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and international trade

by

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Abstract

Within a two-sector-two-country model of trade with aggregate scale economies and unionisation, a more generous welfare state in one country increases welfare in that country and can have positive spillover effects on the other. Furthermore, synchronised expansions of social security are more welfare enhancing than unilateral ones. Our results counter the fears that a race to the bottom in social standards may result from the ‘shrinking-tax-base’ entailed by international capital mobility. While affecting trade patterns and income distribution, capital mobility interacts with welfare state policies in increasing welfare, *even* when capital flows out of the country that initiates the shock.

Keywords: welfare state; circular causation; international trade

JEL Classification: E6, F1, F4, H3, J5

Outline

1. Introduction
2. The model
3. General Equilibrium
4. Policy analysis
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Non-Technical Summary

Increasingly, welfare states are seen as being incompatible with economic globalisation. Two main arguments define the emerging conventional wisdom. First, in an environment characterised by deep trade integration, welfare state policies and the taxation necessary to finance them (by raising domestic firms' costs) are thought to adversely affect a country's economic performance vis-à-vis its competitors. Second, the credible threat of exit of increasingly mobile capital allegedly weakens governments' ability to sustain programmes of social insurance by reducing their control over *both* volume (via a shrinking tax base) *and* structure (via a shift of taxation on to less mobile factors such as labour) of the tax revenue. Real world evidence, however, is somewhat at odds with the normative implications of this conventional wisdom. Market integration, in fact, does not appear to have led to either a reduction of tax burdens or to any systematic retrenchment of welfare states in advanced industrial economies. This could be explained by the increasing needs for social insurance and income redistribution that result from internationally generated risk and economic dislocations (the so called *compensation hypothesis*), or more simply, by the fact that globalisation may not yet have reached the point at which government are unable to sustain public expenditure programmes.

In this paper we contend that these stylised facts may instead suggest that welfare states and globalisation are compatible and we argue that the source of this compatibility lies in the imperfectly competitive nature of markets. We construct a two-country model of trade with aggregate scale economies stemming from an input output structure (to capture the complex intersectoral linkages characterising mature industrial economies) and unionised labour markets and use it to examine the effects of unilateral and harmonised increases in unemployment benefits on the pattern of specialisation and aggregate welfare with and without international capital mobility. We find that:

1. International trade and capital mobility need not lead to a reduction in the revenue raising capacity of governments, but can complement social insurance policies in increasing welfare, thus facilitating the provision of a more generous welfare protection. Hence, a race to the bottom in social standards does not inevitably emerge from the 'shrinking-tax-base' that is an expected consequence of international capital mobility. Capital mobility affects the pattern of specialisation and the distribution of the welfare gains amongst factors of production, but it interacts with welfare state policies in increasing welfare, *even* in those cases when capital flows out of the country that initiates the policy shock. Therefore, although the specific effects of the policy depends on the policy mix adopted by the two governments and on the strength of the vertical linkages between sectors, the major qualitative results of the paper are robust and casts doubt on the view that the pressures of globalisation can only be met by a retrenchment of social transfer programmes.
2. Unilateral attempts to roll back the welfare state would be welfare reducing for the country which implements the policy and will typically have negative welfare spillover effects on its trading partners. Synchronised retrenchments would yield even larger welfare losses for both economies.

1. INTRODUCTION

Large-scale public provision of social insurance and progressive systems of redistributive taxation, which have been a defining characteristic of advanced industrial economies since the end of the Second World War, are increasingly perceived as being incompatible with economic globalisation. Two main arguments define the emerging conventional wisdom. First, in an environment characterised by deep trade integration, welfare state policies and the taxation necessary to finance them (by raising domestic firms' costs) are thought to adversely affect a country's economic performance vis-à-vis its competitors¹. Second, the credible threat of exit (in response to more favourable tax treatments) of increasingly mobile capital and firms is allegedly bound to lead to a shrinking of the tax base and to pressures to shift the burden of taxation on to less mobile factors such as labour, thus effectively reducing governments' ability to finance social policies by weakening their control over *both* volume *and* structure of the tax revenue. These arguments are embedded even in more sceptical analyses, such as those that point out that globalisation increases insecurity and income inequalities and warn against the danger of a 'race-to-the-bottom' in social and labour standards as countries compete with each other to attract and/or retain industry (see for instance Rodrik, 1997).

A number of stylised facts, however, call for a more careful examination of this conventional wisdom. First, overall tax burdens in advanced industrial economies do not appear to have significantly reduced between the mid-1960s and the mid-1990s, despite the increase in market integration experienced in that period. Second, although labour income taxes as a proportion of government revenue have grown faster than capital taxation, the average effective tax rate on capital has increased in many OECD countries (OECD 1996; Baldwin and Krugman, 2000; Garrett and Mitchell, 2001; Swank, 2002). Third, despite wide cross-country diversity in spending levels, social expenditure in OECD countries (except Norway) has increased up until the second half of the 1990s; in the European Union, subsequent reforms have generally been limited to a restructuring of expenditure and whilst some areas of social protection have modestly declined others have enjoyed stability or even a slow growth (European Commission, 2002). In general, therefore, strong and convincing evidence that the increased extent of goods and capital market integration during the last decades has contributed systematically to the retrenchment of mature welfare states does not seem to exist.

¹ This is the 'distortionary argument' for welfare state retrenchment in a global economy, as developed for instance in Alesina and Perotti (1997).

Clearly, these stylised facts need not be at odds with the conventional wisdom. For instance, they could be ascribed to the resistance to the rolling back of welfare states erected by a public whose needs for social insurance and income redistribution are heightened by increasing exposure to internationally generated risk and economic dislocations – the so called *compensation hypothesis* (see for instance, Garrett, 1998, and Rodrik, 1998). More generally, it could be argued that globalisation has not yet reached the point at which governments are unable to sustain welfare state programmes. However, and perhaps more intriguingly, the aforementioned stylised facts can also be interpreted as casting doubts on the incompatibility between welfare states and high degrees of economic integration, particularly in view of recent empirical studies that find a positive relationship between openness and the size of the welfare state (e.g. Rodrik, 1998) and between social security expenditure and competitiveness (e.g. De Grauwe and Polan, 2003)².

Political scientists argue convincingly in favour of the compatibility between welfare states and openness and explain it pointing out that the extent to which the economic and political pressures stemming from globalisation are translated into welfare state retrenchment will typically depend on country-specific factors, such as: (i) the institutional features of the socio-political representation system (e.g. type of electoral and interest representation); (ii) the nature of the welfare state (e.g. its degree of universalism); and (iii) the characteristics of the labour market (e.g. the degree of centralisation of the wage setting process). Along these lines, Garret (1998) asserts that social democratic corporatism is the main way to reconcile the need for social insurance with the pressures that an increasingly integrated world economy exerts on governments' ability to pursue welfare state policies: in exchange for social protection, 'encompassing' corporatist unions will offer wage moderation, thus limiting the distortionary effects of the welfare state³. More generally, in the corporatist social pact, welfare state policies are effectively a means to restrain social conflict which – as discussed in De Grauwe and Polan (2003) – may in itself harm a country's economic prosperity and performance.

² De Grauwe and Polan (2003) find that social spending increases competitiveness and show that the reverse causality (i.e. that higher competitiveness leads to larger welfare states) is weak. These results contradict those obtained by Alesina and Perotti (1997). De Grauwe and Polan, however, use multidimensional indices of competitiveness that contain but transcend the cost and price competitiveness used by Alesina and Perotti. These measures (developed by the IMD of Lausanne and the World Economic Forum) include, among others, factors such as quality of human capital, efficiency of government sector, and ability to innovate.

³ Seen in this light, the current trend towards decentralisation of wage bargaining in most – albeit not all – European countries (as documented for instance by Boeri *et al.*, 2001) would predict the unavoidability of the collusion course between globalisation and welfare states.

In this paper we contend that there may be more eminently economic reasons for the compatibility between welfare state policies and globalisation, and we argue that these reasons lie in the imperfectly competitive nature of goods and factor markets. It is well known that in a second-best world – which is, after all, at the very core of the rationale behind the existence of the welfare state – economic policy can be welfare improving⁴. Diverging from the conventional wisdom, we show that welfare states can in fact complement rather than being in conflict with globalisation forces in improving economic performance. More specifically, we find that international trade openness and capital mobility do not inevitably lead to a race to the bottom in social standards via a reduction of the revenue raising capacity of governments. Our analysis does not counter the importance of institutional factors, such as the specific nature of the wage setting process, but suggests that these factors may not be necessary for reconciling the needs for social insurance with the pressures stemming from economic openness.

To illustrate these points, we construct a model of international trade between two countries characterised by vertical linkages between sectors, unionised labour markets and welfare state policies in the form of unemployment benefits financed via proportional factor income taxation. We examine the effects of unilateral and harmonised expansions of unemployment insurance, with and without capital mobility. Our findings suggest that welfare state policies can be compatible with trade openness and need not hinder a country's economic performance vis-à-vis a trading partner whose government offers a lower degree of social protection. An increase in the generosity of welfare state provision in one country is shown to have positive welfare effects in that country: with vertical linkages, the increase in the demand for final goods triggered by the expansionary policy results in a correction of the sub-optimal provision of intermediate inputs, thus leading to a rise in aggregate efficiency, real income and welfare⁵. We also find that such a policy in general has positive spillover effects that benefit the trading partner. Furthermore, the positive welfare effects for both countries are typically not weakened by capital mobility. In this respect, therefore, our results counter the fears that a race to the bottom in social standards may inevitably emerge

⁴ Examining the effects of social policy on employment and growth, van der Ploeg (2003) argues that the distortion of imperfectly competitive labour markets may be corrected by social policies financed by (distortionary) progressive taxation and shows that conditional unemployment benefits may spur job creation. In Acemoglu and Shimer (2000), unemployment insurance improves allocative efficiency by enabling workers to pursue riskier and more productive options.

⁵ In the Grauwe and Polan (2003) social expenditure affects workers' productivity by entering directly the production function of the private sector. In our model the effects of government policy on aggregate efficiency emerges *endogenously* and is does not result from an *a priori* link between social transfers and productivity.

from the ‘shrinking-tax-base’ that is presumably entailed by international capital mobility. The latter, while affecting the pattern of specialisation and the distribution of the welfare gains amongst factors of production, interacts with welfare state policies in increasing welfare, *even* in those cases when capital flows out of the country that initiates the policy shock.

The rest of the paper is organised as follows. The model is set out in Section 2. Section 3 describes the general equilibrium. Section 4 examines the effects of unilateral increases in the generosity of welfare state provision, with and without capital mobility and briefly compares them to those resulting from harmonised policies. Section 5 concludes the paper. An appendix at the end of the paper gives the technical details.

2. THE MODEL

There are two countries – Home and Foreign, denoted by H and F, respectively – that we assume to be identical in every respect (tastes, technologies, institutional features and factor endowments). Thus, for expositional simplicity, we shall limit the description of the model to country H, noting that the same set-up applies to country F. Whenever necessary, we shall denote the variables of country F with an asterisk superscript.

There are two sectors in each country: in sector x , a mass of monopolistically competitive firms supplies horizontally differentiated goods with internal increasing returns to scale; in sector y , firms produce a homogenous good under perfectly competitive conditions. There are vertical linkages between the two sectors that give rise to aggregate scale economies⁶. The output of the downstream sector y is a final consumption good. The output of the upstream sector x is used as an intermediate input in sector y and as a final consumption good by consumers. The products of both sectors are freely traded. In both countries, labour markets are unionised and the government is a provider of welfare protection in the form of unemployment benefits financed via proportional factor income taxation. Consistently with the observed tendency in European labour markets towards segmentation in union coverage and decentralisation in collective bargaining (Boeri *et al*, 2001), in this paper we assume that wages are set by decentralised monopoly unions. Furthermore, given that the deep division of labour and the complex inter-industry linkages typical of industrial economies are known to result in high degrees of specialisation and, to

⁶ Inter-industry connections are an important source of external returns to scale in manufacturing – see Bartelsman, *et al.* (1994) for evidence – and they have been extensively acknowledged by the theoretical literature, e.g. Eithier (1982), Matzuyama (1995) and Venables (1996).

some extent, in some sector specificity of factors of production⁷, we assume that labour is used directly only in sector x , while sector y employs it only indirectly, via the use of intermediates as inputs⁸.

2.1. Final consumers

The preferences of the representative consumer are characterised by the utility function

$$U = \left(\frac{X_c}{\mu} \right)^\mu \left(\frac{Y_c}{1-\mu} \right)^{1-\mu} + (1-\xi)\tilde{V}, \quad (1)$$

where $0 < \mu < 1$, X_c and Y_c are the consumption of the goods produced by sectors x and y respectively, and \tilde{V} is the utility of leisure. The individual is endowed with one unit of labour and supplies it inelastically in the labour market; $\xi = 1$ if the individual is employed and $\xi = 0$ otherwise. Constrained optimisation of (1) yields the demand functions

$$X_c = \mu \frac{M}{P_x}, \quad (2)$$

$$Y_c = (1-\mu) \frac{M}{P_y}, \quad (3)$$

where P_x and P_y are the prices of the two goods and M is nominal disposable income to be defined later.

We assume that the differentiated good is freely traded internationally and is aggregated into a CES basket defined over the goods produced in both countries, that is

$$X = \left(\int_{i \in N} x_i^{\frac{\sigma-1}{\sigma}} di + \int_{i \in N^*} x_i^* \frac{\sigma-1}{\sigma} di \right)^{\frac{\sigma}{\sigma-1}}, \quad (4)$$

where x_i is the quantity of a typical variety of the good produced in sector x , $\sigma > 1$ denotes the elasticity of substitution between varieties, N is the mass of available varieties and an asterisk refers to the corresponding variables of country F. The industry price index dual to (4), common to both countries, will therefore be

⁷ Economic history documents that whilst the technological advances in the early phases of industrialisation (whereby capital and unskilled workers were substituted for artisan skills) led to an increase in inter-sectoral labour mobility, starting from the 1920s – albeit to different extents in different countries – the growing complementarity between skills and technology led to an increase in sector specificity of labour. For a discussion of these issues see, for instance, Hiscox (2002).

⁸ Relaxing this assumption would not alter the qualitative nature of the results of the paper.

$$P_x = P_x^* = \left(\int_{i \in N} p_i^{1-\sigma} di + \int_{i \in N^*} p_i^{*1-\sigma} di \right)^{\frac{1}{1-\sigma}}, \quad (5)$$

where p_i and p_i^* are the prices of a typical variety i produced in H and F respectively.

2.2. Producers

There are two primary inputs in the economy that we call labour and capital, denoted by L and K , whose rates of returns are w and r , respectively. It is assumed that L is specific to sector x while K is used in both sectors.

