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

Hassan Molana
University of Dundee

Catia Montagna
University of Aberdeen

George E. Onwordi
University of Aberdeen

April 2017

Abstract: We examine how labour market and welfare state reforms affect long-run unemployment and the dynamic behaviour of an economy characterised by a *liberal* welfare state system in response to international shocks. The shares of different income sources in household income shed 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 and steady-state unemployment, *flexicurity* reforms appear to lead to a higher volatility in unemployment and GDP in response to exogenous foreign shocks; training expenditure, by improving firms' productivity, can however reduce these effects.

1. INTRODUCTION

We examine how labour market and welfare state reforms in the direction of *flexicurity* affect long-run unemployment and the dynamic response to international shocks of an economy characterised by a *liberal* welfare state regime. An analysis of the behaviour of shares of different household income sources sheds light on the distributional impact of policy reforms and shocks.

Interest in the functioning of the labour market as a central determinant of unemployment and concerns about the falling shares of labour income vis-à-vis capital and profits have been heightened by, but well precede, the Great Recession. On the one hand, labour market deregulation and welfare state retrenchments have been advocated as means to support employment[1] and firms' competitiveness against the challenges posed by globalisation. On the other hand, a growing sense of insecurity is reflected in greater demand for stronger social safety nets. The notion of *flexicurity* has been widely embraced as a guideline for welfare state reforms[2] capable of addressing both of these 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 enhance employability can be combined with reductions of labour market rigidities, thus allowing firms to respond flexibly to changes in competitive conditions.

In this paper we argue that an assessment of the effects of labour market reforms on labour market outcomes and their role in offsetting the effects of shocks requires capturing (at least some of) the complex interaction between a multiplicity of policy instruments as well as key general equilibrium effects.[3] To this end, we allow for a rich menu of both ALMPs and passive labour market policies (PLMPs) within a dynamic stochastic general equilibrium model of a small open economy characterised by good and labour market imperfections and vertical linkages in production. The basic structure of the labour market follows Mortensen and Pissarides (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 a public employment agency that acts as an intermediary between workers and firms. In addition, since training policies are typically implemented as productivity-enhancing treatments (Crépon *et al*., 2016), we assume that training expenditure is not a mere cost (as is typical in the literature, e.g. Stähler and Thomas, 2012), but also a means to increase the productivity of training. Whilst assuming direct matching between workers and firms would not alter the results, our setup allows for a sharper distinction between ALMPs aimed at improving a worker's matching probability (e.g. via higher vacancy creation) and those aimed at improving her employability.[4]

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[1] 'Rigid' labour markets have been held responsible for the weaker employment performance of Europe relative to the US. See, e.g., Blanchard and Wolfers (2000) and Nickell, *et al*. (2005).

[2] These policies are central to the "European Employment Strategy" and are a cornerstone of the Social Investment model of the welfare state (European Commission, 2013).

[3] Crépon *et al*. (2016) argue that policy evaluations of individual instruments often suggest limited effectiveness because of their failure to capture equilibrium and feedback effects.

[4] Employment agencies are often privately owned, but in Europe there is a much stronger public presence, with governments either offering services directly or through public tenders. A recent European Labour Force Survey (http://ec.europa.eu/eurostat/web/lfs/_data/database) shows great inter-country variability in the percentage of unemployed contacting private and public employment agencies: e.g. 4% and 44%, respectively, in Denmark and 25% and 53% in the UK, with an EU average of 22% and 53.2%. Evaluations of private versus public services

Starting from a *liberal* welfare system (such as the UK's) with high flexibility and low unemployment insurance, we examine a range of reforms in the direction of a *flexicurity* system characterised by relatively high (but lower) flexibility, high unemployment insurance and ALMPs. We begin by assessing the role of policy reforms in reshaping the long-run equilibrium of the economy. We then investigate the extent to which these reforms alter the dynamic response of the economy to international (trade and external demand) shocks.

Our results suggest that reform packages exist that can improve upon the labour market outcomes of a *liberal* welfare state system. When accompanied by ALMPs that foster employability and job creation, more generous PLMPs that offer higher protection to the unemployed can reduce unemployment and increase the level of economic activity. Interestingly, when leading to an increase in productivity, reforms shift 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 differ pre- and post-reform. Even when they reduce labour market flexibility relative to a *liberal* welfare state and result in lower steady-state unemployment levels, reforms in the direction of *flexicurity* appear to increase volatility in employment and GDP in response to exogenous shocks. An important result is that higher levels of training expenditure, by enhancing firms' productivity, can reduce the adverse effects on GDP of negative shocks as well as dampen the amplification and persistence of these shocks on unemployment.

A strand of the literature to which our paper is related focuses on the effects of labour market reforms on labour market outcomes. Blanchard and Giavazzi (2003) examine the long-run implications of product and labour market reforms. 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 frictions; 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 and Keuschnig (2015) consider the effects of *flexicurity* policies on job reallocation from declining to expanding sectors. Within a similar framework, Davoine (2015) shows that education can act as a self-insurance device. Dabusinskas, *et al*. (2016) examine how differences in labour market institutions affect the dynamic adjustment of labour markets. These contributions typically do not consider the interaction between labour markets and international openness. In an asymmetric two country model, Felbermayr *et al*. (2013) show that labour market rigidities that increase unemployment in one country also do so in its trading partner, but do not examine the dynamic adjustments to shocks and their policy menu is more limited than in this paper.

Another strand of the literature examines the business cycle implications of economic integration. Cacciatore *et al*. (2016a) study how the business cycle affects the dynamic impact of labour and product market reforms. 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

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suggest the latter to be much more effective in improving employment outcomes (e.g, Behaghel *et al*., 2014 and Winterhager, 2006).

market entry restrictions) for non-traded services and professions, they assume that the monopolistic good is non-traded.[5] Within a similar framework, Cacciatore (2014) considers the effects of trade liberalisation with intercountry differences in labour market frictions. Although these papers analyse some policy combinations, they restrict 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, with particular focus on the way they affect different income groups. Our analysis sheds lights on the distributional impact of shocks and policy reforms, by tracing changes in shares of household income from different sources.[6] A burgeoning literature highlights the role of technology in explaining the long-run (secular) trends in inequality (e.g. Karabarbounis and Neiman, 2014a,b; Piketty and Zucman, 2014; Summers, 2014; Rognlie, 2014) but devotes little attention to effects of international shocks and policy reforms on the shares of income types in household income.[7]

The rest of the paper is organised as follows. Section 2 outlines the model. Section 3 carries out the analysis of policy reforms and of the dynamic effects of exogenous shocks in the different policy regimes. Section 4 concludes the paper.

2. THE MODEL

The economy consists of two vertically integrated sectors: a non-traded final good is produced competitively by aggregating imported and domestically produced varieties of an intermediate input. The latter is produced by monopolistically competitive firms using capital and labour, assumed to be internationally mobile and immobile, respectively. The economy is '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. The final good is used for public and private consumption as well as investment.

2.1. Households

The representative household owns the intermediate sector firms, supplies them with capital and labour, and uses capital accumulation to build its wealth. At any time *t*, a continuum of household members, whose measure is normalised to unity, are either employed or unemployed. Those in employment, denoted by $N_t \in [0,1]$, are trained by a hiring agency and negotiate with it hours of work and the hourly wage, denoted by h_t^n and w_t^n, respectively. The unemployed $(1-N_t)$ receive an unemployment benefit b_t from the government and search for

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[5] The tradability of the intermediate goods in a similar framework is assumed instead in Cacciatore *et al*. (2016b) who focus on the implications of market deregulation for monetary policy in a Monetary Union.

[6] A different strand of the literature considers the effects of trade on intra and inter-firm wage distribution, e.g. Egger and Kreikemeir (2012); Montagna and Nocco (2013); Helpman *et al*. (2016). In a model with *directed* job search and firm heterogeneity, Felbermayr *et al*. (2016) study the impact of policy reforms on 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. Empirically, De Agostini *et al*. (2016), Biewen and Juhasz (2012) and Bargain *et al*. (2016) study the effects of welfare state policies on income distribution.

