Navigating Cost-Cutting Practices to Cope with Crisis: Insights from the Hotel Industry during COVID-19

Abstract

The unpredictable nature of crises poses a significant challenge to the operation of businesses. Hotels often resort to reactive measures, specifically cost reduction strategies, as their primary means of surviving a crisis. Despite the challenges that firms often face in determining which expenses to prioritize to improve their chance of survival, no prior studies have delved into this pressing matter. Thus, this study applied machine learning classification models to prove which expense should be targeted for cuts first to increase the odds of surviving a crisis. We proposed that food and beverage salaries were the most important operating expense as a determinant of a good-performing hotel during the COVID-19 crisis, and marketing expenses were the second most important operating expense. We also found that the relative importance of hotel operating expenses had changed before and during COVID-19.

Keywords: Hotel industry, Crisis management, Cost-reduction strategy, Machine learning, Random forest classification

1. INTRODUCTION

No company can be fully shielded from unforeseen disruptions and potential revenue declines during crises. During the 2008 financial crisis, few anticipated the bankruptcy of Lehman Brothers, one of the world's leading investment banks at the time, as many perceived it to be "too big to fail" (Crosina & Pratt, 2019). From as far back as the Great Depression in the 1930s to the most recent 2020 COVID-19 pandemic, crises often erupt unexpectedly, leaving firms unprepared and vulnerable to their consequences (Romagosa, 2020). In particular, health-related crises, such as the SARS outbreak and COVID-19 pandemic, impact the hotel industry more severely than any other (Japutra & Situmorang, 2021). The most immediate negative impact of a health-related crisis on hotel firms' revenue originates from government-imposed lockdowns and travel restrictions (Harchandani & Shome, 2023). These measures result in the broad closure of non-essential businesses, with hotels being a prime example.

The negative impact of health-related crises on firms' revenue streams is even more severe in the hotel industry than in the restaurant sector, despite both belonging to the same hospitality domain. Hotel firms are typically characterized by lower operational flexibility than restaurant firms because of the former's heavy reliance on room sales from outside travelers (Okhrimenko et al., 2022). Therefore, while many restaurants quickly pivoted to takeout and delivery services when dine-in services were restricted after the outbreak of COVID-19, hotels did not have a comparable pivot option. Although some hotels did offer quarantine packages, these options tended not to compensate for the loss of regular business.

Given the unpredictable nature of crises, the effective implementation of both proactive and reactive measures is vital to overcome a crisis. Regarding proactive measures, both industry practices and the literature underscore the importance of setting aside cash in advance as a safeguard against potential cash shortfalls during a crisis (Asimakopoulos et al., 2019; Lozano & Yaman, 2020). The concept of hoarding cash reserves is supported by the precautionary motive theory. This theory posits that firms should hold onto a certain amount of internally generated cash, instead of reinvesting everything back in the business, to minimize the use of expensive external financing in times of crisis (Lozano & Yaman, 2020). However, hotel firms are typically not in a favorable position to save cash. The hotel industry is known for its high capital intensity (Peng et al., 2020). Therefore, the frequent and massive cash spending required for property maintenance and updates to stay competitive leads to consistent cash outflows, which makes it difficult for hotel firms to save cash for future use (Gao et al., 2013).

Consequently, cost reduction strategies, which are the most commonly embraced reactive measure firms adopt during a crisis (Hong et al., 2012), could play a highly important role for hotel firms navigating crises. Indeed, the COVID-19 pandemic demonstrated how immediately and drastically hotel firms implement cost-cutting measures in times of crisis by shutting down unoccupied floors, reducing staff, and scaling back marketing budgets (Sharma et al., 2021). The theoretical basis for a cost reduction strategy as a reactive measure can be found in contingency theory. This theory postulates that there is no single best approach for managing an organization. Rather, the most effective strategy is contingent on both the internal and external circumstances (Anwar, 2015).

However, the cost reduction strategy is not without challenges for hotel firms. Even the most common cost-cutting area during a crisis—salary expenses—could have an unintended negative impact on firm performance. With fewer staff, service quality might decline, leading to unsatisfied customers and a subsequent decline in firm performance (Luan et al., 2013). In addition, layoffs and salary cuts can trigger decreased motivation and loyalty among the remaining employees, which can affect their work productivity (Tu et al., 2021). Given this complexity, it is clear why determining which expenses to prioritize for cost reduction during a crisis is not a straightforward decision for hotel firms.

Given the significant role that an effective cost reduction strategy plays in the survival of hotel firms during crises, the current study aimed to investigate the relative importance of major operating expenses on hotels' operating profitability during normal and crisis circumstances. Specifically, to tackle the research question, the current study employed machine learning classification algorithms with the support of panel regression models. This combined approach allowed for exploiting the predictive power of machine-learning-based classification models and the high interpretability of panel regression models.

Furthermore, the COVID-19 pandemic was selected as the case for analysis owing to the aforementioned severe adverse implications of the crisis for hotel firms. That is, all hotels had to reduce their operating expenses to overcome the crisis under government-imposed lockdowns and travel restrictions, which is one of the most extreme cases of the crisis. In addition, this study used the hotel performance data of the three most popular tourist destinations in Asia—namely, Hong Kong, Japan, and Singapore—which were, ironically, the most severely impacted by the COVID-19 pandemic. Most hotels in Hong Kong, Japan, and Singapore enjoyed the highest tourist demand and maintained sizable operating resources before the COVID-19 pandemic. Therefore, the budget cuts to their operating expenses during the COVID-19 pandemic period would constitute of the most extreme examples in the history of the hotel industry.

2. LITERATURE REVIEW

2.1 A cost reduction strategy as crisis management in the hotel industry

A crisis is any single or series of events that cause a major disturbance to firms' normal business operations (Tjiptono et al., 2022). An extended record of low profits due to a prolonged crisis can threaten a firm's very existence (Evans et al., 2014). Therefore, for the continuity of business, it is essential for firm managers to have effective and sensible crisis-coping mechanisms in place. In this regard, previous literature has identified that firm managers commonly adopt the following two measures to endure a crisis: one is to reserve cash in advance in preparation for an unexpected future crisis (Asimakopoulos et al., 2019; Lozano & Yaman, 2020) and the other is to pursue cost reduction initiatives in response to a significant drop in revenue during a crisis (Hong et al., 2012). The former measure is considered an example of firms' proactive crisis management, whereas the latter is reactive.

The precautionary motive theory provides a theoretical background for managers' motive to build cash reserves to withstand crises. The cost of using internally generated cash to finance business activities is much cheaper than that of external financing (Chen & Chen, 2011). Raising cash by issuing stocks requires firms to distribute some of their earnings to shareholders in the form of dividends or share buybacks (Adedeji, 1998). In addition, borrowing cash from the credit market inevitably incurs interest payments (Beneda & Nelson, 2003). On the contrary, employing internally generated cash to fund business activities does not involve such obligations (Vanacker & Manigart, 2010). In this regard, the precautionary motive theory posits that firm managers have a precautionary motive to hoard internally generated cash to minimize the use of costly external capital to finance unforeseen future events (Lozano & Yaman, 2020). Crises typically occur when they are least expected. Therefore, from the perspective of the precautionary motive theory, a crisis can be regarded as an unforeseen future event that requires firm managers to preemptively build cash reserves to avoid the anticipated cash shortage during the crisis.

Despite the importance of preemptively building cash reserves to survive a crisis, hotel firms are generally in a difficult position with respect to reserving cash. Hotels have high fixed and operating costs, including property maintenance, staffing, utilities, and marketing (Peng et al., 2020). These regular cash outflows limit hotel firms' ability to store substantial amounts of cash (Gao et al., 2013). Moreover, with the fierce competition and rapidly changing customer trend in the hotel industry, the cycle of having to update and renovate hotel properties to attract ever-elusive customers is becoming shorter (Black et al., 2022). Indeed, the hotel industry's deeply indebted nature (i.e., its substantial reliance on debt financing) largely stems from its significant cash expenditures on maintaining, renovating, and updating fixed assets (Traver, 2021). This heavy dependency on debt financing obliges hotel firms to consistently service their debt, further straining their available cash flows. Collectively, these factors pose challenges for hotel firms in earmarking sufficient internally generated cash for future crises.

