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UNIONS AND EQUITY

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***Abstract**: Trade unions have been successful in compressing the wage distribution but not in influencing the share of national income going to labour. This paper claims that a compressed wage distribution provides insurance in the same way that the tax and benefit system does and thus may be welfare-improving. Moreover, a union-based wage compression system may be a better than a conventional tax-benefit system in providing such insurance and may well complement the operation of the latter.*

Models of wage compression and of taxes and benefits are evaluated and then combined in a single model. The wage compression system works well for the least skilled but the tax-benefit approach is better if average utility is being maximized. In the combined model the two mechanisms complement one another. Equity-efficiency trade-offs in the combined system mostly dominate those obtained from each mechanism acting on its own.

A key factor is the willingness of skilled workers to "defect" from a wage compression agreement. Encouraging "defection" may appeal to policy-makers (labour markets are more "flexible") but the benefits of a compressed wage distribution may be lost, placing stress on welfare state institutions and undermining the insurance function that the combined wage-compression/tax-benefit system delivers relatively efficiently.

JEL classification:H23; J51. Keywords: trade unions, distribution, tax-benefit system

1. Introduction

Trade unions appear to have been remarkably successful in compressing the wage distribution while being much less successful in influencing the share of national income going to labour. This paper explores the significance of this observation. The central thesis is that a compressed wage distribution provides a form of insurance in the same way that the tax and benefit system does. Moreover, it may do so in relatively efficient way.

It has been argued that the way to understand welfare state institutions like redistributional taxes and benefits is to observe that they provide insurance against bad outcomes in the process whereby individuals are allocated abilities and career opportunities (Varian, 1980; Diamond, Helms and Mirrlees, 1980; Mirrlees, 1995; Sinn, 1995). Organising such insurance via private markets would require the signing of life-long contracts on behalf of individuals at the time of their birth - or even before. There are legal barriers to the existence of such insurance markets. Sinn (1995, p. 497) points out that the resulting contracts would approximate bondage; as such, they would probably be unacceptable and unenforceable. Mirrlees (1995, p. 385, n. 2) notes that legal changes which allowed parents to contract obligations for children would make a system of market-provided insurance possible, but he raises doubts as to whether parents would be the best judges of their children's interests in this situation; perhaps the state would do better. Another argument for state provision of this form of insurance is that the existence of a fiscal system (justified, in the first instance, by the need to fund public goods) gives it a mechanism for dealing with the adverse selection problem and for collecting "premiums" (i.e. taxes to fund transfers) cheaply.

Nevertheless, there are well-known disincentive costs associated with tax-benefit systems. This raises the question of whether another mechanism for compressing ex

post outcomes might be able to provide a similar degree of ex ante insurance with lower efficiency losses. The mechanism I have in mind is a trade union-negotiated wage schedule which compresses wage rates for different degrees of skill, raising the wages of low skilled workers above their marginal products while lowering the wages of skilled workers below theirs. An agreement of this type between unions and employers would have to include a protocol covering the employment of lower skilled workers since, in its absence, employers would simply pocket the wage concessions offered by higher skilled workers and recruit lower skilled workers from the competitive labour market.[1] *There would also need to be some mechanism preventing higher skilled workers from leaving the union and offering their labour in the competitive sector.*

[1] *It is interesting to note that, while general (wage, employment) bargains [as envisaged by the "efficient bargain" model of trade union behaviour] are rare (Oswald, 1989; Layard, Nickell and Jackman, 1991, pp. 112-8), it has been less uncommon for agreements covering skilled workers to specify some norm for the ratio of the numbers of unskilled to skilled workers.*

The fact that union "egalitarianism" can provide income insurance has been noted by Horn and Svensson (1986) and by Agell and Lommerud (1992); see also Agell (1999). In the paper by Horn and Svensson a monopoly union representing identical, risk-averse workers bargains with competitive firms. Uncertainty is present because firms employ a stochastic technology which reduces workers' productivity in "bad" states. An optimal contract reduces the variability of wages; it also reduces the variability of employment.[2] Clearly, the type of uncertainty envisaged by Horn and Svensson is that which manifests itself at business cycle frequencies. The approach taken by Agell and Lommerud is quite different, and is closer to that adopted here. Agell and Lommerud have (initially identical) individuals facing uncertainty about whether they are destined to become skilled or unskilled workers, with much longer-term implications for income and utility levels. This type of uncertainty is very hard to deal with. Conventional insurance markets cannot provide adequate risk pooling in this case; nor, it appears, could optimal contracts of the Horn-Svensson type. On the other hand, both a tax-benefit system and a union-influenced system of wage determination can provide insurance against an unlucky draw in the skills lottery. Agell and Lommerud draw this analogy and develop a union-based wage compression model. They show that, if workers' utility is concave in income and their reservation wage is close to the competitive wage of unskilled workers, a monopoly union will pursue an egalitarian wage policy. Although they note that a tax-benefit system can also provide income insurance they do not present a formal comparison of the two mechanisms; developing such a comparison is the major purpose of this paper.[3]

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[2] *The authors note that this latter effect is contrary to the stylised facts.*

[3] *Because I am concerned with this comparison, my modelling approach differs from that of Agell and Lommerud. They assume two skill levels ("skilled" and "unskilled") and a production function in which these two types of labour are imperfect substitutes. Both types of labour are supplied inelastically; neither leisure nor unemployment is modelled. Where taxes and benefits are mentioned they are*

The plan of the paper is as follows. Section 2 provides a brief review of some evidence about what unions in OECD countries have achieved - and not achieved. In Section 3 I present a model of union behaviour in which the emphasis is on compressing the wage distribution of union members. To allow comparison with a tax-benefit system, I develop the model in three steps: first I consider a tax-benefit system without unions; then I look at a union-based system of wage compression, and finally I examine the interaction of the two redistribution mechanisms. Welfare comparisons show that the two mechanisms may well complement one another. In Section 4 I modify the combined model by having union members (rather than a social planner) set the parameters of the wage compression system; in particular, I assume that the median union member is decisive. Since union membership is endogenous in the model it is necessary to identify policies for the union which are proof against any proposed change. One interesting implication is that a union with endogenous membership may adopt an insufficiently radical wage compression policy; this contrasts with other median voter models of union behaviour where such voters, "insulated" by seniority from the threat of unemployment, support "too radical" a policy by attempting, say, to raise wages at the expense of higher

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treated as exogenous. In the model developed below there is a continuum of skill levels but workers with different skill levels are perfect substitutes: they simply produce different amounts of output. Labour supply depends on the (post-tax and post-benefit) wage. The tax-benefit system is modelled by imposing a government budget constraint.

unemployment. In Section 5 I draw some conclusions.

