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Load Factor, Service Failures and Customer Complaints in US Airline Industry.

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Load factor, service failures and customer complaints in US airline industry.

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ABSTRACT

Comprehension of customer complaints is regarded as an essential factor for firms to recognize the service problem to recover the service. This study objective is to investigate the relationship between load factor, service failures, and customer complaints in the US airline industry by analyzing the panel data. In particular, the lagged effect and nonlinear relationship between load factor, service failure and customer complaints. The results reveal that the load factor has a positive effect on service failure. Furthermore, the load factor and the indicators of service failure which are airline cancellation, delay, and mishandled baggage have a lagged effect on customer complaints. Finally, the airline cancellations, delay, and load factor show the non-linear relationship with customer complaints in the airline industry. Contributions of this paper are twofold. First, the effects of load factor and service failures on customer complaints were able to be detected accurately, by using longitudinal data. Secondly, empirical results provide implications to the existing body of knowledge on service failure and service quality, and proposed findings can provide implications for airline management.

Keywords: Customer complaints, service failure, load factor, airline, panel data

1. Introduction

It is commonly acknowledged that the aviation sector plays a significant role in current global economy. One of the most commonly effective performance metrics in the airline industry is the passenger load factor of an aircraft (Mayer et at., 2015). Load factor which is the percentage of available seats that are occupied by passengers driven by consumers' demand-substitution patterns (Dana et al., 2019). As shown in the Fig.1, the average load factor for US domestic airlines increased from 70% in 2002 to 85% in 2019. The growth trend can be detected in these years, which seems to be advantageous for airlines. This is because the load factor is a measure of achievement for the airline business since it directly revels the competency and performance of aircraft through the number of passengers (Tesfaye & Solibakke, 2015).

However, there exist conflicting perspectives as to whether the high load factor could lead to an increase in customer satisfaction and operational performance for the aviation system. Differ from the above view, the opponents discussed that the increase in load factor leads to increased stress in the aviation service system, which results in a greater seat utilization rate, more passengers to board and disembark each trip, more passengers for a fixed size flight employee to serve, and more baggage to handle each flight (Moss & Moss, 2016). The increased stress is probably going to lead to more lost baggage, delays caused by the time it takes to board and deplane, and denied boardings, which could lead to service problems.

In addition, with the increasing load factor in the airline industry, service failures are also increased recently, which could lead to increase in customer complaints According to the Airline Quality Rating (AQR), the mishandled baggage rate increased from 2.43 per 1,000 enplaned passengers in 2018 to 5.57 per 1,000 checked bags in 2019, and the involuntary denied boarding rate rose from 0.14 per 10,000 passengers in 2018 to 0.19 per 10,000 passengers in 2019. Furthermore, the industry-wide rate of consumer complaints climbed marginally from 1.04 per 100,000 passengers in 2018 to 1.06 per 100,000 passengers in 2019, and 74% of the 9,547 complaints filed with the DOT about all domestic U.S. carriers were about concerns with flights, baggage, reservations, ticketing, and boarding, or customer service. According to the theoretical propositions in the literature, service failures have a detrimental influence on consumer complaints and subsequent purchasing patterns. Ineffective

handling of customer complaints has a detrimental effect on businesses, such as customer complaints. If the failed services are not effectively recovered, dissatisfied consumers will eventually switch to competitors, which is a big source of bad word of mouth (Anderson 1994, Fornell 1992). Due to the unpredictable happenings in this sector, businesses must have plans in place for handling failures.

Customer complaints triggered by service failure should be valued by service firms especially the airline industry. As shown in Figure 2 and 3 with the increasing number of customer complaints the operating revenue and total assets decreased gradually, indicating that customer complaints have a detrimental effect on firms' financial performance in airline industry. These two figures also have a consistent finding with the concerning that consumer complaints lead to higher operating costs, lower operating revenues, and lower operating income (Behn & Riley., 1999). According to Service-Profit Chain model, increasing internal and external service quality has an impact on customer dissatisfaction and brand loyalty, which in turn has an impact on firm profitability and future firm's performance (Heskett et al., 1994; Moss et al., 2016; Banker et al., 2000). The importance of customer complaints management could be stem from the detrimental effect of customer complaints on financial performance. Firstly, bad word-of-mouth from dissatisfied customers higher the cost of acquiring new consumers and decrease the company's reputation overall (Anderson, 1998). Secondly, customer dissatisfaction requires service firms to devote more recourse to managing returns, rework, customer loyalty and complaint management, which could result in the decrease of productivity through increasing the expenses and price premium (Deming & Edwards, 1982; Reichheld & Sasser, 1990). Therefore, the customer complaints management is crucial to the firm's performance in service industry.

A fundamental inquiry of this research stems from an evident but paradoxical observation that firms tend to tolerate high load factors to improve competency and performance. If the high passenger load factor is indeed a good thing for firm performance as the literature suggest (e.g., Tesfay & Solibakke,2015), why in the first place do firms tend to make a trade-off between airline tickets and load factors to balance the airline capacity and improve the customer satisfaction? In addition to this, it is not a good indicator for customers if the industry performance cannot be improved. If the airline industry tends to tolerate service failures such as oversales to avoid no-shows and cancellations problem whether it could lead to service problem such as increased dissatisfied customers still have

been rarely verified.

Thus, to inspired by above background and problems, this paper objectives to investigate following research questions:

1) Does the load factor lead to a decrease in service failure?
2) Do load factor and service failure have a lagged effect on customer complains?
3) Do load factor and service failure have non-linear relationship with customer complaints?

In this paper, monthly data of 14 airlines were obtained from the official database which are the Department of Transportation, Bureau of Transportation Statistics, BTS-form 41-traffic, and Air Travel Consumer Report of the United States from 2009 to 2019. We used mishandled baggage, airline cancellation, and airline delay as indicators of service failures. The whole dataset is in an unbalanced panel structure due to the missing data for several airlines. The investigation is conducted based on the firm-level data to investigate the effect of load factor and customer complaints because these two variables seem to be dependent on firms rather than industry.

This research has its uniqueness contributing to academia compared to other studies. Firstly, our study contributes to more reliable results by using an acceptable measure of cancellations, which is one of the most essential service aspects investigated by Parast et al (2020), while the other two influencing factors of service failure (mishandled baggage, delay) and load factor are included to investigate the effect of load factor on service failure and customer complaints. Secondly, we investigated whether or not lagged effects of load factor and service failures on customer complaints can be found in the proposed OLS models because it is possible that some service failure factors could not directly influence the customer complaints in the current period, but the relationship between them could be shown in the lagged period. Thirdly, we also conducted a test to detect the nonlinear relationship between load factor, service failures, and customer complaints to investigate the U-shaped relationship. Finally, since the domestic airline industry in the US is both significant and contentious, our analysis may help give researchers and practitioners a crucial issue for discussion. Our research offers new insights into service quality, particularly those in charge of handling

passenger complaints.

The paper begins by reviewing the literature on load factors and service failures, and hypotheses with customer complaints of a firm are developed in this section. After then, we describe the data, variables for models and methodology for the analysis. Next, we proposed the empirical results followed by a discussion of our findings. Finally, the conclusion, implication, limitations, and future research directions are described in the last section.

