

Harmful Raises: A Game Theory Analysis of Amazon's Wage Decision

Amazon stirred the pot when it announced in 2018 that it would increase the minimum wage for all its workers in the United States to \$15 an hour.¹ Many economists noted that the company's decision resembled an attempt at achieving what is known as an efficiency wage, a theory that paying workers above the market rate can increase productivity, decrease shirking, and reduce overall turnover. Harvard Business Review gave credence to this concept, explaining that "there's reason to think that a pay hike would be good both for Amazon's employees and its bottom line."² However, this simple story fails to consider how Amazon's competitors would respond if, for example, the company were to increase its wages by 20 percent. Analyzing these more nuanced tradeoffs through game theory shows how wage increases can result in problems that outweigh the ostensible benefits of efficiency wage theory.

The efficiency wage was popularized in the late 20th century by prominent economists such as Joseph Stiglitz, Carl Shapiro, and George Akerlof. Early iterations of the theory, such as Henry Leibenstein's work in 1957, established a rudimentary but foundational link between wages and efficiency in low-developed countries.³ Workers paid more can afford more food and necessities; in turn, firms get healthier and more productive employees. This trend is seen in more developed countries, as well: in 1979, Robert Solow developed a model centered around boosting worker morale in developed countries for the purpose of enhancing company productivity.⁴

¹ Karen Weise, "Amazon to Raise Minimum Wage to \$15 for All U.S. Workers," *The New York Times*, last modified October 2, 2018, accessed June 26, 2022, <https://www.nytimes.com/2018/10/02/business/amazon-minimum-wage.html>.

² Ray Fisman and Michael Luca, "How Amazon's Higher Wages Could Increase Productivity," *Harvard Business Review*, last modified October 10, 2018, accessed June 27, 2022, <https://hbr.org/2018/10/how-amazons-higher-wages-could-increase-productivity>.

³ Lawrence F. Katz, "Efficiency Wage Theories: A Partial Evaluation," *NBER Macroeconomics Annual* 1 (January 1986): 238, accessed June 27, 2022, <https://doi.org/10.1086/654025>.

⁴ *Ibid.*

At first glance, the literature appears to support the sentiment that wages sizably above the market-clearing price would deliver Amazon greater profits. There are three main reasons why this assumption is reasonable. The first is shirking, as described in Janet Yellen's 1984 work explaining firms' reluctance to lower wages even in the presence of unemployment. In almost all jobs, Yellen writes, employees have a certain degree of autonomy regarding their output; they can either work or choose to shirk. Assuming that maximizing free time is generally pleasurable, workers who want to shirk must weigh that pleasure against the cost of being fired. "Under these circumstances, the payment of a wage in excess of market clearing may be an effective way for firms to provide workers with the incentive to work rather than shirk," Yellen writes.⁵ If a firm pays considerably higher than the market average, workers have a stronger incentive not to shirk, as doing so would mean the loss of favorable wages. The same logic applies to employee turnover: "Turnover is costly to firms through its direct costs . . . as well as indirect costs . . . As a result, firms utilize wage policy to economize on turnover."⁶ Lastly, as postulated in Solow (1979), companies observe higher productivity from workers who receive an efficiency wage because they are more content with a comparatively higher salary.⁷

In addition to theoretical models, historical analysis of the efficiency wage theory appears to suggest it could benefit Amazon significantly. In 1914, Henry Ford began to pay his factory workers \$5 a day when the average daily wage stood at only \$2 or \$3. In an empirical analysis of this decision conducted by Daniel Raff and Lawrence Summers in 1987, the two concluded that "there is vivid evidence that the introduction of the five-dollar day resulted in substantial queues for Ford jobs," and that "significant increases in Ford productivity and profits accompanied the new regime."⁸ Many experts attributed the lackluster working conditions in Ford's factory as the

⁵ Janet L. Yellen, "Efficiency Wage Models of Unemployment," *American Economic Review* 74, no. 2 (May 1984): 202, accessed June 27, 2022, <https://www.jstor.org/stable/1816355>.

⁶ *Ibid.*

⁷ Robert M. Solow, "Another Possible Source of Wage Stickiness," *Journal of Macroeconomics* 1, no. 1 (December 1979): accessed June 27, 2022, [https://doi.org/10.1016/0164-0704\(79\)90022-3](https://doi.org/10.1016/0164-0704(79)90022-3).

