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Unraveling the Nexus Between Airline Supply and Air Travel Demand: An Empirical Investigation Using Granger Causality and Bayesian Networks

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Abstract: We analyzed the dynamic equilibrium process between demand and supply in the international airline market by utilizing Granger causality and Bayesian Networks (BN) based on South Korea's aviation performance data. To examine whether the interrelationship between demand and supply varies depending on the classification of external factors, we tested for changes in causality based on reasonable segmentation of sub-market, time window, and time lag. Based on the results of the Granger causality analysis, we constructed a BN model to determine whether economic factors influence changes in the causal relationship between demand and supply, as well as to track the dynamic equilibrium path of demand and supply. The international airline market was classified into national and foreign carriers, as well as full-service carriers (FSCs) and low-cost carriers (LCCs). Time windows were set on a monthly, quarterly, and annual basis, while time lags were set with the minimum duration based on the unit of time window and the maximum duration based on data availability. Supply variables included the number of operations, available seat capacity, and load factor, whereas demand was represented by the number of revenue passengers. Our findings support the hypothesis that airline supply and demand factors in South Korea's international airline market exhibit mutual causality. Moreover, the causality from demand to supply was found to be somewhat clearer than the reverse case. As the time window shortened, the interrelationship became more evident, and the influence of demand on supply exhibited a shorter time lag while maintaining a longer duration compared to the opposite direction. In terms of market segmentation, the relationship between supply and demand was more distinct in the LCC market compared to the FSC market and in the national carrier market compared to the foreign carrier market. The BN model incorporating economic factors confirmed that the causal relationship between airline supply and demand could appear independently of economic influences when analyzing total monthly demand. Ultimately, our study confirms the existence of a mutual causal relationship between airline supply and demand in South Korea's international airline market. From an academic perspective, we provide insights into the dynamic equilibrium characteristics and pathways of supply and demand in the airline industry.

Keywords: the nexus between supply and demand; airline supply; air travel demand; granger causality; bayesian network

1. Introduction

In the process of forming international airline demand, we aimed to examine the mutual causal relationship between airline supply and air travel demand, segmented by sub-market, time window, and time lag. Due to the characteristics of the market—such as airline business models, the time-series nature of the data, and the presence and persistence of mutual influence—it is difficult to analyze the relationship between supply and demand from a purely aggregate perspective [1].

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At the national level, international demand can be segmented into markets based on the classification of flag carriers and foreign carriers, as well as full-service carriers (FSCs) and low-cost carriers (LCCs). From a time-series perspective, demand can be divided into monthly, quarterly, and yearly units. Additionally, the complexity of the dynamic equilibrium mechanism may vary depending on how long the mutual influence between supply and demand persists [2]. We categorized South Korea's international airline performance data into subgroups based on airline supply factors and demand, and we identified the mutual causal relationship between supply factors and demand within these given sample groups.

To test the causal relationship between airline supply and demand, we utilized Granger causality analysis, a method commonly used in economics, etc. Granger causality analysis has been applied in various fields to investigate the mutual causal relationship between supply and demand [3]. However, within our scope of review, we found no previous research in the aviation industry that has conducted a segmented analysis of the dynamic relationship between supply and demand based on real operational data, considering market segmentation, time window, and time lag. While theoretical claims suggest a mutual relationship between airline supply and demand [1], empirical verification using actual performance data has not been conducted. To validate this claim, we analyze the mutual causal relationship between airline supply and demand in South Korea's international airline market.

Rather than examining exogenous factors, we focus on the endogenous relationship between airline supply factors and demand. Airline demand is influenced by external socioeconomic factors [4]. Accordingly, previous studies have examined how events such as the global financial crisis and COVID-19 impact the endogenous causal relationship between supply and demand [5]. However, rather than analyzing shifts in dynamic equilibrium caused by external events, we investigate how the system finds its endogenous dynamic equilibrium in the absence of external shocks. In particular, we aim to reveal the mutual causal relationship between supply and demand based on detailed analyses of market segmentation, time window, and time lag.