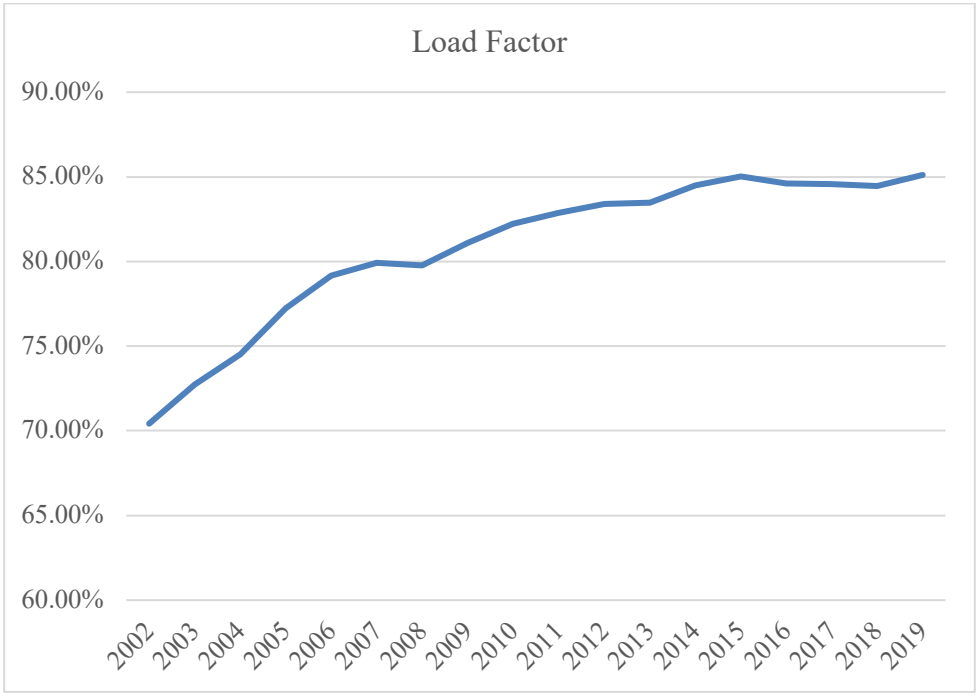

Figure 1.

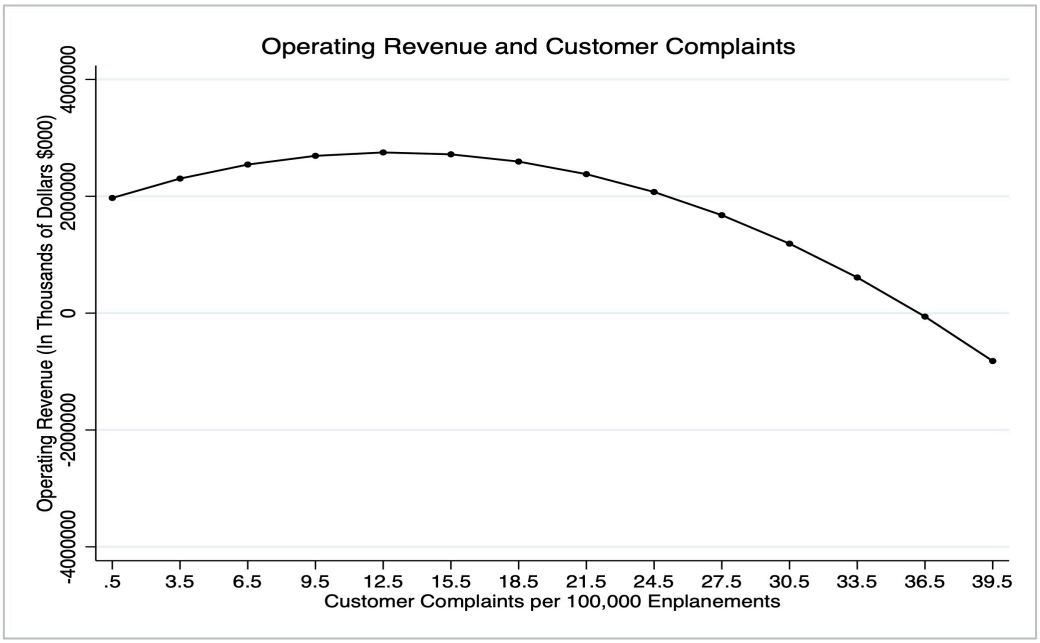

Figure 2

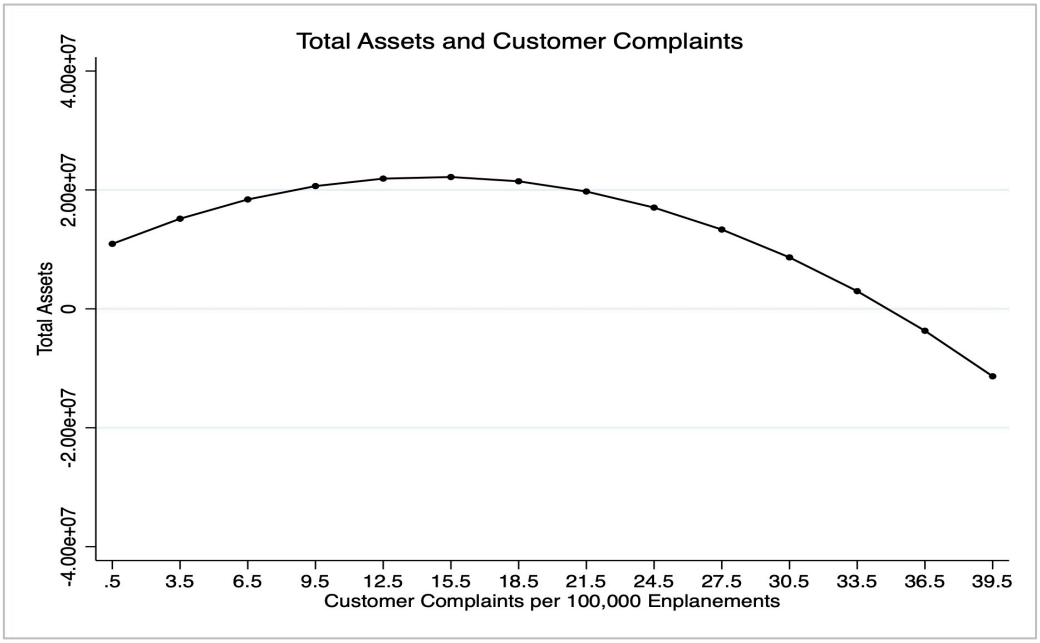

Figure 3

2. Literature Review & Conceptual Framework

In this section, the concepts and background of the load factor, service failure, and customer complaints are described by reviewing previous studies. Moreover, the hypothesis which is investigated in this paper is developed based on theories and literature review.

2.1 Load factor

In reality, evaluating the changes in the efficiency of performance plays an essential role in the airline industry. The efficiency of airline performance depends on several factors such as load factor, operational system effectiveness, and advanced technology (Lee et al., 2009). One of the most utilized to measure the performance and efficiency of the airline industry is the passenger load factor (Wang et al., 2009). The load factor of an airline which is the percentage of seats that are occupied by customers is the indicator of aircraft demand and capacity management (Tesfay et at., 2015). According to Sibdari and Pyke (2018), the average airline size and frequency increased by almost 20%, and the average load factor in US airlines increased by around 20% in the last decade.

The influencing driver of load factor has been examined in previous studies. (Wang et al.,2009) discussed this issue based on revenue management theory, the main influence factors such as the macro-economic environment, oil price, market fluctuation, seasonal effect, price differentiation, and airline capacity were concluded. Mhlanga et al (2018) mentioned that the importance of the high load factor outweighs the aircraft size. For instance, A smaller aircraft with a 90% seat occupancy rate is more efficient than a larger aircraft with a 50% seat occupancy rate. Some previous studies found that with the increase in load factor, the total asset of the airline is declining, and the profitability of the airline can be improved, suggesting that load factor exists the substantial economics (Hansen et al., 2001; Chua et al., 2005).

