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## Queuing Management for Congestion Costs and Profit Potential

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## ABSTRACT

Congestion costs refer to opportunity losses (profit losses) caused by customers' balking or reneging behavior owing to congestion. A previous model of congestion costs showed that profits decrease when utilization rates increase too much, clarifying that controlling the rate of balking or reneging is essential to maximizing a business profits. This study aims to extend the preceding model and explore the significance of controlling customers' balking or reneging behavior during congestion through simulation. It also discusses the profit potential and ways of behavior control and then explores the role of queuing management in addressing congestion problems. Proper queuing management can prevent customers' balking or reneging owing to wait times and contribute to improved profits and a better customer experience. It has attracted attention as a means of building competitive advantage.

**Keywords**: congestion costs, balking behavior, reneging behavior, queuing management, profit potential

## 1 INTRODUCTION

Recent research on the congestion costs has offered insights into the relation between cost behavior and utilization. In the context of traditional management accounting, the contribution-margin approach has been adopted to tackle the challenge of effectively utilizing unutilized capacity. From the perspective of economies of scale, maximizing capacity utilization has also been recommended. The concept of congestion costs has a significant impact on business profits in various sectors, from manufacturing to health care. In the latter, utilization management underscores the significance of maintaining a certain degree of flexibility in the number of hospital beds (Noreen & Soderstrom, 1994). Initially, bed occupancy management policies in hospitals seemed to contradict management policies advocating for increased capacity utilization. In reality, the rationale for occupancy management in the health care industry can be traced to congestion costs, defined as "the additional costs incurred by congestion" (Hirai & Kataoka, 2024).

The present study focused on opportunity losses (profit losses) attributable to customers' balking or reneging behavior caused by congestion, as previously discussed by Hirai and Kataoka (2024). Congestion costs themselves have not been observed, although a few studies have tackled the concept. For example, the congestion costs discussed in Banker et al. (1988) are based on the theory of queues. Banker et al. (1988) only presented the possibility of relatively large total fixed costs to avoid congestion. Balakrishnan and Soderstrom (2000) examined the existence of mixed costs in their study of obstetrics and gynecology. However, these studies have not paid special attention to customers' balking or reneging behavior caused by congestion. A critical question remains: why do customers hesitate to visit a hospital when they anticipate a prolonged waiting time for consultation? Time Trade Systems, Inc. (2013) identified waiting times as the primary factor of customer attrition for retailers, a trend that persists despite the rapid transition to virtual queues. Indeed, Yu (2020) reported that Americans spend approximately 37 billion hours per year waiting.

The present study extends the model of Hirai and Kataoka (2024) and elucidates the significance of controlling customers' balking or reneging behavior caused by congestion through simulation. Additionally, we examine the economic implications of these controls and measures.

## 2 REVIEW OF PRIOR RESEARCH

Recent research results on the congestion costs have facilitated a more profound understanding of cost behavior in relation to utilization rates. The prevailing notion is that congestion costs emerge when utilization rates approach 100%, leveraging effective utilization of unoccupied capacity (Banker et al., 1988; Hirai & Kataoka, 2024). For instance, according to Banker et al. (2014), fixed costs increase to mitigate congestion costs, especially under high demand uncertainty. However, they did not directly measure or observe congestion costs; instead, they increased capacity in advance and chose a cost structure with relatively high fixed costs to avoid congestion costs that were predicted to occur in situations where the utilization rate was close to 100%. Another view is that increasing uncertainty leads to the risk of large fluctuations in the utilization rate, causing fixed costs to become more variable (Balakrishnan et al., 2008). Furthermore, Holzhacker et al. (2015) proposed that, in circumstances where demand uncertainty and financial risk increase, managers modify their resource procurement behavior, resulting in an increase in cost elasticity, both directly and indirectly (Kataoka, 2016).

