Structural Change and the Labour Market Effects of Globalisation [‡]

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Why is the average citizen so worried about globalisation and the average economist so unworried? It is surely true, but unuseful, to say that the citizen and the economist simply do not understand the benefits and costs of globalisation in the same way. There are good reasons why the economist feels comfortable arguing that, at least at an aggregate level, globalisation is either no big deal or a substantial boon. It would be comforting to conclude that the citizen is simply wrong, with the obvious implication being that a little bit more effort at public education would help reduce globalphobia. There may be a significant element of truth here, but the consequences of introducing irrationality, ignorance, and learning into our models are substantial.[1] It seems to us to be useful to consider the possibility that the widespread concern with globalisation emerges as a result of changes that are, to some extent, obscured when we apply standard trade-theoretic methods to understand globalisation. In this paper we are interested in effects of globalisation that operate on the labour market indirectly by transforming the structures that support one set of equilibria and induce change in those equilibria. We will develop our analysis in terms of the interdependence between economic and political structures in a given national economy. Because the economic and political structures are related, changes in the relationship of a national economy to the global economy can produce profound changes in the political-economic arrangements of a country. In addition to affecting equilibrium wages and employment, such changes could well be unsettling in themselves.

We begin, in the next two sections, by briefly rehearsing the main framework within which most economists (at least trade economists) have considered the effects of globalisation, and found them to be essentially unproblematic. In section III, we develop a simple model of political economic equilibrium with firm-union bargaining and a welfare

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[1] Hall and Nelson (2001) develop a simple, preliminary analysis of this sort.

state. Using this model, we consider the impact of increased openness. Section IV presents some empirical work that we find broadly consistent with the model. Section V concludes.

I.   The Direct Labour Market Effects of Globalisation

The professional literature (to say nothing of the popular literature) on the direct labour market effects of globalisation is enormous. The essential empirical issue is macroeconomic: accounting for the *economy-wide* rise of the skill-premium at a time when the share of skilled to unskilled workers is rising. Thinking systematically about the role of globalisation in this context requires a model of the economy as a whole with sufficient structure that the link to the world economy can be treated explicitly, but simple enough that it generates guidance for both empirical work and policy. Standard low-dimensional trade theoretic models provide just such a framework and, not surprisingly, they lie at the heart of a sizable majority of the theoretical work and an even larger share of the empirical work on trade (migration, foreign direct investment) and wages.[2]

As the story has now been told many times, in response to early work in the one-sector framework, trade economists successfully argued that the natural framework for thinking about the effect of trade on labour markets, at least from a maintained assumption of competitive markets, was the Stolper-Samuelson theorem and its various generalisations.[3] The theoretical account of trade shocks as running from commodity-price changes to factor-price changes provided a compelling equilibrium mechanism, and some useful rough empirical checks, but the real success came with the development and refinement of the mandated wage regression methodology. The solid theoretical foundations of the mandated

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[2] As Gaston and Nelson (2002) argue, the one-sector model used by labour economists has the virtue of providing clear guidance for empirical work, but must introduce the effect of standard globalisation shocks (trade, immigration, foreign direct investment) in an essentially *ad hoc* way. That is, they shift either demand or supply, but there is no essential equilibrium relationship between globalisation and the labour market.

wage regression approach led to the almost complete displacement of the factor-content study as a framework for empirical study. The interpretation of the empirical results, as well as the appropriate implementation of the framework, is not without controversy, but the aggregate professional prior would seem to have settled on the conclusion that trade has a small effect on the skill-premium (maybe 10-20%), but that other factors (especially technological change) are more important.

The analysis of immigration would appear to be very different, but in fact contains strong similarities to the above story. The obvious problem with the trade-theoretic framework from the perspective of evaluating immigration shocks is that, as long as we assume the commodity and factor markets are competitive and, as seems quite the most plausible assumption, that the number of goods exceeds the number of factors, then we are stuck with what Leamer (1995) calls the *factor-price insensitivity theorem*. This result, which is the single-country analogue of the factor-price equalisation theorem, asserts that, under the dimensionality and competitiveness assumptions already mentioned, as long as the economy produces the same types of goods before and after an immigration shock (the endowment remains inside the same cone of diversification), the change in endowment will leave relative factor-prices unchanged. Since the goal is to find globalisation effects that might help account for the changing skill-premium, this feature of the trade-theoretic model would seem to be a problem. However, it turned out that most studies found only extremely small effects of immigration on the skill-premium.

To the extent that foreign direct investment (FDI) could be seen as capital arbitrage, factor-price insensitivity would apply there as well. The problem in this case is that economists had long become convinced that FDI was fundamentally not about capital

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arbitrage. This was the fundamental realisation in Hymer's (1960) classic dissertation that is generally credited with beginning the modern theory of foreign direct investment. Starting with Caves (1971) a large body of research has incorporated the insights of the firm-theoretic approach by interpreting FDI as an arbitrage of firm-specific capital. Similarly, monopolistic competition models could be enlisted to analyse FDI by interpreting one input as managerial or headquarters services (Helpman, 1984). But this has always been only uneasily related to the firm-theoretic foundations of the modern theory of FDI. The problems become more obvious when outsourcing becomes part of the picture. We pick up that part of the story in the next section.

II.   Indirect Labour Market Effects of Globalisation: Some Preliminary Remarks

Implicit in all the comparative static analyses discussed in the previous section is the assumption that the underlying structure of the economy is unchanged by whatever is taken to be the relevant globalising force – trade, immigration, FDI. However, one of the essential claims in much of the popular writing on globalisation, and surely a major source of the general social concern about globalisation, is its transformative nature. That is, globalisation is taken to transform the economic and political structures in ways that might be obscured when we apply the standard toolkit of trade theory.

Consider the case of global outsourcing, one of the characteristic aspects of contemporary globalisation (Feenstra, 1998). From a microeconomic or firm-theoretic point of view, outsourcing is just the reverse process of internalisation, which has long been central to the theory of foreign direct investment. However, from the macroeconomic (e.g., trade-theoretic) perspective, internalisation and externalisation are radical innovations relative to the models used to understand trade and migration. That is, when we come to focus explicitly on outsourcing, it becomes clear that we are dealing with non-marginal change in production structure that does not really permit simple extension of standard techniques.

Where allocation of production among existing facilities is trade-theoretically straightforward, the decision to outsource creates new technologies and transforms the dimensionality of the underlying model.[4] This recognition is increasingly being made in the theoretical literature on outsourcing (Jones and Kierzkowski, 2001; Deardorff, 2001; Kohler, 2001), but empirical work on the link between outsourcing and wages continues to use a mandated wage approach that manifestly does not permit such non-marginal change (e.g., Feenstra and Hanson, 1999).