Given hotel firms' innate difficulty in implementing proactive measures against crises, their reactive approach—that is, a cost reduction strategy—could be even more vital for them to survive a crisis. A cost reduction strategy is a classic case of a top-down approach, where the top management discusses which expenses should be reduced, defines the amount of money by which the expenses should be reduced, and advises the lower-level management to perform adequate reductions to achieve a necessary savings target (Milić, 2011). As profit is essentially the difference between revenue and expenses, firm managers' attempt to reduce expenses in response to a significant decrease in revenue during a crisis could be their natural reaction to maintain a certain level of profit (Su & Tang, 2016).

Theoretically, implementing a cost reduction strategy in response to a crisis is in line with the argument of contingency theory. Contingency theory, one of the prevailing organizational theories, rests upon the premise that there is no one best way to lead an organization. Instead, the optimal course of action is contingent (dependent) on the internal and external situations (Anwar, 2015). Any internal and external environmental conditions that disrupt a firm's regular business operations could count as contingency factors that require managerial situational decision-

making (Heiens & Pleshko, 2011). For example, changes in the expectations and needs of external stakeholders, including customers, suppliers, and regulatory agencies, can influence organizational decisions and structures (Ong et al., 2019). In addition, changes in the resources available to the organization, including financial, human, and technological resources, can require an alteration of the firm's structure and strategy (Zabihi Khargh et al., 2018). Similarly, from the contingency theory perspective, the disruption of a firm's regular business operations during a crisis, coupled with the consequent sharp decline in revenue, could call for a situational modification of the firm's current cost system.

In sum, hotel firms' innate difficulty in setting aside internally generated cash for future crises could emphasize the greater need for a hotel firm to implement an effective cost reduction strategy to survive a crisis. Especially in the case of an epidemic-induced crisis, as in the cases of the SARS outbreak and COVID-19 pandemic, frequent changes in government rules and policies concerning domestic and international travel introduce great uncertainty for hotel demand. Consequently, given the great negative impact and unpredictability that crises impose on hotel demand and revenue, hotel firms' cost structure, which can still be more easily controlled by a managerial top-down approach than revenue, must be wisely managed to survive a crisis.

2.2. The major challenge that firm managers face in implementing a cost reduction strategy as crisis management

As mentioned, a crisis period is characterized by a fall in revenue, which prompts firm managers to impose strict control over expenses to maintain a certain level of profit. However, as is often cited by industry reports, when firm managers implement a cost reduction strategy, they often struggle to distinguish which expenses they should cut during a crisis (Golobrodska, 2023). Such a struggle could be attributed to the fact that although a reduction in any type of expense certainly and immediately contributes to a decrease in the firm's total expenses during a crisis, not all reduced expenses are equally effective in improving the firm's chance of surviving the crisis.

In fact, some researchers have even cast doubt on the effectiveness of the two most frequently cut expenses during a crisis in improving the chance of survival—that is, marketing and salary expenses. One of the first expenses that firm managers consider cutting during a recession is marketing expenses, based on the notion that if there are no customers to market to, there is no need for marketing activities (Currim et al., 2016). In the aftermath of the 2008 Great Recession, U.S. firms reduced their marketing spending by 18% in 2009 (Perrin, 2020). Similarly, during the COVID-19 pandemic, advertising expenditures by U.S. firms declined, though to a lesser extent, with a 10% decrease recorded (World Economic Forum, 2020).

However, after investigating U.S. firms from 1975 to 2003, O'Malley et al. (2011) provided empirical evidence that decreased marketing expenses during recessions led to greater earnings shrinkages than did decreased marketing expenses during non-recessionary periods. Similarly, Candemir and Zalluhoglu (2011) explored how Turkish firms adjusted their marketing budgets in response to the economic downturns of 2001 and 2008. They suggested that firms that

maintained or strategically allocated their marketing expenditures experienced more stable sales and were able to retain customer loyalty. In the context of the hotel industry, Singh and Dev (2015) drew a similar conclusion. During the 2008 financial crisis, U.S. hotel firms performed better than others when they invested more in marketing than in other operating areas. The above-mentioned studies shared the same underlying logic in their arguments: if a firm can afford to maintain its pre-crisis level of communication with customers during a recession, its brand voice could be heard much more clearly than the brand voices of its competitors that cut or reduced their advertising and promotion budgets.

Salary expenses represent another priority area of operating expenses that firm managers are pressured to cut during a crisis through mass layoffs or reduced compensation (Van Dalen & Henkens, 2013). Katz and Krueger (2016) found that U.S. firms often reduce employment, freeze wages, or implement hiring freezes during recessions as a means of managing costs. Similarly, Fabiani et al. (2015) utilized a cross-country firm-level survey to examine how European firms responded to the severe demand and credit contraction caused by the global Great Recession of 2009. The findings indicate that the predominant strategy adopted by firms to overcome the 2009 global recession was labor cost reduction.

However, similar to what was discussed regarding marketing expenses, reducing salaries during a crisis does not occur without a negative impact on the overall firm performance. The fear and uncertainty felt by employees due to mass layoffs or reduced compensation could be negatively reflected in the employees' motivation, potentially leading to a drop in productivity (Tu et al., 2021). In line with this view, Luan (2012) demonstrated that when publicly traded Taiwanese firms cut salaries during the 2008 crisis, it adversely affected their overall profitability, as measured by return on assets. In addition, although not directly tied to firms' profitability or accounting performance, Marshall et al. (2012) demonstrated that stock prices tend to decline in response to employee layoffs, based on evidence from the UK during the 2008 global financial crisis. They explained that, while layoffs are commonly viewed as cost-cutting measures, they often signal negative market expectations about a firm's future prospects. In the field of hospitality research, although no studies have directly examined the impact of salary reductions on firms' accounting performance during a crisis, Tu et al. (2021) conducted a survey study on theme park employees in Hubei province, China. The study uncovered that those layoffs induced by COVID-19 significantly undermined the morale and motivation of the remaining employees.

As illustrated above, the potential adverse effects of cost reductions on firm performance could challenge firm managers in deciding where to cut spending to maximize the firm's chances of weathering a crisis. However, both within the hospitality research and in academia at large, there has been limited effort to examine the relative significance of various expense reductions in terms of enhancing the chances of surviving a crisis. In the hospitality field, the study by Amrik and Chekitan (2015), which was introduced above, is the sole investigation into the impact of a cost reduction strategy on firm performance during a crisis. Similarly, research outside of hospitality on cost reduction as crisis management has primarily centered on the impact of reducing individual expense items on firm performance during a crisis. Therefore, given the research gap in the existing literature and the great implication that an effective cost reduction

strategy has for the survival of hotel firms during crises, it is essential to identify which expenses need to be prioritized for cost reduction to improve the chance of surviving a crisis.

3. METHODOLOGY

3.1 Sample data

The sample of this study comprised the property-level operating performance of hotels in Hong Kong, Japan, and Singapore from 2017 to 2022—that is, during the pre-COVID pandemic years (2017–2019) and during the COVID-19 pandemic years (2020–2022). The data were gathered by STR (formerly known as Smith Travel Research) and contained 127 hotels (631 observations), including 30 hotels in Hong Kong (150 observations), 51 hotels in Japan (262 observations), and 46 hotels in Singapore (219 observations), with some missing data.

3.2 Variables

This study used a hotel's operating profitability ratio (EBITDA / Total Revenue) to measure business performance—namely, earnings before interest, tax, depreciation, and amortization (EBITDA) over total revenue. Further, for a dependent variable, this study used a dummy variable: 1 for hotels with a stronger business performance (EBITDA / Total Revenue) than other hotels (Good Performer) and 0 for hotels with a weaker business performance (EBITDA / Total Revenue) than other hotels (Poor Performer) each year in each destination.

For operating management practices, this study used the salary expense ratio (Salary / Total Revenue) of the rooms and food and beverage departments and the total expense ratio (Expense / Total Revenue) of the marketing and administrative and general departments as independent variables during the pre-COVID-19 pandemic (2017–2019) and COVID-19 pandemic (2020–2022) periods. We only included salary expenses in the rooms and food and beverage departments because the other expenses (e.g., cost of goods sold) were mostly variable costs, which would directly change with changes in revenue.

This study included the service type dummy (full service or limited service), hotel class (luxury, upper-upscale, upper midscale, upscale, midscale, and economy), hotel location (urban, suburban, resort, airport, and small metro/town), destination (Hong Kong, Japan, and Singapore), and year dummy variables for control variables.

3.3 Statistical models

To identify how one hotel could consistently perform better than others, this study utilized machine learning classification algorithms to compare the impacts of hotel management practices (Salary Expense or Departmental Operating Expense / Total Revenue) on operating performance (EBITDA / Total Revenue) between hotels with higher operating profitability and lower operating profitability during the pre-crisis (2017–2019) and crisis (2020–2022) periods.