The horizontally differentiated product in sector x is produced by an endogenously determined (via free-entry and exit) mass of identical firms according to an increasing returns to scale technology which uses – both as variable and fixed input requirement – a Cobb-Douglas basket of capital and labour, $I_i = (l_i / \alpha)^\alpha (k_i / (1-\alpha))^{1-\alpha}$, where l_i and k_i are firm i 's inputs of labour and capital and $0 < \alpha < 1$ is a constant. The production function and the total cost of a typical firm i are given respectively by $x_i = I_i - \phi$ and $c_i = w_i l_i + r k_i$, where $\phi > 0$ captures the fixed cost of production, which is assumed to be the same for all firms. Given the production technology, the minimum total cost of producing x_i is $c_i = \eta_i (x_i + \phi)$ and the corresponding input demands are given by

$$l_i = \alpha \frac{\eta_i}{w_i} (x_i + \phi), \quad (6)$$

$$k_i = (1-\alpha) \frac{\eta_i}{r} (x_i + \phi), \quad (7)$$

where $\eta_i = w_i^\alpha r^{1-\alpha}$. The existence of a fixed input requirement gives rise to an incentive to specialise and results in a one-to-one correspondence between the mass of firms and that of available varieties. The firm's profit therefore is $\pi_i = p_i x_i - c_i$, or

$$\pi_i = p_i x_i - \eta_i (\phi + x_i). \quad (8)$$

Firms in sector y are perfectly competitive and produce a homogenous final consumption good using capital and a basket of the intermediate varieties produced in sector x . The latter is a composite input assumed to be assembled according to the CES aggregator in (4). Labour is therefore not used directly in sector y but is embodied in X . For any given mass of intermediate varieties, the sector's production technology is a constant returns to scale Cobb-Douglas, $Y = A X_y^\lambda K_y^{1-\lambda}$, where $A > 0$ and $0 < \lambda < 1$ are constant parameters. The

CES nature of X however implies that there are increasing returns to the range of available varieties since the productivity of the intermediate basket, and hence total factor productivity in sector y , is increasing in $(N+N^*)$. Clearly, given that the intermediate good is freely traded internationally, these external economies are not country (or location) specific, i.e. there are ‘international returns to scale’. Furthermore, the increase in the average productivity of factors stemming from a given rise in $(N+N^*)$ will be higher the smaller is the elasticity of substitution between varieties, σ . The total cost of producing Y is $C_y = P_x X_y + rK_y$. Given the production function and using the normalisation $A = \lambda^{-\lambda} (1-\lambda)^{\lambda-1}$, the minimum cost function will be $C_y = (P_x^\lambda r^{1-\lambda}) Y$. Since the industry is perfectly competitive, the production level is determined by the equality between price and average cost,

$$P_y = P_x^\lambda r^{1-\lambda}. \quad (9)$$

Finally, the constant returns to scale technology and the perfect competition assumption imply that input demands by sector y are

$$X_y = \lambda Y \frac{P_y}{P_x}, \quad (10)$$

$$K_y = (1-\lambda) Y \frac{P_y}{r}. \quad (11)$$

2.3. Factor markets

In the first instance we shall assume that both primary factors of production, L and K , are internationally immobile and later analyse the consequences of allowing for capital mobility. In both countries, the market for capital is assumed to be perfectly competitive with r adjusting to satisfy the resource constraint,

$$K_y + \int_{i \in N} k_i di = \bar{K}, \quad (12)$$

where \bar{K} is the country’s endowment of capital.

In both countries, the labour market is unionised. We assume that wages are set by decentralised monopoly unions, with employment being determined by firms (this aspect of the model is based on Alesina and Perotti, 1997, and Molana and Montagna, 2002). More precisely, we assume there to be a number of identical unions, denoted by J ; a large (small) J indicates a large (small) number of small (large) unions. A typical union j will have a mass

of members $\bar{L}_j = \bar{L}/J$, where \bar{L} is the total labour force in the country, and will embrace the workers of, and set wages for, a mass of firms $N_j = N/J$.⁹ Unionisation implies that involuntary unemployment persists in equilibrium and that each union will have some unemployed members¹⁰ – i.e. $L_j < \bar{L}_j$ where L_j is the union's mass of employed members. The objective function of a typical union j can be obtained from (1) and is given by the expected utility of its typical member,

$$V_j = \frac{L_j}{\bar{L}_j} \frac{(1-t)w_j}{P} + \frac{\bar{L}_j - L_j}{\bar{L}_j} \frac{bw_j}{P} + \frac{\bar{L}_j - L_j}{\bar{L}_j} \tilde{V}, \quad (13)$$

where

$$P = P_x^\mu P_y^{1-\mu} \quad (14)$$

is the consumer price index, t is the labour income tax rate, and the benefit received by an unemployed worker is assumed to depend on the wage rate by a factor of proportionality b that is determined by the government. We assume that unemployment benefit payments are not taxed, i.e. they are net transfers¹¹. As will be explained later, the union will choose w_j to maximise (13) subject to the relevant constraints. Note that the above objective function implies that the union faces a trade-off between real wage and employment, reflected in downward sloping indifference curves in the $(w/P, L)$ space. Finally, given the assumption of symmetry between firms in sector x , it follows that the wage set by a union is the same for all the firms it covers, i.e. $w_{i \in N_j} = w_j$.

2.4. Government sector and aggregate income

In each country, the government is a provider of welfare protection in the form of unemployment benefits financed via proportional factor income taxation. Noting that

$$\bar{L} = \sum_{j=1}^J \bar{L}_j \geq L = \sum_{j=1}^J L_j, \text{ the government budget constraint is given by}$$

⁹ For a given J , the fixed labour endowment implies that the membership of each union is constant. Hence, despite the fact that the mass of firms covered by each union varies with N , its size is constant and changes in N have no implications for the assumption of decentralised union behaviour.

¹⁰ We follow the literature in assuming that unemployed workers from other unions cannot be employed in a given union's sector before the latter's unemployed members are hired.

¹¹ Assuming a lump-sum benefit or indexing the benefit to the after tax wage would not qualitatively alter the results. Unemployment benefits are assumed not to be taxed to reflect a progressive income tax system.

$$\sum_{j=1}^J bw_j(\bar{L}_j - L_j) = \sum_{j=1}^J tw_jL_j + qr\bar{K}, \quad (15)$$

The right-hand-side of equation (15) is the total tax revenue extracted from the primary factors, where q is the capital income tax rate, and the left-hand-side of the equation gives the total unemployment benefit bill.

Aggregate income of consumers, M , is determined by total disposable incomes of primary factors and the transfers from the public to private sector,

$$M = \sum_{j=1}^J [(1-t)w_jL_j + bw_j(\bar{L}_j - L_j)] + (1-q)r\bar{K}. \quad (16)$$

Using (15), it follows that M is simply the sum of primary factors' gross income, i.e.

$$M = \sum_{j=1}^J w_jL_j + r\bar{K}.$$

3. GENERAL EQUILIBRIUM

Given the assumed preferences and technologies, the total expenditure in country H on the varieties of good X, produced in both countries, is given by

$$E_x = \mu M + \lambda Y. \quad (17)$$

The two terms on the right-hand-side of (17) are the total expenditures by the country's consumers and firms in sector y , respectively. The demand functions for the variety facing a typical firm i , in countries H and F, are

$$\begin{cases} x_i = \frac{E_x}{P_x} \left(\frac{p_i}{P_x} \right)^{-\sigma} + \frac{E_x^*}{P_x^*} \left(\frac{p_i}{P_x^*} \right)^{-\sigma}, \\ x_i^* = \frac{E_x}{P_x} \left(\frac{p_i^*}{P_x} \right)^{-\sigma} + \frac{E_x^*}{P_x^*} \left(\frac{p_i^*}{P_x^*} \right)^{-\sigma}, \end{cases} \quad (18)$$

where $P_x^* = P_x$ is given by (5). The representative firm in sector x maximises the profit function in (8) subject to (5), its demand in (18), and taking the total expenditures (E_x and E_x^*) and the wage set by the union as given. The first order condition for this maximisation yields the firms' optimal price rule which, for a typical firm i covered by union j , is

$$p_{i \in N_j} = \frac{\sigma}{\sigma - 1} \eta_{i \in N_j}, \quad (19)$$

where now $\eta_{i \in N_j} = w_j^\alpha r^{1-\alpha}$.

The mass of firms in sector x in each country is endogenously determined via free-entry and exit. Hence, at the free-entry equilibrium, all firms in both countries will break even. Substituting (19) into (8) and setting the resulting equations equal to zero, we obtain the equilibrium output scale of a typical firm in sector x ,

$$x_{i \in N_j} = \phi(\sigma - 1). \quad (20)$$

As equation (20) indicates, in the symmetric equilibrium the optimal output scale is the same for all firms and is constant¹².

The wage rates are determined by the monopoly unions. A typical union j maximises its objective function in (13) subject to the labour demand it faces,

$$L_j = \int_{i \in N_j} l_i di, \quad (21)$$

and (5), (14), the demand facing the firms in (18), and firms' mark-up rule in (19). It can be shown that the wage setting equation resulting from this optimisation is

$$\frac{w_j}{P} = \frac{\tilde{V}}{(1-t-b) - \varepsilon_j \left(1-t-b + b \frac{\bar{L}_j}{L_j} \right)}, \quad (22)$$

where $\varepsilon_j = (1 - \varepsilon_{jP}) / \varepsilon_{jL}$ is a measure of unions' monopoly power, with $\varepsilon_{jL} > 0$ and $0 < \varepsilon_{jP} < 1$ respectively denoting the wage elasticity of labour demand facing the union and the elasticity of the consumer price index with respect to the wage set by the union – see A1 in the Appendix for the derivation of (22), ε_{jP} and ε_{jL} .

Equation (22) can be interpreted as a behavioural rule according to which unions set the (real) wage of their members by a mark-up over the reservation wage, \tilde{V} . A number of points are worth noting at this stage. First, it is clear that the optimal real wage is positively related to both labour income tax rate and unemployment benefit: (i) a ceteris paribus increase in t , by reducing the after tax wage, induces the unions to bid up the nominal wage;

¹² The constant elasticity of substitution assumption and the lack of strategic interaction between firms imply that the extent to which each firm exploits internal increasing returns to scale depends only on the elasticity of substitution between varieties and the fixed cost, and is unaffected by the size of the market.

and (ii) a higher unemployment benefit rate, by reducing the utility difference between being employed and unemployed, persuades the unions to increase their wage demands. Second, the real wage is positively related to ε_j , which implies a negative relationship with both ε_{jL} and ε_{jP} : an increase in ε_{jL} reduces the rent extracting ability of the union, thus leading it to restrain its wage demands, while an increase in ε_{jP} raises the extent to which a higher wage reduces, *ceteris paribus*, the purchasing power of union members. Finally, a *ceteris paribus* rise in employment reduces real wage demands.

Given the assumed symmetry between firms, unions and countries, we drop the subscripts i and j from the equations and set $\bar{K}^* = \bar{K}$, $\bar{L}^* = \bar{L}$, $\tilde{V}^* = \tilde{V}$, and $J^* = J$. Also, in the rest of the paper we use good Y as numeraire and set $P_y = P_y^* = 1$. The equations of the model for both countries are, for convenience, repeated in Table 1 below which also includes the balance of payment equation and the goods market equilibrium conditions in sectors y and x , i.e. equations (23), (24) and (25) respectively¹³. The model can be solved to determine the endogenous variables N , x , Y , L , w , p , P_x , P , r , M , E_x , their foreign counterparts, and the policy instrument that the government of each country chooses to let vary in order to balance its budget. The latter are one of (t, q, b) and (t^*, q^*, b^*) but, given our purpose, country H is always assumed to choose its benefit rate exogenously.

3.1. Characteristics of the model

Before proceeding to the policy analysis, it is useful to highlight some of the properties of the model (see A2 in the Appendix for details). The symmetric nature of the two countries implies that

(3.1.1) In equilibrium prices are equalised across countries, i.e. $p^* = p$, $P_x^* = P_x$, $P^* = P$, $r^* = r$, and $w^* = w$ always hold.

(3.1.2) In equilibrium the optimal output scale and firm-level employment are the same for all home and foreign firms in sector x , i.e. $x^* = x$ and $(L^* / N^*) = (L / N)$ always hold.

¹³ These three equations are reported for completeness; it is easy to show that they can be obtained from the other equations using Walras' law.

(3.1.3) An increase in the employment ratio L/L^* , from one equilibrium to another, is accompanied by:

- (I) a rise in the ratio of mass of firms in sector x , N/N^* , and hence the ratio of the corresponding production, $(Nx)/(N^*x^*)$;
- (II) a rise in the ratio of both nominal incomes, M/M^* and real incomes, $(M/P)/(M^*/P^*)$; and
- (III) a fall in the ratio of production in sector y , Y/Y^* .

Table 1. Equations of the model without capital mobility†

(5)	$P_x = \left(Np^{1-\sigma} + N^*p^{*1-\sigma} \right)^{\frac{1}{1-\sigma}} = P_x^*$	
(9)	$r^{1-\lambda} P_x^\lambda = 1$	$r^{*1-\lambda} P_x^{*\lambda} = 1$
(12)	$\bar{K} = \frac{(1-\alpha)Npx + (1-\lambda)Y}{r}$	$\bar{K}^* = \frac{(1-\alpha)N^*p^*x^* + (1-\lambda)Y^*}{r^*}$
(14)	$P = P_x^\mu$	$P^* = P_x^{*\mu}$
(15)	$bw(\bar{L} - L) = twL + qr\bar{K}$	$b^*w^*(\bar{L}^* - L^*) = t^*w^*L^* + q^*r^*\bar{K}^*$
(16)	$M = bw(\bar{L} - L) + (1-t)wL + (1-q)r\bar{K}$	$M^* = b^*w^*(\bar{L}^* - L^*) + (1-t^*)w^*L^* + (1-q^*)r^*\bar{K}^*$
(17)	$E_x = \mu M + \lambda Y$	$E_x^* = \mu M^* + \lambda Y^*$
(18)	$x = (E_x + E_x^*)P_x^{\sigma-1} p^{-\sigma}$	$x^* = (E_x^* + E_x^*)P_x^{*\sigma-1} p^{*\sigma}$
(19)	$p = \frac{\sigma}{\sigma-1} w^\alpha r^{1-\alpha}$	$p^* = \frac{\sigma}{\sigma-1} w^{*\alpha} r^{*1-\alpha}$
(20)	$x = \phi(\sigma-1) = x^*$	
(21)	$L = \alpha N \frac{px}{w}$	$L^* = \alpha N^* \frac{p^*x^*}{w^*}$
(22)	$\frac{w}{P} = \frac{\tilde{V}}{(1-t-b) - \varepsilon \left(1-t-b + b \frac{\bar{L}}{L} \right)}$	$\frac{w^*}{P^*} = \frac{\tilde{V}^*}{(1-t^*-b^*) - \varepsilon^* \left(1-t^*-b^* + b^* \frac{\bar{L}^*}{L^*} \right)}$
(23)	$(Y - (1-\mu)M) + (Npx - E_x) = 0$	$(Y^* - (1-\mu)M^*) + (N^*p^*x^* - E_x^*) = 0$
(24)	$Y + Y^* = (1-\mu)(M + M^*)$	
(25)	$E_x + E_x^* = Npx + N^*p^*x^*$	

† In the capital market equilibrium condition and labour demand, given in equations (12) and (21), the left-hand-sides are now replaced by the appropriate demand components; equation (21) is now written in terms of the aggregate, economy-wide, level of employment rather than the union level of employment.

