

## The rise and fall of piecework

### Incidence of piecework has significantly reduced in advanced industrialized economies—has its decline gone too far?

Keywords: piecework, timework, incentive pay

#### ELEVATOR PITCH

A pieceworker receives a fixed rate for each unit (“piece”) produced or action performed. In part, the rate reflects a cost of monitoring output. A timeworker receives a fixed wage rate per hour that, in the short term, does not vary with output performance. From the 18th century up to the last third of the 20th century these were the two dominant payment methods in the manufacturing and production industries. Yet, today the incidence of piecework in advanced economies is very small, having lost considerable ground to time rates and to other forms of incentive pay. What caused this transformation, and has the movement away from piecework gone too far?

#### KEY FINDINGS

##### Pros

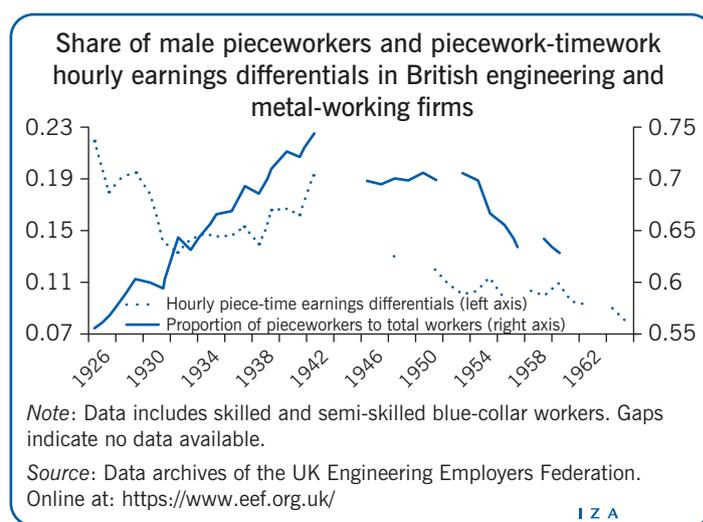
- + Piecework is suited to low-output monitoring costs and long production runs.
- + Firms employing workers with wide variations in ability can benefit from piecework.
- + Piecework firms are more likely to retain their more able workers in tight labor markets.
- + Piecework pay is positively correlated with prevailing business conditions.
- + Piecework avoids subjective assessments of work performance.

##### Cons

- Changes in product lines and technology increase the costs of setting and negotiating piece rates.
- Output requiring joint inputs among workers is difficult to monitor and reward on an individual basis.
- Piecework is not suited to manufacture that involves “hard-to-observe” process innovations.
- Just-in-time production processes reduce the need for maximizing individual output.
- Piecework discourages individuals from sharing insights into more efficient task executions.

#### AUTHOR’S MAIN MESSAGE

Up until the late 1960s, there was a high incidence of piecework in manufacturing sectors of advanced economies. Among other traditional advantages to workers and employers, piecework resulted in higher productivity and wages than comparable timework. Yet the last 50 years have witnessed a dramatic decline in piecework. Major challenges include advances in production methods and technology, as well as low labor and production costs in emerging economies. There is little call for policy intervention to reverse the declining trend, since disadvantages of piecework now overwhelmingly predominate.



## MOTIVATION

During the first two-thirds of the 20th century, piecework pay systems were common in manufacturing. They were especially prevalent in engineering and metalworking (EM) industries. An enquiry undertaken in October 1931 into the pay and hours of 214,000 German EM workers, employed within 502 plants at 103 localities, reported that 65% of skilled and semi-skilled workers and 23% of unskilled workers were on piece rates. In October 1931, the Engineering Employers Federation (EEF), representing nearly 2,000 firms throughout the UK, reported very similar respective percentages of 59% and 16%. Over the period 1926–1965, about two-thirds of blue-collar workers in the EEF (ranging between 1,800 and 5,000 firms) were paid piece rates [1].

Industrial divisions 27–34 of the British Labor Force Survey for the years 2001–2005, covering a reasonably similar range of metal-working activities to those represented in the EEF coverage, show that only about 1% of process, plant, and machine operatives received pay that included “piecework payments or tips or gratuities.” Much in line with these observations, a US study reports from various sources that, across manufacturing, 30% of employees were paid piece rates in the 1930s, 14% in the 1980s, and less than 5% in 2003 [2].