2. Trade Unions, Labour's Share and the Distribution of Earnings

Almost all existing attempts to model trade union behaviour start from the proposition that unions exist to raise the wages of their members; see, for example, the studies surveyed in Booth (1995), Pencavel (1991) and Ulph and Ulph (1990). Many models also attribute other objectives to trade unions, by positing, for example, that unions also value the employment prospects of their members. The existence of multiple objectives on the part of unions gives rise to possible trade-offs which complicate the measurement of union strength. Nevertheless, it seems clear that strong, effective unions should have a positive impact on their members' incomes, at least over some range.[4] *However there is evidence to show that unions have not been effective in raising the share of output which goes to labour. To illustrate this, three measures of labour's share were calculated, based on data from OECD countries. (See Table A1 in the Appendix.) The first measure (called* $share_1$*) is the ratio of the take-home pay (after income tax and employee's social security contributions) of an average production worker to GDP/employee. The second (*$share_2$*) is the ratio of total wage costs (gross pay plus employer's social security contributions) to GDP/employee. Finally,* $share_3$ *is obtained by adjusting* $share_1$ *(which is defined in terms of take-home pay) for the incidence of*

[4] *Some models of union behaviour predict more complex relationships between indicators of union strength and the real wage. For example, Calmfors and Driffill (1988) argue that the relationship between the degree of centralization of wage bargaining and the resulting real wage is "hump-shaped": the real wage is raised most (and employment most reduced) where unions are moderately strong but not so "large and all-encompassing" that they moderate their behaviour by taking into account the inflationary and unemployment effects of wage increases. See also Rowthorn (1991, 1992a, 1992b). The issue of a "hump-shaped" real wage versus union strength relationship is addressed below.*

consumption taxes. This means that $share_1$ and $share_3$ measure labour's share for this category of worker from the worker's point of view while $share_2$ measures labour's share from the firm's point of view. Table A1 also lists two measures of trade union strength: union density and the proportion of employees covered by collective bargaining agreements.[5] *There is certainly no clear positive relationship between these two measures of union strength and these various measures of labour's share. Where a relationship can be detected it appears to be negative rather than positive or "hump-shaped" as in Calmfors and Driffill (1988).*[6] *Thus OLS regressions*[7] *of $share_1$ and of $share_3$ against trade union density and bargaining coverage produced insignificant coefficients in the case of union density and a negative relationship in the case of the coverage variable. In the case of $share_2$, both measures of trade union strength proved to be insignificant. On the other hand, a significant positive association was detected between trade union strength and ($share_2$ - $share_3$) which we may interpret as the "wedge" between labour's share as viewed by firms and labour's share as viewed by workers.*

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[5] *Union density and collective bargaining coverage data were available for only 19 of the 24 countries listed in Table A1.*

[6] *Terms in (union density)^2 and (coverage)^2 were included in the regressions discussed in this section to capture the possibility that the relationship between union strength and the wage share is non-linear; that is, "hump-shaped", as in Calmfors and Driffill (1988). Calmfors and Driffill conduct their analysis in terms of what they define as the "degree of centralization" in wage bargaining rather than in terms of trade union density or bargaining coverage. However their measure is quite highly correlated with the latter two variables. Thus the Spearman rank correlation between their measure and trade union density as listed in Table A1 (excluding Portugal and Spain, for which they do not provide rankings) is 0.613. The rank correlation between their measure and bargaining coverage is 0.627. [Note that OECD (1997, Table 3.4) obtains higher correlations still - 0.71 and 0.70, respectively - using data from 1990 rather than from 1994.]*

[7] *Details of these regressions are available from the author and at http://www.economics.ox.ac.uk/tjos.union.*

To investigate the relationship between union strength and earnings inequality data from OECD (1996, Table 3.1) was used.[8] From these data the D9/D1 decile ratio[9] was calculated for 1990 and also for the earliest and latest years for which data is provided. To capture changes in inequality over time in each country a new

[8] *A number of studies have investigated the link between unions and the distribution of earnings: see Gregory and Thompson (1981), Freeman (1980, 1982, 1993), Freeman and Medoff (1985, chapter 5), Metcalf (1982), Gosling and Machin (1993), Kalleberg and Colbj□rnsen (1990), Blau and Kahn (1996) and Kahn (1998). My focus is on the distribution of earnings between different individuals. This should be distinguished from wage dispersion across industries, as studied by Freeman (1988) and Rowthorn (1991, 1992a, 1992b).*

[9] *The ratio of the upper earnings limit of the ninth decile of workers to the upper limit of the first decile.*

$$D9/D1_{trend} = \frac{D9/D1_n D9/D1_m}{nm}$$

variable, $D9/D1_{trend}$ was defined:

where m and n refer to the earliest and latest years for which data are available. These data are shown in Tables A2, A3 and A4 for males, females and all employees, respectively.

These estimates of D9/D1 for these three categories of employees were then used as the dependent variable in OLS regressions with trade union density and bargaining coverage as potential explanatory variables.[10] The results for males suggest that trade union strength is associated with a more equal distribution of earnings. The coefficient on bargaining coverage is significant at the 5% level while that on trade union density is very close to being so. While these regressions leave much of the cross-sectional variation in earnings inequality unexplained, the trade union effect appears clear and large in magnitude. The results for females show that trade union strength is again significant, but for females it is trade union density rather than bargaining coverage that appears to matter. The results for males and females together also show significant union effects. Here it does not matter which measure of union strength is used, although the trade union density variable does a little better than the bargaining coverage variable.

[10] As before, I experimented with *density* and *density*^{2} and *coverage* and *coverage*^{2} to see whether a non-linear relationship may be present.

Having established that trade union strength is associated with a compressed earnings distribution at a particular point in time, it is of interest to investigate whether trade unions have been effective in resisting the rise in inequality which has occurred in a number of OECD countries during the 1980s and the first half of the 1990s. To do this the per annum change in D9/D1 was regressed against trade union density and bargaining coverage. This is a rather rough-and-ready approach to what is, clearly, a complex dynamic process.[11] *Nevertheless, use of this summary measure of how wage inequality has changed does yield some insights. It appears that bargaining coverage can go some way to explain why some countries did not experience a large rise in earnings inequality among male workers. However, it appears that this was not so for female workers. Finally, taking both groups together (which allows the inclusion of data from Denmark, the Netherlands and Norway) produced support for the view that a high degree of bargaining coverage was a significant factor in damping increased earnings inequality within the whole workforce.*

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[11] *As charts 3.1 and 3.2 in OECD (1996) illustrate, changes in D9/D1 for various categories of workers in different countries have not followed simple trends. Some of the changes are compressed into a relatively short period following (or followed by) approximate stability. Sometimes the direction of change actually reverses. Finally, there appear to be business cycle effects in a number of countries, but these display no clear pattern.*

3. A Wage Compression Model

The previous section discussed evidence that, while unions have not been successful in increasing the share of output going to labour, they have been successful in compressing the wage distribution. The remainder of the paper explores some of the implications of this for social welfare and public policy. It does this by examining a model of trade union behaviour in which compressing the distribution of earnings plays a key role. In fact, in order to focus on the wage compression/insurance effect of trade unions, I will assume that the union has no impact on the average wage negotiated for its members.[12] *Instead, it will negotiate a wage schedule* $\Theta(s)$ *which will raise the wages of lower skilled workers and lower*

$$w(s_i) = \Theta[\rho(s_i)]$$

the wages of higher skilled:

where $w(s_i)$ *is the wage paid to a worker with skill level* s_i *and* $\rho(s_i)$ *is this worker's productivity.*[13] *To simplify the notation* s_i *will be defined in such a was as to make* s_i *equal to* $\rho(s_i)$*. I will suppose that the union covers all workers whose skill levels lie between* s_{Umin} *and* s_{Umax}*, although there could be workers whose* s_i *is below* s_{Umin} *who are not members of the union. Similarly, there may be [in fact,*

[12] *Clearly, this is an extreme assumption which is adopted here so that we may focus on the wage compression effect. It would be possible to combine the wage compression motive with a traditional "wage push" model of union behaviour, but such an extension is beyond the scope of this paper.*

