



An Analysis of the Vast Gap in Application Scope Between Piece Rate and Efficiency Wages in Recent years

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Abstract. Piece Rate and Efficiency Wages, two categories of incentive systems, which are based on similar economic hypotheses and both win high recognition in their early stages, have had an enormous gap in the scope of application in recent years. This essay elaborates on the reasons from both internal and external perspectives. It finds that, although based on similar inherent defects, Efficiency Wages can win wider application scope because it better meets the intrinsic and extrinsic needs of employees, has fewer constraints on application, and is in line with the incentive needs of industries in the current era.

Keywords: Piece Rate · Efficiency Wages · intrinsic needs · extrinsic needs

1 Introduction

1.1 Background Introduction

Incentive systems are one of the most essential components for a firm as a function to increase efficiency, decrease shirking, attract and retain talents, and mitigate agency problems [1]. However, different incentive mechanisms have their corresponding applicable scenarios, and enterprises should make choices according to features of their situation, including industry, the costs of monitoring, output measurability, and level of risks [2]. For example, corporations in the manufacturing and agricultural industries usually adopt Piece Rates because most of their outputs can be measured in pieces [3]. Besides, utilizing the Piece Rate can contribute to dealing with pre-contractual opportunism as well as aligning interests of the firm and workers at the post-contractual stage [1]. However, not all manufacturing companies use Piece Rates. Taking Ford as an example, in the early 20th century, the mobility of auto workers was high due to the rapid development of the automobile manufacturing industry. By using an Efficiency Wage Strategy, Ford successfully retained and attracted numerous skilled workers and promoted the stable development of the enterprise [4]. Thus it can be seen that both Piece Rate and Efficiency Wages can be effective incentive mechanisms as long as they are reasonably applied. This essay will first introduce the Piece Rate and Efficiency Wages based on their economic hypotheses and formula, followed by the analysis of the gap of application scope

between these two theories from three dimensions. After that, a suggestion on how to retain the effectiveness of incentive systems will be put forward.

1.2 Introduction of Piece Rate

The Piece Rate, invented by F.W. Taylor, is a kind of performance-related compensation system [1]. It is recognized as one of the most important incentive theories in the nineteenth century [5]. According to Drury (1915), Piece Rate Theory not only expanded the aspects of management problems, but also prompted the art of management [6]. Based on the Individual Pay for Performance Strategy and the assumption of people are driven by money [5], the Piece Rate pays employees a fixed amount for each unit of output produced [1]. The way in which the Piece Rate plays an incentive role can be seen through its formula ‘Total payment = $s + b \cdot q$ ’. It shows that based on constant fixed salary (s) and piece rate (b), the only way for employees to gain higher payments is to increase productivity (q). As Fig. 1 illustrates, if employees are paid in the fixed wage (red curve), they have a tendency to work at the minimum level of effort (A), because their payments will not increase for their hard work. However, in the Piece Rate System (black curve), if they can produce more than the q^* level, their salaries can increase (from s to s' in this scenario). Moreover, compared with other management philosophies in the 19 century, which comprise many utopian ideas such as profit-sharing [7], Piece Rate showed a high level of practicality and realism and won wide recognition and application in its early stage [5].

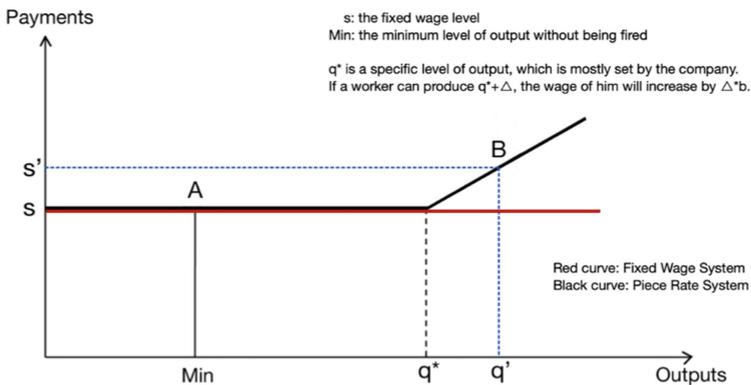


Fig. 1. The relationship between laborers’ output and payments in difference incentive systems (The image is original) Adapted from: Lazear (1999) [8]