Machine learning classification algorithms use predetermined input training data (e.g., debts, profits, assets, and sales) and predict the probability of whether the subsequent or future data will fall into the predetermined categories (e.g., bankrupt or not bankrupt; Kotsiantis et al., 2007). One important statistic of the machine learning classification algorithm is its classification accuracy, measured by the model prediction performance in the subsequent dataset. This study entailed analyzing the model accuracy between three different statistical classification models—namely, logistic regression, decision tree, and random forest models—and confirming the relative importance of hotel management practices in each department to achieve stronger operating profitability based on the most accurate model. In all three models, 70% of the sample was randomly split for training and the rest (30%) was used to test the model accuracy.

3.3.1 Logistic regression model

In the model, Y denotes the binary outcome of interest—1 for hotels that have higher operating profitability (EBITDA / Total Revenue) than the industry average each year in each destination (Good-performing hotel) and 0 for hotels that have lower operating profitability (EBITDA / Total Revenue) than the industry average each year in each destination (Poor-performing hotel)—and X_1,…., X_9 are the explanatory variables—X_1 is a ratio of rooms department salaries over total revenue (Rooms Salary/ Total Revenue), X_2 is a ratio of food and beverage department salaries over total revenue (Food and Beverage Salary/ Total Revenue), X_3 is a ratio of total marketing expenses over total revenue (Marketing / Total Revenue), X_4 is a ratio of total administrative and general expenses over total revenue (Administrative and General / Total Revenue), X_5 is a full-service dummy variable (Full), X_6 is a categorical variable of the destination (Destination), X_7 is a categorical variable of hotel class (Hotel Class), X_8 is a categorical variable of hotel location (Hotel Location), and X_9 is a year dummy variable (Year). Then, the logistic regression model is the conditional probability P(Y = 1| X_1,…., X_9) to X_1,…., X_9 through

$$P(Y = 1| X_1,\ldots, X_9) = \frac{\exp(\beta_1 X_1 + \cdots + \beta_9 X_9)}{1+\exp(\beta_1 X_1 + \cdots + \beta_9 X_9)},$$

where $\beta_0, \ldots, \beta_9$ are regression coefficients.

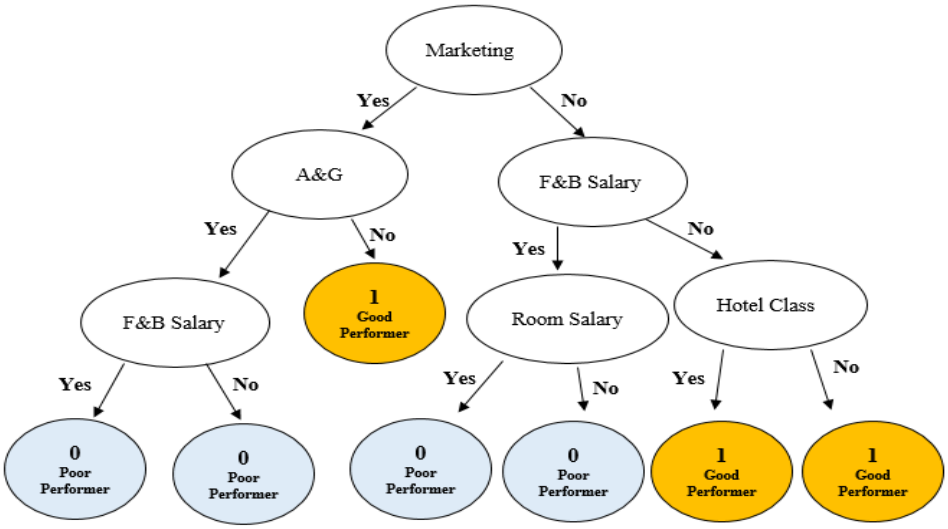
3.3.2 Decision tree model

A decision tree model is aimed at determining the best splits to subset the data. For example, a decision tree model splits hotels by their operating expense ratios and hotel characteristics (e.g., Room Salary, Food and Beverage Salary, Marketing, Administrative and General, Hotel Class) to identify why certain hotels have consistently higher operating profitability than others and what the most important operating expense is for better business performance. The decision tree model calculates the hotel's management practice distributions based on different attributes and prioritizes their importance to find the best data split criterion (e.g., nodes and branches of the tree). The Gini impurity index is a popular and straightforward method for splitting the data.

$$GI = 1 - \sum_{i=1}^{C}(p_i)^2$$

Here, C is the total number of classes and p is the probability of selecting a data point.

Figure 1. Decision Tree Model

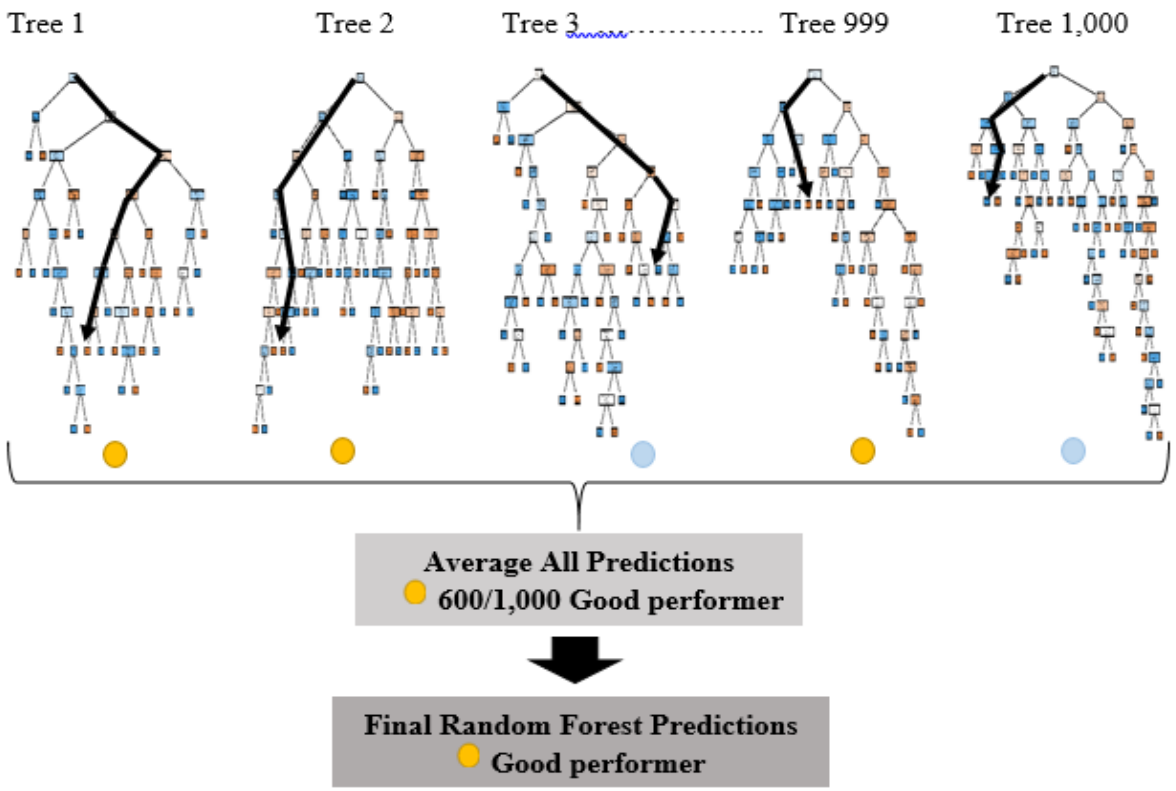


Here, 1 represents hotels that have higher operating profitability (EBITDA / Total Revenue) than other hotels and 0 represents hotels that have lower operating profitability than other hotels in each year, in each destination.

3.3.3 Random forest model

A random forest model (Breiman, 2001) is one of the most successful machine learning classification algorithms (Biau & Scornet, 2016) for distinguishing the management practices of hotels that have performed consistently better from those of hotels that have performed consistently worse during the recent four years. "Random forests are a combination of tree predictors such that each tree depends on the values of a random vector sampled independently and with the same distribution for all trees in the forest" (Breiman, 2001, p. 5). That is, a random forest model develops multiple decision trees with randomly selected subset data and then combines the various outcomes from these numerous decision trees to find a single best conclusion, where each decision tree is aimed at finding the best split to subset data based on a set of decision rules. By adopting multiple decision trees, the random forest model reduces the risk of overfitting and improves the model's accuracy. From the random forest model, we can further identify the comparative importance of each operating expense of a hotel to have higher operating profitability than other hotels (or to be classified as a better performer) during a crisis.