In the case of outsourcing, because it directly transforms dimensionality in our standard models, we can see how structural change interferes with inference based on those tools in a straightforward way. The role played by broader social institutions in supporting economic and political-economic outcomes is less well understood, although elements of such an analysis are beginning to be developed in economics, drawing to a considerable degree on existing research in political science and sociology.[5] In this paper we are interested in the relationship between globalisation, unions and welfare states. Loosely speaking, the idea is that part of the support for an equilibrium in which relatively unskilled workers receive high wages comes from the mutually supporting institutions of unions and welfare states. That is, as a result of labour market institutions, in this case a union, some workers receive a higher wage than other otherwise identical workers. There are insiders and outsiders. In addition, because there is unemployment in equilibrium, we will assume that there is some governmental transfer to the unemployed. It should be clear that globalisation could change each of the components of this relationship, with implications for equilibrium

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[4] Consider a two-good model in which one sector decides to outsource. Either the original sector disappears, producing a three good model (i.e., the original good unchanged good, and the two new sectors created by splitting the old technology) or a four good model (if some firms continue to produce the final good under a unified technology). In either case, the dimensionality of both the price vector and the technology matrix must change, rendering standard comparative static methods problematic.

relative wages. With respect to the first, there is now a sizable body of research examining the relationship between the institutional structure of the unionised sector of an economy (i.e., the extent and centralisation of organisation) and various measures of macroeconomic performance. Countries with encompassing labour market institutions (i.e., large unionised sectors with centralised bargaining) are characterised by: lower wage inequality (Rowthorn, 1992; Zweimüller and Barth 1994; OECD, 1997); lower unemployment (OECD, 1997); and higher growth (Calmfors and Driffill, 1988; Rowthorn, 1992; Calmfors, 1993; Danthine and Hunt, 1994). The usual explanation involves the ability of centralised bargaining institutions to internalise negative wage externalities (Calmfors, 1993; Garrett, 1998). That is, where strong sectoral unions pursue wage gains relative to some perceived market wage, resulting in cost-push inflation, reduced employment, lower growth, and intersectoral inequality, the centralised union recognises these negative externalities and takes them into account in its bargaining. Thus, as unionisation has declined, there is some evidence that wage inequality has increased (Freeman, 1998).

Globalisation is widely thought to have affected unions. On the one hand, globalisation is generally taken to imply increased competition that, even without any change in relative bargaining power, will squeeze sectoral rents and lead to reduced wages in post-globalisation bargains. In a closely related fashion, by raising the elasticity of demand for labour, imports can be seen to directly reduce the market power of unions. An alternative argument turns on the expectation that firms/capital are globally more mobile than labour. The existence of an exit option, even if not exercised, changes the relative bargaining power of the firm and the union. Thus, even without an observed increase in trade, unions should do worse in bargains after the cost of globalisation of production (via importing, outsourcing or

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[5] See Persson (2002) for a recent discussion with application to macroeconomic policy and Hall and Nelson (1992) give an early institutional comparative static analysis of trade policy.

FDI) fall. Finally, by affecting the return to union membership, the size of unions may decline, causing a further erosion of bargaining power.

Increased inequality, and real deterioration in the labour market outcomes of unskilled workers, is also directly related to changes in demand for welfare state provision. For example, it has been observed that despite increases in the dispersion of earned incomes that, in some countries at least, inequality in post-transfer and post-tax income inequality has *not* grown (e.g., Gottschalk and Smeeding, 1997; Aaberge *et al.*, 2000). This suggests that political pressures have been brought to bear on the generosity of public transfers at a time when earned incomes have become more unequally distributed. From a political economic perspective, the growing inequality of income could be associated with strong compositional effects on the demand for public insurance. In particular, it seems to be the case that the growing size and economic significance of sectors of the economy that pay higher wages for certain types of workers, could somewhat paradoxically result in political pressures that lead to higher levels of transfer payments to disadvantaged workers. It has been suggested that this could result from changes in the identity of the median voter (e.g., Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Saint-Paul and Verdier, 1996) or as an optimal response to increased income risk in an increasingly open economy (e.g., Rodrik, 1998). In this paper we consider an alternative account in which self-interested behaviour and institutional features of labour determine public insurance policy outcomes. Specifically, we examine how the demand for unemployment benefits may change during periods of trade liberalisation, when collective bargaining is more or less centralised.

Where the effect of globalisation on unions is taken to be generally negative, the effects on the welfare state are potentially more mixed. On the negative side, scholars such as Steinmo (1994) and Tanzi (1995) argue that increased mobility of capital not only erodes the tax base, reducing the state's ability fund welfare state programs, but by shifting taxes

onto labour, the capacity of the state to redistribute is reduced. In a similar fashion, Garrett (1998) has argued that, by forcing states to turn increasingly to borrowing to fund welfare state programs, the international capital market ends up imposing an increasing premium on large welfare states. In ways that are harder to quantify, but seem *prima facie* plausible, the decreasing cost of the exit option increases the relative power of business in policy-making (Huber and Stephens, 1998). Finally, it has been argued that globalisation increases the general credibility of orthodox (i.e., market-oriented) policy advice, thus reducing the plausibility of arguments supporting welfare state expansion and enhancing the credibility of arguments in favour of welfare state retrenchment (Evans, 1997; Krugman, 1999). On the other hand, there are a number of reasons for believing that the sources of pressure for change are, at a minimum, not overwhelming. First, as has been widely noted for some time, the classic, large welfare states developed in the context of considerably more open economies than did the smaller, market conforming welfare states (Katzenstein, 1985; Huber and Stephens, 1998). As Rodrik (1998) has argued, this may be related to increased income risk. Interestingly, Bordo, Eichengreen and Irwin (1999) carry this argument further, suggesting that the presence of sizable welfare states, and Keynesian macroeconomic policy, may have played an important role in providing sufficient indifference to globalisation, that policies like support for the GATT/WTO system and the Bretton Woods institutions continued even in the face of recessions that might have had system closing consequences in earlier eras. In addition, current welfare states show considerable heterogeneity in response to the increases in globalisation experienced over the last 15 to years (Garrett, 1998; Swank, 2002). Here it has been widely argued that heterogeneity of domestic political, as well as labour market, institutions support heterogeneity of responses to globalisation (Calmfors and Driffill, 1988; Garrett, 1998; Swank, 2002).

The next section develops a model in which, when collective bargaining is more centralised, or when unions are relatively more concerned with employment growth than with raising worker's wages, the workers seek to encourage policy-makers to raise unemployment benefits. This happens because of the positive effect that higher reservation wages have on negotiated wages. In contrast, if wage and employment levels are negotiated in an extremely decentralised environment in which workers earn higher wages but are exposed to greater degrees of employment risk, then the workers whose employment is at greatest risk ally themselves with employers to lobby for reductions in transfer payments and benefits and the taxes which are necessary to finance them. That is, there is political pressure to decrease both unemployment benefits and taxes, but this tendency is largely reversed during times of greater openness to international competition.