Although load factors are an essential indicator of an airline's operational performance, the effect of load factor have to be cautious from the business perspective. The increase in load factor takes the burden on the aviation service system and employee capacity (Moss et al., 2016). On the other hand, passengers who preferred less crowded airline tends to desire low-load factor airline. As reviewed in the literature, the load factor can be positive or negative to firms depending on the financial or service

operations perspective. Although there have been conflicting findings about the effect of load factors, researchers still pay little attention to how load variables affect airline services. Thus, our study aims to empirically investigate the impact of load factor on service effectiveness and customer satisfaction.

2.2 Service failure

Service failure has been widely studied from various perspectives. Service failure can be commonly defined as service quality that cannot reach the expectation of customers, which can be viewed as the opposite of service quality (Zeithaml et al.,1988). However, the definition of service failure has been explained from the firm's perspective and the customer's perspective. According to Berry and Parasuraman (2004), service failure was defined as mistakes in the delivery or outcomes of the service of a firm. In addition, service failure can also be defined as clients who are dissatisfied with the service process or whose received service falls short of their prior expectations (Parasuraman et al., 1985; Heskett, J.L.1990; Hoffman and Bateson, 2010).

Due to the uncertainty of the business environment and customer demand, service failure is difficult to evite in nowadays (Collier and Meyer, 2000). Thus, previous studies have widely investigated the educational and significant lessons from the occurrence of service failure (Day,1994). Firstly, service failure leads to the dissatisfaction of customers, which could exist the possibility of losing customers (Smith et al., 1999). Secondly, firms can employ a recovery strategy to resolve the failure. For example, firms could apologize for the service error and provide promotion incentives or compensation to the customer (Smith et al., 1999). In this way, the communication between the customer and service firm could be improved and even convert the unsatisfied customer to loyal customers, which promotes the customers' repeated purchase behavior (Heskett et al. 1997). Thirdly, customers tend to expect efficient recovers when service failures occur, but poor service recovery cause customer complaints and even bad word-of-mouth behavior of customers. ((Bitner et al., 1990). Although many previous papers investigate the consequences and recovery method of service failure, the causes and effects of service failure in the airline industry were the subject of very few research.

2.2.1 Key attributes of service failures in airline industry.

Service failure has been described in different categories in the airline industry. The first category of airline service failure is related to financial performance. Operations management literature has investigated the negative effect of service failure on financial performance using the operating revenue, operating income, ROA, and load factors for the measurement of profitability (Weun et al., 2004; Behn et al., 1999; Moss et al., 2016), and the relationship between them moderated by the airline strategies which are point-to-point and hub-and-spoke (Mellat et al., 2015). In addition, the nonlinear relationship between service failures on profitability using flight delays, involuntarily denied boarding and mishandled baggage as the measurement of service failure is based on longitudinal data (Golmohammadi et al., 2020). Also, the reason for the relationship between arrival delays and airline financial performance exists inverted U-shaped for non-focused airlines but linear and negative for focused airlines has been discussed by Mayer and Sinai (2003).

The second category of airline service failure research studied non-financial effects which are several service quality problems of service failures such as customer dissatisfaction, customer loyalty, customer purchase behaviors, customer retention, and service recovery efforts (Lapré & Tsikriktsis, 2006; Park et al., 2004; Steyn et al.,2011). Service quality as one of the significant areas of airline operational performance is directly related to the customer consumption experience. Thus, this paper will mainly focus on the non-financial effects of service failures.

As mentioned above, prior studies determined the various main measurement of service failure in the airline industry. Service operations identified that flight cancellations, mishandled baggage, overbooking, delays, and so on have a negative effect on customer repurchase intentions in the airline industry (Sim et al., 2010). Also, according to the DOT, mishandled baggage, airline cancellations, oversales, and delay as the main category of the trigger of customer complaints occupy a large percentage. However, due to the quarterly data of oversales, we determined to exclude this variable from our investigation. Thus, we incorporate flight cancellation, delay, and mishandled baggage as the main research indicator for service failure in this research.

2.3 Customer complaints

Customer complaints cannot be avoided in nowadays business environment. Customer complaint in the service industry is an expression of customers dissatisfied with provided products or services (Gronroos, 1988). Customer dissatisfaction occurs when the ex-ante expectations for a product or service are higher than the ex-post (Zeithaml et al. 1990). In addition, Anderson (1994) discussed that customer dissatisfaction is based on the previous, present, and anticipated future experience, which reflects the degree of loyalty and repurchase intention. According to Sim et al. (2010), a variable examining consumer complaints to the US Department of Transportation is utilized as a stand-in for customer satisfaction.

Customer complaints play a positive and negative effect on service firms. From a positive perspective, customer complaint as essential feedback from customers allows service firms to recognize the service problem to adjust the service strategy and resolve their problems (Etzel and Silverman, 1981; Nyer, 2000). However, customer complaints play a negative impact on service firms. Specifically, it damages the company's reputation and raises the expense of acquiring new clients. (Anderson 1994, Fornell 1992).

Regarding the situation with the airline industry, there are some studies that investigated the effect of customer complaints. Some studies take the airline size and operations strategies into consideration. It has been investigated that the positive effect of delay and cancellations on customer complaints is more serve for network airlines than for low-cost airlines, and this effect is more significant for large-size airlines (Parast & Golmohammadi, 2020). However, some authors asserted that it is a confusing issue for airlines whether customer complaints show the learning-curve pattern (Tsikriktsis & Heineke, 2004). Lapré and Tsikriktsis (2006) discussed that Customers' expectations may rise over time, and even if a product or service gets better, customer dissatisfaction may not decrease based on the learning-curve pattern theories.

2.4 The conceptual model building and research hypothesis

The conceptual model of the hypothesis is illustrated in Fig.4. As shown in Fig.4, the research model represents the framework of the relationship between load factor, service failure, and customer complaints. The causal associations among the three variables shown in Fig.4 seem straightforward, to our knowledge this study is the only one to examine the load factor and customer complaints as the antecedents and effect of service failure simultaneously.