1.3 Introduction of Efficiency Wages

Theorized by Adam Smith in the eighteenth century, Efficiency Wages is a non-performance-related compensation system with the main idea that firms can avoid shirking and improve productivity by paying more than prevailing competitive wages to

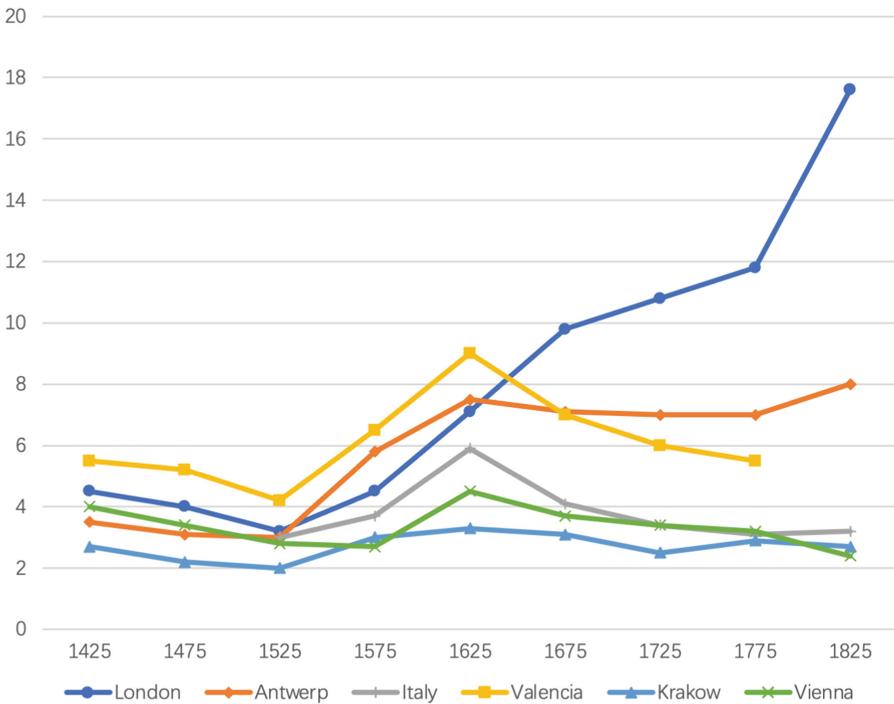


Fig. 2. Laborers' nominal wages, 1375–1825 (grams of silver wages per day) (The image is original) Adapted from: Allen (2001) [12].

workers [1]. On the foundation of the Shirking model proposed by Shapiro and Stiglitz (1983), it is believed that Efficiency Wages can serve as a restraint mechanism to reduce workers' obligation evasion by increasing the cost of being dismissed [9]. This can also be explained by its formula ' $p(w-w^*) > g$ ', which means workers tend to work hard if the expected cost of shirking outweighs the gain from shirking (g) [2]. Additionally, Efficiency Wages is also based on the Gift Exchange theory to play an incentive role. In this theory, paying high wages is often regarded as a gift from employers to workers, thus workers will work hard to repay employers [10]. There is much evidence that can approve the effectiveness of Efficiency Wages. Take Britain in the eighteenth century as an example. According to Allen (2015), by utilizing Efficiency Wages in the manufacturing industry, Britain achieved a surge of labor productivity and promoted the industrial revolution, while the relatively low wage level in other European countries restrained workers' enthusiasm and innovation, thereby impeding the development of production technology to a certain extent [11] (see Fig. 2).

Both Piece Rate and Efficiency Wages have had won high recognition and wide application in their early stage. However, in recent years, it is found that the scope of application of the Piece Rate is becoming narrow, while there is an increasing number of companies adopting Efficiency Wages. This can be explained from three dimensions: the satisfaction of employees' needs, the constraints on application, and the degree of compliance with the needs of the current industries.

