



ELSEVIER

European Economic Review 45 (2001) 1851–1875

EUROPEAN
ECONOMIC
REVIEW

www.elsevier.com/locate/econbase

Centralized bargaining and reorganized work: Are they compatible?

Assar Lindbeck^{a,b}, Dennis J. Snower^{c,d,e,*}

^a*IIES, University of Stockholm, S106 91 Stockholm, Sweden*

^b*IUI, Stockholm, Sweden*

^c*Department of Economics, Birkbeck College, University of London, 7 Gresse Street,
London W1P 2LL, UK*

^d*CEPR, London, UK*

^e*IZA, Bonn, Germany*

Received 1 March 1998; received in revised form 1 May 2000

Abstract

The paper examines the implications for wage bargaining of an important aspect of the ongoing reorganization of work – the move from occupational specialization toward multi-tasking. The analysis shows how, on account of such reorganization, centralized bargaining becomes increasingly inefficient and detrimental to firms' profit opportunities, since it prevents firms from offering their employees adequate incentives to perform the appropriate mix of tasks. The paper also shows how centralized bargaining inhibits firms from using wages to induce workers to learn how to use their experience from one set of tasks to enhance their performance at other tasks. In this way, the paper may also help explain the increasing resistance to centralized bargaining in various advanced market economies. © 2001 Elsevier Science B.V. All rights reserved.

JEL classification: D23; J24; J31; J51; J53

Keywords: Centralized wage bargaining; Restructuring of firms; Information flows; Employment; Wage formation

* Corresponding author. Tel.: + 44-171-631-6408.

E-mail address: dsnowe@econ.bbk.ac.uk (D.J. Snower).

1. Introduction

A large and growing literature documents the widespread reorganization of work within firms in advanced market economies. The evidence, as summarized in Section 2, indicates that the new break-throughs in information and production technologies have made it profitable for firms to flatten the hierarchies of control and responsibility and to allow for greater decentralization of decision-making. In the traditional firms, work was divided into well-defined families of tasks, each often performed in a different department, such as the production, marketing, sales, accounting, and product development departments. Production workers were often assigned highly specialized and monotonous tasks. Labor, like capital equipment, was treated as a single-purpose input; and this, in fact, is also the way labor and capital are depicted in mainstream production theory. In the contemporary reorganization of work, by contrast, firms use labor in more flexible and versatile ways. Workers increasingly combine different tasks in wide varieties of ways to suit the new production technologies, workers' preferences for more varied work, and customers' varied needs. Recent evidence suggests that the new forms of work are often organized around small, customer-oriented teams rather than large functional departments, with considerable discretion for both teams and individual workers.

We will call the traditional organization of work, with substantial specialization by task and centralization of responsibilities, a 'Tayloristic' organization. The newly emerging work organization, characterized by multi-tasking and decentralization of work responsibilities, will be called 'holistic'. In this context, we will interpret job rotation and multi-tasking widely, to include not only the pursuit of several traditional occupational tasks, but also communication with other employees and customers, participation in consultative groups, and so on.

To some extent, the resulting breakdown of occupational barriers amounts to a reversal of a trend that began with the Industrial Revolution, in which productivity improvements were exploited through increasing specialization of work.¹ But it is important to note that reduced task specialization among workers does not necessarily imply reduced specialization in production among firms. Quite the contrary, job rotation and multi-tasking often occurs simultaneously with a down-sizing process that involves more narrow focus on a firm's 'core competencies' in production.

This paper examines the implications of this reorganization of work for centralized wage bargaining. Our analysis suggests that when work is reorganized, the efficiency cost of centralized wage bargaining rises, since it prevents

¹ This is, of course, just a general tendency, to which exceptions are not uncommon. Indeed, specialization of work may have continued to increase in some fields, such as in research and advanced medicine.

firms from offering their employees the incentives to perform the appropriate mix of tasks. The intuition underlying this result may be summarized as follows.

Although the content of centralized bargaining arrangements varies across countries,² those conducting such bargaining are everywhere forced to apply highly standardized principles for wage setting. The reason is that they have very little, if any, information about conditions in individual firms. A very common form of such standardization is that central negotiators often strive towards ‘equal pay for equal work’, which means paying different employees the same (or similar) amounts for the same tasks. Centralized wage bargaining of this type may not be severely inefficient when different workers do different tasks, particularly if workers within an occupation have similar productivity. But once work is restructured to promote multi-tasking and employees’ decentralized choices among tasks, the practice may become very inefficient indeed.

The source of the inefficiency is to be found in the complementarities among the multiple tasks performed by individual employees. Such complementarities are a primary motive for multi-tasking. For example, insights gained on one position on the production line may be put to use on other position on the line. Similarly, the knowledge an employee acquires in one production team may be useful when the employee moves to another team. In a similar vein, experiences on production work may be put to use in quality control; information about customer preferences gained through selling may be useful in employee training; and knowledge acquired through product repairs may be applied to production work or even product development. When different employees combine different sets of complementary tasks, there is no reason to believe that the marginal product of one employee’s time at a particular task should be similar to the marginal product of another employee’s time at that task, even if the two employees have the same abilities. For instance, there is no reason why time spent with customers should affect the productivity of a customer service employee in the same way as it affects the productivity of a production worker or a trainer of new recruits. The same principle holds, though to a lesser degree, even when different employees perform the same set of tasks, but in different proportions.

Consequently, the restructured firms have an incentive to offer different workers different wages at the same tasks. Moreover, firms have an incentive to reward workers for learning how to use their experience gained at one set of tasks to enhance their performance at another set of tasks. But it is precisely these practices that centralized bargaining inhibits. Thus we argue that the reorganization from occupational specialization to multi-tasking raises the efficiency costs of

² At one extreme, Austria and the Nordic countries have traditionally had highly centralized wage bargaining processes. In other countries, such as France, Germany, Italy, and the Netherlands, the important wage setting decisions tend to be made at the industry level.

centralized bargaining and thereby gives employers and employees growing incentives to choose decentralized bargaining arrangements instead.

Beyond that, we argue that the above inefficiency cannot be avoided by reforming the nature of the centralized wage bargaining process. In particular, suppose that centralized bargainers would stop imposing wage uniformity on the traditional occupational categories and, instead, tried imposing it on the new occupational clusters that emerge under multi-tasking. In practice, this would be an insuperably difficult task, since the switch to multi-tasking is likely to make work more idiosyncratic in terms of task assignments among employees, both within most reorganized firms and across such firms. The problem is magnified by the firms' need to assign multiple tasks not just on the basis of workers' abilities at these tasks, but also with regard to their judgement, initiative, creativity and social competence. And insofar as workers differ in terms of these latter attributes, even when they are of equal ability at particular tasks, it will be efficient to allocate different task clusters to workers of equal ability.

But even if centralized wage bargaining could be reformed along the lines above, it would still be inefficient for the reorganized work for the following reason. Under multi-tasking, wages have a dual role: they influence *both* the number of people employed *and* their time allocations across tasks. Thus, to maximize profits firms need to give their employees sufficiently large diversity of wage signals to perform this dual role. Imposing wage uniformity within occupational clusters restricts this diversity. Thus even if the centrally determined wages were to induce efficient levels of employment, they will not in general ensure that the time allocations across tasks are efficient as well.

In these ways our analysis provides a rationale for the trend towards more decentralized wage bargaining, as described in Section 2.