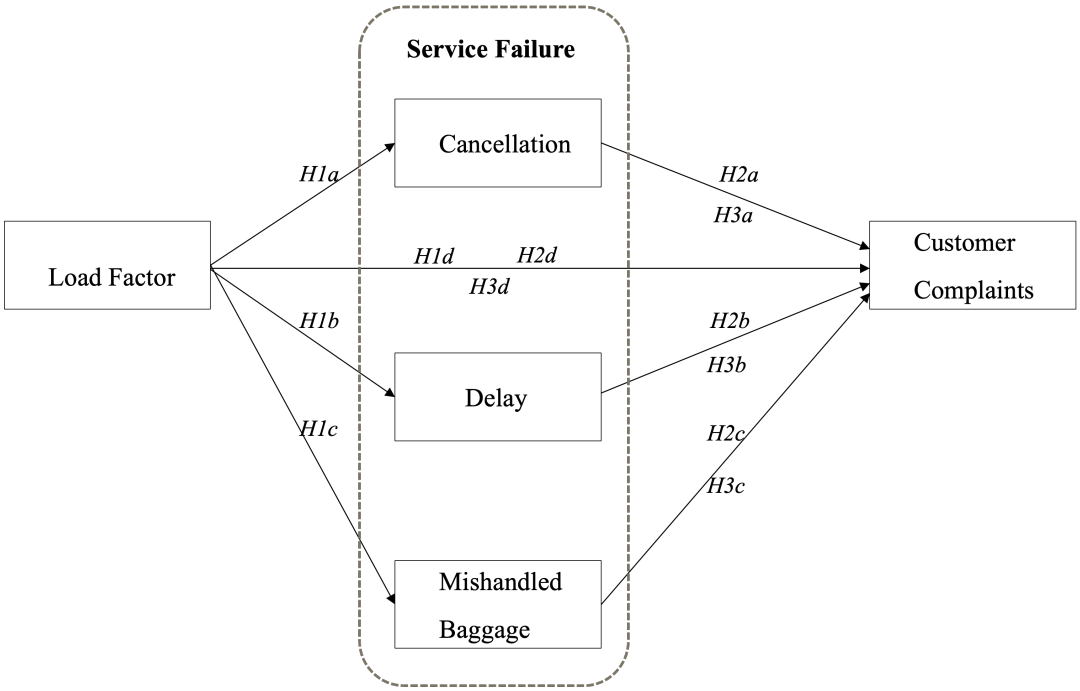

Figure 4. conceptual model

2.4.1 Load factor and service failure

The load factor is not always provided benefits for the airline industry. Although the load factor contiguously increases in recent years, the stress of the service system should not be ignored. With the increasing number of airline load factors, baggage handling has been difficult. Thus, lost baggage, resulting in delays, cancellations, and denied boarding could occur due to the added stress of the service system (Moss & Moss, 2016). For this reason, the load factor is not only related to the success of the service firm but also the customer satisfaction. Furthermore, more seats may result in a reduction in legroom and a reduction in the amount of available overhead storage, which could significantly annoy passengers. Additionally, these capacity considerations may result in additional route cancellations, aircraft delays, and airport congestion, particularly for smaller cities (Stock, 2013; Carey and Nicas, 2015). Furthermore, although an aircraft could be less likely to occur more mishandled baggage, delay, and cancellation numbers with more passengers, it takes longer to board a full flight and handle the baggage. Thus, the effect of the load factor on service failure might be either positive or negative. However, we anticipate that improved load factors will increase service failures. Based on the above literature, the hypothesis can be developed as below.

H1: When load factor increases, a firm service failure increase

H1a: Increased airline load factor positively affects flight cancellation.

H1b: Increased airline load factor positively effects delay.

H1c: Increased airline load factor positively affects mishandled baggage.

H1d: Increased airline load factor positively affects customer complaints.

2.4.2 Service failure and customer complaints

It is obvious that consumers' perceptions of service failure have a direct and detrimental effect on their level of satisfaction (Keiningham., 2014). Additionally, the significance of various service failures to customers varies. Negative word-of-mouth behavior can be used by disgruntled consumers and due to bad service, some businesses may have a yearly loss of 10-15% of their annual volume (Blodgett et al. 1993). Furthermore, the negative effects of service failure on customers cause them to leave, which increases the cost of acquiring new customers and repairing the reputational harm done to the business (Schlesinger and Heskett, 1991).

However, it has been investigated that customer complaints in the airline industry show the U-shaped function of operating experience due to the learning-curve pattern and the airlines which are adopted point-to-point logistics system can quickly learn the method of reducing customer dissatisfaction than the airlines that take hub-and-spoke logistics system. In addition, Lapré (2011) discussed that the tendency to complain is where the U-shaped learning-curve effect and learning-curve heterogeneity come from. Also, customer discontent did not decrease sustainably as a result of service failure decreases over the long run and eventually, customers started to complain more frequently. In addition to this, it has been noted that customer satisfaction is positively related to the current and previous period service quality and the customer perception will be occurred in the future period, meaning that the service quality shows a lagged effect to customer satisfaction (Anderson et al., 1994).

Flight cancellations, which represent a service failure, are a significant operational failure for airlines and have a variety of causes (Gopalakrishnan & Johnson, 2005). Passengers are typically more understanding when an airline must cancel a flight due to an event outside of its control, such as bad weather or terrorist activity (Huertas, & Trigos, 2014). However, passengers become extremely upset and dissatisfied with the company when their flight is the only one that is canceled. Similarly, the airline delay is highly correlated to customer dissatisfaction, because the process variation in services causes customer dissatisfaction (Tsikriktsis and Heineke, 2004). If a customer misses a particular event or a crucial business meeting, they will probably consider a 1-hour flight delay to be

significant (Keiningham et al., 2014). Furthermore, the intricacy of the airline network limits the flexibility of rerouting, thus these companies work hard to offer more options for promptly returning passengers' luggage. Customers are not likely to risk switching brands if the quality of the present brand is adequate (Wernerfelt,1991). Passengers may therefore move to other airlines if they have had baggage mistreated, such as lost, damaged, delayed, or stolen baggage. Additionally, a delayed baggage operation may affect the flight schedule, aggravating the consumer. Thus, the following hypothesis can be posited:

H2a: Airline cancellation and customer complaints have a non-linear relationship.

H2b: The airline's delay and customer complaints have a non-linear relationship.

H2c: The mishandled baggage and customer complaints have a non-linear relationship.

H2d: The load factor and customer complaints have a non-linear relationship.

H3a: The airline cancellation has a lagged effect on customer complaints in the airline industry.

H3b: The airline delay has a lagged effect on customer complaints in the airline industry.

H3c: The mishandled baggage has a lagged effect on customer complaints in the airline industry.

H3d: The load factor has a lagged effect on customer complaints in the airline industry.

3. Methodology

3.1 Data source

The present study conducted the data from the U.S Department of Transportation (DOT), Bureau of Transportation Statistics (BTS), Air Travel Consumer Report (ATCR), and BTS-form 41-traffic. 1848 monthly observations for 14 airlines spanning from 2009 to 2019 are analyzed and the whole dataset is in an unbalanced panel structure due to the missing data for several airlines. The 14 airlines included Alaska, American, Delta, Endeavor, Envoy, ExpressJet, Frontier, Hawaiian, JetBlue, Mesa, SkyWest, Southwest, Spirit, and United Airlines. We excluded some airlines that are reported in consumer reports, (e.g., Comair, Continental, Northwest, and so on) because these airlines ceased operations or combined with other airlines in the observation period. Prior research has used these databases and the methods indicated in the next section to investigate the connection between airline service failure and customer satisfaction.

3.2 Empirical model

The empirical model is provided in Equation (1)-(6), which indicates the relationship between load factor, service failure, and customer complaints in the fixed effect regression (2FE) methodology.

Firstly, we conducted an analysis to examine the effect of load factor on service failure and customer complaints in Equation (1)-(4). i denotes the airlines and t denotes the month. $\mu_i$and γ_t are the unit and time fixed effects, $\varepsilon_{it}$is the error term.

1) $Mishandled\ Baggage_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \beta_1 Load\ Factor_{it} + \mu_i + \gamma_t + \varepsilon_{it}$

2) $Cancellation_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \beta_1 Load\ Factor_{it} + \mu_i + \gamma_t + \varepsilon_{it}$

3) $Delay_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \beta_1 Load\ Factor_{it} + \mu_i + \gamma_t + \varepsilon_{it}$

4) $Complaints_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \beta_1 Load\ Factor_{it} + \mu_i + \gamma_t + \varepsilon_{it}$

(i: airlines, t: month)

Secondly, we show the lagged effects of service failure on customer complaints in equation (5). The indicator of service failures is mishandled baggage, cancellation, and delay.