In light of the preceding studies, Hirai and Kataoka (2024) developed a model for congestion cost based on the theory of queues. By incorporating this model into the cost behavior, they conducted a profit and loss calculation simulation and determined the optimal utilization rates. The primary contribution of the Hirai and Kataoka model lies in its visualization and modeling of congestion costs.

A critical aspect of congestion costs arising from the presence of queues is the opportunity losses caused by customers' avoidance of non-monetary, invisible costs (hidden costs) (Lovelock & Wright, 1999). Hirai and Kataoka (2024) estimated the total number of potential customers who consider purchasing or consuming the products and services offered by companies, alongside the number of customers who exhibit balking behavior (deciding not to join a queue after observing its length) and reneging behavior (leaving the queue after initially joining). Defining the speed of demand for products (sales volume) per unit of time as $\lambda$, the speed of processing (the quantity that can be processed; capacity) per unit of time as $\mu$, and the proportion of customers who have taken balking/reneging action as $n$ $(0 \leq n \leq 1)$, Hirai and Kataoka (2024) expressed the number of customers who have taken balking/reneging action as

$(CT - T_e) \times \lambda \times n/(1-n)$. According to an M/M/1 system[1] based on queuing theory, in this case, if the tact time (= available operating time/demand in the production plan) is $T_a$, the demand speed $\lambda$ for the product can be expressed as $\lambda = 1/T_a$; if the offer time (processing time) is $T_e$, the processing speed $\mu$ for the product can be expressed as $\mu = 1/T_e$ (Ota and Kataoka 2020, 55). The production lead time, $CT$, which is the average time required from the receipt of an order to the actual completion of product or service provision, is calculated as $CT = 1/(\mu - \lambda)$. If the sales price is defined as the opportunity loss per customer who engages in balking/reneging behavior, opportunity losses can be calculated as follows.

$$f_{(\lambda)} = p \times \frac{\lambda^2}{\mu^2 - \mu\lambda} \times \frac{n}{(1-n)} \qquad (1)$$

According to equation (1), as the length of both the waiting queue and duration increase, the opportunity cost will concomitantly rise. Notably, Banker et al. (2014) did not directly measure or observe congestion costs, whereas Balakrishnan and Soderstrom (2000) presented evidence of congestion costs incurred by obstetricians and gynecologists. These costs are based on expenditure costs that can be measured using cost accounting (cost accounting system) linked to the general accounting system. In contrast, the congestion costs examined by Hirai and Kataoka (2024) emphasize opportunity losses, focusing on customer behavior.

The second contribution of the Hirai and Kataoka model is that it clarifies the existence of a sales volume at which marginal revenue and marginal cost are equal. Congestion costs increase rapidly as the utilization rate increases. Traditional cost–volume–profit (CVP) analysis assumes that the marginal revenue (price) remains constant. However, the optimal sales volume occurs when both the marginal revenue and marginal cost are equal. Once the optimal sales quantity has been determined, the optimal operating rate can be determined accordingly. Hirai and Kataoka (2024) introduced congestion costs into traditional CVP analysis and proposed the following new profit function model.

$$\tilde{\pi}_{(x)} = (p-a)x - b - p \times \frac{x^2}{\mu^2 - \mu x} \times \frac{n}{(1-n)} \qquad (2)$$

The utilization rates at the optimal sales quantity, $x^*$, which yields the maximum value of $\tilde{\pi}_{(x)}$ in equation (2) is the optimal utilization rate, $x^*/\mu$. However, given that the processing speed per unit of time (processable quantity) $\mu$ in equation (2) represents capacity size, the saleable quantity must be less than or equal to the suppliable capacity quantity ($0 \leq x \leq \mu$). The $\tilde{\pi}'_{(x)}$ obtained by differentiating equation (2) represents the opportunity loss or marginal opportunity loss per unit of product or service that occurs when the optimal sales quantity $x^*$ cannot be achieved, which is when the optimal utilization rates cannot be achieved. In other words, this per-unit opportunity loss can be said to be the improvement effect that can be obtained by approaching the optimal sales quantity. In addition, the new profit function in equation (2) indicates the possibility of two break-even sales volumes, unlike in traditional CVP analysis.

