## Title
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## Publication date
1989-04

## Series
UCD Centre for Economic Research Working Paper Series; WP89/7

## Publisher
University College Dublin. School of Economics

## Item record/more information
http://hdl.handle.net/10197/1464

## Notes
A hard copy is available in UCD Library at GEN 330.08 IR/UNI
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by

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Working Paper No. WP89/7

April 1989

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Declining High-Wage Industries
and Structural Adjustment Policy

Frank Barry*
April 1989

Abstract

In this paper a sector-specific disturbance generates unemployment that co-exists with relatively high wages in the adversely-affected industry. Previous analyses have interpreted this unemployment as "classical" in nature, assuming it to be caused by arbitrary wage rigidities, and have concluded that some degree of subsidisation of the contracting sector is warranted on efficiency grounds. The present paper proposes an alternative "structural" explanation in which the privately-optimal response of workers and firms within a unionised high-wage industry leads to inefficiently low levels of labour transfer and a correspondingly high rate of sectoral unemployment. Subsidisation of the declining industry under these circumstances reduces efficiency. Several policies capable of achieving the optimal allocation of labour are explored, and the associated tax costs and income distributional effects analysed.

* I am indebted to David Lilien and Dan Seidmann for very helpful discussions, and to Peter Neary, Ami Glazer, and participants in seminars at the University of California, Irvine, and University College Dublin for useful comments on earlier drafts of the paper.
1: Introduction

The unusual magnitude and frequency of the sector-specific shocks which have buffeted Western economies in recent years have been widely recognised. These disturbances include increased foreign competition from the newly-industrialising countries as well as major terms-of-trade shifts brought about, for example, by the oil-price increases of the 1970's. Some economists, such as David Lilien (1982) and more recently Steven Davis (1987), have argued that a considerable proportion of the aggregate fluctuations in employment experienced over the last few decades may be a result of the intersectoral shifts in labour demand induced by such shocks.

While this view of the relative importance of sector-specific as opposed to aggregate-demand disturbances remains controversial, it naturally draws attention to the issue of whether there is a role for government in the resulting process of structural change. According to the logic of the first theorem of welfare economics, intervention in this process may be justified on the grounds of Pareto efficiency if product or factor markets are distorted. The literature on optimal intervention in the wake of sector-specific shocks has dealt mainly with two particular market imperfections, both of which have been taken to enhance the case for the subsidisation of declining industries.

The first of these involves congestion effects in the labour market. Lapan (1976) and Cassing and Ochs (1978) have shown that
intervention to slow down the rate of adjustment is warranted in this situation since individuals and firms fail to take into account the impact of their severance decisions on the unemployment experience of others. Parsons (1980), however, finds no support for the congestion hypothesis in a test on U.S. data, concluding that: "if anything, the rate of (intersectoral) transfer rises with industry unemployment, perhaps as the result of a reduced likelihood of rapid recall to the previous firm."

The second and more frequently discussed distortion which can justify intervention on efficiency grounds is an assumed wage rigidity in the declining sector, introduced in various forms by Lapan (1976), Ray (1979), Neary (1982), Forster and Rees (1983), Flam, Persson and Svensson (1983), Steigum (1984), and Djajic and Purvis (1987). With wage stickiness generating unemployment or intersectoral labour transfer in excess of that associated with a flexible-wage adjustment process, the implication emerging from this work is that the declining industry should be subsidised to some extent in order to replicate as closely as possible the behaviour of an undistorted economy.

It has come to be recognised from recent developments in macroeconomic theory, however, that the desirability of intervention and the form of intervention required, if any, may depend substantially on the motivation underlying the wage distortion, a building block of the model which has been left unspecified in the work mentioned above. Several of the papers cited allude vaguely to "trade-union behaviour." The argument to
be presented here is that in the types of situations discussed in the existing literature, explicit modelling of bargaining agreements between workers and firms in the unionised sector leads to the conclusion that Pareto efficiency requires intervention to reduce, rather than to maintain, the size of the declining industry.

The present paper develops a model of a two-sector economy, one sector of which exhibits high wages and a strong union, characteristics shared by those industries in Europe and/or North America which, along with textiles, represent the most important recent embodiments of the declining industries problem - coal and iron ore mining, steel and car production, and shipbuilding. An important characteristic shared by these industries is their strong regional concentration, implying that they are large relative to the size of the local labour market. This in turn means that their contraction will reduce the equilibrium wage in the regional market. On this basis the present paper adopts the assumption that the unionised sector is 'large', as indeed does the theoretical literature already referred to, since a sector-specific shock would not otherwise affect equilibrium wages. The literature cited above, and the present paper, may therefore be interpreted as applying to the issue of how regional employment can be maintained when a large sector goes into decline. Given the structural adjustments likely to follow the creation of a single European market, and the low degree of regional labour mobility prevailing in particular on this side of the Atlantic, this interpretation would seem to be of considerable practical
importance.