Figure 2. Random Forest Model



3.3.4 Fixed-effects regression model

This study included a fixed-effects regression model only to support the interpretability of the findings from the random forest models.

$$Y_1 = \beta_0 + \beta_1 * RoomSalary + \beta_2 * F\&BSalary + \beta_3 * Marketing + \beta_4 * A\&G + \beta_5 * Full + \beta_6 * Destination + \beta_7 * HotelClass + \beta_8 * Location + \beta_9 * Year + \epsilon$$

Here, Y_1 is the hotel's operating profitability ratio (EBITDA / Total Revenue), and the model uses the heteroscedasticity robust standard error to control the endogeneity issue.

4. STATISTICAL RESULTS

4.1 Descriptive statistics

As shown in Table 1, the operating profitability ratio (EBITDA / Total Revenue) of hotels in Hong Kong (0.31) and Singapore (0.29) was quite similar, but it was slightly low in Japan (0.17) before the COVID-19 pandemic (2017, 2018, and 2019). During that period, the operating profitability ratio gap between good-performing (0.35) and poor-performing (0.15) hotels was 0.20, but it became 0.38 and wider (0.19 in good-performing hotels and −0.19 in poor-performing hotels) during the COVID-19 pandemic period. In terms of operating expense ratios, the rooms department salary ratio (Room Salary / Total Revenue), marketing expense ratio

(Marketing / Total Revenue) and administrative and general expense ratio (Administrative and General / Total Revenue) were very similar between good- and poor-performing hotels (6–7% of total revenue) during the pre-COVID-19 pandemic years. However, all operating expense ratios of good-performing hotels became lower than those of poor-performing hotels during the COVID-19 pandemic years (rooms department salary ratio [0.09 vs. 0.11], food and beverage department salary ratio [0.13 vs. 0.21], marketing expense ratio [0.07 vs. 0.09], and administrative and general expense ratio [0.09 vs. 0.11]), which widened the operating profitability ratio gap between them. Interestingly, the food and beverage department salary ratio (Food and Beverage Salary / Total Revenue) was the hotels' highest operating expense ratio in all destinations during the pre-COVID-19 and COVID-19 pandemic periods. As we expected, the occupancy percentage (e.g., 82.82% on average) was very similar among the hotels in Hong Kong (83.76%), Japan (81.62%), and Singapore (83.57%) before the COVID-19 pandemic period (2017, 2018, and 2019).

Table 1. Descriptive Statistics

		2017–2022			2017–2019			2020–2022		
		All	**Good**	**Poor**	**All**	**Good**	**Poor**	**All**	**Good**	**Poor**
EBITDA / Total Revenue	HK	0.12	0.24	−0.01	0.31	0.38	0.25	−0.16	0.05	−0.38
	JP	0.04	0.20	−0.13	0.17	0.29	0.05	−0.13	0.09	−0.36
	SP	0.27	0.39	0.15	0.29	0.39	0.19	0.25	0.39	0.10
	All	**0.13**	**0.28**	**−0.00**	**0.25**	**0.35**	**0.15**	**0.00**	**0.19**	**−0.19**
Room Salary / Total Revenue	HK	0.10	0.09	0.12	0.08	0.07	0.09	0.13	0.11	0.15
	JP	0.08	0.08	0.08	0.06	0.07	0.06	0.10	0.09	0.12
	SP	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	All	**0.09**	**0.08**	**0.09**	**0.07**	**0.07**	**0.07**	**0.10**	**0.09**	**0.11**
Food and Beverage Salary / Total Revenue	HK	0.15	0.12	0.18	0.11	0.10	0.13	0.21	0.16	0.26
	JP	0.16	0.14	0.18	0.13	0.12	0.14	0.20	0.16	0.23
	SP	0.10	0.07	0.12	0.09	0.08	0.10	0.10	0.06	0.15
	All	**0.14**	**0.11**	**0.16**	**0.11**	**0.10**	**0.13**	**0.17**	**0.13**	**0.21**
Marketing / Total Revenue	HK	0.07	0.06	0.07	0.06	0.05	0.06	0.08	0.07	0.09
	JP	0.08	0.07	0.09	0.06	0.06	0.07	0.09	0.08	0.11
	SP	0.07	0.06	0.07	0.07	0.06	0.07	0.06	0.05	0.07
	All	**0.07**	**0.06**	**0.08**	**0.06**	**0.06**	**0.07**	**0.08**	**0.07**	**0.09**
Administrative and General / Total Revenue	HK	0.09	0.08	0.10	0.07	0.06	0.07	0.12	0.11	0.13
	JP	0.08	0.07	0.08	0.07	0.07	0.07	0.09	0.08	0.11
	SP	0.09	0.09	0.09	0.08	0.08	0.09	0.10	0.10	0.10
	All	**0.09**	**0.08**	**0.09**	**0.07**	**0.07**	**0.07**	**0.10**	**0.09**	**0.11**
Occupancy %	HK	66.47	70.91	61.92	83.76	85.33	82.16	41.25	49.97	32.23
	JP	63.13	62.92	63.36	81.62	80.01	83.25	40.92	42.72	39.02
	SP	77.00	81.83	72.05	83.57	86.07	80.98	69.88	77.19	62.42
	All	**68.74**	**71.37**	**66.04**	**82.82**	**83.39**	**82.23**	**51.66**	**56.87**	**46.26**
ADR	HK	216	223	209	256	283	229	157	135	180
	JP	293	333	253	300	362	238	285	298	270
	SP	170	159	182	200	195	206	138	120	157
	All	**232**	**246**	**218**	**256**	**286**	**225**	**203**	**198**	**209**
RevPAR	HK	147	163	132	213	238	186	52	53	52
	JP	177	203	150	240	279	200	102	113	89
	SP	126	125	127	165	166	164	84	81	87
	All	**152**	**167**	**138**	**208**	**231**	**185**	**85**	**89**	**80**
Observations	HK	150	76	74	89	45	44	61	31	30
	JP	262	133	129	143	72	71	119	61	58
	SP	219	111	108	114	58	56	105	53	52
	All	**631**	**320**	**311**	**346**	**175**	**171**	**258**	**145**	**140**

Note: HK represents Hong Kong, JP represents Japan, and SP represents Singapore

Figure 3 shows the distinctive difference in operating profitability ratio (EBITDA / Total Revenue) between good-performing and poor-performing hotels, especially during the COVID-19 pandemic period.

Figure 3. Operating Performance of Good-Performing Hotels vs. Poor-Performing Hotels