[7] Guvenen *et al*. (2014) study the effects of business cycle on individual earnings.

jobs available in the form of vacancies posted by the agency.[8] We assume that members of the household completely insure each other against any income uncertainties by sharing all income.[9]

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

$$C_{t+s} + I_{t+s} + T_{t+s} = N_{t+s} w^n_{t+s} h^n_{t+s} + (1 - N_{t+s}) b_{t+s}$$
$$+ \Pi_{t+s} + r_{t+s} \int_{i \in M} k_{it+s} di + r^*_{t+s} \left(K_{t+s} - \int_{i \in M} k_{it+s} di \right), \tag{1}$$

where C, I, K, Π and T are measured in terms of the final good and respectively represent the real values of consumption, investment, capital stock, profit income and a lump sum tax paid to the government. r is the domestic rate of return on capital while r^* denotes its foreign equivalent. Thus, the household receives capital income $r_{t+s} \int_{i \in M} k_{it+s} di$, where M and k_i are the mass of firms (indexed by i) and firm i's capital requirement, respectively. The budget constraint above also reflects the economy's international borrowing/lending of capital with an inflow (outflow) of capital corresponding to $K_{t+s} - \int_{i \in M} k_{it+s} di > 0 (< 0)$. We further assume that the interest rate differential is determined by the extent of capital mobility and invoke

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

where $\kappa \geq 0$ is an exogenously fixed inverse measure of capital mobility: 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; $\kappa \to \infty$ implies no mobility and $\int_{i \in M} k_i di = K$ ought to hold for any r and r^*. The stock of capital depreciates 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, assumed to be infinitely-lived, maximises the expected present value of lifetime utility

$$E_t \sum_{s=0}^{\infty} \beta^s \left(\frac{(C_{t+s})^{1-\alpha_c}}{1-\alpha_c} - \frac{\xi N_{t+s} \left(h^n_{t+s} \right)^{1+\alpha_h}}{1+\alpha_h} \right); \; \alpha_h > 0, \; 0 < \alpha_c \leq 1, \tag{4}$$

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[8] No conditionality is assumed on the receipt of unemployment benefits as in, e.g., Andersen and Svarer (2014) who address the moral hazard problem associated with unemployment insurance and show that it can be mitigated by imposing workfare requirements on the eligibility for unemployment support.

[9] See, e.g., Andolfatto (1996).

where E_t is the expectations operator conditional on the information available at time t, $\beta \in (0,1)$ is the subjective time preference discount factor, and ξ captures the relative weight of disutility of work. 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 $\left\{w_{t+s}^n, h_{t+s}^n, N_{t+s}, k_{it+s}, \Pi_{t+s}, r_{t+s}, r_{t+s}^*, T_{t+s}, b_{t+s}\right\}_{s=0}^{\infty}$ as given. Denoting the Lagrange multiplier associated with the optimisation by Λ_{t+s}, the first order conditions can be shown to satisfy

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

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

For later use, we define

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

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

2.2. The final good sector

The homogenous final good is produced by a competitive sector according to a CES technology that aggregates domestically produced and imported varieties of a differentiated product:

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

where Y is the quantity of the final good, y_i^d and y_i^* are the quantities of the domestically produced and imported varieties of the differentiated product, M and M^* denote the respective mass of available varieties, and $\sigma > 1$ is the elasticity of substitution between any two varieties. The 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 the final good and of the domestic and foreign intermediates, respectively, 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), the intermediate demand functions by the final good sector are

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

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

Invoking the zero profit condition implied by the perfect competition assumption and using (9), (10) and (11), we obtain the price index dual to (8)

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

2.3. The intermediate sector

The intermediate sector is monopolistically competitive and each firm $i \in M$ produces a single variety of the good facing the domestic demand in (10) and the foreign demand

$$y_{it}^x = \frac{F_t^*}{M}\left(\phi_t p_{it}^d\right)^{-\sigma}, \tag{13}$$

where F^* is an exogenous scale factor measuring real foreign expenditure on this good and σ and ϕ are the same as for the domestic sector. The total demand facing the firm at period t is

$$z_{it} = y_{it}^g + y_{it}^d + \phi_t y_{it}^x, \tag{14}$$

where y_{it}^g is the government's demand which is explained later.

Each variety is produced using a composite input (a) comprising capital (k) and 'effective' labour man-hours (l). Using a Cobb-Douglas technology, we define the input basket of the representative firms by

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

and assume an input requirement of

$$z_{it} = \rho a_{it}, \tag{16}$$

where $\rho > 0$ is the total factor productivity parameter, common to all firms. Total cost is

$$p_t^a a_{it} = w_t l_{it} + r_t k_{it}, \tag{17}$$

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[10] Thus, for a firm to use one unit of the foreign good, $\phi \ge 1$ units need to be shipped.

where p^a denotes the unit input cost and w is the hourly wage paid by the firm. Given (15) and (17), cost minimisation implies

$$p_t^a = w_t^\gamma r_t^{1-\gamma}.$$ (18)

The input demands of firm i, obtained by applying Shephard's lemma to (17), 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 is

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

Maximisation of (21) subject to (10), (13) and (14) yields the price mark-up equation

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

2.4. The labour market

In the labour market, a public employment agency acts as an intermediary between labour demand and supply by creating and filling job vacancies and training the workers. We assume that job losses occur at an exogenous constant rate η,[11] and that the number of job seekers in each period is given only by those who began the period without a job $(1-N_t)$. Denoting the number of vacancies by V_t, the aggregate matching function is $\mathfrak{M}_t = \chi(1-N_t)^\mu V_t^{1-\mu}$, where $\chi>0$ and $\mu \in (0,1)$. Assuming that those newly-hired in a period start working at the beginning of the following period, the number of employed workers evolves according to $N_t = (1-\eta)N_{t-1} + \mathfrak{M}_{t-1}$.[12]

Each period the agency trains all the workers it has hired by converting h_t^n man-hours supplied by a worker into h_t *effective* man-hours which are offered to the intermediate firms at the hourly rate w_t. Training occurs according to the concave technology

$$h_t = \frac{e_t}{\varepsilon}\left(h_t^n\right)^\varepsilon, \ 0<\varepsilon<1,$$ (23)

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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 (e.g., Blanchard and Gali, 2010) in assuming that job separations are exogenous.

[12] An alternative is to distinguish between the *unemployed* and the *effective job seekers* defining them by $u_t = 1 - N_t$ and $U_t = 1 - (1-\eta)N_{t-1}$, respectively, and assume that new hires start working in the period they are matched, so that $u_t = U_t - \mathfrak{M}_t$ (e.g., Blanchard and Gali, 2010).

where $e_t > 0$ is a measure of the productivity of training.[13] Conventionally, training expenditure is modelled merely as a cost (e.g. Pissarides, 2009; Stähler and Thomas, 2012). We however allow such expenditure to be also productivity-enhancing on the grounds that it is typically aimed at increasing (and hence may have an effect on) the human capital and employability of the workforce.[14] In particular, we assume that the productivity coefficient e_t depends positively on the per-capita expenditure on training (measured in units of the final good), x_t^T, according to

$$e_t = \overline{e} + \left(\varepsilon - \overline{e}\right)\left(1 - \exp\left(-\tau\left(\frac{x_t^T}{\overline{x}^T} - 1\right)\right)\right),$$ (24)

where $\overline{x}^T$ and $\overline{e}$ are base values of x_t^T and e_t respectively and $\tau \in (0,1)$ ensures decreasing returns to training expenditure. Thus, $e_t = \overline{e}$ if either $\overline{e} = \varepsilon$ or $x_t^T = \overline{x}^T$, and $x_t^T > \overline{x}^T \Leftrightarrow e_t > \overline{e}$ as long as $\overline{e} < \varepsilon$, and hence x^T can be thought of as an active labour market policy instrument that influences workers' employability.