4. POLICY ANALYSIS

The aim of this section is to examine the effects on the two economies of welfare state policy shocks in the form of increases in the unemployment benefit rates. We first consider unilateral policy changes undertaken by the government in H, without and with capital mobility. We then briefly examine the implications of harmonised policy shocks. In general, international trade flows imply that the two economies are interdependent and that policy changes in one country have budgetary implications for both governments. Hence, starting from an initial fully symmetric equilibrium (see A3 in the Appendix), a given policy shock (for example, a unilateral increase in b in H) will correspond to a number of different cases depending on which instrument is chosen by each government to offset the ensuing budgetary imbalances (in the example, t or q in H and t^* , q^* or b^* in F).

In each case, the policy multipliers are measured by the (total) effect of the shock (a rise in b) on the variables of interest when in each country one of the policy instruments is allowed to vary. Given the complexity of the algebra involved in determining and comparing the signs and magnitudes of these multipliers, we do not provide the analytical expressions for them in the paper and only give graphs which plot their numerically simulated values against λ , to highlight the role of vertical linkages in transmitting the policy effects (see A5 in the Appendix for details).

4.1. Unilateral policy shocks without capital mobility

As a benchmark case, we first present the analysis of the effect of a rise in b when both governments use the tax rate on labour income, t and t^* . Also, given that in the absence of capital mobility the use of the tax rate on capital is less interesting, in this subsection we only analyse the use of t by the government in H, and postpone the use of q to the next subsection where we allow for capital mobility.

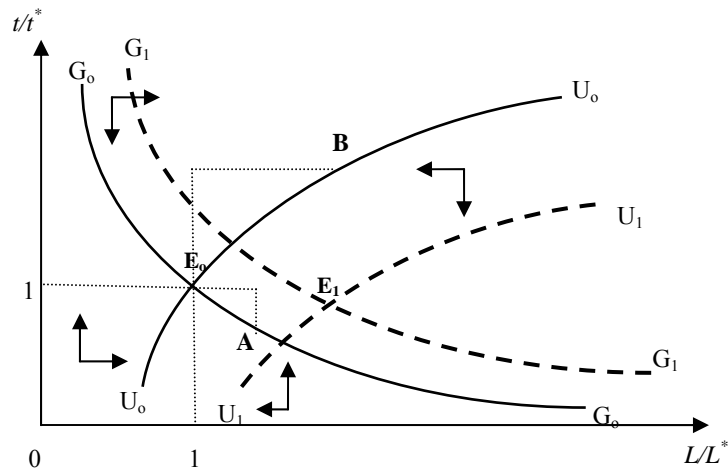
4.1.1. Effects of a rise in b when budgetary impacts are offset by t and t^*

In order to illustrate how the policy works, in the benchmark case we first reduce the model to two equations which describe the relative position of the two countries in the neighbourhood of the initial symmetric equilibrium. One equation is obtained using the two government budget constraints; recalling that $w^* = w$ and $r^* = r$ hold in all equilibria (see subsection 3.1) and given that in this particular case $q^* r^* \bar{K} = qr\bar{K}$ should also hold since $q^* = q$, the two equations in (15) in Table 1 imply

$$b(\bar{L} - L) - tL = b^*(\bar{L} - L^*) - t^*L^*. \quad (26)$$

We have sketched the graph of (26) in Figure 1 below as the G_0G_0 curve which depicts combinations of equilibrium values of t/t^* and L/L^* that satisfy both governments' budget constraints when $b^*/b=1$. It is easy to show that the G_0G_0 curve is downward sloping. Starting from point on the curve such as E_0 , which corresponds to the initial symmetric equilibrium where both governments have a balanced budget and $L^*/L = t^*/t = b^*/b = 1$, a ceteris paribus rise in L will take us above the curve where – as a result of the increased tax base – the home government's budget is in surplus. The domestic tax rate will have to fall for the budget to be brought into balance, hence moving down to a point such as A. The vertical arrows show the direction of the movements above and below the G_0G_0 . It is also easy to verify that a ceteris paribus increase in b will shift the G_0G_0 curve outwards: the higher unemployment benefits will throw the home government's budget into deficit and, for any given level of L , a higher tax rate t will be required to offset the deficit.

Figure 1. Effects of a rise in b/b^* (no capital mobility) when t and t^* are used as policy instruments



The second equilibrium relationship is obtained from the unions' wage setting equations. The fact that $w^* = w$ and $P^* = P$ always hold in equilibrium implies that the real wages in the two countries are equalised. The two equations in (22) in Table 1 then imply

$$t + b + \varepsilon \left(1 - t - b + b \frac{\bar{L}}{L} \right) = t^* + b^* + \varepsilon \left(1 - t^* - b^* + b^* \frac{\bar{L}}{L^*} \right). \quad (27)$$

The graph of (27) is sketched in Figure 1 as the U_0U_0 curve. This curve depicts combinations of equilibrium values of t/t^* and L/L^* that satisfy the equality of unions' real wage demands in the two countries, ω say, with a particular level of the common equilibrium real wage, w/P ,

determined by the rest of the economy. The curve is upward sloping: starting from a point on the curve such as E_0 , which corresponds to the initial symmetric equilibrium, a ceteris paribus increase in t will raise the unions' wage demands in H, thus opening a wedge between these wage demands and the equilibrium real wage, i.e. in H ω will exceed w/P . Given the trade-off between real wage and employment facing the unions, an increase in employment in H is required to eliminate this wedge, taking us to a point such as B¹⁴. Also, it is easy to verify that a ceteris paribus increase in b will shift the curve to the right: a higher unemployment benefit rate will prompt the unions to raise their wage demands; for any given t/t^* , L/L^* must rise to bring the unions' real wage demands down to the prevailing equilibrium real wage. The horizontal arrows show the direction of the movements above and below the U_0U_0 .

Solving equations (26) and (27) determines the general equilibrium values of t/t^* and L/L^* . In Figure 1 the initial symmetric equilibrium occurs at point E_0 , where the G_0G_0 and U_0U_0 curves intersect. An exogenous increase in the rate of unemployment benefit in H (corresponding to a rise in b/b^*) will then shift both curves to the right, hence resulting unambiguously in a higher L/L^* which may even be accompanied by a fall in t/t^* . In other words, the policy may entail a shift from the initial symmetric equilibrium E_0 to a new asymmetric equilibrium such as E_1 , where country H is characterised by a higher relative employment level and a lower relative tax rate. Furthermore, as highlighted in subsection 3.1, a rise in L/L^* implies a larger $(M/P)/(M^*/P^*)$ and $(Nx)/(N^*x^*)$ and a smaller Y/Y^* . Hence, starting from a completely symmetric pattern of production and with trade being entirely intra-industry, the asymmetry that the policy shock in H generates between the two countries leads to a divergence in production structures and to the emergence of inter-industry trade, with country H becoming a net exporter of good X and country F exporting good Y .

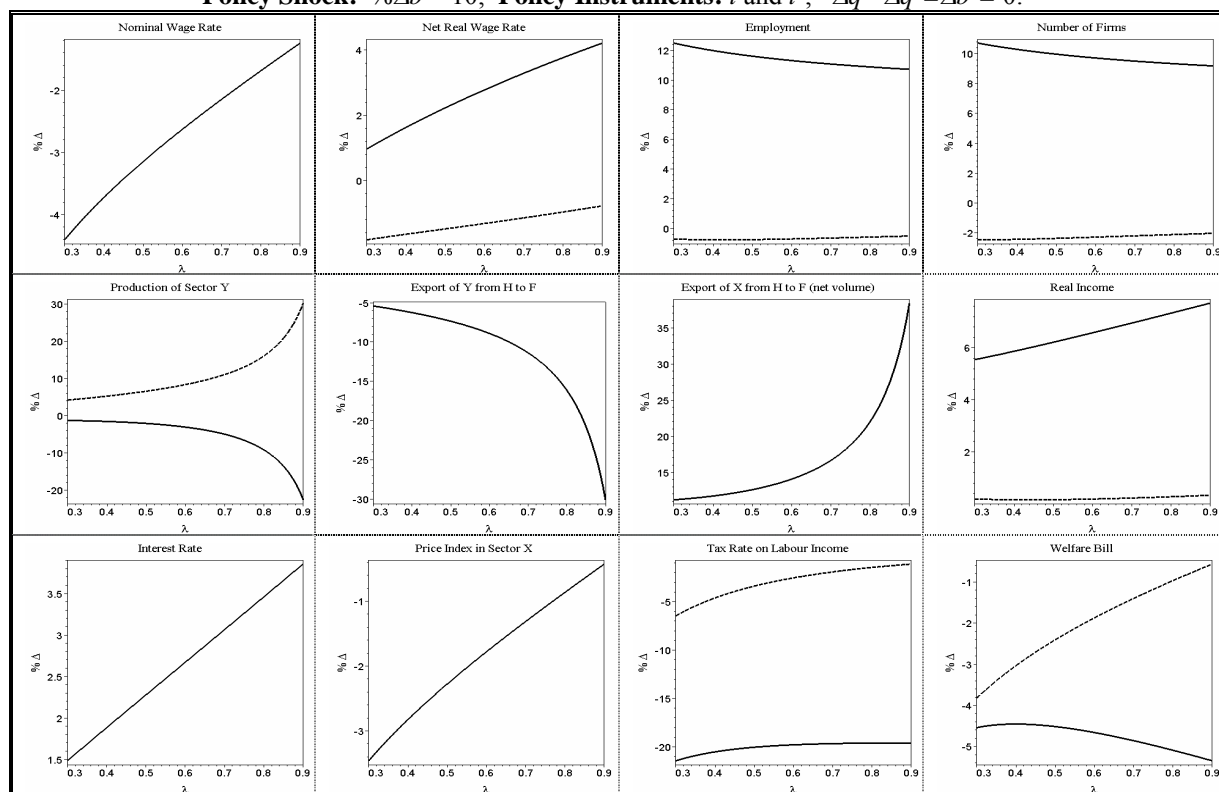
To gain more insight into the consequences of a unilateral increase in unemployment benefit by the government in country H and the role of vertical linkages in transmitting the effects of the policy, we refer to the numerical multipliers in Table 2 below. We use the indirect utility function, given by $V = M/P + \tilde{V}(\bar{L} - L)$, as a measure of aggregate welfare. For ease of comparison across the different cases, we plot the numerical multipliers for V for

¹⁴ Mathematically, it can be shown that a sufficient condition for the UU to slope positively is that the unions' monopoly power, ε (ε^*), is *sufficiently* inelastic in L (L^*). This condition – which is in line with the assumption of small unions – also ensures a trade-off in (22) between the real wage set by the unions and the employment level set by firms. It is worth noting here that the shapes of the GG and UU ensure existence and uniqueness of equilibrium, whilst the direction of arrows above and below the curves ensures stability.

all policy shocks in Table A5 in the Appendix. Consistently with the above analysis, the policy multipliers show that:

- (i) Country H becomes relatively specialised in the production, and becomes a net exporter, of good X (L and N increase in H and may fall in F).
- (ii) Country F becomes relatively specialised in the production, and becomes an exporter, of good Y .
- (iii) Real (and nominal) income increases substantially in H and does not fall in F.
- (iv) The tax rate on labour income falls in both countries but substantially more in H.
- (v) The nominal wage falls in both countries.
- (vi) Country H experiences substantial welfare gains, and there are also positive welfare spillovers to country F.
- (vii) Both the extent of production and trade specialisation and the welfare gains (to both countries) generated by the policy are positively related to the extent of vertical linkages.

Table 2. Multipliers for the Unilateral Welfare Policy without Capital Mobility†
Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and t^* ; $\Delta q = \Delta q^* = \Delta b^* = 0$.



† Parameter values are $\tilde{V} = 1$; $\mu = 0.4$; $\sigma = 6$; $\alpha = 0.7$; $\bar{K} = \bar{L} = 10^6 \phi$; $J = 100$; $b_o = b_o^*$; $t_o = t_o^*$; $q_o = q_o^*$; and $t_o = q_o = 0.5b_o$. When multipliers for H and F are different the graph for F is depicted by a broken curve.

To highlight the intuition underlying these effects, the adjustment process following the policy can be sketched as follows. For a given mass of firms ($N+N^*$), a unilateral increase in b in country H will initially prompt the unions in that country to set higher

nominal wages. This will have two effects. First, as firms mark-up their prices, the higher domestic wage translates into a higher price for each of the domestic varieties of the differentiated good, thus raising the price index of this good both in H and in F. This triggers a substitution of Y for X by consumers and of K for X by firms producing Y ; hence, this first effect works towards a reduction of the aggregate demand for X . Second, the increase in the benefit rate and the subsequent rise in the wage rate in H raise aggregate nominal income and stimulate home consumers' demand for both Y and X (note that in the absence of trade barriers, the increase in the demand for X will affect home and foreign firms symmetrically). In addition, the higher demand for Y will, via the vertical linkages in production, lead to a further increase in the demand for X . It can be shown that of these two immediate impacts of the policy – i.e. before mass of firms, employment levels and other prices adjust – the latter dominates (see A4 in the Appendix), generating a net increase in the demand for X which will trigger entry into sector x .

Although, given the absence of trade barriers, both countries experience a symmetric increase in the demand for X , the extent of entry of new firms into the sector will be different in the two economies. This is because the higher wage and the resulting higher price for each variety in H initially imply that while the industry price index increases for both countries, p/P_x increases in H but p^*/P_x falls in F. As a result, whilst the monopoly power of unions falls in H, it increases in F – i.e. ε falls and ε^* increases, see point (IV) in A2 in the Appendix – thus prompting the unions to bid down (up) the nominal wage in H (F), with opposite consequences on firms' costs in the two countries.