2 Analysis

2.1 Analysis from the Satisfaction of Employees' Needs

Firstly, compared with the Piece Rate, Efficiency Wages can better meet both intrinsic and extrinsic needs of employees. According to Caudill and Porter (2014), the Piece Rate and the Efficiency Wages are based on the hypothesis of economic man, which assumes that wealth (i.e. external needs) is the only desire of people [5]. However, in reality, human beings also have needs in social and psychological levels such as a quest for pleasure, task involvement, and self-realization (i.e. internal needs) [13]. This makes the Piece Rate and the Efficiency Wages inherently flawed in a similar way: focusing on the external needs of the employee at the expense of the internal needs.

Nevertheless, the two mechanisms are not affected by the inherent defect to the same degree. This can be attributed to the fact that although the Efficiency Wages only takes higher wages as an incentive, relative information transferred by such behavior could meet the intrinsic needs of employees to a certain extent. As mentioned in the introduction, one of the main theoretical foundations of Efficiency Wages is the Gift Exchange model. In this situation, paying high wages is not only an economic incentive but also a trust toward employees as well as an affirmation of their value [14]. This information constitutes an incentive for employees to work hard voluntarily, rather than out of the pursuit of income maximization, thereby achieving an increase in productivity.

However, in terms of Piece Rate, it not only ignores employees' intrinsic needs but also fails to realize their financial needs under the influence of the Ratchet effect and unpaid overtime. The Ratchet effect in economics means that when workers paid by piece successfully increase production and earn a large amount of money, companies tend to reduce the piece rate, which leads employees to reduce production in response [15]. As Wu (2017) illustrated, for many workers paid in piece rates, the level of wages per unit time was not increased, but even lower [16]. In this case, a number of workers were forced to work extra shifts without overtime pay, and a seeming alignment of interests between them and managers is achieved by enduring the overtime [16].

2.2 Analysis from the Constraints on the Application

Secondly, Efficiency Wages has fewer constraints on application. According to Neilson (2007), the Piece Rate can only be effective in limited scenarios with at least three requirements, including the correlation between output and effort, the measurability of worker's contribution, and the detectability of quality [1]. For instance, the Piece Rate system is not applicable especially to research and development (R&D) departments. Since most R&D works are creative and susceptible to external circumstances, which lead to the efforts and outputs of R&D employees are unlikely to be positively correlated [17]. In addition, the product development cycle is usually measured in years and the economic benefits are revealed slowly, which makes it difficult to quantify the performance of R&D employees especially in the short term [17]. Lastly, a detectability of quality is also required to conduct Piece Rates. In Kaur et al. (2021)'s experiment, employees who were paid in piece rates spent less time per unit product in order to earn more money

[18]. If there is no corresponding quality supervision, the number of defective products is highly possible to increase.

The applicable situations for Efficiency Wages are wider and highly differ from that of Piece Rate. First, Efficiency Wages can be more feasible when monitoring is costly and difficult. Because if the monitoring cost is too high, providing a higher-than reservation wage might become a relatively cheaper way to reduce shirking [2]. Second, for those enterprises with high turnover costs, Efficiency Wages can be a reasonable choice. As Song and Chen (2016) point out, Efficiency Wages can be helpful to decrease the mobility rate of labor, thus reducing enterprises' recruitment and training costs [19]. Last, Efficiency Wages can work well when the threat of termination is high [2]. For instance, if there is intense competition in the labor market, employees will face a higher probability of being fired (increase 'p' in the ' $p(w-w^*) > g$ '). In this situation, employees have an incentive to work hard to keep their jobs.

2.3 Analysis from the Needs of Current Industries

Lastly, Efficiency Wages is more aligned with the incentive needs of industries in the current era. With the industrial revolution, technological innovation, and the development of modern socialized mass production, the complementarity and specialization of human capital are becoming outstanding, which lead to an increasing number of problems that need to be solved through teamwork [20]. As a result, the production process presents the characteristics of indivisibility, multi-task, and non-standardization, making it difficult to assess individual performance and outputs [20].