The literature emphasizing the advantages of centralized wage bargaining occupies a position analogous to the centralized price setting literature half a century ago. There it was argued that centralized price fixing in product markets is desirable, since the central planner is able to internalize various externalities operative among firms acting in isolation.³ Over the past decades, however, the influence of this central planning literature has gradually waned, as economists have come to appreciate the difficulties of centralized price setting when products, technologies and tastes are highly heterogeneous. This paper suggests that as the contemporary reorganization of work makes jobs more heterogeneous, centralized wage setting becomes more difficult as well. Information about workers' productivities at heterogeneous task clusters is becoming as hard to centralize as information about the marginal revenues and costs of producing different products. As labor markets become more like product markets in terms of their heterogeneity, we argue that the inefficiencies of centralized wage bargaining are

³ See, for example, Lange (1938).

becoming similar to the inefficiencies of centralized price fixing. In this respect, our analysis suggests Hayek's objections to centralized pricing of goods and services now apply increasingly to the labor market as well.⁴

The paper is organized as follows. Section 2 provides a summary of the evidence on the reorganization of work and the decentralization of wage bargaining. Section 3 presents a simple model of how the move from occupational specialization towards multi-tasking raises the efficiency cost of centralized bargaining. Section 4 provides some extensions. Section 5 concludes.

2. An overview of the evidence

The contemporary reorganization of work was first described and analyzed in a sizeable literature in management and business administration.⁵ Various aspects of the reorganization process have also been examined in the economics literature.⁶ The process is a gradual one, proceeding unevenly among firms and countries. Until recently, the evidence of these organizational developments has been based on a large number of case studies. The quantitative importance of the process, therefore, has been uncertain. However, more systematic and representative studies are now available. Comprehensive studies for Japan established long ago the emergence of new types of work organization, sometimes baptized 'The Toyota model' (e.g., Aoki, 1990). Recent studies for the United States and Europe have documented that reorganization of work is a wide-ranging phenomenon in these parts of the world as well. For instance, a representative study by Osterman (1994) documents the development in U.S. manufacturing establishments (with 50 or more employees). The conclusion is that 55% of the establishments were using work teams, 43% work rotation, 34% 'total quality control' (TQM) and 41% quality circles; only 21% had none of these features.⁷ There is also evidence that these organizational forms are a new phenomenon. About half of the observed arrangements were introduced less than five years prior to the survey year of 1992.⁸

⁴ See, for example, von Hayek (1940).

⁵ See, for example, Appelbaum and Bott (1994), Hammer and Champy (1993), Pfeiffer (1994), Wikström and Norman (1994), and Womack et al. (1991).

⁶ See, for instance, Carmichael et al. (1993), Holmstrom and Milgrom (1994), Kremer and Maskin (1995), Lindbeck and Snower (1996, 2000), Milgrom and Roberts (1990), Mitchell et al. (1990), Piore and Sabel (1984), and Yang and Borland (1991).

⁷ For firms in which at least 50% of the workforce was engaged in such activities, the corresponding percentage figures are 41, 27, 24, 27 and 36.

⁸ Forty-nine percent of the teams, 38% of the job rotation practices, 71% of TQM programs and 68% of problem-solving groups or quality circles were introduced in the period 1986–1992. These results are broadly consistent with a study for a sample of large firm by Lawler et al. (1992), according to which 66% of the firms in the sample have quality circles, 47% have self-managed work teams and 64% TQM.

The most comprehensive documentation of the quantitative importance of the shifts to more flexible work organization apparently pertains to the Nordic countries (NUTEK, 1996, 1999). These studies indicate that the majority of establishments (with more than 50 employees) in all Nordic countries – more specifically, 68–75% of these establishments – moved to more flexible organization of work during the 1990s (NUTEK, 1999, Chapter 4).⁹ The most important elements of these reorganizations are delegation of responsibility to production workers, organized development of human capital (training), as well as teamwork, job-rotation, and multi-tasking (reflected in an increase in the average number of tasks per employee).

For instance, daily planning of one's own work has been decentralized to individuals in 57% of Swedish establishments and in 40% of Finnish establishments, and to work teams in 38 and 25%, respectively (NUTEK, 1999, Chapter 2). The figures for quality control and weekly planning of ones own work are somewhat lower, and for customer relations and maintenance considerably lower.¹⁰ Internal information circulation within firms is also reported to have increased. Within the teams, informal work rotation (multi-tasking) is usual. Moreover, formally planned work rotation is recorded in about a fifth of the studied firms. Another finding is that the education level among the employees is higher in reorganized firms than in traditional firms. Employee participation in decision-making within firms seems also to have increased in the other major West European countries (OECD, 1996, Chapter 6). Indeed, in a systematic questionnaire study among managers in this part of the world, four out of five firms report that they have taken steps in this direction (European Foundation, 1997).

In this paper we argue that the above reorganization of work gives a rationale for decentralization in wage setting. There is indeed a trend in this direction, which has also been widely documented,¹¹ though it has taken different forms in different countries. The move towards decentralized bargaining agreements has been particularly pronounced in countries that previously had highly centralized bargaining, namely the Nordic countries. These also happen to be the countries in which the reorganization of work seems recently to have gone the furthest (European Foundation, 1997; NUTEK, 1999).¹² For example, over the 1980s and 1990s wage bargaining arrangements in Denmark and Sweden

⁹ If work places with 10–49 employees are included, the proportion of reorganized work places decreases with about 20 percentage points.

¹⁰ For customer relations the corresponding figure in Sweden (Finland) is 36 (19)% in the case of individuals, and 13 (7)% in the case of teams. For maintenance the figure for Sweden (Finland) is 28 (10)% in the case of individuals and 23 (9)% in the case of teams.

¹¹ Katz (1993) and *European Industrial Relations Review* (1992) give good accounts of this development.

¹² Today, we can only speculate about the reasons for this. One may be that the Nordic countries have rather even and fairly high levels of general education. Another conceivable reason may be that unions and firms are accustomed to close cooperation, in particular on the firm level.

became increasingly fragmented, as these countries moved from a highly centralized system¹³ toward industry-level bargaining. Whereas plant-level bargaining has always been important in these countries (and was responsible for wage drift under the centralized bargaining regime), the centralized bargaining agreements became smaller in scope and influence with the passage of time.¹⁴ Germany's formal bargaining structure has remained largely unchanged over the past two decades, but it has nevertheless witnessed a gradual rise in the importance of plant- and workshop-level bargaining since the beginning of the 1980s, both regarding wages and the organization of work.¹⁵ A similar trend has been witnessed in Italy,¹⁶ which abandoned its *Scala Mobile* in the 1980s. In both Germany and Italy, the scope of national bargaining agreements has shrunk, concentrating increasingly on working hour targets and general conditions of employment, while leaving wage agreements, work organization, and job classifications increasingly to local negotiations.

The UK has witnessed a marked rise in single-employer agreements at the expense of multi-employer contracts¹⁷ and a rise in the number of agreements negotiated below the company level (e.g. the plant, division, or profit-center level) since the start of the Thatcher era.¹⁸ The US has also experienced a drop in multi-employer agreements in favor of company- and plant-level bargaining,¹⁹ accompanied by a decline in pattern bargaining.²⁰ As in other countries, the local negotiations have focused increasingly on work organization and remuneration schemes.²¹

Even though the timing of reorganization of work happens to coincide with the shifts to more decentralized wage bargaining, the latter trend may also have been driven by other factors. For example, Freeman and Gibbons (1993) argue that the decentralization trend is due, in part, to rising volatility in local labor market conditions. Numerous observers have suggested that the decline of centralized bargaining is due to falling union density and rising management power. But this cannot be the whole story since local unions frequently support the move towards decentralization.²²

¹³ In this centralized system the employers' confederation, SAF, and the blue-collar union confederation, LO, negotiated wages and other issues until the early 1980s, providing a lead for subsequent sectoral negotiations.