5) $Complaints_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \mu_i + \gamma_t + \sum_{j=0}^{3} \beta_{j+1} (Mishandled\ Baggage)_{it-j} + \sum_{k=0}^{3} \beta_{k+1} (Cancellation)_{it-k} + \sum_{l=0}^{3} \beta_{l+1} (Delay)_{it-l} + \sum_{l=0}^{3} \beta_{m+1} (Load\ Factor)_{it-m}$

(i: airlines, t: month)

Finally, the non-linear relationship between service failures and customer complaints was investigated in equation (6).

6) $$\text{Complaints}_{it} = \beta_0 + \zeta_1 Firm\ Size_{it} + \zeta_2 Distance_{it} + \mu_i + \gamma_t + \beta_1(Mishandled\ Baggage_{it}) + \beta_2(Mishandled\ Baggage_{it})^2 + \beta_3(Cancellation_{it}) + \beta_4(Cancellation_{it})^2 + \beta_5(Delay_{it}) + \beta_6(Delay_{it})^2 + \beta_7(Load\ Factor_{it}) + \beta_8(Load\ Factor_{it})^2 + \varepsilon_{it}$$

(i: airlines, t: month)

3.3 Variable measurements

3.3.1 Load factor

Passenger load factor as an essential indicator of an airline's operational performance is the ratio of revenue passenger miles to available seat miles for a certain business period (Dana & Greenfield, 2019). Load factor implies the basic load factor data obtained from DOT is reported at the airport level. Data are averaged across all airline routes because our analysis is at the firm level, indicating the airline i's average load factor in month t. The load factor denotes the typical airplane fill rate for a given airline during a specified period of time (Ribbink et al., 2009). According to Ribbink et al. (2009), a larger load factor indicates increased utilization, but it could result in service failures, such as discomfort, less frequent service, and a higher likelihood of being refused to board.

3.3.2 Airline delay

The airline delay is associated with various issues, including airline delays, extreme weather delays, national aviation system delays, security delays and late arriving aircraft delays. Given that delayed flights cause more stress for passengers and put more pressure on airline staff, arrival delays serve as a major gauge of airline performance (Tsikriktsis, 2007). The percentage of airline delays is the proportion of flights operated by a given airline in a given quarter that do not arrive within 15

minutes of the time indicated in the airline's computer reservation system (Mellat-Parast et al., 2015). In this paper, the airline delay calculated as one minus percentage of on time performance rate that reported by DOT.

3.3.3. Airline cancellations

According to the DOT, one obvious reason for airline service failure is flight cancellation, which is measured as the percentage of flights that are canceled annually. It is the number of flights that were scheduled but not executed during the seven calendar days before the departure that were reported in a carrier's computer reservation system. In reality, not only have flights been canceled owing to inclement weather, but also because of a lack of passengers, which makes operations financially unproductive. Customers may feel aggrieved by the airlines' yield management strategies, such as pricing discrimination, overbooking, and deliberate flight cancellations, but their impression of injustice may not have an impact on their loyalty, particularly among business travelers (Da Silva, 2012). Furthermore, flight cancellations lead to costs for passengers in terms of additional travel time and inconvenience such as switching to another flight (Steven et al., 2012). Thus, we included flight cancellations as the measurement of service failures in this paper.

3.3.4. Mishandled baggage.

Mishandled baggage is the percentage of lost, broken, delayed, or stolen bags per 1000 passengers that each airline reports to the DOT. According to Mellat-Parast et al. (2015), airlines must compensate for poorly managed luggage in terms of both reputational harm and additional costs incurred to return or replace lost luggage. Major U.S. airlines have recently been able to reduce the rate of lost and mishandled baggage through improved use of information technology, but it is still a big problem for the aviation sector. In general, the main aspects of baggage handling are controlled by airlines, not airports (Phillips & Sertsios, 2013). Also, airlines are nevertheless liable for passengers in situations where some baggage services are outsourced to qualified suppliers and service errors like lost bags occur (Stamolampros & Korfiatis, 2019). Thus, mishandled baggage is

also a visible source of service failure for airlines.

3.3.5. Customer complaints.

Complaints are ratio (per 100,000 passengers) based on the number filed with the Department in writing, by telephone, via e-mail, or in person. DOT has not decided if the concerns are legitimate. There are no security or safety problems in the report. According to the air travel consumer report, airline delays, cancellations, and mishandled baggage are the main causes of airline service failures (Steven et al., 2012). Furthermore, from the perspective of airlines, customer complaints are the consequences of service failures (Steven et al., 2012). The investigation on the impact of customer complaints is focused on the research of firm-level archival data since it appears that firms, as opposed to industries, are more affected by customer complaints.

3.3.6. Control variables

There are several control variables that may influence the service failure and customer complaints employed in this study. Firstly, we included the firm size as the control variable. Firm size is one of the determining factors that may affect the organizational structure, and firm performance, and strategic advantages (Dean et al., 1998). Airlines of varying sizes offer diverse service deliveries because larger airlines could manage service failures more skillfully due to their high levels of capacity and easier access to service management resources (Mellat-Parast & Fini, 2011). However, smaller airlines provide simpler operations, which could have advanced operations performance in terms of increasing arrival on-time rates, lowering cancellation rates, and baggage handling (Rhoades et al., 2021). In general, operational revenue, total assets, employment, and invested capital are used to measure the firm size (Smyth et al., 1975). In this study, we use the logarithm of employee numbers to operationalize the size variable for reducing the effect of firm size variations among the sample airlines. This is an appropriate proxy since airlines with larger fleets and more destinations should have more pilots, crew, ground staff, etc. (DOT). In addition, according to the literature on service

operations, even though service failures like flight cancellations, delays, missed connections, mishandled baggage, or over boarding can negatively affect customers' intentions to make additional purchases, employees' ability to identify and address issues at the crucial moment can mitigate these effects (Sim, Song, and Killough).

In addition, flight distance is another control variable in this study. It is the ratio of total flight distance to the number of flights an airline files in a month. In general, an airline that provides long-distance travel indicates a superb competitive advantage (Bergantino & Madio, 2020). According to Phillips and Sertsios (2013), service deliveries could be affected by distance through cost management. Thus, the flight distance is considered to be the influencing factor to service failure and customer complaints. Also, we also need dummy variable to control for seasonality, a month to distinguish the impact of airlines from specific months, and control for airlines, because each airline has a different strategy.

4. Results

4.1 Descriptive statistics

As can be seen in Table 1, the descriptive statistics and correlation matrix is summarized. Statistics summary including the mean, standard deviation, min, and max. The mean value of cancellation is near zero meaning that the airline cancellation problem has been slight recently; On the other hand, mishandled baggage has a relatively high mean indicating a tendency of increasing mishandled baggage in the US airline industry. Among variables representing service failure, data on mishandled baggage is widely dispersed compared to other explanatory variables.

Table 1 also displays the correlation relationship between variables in this study. All the explanatory variables are affected by load factor and each independent variable is correlated to the customer complaints. In addition, firm size measured by employee numbers and market share is related to each explanatory variable except for customer complaints except for airline delay. Also, distance is related to load factor, mishandled baggage, and airline delay. However, the market share

and firm size exhibit a strong positive correlation (ρ=0.926), which could lead to technical problems such as multicollinearity issues. The strong positive correlation between firm size and market share implies that big-size airline commonly has a better competitive edge and market share. We kept flight distance and eliminated market share from the proposed models because we tested vif value for all variables and only the market share variable shows 11.77 which is larger than 10. Because correlation analysis only indicates the relation between two variables, a regression analysis was tested to discover the net effect of each independent variable on customer complaints and investigate how these variables are affected by load factors in the airline industry.