The non-unionised sector is modelled as perfectly competitive, while the unionised (high-wage) industry is assumed to possess some degree of monopoly power; workers in this sector form a union in order to restrict entry by other workers and thereby enable themselves to bargain for some of the sector's monopoly profits. Drawing on the work of Hall and Lilien (1979) and McDonald and Solow (1981, 1985), a Nash-bargaining approach to union-firm interaction is adopted, since, unlike most versions of the monopoly union model, it leads to outcomes which are Pareto-efficient for both parties. As Oswald (1985) notes, "this is an obvious characteristic to impose when one large union confronts one large employer."

Although the present paper is motivated by the unemployment problem, the Pareto inefficiencies that warrant government intervention can be seen most clearly in a simplified framework that ignores the existence of unemployment. Accordingly the more complex model with unemployment is introduced only after the basic model has been analysed.

In the scenario presented in this paper a negative shock to the unionised sector leads to an inefficient labour allocation in the economy. Optimal intervention however, as will be shown, must be designed to expedite labour transfer from the declining sector rather than to slow it down. Subsidies to the expanding sector
are capable of achieving the Pareto-efficient allocation of labour, and such policies are indeed frequently adopted in order to stimulate the growth of new industries in regions of high unemployment. Targeted demand-management policies would be likely to have similar effects in a more complete model so that the analysis may shed some light on the important policy issue of the appropriate use of fiscal spending over the course of the adjustment process. Besides discussing optimal policy responses the paper also considers the consequences of subsidising the declining sector, in order to contrast the results with those of the existing literature on structural adjustment policy in the presence of wage distortions.

2: The Unionised Sector

The X-sector is assumed to face a downward-sloping demand curve for its products, all of which are exported. Its gross revenue \( R(L_x, \alpha) \) is a function of the sectoral employment level \( L_x \) and a shock term, \( \alpha \), with the properties: \( R_\alpha, R_{L_x} < 0 \). Shocks may be thought of as arising either on the supply side, e.g. through an increase in the price of raw materials that the sector uses relatively intensively, or on the demand side, through, for example, an inward shift of the foreign demand function resulting from increased competition from the NIC's.

The monopoly profits accruing to the X-sector provide an incentive for X-sector workers to form a union, restrict
migration into the sector, and bargain with the firm for a share of profits. The size of the union, $N_x$, is determined by the number of workers initially in the sector, and union size, as in Hall and Lilien (1979) and McDonald and Solow (1981, 1985), remains constant throughout.4

As is well known, an equilibrium which maximises returns to the X-sector (firm and union together) cannot in general be achieved simply by agreeing on an average wage and allowing the firm to determine the consequent level of employment. An outcome on the contract curve generally requires that the union be able to exercise some influence over the level of employment as well as over the wage rate. The best-known solution to the efficient bargaining problem, and the one adopted here, is the Nash approach, which maximises the product of the gains made by the firm and the union respectively, over and above the outcome that would have emerged for each had no contract been agreed upon.

The firm's profit in the event of a bargain being struck is: $R(L_x, a) - w_t I_x$, while the total income of union members5 is: $w_t L_x + [N_x - L_x] F_y (L - L_x)$. With full employment of the fixed labour force $L$, the latter term represents the amount earned by any $X$-sector union members who, having lost their jobs in $X$, are now working in the $Y$-sector. $X$-sector job loss, and the resulting fall in income, may be assumed to be by random draw.

This framework, however, should be thought of as a way of modelling the level of redundancy payments agreed between union
and firm so that no income loss arises for displaced workers. In this interpretation, the wage bill paid by the X-sector firm, \(w_XL_X\), represents current wages plus (a flow value of) redundancy payments made, and the union's total income therefore consists of terms representing current wages paid by the X-sector firm plus this flow value of redundancy payments plus wages earned in the Y-sector by workers made redundant in X. In this case the union's total income is divided evenly between all initial X-sector workers, who are therefore indifferent between continuing to work in X or being made redundant and receiving work in the lower-paid Y-sector.

The no-contract outcome that the parties take into account in the bargaining process is the income received during a strike.\(^6\) Ignoring fixed costs, this amount is zero for firms and \(N_XF_L(L)\) for the union, whose members are assumed to have the option of working in the Y-sector.