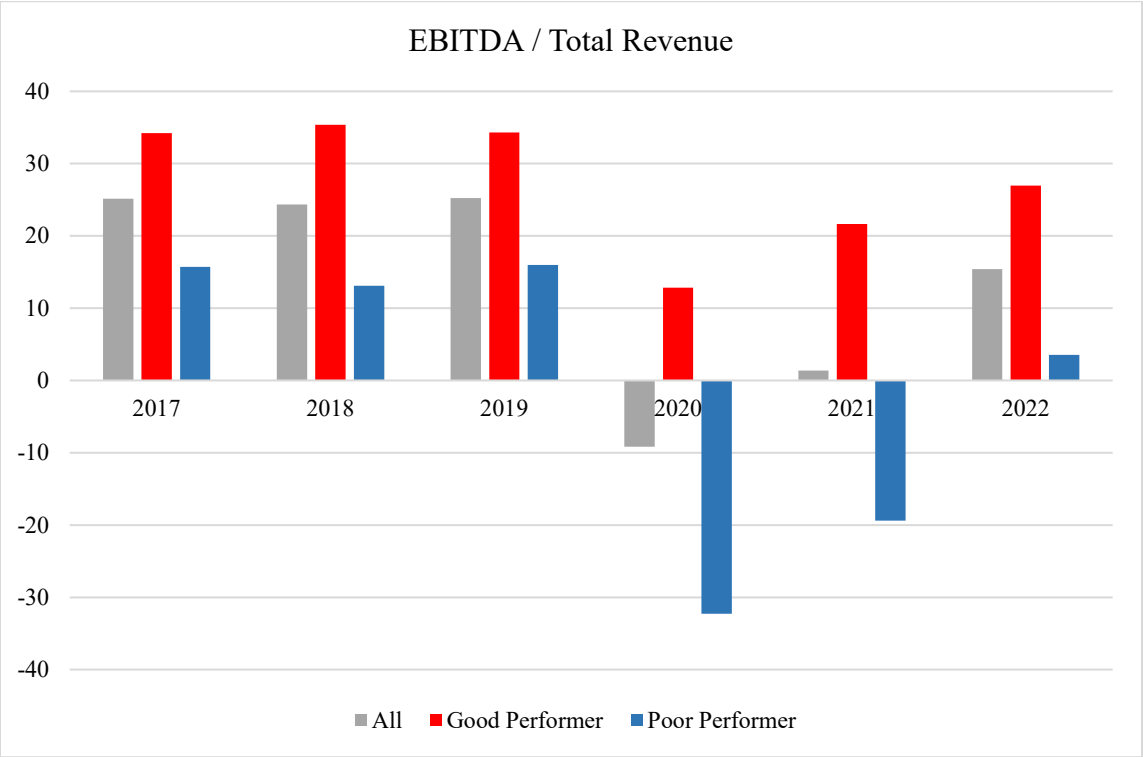
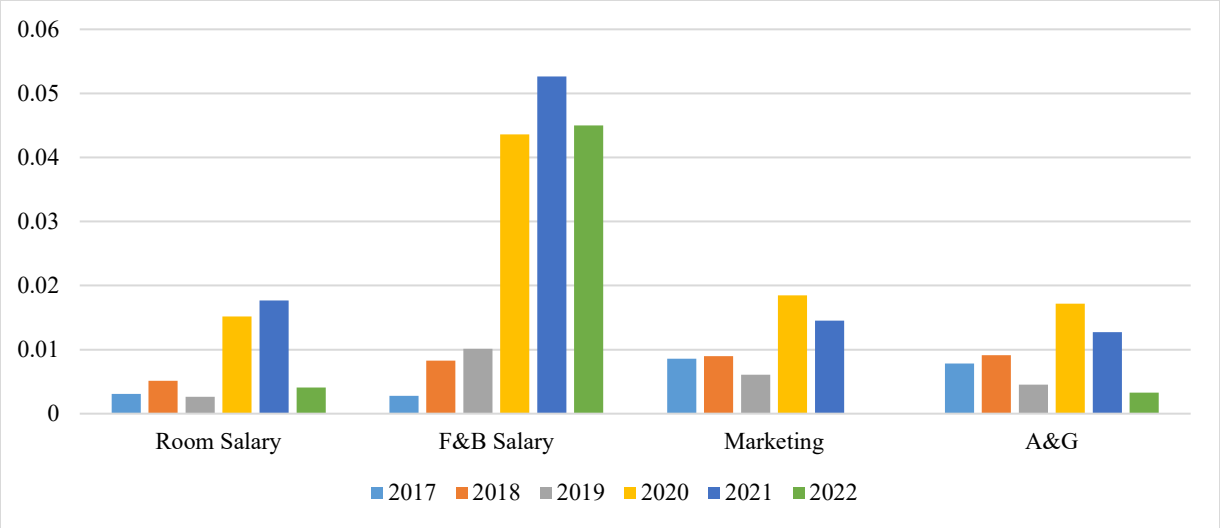


Figure 4 illustrates clearly the discrepancy in the operating expense management practices of good-performing and poor-performing hotels: subtraction of the operating expense ratio between poor-performing hotels and good-performing hotels. In all operating expense ratios, the poor-performing hotels had higher expense ratios than good-performing hotels. The poor-performing hotels spent more on food and beverage and rooms departments salaries, marketing expenses, and administrative and general expenses than good-performing hotels relative to their total revenue, especially during the COVID-19 pandemic years, thus representing the inefficient operating expense management practices of the poor-performing hotels. In particular, the food and beverage department salary ratio of poor-performing hotels was significantly higher than that of good-performing hotels during the COVID-19 pandemic years. The figures indicated the stickiness of food and beverage salaries in poor-performing hotels.

Figure 4. Operating Expense Ratio Gaps (Poor-Performing Hotels – Good-Performing Hotels)



4.2 Statistical analysis

In terms of the model accuracy, the results confirmed that the random forest model had the highest accuracy of all models over the different periods. The model accuracy of the logistic regression, decision tree, and random forest models was 0.5211, 0.6526, and 0.7474, respectively, when the hotel's performance data included all years (2017–2022). The random forest model improved the model accuracy by more than 22 and 9 percentage points compared to the logistic regression and decision tree models, respectively. As shown in Table 2, the model accuracy was calculated by the true good performer (74) and true poor performer (68) overall cases ((74 + 68) / (74 + 68 + 26 + 22) = 0.7474). In addition, the true good performer rate of the random forest model was 77.08% (= 74 / (74 + 22)) and the false good performer rate of the random forest model was 27.66% (= 26 / (26 + 68)).

Table 2. Confusion Matrix of the Random Forest Model

2017–2022		Predicted	
		Poor Performer	Good Performer
Actual	Poor Performer	68	26
	Good Performer	22	74

Furthermore, we identified the relative importance of each operating expense for the hotel's higher operating profitability in the random forest model. As shown in Figure 6, the efficiencies of the marketing expenses and food and beverage department salaries were the two most critical operating expenses to be classified as good-performing hotels during pre-COVID-19 and COVID-19 pandemic years (between 2017 and 2022). The relative importance of the four most significant operating expenses was the food and beverage department salaries (0.2260), marketing expenses (0.1966), administrative and general expenses (0.1896), and rooms department salaries (0.1644), in order (a higher score represented higher importance to be classified as good-performing hotels; Soman, 2023). The random forest model included 1,000 decision trees, as shown one of the decision trees in Figure 7, and predicted the probability of a hotel being a good-performing hotel

based on these (e.g., good-performing hotels were blue color and poor-performing hotels were brown color).

Figure 6. Relative Importance of Operating Expense for Higher Profitability (2017–2022)

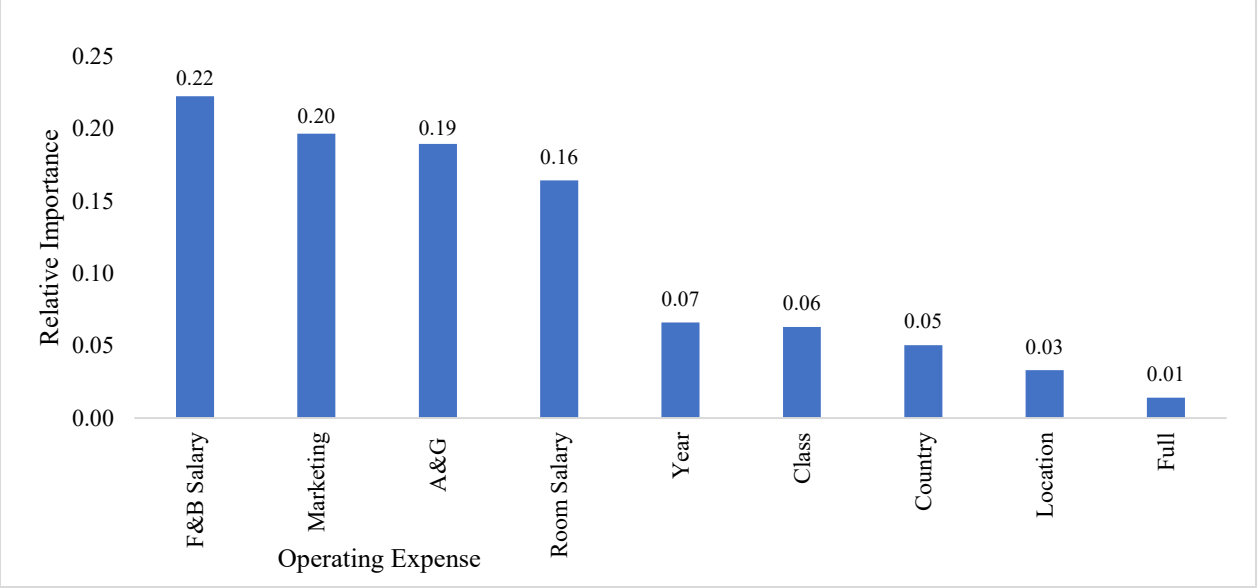
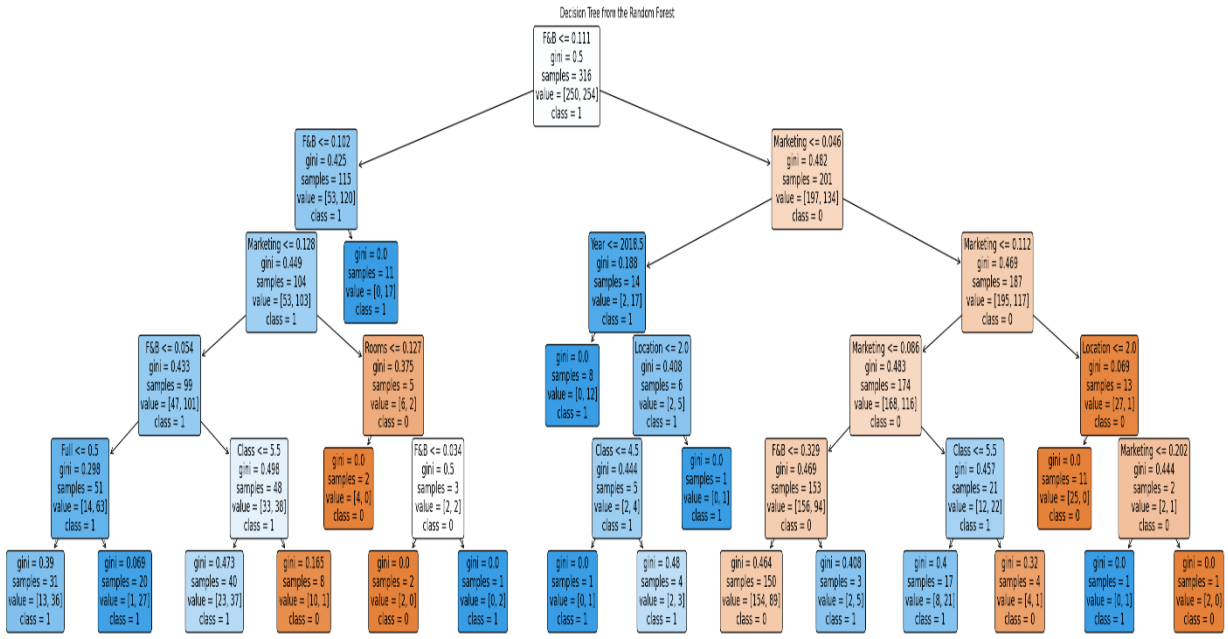