The value of a job to the agency (Ω_t^J) is given by its current net revenue and the discounted future value of the job if it survives separation:

$$\Omega_t^J = w_t h_t - w_t^n h_t^n - x_t^T - \eta f_t + \left(1 - \eta\right) E_t \varsigma_{t+1} \Omega_{t+1}^J,$$ (25)

where f is a government imposed firing cost per job loss, which occurs at the rate η. The value of an open vacancy to the agency (Ω_t^V) is given by its discounted future value less its current cost, where the latter is equivalent to the expected gain arising from future matches,

$$\Omega_t^V = E_t\left[\varsigma_{t+1}\left(q_t^V \Omega_{t+1}^J + \left(1 - q_t^V\right)\Omega_{t+1}^V\right)\right] - x_t^V,$$ (26)

x_t^V is the per unit cost of creating and posting a vacancy (measured in terms of the final good) and q_t^V is the vacancy filling rate.

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

$$x_t^V = q_t^V E_t \varsigma_{t+1} \Omega_{t+1}^J,$$ (27)

which equates the current actual cost of creating a vacancy to the expected value of the corresponding hired worker's contribution. Equations (25) and (27) then imply

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[13] This is in line with Christoffel and Kuester (2008) and de Walque *et al.* (2009). The function in (23) ought to be sufficiently concave to generate $h_t < h_t^n$ at very low values of h.

[14] The meta-analysis by Card *et al* (2015) suggests that the direct treatment effects of ALMPs vary depending on time horizon, type of programme, and participant groups. Overall, training programmes appear to work better for the long term unemployed. Aggregate cross-country evidence (e.g. OECD, 2004) points to a positive correlation between training and the probability of finding employment.

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

and the condition governing vacancy posting activity is given by

$$\frac{x_t^V}{q_t^V} = E_t \left[\varsigma_{t+1} \left(w_{t+1} h_{t+1} - w_{t+1}^n h_{t+1}^n - x_{t+1}^T - \eta f_{t+1} \right) \right] + (1-\eta) E_t \left[\frac{\varsigma_{t+1} x_{t+1}^V}{q_{t+1}^V} \right]. \tag{28}$$

The first term on the right-hand-side is the expected net return and the second term reflects the expectations of corresponding future activity.

A worker's net pay-off from employment is given by

$$\Omega_t^W = w_t^n h_t^n - \left(b_t + \frac{\xi \left(h_t^n \right)^{1+\alpha_h}}{(1+\alpha_h) \Lambda_t} \right) + \left(1 - q_t^U \right) (1-\eta) E_t \left[\varsigma_{t+1} \Omega_{t+1}^W \right]. \tag{29}$$

where q_t^U is the job-finding rate. The terms on the right-hand-side are, respectively, wage income, the value of the reservation wage, and the continuation value of employment if the match lasts.

We assume that w_t^n and h_t^n are determined by efficient Nash bargaining between the household members and the hiring agency. Specifically, maximisation of $\left(\Omega_t^W \right)^\omega \left(\Omega_t^J - \Omega_t^V \right)^{1-\omega}$, where $\omega \in [0,1]$ denotes a worker's relative bargaining power, subject to (25) to (29), yields the match surplus sharing rule,

$$(1-\omega) \Omega_t^W = \omega \Omega_t^J, \tag{30}$$

resulting in the following wage bill of the agency (or wage income of the worker):

$$w_t^n h_t^n = \omega \left(w_t h_t - x_t^T - \eta f_t \right) + \omega (1-\eta) x_t^V \theta_t + (1-\omega) \left(b_t + \frac{e_t w_t \left(h_t^n \right)^\varepsilon}{1+\alpha_h} \right), \tag{31}$$

where $\theta_t = V_t / (1-N_t)$ measures the 'degree of market tightness'. *Ceteris paribus,* the total rent from employment extracted by the household is higher the larger is the profit of the employment agency, the tighter is the labour market, and the higher is the workers' outside option. It can be easily verified that the bargained real wage bill can be expressed as $w_t^n h_t^n = \omega \overline{w}_{B,t} + (1-\omega) \underline{w}_{B,t}$, where $\overline{w}_{B,t}$ and $\underline{w}_{B,t}$ denote respectively the *maximum* wage bill the agency is willing to pay an employee (satisfying $\Omega_t^J = 0$) and the *minimum* wage bill an employee is willing to accept to form a job match (satisfying $\Omega_t^W = 0$).[15]

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[15] The *bargaining set* is $S_t = \overline{w}_{B,t} - \underline{w}_{B,t}$. Equation (30) then implies $\Omega_t^J = (1-\omega) S_t$ and $\Omega_t^W = \omega S_t$.

Finally, the bargained hours equalise a worker's marginal rate of substitution between leisure and consumption and the value of her marginal product to the hiring agency, hence satisfying $\dfrac{\xi\left(h_t^n\right)^{\alpha_h}}{\Lambda_t} = e_t w_t \left(h_t^n\right)^{\varepsilon-1}$.

2.5. The government

The government maintains a balanced budget in each period which finances its expenditure on public consumption (G) and its unemployment benefit bill via lump-sum taxation and the hiring agency's net revenue:[16]

$$\left(1-N_t\right)b_t + \frac{p_t^g G_t}{P_t} = T_t + N_t\left(w_t h_t - w_t^n h_t^n - x_t^T\right) - x_t^V V_t,\tag{32}$$

where p_t^g is the public good price index, G is a CES basket of domestically produced the intermediates

$$G_t = \left(M^{-\frac{1}{\sigma}}\int_{i\in M}\left(y_{it}^g\right)^{1-1/\sigma}di\right)^{\frac{1}{1-1/\sigma}},\tag{33}$$

and

$$y_{it}^g = \frac{G_t}{M}\left(\frac{p_{it}^d}{p_t^g}\right)^{-\sigma},\quad i\in M,\tag{34}$$

is its demand for a typical variety, which satisfies $\int_{i\in M} p_{it}^d y_{it}^g di = p_t^g G_t$ and implies

$$p_t^g = \left(\frac{1}{M}\int_{i\in M}\left(p_{it}^d\right)^{1-\sigma}di\right)^{\frac{1}{1-\sigma}}.\tag{35}$$

2.6. General equilibrium

The labour market clearing condition is

$$N_t h_t = \int_{i\in M} l_{it}di,\tag{36}$$

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[16] Given that the hiring agency is publicly owned, its contemporaneous net revenue accrues to the government and this ensures that the good market clearing condition holds. The fact that this source of income contributes to the financing of other labour market policies (e.g. unemployment benefits) and transfers is broadly consistent with Blanchard and Tirole's (2008) argument that unemployment benefits ought to be funded via firing taxes rather than other taxes. Note that were the agency's contemporaneous net revenue zero, the fact that in the steady-state successful matches should be equal to job losses so as to sustain a constant unemployment rate would imply a negative expected net revenue for the agency in the steady-state, which would eliminate any incentive for such an agency to exist, therefore justifying agency's positive contemporaneous net revenue.

and the balance of payments condition requires the trade balance to be offset by the interest payments on net capital flows,

$$\int_{i \in M} \frac{\phi_t p_{it}^d y_{it}^x}{P_t} di - \int_{i \in M^*} \frac{\phi_t p_{it}^* y_{it}^*}{P_t} di = r_t^* \left(\int_{i \in M} k_{it} di - K_t \right). \qquad (37)$$

The national income identity requires

$$GDP_t = C_t + I_t + x_t^T N_t + x_t^V V_t + \frac{p_t^g G_t}{P_t} + r_t^* \left(\int_{i \in M} k_{it} di - K_t \right), \qquad (38)$$

where

$$GDP_t = \int_{i \in M} \left(w_t l_{it} + r_t k_{it} + \pi_{it} \right) di. \qquad (39)$$

Finally, given that all firms in the intermediate sector face similar cost and demand functions, in equilibrium they will be identical. Therefore, for any firm-level variable x_{it} we shall drop the subscript i and use the aggregation $Mx_t \equiv \int_{i \in M} x_{it} di$.