[13] *In this model there is wage differentiation within the union. As a result, it makes no essential difference whether there is a single union or a number of cooperating unions covering different skill categories. ("Cooperating" here means that workplace norms about the ratio of workers with different skills are respected.) This is in contrast to Calmfors and Driffill (1988) and Rowthorn (1991, 1992a, 1992b) where each union negotiates a single wage so wage differentiation can only arise if there are separate, non-cooperating unions. For an alternative model of wage differentiation within individual unions see Jun (1989).*

usually will be] workers whose s_i is above s_{Umax} and who are also non-members. If

$$\int_{s_{U\min}}^{s_{U\max}} h(s)\Phi(s)\Theta[\rho(s)]ds = \int_{s_{U\min}}^{s_{U\max}} h(s)\Phi(s)\rho(s)ds$$

the agreement has no impact on the profits of firms it must be that

where $h(s)$ is the number of hours of labour supplied by worker with skill level s and $\Phi(s)$ is the density function of s. In what follows I will always assume that the

$$w(s) = \Theta[\rho(s)] = \Theta[s] = w_0 + \theta s$$

schedule defining the way wages are compressed takes the following linear form:

for some constant $\theta \leq 1$. I will also usually assume that the distribution of skills is uniform on [0,1].

In order to compare this system for compressing incomes with the tax-benefit alternative, a simple tax-financed benefit will be considered. An untaxed benefit, b, will be paid to everyone, whether they are employed or not.[14] This will be financed by a proportional tax at rate t on all wage income. There are no other taxes or government expenditures and the government's budget is balanced. In both the union-based and tax-benefit systems individuals have the following utility function, defined over leisure (1-h), where h is labour time supplied, and consumption, c.

[14] *An alternative approach would be to model benefits as going only to the unemployed. This would change the details of the analysis, but not the general conclusions. The assumption in the text is preferred because, in practice, governments fund many benefits (both transfers and benefits in kind) which are enjoyed by households which also supply labour. These benefits are roughly equal across the income distribution; see Sefton (1997).*

$$u(h,c) = (1h)^{\frac{1}{2}} + c^{\frac{1}{2}}$$

$$= (1h)^{\frac{1}{2}} + (wh(1t) + b)^{\frac{1}{2}}$$

It is straightforward to show that the labour time an agent would prefer to supply

$$h^* = \frac{w^2(1t)^2 b}{w(1t)(1 + w(1t))}$$

in these circumstances is

I will assume that agents can supply this amount of labour, so long as h^* is greater than zero; in other words, agents are not constrained by legislation or norms imposed by firms (or unions) concerning the length of the working day. If h^* is less than zero (i.e because w is small relative to t and/or b) the agent supplies no labour and simply consumes b; this is a situation of voluntary unemployment.

While my aim is to develop a model in which both unions and a tax-benefit system are present, it is useful to begin by considering each system on its own.

(a) A tax-benefit system (without unions)

$$\int_{s_1}^{1.0} \frac{(w^2(1t)^2 b)wt}{w(1t)(1 + w(1t))} ds = \int_{0}^{1.0} b ds$$

The key relationship here is the government's budget identity:

Noting that, in this case, $w=s$ we obtain

$$\int_{s_1}^{1.0} \frac{(s^2(1t)^2 b)t}{(1t)(1+s(1t))} ds = b$$

The integral on the LHS may be simplified by using the following change of

$$x = s(1t)$$

variable

$$\frac{t}{(1t)^2} \int_{x_1}^{x_2} \frac{x^2}{1+x} dx \frac{tb}{(1t)^2} \int_{x_1}^{x_2} \frac{dx}{1+x} = b$$

so that the equation becomes

$$x_2 = 1t$$

with

$$x_1 = s_1(1t)$$

and

where s_1 is the skill level of the individual who is just at the margin of voluntary

$$s_1 = \frac{\sqrt{b}}{1t}$$

unemployment. For this person

Thus we have

$$\frac{t}{(1t)^2}\int_{\sqrt{b}}^{1t} x dx \frac{t}{(1t)^2}\int_{\sqrt{b}}^{1t}\frac{xdx}{1+x}\frac{tb}{(1t)^2}\int_{\sqrt{b}}^{1t}\frac{dx}{1+x} = b$$

$$\frac{t}{(1t)^2}[\frac{(1t)^2}{2}\frac{b}{2}(1t)+\ln(2t)+$$
$$\sqrt{b}\ln(1+\sqrt{b})b\ln(2t)+b\ln(1+\sqrt{b})] = b$$

so that

This non-linear equation in the tax rate, t, and the benefit level, b, gives combinations of values of t and b for which the government's budget is balanced. It is solved numerically to produce the diagrams shown below. For a selected value of the tax rate t (and the corresponding value of the benefit level) it is possible to calculate utility levels for agents with different amounts of skill and hence total utility for all agents taken together. It is also possible to calculate total output as a function of the tax rate.

What happens as the tax rate is increased is that benefits become more generous. This increases post-tax and post-benefit income of low-skilled workers and reduces that of higher-skilled workers. Since the marginal utility of income falls with income, a more equal distribution of income initially raises total (and average) utility. But another effect of higher tax and benefit rates is that more low skilled workers choose voluntary unemployment and that higher skilled workers choose to supply less labour. These two effects reduce total output available for redistribution and they eventually outweigh the beneficial impact of a more equal income distribution on total (and average) utility. A utilitarian should stop increasing tax and benefit rates just before this begins to happen. This is shown as U^* in Figure 1. On the other hand, increasing the tax rate past this point would allow more

generous benefits to be paid and this will increase the utility of the worst off (i.e. least skilled) members of society even though total (and average) utility is falling. A policy maker with a Rawlsian social welfare function[15] would continue to increase the tax rate until total government revenue (and hence, in this model, the per capita benefit level) was maximised. This occurs at R^* in Figure 1. Redistributing income past this point would actually make the least skilled members of society worse off.

(b) A union-based system of wage compression.

In the very simple case of a uniform skill distribution between s=0 and s=1 and

$$\int_0^1 h(s)w(s)ds = \int_0^1 h(s)sds$$

where everyone belongs to the union, equation (3) becomes

$$w(s) = w_0 + \theta s$$

Noting that

and that there are no taxes or benefits, the amount of labour time a worker of

$$h(s) = \frac{w_0 + \theta s}{1 + w_0 + \theta s}$$

skill level s would choose to supply is given by

Equation (17) then becomes

[15] *There is a solecism in this use of "Rawlsian". I am using it to describe a policy-maker who attempts to maximize the utility of the worst off person. This should be distinguished from Rawls's own position in Rawls (1972) which is in terms of "primary social goods" (Rawls's list includes "income and wealth") rather than utility.*

$$\int_0^1 \frac{w_0+\theta s}{1+w_0+\theta s}(w_o+\theta s)ds = \int_0^1 \frac{w_0+\theta s}{1+w_0+\theta s} sds$$

Evaluation of the two integrals in equation (20) allows us to specify, in equation (21), those combinations of w_0 *and* θ *which satisfy the condition that firms' profits are the same under a union-based wage compression system as they would be in a*

$$(\theta 1 w_0)\ln(1+\frac{\theta}{1+w_0}) = \theta^2[\frac{3}{2}w_0\frac{1}{\theta}\frac{\theta}{2}]$$

competitive labour market.