Table 1. Descriptive Statistics and Correlation matrix

	Load Factor	Mishandled Baggage	Cancellation	Delay	Customer Complaint	Firm Size	Market Share	Distance
Load Factor	1.000							
Mishandled Baggage	-0.416**	1.000						
Cancellation	-0.409**	0.555**	1.000					
Delay	-0.112**	0.404**	0.626**	1.000				
Customer Complaint	0.206**	-0.048†	0.112**	0.337**	1.000			
Firm Size	0.182**	-0.080**	-0.098**	0.006	-0.055*	1.000		
Market Share	0.265**	-0.190**	-0.175**	-0.035	-0.010	0.926**	1.000	
Distance	0.063**	-0.049†	-0.024	0.152**	-0.025	0.788**	0.830**	1.000
Mean	0.828	3.757	0.016	0.200	1.341	9.391	0.060	13.003
SD	0.047	1.868	0.017	0.072	1.783	1.204	0.062	0.952
Min	0.624	1.080	0.000	0.036	0.000	7.340	0.003	11.098
Max	0.949	15.380	0.154	0.501	31.290	11.541	0.201	15.363

t statistics in parentheses

†p<0.10; *p<0.05; **p<0.01

4.2 Effect of load factor on service failures and customer complaints

As shown in Table 2, In stage 1, we investigated the linear relationship between load factor, customer complaints and three service failure measures, including flight cancellations, delay, and mishandled baggage. Table 2 provides the results of equation (1)-(4). This analysis suggests that the load factor has a significant ($p <= 0.01$) effect airline delay, whereas the load factor has not a significant effect on flight cancellations, mishandled baggage and customer complaints. Thus, hypothesis 1 supported one of three service failure attributes, indicating that service failures increase with a higher load factor.

Regarding to the control variables, the coefficient estimates differ between the three regressions, as shown in column (1)- (4) of table 2. First, firm size has a negative effect on flight cancellations and customer complaints, whereas it has a positive effect on mishandled baggage, indicating that a big firm size that has a large number of employee number can decrease the probability of occurrence of cancellations and customer complaints but increase the rate of mishandled baggage. It could be explained that big-size firms have a big market share and attract more passengers which could decrease the cancellation rate, but with the increasing number of passenger number of big firm size airlines, the mishandled rate could be increased and put a burden on the employee to handle the baggage. However, large firm could employ more employee number than small firm size company, which contributes to decrease of customer complaints. Second, flight distance has a positive effect on flight cancellations, delay and customer complaints, implying that long-distance flight increases the uncertainty of service quality such as flight cancellation and on-time performance rate, and it is hard for airlines to handle flight issues such as customer complaints due to the long distance.

Table 2. Impact of load factor on service failures

Variables	(1)	(2)	(3)	(4)
	Cancellation	Delay	Mishandled Baggage	Customer Complaints
Intercept	-0.019	-1.197**	-2.168	-0.394
	(0.017)	(0.067)	(1.656)	(1.770)
Load Factor	0.021	0.174**	0.223	4.896**
	(0.013)	(0.051)	(1.258)	(1.340)
Control Variable				
Firm Size	-0.004*	-0.007	0.492**	-1.574**
	(0.002)	(0.007)	(0.168)	(0.175)
Distance	0.004**	0.022**	0.099	0.928**
	(0.001)	(0.005)	(0.126)	(0.132)
Fixed effects				
Month	Yes	Yes	Yes	Yes
Airlines	Yes	Yes	Yes	Yes
N	1632	1632	1608	1632
R^2	0.412	0.544	0.585	0.477
adj. R^2	0.403	0.536	0.578	0.469
F	41.701	70.746	82.492	54.276

t statistics in parentheses

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

4.3 Current and lagged effect of load factors and service failures on customer complaints

In this section, our primary interest is to investigate the current-period effect of service failures on customer complaints and explore the lagged effects of service failures on customer complaints. There are several significant associations were found in the three-lagged effect model. The main statistical findings are summarized in Table 3. Regarding to the effect of independent variables under investigation, it turned out that load factor and airline delay effect on customer complaints. Airline load factor is explored to have a positive association with customer complaints ($\beta = 3.305$, p <0.01) and airline delay have a positive association with customer complaints ($\beta = 9.503$, p <0.01) in current period. Also, lagged effects, load factor and airline delay have also a associations with customer complaints ($\beta = 4.882$, p <0.05 for $Load\ Factor_{\ t-1}$ on customer complaints; $\beta = 2.694$, p <0.05 for $Delay_{\ t-1}$ on customer complaints). These results appear to reasonable because more passenger number in a limited space lead to more complaints in terms of ticketing, reservation and boarding process, because these factors are the main complaint categories. The unsatisfied passenger could complaint to the DOT not only in a current period, but also the next month after flight experiences. In addition, the higher delay rate leads to increased customer complaints, indicating that the high delay rate dissatisfies passenger expectations, a measurement of service failure (Zeithaml et al., 1988), and experienced long delay passenger not only do not use experienced airline again, but they also spread negative words and complaint to airline (Bolfing, 1989). With regard to the mishandled baggage, although no significant association with customer complaints in current-period, positive effects are observed after three period ($\beta = 0.109$, p <0.05 for $Mishandled\ baggage_{\ t-3}$). It could be comprehended that the negative effect of mishandled baggage could be adjusted by the effort of employees. According to the DOT, passengers commonly register lost luggage at present and airline responsible to handled mishandled baggage after a while, but customer complaints could increase if baggage could not be found at a given period, so the lagged effect occur after three period. The analysis results still confirm that flight cancellations have not significant effect on the customer complaints in the short-term period, but it shows the negative lagged effect on customer complaints ($\beta = -13.070$, p <0.01 for $Cancellations_{\ t-3}$), indicating that firms can employ recover strategy to resolve the service failure. For example, firms could apologize for the service error and provide

promotion incentive or compensation to the customer. In this way, the communication between customer and service firm could be improved and even convert unsatisfied customer to the loyal customers, which promote the customers' repeated purchase behavior and firms 'reputation. Thus, hypothesis H3a to H3d were supported.

Also, limited employee in a flight is less likely to provide high level service quality for the large number of employees and comfort passengers when the service failures occur. Firm size measured by employee number has a negative effect on customer complaints, meaning that larger company which employ more employees for their firm. The large labor capacity allows them to overcome some traditional barriers such as customer complaints. Furthermore, customers who take long-distance flight are likely to have more customer complaints because the limited space and crowding airplane could lead to the unsatisfaction of passengers (Moss et al., 2016). With respect to airline and time, airline operations performance could be different from the different strategy that like taken and it is might that due to the vacation and seasonality problem purchasing tickets could have the different fluctuations.