3. POLICY ANALYSIS

In this section we examine the effects of different permanent reforms and transitory shocks on labour market outcomes and on the shares of different income sources in household income.[17]

In our model, the labour share in household gross income (*HGI*) can be written as $\frac{Nw^n h^n}{HGI} = \frac{Nwh}{GDP} \frac{Nw^n h^n}{Nwh} \frac{GDP}{HGI}$. The labour income share of GDP, $Nwh / GDP = \gamma(1-\sigma)/\sigma$, is constant given the assumed technology; however, the other two ratios on the right-hand-side vary due to labour market imperfections (that result in a wedge between the gross wage income received by the worker and the gross wage paid by the firm) and net exports and transfers (that generate a wedge between household gross income and GDP. Similarly, whilst the capital income and profit shares of GDP are also constant, they vary depending on the wedge between *GDP* and household income. Figure 1 illustrates, for a selection of countries for the period 1991-2014, that the volatility of wage income as a share of household income is indeed higher than as a share of *GDP*. Since they reflect the role of transfers and taxation, household incomes are also arguably a better reflection of living standards than factor income shares (e.g., Atkinson, 2013).

Figure 1 around here

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[17] Whilst a representative agent framework is not the best vehicle to analyse issues of income distribution, models with consumer heterogeneity have been shown to give near equivalence inequality results with representative agent real business cycle models (Krusell and Smith, 1998).

3.1. Welfare state reforms

At the core of *flexicurity* is the combination of relatively low degrees of employment protection with generous unemployment support accompanied by the adoption of ALMPs aimed at increasing employability and improving the quality of matching in the labour market.

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 consider the effects of permanent reforms towards a *flexicurity* system with relatively high flexibility and unemployment insurance, and an emphasis on ALMPs. We define a reform as a permanent change in a set of exogenous variables of the benchmark (i.e. pre-reform) calibration of the model. The new steady-state solutions then represent the post-reform economy.

Taking the UK as an example of a *liberal* welfare system, we calibrate the steady-state 'pre-reform' benchmark version of the model using UK data. For the freely determined parameters, we use values that are commonly used in similar studies (see the Appendix for details). We assume $r = r^*$ to hold in the steady-state: there is no capital flows and the trade balance is satisfied. Using Denmark as an example of a *flexicurity* system, the relevant parameters in the benchmark model are changed in the direction of and by a proportion consistent with taking the UK values closer to the corresponding Danish ones. Therefore, we are not contrasting different welfare state regimes across countries (which would require different initial calibrations) but examining how reforms in a given economy affect its performance.

Interestingly, relative to the UK, the Danish *flexicurity* system is characterised by higher security (higher unemployment benefit rates) and greater rigidity (reflected in a higher firing cost), alongside a lower vacancy creation cost and higher training expenditure. Thus, we shall consider the following changes to the four policy ingredients that in our model capture the key pillars of *flexicurity*:

(a) An increase in unemployment benefit rate (b);

(b) An increase in per-capita training expenditure (x^T);

(c) An increase in firing cost (f) ;

(d) A reduction in unit vacancy creation cost (x^V).

These policies are then combined to obtain the following four 'reform packages' (denoted by RP1 to RP4):

RP1: comprising $(a) \& (b)$

RP2: comprising $(a) \& (c)$

RP3: comprising $(a), (c) \& (d)$

RP4: comprising $(a), (b), (c) \& (d)$

RP4 corresponds to a 'full' move towards the Danish system. However, from a positive as well as normative perspective, it proves informative to consider the other intermediate reform packages, particularly since considerable heterogeneity persists within Europe in the emphases placed on different individual welfare state elements.

Table 1 shows how the benchmark values of selected variables are affected when the policies outlined in (a) to (d) above are implemented in isolation.

Table 1 around here

Comparing the columns labelled 'Benchmark' and (a) in Table 1 reveals that an increase in b reduces vacancies and the number of labour market matches, and results in higher unemployment and lower *GDP*. By increasing a worker's outside option, the policy raises the acceptable *minimum* wage bill required to form a match ($\underline{w}_{B,t}$), resulting in a lower marginal gain from hiring for the employment agency, which reduces the number of vacancies created. The Beveridge curve equilibrium then requires the resulting reduction in labour market tightness to 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 negative interest rate differential and to a reduction in investment and capital stock. The increase in the (relative) price of the typical domestic variety (p^d) result in greater outsourcing (a larger share of imported intermediates) and in a fall in aggregate profits. Despite the higher unemployment, the reform reallocates household gross and disposable income away from capital and profits towards labour income. These results are broadly consistent with the conventional view that PLMPs are ultimately contractionary.

As is evident from column (c), an increase in f mildly raises unemployment.[18] The policy reduces the value of a job to the agency (Ω^J) and the *maximum* wage bill the agency is willing to pay an employee ($\overline{w}_{B,t}$). The job creation condition in (28) then implies a scaling back on vacancy creation, leading to lower market tightness and job finding rates and to a downward movement along the Beveridge curve. By inducing workers to accept lower wages, the policy results in a (mild) redistribution away from labour income.

The impacts of an increase in training expenditure (x^T) and a reduction in vacancy creation cost (x^V), reported in columns (b) and (d) respectively, are quantitatively more substantial. Although both policies result in an upward movement along the Beveridge curve, increasing vacancy creation and reducing unemployment, the effects of an increase in x^T are relatively stronger. A higher x^T has two opposing effects on the job creation condition. First, by increasing the cost of a match, it reduces Ω^J, thus working towards a reduction in vacancies. Second, the productivity-enhancing effect of training increases h/h^n and Ω^J, thus dominating the former effect and resulting in a much greater vacancy creation and lower unemployment. The higher productivity also raises the marginal product of capital and triggers an incipient positive interest rate differential that results in higher investment and capital stock. The substantial increase in price competitiveness reduces outsourcing and leads to a large increase in profits that dominates the increase in wage income, explaining a fall in household's labour income share. For a given degree of market tightness, a reduction in x^V increases vacancy

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[18] Empirical evidence shows that employment protection tends to have small and ambiguous effects on employment (e.g. OECD, 2013).

creation and market tightness (θ). This results in a higher total rent from employment extracted by a worker and explains the redistribution effects of x^V towards wage income.

Having examined the impact of individual policies in isolation, Table 2 reports the effects of the reform packages specified above.

Table 2 around here

RP1 combines an increase in unemployment benefit with an increase in the training expenditure per worker and places emphasis on providing security to the unemployed while increasing employability. This reform results in an upward movement along the Beveridge curve 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*. Thus, when combined with greater investment in workers' productivity, higher unemployment insurance increases firms' productivity, reduces outsourcing, and raises *GDP*. It reduces, however, the wage share of household's disposable income.

RP2 combines an increase in unemployment benefits with an increase in firing costs, and results in a redistribution of income towards wages. However, consistent with the effects of the individual policy instruments, the share of imported varieties increases, as does unemployment, and the resulting contractionary downward move along the Beveridge curve reduces *GDP*.

By augmenting RP2 with a reduction in the vacancy creation costs, RP3 reverses the contractionary outcome of RP2 and leads to a rise in vacancies, lower unemployment and higher *GDP*, while income shares change in favour of wage earners. RP4, which combines all the policies, is the most comprehensive step towards the Danish *flexicurity* system and has the greatest effects in terms of unemployment reduction and economy wide expansion, whilst reducing the wage share in total income.

The above results suggest that reform packages combining PLMPs and ALMPs exist that can improve upon the labour market outcomes of a *liberal* welfare state system. In particular, when accompanied by ALMPs that foster employability and job creation, more generous support for the unemployed can, in fact, reduce unemployment and increase the level of economic activity. Clearly, given that the changes to individual instruments can have opposing effects on labour market outcomes, the choice of their relative magnitude in the design the reform package matters. These reforms also tend to reduce the share of wage and raise that of capital and profits in household income; although this could be seen as counterintuitive at first glance, it is explained by the higher productivity and lower outsourcing that ensue the reforms.