¹⁴ For example, *European Industrial Relations Review*, 1992.

¹⁵ For example, Streeck (1984) and Windolf (1989).

¹⁶ *European Industrial Relations Review* (1992), Locke (1992), Windolf (1989).

¹⁷ Brown (1981), Marginson et al. (1988), Millward et al. (1992).

¹⁸ Brown and Walsh (1991), *Industrial Relations Review and Report* (1989), Marginson et al. (1988).

¹⁹ Katz and Kochan (1992) and Turner (1991).

²⁰ Budd (1992), Katz and Meltz (1989).

²¹ Cutcher-Gershenfeld (1991), Eaton and Voos (1992).

²² See, for example, Katz (1993).

Numerous case studies suggest that changes in the organization of work have played a critical role in the decline of centralized bargaining.²³ To the best of our knowledge, however, no attempt appears to have been made thus far to provide a theory of how this could happen. This paper seeks to do so.

3. Multi-tasking with different task proportions

We begin with a particularly simple demonstration of how the switch from task specialization to multi-tasking raises the efficiency cost of centralized bargaining. For this purpose, we assume that different employees perform the same set of tasks, but in different proportions. It is then easy to extend this analysis to show how this efficiency problem of centralized bargaining can occur under the more prevalent form of multi-tasking, namely, when different employees perform different sets of tasks.

3.1. Production and labor services

Consider a firm that produces an output q through two tasks (1 and 2), and employs two types of workers, who differ in terms of their comparative advantage at these tasks: type-1 workers are comparatively better at task 1 and type-2 workers are comparatively better at task 2 (as formalized below).

Let λ_i , $i = 1, 2$ be the total labor services that these two types of workers provide at task i . The production function, relating these labor services to the firm's output, is

$$q = f(\lambda_1, \lambda_2), \quad (1)$$

where $(\partial f / \partial \lambda_1) > 0$ and $(\partial^2 f / \partial \lambda_1^2) < 0$.

The determinants of these labor services are defined as follows:

- Let τ be the fraction²⁴ of a type-1 worker's time devoted to task 1, and $(1 - \tau)$ be the fraction devoted to task 2. Similarly, let T be the fraction of

²³ For instance, Katz (1993), Locke (1992) and Turner (1991). Empirical studies also suggest that much more complex remuneration systems are used in reorganized firms than in traditional firms. For instance, there is a much higher frequency of various types of ability pay and performance pay, such as pays for qualification and bonus for individual attitude, team bonus for output, and profit sharing (European Foundation, Chapter 10; NUTEK, 1999, Chapter 3).

²⁴ To focus attention on the distinction between specialization of work and multi-tasking, we make the simplifying assumption that each worker's available working time is given (normalized to unity) and we will examine how this time is divided between the two available tasks. Extending our analysis to the case in which the workers' total available time is endogenously determined as well does not substantively affect our qualitative conclusions, provided that workers' utilities decline with total hours of work performed.

the type-2 worker's time spent at task 2, and $(1 - T)$ be the fraction spent at task 1.

- Let e_1 and e_2 be the type-1 worker's labor endowment at tasks 1 and 2, respectively (i.e. the efficiency units of labor provided by that worker at these tasks). Similarly, let E_1 and E_2 be the type-2 worker's labor endowment at tasks 1 and 2, respectively.
- Finally, let n and N be the number of type-1 and type-2 workers employed, respectively.

(Observe that the variables pertaining to type-1 workers are in lower case, whereas those pertaining to type-2 workers are in upper case.) The type-1 workers have a comparative advantage at task 1 (relative to worker 2 at task 1) in the sense that $(e_1/e_2) > (E_1/E_2)$, for any given $\tau = T$.

Then the labor services provided at the two tasks may be expressed as

$$\begin{aligned}\lambda_1 &= e_1 \tau n + E_1(1 - T)N, \\ \lambda_2 &= e_2(1 - \tau)n + E_2 TN.\end{aligned}\tag{2}$$

Along the lines of Lindbeck and Snower (2000), we assume that each worker's labor endowment (e_i and E_i , $i = 1, 2$) at a particular task is a function of two factors: (i) the 'return to specialization', whereby a worker's productivity at a task rises with experience at that task, and (ii) an 'informational task complementarity', whereby the worker's productivity at a task depends on the information gained from the experience acquired at another task.²⁵ Although these two factors may not be easy to separate in practice, it is conceptually convenient to represent them by two separate variables.

For the type-1 worker, let s_i , $i = 1, 2$, be the returns to specialization at task i , and let c_i , $i = 1, 2$, be the informational task complementarities running to task i (i.e. the rise in the worker's productivity at task i achieved by gaining information about the other task). We assume that the type-1 worker's returns to specialization at a task depend positively on the fraction of time spent at that task (*ceteris paribus*):

$$s_1 = s_1(\tau) \quad \text{and} \quad s_2 = s_2(1 - \tau),\tag{3a}$$

where $s'_1, s'_2 > 0$.

Regarding the informational task complementarities, we assume that the greater is the fraction of time that a type-1 worker spends at one task (*ceteris*

²⁵ For example, workers often function better within a production team if they have experience not only of their particular task, but also those of other team members, as well as tasks of other teams. Another example is that the information about customer preferences that a worker gains at the task of marketing can generate information that is useful in product design or in the provision of ancillary services.

paribus), the greater will be the worker's productivity at the other task:

$$c_1 = c_1(1 - \tau) \quad \text{and} \quad c_2 = c_2(\tau), \quad (3b)$$

where $c'_1, c'_2 > 0$.

Then a type-1 worker's labor endowment may be expressed in terms of the returns to specialization and the informational task complementarity:

$$e_1 = e_1(s_1, c_1) \quad \text{and} \quad e_2 = e_2(s_2, c_2), \quad (3c)$$

where $(\partial e_i / \partial s_i) > 0$ and $(\partial e_i / \partial c_i) > 0$, $i = 1, 2$.

For the type-2 worker, along the same lines, the returns to specialization at the two tasks are

$$S_1 = S_1(1 - T) \quad \text{and} \quad S_2 = S_2(T), \quad (4a)$$

where $S'_1, S'_2 > 0$; and the informational task complementarities are

$$C_1 = C_1(T) \quad \text{and} \quad C_2 = C_2(1 - T), \quad (4b)$$

where $C'_1, C'_2 > 0$. Thus the type-2 worker's labor endowment may be expressed as

$$E_1 = E_1(S_1, C_1) \quad \text{and} \quad E_2 = E_2(S_2, C_2), \quad (4c)$$

where $(\partial E_i / \partial S_i) > 0$ and $(\partial E_i / \partial C_i) > 0$, $i = 1, 2$.

By (2)–(4c), the labor services λ_1 and λ_2 may be expressed in terms of the number of workers employed and their time allocation between tasks:²⁶ $\lambda_1 = \lambda_1(\tau, T; n, N)$ and $\lambda_2 = \lambda_2(\tau, T; n, N)$. Thus the firm's production function (1) may also be expressed in terms of these arguments:

$$q = q(\tau, T; n, N). \quad (1')$$

3.2. *Wages and labor costs*

An important aspect of multi-tasking, documented in the recent empirical literature, is that employees often have discretion over the proportions in which different tasks are performed. In practice, employers generally determine the range of tasks that each of their employees perform, while the employees often

²⁶Note that the labor services (λ_i , $i = 1, 2$) depend on the time allocations (τ and T), the productivities (e_j and E_j , $j = 1, 2$), and the number of type-1 and type-2 workers employed. The productivities, in turn, depend on the time allocations (by (3a)–(3c) and (4a)–(4c)). Consequently, the labor services are a function simply of the time allocations and the number of workers employed.

have some latitude in deciding the task mix.²⁷ This aspect is a significant source of decentralization of decision making within restructured enterprises. Employees often have a significant amount of tacit, local information that cannot be readily transmitted to management. To exploit this information, the employees often have some control over how to mix the tasks within their remit. Beyond that, task mixing is usually difficult to monitor, and thus managers often have little alternative but to leave some of the decision making to the employees. Managers can, however, influence their employees decisions through wage incentives. These wage incentives may be distorted through centralized wage bargaining. It is this wage setting problem to which we now turn.