Since piecework has traditionally been associated with several advantages to workers and employers—such as improved labor productivity, higher wages, and lower job-quit propensities—the question arises as to whether its reduced incidence has gone too far. Might it be worthwhile for policymakers to address the question of whether piecework could profitably play a more substantial role within the macro manufacturing economy?

Labor economists have analysed reasons for and against the use of piece rates rather than time rates [3]. Based on labor market experience during a prolonged growth period in the first half of the 20th century in UK engineering and metal manufacture, this contribution considers several pro-piecework arguments that are highlighted in the theoretical literature. They cover the key traditional advantages of piecework and apply to a wider manufacturing context. Against this backdrop, a range of subsequent manufacturing developments are discussed, which have served to erode the earlier perceived advantages of this work practice.

## DISCUSSION OF PROS AND CONS

### Traditional advantages of piecework

The period between the mid-1920s and the mid-1940s marked an especially strong growth in the incidence of piecework within EM firms. As shown in the illustration on page 1, the proportion of piece rate to total skilled and semi-skilled blue-collar workers rose from 54% in 1926 to a peak of 74% in 1942. This particular example illustrates traditional advantages of piecework that were also relevant in a wider manufacturing context.

Workers who are attracted to piecework prefer wages that relate directly to their individual contribution to a firm’s total per-period output. They tend to be more productive workers who expect to earn more this way than they would under equivalent timework. On average, there are positive hourly pay differentials between

pieceworkers and timeworkers undertaking equivalent work. The average piecework-timework hourly earnings differential of blue-collar EM workers in the illustration on page 1 was 16% between 1926 and 1942. Much in line with this finding, a US study reports a 14% piecework premium for US footwear, and boys' suits and coats manufacture, covering 100,000 workers in 500 firms [4].

Long production runs of given products tend to favor the use of piecework. Product stability helps workers to achieve their best performance and highest earnings through repetitive "learning by doing." It also serves to reduce the costs to employers associated with recalculating and renegotiating piece rates linked to product changes. Beginning in 1935, the period running up to and during the Second World War produced a surge in engineering-related output, due to a prolonged armaments boom. The UK EM workforce expanded from 2.3 million to 4.8 million workers between 1935 and 1943, with a considerable growth in the proportion of pieceworkers. The EM workforce was, during this period, engaged in long production runs of munitions, aircraft, military vehicles, and other war-related output.

At this time, the better the employment opportunities available to workers in the industry were, the greater the losses incurred by a firm if they failed to sort and remunerate workers by the value they added. Acute skilled-labor shortages in engineering during the war produced intense inter-firm competition for scarce labor resources. Workers were potentially highly mobile because their trade skills were largely general, rather than company-specific. Firms offset high job-quit propensities by rewarding individual value added through piecework, with the aim of retaining their most productive workers. Work shirking was especially anathema to wartime production. The threat of dismissal to shirking timeworkers has little impact when alternative opportunities are abundant. This consideration also favors a greater concentration on piecework, with its emphasis on payments-by-results [5].

The more heterogeneous the ability levels across a given workforce, the more advantageous it is to adopt a piecework system. It is clearly important to find and remove workers whose lack of ability and/or work commitment has a negative effect on the performance of the overall workforce. Worker diversity greatly increased at the start of the Second World War, since substantial and sustained increases in product demand forced EM industries to recruit large numbers of inexperienced workers. Predominant here were females. In 1939, women comprised 11% of EM workers in the UK; by 1943, this had risen to 38%. Jobs traditionally dominated by skilled men were broken down into more narrowly defined ranges of job tasks. Fewer specified job tasks per job meant that there was less scope for mixing and varying task sequences, which is an outcome likely to lower the costs of arriving at piecework contracts. Like their male counterparts, most female recruits were paid piece rates.