This equation can be solved numerically, allowing us to generate Figure 2. Figure 2 shows average *utility (the upper curve) and the utility of the* least skilled worker *(lower curve) for different values of* θ*. It is clear that the least skilled worker would prefer a completely compressed wage distribution (*$\theta = 0$*) and that a Rawlsian social planner, taking this into account, would choose the point marked* R^* *in Figure 2. However, this outcome would not maximize total utility. Many higher skilled workers would be worse off in that they would receive a wage that was below their marginal product. Moreover, faced with this wage*[16] *they would choose to supply less labour than they would if their wage more closely reflected their skill. As a consequence, total (and average) utility is maximized when the degree of wage compression is less extreme. In Figure 2 this occurs at* U^* *where* θ *is about 0.44.*

[16] *Recall that we are assuming here that high skilled workers do not/cannot leave the union and bargain with employers on an individual basis.*

A comparison of Figures 1 and 2 shows that the wage compression system generates a much better outcome for the least skilled - as we would expect - but that it can lead to a lower level of average utility (when this is the variable being maximized) than the tax-benefit system with which it is compared. Other comparisons of the impact of the two systems on equity and efficiency are provided in Figures 4 and 5. Figure 4 represents the equity-efficiency trade-off in a way which is based on Breit's (1974) "geometrical artifact" in which output is plotted against the Gini coefficient of consumption - let us call this Gini(C) for convenience. Breit argues that the preferred combination of output and equity may then be chosen according to one's preferences. He represents such preferences by drawing an indifference map in output-Gini(C) space. Breit notes that it is plausible that most people would be prepared to sacrifice equity only if more output was obtained in the process. He therefore draws his indifference curves sloping downwards and to the left, and suggests that they will be convex to the origin. In Breit's diagram [reproduced from his article as Figure 3] the curve through W, P and H shows available combinations of output and Gini(C) while the indifference curves are labelled I and II.

In order to produce Figure 4, which shows output-Gini(C) trade-offs for the tax-benefit and union-based wage compression systems, different values of the tax rate t and of the wage compression variable θ were selected. Aggregate output and the Gini coefficient of consumption were then calculated and plotted against one another for each system. As was to be expected, under both systems it is the case that the redistributional mechanism can be deployed more vigorously[17] so that Gini(C) is lower, but only at the cost of forgone output. As is also clear from

[17] *That is, by selecting a higher t or a lower θ.*

Figure 2, the union-based approach to wage compression appears to dominate the tax-benefit system, in that it delivers a larger reduction in consumption inequality (as measured by Gini(C)) for a given fall in output. This may appear to be a good argument for retaining the union-based system if equity remains a desirable end and if the alternative is more vigorously applied tax-based redistributional mechanism. However, the issue is not as clear-cut as this, since adjudicating the matter in output-Gini(C) space (following Breit (1974), Lambert (1985a, 1985b, 1993)) may not be appropriate.

The reason is that the focus on output neglects another cost of the union-based system: the utility loss which occurs as a consequence of agents being constrained in their labour supply decisions. What matters, fundamentally, is utility and the distribution of utility, not output and its distribution. A more soundly based approach, therefore, is to measure efficiency in terms of total (or average) utility and equity in terms of the distribution of utility. Figure 5 does this. As before, the tax rate t and the wage compression parameter θ are varied but this time the effect on total utility and its distribution (as measured by the Gini coefficient for the distribution of utilities - Gini(U)) is observed.[18] *In Figure 5, as in Figure 4, more preferred outcomes lie to the north-west. But now it is not possible to say which of the two redistributional mechanisms under consideration is to be preferred since the equity-efficiency trade-offs cross. Thus, a social planner with preferences represented by indifference curve I_1 might choose a tax-benefit system so as to*

[18] *Note that utility will be more equally distributed than skill or consumption because of the way in which the utility function is specified; in particular, $u(h,c)$ lies between 1.0 and 1.4142, whereas output (and hence consumption when there is no redistribution) can range between 0 and 0.5. Changing the specification of the utility function will also change Gini(U). However, this does not undermine the usefulness of Gini(U). All that we have in mind is performing a comparison of two redistributional mechanisms. Gini(U) may be used so long as utility is specified in the same way under each redistributional mechanism.*

arrive at point A. Another, with preferences represented by I_2, might well favour a union based wage compression system in order to arrive at point B. Note that the two preference maps represented by I_1 and I_2 may differ only slightly and yet preferred outcomes A and B may be very different. For example, a small fall in inequality aversion (from I_2 to I_1) might lead to an institutional shift away from a union-based wage compression system and put more stress on the tax-benefit system. But since the tax-benefit system is rather inefficient at delivering very egalitarian outcomes (the tax-benefit trade-off lies a long way below the wage compression trade-off at B), the likely outcome is a shift to A which represents a large increase in inequality compared to B.

(c) Combining union and tax-benefit effects

So far we have been comparing a union-based wage compression system with a tax-benefit system by looking at each as if it operated in isolation. In reality the two systems interact. In this section we consider a slightly more realistic situation in which a union bargains with employers in order to produce a compressed wage distribution for its members but in which (i) there is a tax-benefit system, (ii) [as a result of which] some [low skilled] workers choose to supply no labour and (iii) some [higher skilled] workers choose not to be members of the union and to supply labour on a competitive labour market. Higher skilled workers who supply labour in this way receive a pre-tax wage equal to their productivity which is defined in such a way as to be equal to their skill level s. As before we assume that s is uniformly distributed on [0,1]. We also retain the utility function we have been employing up until now (equation (5)).

Thus there are three groups which need to be distinguished.

(i) The unemployed. They have skill levels in the range $0 \le s \le s_1$. The supply no labour and receive (as does everyone else) a non-contingent benefit b.

(ii) Union members. They have skill levels in the range $s_1 \le s \le s_2$. The receive a wage

$$w_u = w_0 + \theta s$$

where w_0 and θ are parameters which emerge from union-firm negotiations.

$$h_u(s) = \frac{(w_0 + \theta s)^2 (1-t)^2 b}{(w_0 + \theta s)(1-t)(1 + (w_0 + \theta s)(1-t))}$$

They supply labour according to

Note that we are assuming that only union members receive the union-negotiated wage. In other words, there is no distinction here between union membership and bargaining coverage even though this distinction is important in many countries, as Table A1 and the discussion in Section 2 demonstrate.

(iii) Non-union members. They have skill levels in the range $s_2 \le s \le 1.0$. They

$$w_n = s$$

receive a wage

$$h_n(s) = \frac{s(1-t)^2 b}{s(1-t)(1 + s(1-t))}$$

and supply labour according to

The boundaries between these three groups (i.e. s_1 and s_2) are determined in the following way.