Suppose that in the absence of centralized bargaining, the firm can offer (at least implicitly²⁸) a different wage to each worker at each task: each type-1 worker receives the real wages w_1 and w_2 at tasks 1 and 2, respectively; and each type-2 worker receives the real wages W_1 and W_2 at these tasks. Then the firm's labor costs are

$$\kappa = w_1 \tau n + w_2 (1 - \tau) n + W_1 (1 - T) N + W_2 T N. \quad (5)$$

Given these wages, each worker decides on his time allocation between the two tasks. For simplicity, let the utility function of each type-1 worker be

$$u = y + v(\tau), \quad (6a)$$

where $y = w_1 \tau + w_2 (1 - \tau)$ is the worker's wage income²⁹ and $v(\tau) < 0$ is the disutility of work. The worker has 'specialist preferences' when $v'(\tau) > 0$ for $0 \leq \tau \leq 1$, so that the worker's utility rises as he allocates more time to the task at which he has a comparative advantage. On the other hand, the worker has 'versatile preferences' when, for some $\tau = \tau^0$ (a constant, $0 < \tau^0 < 1$), $v'(\tau) > 0$ for $\tau \leq \tau^0$ and $v'(\tau) < 0$ for $\tau \geq \tau^0$. Here the worker's most preferred time allocation is $\tau = \tau^0$, involving multi-tasking, and utility falls as the time allocation diverges from this most preferred allocation.

²⁷ Alternatively, employers may determine the task mix that each employee is to perform, but the employee determines his effort level at each task, in response to wage incentives (as addressed in Section 4). Yet another possibility is that the employees are in a better position than the employer to identify the most profitable task mix (from the range of designated tasks, set by the employer) as the profit opportunities arise, while the employer evaluates the employees' performance ex post. In that event, it may be profitable for the employer to award 'flexibility bonuses'. (Lindbeck and Snower (2000) analyze the organization of work when the firm determines its employees' task mix unilaterally.)

²⁸ Explicitly, the firm may offer each worker a single wage which depends on the task mix that worker performs. This is of course analytically equivalent to offering workers different wages for different tasks.

²⁹ The inclusion of non-wage income would not affect the conclusions of our analysis, since utility is linear in income and thus there is no income effect.

The prevailing wages w_1 and w_2 are predetermined when the workers make their time allocation decisions. The first-order condition for the type-1 worker's utility maximization is

$$\frac{du}{d\tau} = (w_1 - w_2) + v'(\tau) \geq 0, \quad \frac{du}{d\tau}(1 - \tau) = 0. \quad (6b)$$

Similarly, the utility function of each type-2 worker is

$$U = Y + V(T), \quad (7a)$$

where $Y = W_1(1 - T) + W_2(T)$ is the worker's wage income. The first-order condition for this worker's utility maximization is

$$\frac{dU}{dT} = (W_2 - W_1) + V'(T) \geq 0, \quad \frac{dU}{dT}(1 - T) = 0. \quad (7b)$$

For simplicity, the firm is assumed to know the workers' reaction functions (6b) and (7b) when setting wages. We now proceed to the firm's decision making problem.

3.3. Profit maximization and the organization of work

The firm offers the wages w_1 , w_2 , W_1 , and W_2 that elicit the profit-maximizing time allocations³⁰ τ^* and T^* . In addition, the firm makes the profit-maximizing employment decisions n^* and N^* . The firm's decision making problem may therefore be expressed as maximizing profit³¹ $\pi = q - \kappa$ with respect to the wages w_1 , w_2 , W_1 , and W_2 and the employment levels n^* and N^* , subject to the production function (1), the labor services described by (2)–(4c), the labor cost function (5), and the workers' reaction functions (6b) and (7b). To maximize profit, the firm finds the lowest feasible wages necessary to induce the workers to offer the profit-maximizing time allocations τ^* and T^* . Thus the reaction functions (6b) and (7b) hold as equalities

$$w_1 - w_2 = -v'(\tau) \quad \text{and} \quad W_2 - W_1 = -V'(T). \quad (8)$$

³⁰By implication, the organization of work is determined on the basis of profit-maximizing principles. At the cost of some expositional simplicity, but without affecting the qualitative conclusions of our analysis, the organization of work could alternatively be portrayed as the outcome of a Nash bargain between the firm and its employees. The latter is perhaps more closely in line with the process or organizational change in various OECD countries. (For evidence, see for example, Katz, 1993.)

³¹Since the wages w_1 , w_2 , W_1 , and W_2 are functions of the time allocations τ and T , by Eqs. (6b) and (7b), we can state the firm's profit-maximization problem in terms of the time allocations rather than the wages, even though the wages are actually the firm's choice variables.

Furthermore, the firm sets these wages at the minimum levels necessary to induce the workers to work. Suppose that workers' utility from not working is zero. Then the type-1 and type-2 workers' reservation wages (at which the worker is indifferent between providing a time unit of labor and providing none) are defined as³²

$$\begin{aligned} w_1\tau + w_2(1 - \tau) + v(\tau) &= 0, \\ W_2T + W_1(1 - T) + V(T) &= 0. \end{aligned} \quad (9)$$

Substituting (8) and (9) into the firm's costs function (5), we obtain

$$\kappa = -v'(\tau)n - V'(T)N. \quad (5')$$

Then the firm's problem may be restated as follows:³³

$$\text{Maximize } \pi = q(\tau, T; n, N) + v'(\tau)n + V'(T)N. \quad (10)$$

$\tau, T; n, N$

To avoid trivial solutions, we assume that the profit-maximizing employment levels n and N are positive.³⁴ Then the first-order conditions are

$$\frac{\partial \pi}{\partial n} = \frac{\partial q}{\partial n} + v'(\tau) = 0, \quad \frac{\partial \pi}{\partial N} = \frac{\partial q}{\partial N} + V'(T) = 0, \quad (11a)$$

$$\frac{\partial \pi}{\partial \tau} = \frac{\partial q}{\partial \tau} + v'(\tau)n \geq 0 \quad \text{and} \quad \frac{\partial \pi}{\partial \tau}(1 - \tau) = 0, \quad (11b)$$

$$\frac{\partial \pi}{\partial T} = \frac{\partial q}{\partial T} + V'(T)N \geq 0 \quad \text{and} \quad \frac{\partial \pi}{\partial T}(1 - T) = 0. \quad (11c)$$

It is easy to see that these profit-maximizing decisions are efficient. The efficient outcome is one that permits the employer and the employees to maximize output minus the associated disutility of work: $q(\tau, T; n, N) + v(\tau)n + V(T)N$. This is equivalent to maximizing profit, by (10).

We define a Tayloristic organization of work as one in which workers specialize by task. By contrast, we let a 'holistic' work organization be one in which workers engage in multi-tasking, with the freedom to choose their task

³²If the wages are the outcome of a Nash bargain between the firm and each employee, the right-hand sides of these equations are positive constant (i.e. the positive level of utility each employee receives as result of the bargain).