Table 3. Lagged effect of load factor and service failure on customer complaints

Variables	(1)	(2)
	Customer Complaints	Customer Complaints
Intercept	1.423	-0.348
	(1.683)	(1.880)
$\text{Load Factor}_{(t)}$	3.305**	-0.327
	(1.281)	(1.930)
$\text{Load Factor}_{(t-1)}$		4.882*
		(2.268)
$\text{Load Factor}_{(t-2)}$		-1.048
		(2.293)
$\text{Load Factor}_{(t-3)}$		2.503
		(1.883)
$\text{Cancellation}_{(t)}$	-1.249	5.652†
	(3.038)	(3.297)
$\text{Cancellation}_{(t-1)}$		-4.528
		(3.449)
$\text{Cancellation}_{(t-2)}$		-4.756
		(3.469)
$\text{Cancellation}_{(t-3)}$		-13.070**
		(3.346)
$\text{Delay}_{(t)}$	9.503**	6.570**
	(0.803)	(1.011)
$\text{Delay}_{(t-1)}$		2.694*
		(1.151)
$\text{Delay}_{(t-2)}$		1.307
		(1.148)
$\text{Delay}_{(t-3)}$		4.609**
		(1.009)
$\text{Mishandled Baggage}_{(t)}$	-0.027	-0.060
	(0.028)	(0.052)
$\text{Mishandled Baggage}_{(t-1)}$		-0.058
		(0.065)

Mishandled Baggage$_{(t-2)}$		-0.011
		(0.065)
Mishandled Baggage$_{(t-3)}$		0.109*
		(0.052)
Control Variables		
Firm Size	-1.545**	-1.581**
	(0.172)	(0.178)
Distance	0.750**	0.678**
	(0.129)	(0.133)
Fixed effects		
Airlines	Yes	Yes
Time	Yes	Yes
N	1608	1554
R-sq	0.538	0.553
adj. R-sq	0.529	0.541

t statistics in parentheses

†p<0.10; *p<0.05; **p<0.01

4.4 Non-linear relationship between load factor, service failures and customer complaints.

This section provides the non-linear relationship results between service failures and customer complaints in table (4). In this model, column (5), support our hypothesis that customer complaint has a non-linear relationship with flight cancellation, and we find that the coefficients of and Cancellation^2 (-176.353, $p < 0.05$) is statistically significant. As described in Figure.5, customer complaint increases nonlinearly with the increase of cancellations, but decreases nonlinearly after certain point $(8.07/(2*176.35)) \approx 0.023$. This indicates that the negative effect of airline cancellation on customer complaints gradually decreased with the increasing number of cancellations, showing the similar results with lagged effect results that mentioned in the last section. It could also be explained that the service recovery may also affect the trend of customer complaints. Also, the adjusted R is 55%, indicating that our model fit is good.

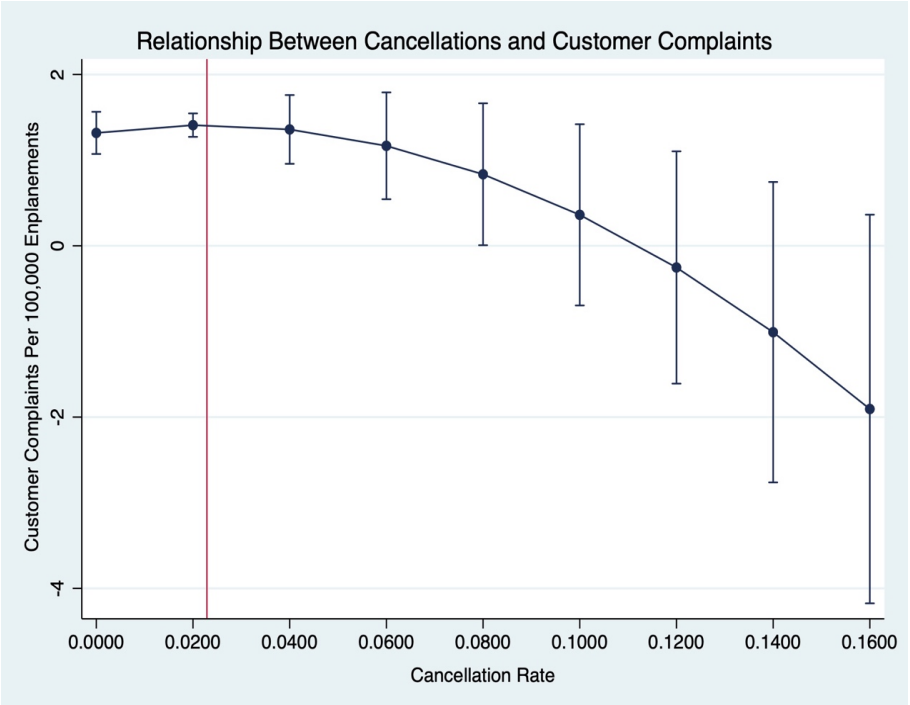

Figure 5. Relationship between cancellation and customer complaints

Furthermore, we also estimate equation (6) to test the relationship between airline delay and customer complaints using ordinary least squares methodology. The results from column (5) support our hypothesis 2b that customer complaint has a non-linear relationship with airline delay. We find that the coefficients of $Delay^2$ (46.694, $p < 0.01$) are statistically significant. As described in Figure 3, increasing airline delay leads to more customer complaints, although the level of complaints bottoms at around an 13% airline delay, increases dramatically and nonlinearly after this point. Regarding to the mishandled baggage, the squared term is not showing the significant value, implying that there is not non-linear relationship between mishandled baggage and customer complaints.

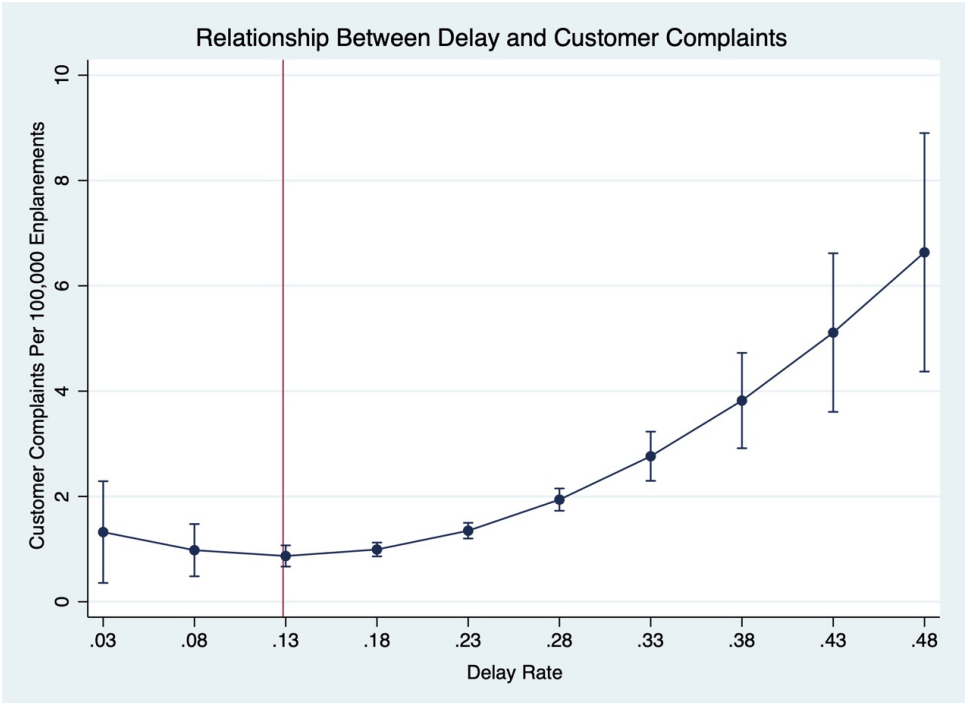

Figure 6. Relationship between airline delay and customer complaints

Finally, we estimate equation 6 to test our hypothesis h2d using ordinary least squares methodology. In this model, column 5, support our hypothesis that customer complaint has an inverted-U relationship with load factor, and we find that the coefficients of Load factor^2 (-17.161, $p < 0.1$) is statistically significant. Figure. 7 indicate that the peak point of flight cancellation is about (30.635/ (2*17.161) ≈ 0.89), so customer complaints increase nonlinearly with the increase of load factor to 0.80, and showing slightly decreasing pattern after this point.