We thoroughly examined the aforementioned two contributions and found the

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[1] The M/M/1 model in queuing theory is a model of a queue in which requests from customers in a row are processed by one server on a first-come, first-served basis, where the requests arriving at the server follow a Poisson distribution and the server processing time, an exponential distribution (Hopp and Spearman, 2001).

simulation presented by the Hirai and Kataoka model to be a simplified model that fixed variables other than sales volume to express the impact of the waiting line using congestion costs. The employment of a simplified model underscores the impact of specific variables and posits the potential for extending the model to encompass changes in other variables.

# 3 FACTORS AFFECTING CONGESTION AND MODELING

## 3.1 Focusing on the rate of balking or reneging: Application of the Hirai and Kataoka model

The Hirai and Kataoka model introduced a novel profit function, with sales volume as the explanatory variable and profit as the dependent variable, under the assumption that the selling price, variable costs, fixed costs, production capacity, and rate of balking or reneging remain constant. However, to facilitate simulation, the model assumes that numerous numerical parameters are fixed. In essence, the Hirai and Kataoka model employed an approach that focused on the changes in costs and profits in response to variations in sales volume. One of the distinctive features of the model is its significant enhancement in extensibility achieved by modeling congestion costs. By visualizing how changes in various variables affect the dependent variables, such as costs and profits, the model offers potential applications for managerial decision-making. In particular, the current work focuses on the management issue of controlling customers' balking or reneging behavior caused by congestion. Therefore, we focused on the rate of balking or reneging $n$ in equations (1) and (2).

The profit plan in the traditional CVP model demonstrates only one break-even point and a full-capacity optimal sales quantity. In contrast, the simulation employing the updated profit function that incorporates the congestion cost, as proposed by the Hirai and Kataoka model, can calculate the optimal sales volume and optimal utilization rates, in addition to identifying the existence of two break-even points. The simulation of the Hirai and Kataoka model reveals the rate of balking or reneging of 75%, subject to variation based on temporal and seasonal factors, with instances of congestion and its absence occurring in different periods of the day and year. For instance, the restaurant industry has a high volume of customers during lunch and dinner hours, which leads to congestion, whereas periods outside these peak times may experience relatively calm conditions. This phenomenon can be explained by heavy traffic congestion during the morning and evening commutes, contrasted with calm conditions late at night. A similar dynamic is observed in the hotel industry, where the workload of hotel staff varies significantly between peak and off-season periods. Changes in the rate of balking or reneging may also be influenced by these seasonal fluctuations. Therefore, understanding the cost and profit behaviors in response to changes in the rate of balking or reneging is the key to controlling the rate of balking or reneging. To this end, we conducted a simulation focusing on the rate of balking or reneging for equation (2) of the Hirai and Kataoka model shown in section 2.

## 3.2 Simulation

Here, we calculate the optimal sales quantity and profit (i.e., the maximum value) using numerical examples, and also calculate the break-even point based on the new profit function to check the impact of changes in the rate of balking or reneging ($n$). We set the calculation conditions as follows:

- Selling price: $p = 2{,}000$ USD
- Variable cost per unit of product or service: $a = 1{,}200$ USD
- Fixed cost equivalent: $b = 4{,}000{,}000$ USD
- Production capacity: $\mu = 10{,}000$ units
- Rate of balking or reneging : $n = 0.05,\ 0.10,\ 0.15,\ \cdots,\ 0.90,\ 0.95$

First, in the traditional CVP analysis using this numerical example, the break-even sales quantity $x_{BE}$ can be calculated as 4,000,000 / (2,000 - 1,200) = 5,000 units. If the set target sales quantity exceeds this break-even sales quantity, then the target profit will be calculated automatically.