Since output-related pay is positively related to productivity and product demand, one might expect there to be, a priori, a stronger and positive association between piece-rate pay and the level of demand for the firm's product(s), compared with time-rated pay. Both UK and US studies have produced evidence in line with these expected comparative outcomes [1]. The illustration on page 1 reflects a stronger positive business cycle correlation of piecework remuneration through the observed narrowing of the piece-time differentials during the Great Depression from 1929 to 1933. This allows piecework employers to adjust their labor costs in line with the

overall business climate of the firm more easily. Such flexibility can help to preserve jobs during slack market conditions and attract strong recruits during cyclical upturns. The pieceworkers' pay premium is likely, in part, to reflect the risk of higher cyclical pay fluctuations.

### **Reasons for the decline of piecework**

As is shown in the illustration on page 1, there was both a drop in the UK proportion of EM blue-collar pieceworkers following the Second World War as well as a narrowing of the pieceworker earnings differentials. By 1965, the wage differentials had reduced to one-half of their 1926–1942 average, from 16% to 8%. This marked the beginning of a continued and major decline in pieceworking in these industries, as well as more generally in European and North American manufacturing.

### ***Greater recourse to alternative incentive-compatible pay methods***

The steep falls in the incidence of piecework as a payment-by-results method have coincided with sharp rises in company preferences for other forms of incentive pay. Individual and group merit awards, as well as profit- and gain-sharing, are currently the dominant forms of incentive pay in Europe and the US [6]. Like piece rates, there are merit awards paid to the individual. Examples include recognition of the quality of work performance as it variously relates to ability, special aptitudes, work experience, timekeeping, and length of tenure. Unlike piece rates, these payments involve some degree of subjective assessments of performance.

Merit awards can also apply to groups or teams of workers. Such awards may be in recognition of the levels of skill and work quality realized within departments or workshops of the firm. Group incentives typically rule out the use of piecework, given the high costs of identifying each group member's contribution to output.

At company level, remuneration deriving from profit sharing, gain sharing, and share ownership are common ways of encouraging strong workforce contributions to a company's financial performance or other corporate objectives, such as levels of customer satisfaction.

### ***De-industrialization and globalization***

Since the 1960s, advanced economies such as the US, Germany, Japan, and the UK have moved away from producing low-technology manufactured goods toward high-end technology products. At the same time, they experienced sustained growth rates in financial, retailing, and other public and private services. These developments shifted the emphasis away from industries where piecework was traditionally prevalent to those in which individual output is more difficult to calibrate.

Moreover, the changes have been exacerbated by increasing globalization. High competition and low profitability in the textiles, garment, and footwear sectors led companies to undertake production offshore—such as in China, India, Vietnam, Thailand, Brazil, and Indonesia—particularly to take advantage of considerably lower direct wage and non-wage labor costs, as well as production costs.

Garment manufacture is controlled by a relatively few large corporations that subcontract their requirements to offshore producers. Homework (dominated by female workers) accounts for substantial proportions of total garment output. Workers cut and stitch garments and are typically “paid by the piece.” Home-based work accounts for 60% of women and children’s clothing production in Asia and Latin America, with workers receiving very low piece rates [7]. Cost competitiveness with advanced economies not only derives from much lower piece rates but also from an almost complete absence of supplementary labor payments, such as sickness cover and holiday pay. Workers themselves often incur significant proportions of production costs, such as the provision of workplaces and equipment. As far as costs of setting piece rates are concerned, there is little or no worker involvement in terms and conditions of piecework contracts.

US shoe manufacturing, which is an industry that had nearly 90% of its workforce paid via piece rates before the Second World War, suffered an 88% reduction in employment between 1966 and 2001, due to a combination of low labor costs in newly emerging economies, relatively low capital requirements, and reduced US import tariff barriers [8].

### ***Changes in product lines and production technology***

Major and rapid expansions of new product lines and changes in production technology incur costs of reevaluating and renegotiating piece rates and time settings. Failure to revise rates in line with technological improvements effectively transfers associated rents to pieceworkers and results in piece rates running away from comparable time rates. Rather than incur the costs of piece-rate reevaluations it may become more attractive to employers to switch to timework or to other remuneration alternatives.