The Nash solution to the bargaining problem is therefore the X-sector wage and employment level\(^7\) that maximises:

\[
\begin{align*}
(1) & \quad [R(L_X, \alpha) - w_XL_X] [w_XL_X + \{N_X - L_Y\}F_Y(L_Y) - N_YF_L(L)] \\
& \text{subject to:} \\
(2) & \quad L = L_X + L_Y
\end{align*}
\]

The first-order conditions for the solution of this maximisation problem imply\(^8\):
(3) \[ w_x = \frac{[R(L_x, \alpha) - (N_x - L_x)F_L(L_x) + N_xF_{LL}(L)]}{2L_x} \]
and

(4) \[ R_x = F_L(L_x) + (N_x - L_x)F_{LL} \]

Using a Taylor series expansion to write \( F_L(L) \) in terms of \( F_L(L_x) \) reveals that (3) may also be written:

(3') \[ w_x = \frac{[R(L_x, \alpha)/L_x + R_L + L_xF_{LL}]}{2} \]

This differs in the \( F_{LL} \) term from the usual Nash solution in which the wage is equal to the arithmetic mean of the average and marginal revenue products of labour. The lower value of the X-sector wage in the present case is due to the size of the sector relative to the local labour market; the union has less power vis-a-vis employers in the event of a strike when transfer into the Y-sector reduces the wage prevailing there.

3: The Social Optimum

The second sector of the economy, the Y-sector, is assumed to be perfectly competitive, and its price, determined on world markets, remains constant throughout the analysis and is normalised at unity. The gross revenue of this sector is \( F(L_y) \), and the Y-sector wage is:

(5) \[ F_L(L_y) = w_y \]

Gross national (or regional) product is taken as the measure of
social efficiency, $\Omega$, measured in units of commodity $Y$:

$$\Omega = R(L_x, \alpha) + F(L_y)$$

where these functions have standard properties expressed in terms of first and second derivatives: $R_L, F_L > 0; R_{LL}, F_{LL} < 0$.

The socially efficient levels of production and employment are specified by the first order condition for the maximisation of $\Omega$ subject to (2):

$$R_L = F_L$$

Maximisation of GNP therefore requires equality between the value marginal revenue product of labour in $X$ and the value marginal product in $Y$. This would clearly be achieved under conditions of perfect intersectoral labour mobility.

On the assumption made earlier that union membership is equal to the level of employment in $X$ initially, equation (4) reduces to (7), and the initial equilibrium of the economy is therefore efficient not only for the $X$-sector, but also for the economy as a whole. Unionisation under these circumstances, however, precludes an optimal response to changes in the economic environment; the level of redundancies agreed upon will not be globally-efficient when the union takes into account the impact that redundancies will have on the $Y$-sector wage that can be earned by those of its members made redundant.
4: Effects of a Decline in X-sector Profitability

The X-sector is assumed to be subjected to a disturbance, represented by an increase in $\alpha$, which has the effect of permanently reducing its profitability.

From equations (2) and (7) the socially efficient response of the economy is seen to involve a decline in X-sector wages and production, a transfer of labour from X to Y, and lower wages alongside increased production in the Y-sector. This efficient response is described in the following equation system:

\[ \frac{dL_*}{d\alpha} = -\mu R_{L*} < 0 \]

\[ \frac{dw_*}{d\alpha} = \mu R_{L*} F_{LL} < 0 \]

where $\mu^{-1} = R_{LL} + F_{LL} < 0$

The actual response differs from the optimal response however, since the size of the X-sector influences wages in Y, and the union must take this into account in deciding the terms of any redundancy agreement. From equations (3) and (4) the actual response of the economy is seen to entail:

\[ \frac{dL*}{d\alpha} = -\phi 2R_{L*} L_Y < 0 \]

\[ \frac{dw}{d\alpha} = \phi [R_{d}(R_{LL} + 2F_{LL}) + R_{La}(F_{LL}L_Y - R_{LL}L_Y/2)] \]

where $\phi^{-1} = 2L_Y(R_{LL} + 2F_{LL}) < 0$
A comparison of equation systems (8) and (9) immediately reveals that the amount of labour transferred into the Y-sector is less than that required for social efficiency. Thus the existence of a union in the declining sector gives rise to overmanning or overemployment, rather than the underemployment that conventionally appears in the declining-industries literature. The nature of this overmanning is in turn quite different from that studied by McDonald and Solow (1981).

As is frequently found in trade-union models, whether of the Nash-bargaining or monopoly-union variety, the impact of a shock on the union wage is ambiguous. Two conflicting forces arise in the Nash models. On the one hand, a reduction in profits imparts a downward tendency to the sectoral wage, since the Nash solution is essentially a profit-sharing arrangement. On the other hand however, upward pressure is exerted on the wage since any agreement on labour-shedding must be 'purchased' from the union, as can be seen from the fact that the firm, even in the initial equilibrium, would ideally like to employ fewer workers.\(^9\)

The welfare loss to the economy resulting from the distortion under discussion is measured by the area of the appropriate Harberger triangle as:

\[
(10) \quad (L_X - L_X^*)[F_L(L - L_X) - R_L(L_X)] / 2
\]
where $L_x^*$ is the X-sector's labour allocation in the distortion-free equilibrium. The pre-shock welfare loss is clearly zero if $N_x = L_x$, as assumed for ease of exposition, so that $L_x = L_x^*$ initially.