Substituting the sales price, variable cost per unit of product or service, fixed cost equivalent, maximum production quantity, and rate of balking or reneging into this gives the following equation for calculating the new profit function $\tilde{\pi}_{(x)}$.

$$\tilde{\pi}_{(x)} = (2{,}000 - 1{,}200)x - 4{,}000{,}000 - 2{,}000 \times \frac{x^2}{10{,}000^2 - 10{,}000x} \times \frac{n}{(1-n)}$$
$$= 800x - 4{,}000{,}000 - \frac{2{,}000 \times n \times x^2}{(10{,}000^2 - 10{,}000x) \times (1-n)}$$
(3)

As with equation (2), the optimal sales quantity $\tilde{\pi}_{(x)}$ that gives the maximum value of $x^*$ in equation (3) is the optimal utilization rates $\frac{x^*}{\mu}$. The optimal sales quantity $x^*$, profit $\tilde{\pi}_{(x)}$ (maximum value), and the break-even sales quantity $\tilde{x}_{BE}$ when $n$ is moved from 0.05 to 0.95 are shown in Figure 1. The difference (Δ) between the optimal sales quantity and profit is also shown.

Table 1: Optimal sales quantity, profit potential, and break-even sales quantity

| $n$ | optimal sales quantity | ⊿optimal sales quantity | profit potential | ⊿profit | break-even sales quantity | |
|---|---|---|---|---|---|---|
| 0.05 | 9,964 | | 3,942,170 | | 5,000.07 | 9,999.74 |
| 0.10 | 9,947 | 16 | 3,916,120 | 26,050 | 5,000.14 | 9,999.44 |
| 0.15 | 9,934 | 14 | 3,894,430 | 21,690 | 5,000.22 | 9,999.12 |
| 0.20 | 9,921 | 13 | 3,874,500 | 19,930 | 5,000.31 | 9,998.75 |
| 0.25 | 9,909 | 12 | 3,855,270 | 19,230 | 5,000.42 | 9,998.33 |
| 0.30 | 9,897 | 12 | 3,836,090 | 19,180 | 5,000.54 | 9,997.86 |
| 0.35 | 9,884 | 13 | 3,816,500 | 19,590 | 5,000.67 | 9,997.31 |
| 0.40 | 9,871 | 13 | 3,796,090 | 20,410 | 5,000.83 | 9,996.67 |
| 0.45 | 9,857 | 14 | 3,774,420 | 21,670 | 5,001.02 | 9,995.91 |
| 0.50 | 9,842 | 15 | 3,750,990 | 23,430 | 5,001.25 | 9,995.00 |
| 0.55 | 9,825 | 17 | 3,725,160 | 25,830 | 5,001.53 | 9,993.89 |
| 0.60 | 9,806 | 19 | 3,696,100 | 29,060 | 5,001.88 | 9,992.50 |
| 0.65 | 9,785 | 22 | 3,662,590 | 33,510 | 5,002.32 | 9,990.71 |
| 0.70 | 9,759 | 26 | 3,622,780 | 39,810 | 5,002.92 | 9,988.33 |
| 0.75 | 9,726 | 32 | 3,573,660 | 49,120 | 5,003.76 | 9,985.00 |
| 0.80 | 9,684 | 42 | 3,509,780 | 63,880 | 5,005.02 | 9,980.00 |
| 0.85 | 9,624 | 60 | 3,420,020 | 89,760 | 5,007.11 | 9,971.67 |
| 0.90 | 9,526 | 98 | 3,276,200 | 143,820 | 5,011.33 | 9,955.00 |
| 0.95 | 9,312 | 214 | 2,970,660 | 305,540 | 5,024.10 | 9,904.99 |