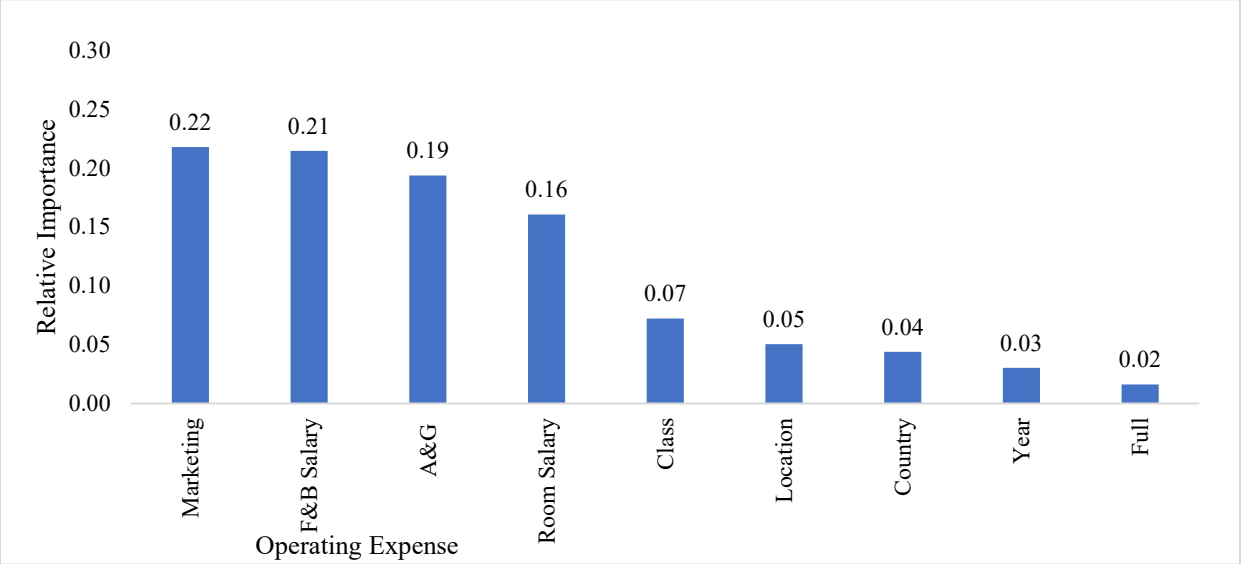
Figure 7. Example of the Actual Random Forest Model Outcome (2017–2022)



However, as shown in Figure 8, the two most important operating expense for a hotel's higher operating profitability (to be classified as good-performing hotels) was marketing expenses and food and beverage department salaries during the pre-COVID-19 period (between 2017 and 2019). The relative importance of the four most significant operating expenses was marketing expenses (0.2178), food and beverage department salaries (0.2147), administrative and general

expenses (0.1938), and rooms department salaries (0.1605), in order, during the pre-COVID-19 pandemic years (a higher score represented higher importance to be classified as good-performing hotels). The model accuracy of the random forest model was 0.7212, and for the logistic regression and decision tree models, it was 0.5673 and 0.6346, respectively. The random forest model improved the model accuracy by more than 15 and 8 percentage points, respectively, compared to the logistic regression and decision tree models.

Figure 8. Relative Importance of Operating Expense for Higher Profitability (2017–2019)



As shown in Table 3, the model accuracy was calculated by the true good performer (74) and true poor performer (68) overall cases ((37 + 38) / (37 + 38 + 13 + 16) = 0.7212). In addition, the true good performer rate of the random forest model was 69.81% (= 37 / (37 + 16)) and the false good performer rate of the random forest model was 25.49% (= 13 / (38 + 13)).

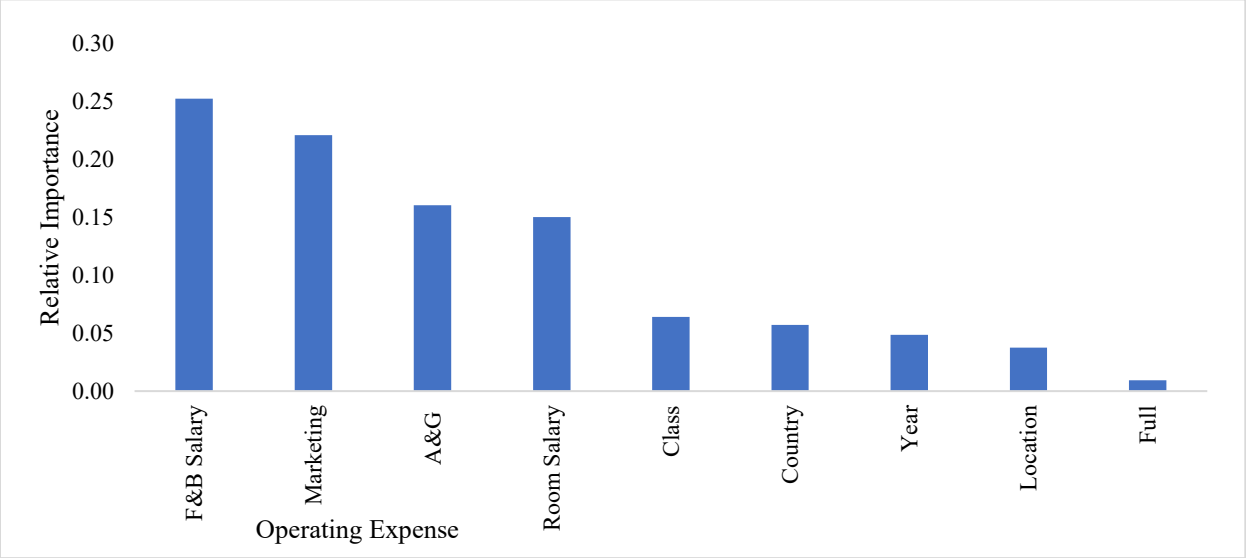
Table 3. Confusion Matrix of the Random Forest Model

2017–2019		Predicted	
		Poor Performer	Good Performer
Actual	Poor Performer	38	13
	Good Performer	16	37

More significantly, the two most important operating expenses for a hotel's higher operating profitability was food and beverage department salaries and marketing expenses during the COVID-19 pandemic years (between 2020 and 2022), as shown in Figure 9. The relative importance of operating expenses was food and beverage department salaries (0.2522), marketing expenses (0.2209), administrative and general expenses (0.1604), and rooms department salaries (0.1502), in order, during the crisis years (a higher score represented higher importance to be classified as good-performing hotels). The model accuracy of the random forest model was 0.7674, whereas the model accuracy of the logistic regression and decision tree models was 0.5698 and 0.6163, respectively. The random forest model improved the model

accuracy by more than 19 and 15 percentage points, respectively, compared to the logistic regression and decision tree models.