³³Instead of finding the profit-maximizing wages w_1 , w_2 , W_1 , and W_2 , we frame the problem in terms of the profit-maximizing time allocations τ^* and T^* elicited by these wages.

³⁴Since the aim of this analysis is to depict the organization of work, the focus of our analysis is on the profit-maximizing time allocations τ and T , and thus no insights are gained from taking account of the non-negativity constraints on n and N .

allocation in response to wage incentives.³⁵ When profit is maximized at a corner point of the feasible time allocations:

$$\tau^* = T^* = 1. \quad (12a)$$

Here workers specialize completely in accordance with their comparative advantage, and the organization of work will be Tayloristic. On the other hand, when profit is maximized in the interior region of the feasible time allocations:

$$0 < \tau^*, \quad T^* < 1, \quad (12b)$$

so that workers engage in multi-tasking, there is a holistic organization of work.

Our model identifies four major determinants of the organization of work:

- *The return to specialization versus the return to informational task complementarities:* As τ rises from zero to unity, the type-1 worker's return to specialization (s) at task 1 rises, but the informational task complementarity (c) falls. Analogously for the type-2 worker. The greater the decline in the informational task complementarity relative to the rise in the return to specialization, the greater the incentive to establish a holistic work organization.
- *The technological task complementarity versus substitutability:* As τ rises from zero to unity, there are diminishing returns to labor at task 1 ($\partial^2 f / \partial \lambda_1^2 < 0$). On the other hand, there may be a 'technological task complementarity', so that the two tasks are Edgeworth complements in the production function, $\partial^2 f / (\partial \lambda_1 \partial \lambda_2) > 0$. Then a rise in the type-1 worker's time allocation τ , while reducing the marginal product of task 1, raises the marginal product of task 2; and analogously for the type-2 worker. The greater the technological task complementarity relative to the rate of diminishing returns, the greater the incentive for holistic work organization.³⁶
- *Specialist versus versatile endowments of workers:* If type-1 workers' endowments are versatile (i.e. their comparative advantage at task 1 is small) then, as τ approaches unity, the output foregone at task 2 rises relative to the extra output generated through task 1. Analogously for the type-2 workers. Thus the more versatile are the workers' endowments, the greater the incentive for a holistic work organization.
- *Specialist versus versatile preferences of workers:* If type-1 workers have versatile preferences then, as τ approaches unity, the wage cost of these

³⁵ Whereas this paper concentrates on the *intra-personal* allocation of time across complementary tasks, much of the existing literature on specialization of work focuses on the *inter-personal* coordination of workers performing complementary tasks. (See, for instance, Becker and Murphy, 1992; Bolton and Dewatripont, 1994; Krugman, 1987; Stigler, 1951.)

³⁶ If, instead, there is a technological task substitutability ($\partial^2 f / (\partial \lambda_1 \partial \lambda_2) < 0$), this feature reinforces the diminishing returns in providing an incentive for a Tayloristic work organization.

workers eventually rises. (The reason is that when preferences are versatile, $v(\tau)$ achieves a maximum when the time allocation τ is in the interior of the feasible region: $\tau = \tau^0$, $0 \leq \tau^0 \leq 1$.) Analogously for the type-2 workers. The more versatile are the workers' preferences (i.e. the closer to 1/2 and the further from 1 their time allocations τ^0 and T^0 lie), the greater the incentive for a holistic work organization.

Figs. 1a and b illustrate the first order condition (11b) in a Tayloristic and a holistic organization, respectively.³⁷ Observe that in the Tayloristic organization, the marginal product $\partial f/\partial \tau$ declines slowly relative to the marginal cost $\partial \kappa/\partial \tau$, and thus the optimal organization of work involves complete specialization: $\tau^* = 1$. In the holistic organization, by contrast, the marginal product declines rapidly relative to the marginal cost, and thus the profit-maximizing time allocation τ^* lies in the interior of the feasible region $0 < \tau \leq 1$.

The recent literature on the business organization (discussed above) suggests that the reorganization of work from Tayloristic to holistic lines is driven significantly by changes in production and information technologies that make tasks more complementary to one another. Changes in human capital that make workers more versatile and give them preferences favoring versatile work reinforce this process. In terms of Fig. 1, these developments imply that the marginal product curve $\partial f/\partial \tau$ becomes more steeply downward-sloping and the marginal cost $\partial \kappa/\partial \tau$ becomes more steeply upward-sloping with the passage of time. As result, the profit-maximizing allocation of hours between the two tasks shifts from specialization (in Fig. 1a) to multi-tasking (in Fig. 1b).

3.4. *The influence of centralized bargaining*

As noted, a salient characteristic of centralized wage bargaining is that it imposes some uniformity of wages across workers at given tasks. To make this point starkly in the context of our analysis, let us simply assume that centralized bargaining imposes the following constraint on wage setting:³⁸

$$w_1 = W_1 \quad \text{and} \quad w_2 = W_2, \quad (13)$$

i.e. the wage of both workers at task 1 is the same, and similarly for task 2.

When work is organized along Tayloristic lines ($\tau^* = T^* = 1$), the centralized bargaining constraint (13) need not be inefficient. By (9), the efficient and

³⁷ Analogous figures could of course be drawn for worker 2.

³⁸ Alternatively, we could portray this function of centralized bargaining as setting lower and upper bounds on the dispersion of wages across workers at given tasks. Provided that these constraints are binding, this extension would not affect the qualitative conclusions of our analysis.

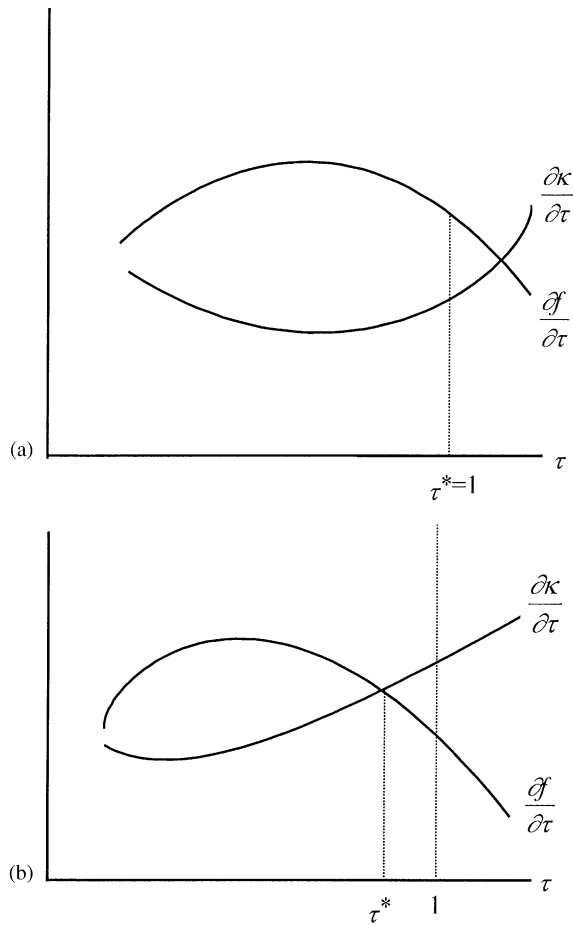


Fig. 1. The profit maximising organisation of work.

profit-maximizing wages under this form of organization is

$$w_1 = -v(1) \quad \text{and} \quad W_2 = -V(1). \tag{14}$$

If the centrally bargained wages are set at these levels, the resulting employment and work organization will be efficient and profit maximizing.