In an era of rapid globalisation, labour market deregulation and microeconomic reform, the associated decentralisation of collective bargaining results in wages that are more closely aligned with productivity. However, these developments also expose the same workers to greater unemployment risk. Thus, they have an incentive to influence the direction of public insurance policies. There is considerable evidence that unions have played a prominent role in influencing policies that affect the welfare of their members. For example, there is the well-documented support by the trade union movement for higher minimum wages (see, e.g., Ehrenberg, 1994, pp.44-45). In fact, union influence extends well beyond minimum wage legislation. Kau and Rubin (1981) found that U.S. unions use their political contributions in a systematic and coordinated manner. Union campaign contributions are *always* significant in explaining not only voting on minimum wages, but also wage-price controls, benefits for strikers, OSHA (which regulates workplace safety) and CETA (i.e., manpower training programs) appropriations.

III.   Indirect Labour Market Effects of Globalisation: A Simple Model

Consider a small open economy populated by workers and shareholders. The economy has two sectors, an unionised sector and a non-unionised sector. Alternatively, following Rama and Tabellini (1998), these could be labelled as the "formal" and informal" sectors of the economy. Our purpose in this section, and the next, is to determine the effects of trade liberalisation and the effect that this has on labour market and redistributive policies, such as unemployment benefits.

3.1 *Production in the unionised sector*: The concave production technology for a representative firm in the unionised sector is represented by $x = f(n)$, where n is employment. Total profits are simply

$$\pi(n, w; p, t) = pf(n) - (1 + t)wn, \tag{1}$$

where w is the wage and $t \in [0,1)$ is a payroll tax levied on the total wage bill.[6]

The domestic relative output price of the good produced by the unionised sector is

$$p = (1 + \tau)p^*, \tag{2}$$

where p^* is the world price and τ is an ad valorem tariff. The tariff is assumed to be determined by multilateral trade negotiations in which the small country has negligible bargaining power, and therefore the tariff is taken as given by all domestic agents.

3.2 *Workers and shareholders*: All individuals in the economy – shareholders, union and non-union workers – are assumed to have the same preferences over consumption goods. The utility of each individual i is given by

$$U^i = c^{z^i} + u(c^{x^i}), \tag{3}$$

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[6] Most OECD countries rely on payroll taxes to fully, or to partially, fund their unemployment insurance systems. See Ehrenberg (1994) and Koskela and Schöb (1999), e.g.

where c^{z^i} is consumption of the numeraire good produced by the non-unionised sector and c^{x^i} is consumption of the good produced by the unionised sector. $u(.)$ is increasing and concave. Individuals maximise utility subject to their expected income constraint.

The quasi-linear form of equation (3) implies that the consumption of c^{x^i} depends only on p. Denoting the aggregate consumption of x by $C(p)$ and aggregate production of x by $X(p)$, the government's tariff revenue is given by

$$T(p) = \tau p^* \big(C(p) - X(p)\big), \tag{4}$$

where $C(p) - X(p)$ represents aggregate imports of good x.[7]

3.3 *Union leadership vs. union workers*: The unionised sector is assumed to have rents to bargain over. The firm and the union leadership, which represents workers, negotiate wages and employment levels. That is, the objectives pursued by a union's leadership and the welfare of individual workers are possibly quite distinct (see Pemberton, 1988).

We assume that the union's objective function in bargaining can be represented by the Stone-Geary utility function, i.e.,

$$U(n,w) = (n - m)^\gamma (c^e - c^v)^\delta , \tag{5}$$

where c^e is the income for an employed worker and c^v denotes the reservation alternative for an unemployed worker. In the following, we assume that the income for an employed worker is $c^e = w$. During the second stage of the game, we treat c^v as exogenous. For individual workers, c^v reflects the value of not working in the unionised sector. It is affected by the value of leisure time, home or non-market production or the wage in the informal sector of the economy. For the purposes of this paper, we assume that the unemployment benefit or income transfer payable to those not employed in the unionised sector affects c^v.

The values of δ and γ in equation (5) indicate the relative importance of wages and employment in bargaining objectives. Pemberton (1988) interpreted a low value for δ as reflecting a relatively greater weight being placed on the desire for high membership on the part of union leadership vis-à-vis the desire for high wages on the part of the median union member.[8] Equation (5) results from interpreting the bargaining objective as deriving from a Nash game played between the union's leadership and the union's median member. The leadership wants a large union (high n), and consequently the lower wages that would achieve this growth or membership objective.[9] The median union member, whose employment is assumed to be secure, is concerned only with maximising wage rents.

One advantage of the Stone-Geary functional form is that it admits some interesting special cases (see Farber, 1986, p.1061). For example, if $\delta = \gamma$ and $m = 0$, then the union's objective is to maximise $U = n(c^e - c^v)$, i.e., the rents for employed union members. In this case, it is useful to think of all encompassing labour market institutions where the bargaining over wages and employment is relatively centralised. When $\gamma = 1$ and $\delta = 0$, the objective is $U = n - m$, i.e., to maximise the size of the union over and above the reservation employment level. When $\delta = 1$ and $\gamma = 0$, the bargaining objective is $U = c^e - c^v$, i.e., the earnings for each of its members over and above their reservation alternative. That is, the

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[7] If aggregate imports are negative, then $\tau > 0$ can be interpreted as an export subsidy. Similarly, if $\tau < 0$, then τ can be interpreted as an import subsidy if aggregate imports are positive, or as an export tax if aggregate imports are negative.

[8] Farber (1986, p.1063) summarising his own earlier research on the United Mine Workers states that the union "*seems to have placed more weight on employment relative to compensation than rent-maximization would imply*". On the other hand, Clark and Oswald (1993) show that unions often care more about wages than employment.

union is completely "wage-oriented" in its negotiations with the firm (see Carruth and Oswald, 1987). Consequently, the union places no importance on "internalising" the adverse impact of higher wages on employment levels.

   3.4 *Wage and employment in the unionised sector*: We assume that bargaining over wages and employment is efficient and that the choice from the set of efficient contracts is the one that maximises the symmetric Nash product, i.e.,

$$S(n,w) = U(n,w)\pi(n,w).$$ (6)

We assume that the solution lies in the interior of the choice set and that S is strictly concave so that the solution is unique and may be characterised by the following first-order conditions. (We suppress arguments where no ambiguity exists and use subscripts to denote partial derivatives.)

$$S_w(.) = S(.)\left[\delta\Delta^{-1} - (1+t)n\pi^{-1}\right] = 0$$ (7a)

$$S_n(.) = S(.)\left[\gamma(n-m)^{-1} + (pf_n - (1+t)w)\pi^{-1}\right] = 0,$$ (7b)

where $\Delta = c^e - c^v$ is the economic rent to employed workers. Substituting (7a) into (7b), we obtain the contract curve, i.e.,

$$(\gamma - \delta l)w = \gamma c^v - \frac{\delta l p f_n}{(1+t)},$$ (8)

where $l = (n-m)/n$, $l \in (0,1]$. From equation (8), and since $f(.)$ is concave, the contract curve has a positive (negative) slope when $\gamma > (<)\delta l$. Note that when $\gamma = 0$, labour is employed until its marginal revenue product equals its marginal cost, i.e., $pf_n = (1+t)w$;

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[9] Strictly speaking, and in contrast to standard contracting models, m does not represent the number of union workers attached in the pool attached to one firm. Rather, m denotes the fall-back utility level for the union leadership if the sector's employees quit union membership. For example, if the union operates in more than one sector of the economy, it represents union membership in those other sectors (see Pemberton, 1988 and discussion below). In the present context, it is more appropriate to assume that there are m incumbent workers employed elsewhere in the organisation. We follow Pemberton (1988) and Burda (1997) by assuming that $n > m$. Consequently, $(n-m)$ represents the incremental utility gain for the union leadership from the bargaining agreement.

when $\delta = 0$, $w = c^v$ and employment is maximised. In the following we refer to the former case as being equivalent to "decentralised bargaining" because wage and employment outcomes occur along the firm's demand for labour curve.[10] Likewise, the latter case is referred to as "centralised bargaining", because wages and employment are determined by the Nash bargaining condition and lie to the right of the firm's demand for labour curve.