It is worth noting that because the aggregate scale economies generated by sector x are *fully international*, it is irrelevant to sector y 's producers where the intermediate varieties are produced – i.e. the returns to scale are not country or location specific. Therefore, under free trade, both countries will equally benefit from the positive pecuniary externality brought about by the overall expansion of product variety in sector x which will – ceteris paribus – reduce P_x in both countries and lead to: (i) a higher productivity of the intermediate goods that will reduce the cost of production of good Y ; (ii) a lower consumer price index that will foster demand for final goods via the real income effect; and (iii) a substitution of X for Y by consumers, and of X for K by sector y 's producers, that will further stimulate demand for X . The combined effects of these forces will strengthen the increase in the demand for X , and will give rise to a virtuous circle of entry of new firms into the intermediate industry, higher employment and higher aggregate efficiency.

By expanding, sector x will draw resources (i.e. capital) from sector y . Clearly, relative to F, the larger extent of entry in H will draw considerably more on the country's limited endowment of capital. Hence, return to capital will be relatively higher in H where less capital remains available for the production of good Y . This process is reflected in the emergence of a specialisation pattern whereby country H becomes a net exporter of good X , and country F is left to meet the excess demand for good Y . The growth in production of Y in F occurs by shifting capital from sector x , and will not come to a halt until the return to capital in F and H are equalised at a level that is higher than in the initial equilibrium.

Given the expansionary consequences of the policy, its budgetary impacts do not lead to higher tax rates. In fact, the tax rate falls in both countries. In H, the net effect of an increase in b and L and of a fall in w is to *reduce* the unemployment benefit bill. The government tax revenue, however, increases since the proportional increase in L exceeds the proportional fall in w , and r rises. Hence, the government affords to reduce t considerably despite the increase in b . In F, the rise in capital income (since $r^* \bar{K} = r \bar{K}$) and employment turn out to be sufficient to more than compensate for the reduction in labour income tax revenue due to the fall in the wage rate, hence leading to a moderate reduction in t^* .

As is evident from the multipliers in Table A5 in the Appendix, albeit to different extents, both countries benefit from the unilateral policy action undertaken by the government in H. The ultimate source of these welfare gains lies in the partial correction of the sub-optimal production of intermediate varieties induced by the policy. Also note that the magnitude of the welfare gains is directly related to the extent of specialisation (measured by the degree of divergence between the two countries' production structures), and both are increasing in the strength of vertical linkages between sectors (measured by λ). In fact, the larger is λ , the greater will be: (i) the increase in the demand for intermediates following the rise in aggregate demand in H, (ii) the entry of new firms in sector x , and (iii) the pressure that the latter exerts on the country's capital endowments – leading it to specialise in sector x .

In sum, starting from a completely symmetric situation, the country that raises its unemployment benefit rate becomes relatively specialised in the production of good X , it experiences an unambiguous increase in its employment and income, and its trading partner may also benefit from positive spillover effects. We now briefly examine the cases in which the foreign government offsets the effect of the shock by choosing an instrument other than the tax rate on labour income.

4.1.2. Effects of a rise in b when the foreign government uses q^* or b^*

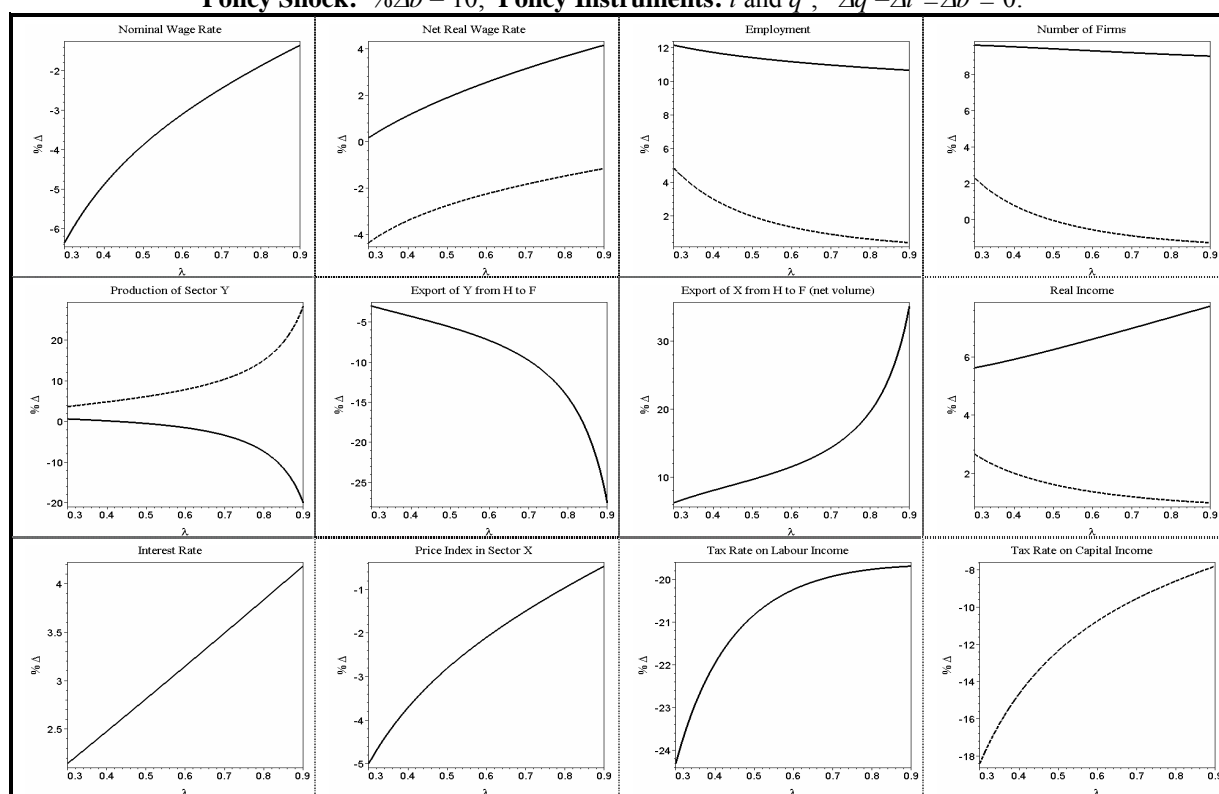
The multipliers for the case in which the government in country F uses q^* are given in Table 3. A comparison between these multipliers and those in Table 2 shows that the main results are qualitatively unaltered: as a result of the unilateral increase in b , country H (F) becomes relatively specialised in good X (Y), and both countries experience increases in real income and (as shown in Table A5) in aggregate welfare. To see what happens to q^* , we rewrite the government budget constraint in country F as

$$b^*(\bar{L} - L^*) = t^*L^* + q^*\bar{K}(r^*/w^*), \quad (15')$$

which shows that, given that L^* and r^* increase and w^* falls, q^* needs to fall to satisfy the government budget constraint¹⁵.

Table 3. Multipliers for the Unilateral Welfare Policy without Capital Mobility[†]

Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and q^* ; $\Delta q = \Delta t = \Delta b^* = 0$.



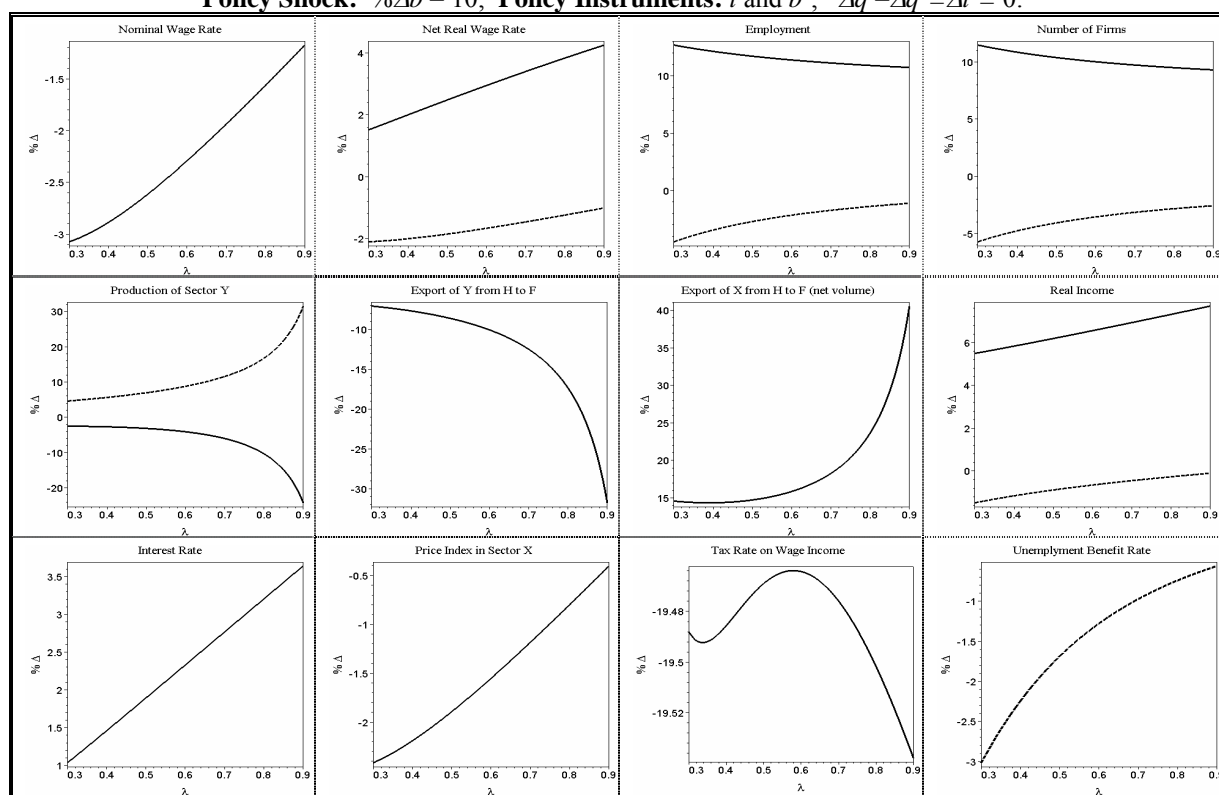
[†] See notes to Table 2.

The multipliers for the case in which the government in F uses b^* to offset the budgetary implications of the shock are given in Table 4. Whilst the policy induced pattern of specialisation is as in the previous cases, and employment, real income and welfare all

¹⁵ In this case and in all the following cases, the effects of the policy could be illustrated graphically by means of the appropriate UU and GG curves as in Figure 1.

increase in H , in this case there are negative spillover effects, with country F experiencing a fall in employment, real income and welfare. This is because, the effects of the policy shock on the foreign government's budget constraint now requires a *reduction* in its unemployment benefit rate. In other words, in terms of provision of welfare protection, the foreign governments' policy is *contractionary*. Inspection of (15') shows that, as a result of the fall in employment, b^* will have to fall if the increase in interest rate is not sufficient to generate an increase in capital income which is large enough to compensate for the lower labour income tax revenue and higher welfare bill, $b^*(\bar{L} - L^*)$.

Table 4. Multipliers for the Unilateral Welfare Policy without Capital Mobility[†]
Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and b^* ; $\Delta q = \Delta q^* = \Delta t^* = 0$.



[†] See notes to Table 2.

The results so far suggest that whilst some of the specific effects of a unilateral increase in unemployment insurance in one country depend on the fiscal instrument used by governments, the broad qualitative effects in all cases are robust in challenging the received wisdom that welfare states and international openness are incompatible. It may of course be argued that the crucial factor behind the clash between globalisation and welfare states is the high degree of capital market integration that characterises the current wave of globalisation and, by leading to a shrinking tax base, makes it more difficult for governments to support programmes of income redistribution. In the following subsection we extend the model to allow for capital mobility and examine whether it reverses the results obtained above.

4.2. Unilateral policy shocks with capital mobility

With capital mobility, the stock of capital available to a country can exceed or fall short of its endowment, \bar{K} , as capital is now free to flow in or out of the country. Assuming homogeneity and free mobility of capital, the capital demand equations in (12) in Table 1 will now be replaced by

$$\left\{ \begin{array}{l} K = \frac{(1-\alpha)Npx + (1-\lambda)Y}{r}, \\ K^* = \frac{(1-\alpha)N^*p^*x^* + (1-\lambda)Y^*}{r^*}, \\ K + K^* = 2\bar{K}. \end{array} \right. \quad (12')$$

Using the source principle as tax rule, so that the income generated by an inflow of capital is taxed before it is repatriated, the two countries' government budget constraints in equations (15) in Table 1 are now modified as follows

$$\left\{ \begin{array}{l} bw(\bar{L} - L) = twL + qrK, \\ b^*w^*(\bar{L}^* - L^*) = t^*w^*L^* + q^*r^*K^*. \end{array} \right. \quad (15'')$$

Arbitrage in the international capital market ensures that the interest parity condition holds whereby the net of tax interest rates are equalised across the two countries, hence:

$$(1-q)r = (1-q^*)r^*. \quad (28)$$

Finally, the balance of payment equations, i.e. (23) in Table 1, will have to be modified to take account of interest payments,

$$\left\{ \begin{array}{l} (Y - (1-\mu)M) + (Npx - E_x) + (1-q)r(\bar{K} - K) = 0, \\ (Y^* - (1-\mu)M^*) + (N^*p^*x^* - E_x^*) + (1-q^*)r^*(\bar{K} - K^*) = 0. \end{array} \right. \quad (23')$$

The rest of the equations are as in Table 1¹⁶ and the characteristics of the model outlined in subsection 3.1 are preserved except point (III) in 3.1.3 which ought to be modified as follows to take account of capital flows between the countries (see A2 in Appendix):

¹⁶ Note that, given the interest parity condition in (28), the two countries' income equations do not change and are still given by (16).

(III') When capital flows from F to H, $K/K^* > 1$, and a sufficient condition for $Y/Y^* > 1$ is $L/L^* = 1$, but $Y/Y^* > 1$ can also result even if $L/L^* > 1$. When capital flows from H to F, $K/K^* < 1$, and $Y/Y^* < 1$ will follow if $L/L^* \geq 1$.

In addition, given that $r^* = r$ is always restored, the interest parity condition in (28) also implies that $q^* = q$ must also hold in equilibrium. As a result, with free capital mobility governments lose their full control over the capital income tax rate as an independent fiscal instrument.