⁸ Daniel M.G. Raff and Lawrence H. Summers, "Did Henry Ford Pay Efficiency Wages?," *Journal of Labor Economics* 5, no. 4 (October 1987): 57, <https://doi.org/10.3386/w2101>.

impetus for the wage bump; the company needed to keep workers on the line and could not afford any increases in employee turnover.⁹

Amazon finds itself in a similar situation; its hourly wage of \$15 in 2018 represented a significant mark above the national average of \$13.20 for retail workers, according to the Bureau of Labor Statistics.¹⁰ Like Ford, Amazon recorded smashing success shortly after the change, or as The New York Times described, “stratospheric sales and the equivalent of the previous three years’ profits rolled into one.”¹¹ Also mirroring Ford, Amazon’s workers have long bemoaned working conditions, where they face Orwellian-like monitoring and questionable workplace safety standards.

Thus, as we consider whether or not Amazon should increase all working salaries by 20 percent, it is a question of whether the company should pursue the implementation of an efficiency wage — in other words, if significantly outpacing competitors’ salaries would deliver a meaningful increase in productivity, a decrease in turnover, and an ultimate increase in profits. In the existing literature, both theoretical and empirical studies seem to support the increase, so why haven’t more firms implemented this strategy? Why is it a dangerous move for Amazon to raise salaries by 20 percent?

The answer lies in a fundamental flaw within the efficiency wage theory. In particular, it largely neglects the competition among firms in a capitalist market. The benefits of an efficiency wage — low turnover and high loyalty and morale — are not quite products of increased pay. Rather, they are the result of paying higher than competitors. Thus, when one firm raises wages to achieve an efficiency wage, other companies will quickly follow suit to compete for labor, neutralizing the benefits of that increase.

Game theory can reveal how firms should approach an efficiency wage. To simplify the logic, we will use a model with two players — Amazon and its competitors. Each player can choose whether to pay an efficiency wage or market wage. When both players pay market wages,

⁹ Ibid.

¹⁰ "Occupational Employment and Wages, May 2021," U.S. Bureau of Labor Statistics, last modified May 2021, accessed June 27, 2022, <https://www.bls.gov/oes/current/oes412031.htm>.

¹¹ The New York Times, "Inside Amazon's Employment Machine," The New York Times, last modified 2021, accessed June 27, 2022, <https://www.nytimes.com/interactive/2021/06/15/us/amazon-workers.html>.

their worker productivity (**P**) and company profit (**F**) are at a baseline level. However, when they all decide to pay efficiency wages, no one can access certain benefits unique to comparatively higher wages, such as high employee retention, morale, and higher-quality recruits. Thus, employee productivity is still at the base level (**P**). However, labor costs rise due to the higher wages, so profit falls (**F-**).

Now, suppose only one player pays efficiency wages. In that case, that company receives increased employee productivity due to the comparatively higher wages, leading to more profit (**P+**). Because workers for the other player know they're being paid less, those workers will have lower morale and more incentive to shirk or quit. This dissatisfaction leads to less productive labor (**P-**) and decreased company profits (**F-**).

Thus, the decision-making model for efficiency wages can be described using the following payoff matrix:

Figure 1: Wage Game Payoff Matrix

		Amazon's Strategy	
		Efficiency	Market
Competitors' Strategy	Efficiency	Amazon: P, F- Competitors: P, F-	Amazon: P-, F- Competitors: P+, F+
	Market	Amazon: P+, F+ Competitors: P-, F-	Amazon: P, F Competitors: P, F

P and **F** represent a player's productivity and profit, respectively. The plus and minus signs indicate an increase or decrease in those values. This game is set up with two players, Amazon and Amazon's competitors. Figure created by the author.

If only one player pays efficiency wages, that player profits the most. But if all players pay efficiency wages, they all profit less. For Amazon, it profits the most when paying an efficiency wage while its competitors are not. But even when all of its competitors pay efficiency wages: Amazon doesn't want to be left behind, so it must also match those higher wages. Thus, the dominant strategy for Amazon is always to pay above-market wages.

The other player looking at the payoff matrix will come to the same conclusion — it is always better to match or surpass a competitor’s wage once someone else makes the first move. However, when both players pay efficiency wages, the benefits of that higher wage disappear, leaving them with less profit. Here we have our Prisoner’s Dilemma.

Empirical evidence has affirmed the strategy suggested in this model. In 2018, Amazon became one of the first companies in the US to implement a company-wide hourly minimum wage of \$15. But shortly after, Costco raised its minimum wage to \$15 in 2019. Target then did it in 2020, followed by Walmart in 2021.¹² Data collected from the popular jobs website, Glassdoor, shows that Amazon no longer pays the highest hourly rate to its warehouse workers compared to other e-commerce and retail competitors.

Table 1: Average Hourly Wages for Warehouse Jobs at Major Retailers

Company	Average Salary (Hourly)	Notes
Walmart	\$19	Data updated June 27, 2022 from 113,000 reported salaries.
Amazon	\$16	Data updated June 13, 2022 from 181,000 reported salaries.
Costco	\$16	Data updated June 13, 2022 from 15,000 reported salaries.
Target	\$16	Data updated June 9, 2022 from 85,000 reported salaries.

