	0.7871
Consumption / GDP	0.5703	0.6086	0.5773	0.5830	0.6139

See notes to Table 1. RP1 to RP4 refer to the reform packages proposed above.

Figure 1. Comparison of the volatility of wage income shares in household income and in GDP

Denmark's share of wage income

in HGI — in GDP

SD = [3.00 1.13]

UK's share of wage income

in HGI — in GDP

SD = [1.83 1.09]

Germany's share of wage income

in HGI — in GDP

SD = [1.08 0.866]

Sweden's share of wage income

in HGI — in GDP

SD = [2.40 1.11]

HGI is the household gross income and SD is the standard deviation of the series. The series in the graphs are the annual changes in the respective shares.

Figure 2. Effects of stochastic negative shocks to foreign demand and trade

Shock to F^* Shock to ϕ
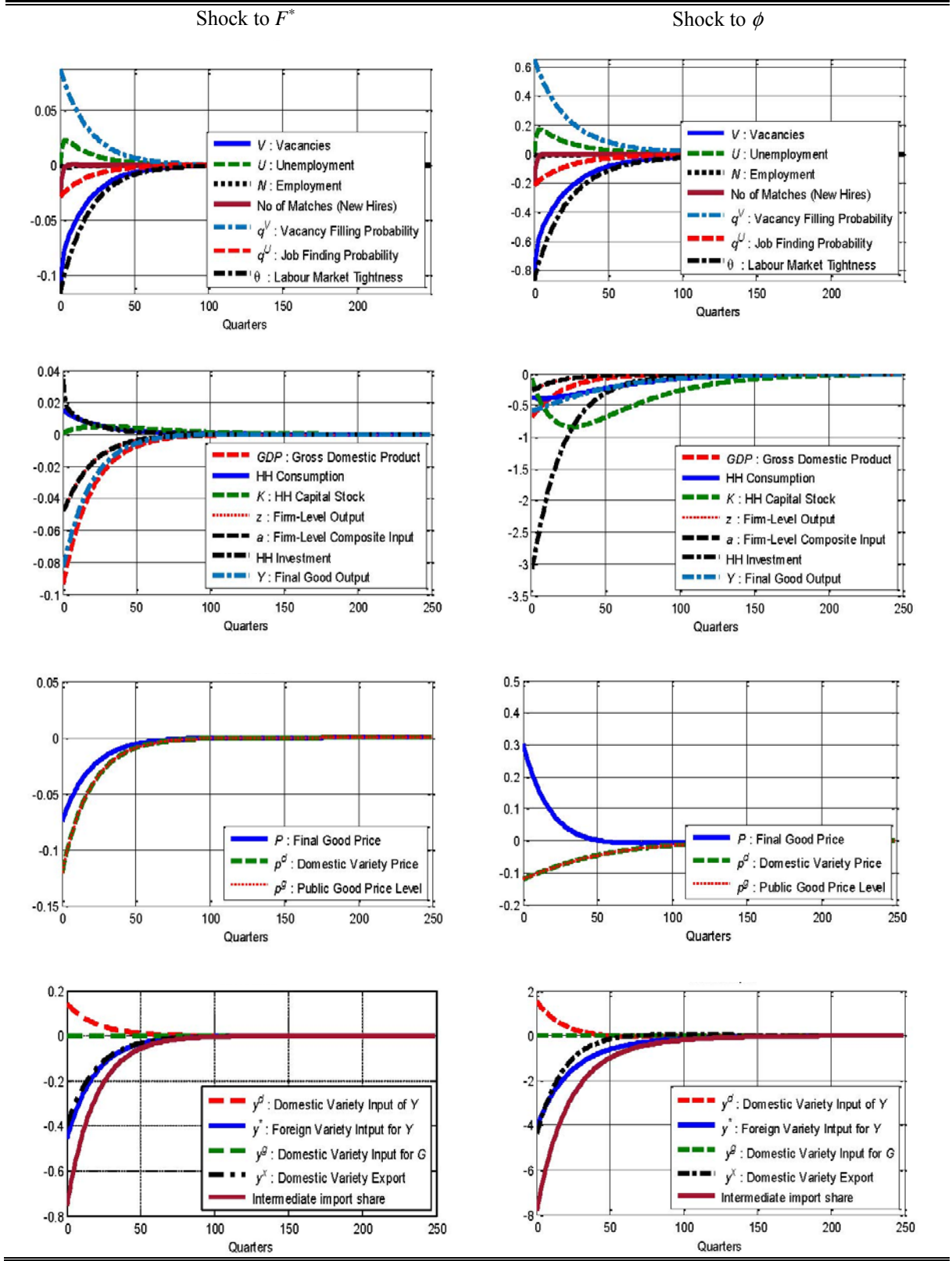
Figure 3. Redistributive effects of stochastic negative foreign demand and trade shocks