The following Proposition summarises the comparative static results for wages and employment. For expositional purposes, we consider a production function with constant elasticity of employment, α. (Derivations are provided in the Appendix.)

> **Proposition 1:** $w(c^v, p^*, \tau, t, m, \gamma, \delta)$ *and* $n(c^v, p^*, \tau, t, m, \gamma, \delta)$. *Suppose that*
> $\alpha = n f_n f^{-1} > 0$, *then*
>
> *(i)* $w_{c^v} > 0$, $w_{p*} \geq 0$, $w_\tau \geq 0$, $w_t \leq 0$, $w_m < 0$, $w_\gamma < 0$ *and* $w_\delta > 0$;
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> *(ii)* $n_{c^v} < 0$, $n_{p*} \geq 0$, $n_\tau \geq 0$, $n_t < 0$, $n_m > 0$, $n_\gamma > 0$ *and* $n_\delta < 0$.

The sign patterns are quite standard. Higher prices, or import tariffs, for the unionised good increase employment and wages. (The possibility of a zero wage effect for the output price and the payroll tax are by-products of adopting an iso-elastic form for the demand for labour curve.) The wage and employment effects of more decentralised wage bargaining and higher values of δ (or lower values of γ) indicate the effect of an increased orientation to the pursuit of higher wages, as opposed to lowering the risk of unemployment. The effects of a higher *m*, given γ, are equivalent to the effects of a higher value of γ, given *m*. (Recall that *m* represents the union leadership's threat point in a Nash bargaining game with the median union member. Hence, a higher *m* strengthens the union leadership's drive for union membership growth.)

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[10] Haskel *et al.* (1997) show that increasing labour market flexibility in the United Kingdom has resulted in labour input being more closely aligned to the business cycle. This implies that wage and employment contracts lie closer to the marginal revenue product or demand for labour curve.

It is readily apparent that the owners of firms will always lose from any policy that involves increasing c^v. Doing so increases wages and lowers output and labour demand by firms. On the other hand, workers may adopt a variety of positions regarding the desirability of various labour market policies and public insurance programs depending on the size of tax increases needed to finance more generous benefits as well as the nature of their preferences. Specifically, whether workers are likely to support higher unemployment benefits depends on the extent to which payroll tax increases are shifted back onto workers (see Ehrenberg, 1994, p.8), the exposure of workers to unemployment and the effect of higher reservation wages on negotiated wages. What is clear is that one of the main effects of higher unemployment benefits is to increase the wage pressure by insiders. Further, some authors (e.g., Saint-Paul, 1996), argue that since incumbent workers are more numerous and better organised than the unemployed, that labour institutions are determined by the interests of the employed. In turn, these decisive voters are likely to support policies and labour market institutions that increase the exclusion of outsiders.

IV. Equilibrium unemployment benefits in a small open economy

In this section, we study the political determination of unemployment benefits. In addition to understanding the effect of different labour institutions on the generosity of benefits, a primary objective is to investigate the relationship between trade liberalisation and unemployment benefits.

4.1 *The lobby group model:* The menu auction model of Bernheim and Whinston (1986) provides a useful framework for understanding the interaction between special interest groups and the government. Interest groups are assumed to have organised exogenously and to consist of individuals with similar interests in policy outcomes. Our focus is upon the unemployment benefit, *b*. Denoting the set of lobby groups by *L*, political contributions are made by the various groups to an incumbent government in return for preferred labour market

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policies, $\Lambda^i(b)$, where $i \in L$. These functions relate the political contributions of lobby groups to feasible policy choices.

An incumbent government is assumed to choose b to maximise the weighted sum of aggregate political contributions and aggregate social welfare. The specific form of the government's objective function is given by

$$V^g(b) = \sum_{i \in L} \Lambda^i(b) + \sum_{j=k,u,n} a^j V^j(b),$$ (9)

where the V^j, $j = k, u, n$ are the gross indirect utility functions for each group of factor owners – capital, incumbent union workers and non-union workers, respectively. The $a^j \geq 0$ are the "weights" that the government place on each group's social welfare, relative to revenues and political contributions. Equation (9) does not restrict the weights attached to the social welfare of each group in the economy to be equal. For example, $a^u > a^n$ would imply that the government places a higher weight on the welfare of union workers compared to the welfare of non-unionised workers (see Rama and Tabellini, 1998 and Fredriksson and Gaston, 1999). This particular feature of the model captures ideological or constituency-specific motives behind policy-making, reflecting a view that governments of different political persuasions treat the different groups differently.

Equilibrium unemployment benefits are the outcome of a two-stage game played between the government and the lobby groups.[11] Aggregating the government's welfare and the welfare of each group in society (net of political contributions), the policy-maker's choice of b is given by

$$b^* = \operatorname{argmax} \sum_{i \in L} V^i(b) + \sum_{j=k,u,n} a^j V^j(b).$$ (10)

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[11] Grossman and Helpman (1994) develop the common agency approach of Bernheim and Whinston (1986). Goldberg and Maggi (1999) emphasize that this is formally equivalent to choosing the unemployment benefit that maximises the joint surplus of all the parties involved.

4.2 *Budgetary considerations*: If we restrict our attention to balanced budget methods of financing higher unemployment benefits, then the revenue available to fund unemployment benefits is given by the sum of payroll taxes and tariff revenues, i.e.,

$$twn + T(p) = (1-n)b. \tag{11}$$

The effects of a trade liberalisation are captured by reductions in τ. This holds true whether τ is an import tariff or subsidy, or it is an export tax or subsidy. Note that there are two avenues through which a reduction in trade barriers may have effects on unemployment benefits. First, in the case of an export subsidy or an import tariff, a lower τ reduces the internal relative price of the domestic good thereby directly reducing employment in the protected sector, and secondly, in the case of an export tax or an import tariff a lower τ reduces the revenue available to fund increases in benefits. Overall, some authors have pointed to the possibility that the generosity of unemployment benefits, and hence the level of taxation needed to finance it, may well influence trade flows, at least in the short run (e.g., Ehrenberg, 1994). Equation (11) recognises that, through the effect on government revenues, freer and more open trade will affect the budget used to fund unemployment benefits.