Those developments mentioned above further narrowed the scope of application of Piece Rate, and many developed countries cut back on the use of this incentive mechanism. Taking the United States as an example, there were 60% of coal mining enterprises implemented the Piece Rates for production line employees at the beginning of the 20th century [21]. By 1945, this proportion decreased to 20% [21]. In addition to the United States, there are also fewer companies adopting this mechanism in other developed countries such as Britain, Sweden, Australia, and Canada [22]. On the contrary, the scope of application of Efficiency Wages even becomes wider. In the post-industrial era, the flattening structure and fuzzy boundary of organizations made employees' working time, workplace, and work forms freer [19]. These changes directly increased the enterprises' emphasis on quality and the difficulty of supervision, which coincide with the suitable scenarios of applying the Efficiency Wages mentioned above [19].

3 Critical Thinking About Piece Rate and Efficiency Wages

However, the Piece Rate is not without merit and the Efficiency Wage is not a panacea. In many developing countries such as India, Bangladesh, and Pakistan, Piece Rates are still widely used in the labor-intensive industries with assembly line production technology [23]. Take the Indian manufacturing industry as an example. According to Kaur et al. (2021), workers' productivity and concentration increased significantly when they were paid depending on the number of plates they made rather than a fixed wage [18]. Besides, it also shows a positive correlation between piece rates and productivity, that is, for every

Table 1. Piece Rate Variation (The image is original) Adapted from: Kaur et al. (2021) [18]

	Hourly Production		Attentiveness Index	
	(1)	(2)	(3)	(4)
Piece rate	0.018** (0.008)		-0.008 (0.009)	
Piece rate = Rs. 3		0.021 (0.015)		0.002 (0.023)
Piece rate = Rs. 4		0.036** (0.016)		-0.015 (0.019)
P-val: equality of coefficients				
Piece rate in (1) and (3)	0.004			
Piece rate = Rs. 3 in (2) and (4)		0.345		
Piece rate = Rs. 4 in (2) and (4)		0.004		
N: worker-hours	4374	4374	4373	4373

Notes: This table shows the impact of changing piece-rates on worker productivity and attentiveness. The observations come from supplementary rounds (without the interim-pay treatment) with 151 workers.

The dependent variables are normalized hourly production in Cols. 1-2 and the attentiveness index in Cols. 3-4. The attentiveness index is an average of three normalized proxies for attentiveness: the average number of leaves, stitches, and double holes (which signify that a stitch was removed in order to correct mistake) per plate during the production hour slot. The production and attentiveness measures are normalized using the same control group mean and standard deviations as the measures in the main rounds.

The piece-rate wage was randomized to be either Rs. 2, 3, or 4, so the omitted category in Cols. 2 and 4 is a piece-rate wage of Rs. 2.

All regressions control for individual, day, and round times hour-of-the-day fixed effects, and also include indicators for shorter production slot lengths. Standard errors are clustered by worker.

1 rupee increase in piece rate, the output increased by 0.018 standard deviations (Table 1). Then, in terms of Efficiency Wages, it cannot be suitable for all situation. According to Song and Chen (2016), compared with previous years, the importance of non-material incentives increase significantly [19]. Especially for the young generation, they not only attach great importance to salary, but also work autonomy, work form, work environment, and future career development prospect. Even though the Efficiency Wages is able to meet some intrinsic needs, its effectiveness is still likely to be weakened.

4 Conclusion

To sum up, although both Piece Rate and Efficiency Wages have merits and demerits, the latter one wins wider scope of application because it better meets the intrinsic and extrinsic needs of employees, has fewer constraints on application, and is in line with the current needs of industries. However, this does not mean that enterprises utilizing Efficiency Wages can be at ease. Because of the gap between artificial simplified mechanisms and complex and changeable reality, no incentive systems can be effective forever. It requires enterprises to enhance their dynamic capability, which means that companies need to continuously adjust and optimize the current incentive systems according to the operation of the company, the demand and supply in the labor market, and the situation of the whole industry to keep the efficiency of incentive systems and realize a stable and long-term development.