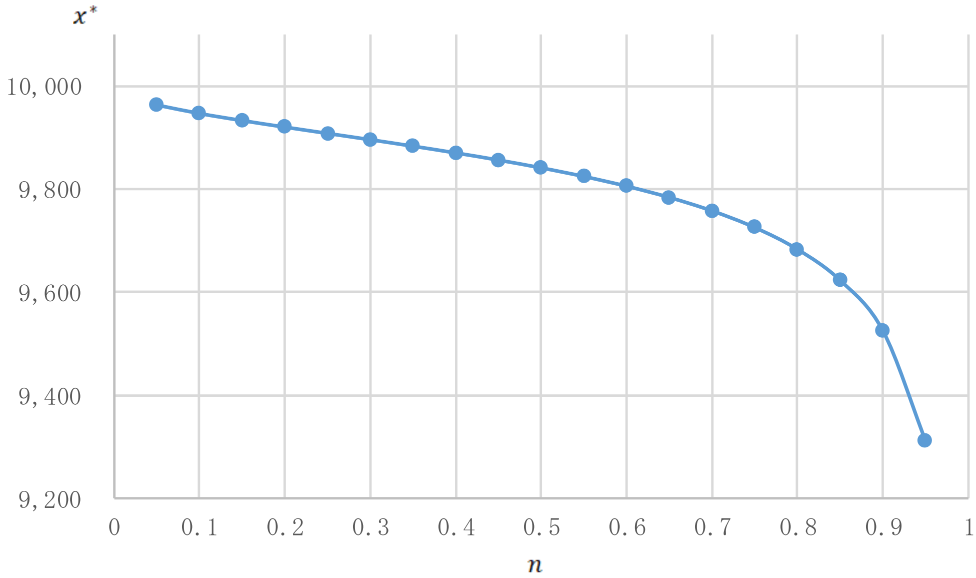


Figure 1: Optimal sales quantity for $n$

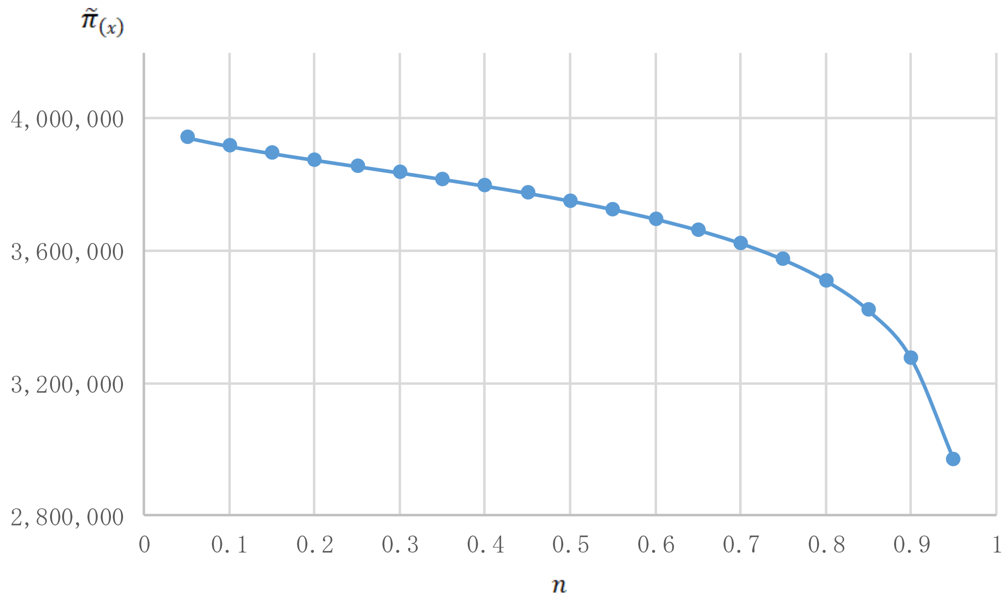


Figure 2: Profit potential (which reaches a maximum value) for $n$

Looking at Table 1 and assuming that $n$ = 0.50 and $\tilde{\pi}_{(x)}$ = 0, two approximate solutions emerge for the break-even sales volume $\tilde{x}_{BE}$, namely, $\tilde{x}_{BE} \approx 5{,}001.25$ units and $\tilde{x}_{BE} \approx 9{,}995.00$ units ($0 \leq x \leq 10{,}000$). The optimal sales quantity can also be obtained when the approximate value of $x^*$ is 9,842 units, and the maximum value of $\tilde{\pi}_{(x^*)}$ is 3,725,160 USD. Figures 1 and 2 graph the break-even sales quantity $\tilde{x}_{BE}$ and profit $\tilde{\pi}_{(x)}$ (maximum value) as the rate of balking or reneging ($n$) changes.