If tariff revenues are not used to fund unemployment benefits, then more generous unemployment benefits need to be matched with higher payroll tax revenues. Since higher benefits have adverse employment effects, this necessitates a higher payroll tax rate.[12] Hence, despite the possibility of beneficial wage effects for some workers, all workers and employers would unambiguously lose from the higher taxes needed to finance more generous

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[12] Since employment is affected by both taxes and unemployment benefits, there are certain permissible values of both t and b for our problem to be well-defined. To illustrate, suppose that tariff revenues are not used to finance benefits, that we have a constant elasticity of production and that $l = 1$. We require that $bg_n n_t < 1$, where $g(n) = (1-n)(nw)^{-1}$, which implies that $t(1+t)^{-1} < (1-\alpha)(1-n)$. The condition for the tax rate also ensures that we are on the Laffer-efficient side of the tax revenue function. This requires that the tax elasticity of employment is not "too" elastic, i.e., $n_t tn^{-1} > -1$ (or that $t(1+t)^{-1} < (1-\alpha)$).

benefits. Consequently, a balanced budget constraint will serve to limit the size of equilibrium unemployment benefits (see below).

4.3 *The impact of higher unemployment benefits on the expected income of workers and shareholders*: Prior to wage and employment negotiations taking place, the income of all of the firm's shareholders is given by equation (1), evaluated at optimal values for *w* and *n*. In addition, using equation (11), and recalling that *C(p)* is independent of expected income, yields

$$I^k(b) = p^* f(n(b)) - w(b)n(b) - (1 - n(b))b. \tag{12}$$

Note that the financing of unemployment benefits is fully "experience-rated" in the sense that firms in the unionised sector with low levels of employment are taxed more heavily.

The total net income of the group of incumbent workers (i.e., aggregated over its membership of *m*) is

$$I^u(b) = mw(b) \tag{13}$$

The expected income of $1 - m$ non-unionised workers is given by

$$I^n(b) = (n(b) - m)w(b) + (1 - n(b))(b + \kappa) \tag{14}$$

The specification for workers assumes that they are risk neutral and that they maximise expected utility. Note that only when $m = 0$ and $\delta = \gamma$ do the preferences of non-union workers coincide with those of the political leadership of the union. We assume that the income while unemployed for workers is given by $c^v = b + \kappa$, where *b* is the government-provided benefit or income transfer and κ represents the value of informal sector or non-market production (e.g., as in Benhabib *et al.* 1991).[13]

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[13] We leave aside the issue of whether unemployment insurance benefits might optimally be provided privately, rather than socially, see Casamatta *et al.* (2000).

Before proceeding it is useful to summarise the effects of changes in the generosity of higher unemployment benefits on the indirect utility of factor owners. (See the Appendix for details.)

$$V_b^k < 0, \; V_b^u > 0 \; \text{ and } V_b^n >,=,< 0. \tag{15}$$

Incumbent workers always prefer higher benefits, because their employment is secure and higher unemployment benefits increase the reservation wages of all workers (which, in turn, increase negotiated wages). Naturally, firms unambiguously prefer lower reservation wages. When $l = 1$, it is straightforward to show that

$$V_b^n = \begin{cases} \geq 0, & \text{if } \dfrac{\delta - \gamma - \alpha}{\alpha \delta} \leq v \\[2mm] < 0, & \text{if } \dfrac{\delta - \gamma - \alpha}{\alpha \delta} \in (v, 1) \end{cases} \tag{16}$$

where $v = 1 - n$ is the percentage of the workforce not employed in the unionised sector. A sufficient condition for a higher value of b to have a positive impact on worker welfare is $\gamma + \alpha > \delta$. In fact, this condition implies that the Nash bargaining condition (NBC) has a steeper slope that the union worker's indifference curve (evaluated at (w^*, n^*)).[14] Only when the rents from union bargaining become larger, which may result from very high levels of wage-oriented bargaining, do workers become concerned about the possible disemployment effects of higher levels of b.

Equation (16) also reveals that a sufficiently high probability of employment in the higher wage and high rent unionised sector lowers worker demand for public insurance. For example, if the unionised sector suffers falling output prices and higher unemployment, then

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[14] From equation (7b), assuming $l = 1$, the slope of the NBC is $-(1 - \alpha)wn^{-1}$ and from equation (8), the slope of the indifference curve evaluated at (w^*, n^*) is $-(1 - \alpha)\delta w[(\gamma + \alpha)n]^{-1}$ (using equations (7b) and (8) to simplify). Comparing the two expressions, the NBC has a relatively steeper slope when $\gamma + \alpha > \delta$. In addition, evaluated at (w^*, n^*), the slope of the union leadership's indifference curve has a steeper slope than the worker's indifference curve as long as $\gamma > \delta$, i.e., when the union leaders are relatively more concerned with employment growth than with higher wages.

the demand for higher unemployment benefits will increase. This result differs from a key finding of median voter models in which unemployment benefits are negatively related to unemployment. As Persson and Tabellini (2002, p.31) note, this seems counterfactual when comparing Europe and the United States. Europe has both higher unemployment and higher unemployment benefits.

4.4 *Socially optimal unemployment benefits*: The presence of a non-lobby group population is important in the context of the Grossman-Helpman model because it admits the possibility that policies shaped by influence-seeking activities are likely to deviate from those chosen by a utilitarian social planner. From equation (10), it is clear that policies will always be socially optimal if the welfare of each group in society is equally weighted and if all groups are politically organised. The socially optimal unemployment benefit is defined as the benefit that maximises aggregate social welfare (in the absence of any lobbying and political contributions). The utilitarian policy-maker assumption is a useful benchmark for discussing the lobby group model. In this case, b is chosen to maximise

$$\Omega(b) = \sum_{j=k,u,n} V^j(b), \tag{17}$$

subject to the government's balanced budget constraint. Summing equations (12) to (14), and using equation (11), yields the following maximand

$$\Omega(b) = p^* f(n(b)) + (1 - n(b))\kappa. \tag{18}$$

The optimal unemployment benefit is simply chosen to maximise the value of market and non-market production.[15]

Obviously, if workers are risk neutral and if non-market production has no value, i.e., $\kappa = 0$, then employment in the unionised sector should be maximised and unemployment

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[15] The maximand is the same regardless of whether τ is an export tax or subsidy or an import tariff or subsidy. See footnote 11.

benefits should never exceed zero (see Acemoglu and Shimer, 1999).[16] We summarise the

key findings in Proposition 2. (Proofs are provided in the Appendix.)

Proposition 2: (Utilitarian policy-maker). *Suppose that $\kappa > 0$, then*

(i) *unemployment benefits are lower when the policy-maker chooses balanced-budget or revenue-neutral policies;*

(ii) *unemployment benefits are only positive if collective bargaining is centralised.*

First, when a policy-maker's balanced budget constraint binds, unemployment

benefits are lower than non-revenue neutral benefits and transfers. Secondly, a more novel

result is that $\gamma > \delta l$ is a necessary condition for the optimal unemployment benefit to be

positive. Recall from equation (16), that this condition implies that the bargaining objective

places relative greater weight on employment growth and job security. Hence, more

centralised bargaining systems are likely to have higher unemployment benefits. Focussing

on the effects of liberalising trade, the key comparative static results are summarised next.