Source: Glassdoor. Table created by the author.

But how exactly would this competition continue? For example, what if Amazon makes headlines again by increasing wages by 20 percent across the board? We can answer this by investigating the optimal strategy for Amazon and its competitors in an infinite prisoner’s dilemma game, rather than the one-time game. In this analysis, we’ll assume that both players understand that an efficiency wage can boost their profits through the aforementioned benefits.

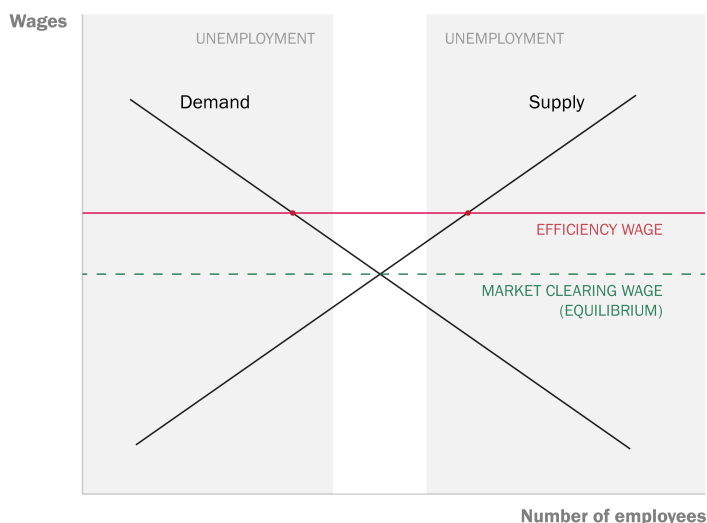
¹² Ibid.

Unlike in the one-time game where defecting (paying an efficiency wage) grants the highest payoff for self-interested rational players, endless repetition in the infinite game allows players to use a strategy that maximizes cooperation to achieve the greatest overall payoffs. Research has found that when collusion between companies is impossible (as conspiring to fix wages is illegal), a different strategy is more prevalent in treatments with a high probability of continuation and payoffs.

Under this strategy, known as tit-for-tat, players first cooperate, then replicate the other player's actions in subsequent rounds. So, companies would hold off on making the first move to raise wages. Then, while mimicking others' actions in subsequent periods, the companies continue cooperating into the indefinite future. This strategy emerged victorious in Robert Axelrod's prisoner's dilemma computer tournament, where computers repeatedly played games against each other. This comes at no surprise, as the payoff matrix in **Figure 1** shows how the aggregate scores produced by both players' repeated choosing of the cooperative strategy generate the best overall results. This is key, as the possibility of retaliation induces the other player not to defect.

In this case, if Amazon raises its wages by 20 percent, other companies using the tit-for-tat strategy would imitate the action in their next move, also raising their wages by 20 percent; as previously discussed, this neutralizes the playing field and erases the benefits Amazon initially achieved through paying higher wages. Companies would experience lower profits across the board due to higher labor costs. Amazon has two options for continuing the game: keep defecting to create a price war or start cooperating by halting the wage hike. The former causes catastrophic damage to the profits of Amazon and its competitors, while the latter generates a mitigated profit loss for these firms.

Furthermore, the 20 percent wage increase by Amazon and its competitors would raise wages much above the market clearing wage, an equilibrium where labor supply and demand are balanced. Wages higher than the market-clearing level in a sector — or a whole industry — would increase the labor supply while firms simultaneously demand less labor. This imbalance of labor demand and labor supply would propel structural unemployment in the sector, industry, and potentially even the entire economy. These relationships are shown in Figure 2.

Figure 2: Efficiency Wage in the Labor Model

The figure depicts how, if all firms paid an efficiency wage (significantly above the market-clearing wage), demand for labor would decrease because firms would seek fewer workers. Simultaneously, the supply of workers would increase due to the higher wages. This creates a pocket of unemployment. Figure created by the author.

This analysis has a profound impact on how companies should approach wage increases. Today, activists and lawmakers alike have called on companies to increase pay in the forms of efficiency wages and living wages, appealing to both ethical and economic reasons. However, even if motivated by goodwill, Amazon must not significantly raise its wages. Doing so would force competitors to follow suit, erasing any perceived efficiency wage benefits and ultimately slashing the company's profits. Further, a potential price war would cause undesired structural unemployment in the sector, industry, or even the entire economy, forcing many workers to choose between unemployment or a lower-paying job.

When the founder of Amazon, Jeff Bezos, spoke in 2018 about the company's decision to raise the minimum hourly wage to \$15, he lauded it as a trendsetting step towards righteousness: "We're excited about this change and encourage our competitors and other large employers to join us."¹³

We can only hope that he didn't mean that.

¹³ Weise, "Amazon to Raise," The New York Times.

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