3.2. Impact of international shocks

We now compare the impact of international shocks to the foreign demand scale factor (F^*) and to the trade cost (ϕ) on the economy before and after the implementation of the different reform packages discussed above, thus shedding light on how reforms alter the short-run behaviour of the economy. To this end, the log-linearised version of the model is augmented with a stochastic AR(1) process which is assumed to generate the path of the exogenous

variable that is subjected to the shock, and the corresponding impulse responses are used to examine the adjustment of the economy in the short-run.

3.2.1. Shock propagation in the benchmark model

The first and second columns of Figure 2 display, respectively, the impulse responses of key endogenous variables to exogenous negative once-and-for-all shocks to foreign demand (i.e. a fall in F^*) and to trade (i.e. an increase ϕ).[19]

Both shocks have the same qualitative effects on labour market outcomes: the number of vacancies, labour market tightness and the job finding probability fall, thus leading to a rise in unemployment. Also, in both cases, consumption, investment, final good output and *GDP* all fall. Due to the fact that they affect the economy through different channels, the two shocks, however, have different quantitative effects, with the shock to ϕ having a much greater impact than the shock to F^*. Whilst a fall in F^* directly reduces demand for the exported varieties, an increase in ϕ directly raises the prices at the point of delivery of both exported and imported varieties and thus leads to a fall in the demand for both exports (y^x) and imports (y^*). As a result, the two shocks have a different impact on the price index *P*. Specifically, in both cases, the fall in y^x reduces firm output and profit and leads to a reduction in vacancy creation and firm-level wage. The latter works towards a lower price for domestic intermediates and a lower price level. A negative trade shock, however, increases the cost of imported varieties and puts an upward pressure on *P*, an effect compounded by the lower competitive pressure on domestic producers who push up variety prices. Hence, whilst *P* falls after a negative foreign demand shock, it increases following a trade shock, with a negative pecuniary externality on the downstream final good sector which experiences a larger drop in productivity. Thus, although it induces a larger increase in the demand facing domestic upstream producers by triggering a substitution away from foreign and towards domestic varieties of the intermediate goods, a trade shock leads to larger growth in unemployment and output contractions.

Figure 2 around here

Both shocks also reduce household disposable income (*HDI*): the higher unemployment benefit income due to rising unemployment, is not sufficient to offset the effect on *HDI* of lower wage, capital and profit income.[20]

These results are broadly consistent with the UK performance during the great recession. Joyce and Sibieta (2013) report a drop in labour income between 2008 and 2009 driven mostly by a lower employment rate and a decline in hours worked. During the same period, there was also a decrease in both the income distributed from firms (e.g. dividends) and the net operating surplus received by households, with only a minimal recovery recorded in 2010 in both cases.[21]

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

[20] Joyce and Sibieta (2013) find that social welfare expenditures contributed positively to the UK's HDI between 2008 and 2009. However, this expenditure includes other forms of welfare spending such as child benefits which we do not consider here. Jenkins *et al.* (2013) show that net of these categories of expenditures, HDI fell in the UK between 2007 and 2009, driven mostly by the fall in wage income and operating surplus.

[21] Source: http://ec.europa.eu/eurostat/web/sector-accounts/data/database.

Household investment and the interest rate also declined between 2008 and 2010 (Jenkins *et al.*, 2013). Consistent with this, we find both negative shocks to generate a trade deficit and a capital outflow resulting in a fall in *r*.

The two shocks also have non-neutral effects on incomes shares, as shown in Figure 3. In both cases, on impact, income is redistributed towards primary factors of production and away from profits. This is because while both wage and capital income fall in response to the shocks, *HDI* falls by more due to the larger drop in profit income. As with the labour market implications of the shock, the redistributive effects of an increase in ϕ are considerably larger than those of a fall in F^*: by increasing *P,* the negative trade shock has a larger 'depressive' effect on the downstream sector's productivity and employment which results in a larger fall in *HDI*, consumption and investment while also stimulating a relatively larger fall in the domestic return to capital that results in a larger capital outflow.

Thus, depending on their source, negative international shocks will have different quantitative short-run consequences for labour market outcomes and household income shares. Specifically, we find that because 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 negative demand shock. Our findings are broadly supported by Chowla, *et al*. (2014) who find that shocks to export prices (not including oil prices) had a more significant impact on the UK economy than foreign demand shocks.

Figure 3 around here

3.2.2. Welfare state reforms and shock propagation

To examine how labour market and welfare state reforms affect shock propagation, we compare the impacts of the negative shocks pre- and post-reform. The impulse response functions for key variables are displayed in Figure 4.

Figure 4 around here

The post-reform effects of the shocks are qualitatively similar to those observed in the benchmark case. However, inspection of the impulse responses reveals that the post-reform economy tends to be more volatile in response to shocks, even when a reform package has reduced steady-state unemployment. Both the speed of the initial response of unemployment and its peak effects are more enhanced in the post-reform relative to the pre-reform regimes, with the highest effects occurring in post-RP2 and post-RP3, and the lowest in post-RP1.

These results may appear counterintuitive considering that RP1 is the only reform combination that does not include an increase in firing cost, *f.* However, with reforms that increase unemployment benefits, workers appropriate a larger share of the match surplus which reduces the value of a job and vacancy creation. Thus, a shock which further reduces the returns to a job match will result in a higher unemployment response (consistent with the findings of Hagedorn and Manovskii, 2008, and Shimer, 2005). The largest adverse effects in terms of unemployment adjustments following a shock occur in post-RP3 and RP2. This is because not only are both associated with higher unemployment benefits, but they also involve higher firing

costs, which further shrinks the initial value of a match. In post-RP1 (the regime with the lowest unemployment response) the negative effect of the higher unemployment benefit is moderated by the higher per-capita training expenditure which raises the efficiency of training and match productivity. The effect of a higher per-capita training expenditure on match productivity also plays a key role in attenuating the amplification of unemployment under post-RP4. In fact, not only does a higher training expenditure offset the negative effects of a higher unemployment benefit and stricter firing rules, but it also tends to reduce the persistence of shocks on unemployment. Additionally, our simulations reveal that reforms characterised by higher training costs, by increasing workers' productivity, help mitigate high output collapses in the event of negative international shocks, as evident by the response of *GPD* whose largest drop also occurs under post-RP2 and RP3.

Reforms also significantly alter the redistributive effects of shocks and an overarching finding of the paper is that reforms which redistribute income away from labour in the long-run tend to weaken the effect of the shock on the wage share of household income.

In sum, 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 in the long-run. Somewhat counterintuitively, these reforms (especially when not characterised by investment in individual workers' skills) appear to result in a higher economic volatility, e.g. greater responses of unemployment and *GDP* to exogenous foreign shocks. Contrary to conventional wisdom, higher employment protection and unemployment insurance do not provide a greater buffer against adverse exogenous events. Instead, an increase in investment in workers' skills (as captured in this model by training expenditure) is found to play a fundamental role in enhancing an economy's ability to adjust to negative shocks and in moderating *GDP* contractions.

These findings germinate clear hypotheses that can be tested empirically, a task that lies beyond the scope of this paper. However, the crude evidence we provide 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. 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. Clearly, a note of caution is necessary in interpreting this evidence. It is important to reiterate that our theoretical analysis 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 recent employment performance having been underpinned by a greater reliance on temporary or zero-hour contract jobs.[22]

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[22] As an indicator, the share of involuntary temporary as a percentage of all temporary jobs in the UK is higher than in Denmark (European Commission, 2014).

Figure 5 around here

4. CONCLUSIONS

Flexicurity has typically been advocated as a means to addressing concerns about both an economy's ability to flexibility respond to changing economic conditions and the growing sense of insecurity resulting from labour market deregulation. Our results suggest that reforms of a flexible *liberal* welfare state system in the direction of *flexicurity* can improve labour market outcomes and increase the level of economic activity when they combine greater income support for the unemployed and stronger firing restrictions with active labour market policies that enhance employability and job creation. Given that the changes to individual instruments can have opposing effects on labour market outcomes, the analysis highlights the importance of the choice of their relative magnitude in designing the reform package.