Whether or not this is the case, the (increased) welfare loss resulting from the sector-specific shock is found from equations (9) and (10) to be:

$$\frac{-F_{LL}\{(L_x-L_x^*)\phi 2R_{La}L_x+(N_x-L_x)\phi 2L_x R_{La}F_{LL}\}\{R_{LL}+F_{LL}\}^{-1}}{2} > 0$$

A shock increases the welfare loss stemming from the distortion, because the greater the proposed transfer of labour, the more concerned the union must be about the level of the Y-sector wage, and the greater the extent, therefore, to which it will prevent the competitive solution from emerging. The greater the sectoral shock, the more desirable government intervention becomes.

5: Effects of a Subsidy to the Declining Sector

Consider the effects in this model of granting a subsidy $s_x$ to X-sector employment, as recommended in the existing literature on declining industries\textsuperscript{10}. Profit in this sector is now:
(12) \[ R(L_X, \alpha) + s_X L_X - w_X L_X \]

and the Nash solution becomes:

(13) \[ R_L = F_L(L_Y) + \{N_X - L_X\}F_{LL} - s_X \]

This policy is clearly incapable of correcting the distortion. Its impact on X-sector wages and employment is:

(14) \[ \frac{dL_X}{ds_X} = -\Phi 2L_X > 0 \]

\[ \text{and } \frac{dw_Y}{ds_X} = \Phi L_X (R_{LL}/2 + 3F_{LL}) > 0 \]

The sector is protected by the subsidy, profitability is enhanced, and X-sector wages are thereby raised. Since the amount of labour released into Y is reduced, wages there are also raised. From (2), (5) and (14) this effect can be found as:

(15) \[ \frac{dw_Y}{ds_X} = \Phi L_X 2F_{LL} > 0 \]

Comparison of (14) and (15) reveals that this policy improves the relative position of the more highly paid (X-sector) workers.

It is also clear that the policy is undesirable on efficiency grounds, since production of X is expanded even further above the social optimum. From equations (2), (6), and (14) it may be found that:
\[ \frac{d\Omega}{ds_y} = \{N_y - L_y\}_{y \rightarrow x} \frac{dL_y}{ds_y} < 0 \]

6: Optimal Intervention

It has been shown that an inefficiently low level of labour transfer occurs in response to the disturbance if sectoral migration decisions are made on the basis of the incentives facing the X-sector alone. A question that arises naturally is whether a coalition of potential beneficiaries could be formed to effect the efficient allocation of labour without the need for government intervention.

What groups in the economy would benefit from a transfer of labour over and above that emerging from the Nash bargain? The owners of Y-sector capital would clearly gain, since further transfer would reduce Y-sector wages. At the agreed X-sector wage, the X-sector firm would also gain, since the wage exceeds the marginal revenue product of labour, and union utility would be reduced by this same amount.\footnote{11} It is not possible to determine in general whether the owners of Y-sector capital alone could secure agreement with the union on labour transfer, but clearly the owners of X- and Y-sector capital together could gain by financing further severance payments to achieve the optimal
labour reallocation, a simple application of the Coase theorem. Such a coalition may be very difficult to form, however, and is assumed here to be unfeasible.

There are various ways in which the government can intervene to secure the socially-efficient allocation of resources; each has a different effect on income distribution however. A tax, τ, levied on the wages of all X-sector workers would obviously induce migration. In this case the union maximand becomes:

\[(w_x - \tau)L_x + \{N_x - L_x\}F_L(L_T)\]

and the Nash solution is:

(17) \[R_L = F_L(L_T) + \{N_x - L_x\}F_{LL} + \tau\]

and \[w_x = [R(L_x, \alpha) + \tau L_x - (N_x - L_x)F_L(L_T) + N_xF_L(L)] / 2L_x\]

A comparison of (17) and (7) reveals, as one would expect, that the optimal degree of migration will be induced if the tax rate τ is set equal to the (negative of the) distortion term \[(N_x - L_x)F_{LL}\]. Since the profitability of X-sector production is enhanced, the X-sector wage rises in accordance with the logic of the bargaining agreement. However, the post-tax wage, \(w_x - \tau\), is reduced.

A factor that policy-makers must take into account in their decision making concerns the income-distribution effects of
policy proposals. It is easily found from (17) that:

\begin{equation}
(18) \quad \frac{d(w_t - \tau)}{dt} = -\Phi[L_t F_{LL}/2 + 3L_t F_{LL}] < 0
\end{equation}

and \( \frac{dw_t}{dt} = -\Phi L_t F_{LL} < 0 \)

These results show that while the policy reduces after-tax wages in both sectors, it has its strongest impact on the high-wage sector, thereby generating a more equal wage distribution. While tax revenues could be spent in a way that ensures that income is not shifted towards capital the political feasibility of this policy nevertheless seems minimal in that it directly taxes those workers who have already borne the brunt of the disturbance.