Figure 9. Relative Importance of Operating Expense for Higher Profitability (2020–2022)



As shown in Table 4, the model accuracy was calculated by the true good performer (34) and true poor performer (32) overall cases ((34 + 32) / (34 + 32 + 10 + 10) = 0.7674). In addition, the true good performer rate of the random forest model was 77.27% (= 34 / (34 + 10)) and the false good performer rate of the random forest model was 23.81% (= 10 / (32 + 10)).

Table 4. Confusion Matrix of the Random Forest Model

2020–2022		Predicted	
		Poor Performer	Good Performer
Actual	Poor Performer	32	10
	Good Performer	10	34

Table 5 indicates that hotels should reduce salary or operating expense ratios to improve their operating profitability. Overall, the food and beverage department salary ratio (Food and Beverage Salary / Total Revenue) had the most significant negative impact (−2.5563, $p < 0.01$) and the marketing expense ratio (Total Marketing Expense / Total Revenue) had the second most significant negative impact (−1.1757, $p < 0.05$) on the operating profitability of a hotel during 2017 and 2022. However, the lower marketing expense ratio (Total Marketing Expense / Total Revenue) was the most important factor (−2.7690, $p < 0.01$) and the lower food and beverage department salary expense (Food and Beverage Salary / Total Revenue) was the second most important factor (−1.6727, $p < 0.01$) for the higher operating profitability of hotels during the pre-COVID-19 pandemic period (2017–2019). More importantly, the food and beverage department salary ratio (Food and Beverage Salary / Total Revenue) showed the most significant negative impact (−1.9922, $p < 0.01$) and the administrative and general expense ratio (Total Administrative and General Expense / Total Revenue) presented the second most significant negative impact (−1.4366, $p < 0.01$) on the operating profitability of hotels during the COVID-19 pandemic period

(2020–2022). The findings support the interpretability of the results from the random forest classification models: hotels would have higher operating profitability if they could lower the proportion of the food and beverage department's salary expenses or total operating expenses in the marketing department.

Table 5. Impact of Operating Expenses on Operating Profitability

	EBITDA / Total Revenue		
	2017–2022	2017–2019	2020–2022
Room Salary / Total Revenue	−0.9025** (0.3794)	−1.3868*** (0.2151)	−0.9171 (0.5589)
Food and Beverage Salary / Total Revenue	−2.5536*** (0.5360)	−1.6727*** (0.2773)	−1.9922*** (0.2967)
Total Marketing Expense / Total Revenue	−1.7357** (0.6965)	−2.7690*** (0.6137)	−1.1415* (0.6557)
Total Administrative and General Expense / Total Revenue	−1.6114*** (0.4681)	−0.1782 (0.5839)	−1.4366*** (0.3165)
Full	0.1025 (0.0825)	-	0.0088 (0.0343)
Destination	-	-	-
Hotel Class	−0.0011 (0.0200)	0.0227 (0.0176)	0.0390** (0.0158)
Location	-	-	-
Year	−0.0027 (0.0055)	0.0037 (0.0031)	0.3897*** (0.0124)
Constant	0.6880*** (11.447)	−6.7957 (6.1167)	−78.2745*** (25.1021)
Observations	631	346	285
Adjusted R^2	0.7812	0.5627	0.6215

Note: *significant at 10%; **significant at 5%; ***significant at 1%; parentheses show the heteroscedasticity robust standard error.

5. CONCLUSIONS

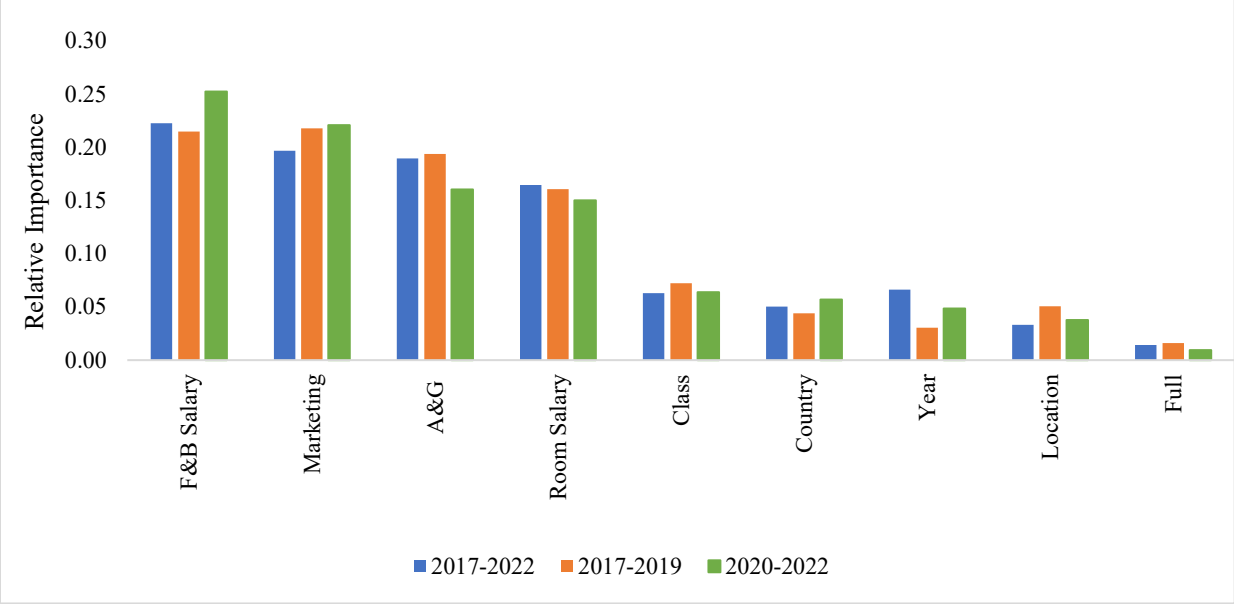
5.1. General discussions

The four major operating expense ratios of hotels (rooms department salaries, food and beverage department salaries, marketing expenses, and administrative and general expenses) were very similar between good-performing and poor-performing hotels in Hong Kong, Japan, and Singapore during the pre-COVID-19 pandemic years. The largest operating expense ratio difference between good-performing and poor-performing hotels was 3 percentage points even though the operating profitability ratio was 24, 20, and 13 percentage points higher in good-performing than in poor-performing hotels in Japan, Singapore, and Hong Kong during the pre-

COVID-19 pandemic years. Whereas in the aspects of RevPAR, the good-performing hotels had $79, $52, and $2 higher than poor-performing hotels in Japan, Hong Kong, and Singapore, respectively, during the pre-COVID-19 pandemic years (refer to Table 1). In summary, the operating profitability of hotels depended mostly on the effectiveness of revenue generation rather than the efficiency of cost management during the pre-COVID-19 pandemic years. This is because larger revenues could reduce the relative proportion of other operating expenses through economies of scale, including rooms and food and beverage costs, which ultimately increased their operating profitability more than operating expenses.

The random forest classification model also indicated that, in general, the salary expense in the food and beverage department and the marketing expenses were the two most important operating expenses for hotels to perform higher operating profitability (Figure 10). However, the relative importance of operating expenses during the pre-COVID-19 pandemic period was different from that during the COVID-19 pandemic period. More specifically, the efficiency of marketing expenses was the most important for good-performing hotels during the pre-COVID-19 pandemic period, while the efficiency of the salary expense in the food and beverage department was the most important for good-performing hotels during the COVID-19 pandemic period. Figure 10 also indicates that the importance of efficient staff management in the food and beverage department was amplified more than that of other departments and became the most critical factor in achieving higher operating profitability of hotels during the COVID-19 pandemic period. In addition, the random forest classification model confirmed that rooms department salaries were the most efficient operating expense for achieving higher operating profitability. Yet there was room for improvement in marketing expenses and food and beverage salary management to enhance operating profitability during the pre-COVID-19 pandemic period.

Figure 10. Relative Importance of Operating Expense for Higher Profitability



The fixed-effects regression model also supported that lower marketing expense (Marketing Expenses / Total Revenue) and food and beverage salary ratios (Food and Beverage Salary / Total Revenue) increased the operating profitability of hotels during the pre-COVID-19 pandemic years. However, the fixed-effects regression model specified that a lower food and beverage salary ratio (Food and Beverage Salary / Total Revenue) and administrative and general expense ratio (Total Administrative and General Expense / Total Revenue) increased the operating profitability (EBITDA / Total Revenue) of hotels during the COVID-19 pandemic years, which was somewhat different from the findings of the random forest classification model in relative importance.