4.2.1. *Effects of a rise in b when budgetary impacts are offset by t and t^**

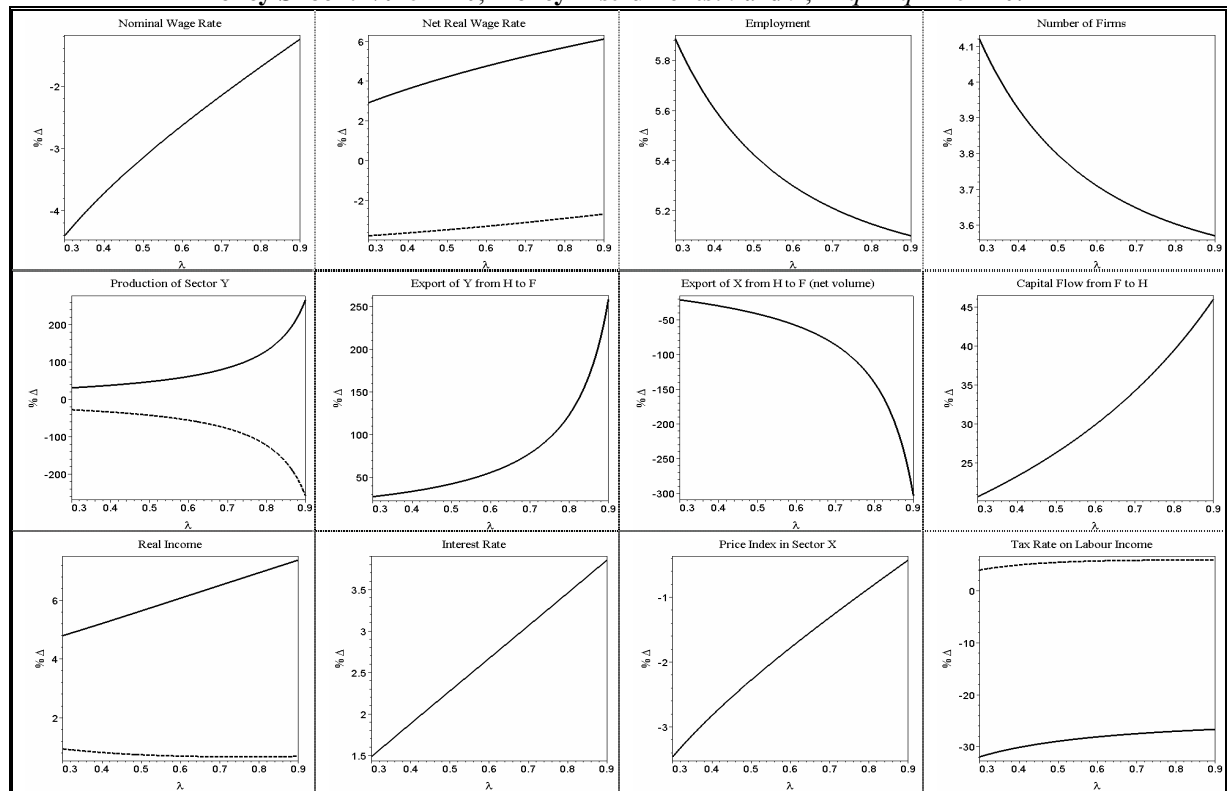
Starting from a symmetric initial equilibrium, in this section we examine the effects of an increase in unemployment benefit in country H when both governments use the labour income tax rates to offset the budgetary implications of the shock. The multipliers associated with this case are illustrated in Tables 5 and A5 and suggest that:

- (i) Capital flows from country F to country H.
- (ii) The level of employment and the mass of firms in sector x rise in *both* countries and this expansion in sector x is symmetric, i.e. $L^* = L$ and $N^* = N$ hold in the new equilibrium.
- (iii) Contrary to the no-capital-mobility case, country H becomes relatively specialised in sector y .
- (iv) Both countries experience increases in real income and aggregate welfare, but these are larger in country H.
- (v) The labour income tax rate falls considerably in country H but increases slightly in country F.

As in the no-capital-mobility case, in country H the rise in b leads to an increase in aggregate demand for final goods that translates into a higher demand for both primary factors and for intermediate varieties. As discussed in subsection 4.1.1, the ensuing entry into sector x will be more enhanced in H than in F. As a result of the stronger excess demand pressure on capital that follows, country H will experience an incipient and temporary positive interest rate differential, i.e. $r > r^*$, that will bring about a capital inflow. This will alter the way in which the policy shock affects the pattern of international specialisation. In fact, capital mobility relaxes (tightens) the resource constraint on capital in H (F). As a result, country H (F) will experience a weaker (stronger) substitution of L and X for K – in sector x and y respectively – that will reduce (increase) the extent to which the demand for X rises, relative to the no-capital-mobility case. In country H (F), a shift of resources from sector x

(y) to sector y (x) will follow, which ultimately reflects a shift of resources from country F to country H *within* sector y. This process will continue until the interest parity condition is restored. In the new equilibrium, the expansion of sector x in H is smaller than when capital is not mobile and the two countries experience the same growth in employment and number of firms. Thus, in a fashion somewhat consistent with Ethier's complementarity theorem (Ethier, 1982), the policy induced international transfer of capital from F to H generates an inequality in the two countries' factor endowments which changes the pattern of trade from one (in the initial symmetric equilibrium) which is entirely intra-industry, to one (in the post policy-shock equilibrium) which is both intra- and inter-industry, with intra-industry trade in sector x and with country H now being an exporter of good Y.

Table 5. Multipliers for the Unilateral Welfare Policy with Capital Mobility[†]
Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and t^* ; $\Delta q = \Delta q^* = \Delta b^* = 0$.



[†] See notes to Table 2.

Finally, two points are worth noting. First, as in the no-capital-mobility case, the degree of specialisation in production and trade is higher the stronger are the vertical linkages in production: the larger is λ , the greater will be (i) the increase in the demand for intermediates following the initial rise in aggregate demand in H; (ii) the ensuing upward pressure on the return to capital; and (iii) the flow of capital from F to H and the ability of country H to increase its production of good Y. Second, the tax rate in country F will rise if

the shrinking tax base it experiences as a result of the capital outflow more than compensates the positive spillover effects of the policy on the country's income.

These results suggest that even with capital mobility an expansion of the welfare state can be afforded and it does not harm a country's economic performance vis-à-vis its trading partner. First, contrary to what implied by the dominant analysis of the effects of globalisation, a unilateral *expansion* and *not* a *retrenchment* of welfare protection attracts internationally mobile capital. Furthermore, the policy is typically beneficial for the country that implements it *and* for its trading partner, despite the fact that the latter may experience a shrinking tax base.

It may be argued that when capital is mobile, in response to the spillover effects of a policy shock in one country, the government of a trading partner may attempt to prevent the exit of capital by adjusting its capital income tax rate. Therefore, we next examine the policy effects in this context, first when H and F respectively use t and q^* , and next when they use q and q^* , as policy instrument.

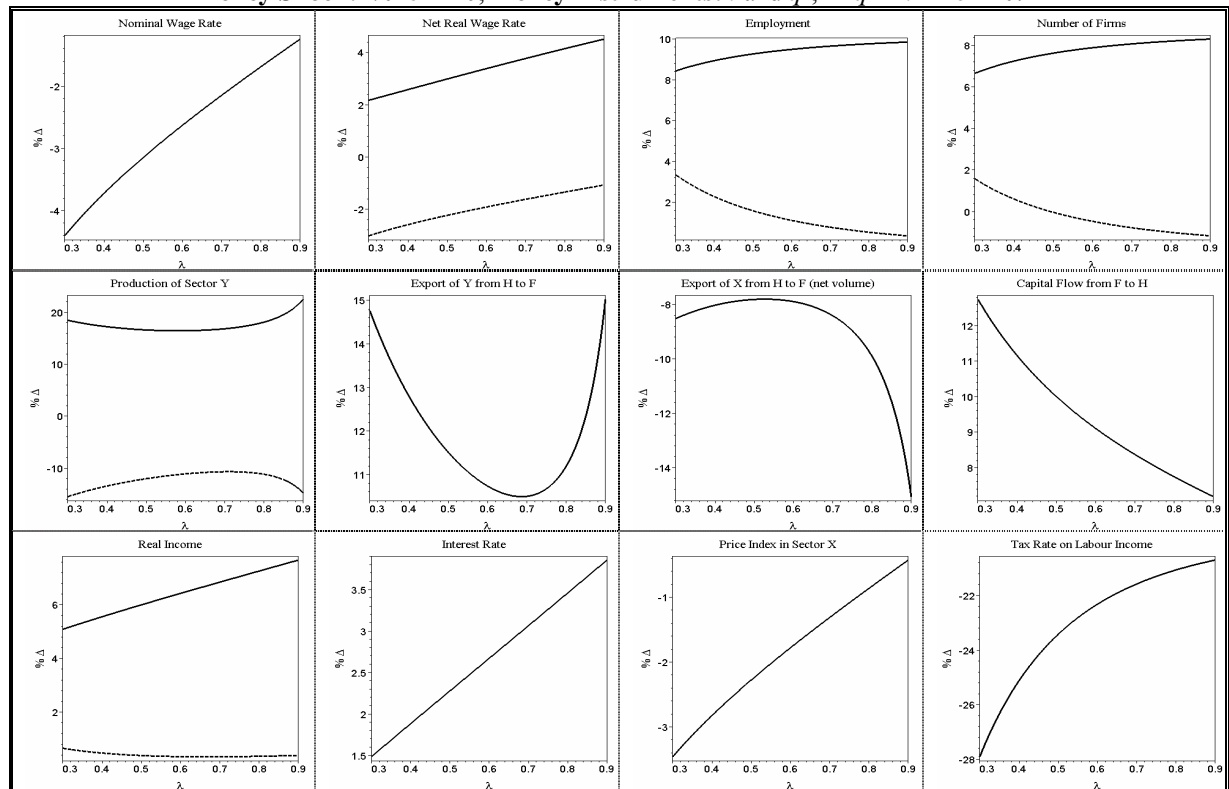
4.2.2. Effects of a rise in b when budgetary impacts are offset by t and q^*

Starting from a symmetric initial equilibrium, even when governments in H and F respectively use t and q^* to offset the budgetary implications of an increase in unemployment benefit rate in country H, the new equilibrium will be characterised by full price equalisation (see subsection 3.1 above). Hence, although the equality $q^* = q$ is likely to be violated during the transition period, it will have to be restored in the new equilibrium, where $r^* = r$ and the interest parity condition in (28) hold. Thus, $dq^*/db = 0$ and it follows that, by choosing to keep q intact, the government in H ultimately divests its trading partner of its 'long-run' control on q^* . However, in this case too an initial rise in r/r^* leads to an outflow of capital from F, resulting in the same qualitative effects as when the two governments use t and t^* . The multipliers for this case are given in Table 6 and in Table A5 and suggest that:

- (i) Capital flows from F to H and employment rises in both countries, but more substantially in H, hence in the new equilibrium $L > L^*$.
- (ii) Sector x always expands in H (i.e. N rises) and, for sufficiently strong vertical linkages, it will shrink in F (i.e. N^* falls).
- (iii) Sector y shrinks in F and expands in H – since in this case $r(K - K^*)$ sufficiently dominates $w(L - L^*)$ (see A2 in the Appendix). As a result, country H becomes an exporter of good Y and a net importer of good X .
- (iv) Real income and aggregate welfare increase considerably (marginally) in H (F).

The rise in income in H enables its government to reduce the tax rate on labour income. In contrast, the choice of capital income tax rate as policy instrument by the government in F implies that the policy cannot affect that rate, as q^* is ultimately bounded by q . This policy, nevertheless, limits the outflow of capital from F. As a result, because the shift of resources – both between the two countries and between the two sectors – will be limited, compared to when the two governments use t and t^* , a less enhanced pattern of international specialisation emerges.

Table 6. Multipliers for the Unilateral Welfare Policy with Capital Mobility[†]
Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and q^* ; $\Delta q = \Delta t^* = \Delta b^* = 0$.



[†] See notes to Table 2.

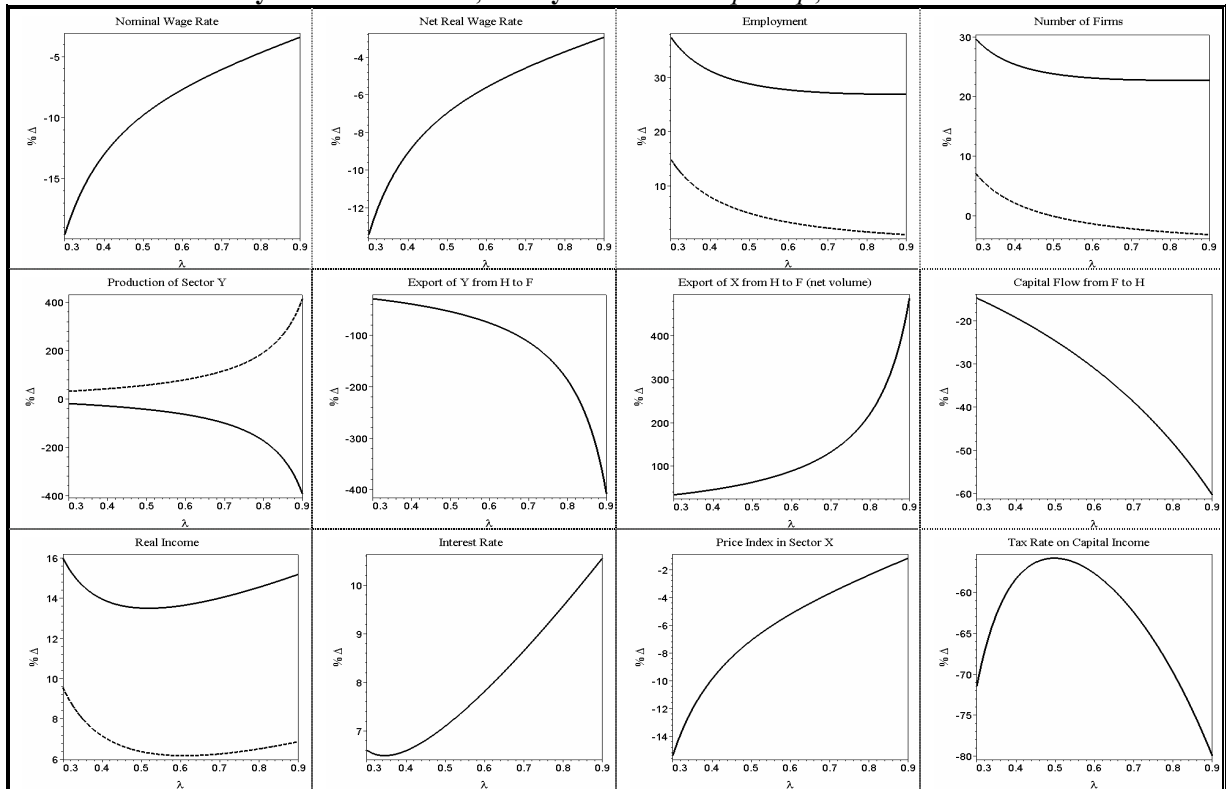
4.2.3. Effects of a rise in b when budgetary impacts are offset by q and q^*

We now consider what may be loosely interpreted as a situation of ‘tax competition’, where *both* governments use the tax rate on capital (the mobile factor) to offset the impact of the policy shock on their budgets. Again, given the interest parity condition in (28) and the fact that in the new equilibrium all prices are equal (see subsection 3.1), $q = q^*$ must ultimately result. But q may diverge from q^* in the transition period and, unlike the previous case, their new (common) equilibrium value can now be different from that in the initial symmetric equilibrium. The multipliers for this case are illustrated in Table 7 and in Table A5 and show that:

- (i) Capital flows from H to F and employment rises in both countries, but more substantially in H, hence in the new equilibrium $L > L^*$.
- (ii) Sector x always expands in H (i.e. N rises) and, for sufficiently strong vertical linkages, it will shrink in F (i.e. N^* falls).
- (iii) Sector y shrinks in H and expands in F.
- (iv) Real income and aggregate welfare increases in both countries, but more so in H.
- (v) The rise in income enables both governments to reduce the tax rate on capital income.