References

1. Neilson, W.S. (2007) *Personnel economics*. Upper Saddle River, NJ.
2. Ma, Q. P. (2021) 'LECTURE 6: Incentive Systems: Employee Compensation'. *BUSI2180: IE*. Available at: https://moodle.nottingham.ac.uk/pluginfile.php/7676590/mod_resource/content/1/2020_IE1%20Lecture%206.pdf (Accessed: 15 October 2021)
3. Gittleman, M. and Pierce, B. (2015) *Pay for performance and compensation inequality: Evidence from the ECEC*. *ILR Review*, 68(1), pp.28-52.
4. Raff, D.M. and Summers, L.H. (1987) *Did Henry Ford pay efficiency wages?*. *Journal of Labor Economics*, 5(4, Part 2), pp. S57-S86.
5. Caudill, H.L. and Porter, C.D. (2014) *An historical perspective of reward systems: Lessons learned*
6. Drury, H. B. (1915) *Scientific Management; a History and Criticism*. New York.
7. Merkle, J.A. (1980) *Management and ideology*. University of California Press.
8. Lazear, E.P. (1999) *Personnel economics: past lessons and future directions*. *Journal of Labor Economics*, 17(2), pp.199-236.
9. Shapiro, C. and Stiglitz, J. E. (1983) *Equilibrium Unemployment as a Worker Discipline Device*. *Bulletin of the American Mathematical Society*, 8(4): 477-481.
10. Akerlof, G.A. (1982) *Labor contracts as partial gift exchange*. *The quarterly journal of economics*, 97(4), pp.543-569.
11. Allen, R.C. (2015) *The high wage economy and the industrial revolution: a restatement*. *The Economic History Review*, 68(1), pp.1-22.
12. Allen, R.C. (2001) *The great divergence in European wages and prices from the Middle Ages to the First World War*. *Explorations in economic history*, 38(4), pp.411-447.
13. Amabile, T. M., Hill, K. G., Hennessey, B. A. and Tighe, E. M. (1994) *The Work Preference Inventory: assessing intrinsic and extrinsic motivational orientations*. *Journal of personality and social psychology*, 66(5), 950.
14. Qian, H.T. (2011) "Liwu jiaohuan lilun" jili fangshi [Incentive model of "Gift exchange theory"]]. *Modern corporate culture magazine*, (19), pp.87-87.
15. Carmichael, H.L. and MacLeod, W.B. (2000) *Worker cooperation and the ratchet effect*. *Journal of Labor Economics*, 18(1), pp.1-19.
16. Wu, W. (2017) *Xinchou xingshi dui laodongzhe gongzi shouru yingxiang de shizheng fenxi [An empirical analysis of the impact of salary forms on workers' wage income]*. *Statistics & Decision*, (5), pp.182-185.
17. Zhang, D.Z., Li, M.J., Huang, X.G., Shi, Z.Q., Xie, D.J., Liu, G.Z. and Zou, L.Y. (2015) *Yanfa ren yuan jixiao kaohe zhibiao sheji yu fenxi [Design and analysis of performance evaluation indicators for R & D personnel]*. *Anhui Science*, (12), pp.35-37.
18. Kaur, S., Mullainathan, S., Oh, S. and Schilbach, F. (2021) *Do Financial Concerns Make Workers Less Productive?*. *National Bureau of Economic Research*.
19. Song, J. and Chen, Y.Y. (2016) *Xiaolv gongzi lilun hexin jiashe de zhiyi yu tuozhan [Query and expansion of the core hypothesis of efficiency wage theory]*. *Research on financial and economic issues*, (8), pp.17-22.
20. Zhang, F.L. (2008) *Why was the Method of Piece Rate Payment not been Carried out Widely?—A New Explanation about the Choice of Payment Methods in the Viewpoint of Human Capital*. *Nankai Economic Studies*, p.06.
21. Glasser, C. (1948) *Union Wage Policy in Bituminous Coal*. *ILR Review*, 1(4), pp.609-623.
22. Johansson, B., Rask, K. and Stenberg, M. (2010) *Piece rates and their effects on health and safety—A literature review*. *Applied ergonomics*, 41(4), pp.607-614.
23. Lopez-Acevedo, G. and Robertson, R. eds. (2016) *Stitches to riches?: apparel employment, trade, and economic development in South Asia*. World Bank Publications.

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