On the other hand, if profit-maximizing organization of work is holistic – with $\tau^* = \tau^0$ and $T^* = T^0$, where $0 < \tau^0, T^0 < 1$ – the situation is radically different. Now, by (8) and (9), the efficient and profit-maximizing wages are

$$\begin{aligned} w_1^0 &= -v'(\tau^0)(1 - \tau^0) - v(\tau^0), \\ W_1^0 &= V'(T^0)T - V(T^0) \end{aligned} \tag{15a}$$

for task-1 work, and

$$w_2^0 = v'(\tau^0)\tau^0 - v(\tau^0),$$

$$W_2^0 = -V'(T^0)(1 - T^0) - V(T^0) \quad (15b)$$

for task-2 work. Here centralized bargaining will generally be inefficient, since there is no reason why w_1^0 should be equal to W_1^0 , and why w_2^0 should be equal to W_2^0 , thereby satisfying the centralized bargaining constraint (13).

The intuitive reason is straightforward. Since workers differ in their abilities and preferences with respect to the two tasks, holistic firms need *four independent wage instruments* (w_1 , w_2 , W_1 , and W_2) to induce the two types workers to allocate their work time optimally across the two tasks. By imposing uniformity of wages across workers at given tasks, centralized bargaining grants firms *two independent wage instruments*, one for each task. In general, this constraint will prevent holistic firms from achieving the efficient and profit-maximizing allocation of labor resources. This problem does not arise for Tayloristic firms: when workers specialize by task, the firm needs only two independent wage instruments to achieve the optimal allocation.

Following similar lines to the analysis above, it can be shown that the switch from task specialization to multi-tasking raises the efficiency cost of centralized bargaining when different employees perform different sets of tasks.

4. Extensions

The model of Section 3 is very restrictive; it is merely a simple analytical device for showing why centralized bargaining becomes inefficient when work is reorganized with emphasis on multi-tasking and decentralization of some work-related decisions. We now extend our analysis in two important ways to indicate the robustness of our result.

4.1. *Is centralized bargaining reformable?*

The efficiency problem of Section 3 arose because the skill categories of traditional centralized bargaining do not correspond to the skill categories of holistic firms. Wage uniformity imposed on traditional occupations is bound to be inefficient when work no longer falls within the traditional occupational boundaries. Is it then possible to reform the centralized wage bargaining so as to avoid this problem of inefficiency? In particular, suppose that centralized wage bargaining were to abandon the traditional occupational categories, and were instead to impose uniformity within the new occupational clusters. Would efficiency be assured?

We argue that the answer is no. To see why, let us return to our analytical framework above and ask how the wage categories of centralized bargaining could be optimally aligned to the new holistic task clusters. Under the Tayloristic organization of work, the occupational categories are divided by task: the type-1 worker has occupation 1 by virtue of performing task 1, and the type-2 worker has occupation 2 by virtue of performing task 2. But under the holistic work organization, workers perform two clusters of tasks: the type-1 worker performs both tasks in one specific proportion ('proportion 1'), while the type-2 worker performs them in another proportion ('proportion 2'). If centralized bargaining categories were to align themselves perfectly to this change in the occupational mix, then the central bargainers would adopt proportions 1 and 2 as the new occupational categories and impose some uniformity of wages with respect to these categories. Within the framework of our analysis, this means that type-1 multi-taskers would get one wage and type-2 multi-taskers would get another. Expressed starkly, the new centralized bargaining constraint would then become

$$w_1 = w_2 \quad \text{and} \quad W_1 = W_2. \quad (13')$$

However, Eqs. (15a) and (15b) indicate that this new centralized bargaining constraint is also inefficient, provided that both types of workers are not completely versatile, i.e. provided that $\tau^0 \neq T^0 \neq 1/2$.

The intuitive reason for the inefficiency is straightforward. In a Tayloristic firm, wages have only one function for the firm: they determine the number of people employed in each occupational category. In order to maximize profits in our model, the firm needs to set these wages at their reservation wage levels: $w_1 = -v(1)$ and $W_2 = -V(1)$, by Eq. (14). (In other words, wages are as low as possible without inducing workers to quit.) In a holistic firm, by contrast, wages have two functions: they determine the number of people employed *and* their division of time among their tasks. Thus, to maximize its profit, the holistic firm needs two wage instruments for each type of worker:

- (i) It needs to pay the reservation wage combination in order to achieve the profit-maximizing employment level. For the type-1 worker, by (9), $w_1 \tau^0 + w_2(1 - \tau^0) = v(\tau^0)$, so that the employment level n of type-1 workers is set so that $(\partial\pi/\partial n) = (\partial q/\partial n) + v'(\tau^0) = 0$, by (11a). Similarly for the type-2 worker.
- (ii) In addition, the firm needs to pay the wage differential that will enable it to achieve the profit-maximizing time allocation between tasks. For the type-1 worker, the wage differential needs to be $(w_1 - w_2) = v'(\tau^0)$, by (6b),³⁹ in order to induce the worker to set his time allocation τ so that

³⁹ When the firm maximizes profit, the first inequality of Eq. (6b) holds as equality.

$(\partial\pi/\partial\tau) = (\partial q/\partial\tau) + v'(\tau)n = 0$, by (11b).⁴⁰ And similarly for the type-2 worker.

But the centralized bargaining constraint (13') gives the firm only one wage instrument for each type of worker. Thus this constraint is inefficient. For the type-1 worker, if the wage $w_1 = w_2$ enables the firm to achieve the profit-maximizing employment level, this wage is bound to induce the workers to choose a non-profit-maximizing time allocation.⁴¹ In short, if centralized bargaining imposes uniformity of wages within each occupational cluster, it may induce firms to employ the efficient number of people or it may induce the workers to allocate their time efficiently across their tasks, but in general it cannot do both.

Beyond that, it is worth noting that our model understates the difficulty for centralized wage bargaining to adjust to the move from Tayloristic to holistic organizations of work. Since our model contains just two tasks and two types of workers, it is easy to identify the change in occupational classification required of centralized bargaining. In practice, firms perform a large number of heterogeneous tasks through the services of a large number of heterogeneous workers. Under these circumstances the move from Tayloristic to holistic organizations of work may involve a vast increase in the number of occupational clusters.

The importance of this heterogeneity comes out even more forcefully when we consider that the efficient formation of occupational clusters within a firm depends, in practice, not only on the technological and informational task complementarities and the employees' skills at the available tasks. It also depends on the employees' social competence, judgement, initiative, and creativity – attributes which do not fall within the domain of any particular task. Since employees of equal productive ability at a particular combination of tasks often differ in terms of these attributes, firms may find it profitable and efficient to allocate different task combinations to workers of equal productive ability.

Besides, as noted, the move from Tayloristic to holistic organizations also commonly involves the firm in switching from large functional departments (e.g. sales, production, finance, and market departments) to smaller customer-oriented teams, producing more differentiated products that are designed specifically for the firm's particular customers. Consequently, the task composition of the holistic occupational clusters is likely to vary from one firm to another.

Given the increase in the number of occupational clusters within firms and the more varied composition of these clusters across firms, centralized wage bargaining may be expected to have trouble establishing occupational

⁴⁰ Under profit maximization, the first inequality of Eq. (11b) holds as equality.

⁴¹ And vice versa: if the wage induces the optimal time allocation, it is bound to lead to a suboptimal employment level.

categories within which wage uniformity can be imposed without threat to efficiency and profitability.

4.2. *Incentives for inter-task learning*

Thus far we have assumed that when workers perform multiple tasks, the informational task complementarities can be reaped *automatically*. In practice, of course, a worker's mere performance of multiple tasks usually does not guarantee that this worker uses the experience gained at one job to improve performance at another job. For this purpose, the worker generally needs to engage in a cognitive process that is generally (a) difficult for the employer to monitor and (b) costly to the employee in terms of effort, concentration, and initiative.