(i) In order to define s_1 *we begin by assuming that the lowest paid union member is just indifferent between being employed and unemployed.*[19] *Since the*

$$u = 1 + \sqrt{b}$$

utility of an unemployed worker is given by

$$u(s_1) = (1 h_u(s_1))^{\frac{1}{2}} + ((w_0 + \theta s_1) h_u(s_1)(1t) + b)^{\frac{1}{2}}$$

and that of an employed union-member with skill level s_1 *is given by*

$$h_u(s_1) = \frac{(w_0 + \theta s_1)^2 (1t)^2 b}{(w_0 + \theta s_1)(1t)(1 + (w_0 + \theta s_1)(1t))} = 0$$

These two expressions will be equal when

$$s_1 = \frac{1}{\theta}\left[\frac{\sqrt{b}}{1t} w_0\right]$$

that is when

(ii) To define s_2 *we introduce a parameter* δ *and specify* s_2 *by the condition that*

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[19] *This assumption links the benefit level to the wage received by the least skilled worker in employment so that a rise in earnings inequality will have a downward impact on benefits. Moffit, Ribar and Wilhelm (1998) have detected such an effect in the U.S.*

$$u_u(s_2) = u_n(s_2)\delta$$

Here δ *is the utility gain that the most highly skilled worker who is currently a union member would achieve if he/she left the union. If* δ *is large, skilled workers stay in the union, even though they could do much better outside; it may be thought of as measuring the cost of "defecting" from the union.*[20]

With s_1 *and* s_2 *determined in this way, it is possible to write down the*

$$\int_0^1 bds = \int_{s_1}^{s_2} h_u(s)(w_0 + \theta s)tds + \int_{s_2}^1 h_n(s)stds$$

government's budget identity:

$$\int_{s_1}^{s_2} h_u(s)(w_0 + \theta s)ds = \int_{s_1}^{s_2} h_u(s)sds$$

It is also possible to specify the wage compression mechanism:

Substitution of the expressions derived above for $h_u(s)$ *and* $h_n(s)$ *allows evaluation of these integrals and the derivation of two (non-linear) relationships between b, t,* w_0 *and* θ*:*

[20] *Despite this interpretation, it is not assumed that non-members suffer a permanent utility loss of* δ*. Once they have left the union their utility depends only on consumption and leisure in the standard way. An alternative approach would have been to subtract* δ *from the utility of all employed non-union members, but this is not done here. Thus a stricter interpretation of* δ *is that it is union members' perceived cost of defecting from the union but that once defection has taken place the person concerned discovers that the cost was zero.*

$$\frac{b}{t} = (w_0 + \frac{\theta}{2}(s_1 + s_2))(s_2 s_1)\frac{(1 s_1)}{(1t)} + \frac{1}{2}(1 s_2)(1 + s_2)$$
$$+ \frac{1b}{(1t)^2}[\frac{1}{\theta}\ln\frac{1+(w_0+\theta s_2)(1t)}{1+(w_0+\theta s_1)(1t)} + \ln\frac{2t}{1+s_2(1t)}]$$

$$[1 + w_0(1t)\theta][(s_2 s_1)\theta(1t)(1b)\ln\frac{1+(w_0+\theta s_2)(1t)}{1+(w_0+\theta s_1)(1t)}] =$$
$$(s_2 s_1)\theta(1\theta)(1t)(w_0 + \frac{\theta}{2}(1t)(s_1 + s_2))$$
$$+ bw_0(1t)\ln\frac{w_0+\theta s_2}{w_0+\theta s_1}$$

and

These two equations were then solved numerically. The approach was to choose a value of δ *(the perceived cost of "defecting" from the union) and then to specify both a tax-benefit system (by, say, selecting the tax rate and ensuring that the benefit level is such that the government's budget constraint holds) and a wage compression system (by, say, selecting* θ *and ensuring that* w_0 *takes an appropriate value so that firms' profits are unaffected.) Output, employment, union membership, utility levels, and other variables of interest can then be computed for this combined system.*

Figure 6 shows some resulting efficiency-equity trade-offs for the combined system. It is clear that the combined system - even allowing for "defection" - dominates each mechanism taken on its own, at least over a range of equity outcomes. (The fact that it does not dominate over the whole range of outcomes is due to "defection"; if this were ruled out the combined system would perform much better

in delivering highly redistributional outcomes.) Interaction between the two mechanisms is clearly evident in the data that were used to generate Figure 6. For example, with a given degree of wage compression negotiated by the union, one effect of a higher tax rate is to make "defection" less attractive to higher skilled workers. This means that they stay in the union and, even though one effect of higher tax revenues is to fund more generous benefits and encourage voluntary unemployment, total union membership rises with the tax rate. The higher tax rate is not only redisributional in itself; it also increases the number of agents subject to the other redistributional mechanism.

This interaction between the two mechanisms raises the issue of what would constitute an optimal policy. In order to define optimality it is necessary to specify the policy-maker's preferences over total utility [U] and the distribution of utility [Gini(U)]. Suppose, for example, that the policy-maker's indifference map in Figure 6 consists of parallel straight lines running north-east to south-west at 45^0. In other words, the policy-maker attempts to maximize

$$SWF = U1000Gini(U)$$

$$U = \int_0^1 u(h,c)ds$$

where

is total utility. Within this framework the parameter δ *(the cost of "defection") acts as a constraint on how redistributional the wage compression system can be. For given values of* δ *the policy-maker could be thought of as choosing b, t,* w_0 *and* θ *in order to maximize this Social Welfare Function. Table 1 shows some*

illustrative results for three different values of δ.

Table 1. Choosing different degrees of wage compression in order to maximize social welfare.

θ	*0.10*	*0.20*	*0.30*	*0.40*	*0.50*	*0.60*	*0.70*	*0.80*	*0.90*
δ= *0.01*									
SWF	*1222.2*	*1220.5*	*1219.7*	*1219.3*	*1219.3*	*1219.4*	*1219.8*	*1220.9*	***1222.6***
t	*0.350*	*0.300*	*0.325*	*0.350*	*0.325*	*0.350*	*0.325*	*0.325*	***0.325***
s_1	*0.0371*	*0.0776*	*0.1347*	*0.1645*	*0.1632*	*0.1952*	*0.1893*	*0.2050*	***0.2398***
s_2	*0.4400*	*0.4170*	*0.4560*	*0.5070*	*0.5300*	*0.6070*	*0.6880*	*0.8690*	***1.0000***
δ= *0.015*									
SWF	***1232.4***	*1225.3*	*1222.3*	*1221.4*	*1220.6*	*1220.9*	*1222.0*	*1224.6*	*1222.6*
t	***0.350***	*0.325*	*0.325*	*0.350*	*0.325*	*0.325*	*0.350*	*0.325*	*0.325*
s_1	***0.0234***	*0.0480*	*0.0999*	*0.1154*	*0.1433*	*0.1634*	*0.1708*	*0.1844*	*0.2398*
s_2	***0.4730***	*0.4770*	*0.5020*	*0.5750*	*0.5920*	*0.7090*	*0.8640*	*1.0000*	*1.0000*
δ= *0.02*									
SWF	***1243.4***	*1240.2*	*1228.9*	*1224.9*	*1223.6*	*1223.4*	*1225.2*	*1224.6*	*1222.6*
t	***0.350***	*0.325*	*0.325*	*0.300*	*0.325*	*0.350*	*0.350*	*0.325*	*0.325*
s_1	***0.0012***	*0.0415*	*0.0660*	*0.0666*	*0.1049*	*0.1300*	*0.1441*	*0.1844*	*0.2398*
s_2	***0.5160***	*0.5080*	*0.5460*	*0.5790*	*0.6700*	*0.8090*	*1.0000*	*1.0000*	*1.0000*