Corollary 1: (Open economy). $b^o(\kappa, p^*, \tau, m, \gamma, \delta)$ *where*

(i) $b^o_\kappa > 0$, $b^o_m > 0$, $b^o_\gamma > 0$ *and* $b^o_\delta < 0$ *;*

(ii) *if international competition lowers product prices and raises unemployment, then unemployment benefits are higher, i.e., $b^o_{p*} \leq 0$;*

(iii) *the impact of trade liberalisation depends on whether tariff revenues are used to fund unemployment benefits. Specifically,*

(a) *if tariff revenues are <u>not</u> used to fund unemployment benefits then*

1. *in the case of an import tariff or an export subsidy, $b^o_\tau \leq 0$; or*

---

2. *in the case of an import subsidy or an export tax,*
$b_\tau^o \geq 0$*;*

(b) *if tariff revenues are used to partially, or to fully, fund unemployment benefits, then*

1. *in the case of an import tariff or an export subsidy,*
$b_\tau^o > 0$*; or*

2. *in the case of an import subsidy or an export tax,*
$b_\tau^o < 0$*.*

Part (*i*) indicates that unemployment benefits are higher when incumbent union workers, whose employment is secure, are more numerous. On the other hand, an aggressive pursuit of wage gains by union leaders or wage-employment contracts that expose workers to excessive amounts of employment risk are balanced by lower unemployment benefits. The effect of higher values of κ reflect the fact that the increased value of time spent in non-market activities relative to production and output in the unionised sector.

Part (*ii*) indicates that regardless of the method of financing, lower world prices raise unemployment benefits. That is, increased global competition is likely to lead to more generous unemployment benefits. The impact of trade liberalisation on the other hand, depends on whether tariff revenues are used to finance unemployment benefits and whether the unionised sector is protected or "anti-protected" (Vousden, 1990, 113). Part (*iii*)(*a*) simply states that for a small open economy liberalising its unionised import-competing sector, optimal unemployment benefits will be higher. The lower tariff operates purely as an adverse domestic output price shock for the unionised sector. Of course, as unemployment benefits rise, income tax burdens are greater for workers and shareholders as well. Part (*iii*)(*b*) indicates that when the unionised sector is protected and all tariff revenues are used to fund unemployment benefits, that the effect of trade liberalisation (assumed to be lower

tariffs and lower subsidies) is to reduce the value of unemployment benefits.[17] When the

unionised sector is "anti-protected", benefits are increased. The effects of a trade

liberalisation are therefore two-fold. First, lower import tariffs and export subsidies increase

competition, which increases unemployment and raises benefits. Secondly, lower tariff or tax

revenues affect the government's budgetary position. In the case of lower import tariffs there

is pressure on b to rise due to greater import competition, but there is an offsetting pressure

on b to fall due to fiscal concerns.[18]

4.5 *The effect of lobbying activities:* To understand the effect that lobbying by interest

groups has on the determination of public insurance and other labour market policies it is

important to identify the groups in an economy that are politically organised or those that do

not actively participate in the political process. If we assume that the political weights

attached to each group of factor owners by the policy-maker are equal, this is readily seen by

rearranging the solution to equation (10) to obtain

$$(1+a)\Omega_b = \sum_{i' \notin L} V_b^{i'} . \tag{19}$$

Among others, Rama and Tabellini (1998) show that the policy distortion is

proportional to the welfare effect of the policy on the unrepresented group in society.

Clearly, unemployment benefits are set at socially inefficient high (low) levels whenever the

left-hand side of equation (19) is negative (positive). This result obtains because of the non-

participation by groups of factor owners workers in the political process who, if represented,

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[17] Such budgetary considerations may provide a theoretical explanation for Blank and Freeman's (1994) argument that some European countries, in the face of increased international competition, tried to reduce the "generosity" of their social programs.

[18] In contrast, when an import subsidy is lowered there is pressure on benefits to be reduced due to higher internal prices, but there is also a relaxation of the government's balanced-budget constraint making the payment of more generous benefits possible. (Likewise, there are offsetting effects for export taxes and subsidies.)

would press for lower (higher) benefits. Further, the degree of the distortion is decreasing in the relative weight placed on social welfare, a.[19]

The comparative static effects of unequal treatment of groups of factor owners in the lobby group are transparent if we assume that only political contributions matter. Suppose that we assume, as seems reasonable, that only organised labour and capital owners make political contributions. For instance, in most OECD countries non-unionised workers are politically unorganised or sufficiently disenfranchised so as not to lobby (nor contribute to) the government for preferred policy outcomes. Clearly, unemployment benefits are lower when the policy-maker weights the welfare of shareholders more heavily.

Finally, to bridge the results of this theoretical discussion to the empirical work that follows, the next proposition contains the results for the politically-determined b^* under the assumption that only organised labour makes political contributions.

>**Proposition 3: (Lobbying).** *Suppose that $\kappa > 0$, that $a^j = a$, and that only organised labour lobbies, then*
>
> i) $b^* > b^o$.
>
>*Further, b^* increases in*
>
> ii) *m, the number if organised workers, and*
>
> iii) *the elasticity of negotiated wages with respect to unemployment benefits;*
>
>*and b^* decreases in*
>
> iv) *a, the incorruptibility of the government, and*
>
> v)   *the elasticity of employment with respect to unemployment benefits.*

The results are straightforward. The first part implies that countries with labour-oriented or left-wing governments have higher unemployment benefits than those countries with conservative or right-wing governments. In terms of the comparative statics, note for

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[19] Some authors have interpreted *a* as measuring a policy-maker's incorruptibility or the willingness of a government to adhere to welfare maximising policies (see Shleifer and Vishny, 1993 or Fredriksson and

the model we consider in this paper, that the demand for higher benefits by incumbent union workers is driven by what Saint-Paul (1996) terms the "wage formation effect". The stronger this wage effect, the higher are unemployment benefits. Likewise, an elastic response of employment to higher benefits would counteract the wage formation effect.

V.   Indirect Labour Market Effects of Globalisation: Some Empirical Results

To test the main implications of the theory, our empirical analysis proceeds by examining unemployment benefit entitlements both within and between countries (see OECD, 1995 Jobs Study). In particular, we investigate whether openness of the economy and labour market institutions might be responsible for the differences. Amongst other things, in the empirical analysis our goal is to provide insights into policy-related questions that remain largely unresolved: First, is greater openness to trade correlated with the unemployment benefit generosity or stringency? Secondly, is there a statistical association between the nature of union participation in the economy, government indebtedness, partisan political effects and unemployment benefits?