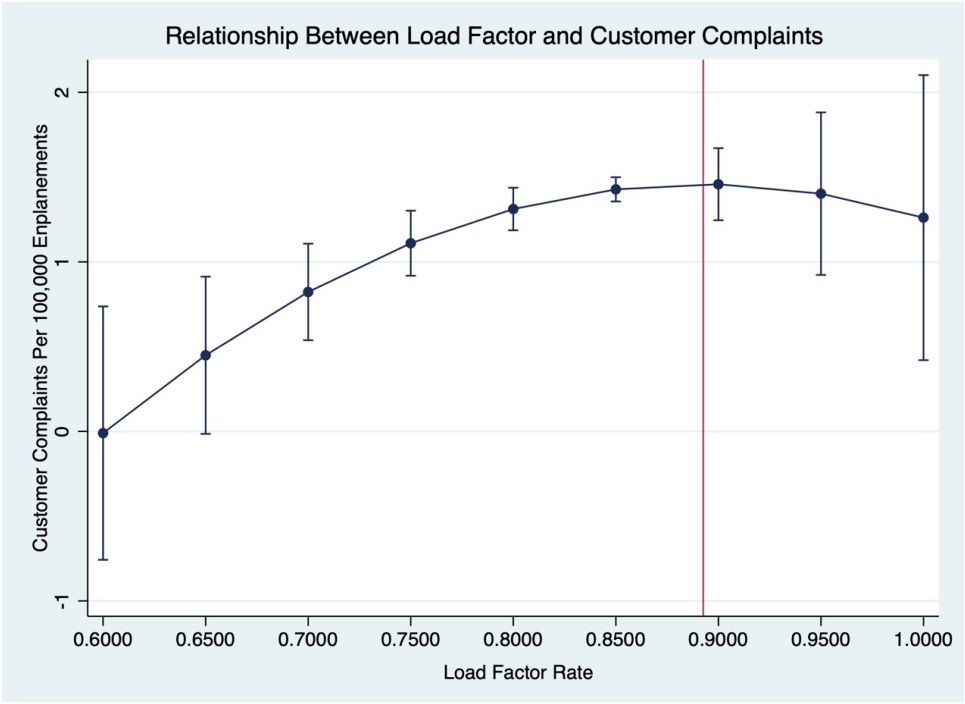

Figure 7. Relationship between load factor and customer complaints

Table 4. U-shaped relationship between service failure and customer complaints

Variables	Dependent variable: customer complaints				
	(1)	(2)	(3)	(4)	(5)
Intercept	2.791*	3.626**	2.935*	-13.513*	-9.372
	(1.406)	(1.368)	(1.396)	(6.737)	(5.915)
Cancellation	32.518**				8.070
	(9.119)				(10.280)
Cancellation^2	-153.632**				-176.353*
	(48.955)				(74.917)
Delay		-7.879			-12.008†
		(5.507)			(6.718)
Delay^2		36.182**			46.694**
		(13.767)			(15.780)
Mishandled Baggage			0.136		0.091
			(0.086)		(0.097)
Mishandled ^{2} Baggage			-0.002		-0.010
			(0.004)		(0.006)
Load Factor				37.808*	30.635*
				(17.237)	(15.190)
Load Factor^2				-20.419†	-17.161†
				(10.927)	(9.625)
Control Variables					
Firm Size	-1.399**	-1.320**	-1.633**	-1.572**	-1.312**
	(0.173)	(0.158)	(0.210)	(0.191)	(0.164)
Distance	0.819**	0.744**	0.975**	0.922**	0.718**
	(0.114)	(0.114)	(0.130)	(0.126)	(0.113)
Fixed effects					
Airlines	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes
N	1632	1632	1608	1632	1608
R^2	0.495	0.550	0.479	0.479	0.559
adj. R^2	0.486	0.542	0.469	0.469	0.550
F	46.220	43.952	44.897	46.351	37.264

t statistics in parentheses
† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

5. Discussion and & Conclusion

Researchers have called for more studies to provide a deeper discussion on the interface between load factors, service failure, and customer complaints in the airline industry. By adopting the analysis, this research provides empirical evidence on the load factor on service failure and customer complaints nu using a longitudinal analysis based on an 11-year panel of data for the US airline industry.

The result of the empirical research indicates the impact of the load factor on customer complaints and service failure. With regard to the passenger load factor, we found that more passengers cause more airline delay. It could be understood that a number of passengers take stress on the service system and employees' workload which could increase the possibility of service failure. In addition, according to the DOT, more passengers in a limited space cause more complaints because reservation and ticketing are the major complaints categories, and these factors are more influential in complaints when the passenger number increase. However, with the employee number increase employee interactions have a significantly diminished role in customer satisfaction evaluations during service failure. An airline that records big-size firms is likely to secure more passengers than other airlines due to its competitive advantage including better service, and passengers using this airline might be satisfied with the service, resulting in fewer complaints in spite of the high passenger load factor. Thus, to support this argument, additional analysis based on survey data will be beneficial for further research.

Other implications for the relationship between service failure and customer complaints are described as follows. From the analysis conducted in this study, although the current-period effect of airline cancellation is not statistically having a significant relationship with customer complaints, the negative lagged effects have been found in the investigation, indicating service recovery effects during the service delivery process. Also, although mishandled baggage has no significant association with customer complaints in the current period, positive effects are observed after three periods. This can be interpreted that baggage handling problems often occur when the amount of baggage exceeds the capacity that an airport can afford to control, and overloaded systems and employees are likely to fail to handle baggage, whereas the negative effects of mishandled baggage customer complaints are

interpreted as the effort of adjustment to current period's effect by employees and this problem are closely related to the airport rather than the airline. In addition, the airline delay and load factor have a lagged effect on customer complaints.

With regard to the U-Shaped relationship between service failure and customer complaints, customer complaint increases nonlinearly with the increase of flight cancellation and load factor and decreases nonlinearly after a specific point. In addition, complaints decrease when delay increases in the beginning, customers will not be very concerned about delays caused by short excess time travel. Also, most of the customers use connecting flights, short delays do not significantly affect the next flight, but it seems that the longer delay could have more effect on the next flight, which resulting in customer complaints increased nonlinearly with the increase of airline delay after certain point. It different with airline cancellations, because airlines would pay full refund and other benefits to passengers and customers should reserve other appropriate flights, but delayed airline cannot pay compensation to customers expect for the situation that passengers buy delay insurance when they buy tickets.

This study also has limitations. The first limitation of the paper is the use of firm-wide data to investigate the relationship between load factor, service failure, and customer complaints. We would have wanted to estimate our models at the route level because airlines compete at the route level, but two of the service failure metrics, mishandled baggage and cancellations, and customer complaints data are only accessible at the firm level. The only place to find airline delay and load factor is at the firm level. A firm-level panel model has to be estimated as a result. In addition, the three indicators of service failure were investigated in this paper, but the other essential trigger of the customer complaints on service failure has not been exported in this paper. Finally, this study investigated the linear relationship between load factor and service failure, a possible future extension could be adopted for the mediating effect of market indicators such as market share and Herfindahl–Hirschman Index (HHI) to further investigate whether the effect of service failure and customer complaints increase.

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