In the top part of the Table, constructed using a relatively low value of δ, *vigorous application of the wage compression mechanism is constrained by the ease with which higher skilled workers can defect. Nevertheless, it is possible to achieve a better outcome (SWF=1222.60) than by using just the tax-benefit mechanism on its own (SWF=1218.37). Interestingly, this optimal outcome occurs when the degree of redistribution negotiated by the union is very modest (*θ*=0.90;*

w_0=0.072).[21] *On the other hand, the tax-benefit system is quite generous and plays a major redistributional role. As a consequence, a large proportion (0.24) of lower skilled workers choose voluntary unemployment. The benefits provided for the unemployed are funded by the taxes paid by higher skilled workers whose wages are only slightly below those they would receive in a competitive labour market. With high pre-tax wages and a moderately high tax rate (t=0.325) tax receipts are substantial - in fact, just substantial enough to pay benefits to all these unemployed workers.*

[21] *Shown in bold in Table 1.*

It is interesting to consider the consequences of making the wage compression mechanism play a larger role in this situation. This could be done by decreasing θ *and increasing* w_0*; that is, by moving leftwards in Table 1. As union-negotiated wages for higher skilled workers fall relative to the wages they could receive in the non-union labour market more and more of them defect (*s_2 *falls). This allows them to increase both their earnings (though the relatively high tax rate that they face discourages labour supply) and their utility. At the same time income distribution (and the distribution of utilities) becomes more dispersed between union members and non-members (although it becomes more compressed among the shrinking number of union members). These effects, acting together, reduce social welfare as specified above. However, eventually another effect now makes itself felt. The more equitable distribution of wage rates among union members encourages lower skilled workers to start supplying labour, reducing voluntary unemployment (*s_1 *falls). This takes some of the stress off the tax-benefit system: even though tax receipts from medium skilled union members are falling as their wages are held down and they supply less labour than they otherwise would, lower unemployment means that government expenditure is falling also, so tax rates do not have to increase as they might otherwise have to - although they do increase slightly.*[22] *The consequence is that an outcome with a high degree of wage compression (*θ*=0.10;* w_0*=0.292)*[23] *is viable - despite the possibility of easy defection - and almost as desirable as the optimum previously described.*

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[22] *Note that the increase in the tax rate (from 0.300 to 0.350) as we move from column 2 to column 1 of this section of Table 1 induces a change in behaviour on the part of workers in the middle of the skill distribution: despite it being easy to defect (*δ *is small) the fact that higher wages outside the union are taxed quite heavily discourages defection. The result is that* s_2 *rises from 0.417 to 0.440.*

[23] *Shown in italics in the Table.*

The consequence of increasing the cost of defection from the union (from δ=0.01 to δ=0.015) is set out in the middle section of Table 1. The optimum outcome (shown in bold) now occurs at a point where the wage compression system is quite rigorous in its application (θ=0.10; w_0=0.296). This allows SWF to rise to 1232.39. At this optimum just over half of all workers choose not to be in the union. If the degree of wage compression is moderated (that is, we move to the right in this section of the Table) more workers in the upper half of the skill distribution remain in the union, but less redistribution occurs within the union. The impact is to lower social welfare as we have defined it. However note that above θ equals 0.5 there is a range of values of θ where increases in θ have the effect of increasing social welfare. What is happening is that the consequences of there being less redistribution within the union are being outweighed by the impact of having more people in the union. There is a local optimum (shown in italics) where a moderate amount of wage compression occurs (θ=0.80; w_0=0.141) past which social welfare starts to fall again.

Further increasing the cost of defecting from the union produces the results shown in the lower third of Table 1. Here, too, there is a local maximum (shown in italics) with a moderate degree of wage compression in which higher skilled choose to remain in the union.[24] However, a better outcome (SWF=1243.35; this case is shown in bold in the Table) may be secured by choosing a high degree of wage compression within the union (θ=0.10; w_0=0.305). The high deflection cost keeps just over half of all workers in the union. There is very little unemployment since the union wage paid to lower skilled workers is relatively generous. The tax rate

[24] *Note that, because the cost of deflecting from the union is relatively large, this "inclusive" local optimum can be obtained with a higher degree of wage compression (θ=0.70 rather than 0.80 or 0.90).*

has risen slightly to fund benefits - which are also quite generous. However this mainly affects workers who have chosen to leave the union. Those higher skilled workers who remain within the union pay relatively little tax for two reasons: their lower hourly wage attracts less tax while it also reduces the number of hours of labour they choose to supply.

A comparison of the three sections of Table 1 illustrates the point that a higher cost of defecting from the union allows a more radical wage compression mechanism to be negotiated which, in turn, secures a better outcome. The level of social welfare achieved in this way (SWF=1243.35) compares favourably with that from the pure tax-benefit case (SWF=1218.37)[25] *and the pure union-based wage compression case with* $\theta=0$, $w_0=0.5$ *and* $t=b=0$ *with no "defections" (SWF=1225.73)*

4. Determining Union Policy on Wage Compression

[25] *For this case* $t=0.330$, $s_1=0.2929$ *and* $s_2=1.0$.

The existence of more than one local maximum in each section of Table 1 raises the question of which outcome might be selected if union members - rather than a social planner - were choosing the parameters of the wage compression schedule. Since, for any given structure of union membership, lower skilled workers would prefer more and higher skilled workers would prefer less wage compression, the natural framework to employ here is one in which the median member/voter decides. The complication is that the parameters of the wage compression schedule help to determine union membership via their impact on unemployment and on the decisions of high skilled workers to defect. This means that the identity of the median member will change as these parameters change.[26] *To deal with this effect the median union member was identified for each* θ, w_0 *combination. The question was then asked: would this individual benefit from a different degree of wage compression? To answer this question a two step procedure was employed. First, for each value of* θ *in the Table 1, the utility of the median union member was calculated and compared with this individual's utility at the next higher and at the next lower value of* θ. *If this individual preferred a higher or lower value of* θ *we may suppose that such a value would be chosen by the union - assuming, of course, that the union employs a decision-making mechanism which weight to members' preferences and members vote for proposed (small) changes in* θ *according to their individual interests. Naturally, at the new value of* θ *this individual will no longer be decisive; someone else will now be the median member and this person's preferences will determine whether there is a further change in* θ. *Thus for the case where the cost of defecting from the union is relatively low* (δ=0.01) *we have the following situation:*

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[26] *See Grossman (1983) and Pemberton (1988) for median voter models of union behaviour. Booth (1984, 1995:108-117) discusses a median voter model with endogenous membership.*

Table 2. Utilities of median union members deciding between different degrees of wage compression : small changes.

$\theta=$	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*
Median Union Member	*239*	*247*	*295*	*336*	*347*	*401*	*439*	*537*	*620*
	u(239)= 1.19752 *u(247)= 1.19754*	*u(247)= 1.19320* *u(239)= 1.19312* *u(295)= 1,19371*	*u(295)= 1.19736* *u(247)= 1.19653* *u(336)= 1.19829*	*u(336)= 1.20148* *u(295)= 1.20023* *u(347)= 1.20187*	*u(347)= 1.20161* *u(336)= 1.20102* *u(401)= 1.20491*	*u(401)= 1.20816* *u(347)= 1.20432* *u(439)= 1.21127*	*u(439)= 1.21385* *u(401)= 1.20962* *u(537)= 1.22614*	*u(537)= 1.23152* *u(439)= 1.21697* *u(620)= 1.24509*	*u(620)= 1.24855* *u(537)= 1.23331*

Suppose θ *happens to be set at 0.5. The median union member is the one 34.7% up the skill distribution (#374 out of 1000 in the numerical implementation I used). For this worker a value of* θ*=0.6 would be preferred since*

$$u(347;\theta = 0.6) = 1.20432 > u(347;\theta = 0.5) = 1.20161$$

Similarly, if a vote shifted θ *to 0.6 the new median member (#401) would prefer* θ*=0.7, and so on, until* θ *reached 0.9. On the other hand, if* θ *happens to be set at 0.2 this mechanism would result in a reduction in* θ *to 0.1. It is interesting to note that there is also an outcome which is stable against the median voter's preferences*[27] *at* θ*=0.4 which would be the outcome if we began at* θ*=0.3 or 0.4.*

The second step was to investigate whether these locally stable outcomes would be proof against a proposed dramatic change in union policy. For example, would the

[27] *Though only over small changes in* θ*; see below.*

median voter at the θ=0.4 equilibrium prefer to move to either of the other two outcomes? Table 3 yields an answer.