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 to lead to a higher volatility in unemployment and *GDP* in response to exogenous foreign shocks.

A compelling result of this study is that investment in workers' skill can help moderate the impact of negative international shocks. Not only does it reduce the volatility in unemployment, by shortening its persistence, but it also lessens the contraction in *GDP* following a negative foreign shock. More generally, our analysis suggests that productivity enhancing policies can complement social protection in countering the effects of negative shocks, thus pointing to the importance of considering the interdependencies between different policy areas (such as for example labour market, education, and industrial policies).

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Appendix – Calibration

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
ξ		scale factor on disutility of work in the utility function	58.88
β		subjective discount factor	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)	matching elasticity	0.754
χ		matching efficiency	0.535
η	(6)	job destruction rate	0.038
$\bar{e}$		efficiency of worker training technology	0.70
τ		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 cost	0.876
q^V	(8)	vacancy-filling probability	0.700
q^U		job-finding probability	0.490
U	(9)	unemployment (rate)	0.072
b	(10)	unemployment benefit rate	0.124
f	(11)	firing penalty	0.034
G	(12)	general public good	0.186
T		Tax paid by households (lump-sum)	0.205
I	(13)	private investment	0.166
C		private consumption	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

Numbers in parentheses in the first column correspond to the notes below which explain the source of values used in calibrations. When there is no note, the calibrated value is determined freely by the implied solution.

(1) Targets profit share in GDP of 0.2 (average over 2008-2014).
    Sources: http://ec.europa.eu/eurostat/web/sector-accounts/data/ annual-data (business profit shares).

(2) Targets labour income share in GDP of 0.5 (average over 2008-2009).
    Source: http://stats.oecd.org/index.aspx?queryid=345.

(3) Set relative to the US TFP normalised to unity (average over 2009-2014).
    Source: https://fred.stlouisfed.org/series/CTFPPPGBA669NRUG.

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

(5)   Set to satisfy Hosios (1990)'s *efficiency* condition, $\mu + \omega = 1$.

(6)   Normalised based on the empirical evidence on job separation rates provided by Hobijn and Sahin (2009).

(7)   Based on simulations of the steady-state equilibrium version of the model calibrated for the UK.

(8)   Corresponds to the EURO Area average (Christoffel *et al.*, 2009), given the absence of empirical estimate.

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

(10)   Targets unemployment benefits replacement rate of 0.23, an approximate value based on evidence
       provided by Nickell *et al*. (2005) and van Vliet and Caminada (2012).

(11)   Set such that the firing cost as ratio of average earning is 0.063, based on the strictness of employment
       protection, OECD (2013).

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

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

(14)   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)   Based on a trade to GDP ratio of 0.6 (average over 2008-2014).
       Sources: http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS.

Table 1. Effects of permanent changes in individual policy instruments

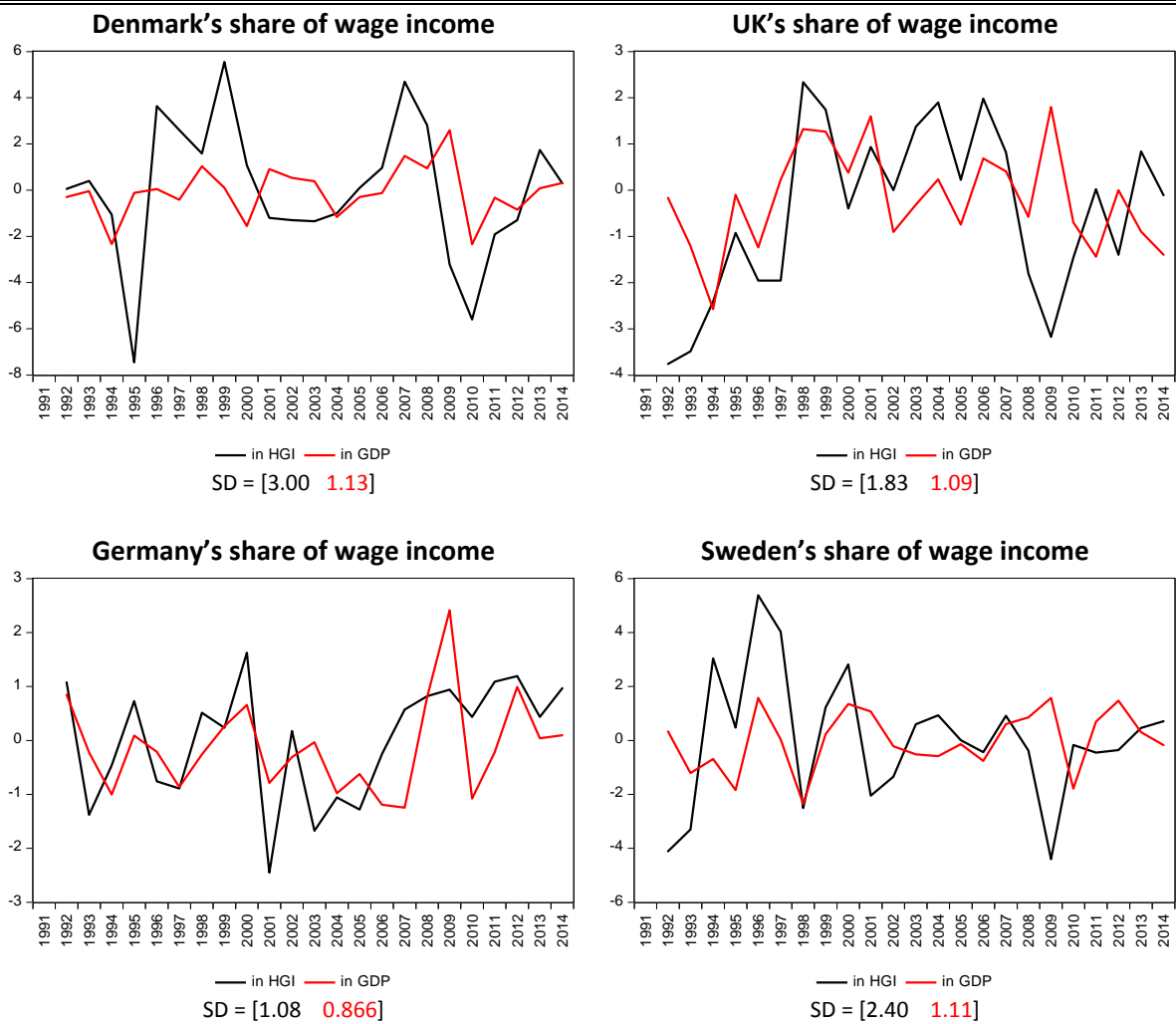| Variables	Benchmark	(a)	(b)	(c)	(d)
GDP	1	0.9936	1.3795	0.9999	1.0048
Unemployment	0.0720	0.0768	0.0665	0.0720	0.0609
Job Value to agency	1.2645	1.0226	1.6450	1.2624	1.0978
Vacancies	0.0504	0.0405	0.0659	0.0503	0.0885
Price Index	0.9700	0.9707	0.9363	0.9700	0.9695
Matches	0.0353	0.0351	0.0357	0.0353	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
Wage Rate (Firm-Level)	3.4119	3.4140	3.3200	3.4119	3.4103
Bargained Wage Rate (per Worker)	2.1296	2.1761	2.7563	2.1278	2.1581
HH Gross 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

HH and HDI are 'Household' and 'Household Disposable Income', respectively. The Benchmark calibration is based on the UK data. Column (a): increase in b; column (b): increase in x^T; column (c): increase in f; column (d): reduction in x^V. Policy changes 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
Wage Rate (Firm-Level)	3.4119	3.3211	3.4140	3.4122	3.3198
Bargained Wage Rate (per Worker)	2.1296	2.1761	2.1743	2.1970	2.8283
HH Gross 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.