Table 7. Multipliers for the Unilateral Welfare Policy with Capital Mobility[†]

Policy Shock: $\% \Delta b = 10$; **Policy Instruments:** q and q^* ; $\Delta t = \Delta t^* = \Delta b^* = 0$.



[†] See notes to Table 2.

In this case too, the usual adjustment process following a rise in b implies that country H initially experiences a positive interest rate differential. The resulting incipient inflow of capital will however be halted and reversed by the reduction of q^* in country F. This will lead to an expansion of sector y in F that – via vertical linkages – will result in an increase in the demand for good X that will be satisfied by imports of the intermediate varieties from H. The fact that sector y expands in F can be seen from point (III') in page 22. The pattern of trade, therefore, reverts to the no-capital-mobility case, with country H becoming a net exporter (importer) of good X (Y). The policy will have adverse redistributive effects on the immobile factor (i.e. labour) whose real rate of return (w/P) falls. However, in both countries (albeit more in country H) aggregate income increases. This, together with the fall in

unemployment, implies that both governments can afford to reduce the tax rate on capital. Finally, both countries experience welfare gains that are the highest amongst the ‘unilateral’ cases.

Hence, a move to a more generous protection against unemployment is more welfare enhancing when there is capital mobility and governments use the tax rate on capital income as their budgetary policy instrument (see Table A5). Although – consistently with the conventional wisdom – this policy favours capital and has adverse redistributive effects for labour, these findings do not lend support to the prediction that a race-to-the-bottom in social policies is likely to result from globalisation.

In general, the results obtained in this subsection are consistent with the no-capital-mobility ones and suggest that whilst capital mobility affects the pattern of specialisation and income distribution, it does not per se lead to a race to the bottom in social policies.

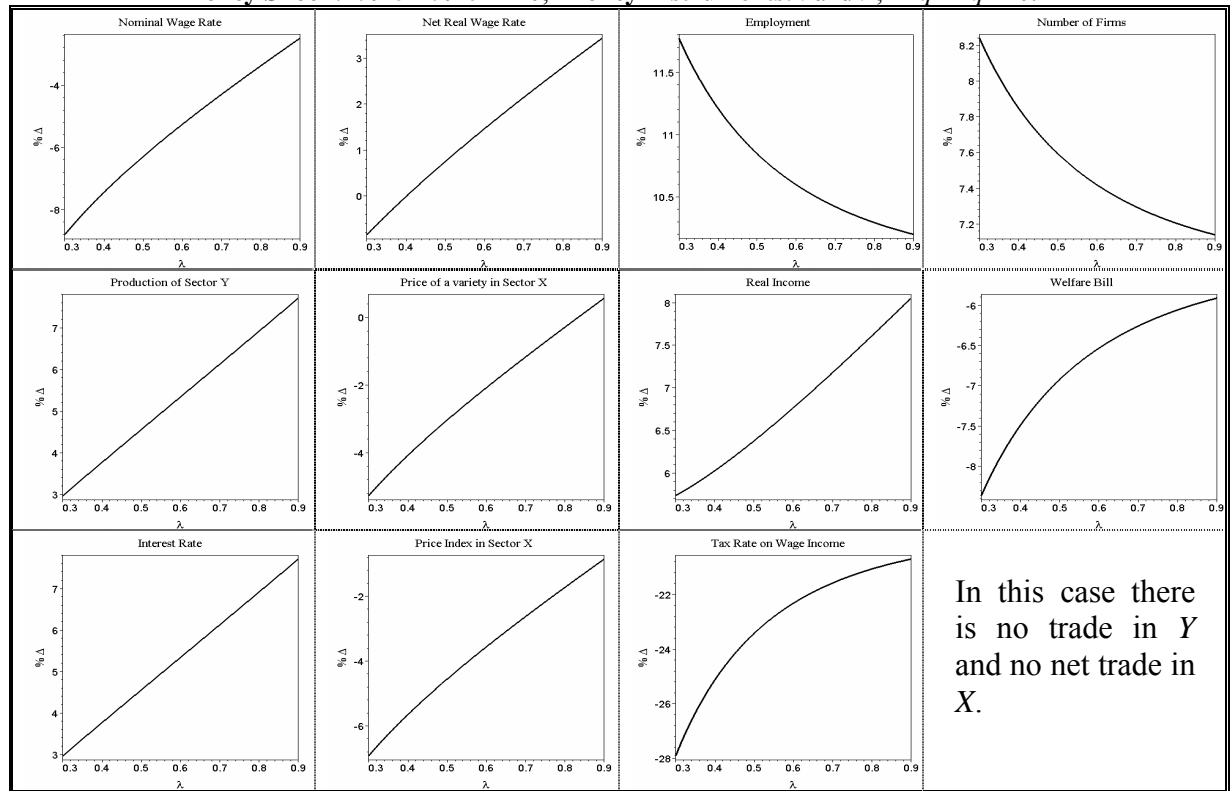
4.3. Symmetric policy shocks

The process of globalisation, perhaps due to the growing interdependence of the integrating economies, has been accompanied by a tendency towards a convergence in the volume and composition of government expenditures. This convergence has been found to be particularly strong amongst EU countries whose economies, bound by the Stability and Growth Pact, are characterized by more similar production and government preference structures (see Sanz and Velázquez, 2003). This evidence begs the question of how a synchronized – as opposed to unilateral – policy affects the economies of highly integrated countries.

To address this issue, in this sub-section we examine the effects of *fully symmetric* policies, when *both* governments increase their welfare provision and offset the budgetary effects of the policy shock by adjusting the *same* factor income tax rate. In the case of no capital mobility, we consider the use of labour income tax as instrument; with capital mobility, we look at the use of capital income tax rates¹⁷. The multipliers for these two cases are illustrated in Tables 8 and 9 respectively. As expected, in both cases (but to a larger extent under capital mobility), a fully harmonised *increase* in unemployment protection generates a symmetric expansion of both sectors and leads to identical improvements in aggregate efficiency and welfare in both countries.

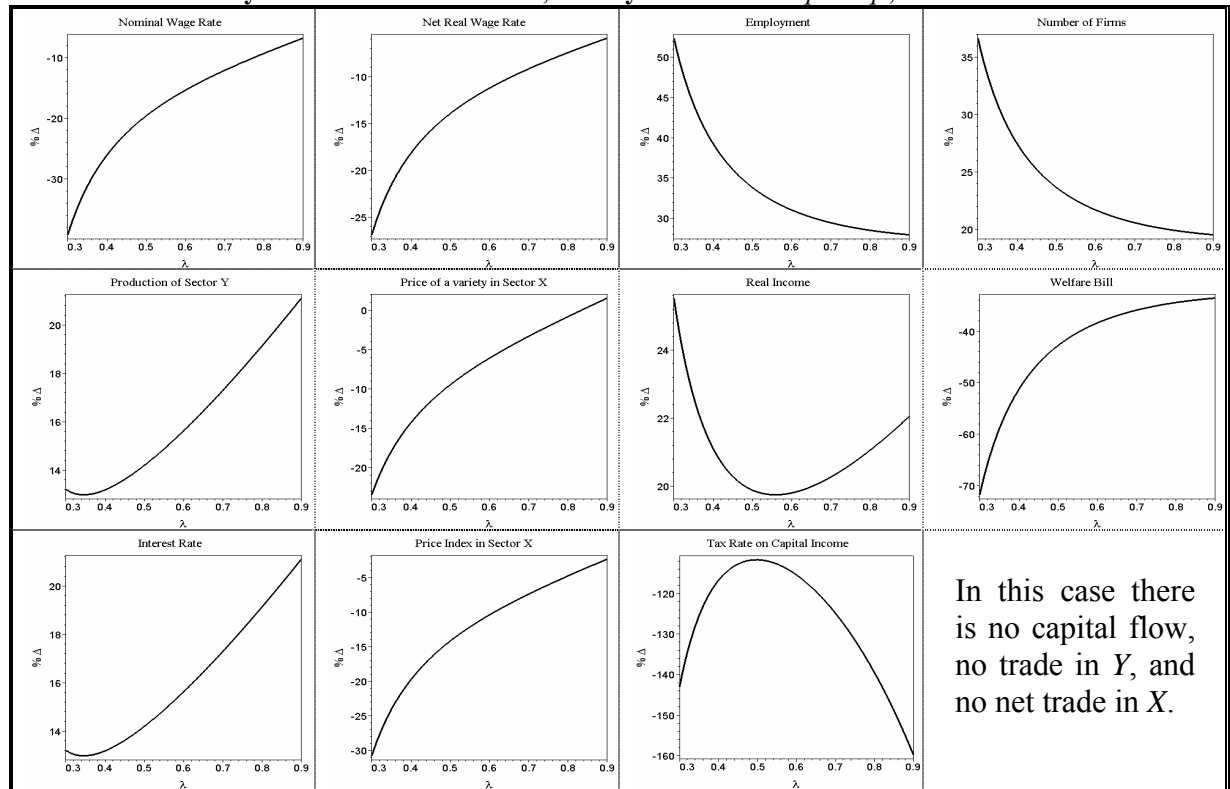
¹⁷ Although with fully harmonised policy shocks there will not be any international reallocation of capital even when capital mobility is allowed for (due to the assumed symmetry between the two countries), with capital mobility the existence of the interest parity condition imposes a restriction on the adjustment of the rate of returns to capital or on the capital tax rates. As a result, the multipliers with and without capital mobility will be quantitatively different whichever instruments governments choose to use.

Table 8. Multipliers for the Symmetric Welfare Policy Shock without Capital Mobility[†]
 Policy Shock: $\% \Delta b = \% \Delta b^* = 10$; Policy Instruments: t and t^* ; $\Delta q = \Delta q^* = 0$.



[†] See notes to Table 2.

Table 9. Multipliers for the Symmetric Welfare Policy Shock with Capital Mobility[†]
 Policy Shock: $\% \Delta b = \% \Delta b^* = 10$; Policy Instruments: q and q^* ; $\Delta t = \Delta t^* = 0$.



[†] See notes to Table 2.

In general, comparison of these multipliers with those associated with unilateral policies suggests that a harmonised expansion of the system of welfare protection leads to stronger positive welfare effects, regardless of the tax instruments used and with or without capital mobility. It therefore follows that the negative welfare effects of a joint retrenchment of the welfare state would be stronger than those resulting from a unilateral one. In other words, were governments to follow the conventional wisdom and *both* contract their unemployment insurance provision, both countries would experience welfare losses that would be larger than if only one government unilaterally did so.

5. SUMMARY AND CONCLUDING REMARKS

This paper has examined the role of welfare state policies in determining the pattern of specialisation and the level of aggregate welfare within a two-sector-two-country model of international trade that allows for economy-wide increasing returns to scale. Our analysis lead to three major conclusions, summarised below.

- (1) International trade and capital mobility need not lead to a reduction in the revenue raising capacity of governments, but can complement social insurance policies in increasing welfare, thus facilitating the provision of a more generous welfare protection. Hence, a race to the bottom in social standards does not inevitably emerge from the ‘shrinking-tax-base’ that is an expected consequence of international capital mobility. Despite the fact that capital mobility affects the pattern of specialisation and the distribution of the welfare gains amongst factors of production, it interacts with welfare state policies in increasing welfare, *even* in those cases when capital flows out of the country that initiates the policy shock. Therefore, although the specific effects of the policy depends on the policy mix adopted by the two governments and on the strength of the vertical linkages between sectors, the major qualitative results of the paper are robust and casts doubt on the universality of the conventional wisdom according to which the pressures of globalisation can only be met by a retrenchment of social transfer programmes.
- (2) Unilateral attempts to roll back the welfare state would be welfare reducing for the country which implements the policy and will typically have negative welfare spillover effects on its trading partners. Synchronised retrenchments would yield even larger welfare losses for both economies.

- (3) Welfare state policies affect the income distribution across factors and the pattern of specialisation in production and trade. Empirical work is required, to extract the stylised facts from an appropriate cross-country dataset, in order to throw light on the exact nature of this influence. However, despite the differences in the theoretical set-up – which prevent direct comparability of the results – our conclusions are broadly consistent with those studies that pinpoint the role of social protection in determining the sectors in which a country specialises (e.g. Estevez-Abe, Iversen and Soskice, 2001, where the welfare state affects skill formation).

Our findings, which are consistent with and help explaining the evidence that goods and capital markets integration has not led to *significant* reductions in welfare state provision and in tax burdens in OECD countries, rest on the imperfectly competitive nature of the economy. In the labour market, unionisation implies that wages are positively related to unemployment benefit and income tax rates. In the goods market, monopolistic competition leads to a suboptimal production of varieties and to the emergence of pecuniary externalities stemming from the links between upstream producers and their customers – i.e. the downstream industry and final consumers. Effectively, the interaction between unions and government policy contributes to the extraction of the rents associated with these pecuniary externalities, thus alleviating the sub-optimal provision of varieties. As a result of the redistributive policy, these rents are ultimately passed on to the consumers of the country that initiates the policy – via a higher aggregate productivity, lower prices and higher incomes – as well as benefiting to some extent the ‘foreign’ consumers – via the existence of international returns to scale and free trade.

It is important to stress that the assumption that unionisation is limited to the upstream sector does not affect the qualitative nature of the results. More generally, unionisation is not necessary for the above results to emerge; any form of labour market imperfection (e.g. efficiency wages) that gives rise to a positive link between wages and policy instruments will lead to similar conclusions.

Finally, our analysis does not intend to suggest that welfare state and redistribution policies are the best way to trigger the virtuous process of cumulative causation described above. It may well be the case that other policies (e.g. industrial policies) may be better suited to tackle the type of market imperfections characterising this model. This issue, nevertheless, does not diminish the relevance of our results. The welfare state has played a specific social and political role in advanced industrial economies and attempts to retrench it are being met by opposition that could lead to a backlash against trade and capital markets

liberalisation. Our concern in this paper has been to shed light on the issue of whether openness and this type of policies are incompatible and our findings suggest that this needs not be the case.