Costs of re-setting piece rates are especially high in economies transiting from wartime to peacetime production. Following the Second World War, British EM employers faced mounting cost pressures linked to re-assessing piecework remuneration and, against a background of one-quarter of firms employing both pieceworkers and timeworkers, combined with strong industrial unionization, they worried about rising piece-time pay differentials [9]. In fact, many employers resorted to the simple expediency of paying pieceworkers equal salary increments to equivalent timeworkers in annual pay rounds. This served to erode hourly earnings differentials because, due to their higher average wages, pieceworkers’ percentage increases were smaller than their timeworker equivalents. The illustration on page 1 shows the degree of this narrowing.

There are advantages in employing timeworkers at times of change in product lines and technology. Employers have some scope in directing timeworkers to new tasks at the same hourly pay rate. In contrast, new tasks involve negotiating and setting new piece rates in a payments-by-results setting. It is likely, therefore, that there would be an increasing incidence of time rates when production methods change during periods of rapid technological improvements. A 1982 US study of 37 manufacturing industries found a declining incidence of incentive pay jobs—involving piecework and production bonuses—relative to straight time jobs [10]. Between the periods 1961–1968 and 1973–1980, the median proportion of workers on time rates increased from 75% to 82%. Two major reasons given are: (i) the increased use of highly automated machines and machine-paced production; and (ii) the costs of revising performance

standards linked to incentive pay during periods of rapid changes in production facilities and techniques.

### ***Group versus individual incentives***

Piecework is most suited to individuals undertaking a small number of job tasks that result in easily measurable output. Extensive use of piecework in relatively large and complex manufacturing plants involves breaking down production processes into many narrowly defined job titles. Associated costs include evaluating relative piece rates across jobs, monitoring output performances, and dealing with potential labor disputes over rates differentials. Since job tasks will involve differences in execution times, it is usually necessary to undertake significant in-process inventories in order to minimize the incidence of downtime in product operations. Pieceworkers, directly remunerated for their per-period performance, would be especially concerned about enforced downtimes due to shortages of parts and materials necessary to execute their tasks.

An alternative strategy is to identify more widely defined clusters of job tasks, allocate groups of the workforce to each cluster, train group members how to perform some or all of the tasks belonging to their cluster, and pay a unified wage rate common to all members of each cluster. Labor costs would be likely to rise since, for example, this strategy would necessitate paying relatively high wages as compensation for the requirement to train for and to execute a wider range of tasks. Group-based merit and bonus incentives may also apply. Cost advantages would include a significant reduction in monitoring costs, reductions of partly finished and final product inventories, and lower costs of setting and negotiating pay scales.

Such a move from piecework to group timework is well illustrated in a study of the switch from a progressive bundle system (PBS) to a modular (teamwork) system of production in the US garment industry in the 1980s and 1990s [11]. Sewing-room assembly is the principal source of employment and PBS entails workers performing single sewing operations as part of a sequence of small steps toward final garment assembly. Since different operations involve varying assembly times, there is a requirement to create buffers of partly finished products between operations in order to minimize downtime. Virtually all workers under PBS were paid piece rates, with significant monitoring and work-in-process inventory costs. In contrast, the modular system involved the formation of work groups with each group responsible for the sewing operations of a significantly larger segment, or all, of a given garment. Members of a module could be required to perform several sewing operations, thereby allowing a degree of work flexibility within each module. Group-based incentive pay schemes largely replaced piece rates. The main comparative advantages of modular assembly in the garment industry is that it enabled garment suppliers with close relationships to retailers to meet increasingly stringent delivery requirements and for lower costs of inventories of both in-process and finished products.

There is one especially important return from the adoption of modular systems. A longitudinal study of a US paper mill reports that, in 1983, four job clusters replaced 96 (time-rated) separate job titles [12]. While total labor costs increased by 40%—all workers in each cluster received the highest pay of any of its old constituent jobs—profits increased substantially due to increases in production and sales revenue,

and reductions in non-labor costs. The study highlights the main contributory factor behind cost reductions and increased machine efficiency: “At the heart of all these specific reasons (for production increases) were workers’ ideas for improving operations that workers had never before offered.” It was now clearly in each worker’s self-interest to improve team performance within the cluster. Individualized piecework is associated with a lack of such motivation. Pieceworkers may well be discouraged from suggestions that lead to enhanced firm-level productive efficiency since this may lead to revised lower performance-related piece rates.