Several subsidy policies, assumed to be financed in a non-distortionary fashion, can also achieve the efficient allocation of resources.

One such option, and one of considerable empirical significance, involves government financing of severance payments – the compensation only of those who leave the declining sector. Consider the granting of a wage subsidy, \( \sigma \), of the same size as the tax discussed above, to workers willing to switch out of the declining sector. The optimal level of this subsidy is:

\begin{equation}
(19) \quad \sigma^* = -(N_t - L_t) F_{LL}
\end{equation}
The owners of X-sector capital benefit from the induced labour transfer, since \( w_X \) exceeds \( R_L \), and X-sector wages rise through the profit-sharing arrangement. The migration itself drives down the marginal product of labour in \( Y \), and thereby reduces the incomes of the initial \( Y \)-sector labour force.

\[
\frac{dw_X}{d\sigma} = \Phi[F_{LL}L_X - 3I_YR_{LL}/2] > 0
\]

\[
\frac{dw_Y}{d\sigma} = -\Phi2L_XF_{LL} < 0
\]

Both policies considered so far therefore, while equivalent in their impact on efficiency, have significantly different effects on income distribution.

Since this last option clearly benefits X-sector workers, it raises the question of how union welfare overall would be affected by the sector-specific shock, were it to be followed by government-financed severance payments sufficient to induce the optimal degree of intersectoral labour transfer. We are left with the paradoxical result that union members may be better off than in the initial pre-shock situation.\(^{14}\)

Now consider the impact of granting an employment subsidy, \( s \), to the \( Y \)-sector. The first order condition for profit maximisation in this case becomes:
and the Nash solution for the $X$-sector is:

\begin{equation}
R_L = [F_L(L_Y) + \{N_X - L_X\}F_{LL} + s]
\end{equation}

and

\[w_X = \frac{[R(L_Y, \alpha) - \{N_X - L_X\}(F_L(L_Y) + s) + N_X(F_L(L) + s)]}{2L_X}\]

By raising wages in $Y$ this policy induces the $X$-sector union to release more labour. A comparison of (22) and the condition for social welfare maximisation, (7), reveals that the optimal labour reallocation can be achieved by setting a value of $s$ equal to $s^*$, where

\begin{equation}
s^* = -F_{LL}(N_X - L_X)
\end{equation}

This value of $s^*$ may alternatively be found by setting $d\Omega/ds = 0$ and solving for the resulting level of $s$.

Two questions remain to be asked about this option; firstly, what are its implications for income distribution, and secondly, how does its cost in terms of taxation compare with the tax costs of the alternative policies available?

From (21) and (22) the following results emerge:\textsuperscript{15}

\begin{equation}
dL_X/ds = \Phi 2L_X < 0
\end{equation}
\[ \frac{dw_t}{ds} = \Phi \left( (R_{LL} + 2F_{LL})L_{Y} - 2(w_{X} - R_{L}) \right) > 0 \]

and \[ \frac{dw_t}{ds} = \Phi 2L_{Y} \left( F_{LL} + F_{LL} \right) > 0 \]

A comparison of the values of \( \frac{dw_t}{ds} \) and \( \frac{dw_t}{ds} \) shows that the Y-sector production subsidy raises wages in that sector more than in the declining industry\(^{16} \). All the policies discussed therefore have quite different effects on income distribution.

The model can also be used to compute the tax costs of the various programmes discussed. The tax burden associated with the optimal Y-sector employment subsidy \( s^* \) is \( s^*L_{Y} \), where \( L_{Y} \) is the post-intervention level of Y-sector employment. The income subsidy granted only to those who transfer across sectors has been denoted \( \sigma^* \); a comparison of \( s^* \) and \( \sigma^* \) from equations (19) and (23) reveals that they are of equal size, and the tax costs of the former policy are therefore of course greater.

7: \textbf{Unemployment}

The market imperfection that creates the possibility of welfare-enhancing government intervention emerges most clearly in the simple full-employment model presented so far. In this section some slight changes in model specification are made to illustrate
how unemployment can be incorporated into the analysis.

The crucial ingredient here is the adoption of a sectoral model of the labour market, in which each member of the total labour force $N$ is associated at each point in time with one, and only one, of the sectoral labour pools, $N_x$ and $N_y$. Such an assumption is common in implicit contract models of the labour market, and is also made in the union models of McDonald and Solow (1981,1985) and Grossman (1984). It is based in general on the limited possibilities for industrial and occupational mobility in the short run because of information and search costs, and the difficulties associated with the acquisition of new skills.