References

- Acemoglu, D. and R. Shimer (2000). "Productivity Gains from Unemployment Insurance", *European Economic Review*, 44, 1195-1224.
- Alesina, A. and R. Perotti (1997). "The Welfare State and Competitiveness", *American Economic Review*, 87, 921-39.
- Baldwin R. and Krugman, P. (2000). "Agglomeration, Integration and Tax Harmonisation", CEPR Discussion Paper No. 2630.
- Bartelsman, E.J., Caballero, R.J. and Lyons, R.K. (1994). "Customer- and Supplier-Driven Externalities", *American Economic Review*, 84, 1075-1084.
- Boeri T., A. Grugiavini, and L. Calmfors (Eds.) (2001). *The Role of Unions in the Twenty-First Century*, Oxford University Press.
- De Grauwe, P. and M. Polan (2003). "Globalisation and Social Spending", CESifo Working Paper No. 885.
- Estevez-Abe, M., T. Iversen, and D. Soskice (2001). "Social Protection and Formation of Skills: A Reinterpretation of the Welfare State", in *Varieties of Capitalism – The Institutional Foundations of Comparative Advantage*, P. A. Hall and D. Soskice (eds), Oxford University Press.
- Ethier, W.J. (1982). "National and International Returns to Scale in the Modern Theory of International Trade", *American Economic Review*, 72, 389-405.
- European Commission (2002). *Public Finances in EMU*, European Economy – Report and Studies, 3.
- Garrett, G. (1998). *Partisan Politics in the Global Economy*, Cambridge University Press, Cambridge.
- Garrett, G. and D. Mitchell (2001). "Globalisation, Government Spending and Taxation in the OECD", *European Journal of Political Research*, 39, 145-177.
- Hiscox, M. J. (2002). *International Trade and Political Conflict: Commerce, Coalitions, and Mobility*, Princeton University Press.
- Matsuyama, K. (1995). "Complementarities and Cumulative Processes in Models of Monopolistic Competition", *Journal of Economic Literature*, XXXIII, 701-29.
- Molana, H. and C. Montagna (2002). "Cumulative Causation, Capital Mobility, and the Welfare State", GEP Research Paper 2002/17, Leverhulme Centre for Globalisation and Economic Policy, School of Economics, University of Nottingham.
- OECD (1996). Revenue Statistics, various issues, OECD Secretariat, Paris.

- Ploeg, F. van der (2003). "Do Social Policies Harm Employment and Growth?", CESifo Working Paper No. 886.
- Rodrik, D. (1997). *Has Globalisation Gone too Far?*, Institute for International Economics, Washington, DC.
- Rodrik, D. (1998). "Why Do More Open Economies Have Bigger Governments", *Journal of Political Economy*, 106, 997-1032.
- Sanz, I. and F. J. Velázquez (2003). "Has the European integration approximated the composition of government expenditures? A comparative analysis between the EU and Non-EU countries of the OECD", GEP Research Paper 2003/09, Leverhulme Centre for Globalisation and Economic Policy, School of Economics, University of Nottingham.
- Swank, D. (2002). *Global Capital, Political Institutions, and Policy Change in Developed Welfare States*, Cambridge University Press, Cambridge.
- Venables, A.J. (1996). "Equilibrium Location of Vertically Linked Industries", *International Economic Review*, 37, 341-59.

Appendix

A1. Derivation of the unions' wage setting rule, equation (22), and monopoly power, ε .

The wage setting equation for a typical union in country H is derived by choosing w_j to maximise the objective function in equation (13). The first order condition is

$$\frac{dV_j}{dw_j} = \frac{1}{L_j} \left[\left((1-t)L_j + b(\bar{L}_j - L_j) \right) \left(\frac{1}{P} - \frac{w_j}{P^2} \frac{dP}{dw_j} \right) + w_j(1-t-b) \frac{dL_j}{dw_j} - \tilde{V} \frac{dL_j}{dw_j} \right] = 0,$$

which can be rearranged as

$$\frac{1}{P} \left((1-t-b)L_j + b\bar{L}_j \right) (1 - \varepsilon_{jP}) - L_j(1-t-b) \varepsilon_{jL} + \tilde{V} \frac{L_j}{w_j} \varepsilon_{jL} = 0, \quad (\text{A1.1})$$

where

$$\varepsilon_{jP} = \frac{w_j}{P} \frac{dP}{dw_j} = \frac{d \log P}{d \log w_j}. \quad (\text{A1.2})$$

and

$$\varepsilon_{jL} = -\frac{w_j}{L_j} \frac{dL_j}{dw_j} = -\frac{d \log L_j}{d \log w_j}, \quad (\text{A1.3})$$

Equation (22) is obtained by solving (A1.1) for $\frac{w_j}{P}$. The equivalent terms for country F can be derived in the same way.

The expressions on the right-hand sides of (A1.2) and (A1.3) are evaluated as follows. First, from the definition of consumer price index – i.e. equation (14), $P = P_x^\mu$ – we obtain $\varepsilon_{jP} = \mu \frac{d \log p_x}{d \log w_j}$. Next, rearranging the CES price index in equation (5) to

separate the prices set by the firms whose workers belong to union j in country H from the rest of the prices, i.e. $P_x = \left(\int_{i \in N_j} p_i^{1-\sigma} di + \int_{i \in N_j} p_i^{1-\sigma} di + \int_{i \in N^*} p_i^{*1-\sigma} di \right)^{\frac{1}{1-\sigma}}$, and differentiating the

result with respect to w_j gives $\frac{dP_x}{dw_j} = \left(\int_{i \in N_j} \left(\frac{p_i}{P_x} \right)^{-\sigma} \frac{dp_i}{dw_j} di \right)$, where we have assumed that

each union is sufficiently small so that its action does not lead to a reaction from others. In

the symmetric equilibrium, therefore, $\frac{dP_x}{dw_j} = \frac{N}{J} \left(\frac{p_i}{P_x} \right)^{-\sigma} \frac{dp_i}{dw_j}$, or

$$\frac{d \log P_x}{d \log w_j} = \frac{N}{J} \left(\frac{p_i}{P_x} \right)^{1-\sigma} \frac{d \log p_i}{d \log w_j}. \quad (\text{A1.4})$$

Finally, from the price setting rule in (19) – i.e. $p_{i \in N_j} = \frac{\sigma}{\sigma-1} w_j^\alpha r^{1-\alpha}$ – we have

$\frac{d \log p_i}{d \log w_j} = \alpha$. Using these, we obtain $\varepsilon_{jP} = \frac{\alpha \mu N}{J} \left(\frac{p_i}{P_x} \right)^{1-\sigma}$, which, dropping the subscripts in the symmetric equilibrium, can be written as

$$\varepsilon_P = \frac{\alpha \mu N}{J} \left(\frac{p}{P_x} \right)^{1-\sigma}. \quad (\text{A1.5})$$

Similar algebraic calculations can be used to show that

$$\varepsilon_P^* = \frac{\alpha \mu N^*}{J^*} \left(\frac{p^*}{P_x^*} \right)^{1-\sigma}. \quad (\text{A1.6})$$

Clearly, given equation (5) in Table 1, $N \left(\frac{p}{P_x} \right)^{1-\sigma} < 1$ and $N^* \left(\frac{p^*}{P_x^*} \right)^{1-\sigma} < 1$ and it follows that $0 < \varepsilon_P < 1$ and $0 < \varepsilon_P^* < 1$. It is also worth noting that we can obtain the following in the same way as we did (A1.4):

$$\frac{d \log P_x^*}{d \log w_j} = \frac{N}{J} \left(\frac{p_i}{P_x^*} \right)^{1-\sigma} \frac{d \log p_i}{d \log w_j}, \quad (\text{A1.7})$$

$$\frac{d \log P_x}{d \log w_j^*} = \frac{N^*}{J^*} \left(\frac{p_i^*}{P_x} \right)^{1-\sigma} \frac{d \log p_i^*}{d \log w_j^*}, \quad (\text{A1.8})$$

$$\frac{d \log P_x^*}{d \log w_j^*} = \frac{N^*}{J^*} \left(\frac{p_i^*}{P_x^*} \right)^{1-\sigma} \frac{d \log p_i^*}{d \log w_j^*}, \quad (\text{A1.9})$$

To evaluate the right-hand-side of (A1.3), to obtain an expression for ε_{jL} , first differentiate the labour demand facing union j in county H – i.e. equation (21), $L_j = \int_{i \in N_j} l_i di$

– with respect to w_j to get $\frac{dL_j}{dw_j} = \int_{i \in N_j} \frac{dl_i}{dw_j} di$. In the symmetric equilibrium, for each j and

for all $i \in N_j$, we have, $L_j = \frac{N l_i}{J}$ and hence $\frac{dL_j}{dw_j} = \frac{N}{J} \frac{dl_i}{dw_j}$. Substituting these in (A1.3)

yields $\varepsilon_{jL} = -\frac{w_j}{l_i} \frac{dl_i}{dw_j} = -\frac{d \log l_i}{d \log w_j}$. Given that firms' labour demand and mark-up

equations, i.e. (6) and (19), imply $l_i = \frac{\alpha(\sigma-1)}{\sigma} \frac{p_i}{w_j} (x_i + \phi)$, we have

$$\varepsilon_{jL} = 1 - \left(\frac{d \log p_i}{d \log w_j} + \frac{x_i}{x_i + \phi} \frac{d \log x_i}{d \log w_j} \right). \quad (\text{A1.10})$$

In order to evaluate the right-hand-side of (A1.10), note that:

- (i) x_i is determined by demand, i.e. equation (18): $x_i = (E_x + E_x^*) P_x^{\sigma-1} p_i^{-\sigma}$. Unions take expenditure $(E_x + E_x^*)$ as given, hence $\frac{d \log x_i}{d \log w_j} = -\sigma \frac{d \log p_i}{d \log w_j} + (\sigma - 1) \frac{d \log P_x}{d \log w_j}$.
- (ii) From the firms' mark-up in (19), $\frac{d \log p_i}{d \log w_j} = \alpha$.
- (iii) From (A1.4), $\frac{d \log P_x}{d \log w_j} = \frac{N}{J} \left(\frac{p_i}{P_x} \right)^{1-\sigma} \frac{d \log p_i}{d \log w_j}$.
- (iv) From the zero profit condition in (20), $\frac{x_i}{x_i + \phi} = \frac{\sigma - 1}{\sigma}$.

Substituting the above in (A1.10), simplifying the result and dropping the subscript j , we obtain

$$\varepsilon_L = 1 + \alpha(\sigma - 2) - \frac{\alpha(\sigma - 1)^2 N}{\sigma J} \left(\frac{p}{P_x} \right)^{1-\sigma}. \quad (\text{A1.11})$$

It is worth noting that $\varepsilon_L > 1$ is very likely if $\frac{N}{J} \left(\frac{p}{P_x} \right)^{1-\sigma}$ is sufficiently small and $\sigma > 2$.

Similar calculations show that

$$\varepsilon_L^* = 1 + \alpha(\sigma - 2) - \frac{\alpha(\sigma - 1)^2 N^*}{\sigma J^*} \left(\frac{p^*}{P_x^*} \right)^{1-\sigma}. \quad (\text{A1.12})$$

A2. Characteristics of the model

The equation numbers in the following refer to those in Table 1.

(I) *Symmetric properties:*

Given free trade,

$$P_x^* = P_x, \quad (\text{A2.1})$$

holds by definition, as imposed in equation (5). It then follows that, equations (9), (14), (20), (18) and (19) respectively always imply:

$$r = r^*, \quad (\text{A2.2})$$

$$P^* = P, \quad (\text{A2.3})$$

$$x^* = x, \quad (\text{A2.4})$$

$$p^* = p, \quad (\text{A2.5})$$

$$w^* = w. \quad (\text{A2.6})$$

(II) Links between factor incomes and expenditure:

From equations (16) and (17) we obtain

$$\begin{cases} M = wL + r\bar{K}, \\ M^* = w^*L^* + r^*\bar{K}. \end{cases} \quad (\text{A2.7})$$

From equations (17) and (24) it follows that

$$E_x + E_x^* = \mu(M + M^*) + \lambda(1 - \mu)(M + M^*),$$

which can be written as

$$E_x + E_x^* = \beta(M + M^*), \quad (\text{A2.8})$$

which, together with (25) implies

$$Npx + N^*p^*x^* = \beta(M + M^*). \quad (\text{A2.9})$$

(A2.9) and (21) yield

$$wL + w^*L^* = \alpha\beta(M + M^*). \quad (\text{A2.10})$$

Finally, from (A2.7) and (A2.10) we obtain

$$r\bar{K} + r^*\bar{K} = (1 - \alpha\beta)(M + M^*). \quad (\text{A2.11})$$

It is easy to verify that the above results are not affected by capital mobility.

(III) Asymmetric changes:

Given that from (A2.7)

$$\frac{M}{M^*} = \frac{r\bar{K} + wL}{r\bar{K} + wL^*}, \quad (\text{A2.12})$$

(A2.2) and (A2.6) imply that an increase in L/L^* will result in a higher Home to Foreign nominal income ratios; (A2.3) then implies that the ratio of real incomes follows the same pattern. Also, from the capital resource constraint in (12) and given (21), we obtain

$$\frac{Y}{Y^*} = \frac{(r/w)\bar{K} - \frac{1-\alpha}{\alpha}L}{(r/w)\bar{K} - \frac{1-\alpha}{\alpha}L^*}, \quad (\text{A2.13})$$

where it can be easily verified that the expressions appearing in the numerator and denominator on the right-hand-side are always positive. Thus, given (A2.2) and (A2.6), (A2.13) implies that a rise in L/L^* will result in a lower Y/Y^* .

While (A2.12) is not affected by capital mobility, allowing for the latter implies – see (12') – that (A2.13) ought to be modified as

$$\frac{Y}{Y^*} = \frac{(r/w)K - \frac{1-\alpha}{\alpha}L}{(r/w)K^* - \frac{1-\alpha}{\alpha}L^*}. \quad (\text{A2.13}')$$

Hence, when capital flows from F to H, $K > K^*$ and a sufficient condition for $Y/Y^* > 1$ is $L/L^* = 1$. But $Y/Y^* > 1$ can also result even if $L/L^* > 1$, provided that $r(K - K^*) > \frac{1-\alpha}{\alpha}w(L - L^*)$ holds. On the other hand, when capital flows from H to F, $K < K^*$ and $Y/Y^* < 1$ will follow if $L/L^* \geq 1$.