An excellent case study of a large US shoe manufacturer embraces all the foregoing reasons for moving from piece rates to time rates [8]. By the mid-1980s, the company faced strong foreign competition and high costs associated with a “loose” piece rate system (resulting from a failure to update piece scales in line with productivity and technology changes both within and across jobs) as well as high in-process inventory and monitoring costs. Its remedies included: (a) the adoption of a continuous flow mode of operation involving work teams with workers trained in wider sets of job functions; (b) the introduction of more styles and higher quality products; and (c) a switch from piece rates to time rates in the early 1990s. While the introduction of time rates modestly reduced productivity, this was more than offset by an increase in so-called *quasi rents*, defined as total revenues minus labor and material costs. Profitability improved because cost reductions more than offset productivity reductions.

### ***Multidimensional tasks and “just-in-time” production***

Advances in precision and automated technologies can potentially enhance product quality and enable speedier product-design improvements. Workers are often required to perform multidimensional tasks; for example, the attainment of high output levels with units of output satisfying prescribed quality standards. However, if the quality of the output is more difficult to measure than the quantity, perhaps because of “difficult-to-observe” production techniques, then a piecework system is likely to encourage an over-emphasis on quantity produced and an under-emphasis on quality attainment [13].

If multidimensional tasks are not complementary, then it might be possible to allocate work between pieceworkers concentrating on the observable production dimensions of the job and workers paid under alternative compensation scheme(s) concerned with the hard-to-observe aspects of the job. This is likely, however, to add to organizational and administrative costs.

The use of just-in-time production methods, with the general aim of minimizing inventory-holding costs, renders even observable production as unsuitable for piecework. Here, the requirement is to produce exact quantities of output per period. This severely reduces interest in a payments-by-results emphasis on encouraging an individual’s best output capability.

## **LIMITATIONS AND GAPS**

This contribution has concentrated on piecework in advanced economies. This understates the more recent incidence of piecework when set in a global context. Piecework’s decline in North America and Europe has coincided with its growth in

newly emerging economies, such as India and China. Lower labor and other production costs and far less negotiating power among workforces in the latter economies have allowed traditional piecework practices to flourish, especially in garment and footwear manufacture. There may also be instances of efficiency gains in the organization and practice of piecework not previously recognized.

Piece rates are a form of incentive pay and there has been a growing incidence of other forms of individual and group incentive payments. But the replacement of piece rates by other types of incentive pay does not necessarily signal the fact that the industry has become universally better at finding ways of achieving improved, especially long-term, profitability through alternative performance pay methods. While statistics on piece rates give reasonably consistent information on a well-understood payments-by-results method, statistics on merit awards and other bonuses can involve a somewhat more opaque interpretation, arising from varying degrees of subjective decision-making. They cover a far greater range of different activities, some of which may not reflect incentivized performance. A survey of the performance and pay of 72,000 employees in 317 UK companies in 2015, carried out by the Chartered Management Institute, found that 30% of managers received bonuses while falling short of performance expectations in the previous year. As with “guaranteed” overtime premium payments, merit and bonus supplements to basic pay in some jobs may represent custom-and-practice and not direct reward for performance. In general, and for comparative purposes with piece rates, more detailed micro breakdowns would be required on precisely why employers make merit and bonus payments.

## SUMMARY AND POLICY ADVICE

The macro policy objectives of attaining strong productivity and wage growth have featured prominently in the recent faltering recoveries of European and North American markets following the Great Recession. Relatively high wages and productivity have been two traditional features associated with piecework. Might there be advantages in attempting structural shifts toward manufacturing techniques that are more amenable to piecework? There would appear to be relatively little scope for such initiatives.

An interesting and repeated finding in recent decades is that while piecework tends to enhance worker productivity relative to timework, its replacement by timework may actually succeed in increasing profitability. This is largely due to significant cost savings under fixed hourly wage rates. Savings include: (i) reduced monitoring of worker performance; (ii) a lower frequency of revising pay scales; and (iii) reductions of in-process and final product inventories.