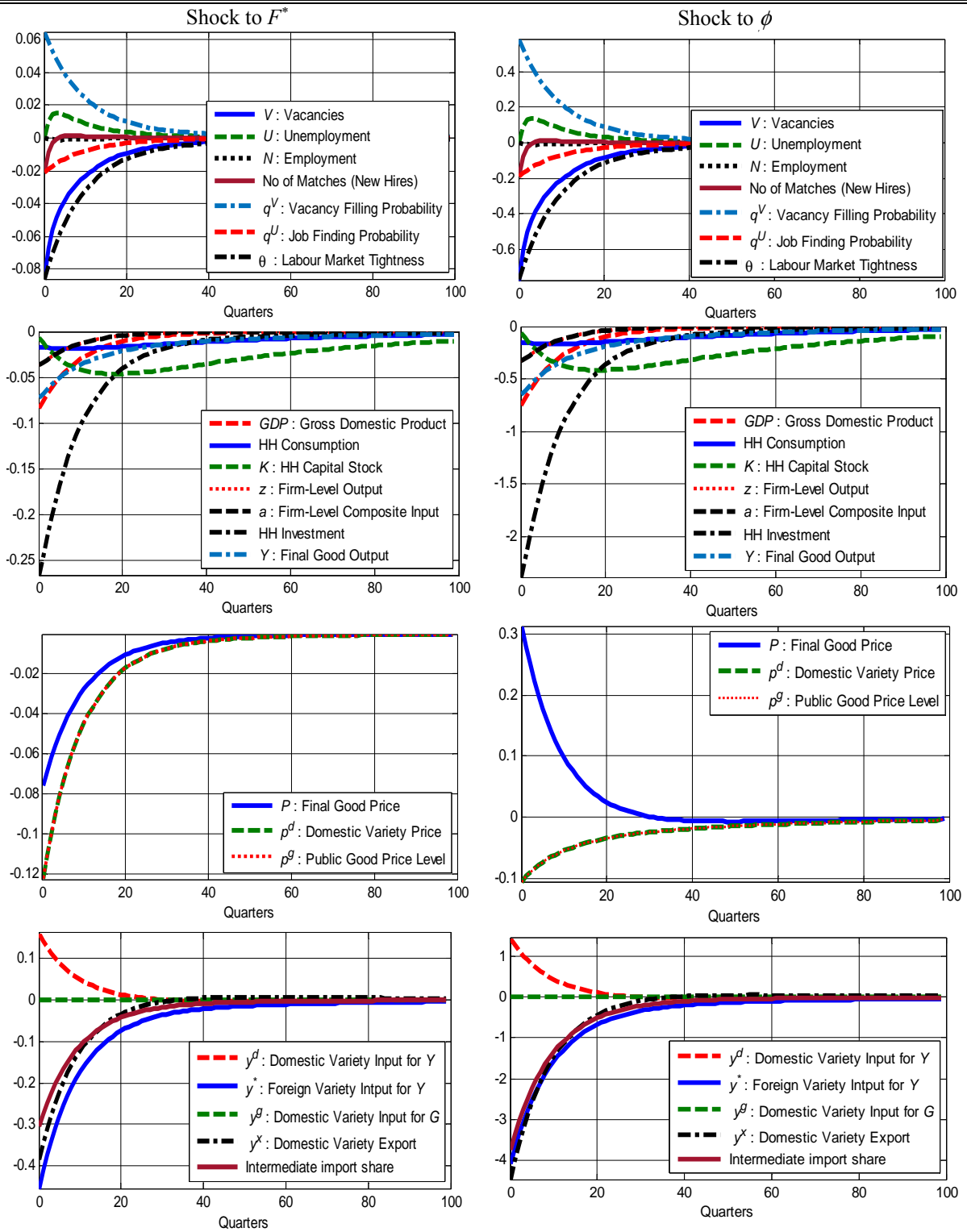**Figure 2. Effects of stochastic negative shocks to foreign demand and trade**