Table 3. Utilities of median union members deciding between different degrees of wage compression : large changes.

Initial (local) equilibrium	*Median trade union member*	*u(239)*	*u(336)*	*u(620)*
θ=0.1	*239*	*1.19752*	*1.19779*	*1.24043*
θ=0.4	*336*	*1.19903*	*1.20148*	*1.24105*
θ=0.9	*620*	*1.19957*	*1.20425*	*1.24855*
no trade union	*-*	*1.19626*	*1.19780*	*1.24364*

Thus it appears that the median member at the θ=0.1 local equilibrium would prefer either of the other two equilibria to this one and, of these two, the θ=0.9 outcome would be preferred. Similarly, the median member at the θ=0.4 outcome would prefer θ to be 0.9. The result is that θ=0.9 is the only equilibrium which is proof against dramatic changes in the degree of wage compression.[28]

The same two-step procedure was employed to investigate the stability of outcomes for the case where the cost of defection from the union was higher at δ=0.02. The results (which are not reported in order to save space) show that there are two locally stable outcomes at θ=0.1 and θ=0.8 but that only the latter is stable

[28] *Note that this equilibrium is also proof against a proposal to dissolve the union.*

against a proposed change in θ from 0.1 to 0.8.[29]

From these experiments we can conclude that a median voter based decision mechanism with endogenous union membership will not necessarily support the optimal union policy with regard to wage compression. However, there is an interesting contrast with some other median voter models of union behaviour (e.g. Grossman (1983), Carruth, Oswald and Findlay (1986), Layard, Nickell and Jackman (1991)) where median union members' preferences lead to socially sub-optimal outcomes. In these models the fact that median voters in unions are likely to be "insulated" by their seniority from the threat of unemployment often leads the union to adopt "too radical" a policy by, for example, attempting to raise wages too much at the expense of higher unemployment. Here, the median voter may well be tempted to vote for an insufficiently radical policy of wage compression in order to tempt higher skilled workers back into the union. This could look attractive to the individual concerned - and, perhaps to the union leadership which may well have its own "managerial" interests, as in Pemberton (1988). But the effect may be to rule out a better outcome in which the union negotiates for a highly compressed wage structure leading to a more equitable distribution of utility and, as it happens, a lower level of unemployment.

5. Conclusion

This paper started from the observation that trade unions have not succeeded in

[29] *The θ=0.8 outcome is also proof against the "no union" option.*

shifting the distribution of income in favour of labour but that they have been successful in compressing the wage distribution. One benefit of a compressed wage distribution is that it provides some insurance against the misfortune of setting out to make your way in a market economy when you lack the skills that are highly valued in the labour market. (It also provides insurance against the impact of rapid change in the particular skills that are valued.) Viewed in this light, a compressed wage distribution may be welfare-improving. Moreover, it may be a more efficient way to provide insurance against bad luck in the distribution of skills than a tax-benefit system.

To investigate this conjecture, the paper presented models of wage compression and of taxes and benefits and then combined these two redistributional mechanisms in a single model.[30] One conclusion that emerged when "pure" versions of the two mechanisms were compared was that the wage compression system worked well in generating good outcomes for the least skilled but that the tax-benefit approach was better if average utility was the variable being maximized. Naturally, the tax-benefit approach looked less attractive when evaluated using a social welfare function which gave more weight to reducing inequality; in this situation the wage compression mechanism came into its own. An insight into why a union-based wage compression system looks attractive in this context may come from noting that such a system has some of the features of a "welfare-to-work" programme based on a reduction in unemployment benefits combined with tax-derived wage subsidies for low-skilled workers (Layard (1986); Phelps (1997)). The key point is

[30] *The model was schematic in that it posited agents with identical preferences who differed only in a (single-valued) skill attribute which was distributed in a rather unrealistic way. It also assumed very simple versions of the wage compression and tax-benefit mechanisms. Other assumptions could be made about preferences, skills and institutional arrangements. While more realistic modelling of these matters might be very interesting, my intention was to focus on the key features of these two redistributional mechanisms, which the model in the paper allowed.*

that the wage compression system (like welfare-to-work) only helps those in employment and discourages voluntary unemployment.

The combined model allowed investigation of interactions between the tax-benefit system and unions' activities in negotiating a compressed wage schedule. It emerged that the two mechanisms complement one another. Equity-efficiency trade-offs obtained for the combined system mostly dominate those obtained from each mechanism acting on its own. The intuition behind this result is that a compressed wage distribution resulting from union-firm negotiations puts less stress on the tax-benefit system. There are two reasons for this. Since low skilled workers receive a higher wage they do not need large tax-derived transfers in order to reach a reasonable utility level. Secondly, the relatively high wage going to low skilled workers means that they are unlikely to choose voluntary unemployment. This, in turn, takes pressure off the tax system.

One problem facing a union-proposed wage compression schedule is that some highly skilled union members have to accept lower utility levels than they could achieve outside. If skilled workers are likely to "defect" from the union this constrains the degree of wage compression that the union can successfully advocate. On the other hand, if skilled workers retain a strong commitment to union membership, even at some personal cost in terms of foregone career opportunities, a quite radically compressed wage schedule may well emerge. This cost of "defecting" from the union (δ in the model) is likely to vary between countries (high in Sweden, low in the United States) and over time (lower in Sweden now than in the past).[31] *Lowering this cost may appear an attractive prospect to policy-*

[31] *See Edin and Holmlund (1995) and Freeman and Gibbons (1995). Note that a lower value of δ does not necessarily imply smaller union membership. As the data in Table 1 suggest, it could lead the union to reduce the degree of wage*

makers (labour markets are more "flexible") but a consequence is that the advantages of a compressed wage distribution are lost. This puts additional stress on welfare state institutions. It also undermines the insurance function that the combination of a union-based compressed wage schedule with a redistributional tax-benefit system delivers relatively efficiently.

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compression in order to retain/attract higher skilled workers with the result that union membership actually rises (together with wage inequality). This may well describe the Swedish case.

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Appendix

Table A1. Labour's share of output per employee.