Shock to F^* Shock to ϕ
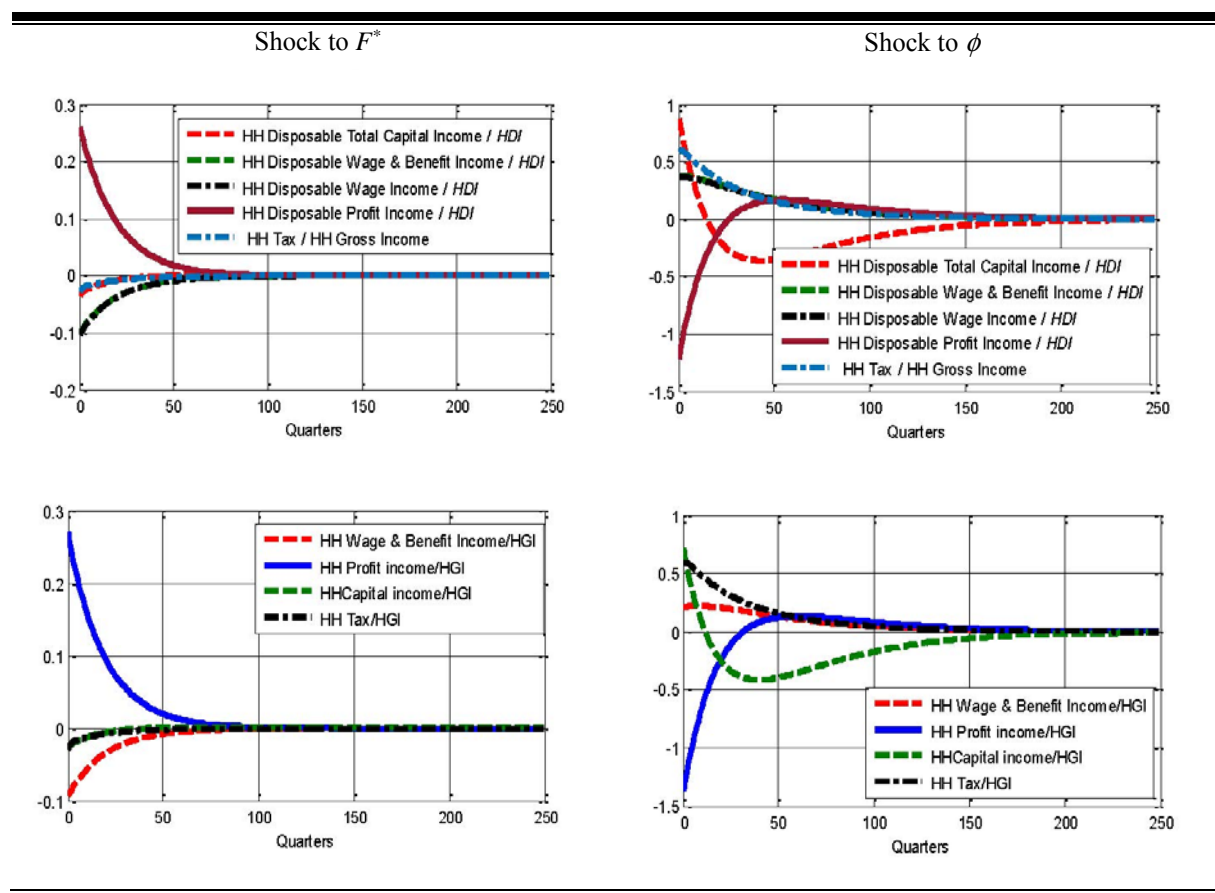
Figure 4. Effects of negative foreign demand and trade shocks before and after reforms