Unemployment may emerge through a lack of jobs for the workers currently locked into the rationed sector, as in Grossman (1984), or through the need to queue for the more highly-paid union jobs, as in the dual labour-market model of McDonald and Solow (1985). For expository purposes it is assumed here that the total number of man-hours worked per period (of one or two years) in a sector is divided evenly between members of the sectoral labour pool, with the number of hours worked by the individual in sector $i$ denoted $l_i = L_i/N_i$, which is the employment rate in the sector. A change in the employment rate may be accomplished through changes in weekly hours worked, in lay-off rates, or in speed of recall. Ignoring income effects in the labour supply function, let the subjective evaluation of the disutility of labour, $u(l_i)$, be an increasing and convex function of the number of hours worked per period by the individual; $u'$, $u'' > 0$.  

20
Social efficiency, \( \Omega \), is now

\[
\Omega = R(L_x, \alpha) + \Phi(L_y) - N_y u(l_x) - N_y u(l_y)
\]

and the first-order conditions for Pareto-efficiency are

\[
R_L = u'(l_x)
\]

\[
F_L = u'(l_y)
\]

and

\[
l_x = l_y
\]

Satisfaction of these conditions requires equality between the value marginal revenue product of labour in \( X \), the value marginal product in \( Y \), and the utility cost of foregone leisure.

Since the \( Y \)-sector is competitive, condition (27) is satisfied by profit- and utility-maximising behaviour which equates \( F_L \), \( u'(l_y) \), and \( w_y \), the \( Y \)-sector wage.

Now consider the Nash bargaining process in the \( X \)-sector. The firm's profit function is exactly as it was in previous sections. The union's utility in the event of a bargain is now:

\[
w_x L_x - N_y u(l_x) + \{N_y - \overline{N}_y\} [u'(l_y)l_y - u(l_y)]
\]

where \( \overline{N}_y \) is the initial number of workers in \( Y \), and therefore also, by assumption, the members of the labour force whose welfare is not taken into account by the union; \( N_y - \overline{N}_y \), by
contrast, is the number of X-sector union members made redundant.

The utility of the union in the event of a strike is:

\[ \overline{N}_x [u'(L_\gamma/N)L_\gamma/N - u(L_\gamma/N)] \]

The bargaining solution is therefore found by maximising the following expression with respect to \( L_\gamma, w_x, \) and \( N_x \):

\[
(29) \quad [R(L_\gamma, y) - w_xL_\gamma] [w_xL_\gamma - N_xu(l_\gamma) + (N_y - \overline{N}_y)\{u'(l_\gamma)l_\gamma - u(l_\gamma)\} - \overline{N}_x\{u'(L_\gamma/N)L_\gamma/N - u(L_\gamma/N)\}] 
\]

for which the first-order conditions are:

\[
(30) \quad R_L = u'(l_\gamma) 
\]

\[
(31) \quad F_L = u'(l_\gamma) 
\]

and

\[
(32) \quad [u'(l_\gamma)l_\gamma - u(l_\gamma)] = [u'(l_\gamma)l_\gamma - u(l_\gamma)] - \{N_y - \overline{N}_y\}l_\gamma^2u''/N_y 
\]

For the initial equilibrium in which \( N_y = \overline{N}_y \) it is easily seen that these conditions collapse to those pertaining to the social welfare maximum. When a negative disturbance hits the X-sector however, causing it to shed labour, \( N_y \) rises above \( \overline{N}_y \) and the conditions for a welfare optimum are violated. Specifically, inspection of equation (32) reveals that in this case \( l_\gamma > l_\gamma \), i.e. the rate of employment in the declining sector is lower than in \( Y \).
From equations (26)-(28) the optimal response of the economy is seen to entail:

\begin{equation}
\frac{dL_x}{d\alpha} = \pi R_{\alpha} \left[ (F_{LL} - u''/N_Y) L_Y/N_X^2 + F_{LL} L_Y/N_Y^2 \right] < 0
\end{equation}

\begin{equation}
\frac{dL_Y}{d\alpha} = \pi R_{\alpha} u'' L_Y/N_X N_Y^2 > 0
\end{equation}

\begin{equation}
\frac{dN_x}{d\alpha} = \pi R_{\alpha} (F_{LL} - u''/N_Y) / N_X < 0
\end{equation}

\begin{equation}
\frac{dL_Y}{d\alpha} = \frac{dL_I}{d\alpha} = \pi R_{\alpha} F_{LL} L_Y/N_X N_Y^2 < 0
\end{equation}

where \( \pi^{-1} = -R_{\alpha} (F_{LL} - u''/N_Y) L_Y/N_X^2 - F_{LL} (R_{\alpha} - u''/N_X) L_Y/N_Y^2 < 0 \)

Efficient adjustment therefore involves a decline in \( x \)-sector production, labour-transfer into \( Y \), lower wages and expanded production in \( Y \), and an increased natural rate of unemployment in both sectors as workers supply less labour.