The findings of this simulation can be explained as follows. First, as shown in Table 1 and Figures 1 to 2, the higher the rate of balking or reneging, the lower the optimal sales quantity and the lower the profit potential obtained when the optimal sales quantity is reached. In addition, the optimal sales quantity and profit amount when the optimal sales quantity is reached both decrease rapidly from around the point where the rate of balking or reneging exceeds 0.7. Furthermore, in all cases, the rate of balking or reneging has two break-even points, but the higher the rate of balking or reneging, the smaller (narrower) the gap between the two break-even points. In short, a high rate of balking or reneging not only reduces profit margins but also narrows the range of sales volumes that can generate a profit. This suggests the importance of managing customer's balking or reneging behavior caused by congestion through queuing management when the rate of balking or reneging exceeds around 0.7.

The second finding is on the effect of improving the rate of balking or reneging through queuing management. If the rate of balking or reneging is improved by 5% from 0.9 to 0.85, the optimal sales quantity will improve by 97.69 units, and the profit amount at the optimal sales quantity will improve by 143,820 USD. Similarly, if the rate of balking or reneging were to improve by 5% from 0.85 to 0.8, the optimal sales volume would improve by 60.05 units, and the profit amount at the optimal sales volume would improve by 89,760 USD. This shows the profit improvement potential that can be gained by controlling the rate of balking or reneging. In other words, by appropriately controlling the rate of balking or reneging, enterprises can keep congestion costs as opportunity losses low.

## 4 CONSIDERATION

According to Banker et al. (1988), a way to avoid congestion and the associated costs in situations of high-capacity utilization is to ensure sufficient capacity in advance, preventing excessive utilization. In addition, Banker et al. (2014) showed that companies that face uncertainty that can cause extremely high levels of capacity utilization tend to choose a cost structure consisting of low variable and high fixed costs. By choosing such a cost structure, companies can avoid congestion and its resulting related costs. Both approaches explain that to keep congestion costs low, companies must ensure a relatively large capacity by investing in fixed resources. In situations where demand is highly uncertain, either approach—choosing a structure with a relatively high proportion of fixed costs (Banker et al., 2014) or preparing sufficient capacity in advance to avoid congestion costs (Banker et al., 1988)—can avoid the strict management of optimal sales volume and optimal operating rate. However, in many cases, the decision is not always easy to make because additional investment in fixed resources requires a large amount of money (Yu, 2020). For example, many Japanese manufacturing companies adopt an approach that aims to shorten lead times and increase processing speeds through improvement activities, rather than additional investment in fixed facilities and fixed resources (Hirai & Kataoka, 2024).

Meanwhile, marketing research offers some interesting findings. Koo and Fishbach (2010) investigated the impact of waiting in line on product value evaluation. They showed that consumers tend to find products with other people waiting in line to be more valuable, and that waiting itself can increase the attractiveness of a product. Munichor and Cooke (2022) analyzed the impact of waiting time on consumer purchasing behavior. Although long waiting times can cause negative emotions, they can shape consumers' social inferences, along with the presence and behavior of other customers, leading to higher purchase intention. Zhou and Soman (2008) explored how perceptions of fairness in consumers' waiting experiences in queues affect customer satisfaction and behavior. This finding suggests that fair queuing management is important for improving customer satisfaction. Furthermore, Liang (2010) argued that wait time is not necessarily a negative experience, and that it can be enjoyable with the appropriate environment and service provision. A way to positively change the customer experience is by improving the quality of wait time. These previous studies suggest improving customer satisfaction through queue management rather than simply pouring additional investment into fixed resources.