The employers' motivation to provide incentives for their employees to engage in this learning process is analogous to their motivation to discourage shirking in the efficiency wage theory. In both cases there is asymmetric information about employees' productivities and employers can use remuneration as an incentive device. In the moral hazard model of Shapiro and Stiglitz (1984), for example, employees receive a wage above the market-clearing wage provided that they are not caught shirking. Similarly, when workers are assigned multiple tasks, they may be offered a bonus for using their experience at one task to enhance their productivity at the other tasks. This bonus is paid only if they are not caught 'shirking', now interpreted as the mindless performance of multiple tasks that yields no informational task complementarities.

To capture this idea in a particularly simple way, let us modify the model of Section 3 so as to make informational task complementarities dependent on work effort. Specifically, let ω denote the worker's effort to use his experience at one task in performing the other task. Then, for simplicity, let us express the informational task complementarities as follows:

$$c_1 = c_1(\omega(1 - \tau)) \quad \text{and} \quad c_2 = c_2(\omega\tau), \quad (3b')$$

where $c_1(\bar{\omega}(1 - \tau)) > C_1(0)$ for $\tau < 1$ and $C_2(\bar{\omega}\tau) > C_2(0)$ for $\tau > 0$. In other words, when the worker expends no intertask effort ($\omega = 0$), then there are no informational task complementarities. We assume that intertask effort is a discrete variable: $\omega = (0, \bar{\omega})$, where $\bar{\omega}$ is a positive constant. When $\omega = 0$, the worker shirks; when $\omega = \bar{\omega}$, he does not.

We modify the worker's utility function in the following simple way to include intertask effort:

$$u = (y + b) + v(\tau) - \omega. \quad (6a')$$

We assume that the firm is unable to monitor the effort level ω directly, but is able to influence it through a bonus payment. Let b be the bonus that the worker receives if he is not caught shirking. Thus if the worker does not shirk, his utility

is $u_n = (y + b) + v(\tau) - \bar{\omega}$. If he does shirk, he faces a probability θ of being detected, in which case he does not receive the bonus b . With probability $(1 - \theta)$ he is not detected and receives b . His associated utility from shirking is $u_s = (1 - \theta)[(y + b) + v(\tau)] + \theta[y + v(\tau)]$.

If the firm sets the bonus as low as possible without inducing the worker to shirk, the wage will be given by the ‘no shirking constraint’: $u_n = u_s$, which implies that

$$b = \frac{\bar{\omega}}{\theta}. \tag{16a}$$

Similarly, for the type-2 worker, let the informational task complementarities be given by

$$C_1 = C_1(\Omega T) \quad \text{and} \quad C_2 = C_2(\Omega(1 - T)), \tag{4b'}$$

where Ω is the worker’s intertask effort $\Omega = (0, \bar{\Omega})$, $C'_1, C'_2 > 0$ and $C_1(0) = C_2(0) = 0$. Moreover, let the type-2 worker’s utility be $U = (Y + B) + V(T) - \Omega$, where B is the type-2 worker’s bonus. Then his no-shirking constraint is

$$B = \frac{\bar{\Omega}}{\theta}. \tag{16b}$$

Suppose that the firm’s production function (1), the returns to specialization (3a) and (4a), the informational task complementarities (3b') and (4b'), the labor endowment functions (3c) and (4c), the detection probability θ , and the effort disutilities $\bar{\omega}$ and $\bar{\Omega}$ are such that it is profit maximizing for the firm to adopt a holistic organization of work. Along the same lines as in Section 3, it can be shown that if this outcome is profit maximizing, it is also efficient.

However, this outcome is unlikely to arise under centralized wage bargaining, for two reasons. First, intertask bonuses generally violate the rule of ‘equal pay for equal work’. Different workers will generally receive different bonuses for a particular task, provided that they use their experience from that task differently in the performance of other tasks. (On this account, the profit-maximizing bonus b will generally differ from the bonus B .) Second, centralized wage bargaining assigns wages to tasks, not bonuses to inter-task learning. The negotiators of the centralized bargaining agreements usually do not have enough information to set such bonuses, since informational task complementarities tend to be highly idiosyncratic across enterprises. The reason is that workers at different enterprises often perform different combinations of tasks, and even when they perform the same sets of tasks, differences in production technologies, customer attributes, opportunities for innovation, and team dynamics would still give rise to different opportunities for the cross-task use of information.

These issues are irrelevant when work is organized along Tayloristic lines, for then informational task complementarities are non-existent. But when work is holistic, these issues become important, for then centralized wage bargaining may prevent firms and their employees from achieving efficient production–employment outcomes. For instance, suppose that centralized bargaining imposed the constraint $b = B = 0$ in the analysis above. Then, by (16a) and (16b), workers would provide no intertask effort: $\omega = \Omega = 0$. Thus there are no informational task complementarities: $c_1 = c_2 = 0$ and $C_1 = C_2 = 0$.

In the absence of informational task complementarities, there will be less multi-tasking than would otherwise have taken place. In other words, if $\tilde{\tau}$ and \tilde{T} are the time allocations in the absence of informational task complementarities, and τ^* and T^* are the profit-maximizing time allocations in the presence of informational task complementarities, then $\tilde{\tau} > \tau^*$ and $\tilde{T} > T^*$. Since the outcome (τ^*, T^*) is profit maximizing and efficient, the outcome $(\tilde{\tau}, \tilde{T})$ is inefficient.

5. Concluding remarks

Centralized bargaining has been acclaimed as a device that enables employers and employees to internalize a variety of externalities.⁴² But over the 1980s and 1990s, country after country relinquished these benefits as bargaining agreements were made at increasingly more local levels. This paper provides a new theoretical explanation for why this happened – one that fits well with the wide body of evidence that the decentralization of wage bargaining went hand-in-hand with changes in the organization of work.

We have argued that the trend away from occupational specialization toward multi-tasking has increased the efficiency cost of centralized bargaining. The underlying reason suggested by our analysis is that the reorganization from Tayloristic to holistic work can lead to a vast increase in the informational requirements for efficient wage setting. When workers are specialized by occupation and when the members of each occupational group have similar productivity and willingness to work, the central bargainers require little information to set wages efficiently. All that is required are estimates of productivity and the reservation wage for each occupation. But once workers engage in multi-tasking, much more information is required for efficient wage setting. In general, the efficient set of wage incentives will vary from one combination of tasks to another. They depend on the constellation of complementarities among these tasks and the effort workers must expend to exploit these complementarities. Only the employers and employees at each establishment have any hope of possessing such detailed, heterogeneous, establishment-specific pieces of

⁴² See, for example, Calmfors and Driffill (1988).

information. Central bargainers simply cannot acquire and assimilate this information, much as central planners are unable to get all the relevant cost and revenue information to determine of the efficient prices of vast arrays of goods and services.

In the absence of detailed information about task complementarities, the negotiators in centralized wage bargaining have little choice but to set wages schematically, such as prescribing one wage (or a range of wages) for every broadly defined group of tasks. However multi-tasking makes this practice patently inefficient, since workers' productivities at any task can vary widely, depending on the other tasks they are performing. The traditional way for centralized wage bargaining to permit some local flexibility is to allow for wage drift, but once this drift becomes large, it undermines the operability of centralized bargaining. For then the central bargainers can retain their clout only if they can distinguish between 'justifiable' wage drift in response to, say, genuine task complementarities, and 'unjustifiable' drift resulting from local rent-seeking. But to make such a distinction, the central bargainers would need the detailed information about complementarities and effort that is beyond their reach.