The actual response differs from the optimal response, however, since less workers transfer from the unionised sector:

\begin{equation}
\frac{dL_x}{d\alpha} < 0; \frac{dL_Y}{d\alpha} > 0.
\end{equation}

\begin{equation}
\frac{dN_x}{d\alpha} = -\varepsilon (F_{LL} - u''/N_Y) R_{\alpha} L_Y^2 u''/N_X < 0
\end{equation}

\begin{equation}
\frac{dL_Y}{d\alpha} = \varepsilon [-F_{LL} R_{\alpha} L_Y^2 u''/N_X N_Y + u'' R_{\alpha} L_Y^2 u''/N_X N_Y^2] < 0
\end{equation}
\[ \frac{dl_x}{d\alpha} = -\varepsilon \left[ F_{ll} R_{la} l_x u'' L_y / N_x N_y^2 \right] < 0 \]

where \( \varepsilon = \left\{ F_{ll} u'' / N_y \right\} R_{ll} \left\{ l_x u'' L_y / N_y^2 \right\} + \left\{ 2F_{ll} u'' / N_y \right\} \left\{ R_{ll} - u'' / N_x \right\} \left\{ l_x^2 u'' / N_y \right\} > 0. \]

A comparison of equation systems (33) and (34) reveals that what has here been called the natural rate of employment in the X-sector, \( l_x \), declines more under the Nash bargaining agreement than is optimal for the economy as a whole. The "overemployment result" derived in the earlier sections of the paper remains, but in the present context is seen to mean that while the unionised sector retains more than its efficient share of the labour force, the workers who remain there experience greater unemployment on average than would be the case if efficient labour transfer were effected.

8: Conclusions

The situation explored in this paper is one in which a sector-specific disturbance generates unemployment that co-exists with relatively high wages in the declining industry. Previous analyses have interpreted this unemployment as "classical" in nature, assuming it to be caused by arbitrary wage rigidities, and have concluded that some degree of subsidisation of the contracting sector is warranted on efficiency grounds.
The present paper proposes an alternative "structural" explanation in which the privately-optimal response of workers and firms within a strongly-unionised high-wage industry leads to inefficiently low levels of labour transfer and a correspondingly high rate of sectoral unemployment. Subsidisation of the declining sector under these circumstances reduces efficiency still further\(^{18}\).

Several policies capable of inducing the optimal degree of labour transfer have been identified here: the direct subsidisation of intersectoral labour transfer (which is equivalent to government financing of severance payments), tax policies directed against the declining sector, and the subsidisation of employment or production in expanding industries. As these policies differ in terms of tax cost, income distributional impact, and political feasibility, the choice hinges on the importance attached to each of these considerations. Government financing of severance payments, for example, represents a gain for unionised workers and a loss for others, while the stimulation of the expanding sector causes both groups of workers to gain, with lower-paid workers gaining relatively more. Both policies are frequently encountered in reality.

Mention might also usefully be made at this stage of several issues related to the topic of the paper which have not been taken into account in the formal model.

Firstly, the analysis can shed some light on the policy issue of
the appropriate use of fiscal spending during the adjustment process, as discussed informally by Harris, Lewis and Purvis (1982). Their contention that government spending directed towards declining sectors leads to a reduction in efficiency is supported here, while fiscal policies targeted towards expanding sectors should prove beneficial in a version of the model expanded to allow room for demand to affect the level of output.

Secondly, in the absence of non-distortionary taxation, the question arises as to which subset of industries in the expanding sector should be stimulated. Again, as Harris, Lewis, and Purvis indicate, an economic analysis based on the assumption of perfect competition cannot aid in the choice between candidates; the focus of attention must be on the potential of various firms or industries to achieve dynamic economies of scale.

Finally, a word on the implications of relaxing the assumption of a fixed stock of capital; it is clear that capital decumulation in the declining industry would exert increased pressure on workers to transfer to other sectors. The social inefficiency identified here would nevertheless persist, and would have to be treated in any discussion expanded to include these effects.
1. Richardson's (1982) conclusion that "workers receiving trade adjustment assistance (under the U.S. Trade Act of 1974) had higher incomes on average than their counterparts who received only standard unemployment insurance" supports the view that high-wage industries in difficulties frequently induce a response from government.

2. Katz (1988, p.515-517) notes that empirically "high wages are positively associated with measures of product market rents."

3. The assumption that there is no domestic consumption of X means that intervention to offset the market power of the industry is not required. The optimal tariff argument does not apply since the industry makes full use of its market power.


5. In McDonald and Solow (1981) the union is concerned with the utility of the wage bill, rather than with the wage bill per se. Their result that the unionised sector exhibits overemployment stems directly from this assumption. Oswald (1985) explains this as arising from the absence of perfect insurance markets: the union reduces the risk of an individual suffering an income loss through unemployment by setting employment above the level it would desire if insurance markets were perfect. The latter in turn is the competitive level. The present paper follows Hall and Lilien (1979) in assuming a constant marginal utility of income, under which conditions McDonald and Solow's overemployment result does not appear, in order to draw a sharp distinction between it and the overemployment emerging from the structure of the model presented here.