As measures for queue management, the following are generally considered: (1) improving operational efficiency, (2) using reservation systems, numbered tickets, fast passes, etc., and (3) offering incentives based on the time of visit to even out business (e.g., happy hours). In addition to these, Yu (2020) proposed pragmatic methodologies for the mitigation of waiting time without the augmentation of capacity, while concurrently enhancing customer experience without a concomitant increase in actual waiting time. Yu (2020) highlighted that the provision of information to customers regarding expected waiting times results in a reduction of their average waiting time. In scenarios where the capacity is constrained, it is advantageous to apprise customers of an extended expected waiting time at the outset, thereby prompting those who are unable to wait to relinquish their position in the queue and facilitate the progression of those who can wait. This approach is conducive to enhancing the overall experience for all parties involved. Yu (2020) also determined that informing customers of a pessimistic (longer) expected waiting time is preferable to informing them of an optimistic (shorter) one. While the percentage of customers who abandon the process at the first instance may be reduced when they are told of a shorter expected waiting time, this effect is outweighed by the dissatisfaction experienced by customers who have to wait longer than expected. Yu (2020) also reported that frequent updates of progress information improve customer experience. Customers who are initially informed of a longer expected waiting time should receive updates more frequently because of the extended waiting time, which engenders the perception that progress is accelerating. Consequently, the percentage of customers who renege is reduced. Provided the initial estimate is not excessively prolonged, the beneficial effect of frequent information updates compensates for the deleterious effect of lengthier estimated wait times on the increase in balking or reneging. Lastly, Yu (2020) suggested that customers who have to wait longer than expected take longer when their turn finally comes. This suggests that by informing customers of longer-than-expected waiting times, companies can provide services to customers in a shorter time and increase the number of customers who receive services within the allotted time. The transition of queues to virtual spaces also provides a cost-effective yet efficient method of enhancing the customer experience by optimizing the communication of expected waiting times.

Hirai and Kataoka (2024) also previously noted that a moderate queue has a positive effect on attracting subsequent customers. They developed a model to analyze the negative impact of congestion costs. Our study focused on the rate of balking or reneging in the Hirai and Kataoka model, using simulations to demonstrate that queue management can yield substantial outcomes when the rate of balking or reneging is high. We confirmed that when the rate of balking or reneging is high, a substantial amount of opportunity loss and lost profit is incurred. This suggests improving customer experience and combining it with revenue management—to manage sales volume through proactive value proposals—by seriously addressing the theory of queues and concept of value for customers.

# 5 CONCLUSION

The simulations conducted using the model we outlined yielded several noteworthy findings. Primarily, our model identified two break-even points. However, we found that the optimal sales quantity and optimal utilization rates varied considerably depending on the rate of balking or reneging. This finding underscores the critical role of effective queue management in ensuring operational efficiency.

Many customers experience waiting times that are unacceptably long. Customers may experience feelings of anxiety, dissatisfaction and stress while waiting, questioning the duration of their wait, the reasons for it, and whether the wait will result in a satisfactory experience. To enhance customer satisfaction, enterprises should consider the rate of balking or reneging as a key performance indicator. Efforts to reduce waiting times and enhance the perception of waiting time can be pivotal in achieving this objective.

# REFERENCES

Anderson, M. C., Banker, R. D., & Janakiraman, S. N. (2003). Are selling, general, and administrative "sticky"? *Journal of Accounting Research*, 41(1), 47-63.

Balakrishnan, R., Sivaramakrishnan, K., & Sprinkle, G. (2008). *Managerial Accounting*. John Wiley & Sons.

Balakrishnan, R., & Soderstrom, N. S. (2000). The cost of system congestion: Evidence from the healthcare sector. *Journal of Management Accounting Research*, 12(1), 97-114. https://doi.org/10.2308/jmar.2000.12.1.97

Banker, R. D. S. M., Datar, S. M., & Kekre, S. (1988). Relevant costs, congestion and stochasticity in production environments. *Journal of Accounting & Economics*, 10(3), 171-197.