(IV) The impact of a firm's price change on unions' monopoly power:

To see how a change in p affects ε , first note that from equation (5),

$$\left(\frac{p}{P_x}\right)^{1-\sigma} = \left(N + N^* \left(\frac{p^*}{p}\right)^{1-\sigma}\right)^{-1}. \quad (\text{A2.14})$$

Thus, a ceteris paribus rise in p reduces $\left(\frac{p}{P_x}\right)^{1-\sigma}$. Given (A1.5) and (A1.11), unions' mark-up factor is

$$\varepsilon = \frac{1 - \varepsilon_p}{\varepsilon_L} = \frac{1 - \frac{\alpha \mu N}{J} \left(\frac{p}{P_x}\right)^{1-\sigma}}{1 + \alpha(\sigma - 2) - \frac{\alpha(\sigma - 1)^2 N}{\sigma J} \left(\frac{p}{P_x}\right)^{1-\sigma}}. \quad (\text{A2.15})$$

It is easy to verify that ε will fall as a result of a ceteris paribus reduction in $\left(\frac{p}{P_x}\right)^{1-\sigma}$ if

$\sigma^2 - \left(2 + \frac{\mu}{1 - \alpha\mu}\right)\sigma + \frac{1}{1 - \alpha\mu} > 0$ holds. The sufficient condition for the latter is

$\sigma > 2 + \frac{\mu}{1 - \alpha\mu}$. Since $0 < \frac{\mu}{1 - \alpha\mu} < 1$, $\sigma > 3$ ensure that the sufficient condition holds. The

same procedure can be used to show that ε^* rises as a result of a ceteris paribus reduction in $\left(\frac{p}{P_x}\right)^{1-\sigma}$.

(V) Employment ratio and its impact on the monopoly power of the unions:

Equations (21) and (A2.4)-(A2.6) imply that employment at the firm level remains the same in the two countries, i.e. $L/N = L^*/N^*$, hence

$$\frac{N^*}{N} = \frac{L^*}{L}. \quad (\text{A2.16})$$

Next, (A2.14) and (A2.5) imply

$$N \left(\frac{p}{P_x} \right)^{1-\sigma} = \frac{N}{N + N^*}$$

from which, using (A2.16), we obtain

$$N \left(\frac{p}{P_x} \right)^{1-\sigma} = \frac{1}{1 + L^*/L}. \quad (\text{A2.17})$$

Given that: (i) from (A2.15) the derivative of ε with respect to $N \left(\frac{p}{P_x} \right)^{1-\sigma}$ is positive – with the sufficient condition $\sigma > 2 + \frac{\mu}{1-\alpha\mu}$; and (ii) the derivative of $N \left(\frac{p}{P_x} \right)^{1-\sigma}$ with respect to L/L^* is positive; it follows that ε is a monotonically increasing function of L/L^* . Similar calculations show that ε^* is a monotonically decreasing function of L/L^* . Note that this result is not affected by capital mobility.

A3. The initial symmetric equilibrium

We calculate the policy multipliers by shocking the model at an initial symmetric equilibrium where the two countries are identical in all respects (see A5 below for the multipliers). Clearly, given the symmetry in endowments and parameters, in such an initial equilibrium there will be no trade in Y , no net trade in X and no capital flows even when capital mobility is allowed for. First note that in the symmetric equilibrium, equations (A2.8)-(A2.11) imply:

$$E_x = \beta M, \quad (\text{A3.1})$$

$$N p x = \beta M, \quad (\text{A3.2})$$

$$wL = \alpha \beta M, \quad (\text{A3.3})$$

$$r\bar{K} = (1 - \alpha \beta) M. \quad (\text{A3.4})$$

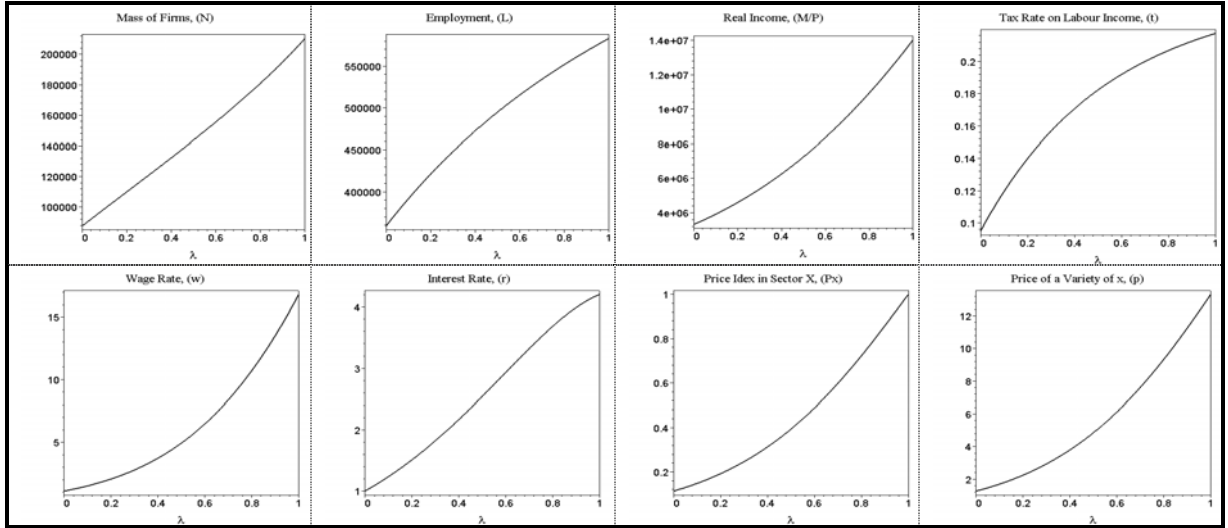
The rest of the equations are given in Table A3.1 below, which are obtained from those in Table 1 (for each equation, the number after the description corresponds to that in Table 1). Note that in the fully symmetric case there is no distinction between Home and Foreign variables and each variable for F is set equal to its corresponding variable in H. In addition, (i) tax rates on income from labour and capital are assumed to be equal, i.e. $q = t$; and (ii) the unemployment benefit rate is set proportional to the tax rate, i.e. $b = \gamma t$ where $\gamma > 1$. The 12 equations – consisting of (A3.1)-(A3.4) and those in Table A3.1 – determine the values of $N, L, Y, x, p, P_x, P, w, r, M, E_x$ and t . The solution is calibrated at $\bar{K} = \bar{L} = 10^6 \phi; \tilde{V} = 1; J = 100; \mu = 0.4; \sigma = 6; \alpha = 0.7; \gamma = 2$ and $\varepsilon = 0.78915$ (the value of ε is

obtained by evaluating (A2.15) at the symmetric equilibrium and at the above parameter values).

Table A3.1 Equations of the model in the initial symmetric equilibrium

(A3.5)	price index in sector y (5):	$P_x = (2N)^{\frac{1}{1-\sigma}} p$
(A3.6)	zero profit condition in sector y (9):	$r^{1-\lambda} P_x^\lambda = 1$
(A3.7)	consumer price index (14):	$P = P_x^\mu$
(A3.8)	government budget constraint (15):	$\gamma w(\bar{L} - L) = wL + r\bar{K}$
(A3.9)	firms price mark-up rule in sector x (19):	$p = \frac{\sigma}{\sigma-1} w^\alpha r^{1-\alpha}$
(A3.10)	zero profit condition in sector x (20):	$x = (\sigma - 1)\phi$
(A3.11)	unions' wage setting rule (22):	$\frac{w}{P} = \frac{\tilde{V}}{1 - \varepsilon - t \left((1 - \varepsilon)(1 + \gamma) + \varepsilon \right)}$
(A3.12)	market clearing condition in sector y (24):	$Y = (1 - \mu)M$

Table A3.2 Initial Symmetric Equilibrium



As can be seen from the above table, all variables in the initial symmetric equilibrium are increasing in the strength of the vertical linkages.

A4. The initial impact of a rise in w on demand for good X

To find the immediate impact (or first round effect) of a rise in w , and hence p as firms markup their price using the rule in (19) (but when N , N^* , L , L^* , p^* and E_x^* have not yet adjusted) on the demand for X , we examine $d(x + x^*)/dw$. From equation (18) in Table 1,

$$x + x^* = (E_x + E_x^*)P_x^{\sigma-1}(p^{-\sigma} + p^{*\sigma}).$$

Totally differentiating the above keeping p^* and E_x^* constant yields

$$d(x + x^*) = \left(\frac{x + x^*}{E_x + E_x^*} \right) dE_x + (\sigma - 1) \left(\frac{x + x^*}{P_x} \right) dP_x - \sigma \left(\frac{x}{p} \right) dp. \quad (\text{A4.1})$$

From (A2.8) and (A2.10) we have $E_x + E_x^* = (wL + w^*L^*)/\alpha$ and hence

$$dE_x = \left(\frac{L}{\alpha} \right) dw, \quad (\text{A4.2})$$

when L, L^*, w^* and E_x^* are kept constant. From equation (5) in Table 1 we obtain

$$dP_x = N \left(\frac{P_x}{p} \right)^\sigma dp, \quad (\text{A4.3})$$

when N, N^* and p^* are kept constant. Finally, from (19) in Table 1 we obtain

$$dp = \alpha \left(\frac{p}{w} \right) dw, \quad (\text{A4.4})$$

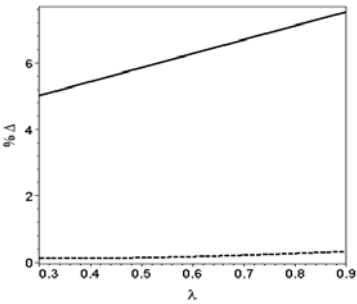
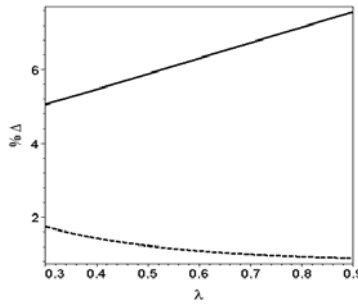
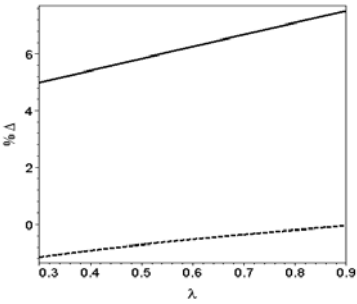
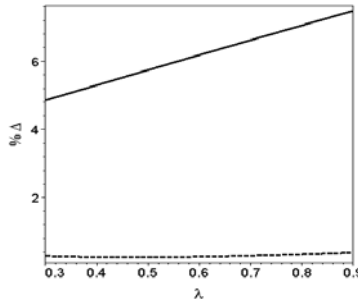
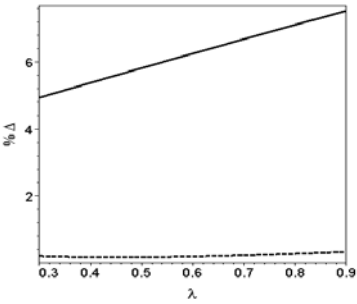
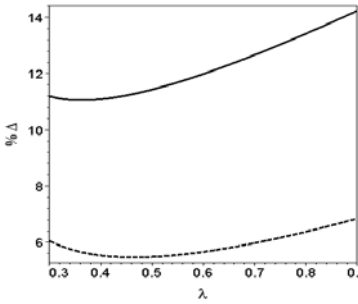
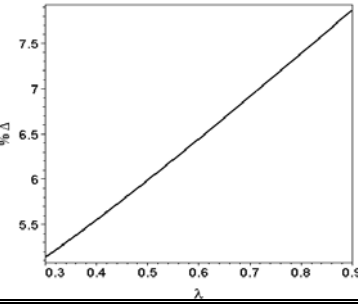
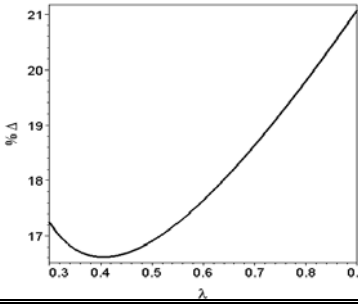
when N, N^* and p^* are kept constant. Substituting (A4.2)-(A4.4) into the right-hand-side of (A4.1) and evaluating the resulting expression in the initial symmetric equilibrium, described in Section A3 above, we obtain

$$\frac{d(x + x^*)}{dw} = \frac{(1 - \alpha)x}{w} > 0.$$

A5. The policy multipliers and numerical simulations

The multipliers are derived by totally differentiating equations (5), (9), (12) and (14) to (22) in Table 1 and solving them to determine dz/db where b is the unemployment benefit rate in H (in the case of unilateral policy shock we set $db^* = 0$ and for harmonised policy shock we let $db^* = db$) and z denotes the endogenous variables of interest, i.e. $N, L, Y, x, p, P_x, P, w, r, M, K$, their counterparts for country F, and the two policy instruments used. These multipliers have very large algebraic expressions and are not provided here, but are available on request from the authors. In general, each is a complex non-linear function of parameters $(\mu, \sigma, \alpha, \phi, \lambda)$, endowments (\bar{K}, \bar{L}) , utility of leisure \tilde{V} , number of unions J , and the initial equilibrium values of the tax and benefit rates, $(t_o, q_o, b_o, t_o^*, q_o^*, b_o^*)$. Using the calibration given above Table A3.1 and the implied tax rate t in Table A3.2, for each scenario we have calculated and plotted the multipliers against λ to illustrate the role of vertical linkages in transmitting the policy effects (See Tables 2 to 9. Table A5 below gives the multipliers for indirect utilities only). We have also verified that these multipliers are qualitatively robust to plausible changes in parameter values

Table A5. Implications of the Policy Shocks on Welfare†

<p>A5.1. No Capital Mobility; $\Delta q = \Delta q^* = \Delta b^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and t^* Indirect Utility</p> 	<p>A5.2. No Capital Mobility; $\Delta q = \Delta t^* = \Delta b^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and q^* Indirect Utility</p> 
<p>A5.3. No Capital Mobility; $\Delta q = \Delta q^* = \Delta t^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and b^* Indirect Utility</p> 	<p>A5.4. Capital Mobility; $\Delta q = \Delta q^* = \Delta b^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and t^* Indirect Utility</p> 
<p>A5.5. Capital Mobility; $\Delta q = \Delta t^* = \Delta b^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: t and q^* Indirect Utility</p> 	<p>A5.6. Capital Mobility; $\Delta t = \Delta t^* = \Delta b^* = 0$. Policy Shock: $\% \Delta b = 10$; Policy Instruments: q and q^* Indirect Utility</p> 
<p>A5.7. No Capital Mobility; $\Delta q = \Delta q^* = 0$. Policy Shock: $\% \Delta b = \Delta b^* = 10$; Policy Instruments: t and t^* Indirect Utility</p> 	<p>A5.8. Capital Mobility; $\Delta t = \Delta t^* = 0$. Policy Shock: $\% \Delta b = \Delta b^* = 10$; Policy Instruments: q and q^* Indirect Utility</p> 

† For calibration see Table 2.