Figure 3. Redistributive effects of stochastic negative foreign demand and trade shocks
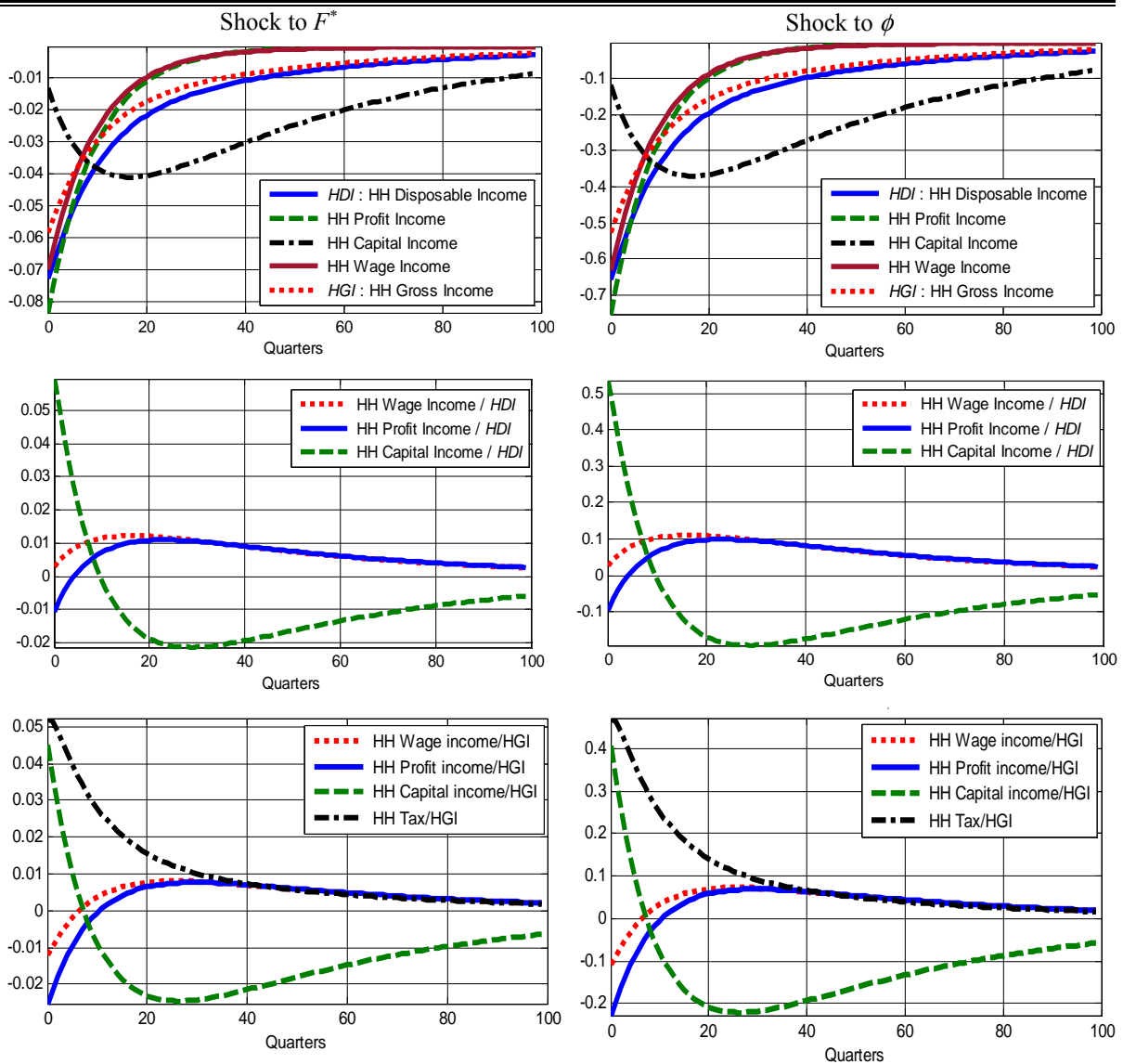
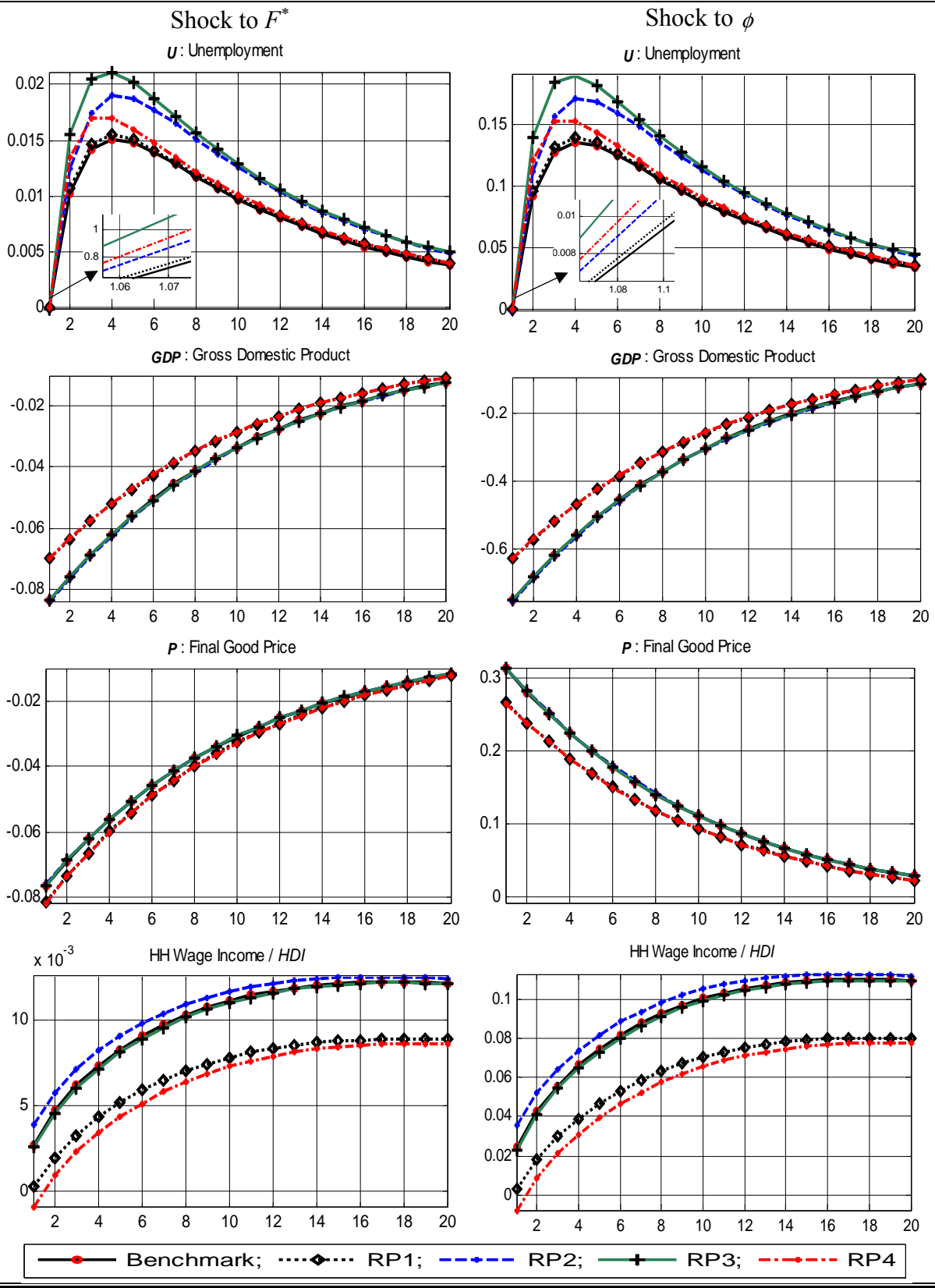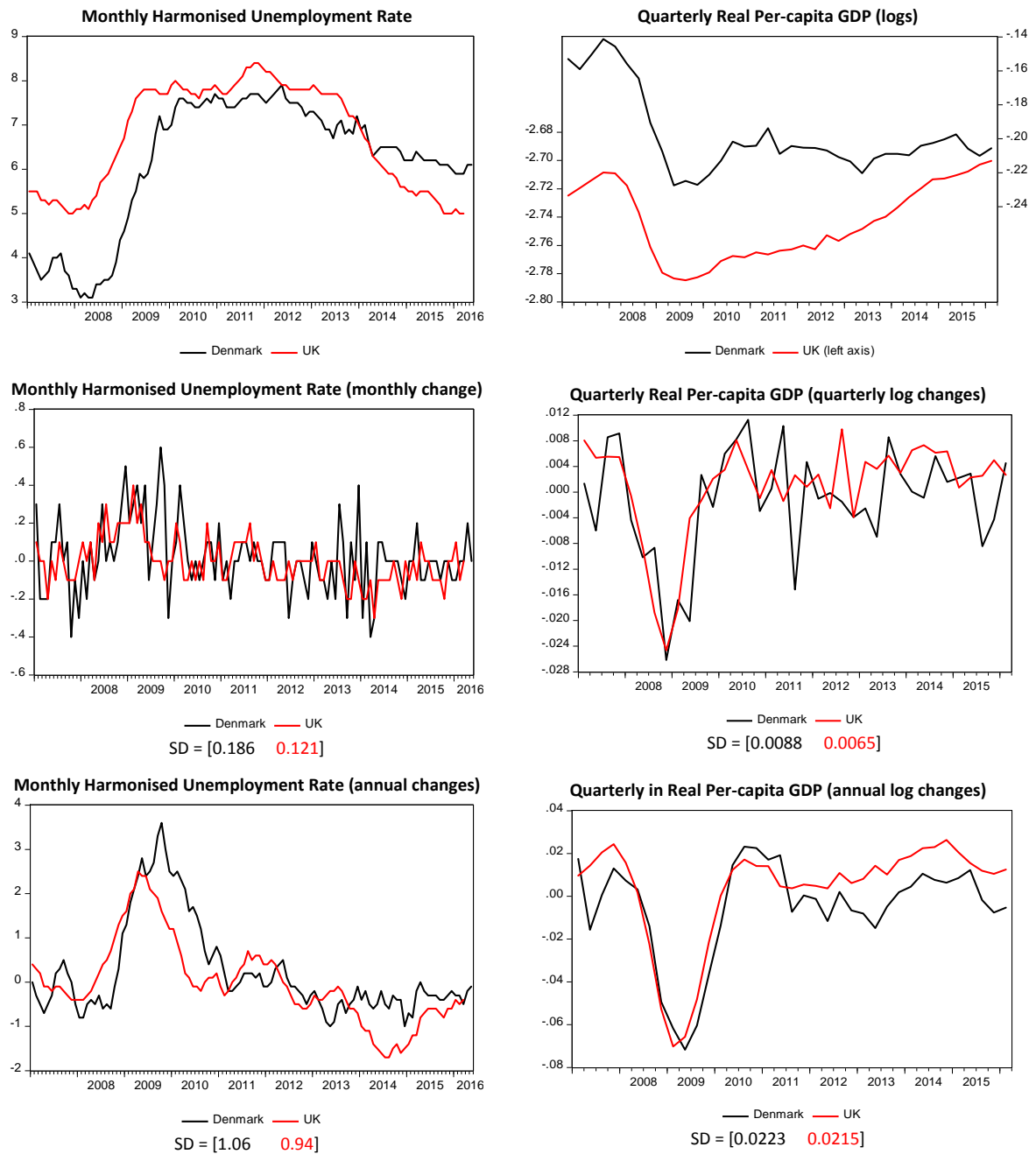**Figure 4. Effects of negative foreign demand and trade shocks before and after reforms**

Shock to F^* — Shock to ϕ

U: Unemployment

GDP: Gross Domestic Product

P: Final Good Price

HH Wage Income / HDI

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