Company decisions to move from piecework to modular systems of production that necessitate teamwork may lead to substantially increased wage costs. Nonetheless, increased profits can result from enhanced speed of production throughputs, shared ideas by team members for production improvements, and lower inventory costs.

Two developments in recent decades especially render a significant return to piecework unlikely in the medium term. First, technological developments involving machine-paced production and just-in-time methodologies largely rule out the adoption of piecework incentives. Second, outsourcing production to developing economies

with significantly lower wage and non-wage labor costs is clearly an effective way of circumventing the cost disadvantages of piecework operations.

This does not preclude continued or new interests in piecework under special circumstances. Perhaps some newly established small- and medium-sized enterprises, with expanding order books and relatively simple production operations that largely exclude teamwork, might usefully consider some of the advantages of piecework. One potentially important advantage in such cases is that of attracting the type of worker who prefers remuneration directly for individual productive effort and performance. This offers the potential of building up and retaining an able and committed workforce, an especially valuable asset when competing with larger organizations in competitive labor markets.

### **Acknowledgments**

The author thanks an anonymous referee and the IZA World of Labor editors for many helpful suggestions on earlier drafts.

### **Competing interests**

The IZA World of Labor project is committed to the *IZA Guiding Principles of Research Integrity*. The author declares to have met these principles.

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## REFERENCES

### Further reading

Lazear, E. “Salaries and piece rates.” *Journal of Business* 59:3 (1986): 405–431.

Pencavel, J. “Work effort, on-the-job screening, and alternative methods of remuneration.” *Research in Labor Economics* 1 (1977): 225–258.

### Key references

- [1] Hart, R. A. “Piecework pay and hourly pay over the cycle.” *Labour Economics* 15:5 (2008): 1006–1022.
- [2] Helper, S., M. Kleiner, and Y. Wang. *Analyzing Compensation Methods in Manufacturing: Piece Rates, Time Rates, or Gain Sharing?* NBER Working Paper Series No. 16540, 2010.
- [3] Lazear, E. P. *Personnel Economics*. Cambridge, MA: MIT Press, 1995.
- [4] Seiler, E. “Piece rate vs. time rate: The effect of incentives on earnings.” *Review of Economics and Statistics* 66:3 (1984): 363–376.
- [5] MacLeod, W., and J. Malcomson. “Implicit contracts, incentive compatibility, and involuntary unemployment.” *Econometrica* 57:2 (1989): 447–480.
- [6] Bryson, A., R. Freeman, C. Lucifora, M. Pellizzari, and V. Perotin. *Paying for Performance: Incentive Pay Schemes and Employers’ Financial Participation*. Centre for Economic Performance Discussion Paper No. 1112, 2012.
- [7] “Garment workers.” *Women in Informal Employment: Globalizing and Organizing (WIEGO)*. Online at: <http://wiego.org/informal-economy/occupational-groups/garment-workers> [Accessed March 9, 2016].
- [8] Freeman, R., and M. Kleiner. “The last American shoe manufacturers: Decreasing productivity and increasing profits in the shift from piece rates to continuous flow production.” *Industrial Relations* 44:2 (2005): 307–330.
- [9] Knowles, K., and T. Hill. “The structure of engineering earnings.” *Bulletin of the Oxford University Institute of Statistics* 16 (1954): 272–328.
- [10] Carlson, N. “Time rates tighten their grip on manufacturing industries.” *Monthly Labor Review* May (1982): 15–22.
- [11] Dunlop, J., and D. Weil. “Diffusion and performance of modular production in the US apparel industry.” *Industrial Relations* 35:3 (1996): 334–355.
- [12] Ichniowski, C. “Human resource practices and productive labor-management relations.” In: Lewin, D., O. Mitchell, and P. Sherer (eds). *Research Frontiers in Industrial Relations and Human Resources*. Madison, WI: Industrial Relations Research Association, 1992.
- [13] Holmstrom, B., and P. Milgrom. “Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design.” *Journal of Law, Economics, and Organization* 7 (1991): 24–52.

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