Shock to F^* Shock to ϕ

—— Benchmark; - - - - RP1; – – RP2; – · – RP3; – · – RP4
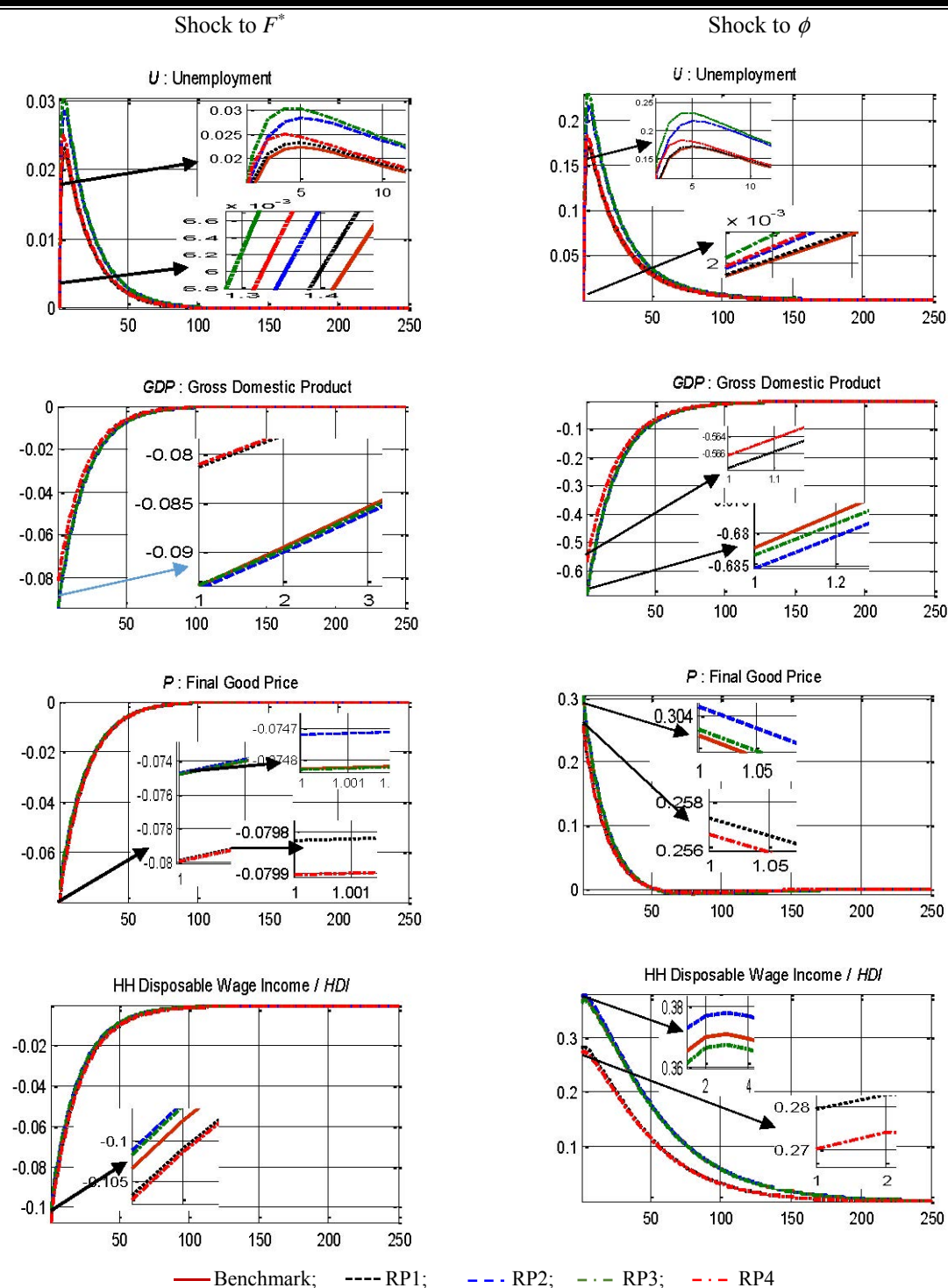
Figure 5. Comparison of Unemployment and GDP Time Series in Denmark and the UK

Monthly Harmonised Unemployment Rate

Quarterly Real Per Capita GDP (logs)

Monthly Harmonised Unemployment Rate (monthly change)

SD=[0.186   0.121]

Quarterly Real Per Capita GDP (quarterly log changes)

SD=[0.0088   0.0065]

Monthly Harmonised Unemployment Rate (annual changes)

SD=[1.06   0.94]

Quarterly in Real Per Capita GDP (annual log changes)

SD=[0.0223   0.0215]

SD is the standard deviation of the series

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