6. Binmore, Rubinstein and Wolinsky (1986) argue that the two basic motives that induce parties to come to a bargain eventually rather than to hold out indefinitely are the risk that the opportunity being bargained over may be lost (e.g. through being snatched by a third party), and impatience to secure the fruits of agreement. In the former case the parties' attitudes to risk are crucial to the outcome, while time preferences are of overriding importance in the latter. With respect to the strategic time-preference model, which is the class to which the analysis of the present paper belongs, they show (p.185) that the no-contract outcomes appropriate to the Nash-bargaining game are the income streams that the parties receive during a dispute.

7. The objection may be raised that employers in fact have a wide degree of latitude in determining the level of employment. Hall and Lilien (1979), however, show that many frequently-encountered contractual arrangements that make the wage bill a function of employment can achieve the type of efficiency assumed here whilst allowing the firm full control over the employment level.
8. It may be noted that the Nash-bargaining solution to the present problem is egalitarian in the sense that the firm's gain, over and above its income in the no-contract case, is equal to the union's.

9. As McDonald and Solow (1981) have shown, in the "small industry" case these competing tendencies would offset each other exactly and thereby give rise to wage rigidity if the elasticity of labour demand at the going wage were invariant to the sectoral shock. This would not occur in the present case because of the presence of an additional factor exerting downward pressure on wages; the union in the present set-up is more willing to trade off a wage reduction for greater employment protection because it must take into account the impact of labour-shedding on the incomes of its members working in the Y-sector. To see this, consider the isoelastically-shifting labour demand function \( R(L_x, \alpha) = S(\alpha L) / \alpha \), which implies

\[
\frac{dw_x}{d\alpha} = \Phi 2 \bar{F}_L \bar{S}'' \bar{L}_x^2 < 0
\]

The \( \bar{F}_L \) term here represents the impact of labour-transfer from X on Y-sector wages. If the X-sector were small this term would disappear, and neither sector's wage would be affected by the shock.

10. An X-sector production subsidy has the same qualitative effects as an employment subsidy in the present one-factor model.

11. Differentiate the profit function and the union maximand with respect to \( L_x \), taking (4) into account, to see that the firm's gain and the union's loss is \( w_x - R_t \).

12. The life-spans of all policies discussed in the paper are assumed to be universally known, so that decisions are made on a full information basis.

13. Although this notion of equity contrasts with the conservative social welfare function that Corden (1974) identifies as underlying many policy decisions, it is nonetheless frequently taken into consideration in discussions of optimal policy response; see, for example, Wolf's (1982) comments on trade adjustment assistance under the U.S. Trade Act of 1974. McCulloch(1984), in her review of the Bhagwati volume, also notes that the "populist reaction" against the protection of the U.S. auto industry was due as much "to the high average wage in the industry as to the direct pocketbook impact at the showroom."

14. Union welfare is measured by \( U = w_x L_x + (N_x - L_x) (F_t (L_t) + B) \), where \( B \) is the wage equivalent of the lump-sum severance payment. (\( B=0 \) initially.) The impact of the \( q \)-shock on union welfare, from (8), is \( R_t/2 < 0 \). To find the overall impact of the shock when followed by a subsidy to induce the optimal degree of labour-transfer (this joint shock being denoted \( \alpha' \)), note from (7) that:

\[
\frac{dw_x}{d\alpha'} = \frac{dw_x}{d\alpha} + \frac{dw_x}{d\beta} \cdot \frac{d\beta}{d\alpha}
\]

28
where \( \frac{dB}{d\alpha} = -(N_y - L_y)F_{\lambda\lambda} \).

Substitution then yields:

\[ \frac{dU}{d\alpha'} = \frac{[R_y - \Phi R_{\lambda\lambda} F_{\lambda\lambda} (2N_y - L_y)]}{2} \]

which is of ambiguous sign.

15. The positivity of \( \frac{dw}{ds} \) can be seen by noting that \( w_x > w_y \) \( \Rightarrow F_{\lambda\lambda} \geq R_{\lambda\lambda} \).

16. This can be seen most clearly by employing the Nash solution and a Taylor series expansion to write

\[ 2(w_x - R_{\lambda\lambda}) \]

as

\[ L_y (F_{\lambda\lambda} - R_{\lambda\lambda}/2) \]

17. This assumption is given some empirical support by Richardson's findings on U.S. trade adjustment assistance that "TAA recipients were much more likely than UI recipients to experience temporary unemployment or reduced hours...They were only barely more likely than UI recipients to have worked for a company that closed down, and much less likely to have changed their industry or occupation between separation and the interview, roughly three years later." (p.333). Also see Lilien (1980) on the importance of temporary layoffs.

18. A similar conclusion is reached by Gerken et al. (1986) in their discussion of the impact of the expansion of West German subsidies to the iron and steel industry since 1983. They propose as an alternative a regionally-oriented wage-subsidy programme.
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