	(1) $Share_1$ (based on take-home pay)	(2) $Share_2$ (based on employers' costs)	(3) $Share_3$ (based on take-home pay adjusted for consumption taxes)	(4) Trade union density	(5) Bargaining coverage
Australia	0.5008	0.5894	0.4671	35	80
Austria	0.3423	0.4753	0.3081	42	98
Belgium	0.3865	0.6489	0.3482	54	90
Canada	0.4578	0.5923	0.4208	38	36
Denmark	0.4231	0.6142	0.3654	76	69
Finland	0.3676	0.6343	0.3239	81	95
France	0.2911	0.4914	0.2604	9	95
Germany	0.4433	0.6819	0.4011	29	92
Greece	0.3204	0.4999	0.2762	-	-
Iceland	0.4893	0.4591	0.4281	-	-
Ireland	0.3686	0.4957	0.3259	-	-
Italy	0.3158	0.4017	0.2861	39	82
Japan	0.4924	0.5798	0.4744	24	21
Korea	0.7165	0.7563	0.6573	-	-
Netherlands	0.4278	0.6433	0.3857	26	81
NZ	0.4793	0.5903	0.4283	30	31
Norway	0.4083	0.5442	0.3535	58	74
Portugal	0.3021	0.4132	0.2639	32	71
Spain	0.3187	0.4793	0.2924	19	78
Sweden	0.3546	0.6396	0.3171	91	89
Switzerland	0.5490	0.6746	0.5189	27	50
Turkey	0.5295	0.8237	0.4884	-	-
UK	0.4570	0.6120	0.4092	34	47
US	0.3737	0.4909	0.3580	16	18

Notes: $Share_1$ is defined as the ratio of take-home pay (i.e. after payment of income tax and employee's social security contributions) for an average production worker with two children and a non-working spouse to GDP/employee. $Share_2$ is the ratio of employers' wage costs (i.e. including employers' social security contributions) to GDP/employee. $Share_3$ is derived by adjusting $Share_1$ for the effect of consumption taxes. The data in columns 1-3 refer to 1996; columns 4 and 5 refer to 1994. Sources: OECD (1998) (for data on pay), IMF (1998) (for data on GDP and employment),

OECD (1997, Table 3.3)(for data on union density and coverage).

Table A2. Earnings inequality in OECD countries. D9/D1 ratios for males.

	D9/D1(earliest)	D9/D1(1990)	D9/D1(latest)	$D9/D1_{trend}$
Australia	2.7378(79)	2.8056	2.9400(95)	0.01264
Austria	2.6406(80)	2.7225	2.7225(89)	0.00910
Belgium	2.3908(86)	2.1980	2.1980(90)	-0.04820
Canada	3.4569(81)	3.9900	3.7714(94)	0.02419
Denmark	-	-	-	-
Finland	2.4382(80)	2.5628	2.5258(94)	0.00626
France	3.3864(79)	3.4506	3.4293(94)	0.00286
Germany	2.3798(83)	2.3100	2.2468(93)	-0.01330
Greece	-		-	-
Iceland	-		-	-
Ireland	-		-	-
Italy	2.2922(79)	2.1925[1]	2.6400(93)	0.02484
Japan	2.5917(79)	2.8372	2.7680(94)	0.01175
Korea	-	-	-	-
Netherlands	-	-	-	-
New Zealand	2.7224(84)	3.0800	3.1683(94)	0.04459
Norway	-	-	-	-
Portugal	3.3228(85)	4.0177[1]	4.1280(93)	0.10065
Spain	-		-	-
Sweden	2.1091(80)	2.1600	2.2032(93)	0.00724
Switzerland	2.4360(91)	2.4360[2]	2.5368(95)	0.02520
Turkey	-	-	-	-
UK	2.4490(79)	3.1132	3.3018(95)	0.05386
US	3.1832(79)	3.9592	4.3452(95)	0.07263

Notes: (1) Based on interpolating 1989 and 1991 data. (2) Based on 1991 data.

Table A3. Earnings inequality in OECD countries. D9/D1 ratios for females.

	D9/D1(earliest)	D9/D1(1990)	D9/D1(latest)	$D9/D1_{trend}$
Australia	2.4000(79)	2.6235	2.5280(95)	0.00800
Austria	3.3582(80)	3.5084	3.6946(94)	0.02403

Belgium	*2.2879(85)*	*2.1996*	*2.2176(93)*	*-0.00879*
Canada	*3.7312(81)*	*3.9900*	*4.0050(94)*	*0.02106*
Denmark	-	-	-	-
Finland	*2.0580(80)*	*2.1098*	*1.9760(94)*	*-0.00586*
France	*2.7030(79)*	*2.8552*	*2.9412(94)*	*0.01588*
Germany	*2.6520(83)*	*2.4016*	*2.2578(93)*	*-0.03942*
Greece	-		-	-
Iceland	-		-	-
Ireland	-		-	-
Italy	*2.9925(79)*	*2.2782*[1]	*2.8012(93)*	*-0.01366*
Japan	*2.1868(79)*	*2.2983*	*2.2419(94)*	*0.00367*
Korea	-	-	-	-
Netherlands	-	-	-	-
New Zealand	*2.4178(84)*	*2.7144*	*2.6219(94)*	*0.02041*
Norway	-	-	-	-
Portugal	*2.7968(85)*	*2.8187*[1]	*3.2526(93)*	*0.05698*
Spain	-	-	-	-
Sweden	*1.6500(80)*	*1.7080*	*1.8200(93)*	*0.01214*
Switzerland	*2.7004(91)*	*2.7004*[2]	*2.5440(95)*	*-0.03910*
Turkey	-	-	-	-
UK	*2.2594(79)*	*2.8640*	*3.1080(95)*	*0.05304*
US	*3.0621(79)*	*3.6672*	*3.9585(95)*	*0.05603*

Notes: (1) Based on interpolating 1989 and 1991 data. (2) Based on 1991 data. Source: OECD (1996), Table 3.1

Table A4. Earnings inequality in OECD countries. D9/D1 ratios for male and female workers.

	D9/D1(earliest)	D9/D1(1990)	D9/D1(latest)	$D9/D1_{trend}$
Australia	2.7388(79)	2.8054	2.9205(95)	0.01136
Austria	3.4532(80)	3.5100	3.6582(94)	0.01464
Belgium	2.3925(86)	2.3040	2.2451(93)	-0.02106
Canada	4.0096(81)	4.4030	4.1952(94)	0.01428
Denmark	2.1432(80)	2.1666	2.1666(90)	0.00234
Finland	2.4585(80)	2.4990	2.3800(94)	-0.00561
France	3.2398(79)	3.2636	3.2835(94)	0.002913
Germany	2.6895(83)	2.5092	2.3184(93)	-0.03711
Greece	-	-	-	-
Iceland	-	-	-	-
Ireland	-	-	-	-
Italy	2.9400(79)	2.2869[1]	2.8000(93)	0.01000
Japan	3.0096(79)	3.1063	3.0155(94)	0.00039
Korea	-	-	-	-
Netherlands	2.5100(85)	2.6062	2.5896(94)	0.00873
New Zealand	2.8900(84)	3.0450	3.0448(94)	0.01548
Norway	2.0586(80)	1.9800[2]	1.9800(91)	-0.00715
Portugal	3.6166(85)	3.4944[1]	4.0508(93)	0.05428
Spain	-	-	-	-
Sweden	2.0410(80)	2.0064	2.1306(93)	0.006892
Switzerland	2.7209(91)	2.7209[2]	2.7189(95)	-0.00050
Turkey	-	-	-	-
UK	2.7885(79)	3.2936	3.3847(95)	0.037263
US	4.1615(93)	4.1615[3]	4.3890(95)	0.11375

Notes: (1) Based on interpolating 1989 and 1991 data. (2) Based on 1991 data. (3) Based on 1993 data. Source: OECD(1996), Table 3.1.