Using panel data for 17 OECD countries, we estimate the fixed effects regression model. The dependent variable in all cases is the OECD's gross benefit replacement rate (*BR*): the proportion of expected income from work that is replaced by unemployment and related welfare benefits.[20] Our model specification considers country fixed-effects and one-period lags of the independent variables, as well as a two-period lag of the dependent variable:[21]

$$BR_{i,t} = \lambda BR_{i,t-2} + \beta' X_{i,t-1} + \theta_i + \varepsilon_{i,t}, \tag{20}$$

Svensson, 2002). However, in the context of pluralist democracies like those of the OECD, which make up our empirical sample, this is clearly a problematic interpretation of public political effort by organised groups.

[20] The OECD produces these data for odd-numbered years from 1961-1999. Martin (1996) provides a detailed description of this variable. The OECD, Directorate for Education, Employment, Labour and Social Affairs, Social Policy Division, was kind enough to provide these data.

[21] The lag of the dependent variable is a control for first-order autocorrelation. We are constrained to use a two-year lag because the variable is only calculated biennially.

where $X_{i,t-1}$ is a vector including measures of openness, political orientation of the government (not lagged), union density, government debt, and a variable constructed by interacting the openness and debt variable; θ_i is the country specific effect; and $\varepsilon_{i,t}$ is a random disturbance term. These are then stacked for estimation as a panel. Table 1 gives definitions, sources, and predicted signs of the variables in $X_{i,t-1}$.[22]

Table 1 about here

In addition, we consider several variations on sample and specification.[23] The results are reported in table 2.[24]

Table 2 about here

Before considering our preferred specification, consider the specification in column (2). This contains the main variables with which we are concerned. As we explained at the end of the previous section, both left-wing governments and widespread coverage of workers by union bargaining are predicted to raise unemployment benefits, and both of these results are clearly present. Our results on these variables are consistent with those in the large empirical literature in comparative political economy focussing on the link between labour market institutions, political orientation, and welfare state outputs.[25] As suggested by our model, and consistent with the widely remarked link between openness to international trade

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[22] Our sample countries are essentially the high-income OECD countries for which we could get at least 10 years of data: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, UK, and US. In fact, our preferred specification also excludes Italy as a result of problems with the dependent variable (see the Annex to Martin, 1996). We initially suspected that there might be problems with the German data as a result of unification, but exclusion of Germany has no qualitative effect, and only very small quantitative effects, on our results.

[23] We considered random effects specifications of all the reported fixed effects specifications. In addition to the usual problems with interpreting random effects, in all but one case the Hausman test rejected the random effects specification in favour of the fixed effects specification.

[24] The reported estimates were produced in PC-Give, using the panel data models module (Doornik, Hendry, Arellano, and Bond, 2001). We checked the results by estimating the models in TSP and EViews with no significant differences in results. That is, although these packages use somewhat different corrections to the standard errors, the qualitative and quantitative differences in significance were small.

and size of welfare state interventions, we find a significant, positive relationship between the trade openness variable and the size of the unemployment benefit. Finally, since the government faces a balanced budget constraint in our model, we introduce a measure of the magnitude of debt as an indicator of how closely the constraint binds. The sign of the coefficient is negative, as predicted, but it is not statistically significant. As in all specifications, the standard errors adjust for heteroskedasticity, and our tests reject the null of first and second-order autocorrelation.

Now consider column (1), which contains the results for our preferred specification. The interpretations of our political orientation and union density variables are the same, but with the introduction of the interaction variable, which is highly significant though quantitatively small, the interpretation of trade openness and government debt become more delicate.[26] Specifically, the values of the coefficients on openness and government debt now vary with each other's levels. That is, they describe conditional relationships, not unconditional ones. In this case, the negative interaction term captures the notion that, at any given level of openness to trade, a standard deviation increase in the government debt to GDP ratio lowers the response of the benefit replacement rate to openness (i.e., the conditional slope) by about 1.1 percentage points (i.e., $-0.0007 \times 58.338 \times 27.132$). Having accounted for this relationship, we are concerned that the estimate of a positive relationship between the unemployment benefit and debt may reflect endogeneity problems that will need to be dealt with in future work on this topic. The remaining specifications of the model yield essentially the same results. Consequently, we find the empirical results reported in table 2 to be quite consistent with the theoretical approach adopted in sections III and IV of this paper.

VI. Conclusions

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[25] See the discussions in Garrett (1998) and Swank (2002).

[26] See Friedrich (1982) for an extended discussion of the use of interaction terms and their interpretation.

From a political economy perspective, institutional features of the labour market help to explain observed trends in public insurance policies. When wage bargaining is extremely decentralised, the lobbying influence of unions allied with the lobbying activities of employers encourages policy-makers to ease tax burdens and cap increases in unemployment benefits. When the risk of unemployment is lower and collective bargaining is more centralised, workers prefer high employment risk-high wage contracts, and this serves to increase the demand for publicly-provided unemployment insurance.

To summarise, we have highlighted the importance of labour market institutions for understanding the incentive for unions to lobby for public insurance policies. Whether wage and employment bargains are conducted at a more decentralised level or, more generally, whether the effect of wage increases on the risk of unemployment is taken into consideration by unions affects observed union attitudes toward public insurance policies.

Table 1: Descriptive Statistics and Summary of Hypotheses

Variable	Label	Hypothesis	Mean	Std. Dev.	Source
Benefit replacement rate, %	*Benef*	.	24.018	14.309	*a*
Government gross debt as percentage of GDP, %	*Debt*	-	36.295	27.132	*b*
Union density, %	*Dentot*	+	44.415	19.111	*c*
Trade openness	*Open*	+	58.338	28.003	*d*
Political orientation of government	*Left*	+	2.354	1.533	*e*

Notes and data sources:

a. Replacement rates (i.e., benefits before tax as a percentage of previous earnings before tax) as defined by legislated entitlements averaged across various circumstances in which an unemployed person may be. OECD (courtesy of OECD Social Policy Division).

b. Consolidated central government gross debt as a fraction of GDP. Robert J. Franzese, Jr., "The Political Economy of Public Debt: An Empirical Examination of the OECD Postwar Experience" paper for the *Wallis Conference on Political Economy*, Northwestern University, November 1998.

c. Total union membership (less self-employed) weighted by total dependent workforce, European countries from Ebbinghaus and Visser (2000). Data for Australia, Canada, Japan, and US from Miriam Golden, Michael Wallerstein and Peter Lange (1998), "Union Centralization Among Advanced Industrial Societies", National Science Foundation.

d. (Total exports of goods and services + total imports of goods and services)/GDP, OECD Main Economic Indicators, Online Access.

e. *Left* = 1 if there is right-wing domination in both government and parliament; = 2 if right-wing or centre parties make up between 33.3% and 66.6% of government; = 3 if centre parties make up 50% or more of government; = 4 if left-wing or centre parties make up between 33.3% and 66.6% of government; and = 5 if left-wing parties dominate the government. Taken from Jaap Woldendorp, Hans Keman and Ian Budge (1998), "Party Government in 20 democracies: an update (1990-1995)", *European Journal of Political Research*, 33(1), pp.125-164.