Banker, R. D., Byzalov, D., & Plehn-Dujowich, J. M. (2014). Demand uncertainty and cost behavior. *Accounting Review*, 89(3), 839-865. https://doi.org/10.2308/accr-50661

Cooper, R., & Kaplan, R. S. (1992). Activity-based systems: Measuring the costs of resource usage. *Accounting Horizons*, September, 1-13.

Datar, S. M., & Rajan, M. V. (2017). *Horngren's Cost Accounting: A Managerial Emphasis 16th edn*. Pearson.

Demski, J. S. (1997). *Managerial Uses of Accounting Information*. Kluwer Academic Publishers.

Hirai, H., & Kataoka, H. (2024). Impact of queues and congestion on costs and profits. *American Accounting Association 2024 Washington DC Annual Meeting*.

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5076325
Holzhacker, M. K., Krishnan, R., & Mahlendorf, M. D. (2015). Unraveling the black box of cost behavior: An empirical investigation of risk drivers, managerial resource procurement, and cost elasticity. *Accounting Review*, 90(6), 2305-2335. https://doi.org/10.2308/accr-51092
Hopp, W. J., & Spearman, M. L. (2001). *Factory Physics: Foundation of Manufacturing Management 2nd edn*. Irwin McGraw-Hill.
Kajiwara, T. (2022). *Strategic Cost Management*. Chuo-Keizaisha. (in Japanese).
Kataoka, H. (2016). Cost behavior and costing. *The Journal of Management Accounting*, 24(2), 3-18. (in Japanese). https://doi.org/10.24747/jma.24.2_3
Kataoka, H., & Hirai, H. (2024). An impact of the queues and the costs of congestion on profits. *Kaikei*, 205(3), 282-296. (in Japanese).
Kato, Y., & Kajiwara, T. (2017). *Introduction to Management Accounting 2nd edn*. Nikkei Inc. (in Japanese).
Koo, M., & Fishbach, A. (2010). A silver lining of standing in line: queuing increases value of products. *Journal of Marketing Research*, 47(4), 713-724. https://doi.org/10.1509/jmkr.47.4.713
Liang, C. (2019). Enjoyable queuing and waiting time. *Time & Society*, 28(2), 543-566. https://doi.org/10.1177/0961463X17702164
Lovelock, C., & Wright, L. (1999). *Principles of Service Marketing and Management*. Prentice Hall.
Miller, J., & Vollman, T. (1985). The hidden factory. *Harvard Business Review*, 63(5), 142-150.
Munichor, N., & Cooke, A. D. J. (2022) Hate the wait? How social inferences can cause customers who wait longer to buy more. *Frontiers in Psychology*, 13, 1-15. https://doi.org/10.3389/fpsyg.2022.990671
Noreen, E., & Soderstrom, N. (1994). Are overhead costs hospital departments. *Journal of Accounting & Economics*, 17(1), 255-278. https://doi.org/10.1016/0165-4101(94)90012-4
Ota, H., & Kataoka, H. (2020). The pitfall of traditional management accounting in the context of S & OP. *Management Accounting Review*, 1(1), 45-62. (in Japanese). https://doi.org/10.20747/mar.1.1_45
Time Trade Systems, Inc. (2013). *Retail Industry Executive Survey*. https://web.timetrade.com/files/content_resource/TT_Retail-Exec-Survey-Brief.pdf
Yu, Q. (2020). *When providing wait times, it pays to underpromise and overdeliver*. Harvard Business Review. https://hbr.org/2020/10/when-providing-wait-times-it-pays-to-underpromise-and-overdeliver
Zhou, R., & Soman, D. (2008). Consumers' waiting in queues: the role of first-order and second-order justice. *Psychology & Marketing*, 25(3), 262-279. https://doi.org/10.1002/mar.20208