During the COVID-19 pandemic period, the operating profitability difference between good-performing and poor-performing hotels widened. For example, the operating profitability ratio was 45, 43, and 29 percentage points higher in good-performing than in poor-performing hotels in Singapore, Hong Kong, and Japan, respectively, during the COVID-19 pandemic years, representing much larger gaps than those during the pre-COVID-19 pandemic years. The operating expense ratio differences were also larger between good-performing and poor-performing hotels during this period. The food and beverage department salary ratio especially was 10, 9, and 7 percentage points higher in poor-performing than in good-performing hotels in Hong Kong, Singapore, and Japan, respectively, between 2020 and 2022. In contrast, the RevPAR of the good-performing hotels showed $24, $1, and −$6 higher than in the poor-performing hotels in Japan, Hong Kong, and Singapore, respectively, during the COVID-19 pandemic years (refer to Table 1). That is, the findings indicate that the operating profitability of hotels depended more on the effectiveness of their operating expense management, including food and beverage salaries, rather than revenue enhancement.

The focus on efficient management of F&B salaries could be closely tied to the unique challenges posed by disease-related crises such as COVID-19. Unlike typical economic downturns, where reduced discretionary spending leads to a decline in hospitality consumption, the pandemic introduced an additional layer of fear—concerns about disease transmission. This fear was particularly acute in venues with large gatherings, such as restaurants. Moreover, major revenue drivers for hotel F&B, including banquets, events, and conferences, were largely canceled or postponed. In this challenging environment, hotels that effectively optimized F&B salary costs had a greater chance of surviving the impact of COVID-19, while those that failed to do so faced greater difficulties. This disparity likely played a crucial role in distinguishing hotels that successfully adapted from those that struggled to navigate the crisis.

Regarding model accuracy, the random forest classification model represented a better machine learning classification algorithm than the logistic regression and decision tree models. The random forest classification model showed 22 and 9 percentage points higher model accuracy during 2017 and 2022, 15 and 8 percentage points higher model accuracy during 2017 and 2019, and 19 and 15 percentage points higher model accuracy during 2020 and 2022 compared to the logistic regression and decision tree models, respectively. Therefore, we drew all our conclusions from the results of the random forest classification models, and the fixed-effects regression models only supported the interpretations regarding operating expense management.

5.2. Implications

During both the pre-COVID-19 pandemic and COVID-19 pandemic periods, the rooms department salary expenses were the most efficient operating expense concerning the operating profitability of hotels. By contrast, marketing and food and beverage salary expenses were less efficient operating expenses than the rooms department salary expenses during the pre-COVID-19 pandemic and COVID-19 pandemic years. Hotel managers tightly controlled the budget and revenue management strategies of the rooms department and yielded the most from them during normal business circumstances. Therefore, there may not have been much room left for efficiency improvements in the rooms department, especially for human resource management, even in a crisis situation.

The noteworthy areas where hotels could have performed better in terms of revenue generation and operating profitability during the COVID-19 pandemic were the marketing and food and beverage departments. In particular, this study confirmed that the salary expense ratio in the food and beverage department was much higher than the operating expense ratios in other departments during the COVID-19 pandemic years. The findings of this study clearly exemplify the stickiness of food and beverage salaries during the COVID-19 pandemic. In this sense, the human resource management of the food and beverage department will be a heavy burden if hotels cannot increase revenue either in-house or outside the hotel property (Mun et al., 2022). Explicitly, hotel managers should develop innovative and flexible food and beverage management strategies (e.g., outsourcing restaurants or technological advancement) not only for normal business conditions but also for probable crisis circumstances (Mun et al., 2019).

The findings of the current study also provide important insights into the role of governments during times of a disease-related crisis, such as COVID-19. The current study highlights that during the COVID-19 pandemic, the inability to generate sufficient revenue relative to F&B salary expenditures was a key factor distinguishing good-performing hotels from poor-performing hotels. However, resorting to indiscriminate staff reductions or salary cuts to align F&B payroll with reduced business activity can have adverse effects on profitability. As discussed in Section 2.2, such measures can demoralize remaining employees, negatively impacting their productivity and work efficiency. Furthermore, if F&B staff reductions occur, the return to normal business operations entails significant rehiring costs, including search expenses and retraining efforts, which further strain resources.

To address these challenges, many governments introduced policies to subsidize payroll expenses for industries severely impacted by the pandemic. For example, in the United Kingdom, the Coronavirus Job Retention Scheme (CJRS) supported employers by covering a significant portion of employees' wages, enabling businesses to retain staff despite reduced operations (Pengelly, 2022). In addition, Canada implemented the Canada Emergency Wage Subsidy (CEWS), which provided subsidies of up to 75 percent of employees' wages to help businesses maintain their workforce and weather the economic downturn caused by the

pandemic (Smart, 2020). Such initiatives can help alleviate the financial burden associated with F&B salary expenditures during crises while preserving workforce stability.

Theoretically, although COVID-19 posed significant challenges to the hotel industry, it ironically presented an invaluable opportunity to reaffirm the principles of contingency theory. As discussed previously, this theory essentially asserts that there is no universal business strategy, structure, or process that guarantees success; rather, success is always contingent on the prevailing internal or external environmental situation (Anwar, 2015). COVID-19 had a tremendous negative external impact on the hotel industry, not only due to the sheer magnitude of its negative effects but also due to its extended duration. Therefore, COVID-19 granted an unparalleled opportunity to evaluate the performance of hotel firms based on their adaptability and response to the dominant external challenges presented by the pandemic.

Moreover, contingency theory predominantly emphasizes the role of leader-driven, top-down organizational adjustments in determining business success amid diverse internal and external challenges, rather than changes and innovations arising at the grassroots level or among frontline employees (Benmira & Agboola, 2021). In this regard, examining cost management strategies in response to COVID-19—which is one of the most typical examples of firms' top-down measures—aligns closely with the foundational premises of contingency theory. The results of the current study clearly show that alterations to a hotel firm's current cost structure during the COVID-19 pandemic could result in marked variation in the firm's operating profitability. These results underscore the importance of aptly adjusting existing business practices in response to shifting business environments—a sentiment that resonates with the core idea of contingency theory.

In terms of model development, this study took advantage of machine learning classification algorithms and the panel regression model. That is, we can confirm the relative importance of operating expenses based on the random forest model and interpret the causal relationships (e.g., direction of expense management) between operating expenses and operating profitability with the support of the panel regression model. This is because the machine learning classification algorithms cannot tell whether hotel managers should reduce or increase certain operating expenses to improve their operating profitability, although they can identify which operating expense is more critical to be classified as a good-performing hotel. By contrast, the regression model can indicate whether hotel managers should reduce or increase certain operating expenses to improve their operating profitability. Using this approach allows us to answer what operating expense hotel managers should control the most or the least to minimize adverse impacts on operating profitability during a crisis.

5.3. Limitations and Future Research

According to contingency theory, the central theoretical framework of this study, the optimal solution for an organization facing a problem varies based on the specific cause and nature of the issue (Anwar, 2015). This indicates the need for caution when extending the findings of this study to crises in the hotel industry arising from different origins. As previously mentioned, the factors underlying the negative impact of a disease-related crisis, such as COVID-19, on the hospitality industry may significantly differ from those driving the adverse effects of a typical

economic downturn. During typical economic downturns, reduced discretionary spending might lead to decreased hospitality consumption. Conversely, during a disease-related crisis, fear of human contact and infection is likely to play a more prominent role in dampening demand in the sector. As a result, the generalizability of this study's findings to crises stemming from distinct causes may be limited.

In addition, due to data availability, we could not test the long-term effects of operating expense reduction on operating performance, even though cost reductions can have unexpected negative long-term effects. For example, heavy employee layoffs can lower employee morale and cause severe difficulties in rehiring staff in the future. In this sense, examining the long-term effects of the cost reduction practices on operating performance will be an important topic for future studies. In addition, this study can be extended to other developed countries, including the United States and European countries, which adopted less strict government-imposed lockdowns and travel restrictions during the COVID-19 pandemic years. Consequently, the impact of hotels' operating expenses or human resource management practices on their operating performance in other developed countries would be different from those of hotels in Hong Kong, Japan, and Singapore.

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