Table 2: Determinants of Benefit Replacement Rates, 1963-1995
(robust standard errors)

	(1)	(2) No Interaction	(3) *Left* Lagged	(4) Contemporaneous	(5) With Italy
Left	0.260**	0.253**	0.162	0.257**	0.258**
	(0.106)	(0.115)	(0.121)	(0.103)	(0.105)
Union density	0.139***	0.133***	0.139***	0.158***	0.111**
	(0.046)	(0.052)	(0.046)	(0.041)	(0.047)
Openness	0.098***	0.044*	0.098***	0.102***	0.081**
	(0.034)	(0.027)	(0.036)	(0.035)	(0.035)
Government debt	0.043**	-0.015	0.043*	0.047**	0.025
	(0.022)	(0.018)	(0.023)	(0.023)	(0.019)
*Openness*Debt*10*	-0.007***		-0.007***	-0.007***	-0.006***
	(0.002)		(0.002)	(0.002)	(0.002)
Benefits(-2)	0.797***	0.812***	0.798***	0.782***	0.817***
	(0.072)	(0.072)	(0.072)	(0.066)	(0.079)
R^2	0.932	0.930	0.931	0.933	0.941
Observations	259	259	259	256	274

Notes: *Benefits* are lagged two years and *Left* is unlagged in all columns, except column (3) where *Left* is lagged one year. All other independent variables are lagged one year, except in column (4) where all variables are contemporaneous with the dependent variable. Column (5) adds Italy to the sample for the column (1) specification. ***,**,* denotes significant at 1, 5, 10 percent level, respectively.

A-1. Derivation of comparative statics in Proposition 1. Solving equations (7b) and (8) we have

$$w = \frac{(\gamma + \alpha l)c^v}{B} \quad \text{and} \quad \frac{f}{n} = \frac{(\gamma + l)(1 + t)c^v}{Bp},$$

where the elasticity of output is $\alpha = \frac{nf_n}{f}$, $l = \frac{n - m}{n}$ and $B = \gamma + \alpha l - (1 - \alpha)\delta l > 0$. It follows that

$$w_{c^v} = \frac{(\gamma + 1)\gamma + (\gamma + l)\alpha l}{y} > 0; \quad n_{c^v} = \frac{-(\gamma + l)Bn}{(1 - \alpha)yc^v} < 0; \quad w_p = \frac{(1 - l)\delta\gamma f}{yn} \geq 0;$$

$$n_p = \frac{(\gamma + l)B(1 + t)n}{(1 - \alpha)yp} > 0; \quad w_\delta = \frac{w_{c^u}(1 - \alpha)lw}{(\gamma + \alpha l)} > 0; \quad n_\delta = \frac{-(\gamma + l)nl}{y} < 0;$$

$$w_\gamma = \frac{-(1 - \alpha)\delta lpf}{y(1 + t)n} < 0; \quad n_\gamma = \frac{(1 + \delta)nl}{y} > 0; \quad w_m = \frac{\gamma w_\gamma}{nl} < 0 \quad \text{and} \quad n_m = \frac{m_\gamma}{nl} > 0;$$

where $y = (\gamma + l)B + (1 - l)(1 + \delta)\gamma > 0$. Furthermore, it follows that

$$w_{p*} = \frac{(1 + \tau)w_p}{(1 + t)} \geq 0; \quad w_\tau = \frac{p^* w_p}{(1 + t)} \geq 0; \quad w_t = \frac{-pw_p}{(1 + t)^2} \leq 0; \quad n_{p*} = \frac{(1 + \tau)n_p}{(1 + t)} \geq 0;$$

$$n_\tau = \frac{p^* n_p}{(1 + t)} \geq 0; \quad \text{and} \quad n_t = \frac{-pn_p}{(1 + t)^2} \leq 0. \quad \blacksquare$$

A-2. Derivation of equation (15). Differentiating equations (12) to (14), using the results listed in A-1, and simplifying we have

$$V_b^k = \frac{-[(1 - l)\gamma + (\gamma + l)\alpha l]n}{y} < 0, \quad V_b^u = mw_{c^u} > 0 \quad \text{and}$$

$$V_b^n = \frac{[(\gamma + 1)\gamma + (\gamma + l)\alpha l - (\gamma + l)\delta]nl}{y} + (1 - n). \quad \blacksquare$$

A-3. Proof of Proposition 2. The solution to the maximisation of equation (18) is

$$\Omega_b = (p^* f_n - \kappa)n_b = 0.$$
(A1)

When benefits are financed out of general revenues, the policy-maker's chooses b to maximise

$$\Omega(b) = p^* f(n(b)) + (1 - n(b))(b + \kappa).$$
(A2)

The solution is given by

$$\Omega_b = (p^* f_n - \kappa) - b + \frac{(1-n)}{n_b} = 0.$$
(A3)

Comparison with equation (A1), and recalling that $n_b < 0$, yields part (*i*) of the Proposition.

Next, use the first order conditions (equations (7a) and (7b)) and the expression for the balanced budget constraint (equation (11)), to obtain

$$b^o = \frac{(1-\alpha)\kappa n}{\alpha(\gamma + l)} \left[\frac{(\gamma + \alpha l)(\gamma - \delta l) - Bl\tau}{B + n(1-\alpha)\delta l} \right],$$
(A4)

where $B = \gamma + \alpha l - (1-\alpha)\delta l > 0$. Part (*ii*) of the Proposition follows. ∎

A-4. Derivation of comparative statics in Corollary 1. From equation (A1), and using the results from A-1 above, the comparative statics in part (*i*) follow directly. Next, when tariff revenues are not used to finance b, then the policy-maker's objective is $\Omega(b) = pf(n(b)) + (1 - n(b))\kappa$, rather than equation (18). Total differentiation of $(pf_n - \kappa)n_b = 0$ yields

$$b_{p^*} = \frac{-(1-l)(1+\delta)\gamma c^v}{(\gamma + l)Bp^*} \leq 0.$$
(A5)

Total differentiation of equation (A-1) yields

$$b_{p^*} = \frac{-(1-l)(1+\delta)\gamma c^v}{(\gamma + l)Bp^*} \leq 0 \text{ and } b_\tau = \frac{-n_\tau}{n_b} > 0.$$
(A6)

In the case of an import tariff or an export subsidy, $n_\tau > 0$. In the case of an import subsidy

or an export tax, $n_\tau < 0$. Parts (*ii*) and (*iii*) follow. ∎

A-4. Proof of Proposition 3. The solution to maximisation of equation (19) is

$$a(p^* f_n - \kappa)n_b = -mw_b. \tag{A7}$$

Defining $\varepsilon_w = \dfrac{bw_b}{w} > 0$ and $\varepsilon_n = \dfrac{bn_b}{n} < 0$, equation (A7) can be rewritten as

$$p^* f_n = \kappa - \frac{(1-l)w\varepsilon_w}{a\varepsilon_n}. \tag{A8}$$

Comparison with equation (A1), and noting that f_n increases in b, yields the Proposition. ∎

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