Our analysis suggests that the trend toward multi-skilling may be driven by advances in information and production technologies that augment the informational and technological task complementarities, improved education that makes workers more versatile across occupational pursuits, and a swing in worker preferences away from Tayloristic jobs and towards holistic work. As such, this reorganizational trend is an efficient response to changes in preferences, technologies, and endowments of physical and human capital. However, the 'same wage for the same job' rule of centralized bargaining impedes this trend, and thereby imposes an ever larger cost on society. In this way our analysis provides a rationale for the decline of centralized bargaining in many industrialized countries. To the extent that centralized wage bargaining has been used in many European countries to compress the wage distribution, our analysis leads us to expect that decentralization of wage decisions will lead to widening wage differentials in these countries.

Acknowledgements

We are indebted for useful by Mike Orszag and Gylfi Zoega as well as of two anonymous referees.

References

- Aoki, M., 1990. A new paradigm of work organization and coordination? In: Marglin, S. (Ed.), *The Golden Age of Capitalism*. Wider Institute, Helsinki, pp. 267–315.
- Appelbaum, E., Bott, R., 1994. *The New American Workplace*. ILR Press, Ithaca, NY.

- Becker, G.S., Murphy, K.M., 1992. The division of labor, coordination costs and knowledge. *Quarterly Journal of Economics* 107 (4), 1137–1160.
- Bolton, P., Dewatripont, M., 1994. The firm as a communication network. *Quarterly Journal of Economics* 109 (4), 809–839.
- Brown, W.A. (Ed.), 1981. *The Changing Contours of British Industrial Relations: A Survey of Manufacturing Industry*. Blackwell, Oxford.
- Brown, W.A., Walsh, J., 1991. Pay determination in Britain in the 1980s: The anatomy of decentralization. *Oxford Review of Economic Policy* 7 (1), 44–59.
- Budd, J.W., 1992. The determinants and extent of UAW pattern bargaining. *Industrial and Labor Relations Review* 45 (3), 523–539.
- Calmfors, L., Driffill, J., 1988. Bargaining structure, corporatism, and macroeconomic performance. *Economic Policy* 6, 14–61.
- Carmichael, I., Horne, H., McLeod, W.B., 1993. Multiskilling technical change and the Japanese Firm. *Economic Journal* 103, 142–160.
- Cutcher-Gershenfeld, J., 1991. The impact on economic performance of a transformation in workplace relations. *Industrial and Labor Relations Review* 44 (2), 241–260.
- Eaton, A.E., Voos, P.B., 1992. Unions and contemporary innovations in work organization, compensation and employee participation. In: Mishel, L., Voos, P. (Eds.), *Unions and Economic Competitiveness*. Economic Policy Institute, Washington, DC, pp. 173–216.
- European Foundation, 1997. *New Forms of Work Organization. Can Europe realise its potential?* Dublin.
- European Industrial Relations Review, 1992. The rise and fall of centralized bargaining. No. 220, April, pp. 20–22.
- Freeman, R., Gibbons, R., 1993. Getting together and breaking apart: The decline of centralized collective bargaining. Working paper no. 4464, NBER, Cambridge, MA.
- Hammer, M., Champy, J., 1993. *Reengineering the Corporations*. Harper Business, New York.
- von Hayek, F.A., 1940. Socialist calculation: The competitive solution. *Economica* 7 (26), 125–149.
- Holmstrom, B., Milgrom, P., 1994. The firm as an incentive system. *American Economic Review* 84 (4), 972–991.
- Katz, H.C., 1993. The decentralization of collective bargaining: A literature review and comparative analysis. *Industrial and Labor Relations Review* 47 (1), 3–22.
- Katz, H.C., Kochan, T.A., 1992. *An Introduction to Collective Bargaining and Industrial Relations*. McGraw-Hill, New York.
- Katz, H.C., Meltz, N., 1989. Changing Work Practices and Productivity in the Auto Industry: A US-Canada Comparison. Proceedings of the 26th Conference of the Canadian Industrial Relations Association, University of Laval Press, Quebec, pp. 384–396.
- Kremer, M., Maskin, E., 1995. Segregation and the rise in inequality. Mimeo.
- Krugman, P.R., 1987. The narrow moving band, the Dutch disease, and the consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economics. *Journal of Development Economics* 27, 41–55.
- Lange, O., 1938. On the economic theory of socialism. In: Lippincott, R.E. (Ed.), *On the Economic Theory of Socialism*, University of Minnesota Press, Minneapolis, pp. 72–96.
- Lawler, E., Morhman, S., Ledford, G., 1992. *Employee Involvement and Total Quality Management: Practices and Results in Fortune 1000 Companies*. Jossey-Bass, San Francisco.
- Lindbeck, A., Snower, D.J., 1996. Reorganization of firms and labor market inequality. *American Economic Review, Papers and Proceedings* 86 (2), 315–321.
- Lindbeck, A., Snower, D.J., 2000. Multi-task learning and the reorganization of work. *Journal of Labor Economics* 18 (3), 353–376.
- Locke, R.M., 1992. The decline of the national union in Italy: Lessons for comparative industrial relations theory. *Industrial and Labor Relations Review* 45 (2), 229–249.

- Marginson, P. et al., 1988. *Beyond the Workplace: Managing Industrial Relations in Multi-Establishment Enterprises*. Blackwell, Oxford.
- Milgrom, P., Roberts, J., 1990. The economics of modern manufacturing technology, strategy and organization. *American Economic Review* 80, 511–528.
- Millward, N. et al., 1992. *Workplace Industrial Relations in Transition*. Dartmouth University Press.
- Mitchell, D.J.B., Lewin, D., Lawler III, E.E., 1990. Alternative pay systems, firm performance, and productivity. In: Blinder, A.S. (Ed.), *Paying for Productivity: A Look at the Evidence*. The Brookings Institution, Washington, DC.
- NUTEK, 1996. *Towards Flexible Organisations*. Swedish National Board for Industrial and Technical Development, B, June, Stockholm.
- NUTEK, 1999. *Flexibility matters: Flexible enterprises in the nordic countries*. Swedish National Board for Industrial and Technical Development, Stockholm.
- OECD, 1996. *Technology, productivity and job creation*. Analytical Report, Vol. 2.
- Osterman, P., 1994. How common is workplace transformation and who adopts it? *Industrial and Labor Relations Review* 47 (2), 173–189.
- Pfeiffer, J., 1994. *Competitive Advantage Through People*. Harvard Business School Press, Boston, MA.
- Piore, M.J., Sabel, F., 1984. *The Second Industrial Divide, Possibilities for Prosperity*. Basic Books, New York.
- Shapiro, C., Stiglitz, J.E., 1984. Equilibrium unemployment as a worker discipline device. *American Economic Review* 74 (3), 433–444.
- Stigler, G.J., 1951. The division of labor is limited by the extent of the market. *Journal of Political Economy* 59, 185–193.
- Streeck, W., 1984. *Industrial Relations in West Germany: A Case Study of the Car Industry*. St. Martin's Press, New York.
- Turner, L., 1991. *Democracy at Work: Changing World Market and Future of Unions*. Cornell University Press, Ithaca, NY.
- Wikström, S., Norman, R., 1994. *Knowledge and Value*. Routledge, London.
- Windolf, P., 1989. Productivity coalitions and the future of corporatism. *Industrial Relations* 28, 1–20.
- Womack, J., Jones, D.J., Roos, D., 1991. *The Machine that Changed the World*. Harper Perennial, New York.
- Yang, Z., Borland, J., 1991. A microeconomic mechanism for economic growth. *Journal of Political Economy* 99, 460–482.