To verify whether the identified Granger causality represents a true causal relationship, we construct a Bayesian Network (BN) based on the statistically significant causal relationships identified. BN has been widely used in various studies as a probabilistic model to represent the interrelationships between factors [6]. Before developing sophisticated models for airline demand forecasting, we use BN to examine whether the causal relationship between supply and demand, as identified through Granger causality analysis, is influenced by exogenous economic factors. Through this approach, we aim to explore the dynamic equilibrium relationship between airline supply and demand in the context of economic factors.

In Chapter 2, we review previous studies on supply and demand in the transportation infrastructure sector, including cases where airline demand forecasting incorporates supply factors and studies that employ BN-based demand forecasting models. Chapter 3 outlines the research methodology, including Granger causality analysis and BN, as well as the data used in the study. Chapter 4 presents the results of the analysis. Finally, in the last chapter, we provide a discussion and conclusion.

2. Literature Review

Research on the demand and supply of transportation infrastructure has been continuously conducted, with several studies analyzing their interrelationship. Gnap analyzed the correlation between road and rail infrastructure in Japan and select European countries and confirmed that increased investment in transportation infrastructure is closely related to improvements in logistics performance [7]. Schwedes examined the transition from traditional supply-oriented transportation planning to demand-oriented transportation planning [8]. Using data from a study on electric vehicle charging infrastructure in Berlin, they assessed the advantages of demand-oriented planning, which moves beyond the conventional "predict and provide" approach to reflect actual user needs and demands. Agatz explored how transportation systems operate under various service models and

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identified new research opportunities [9]. They introduced the concept of "Transportation-Enabled Services (TRENS)" and investigated how transportation systems contribute to the provision of non-transportation services, accessibility improvements, and efficiency enhancements. Furthermore, several studies have examined the influence of external factors, such as economic conditions, on the relationship between supply and demand. Schuckmann conducted a web-based real-time Delphi study to analyze key factors affecting transportation infrastructure development by 2030 [10]. Their research evaluated the impact of factors such as increasing globalization, urbanization, public financial constraints, and population growth on transportation infrastructure demand and supply. Archetti modeled an on-demand transit system using minibuses and confirmed that integrating such systems with existing public transportation can help reduce private vehicle usage and improve transportation efficiency [11]. Doll highlighted the crucial role of public-private partnership (PPP) models in successfully implementing transportation infrastructure projects from a supply perspective and emphasized the need for sustainable financial strategies [12]. Henao analyzed the impact of sustainable transportation infrastructure investments on modal shifts, finding that continuous infrastructure investments led to decreased automobile usage and increased reliance on alternative transportation modes [13]. Their study demonstrated that transportation infrastructure investments directly influence users' mobility choices. Lundaeva developed a more precise demand forecasting model for the airline industry by utilizing historical passenger flow data [14]. Departing from conventional simple statistical forecasting methods, their study combined time series analysis using the Facebook Prophet algorithm with multiple regression analysis. The model incorporated macroeconomic indicators such as regional GDP, median per capita income, and the population sizes of departure and arrival locations. The study emphasized that airline demand forecasting should go beyond simple temporal trend analysis and account for its relationship with airline supply levels.

As an extension of research on demand and supply in the transportation market, we aim to empirically test the mutual causal relationship between airline supply and demand based on actual airline market performance and examine its characteristics.

In academic research, increasing attention is being given to airline demand forecasting models that incorporate supply factors, as opposed to studies that focus solely on demand-side factors. Abdi analyzed the impact of airline seat supply and pricing strategies on demand forecasting [15]. They developed a demand forecasting model using multiple regression analysis, incorporating seat availability and price fluctuations from the supply side. Their study nafound that seat supply and pricing strategies play a crucial role in the accuracy of demand forecasting and confirmed that demand forecasting models considering supply factors contribute to revenue maximization for airlines. Pivac examined the impact of differentiated pricing strategies in the air cargo industry on demand forecasting [16]. Their findings indicated that a demand forecasting model that simultaneously accounts for supply factors (such as cargo space availability) and pricing strategies is more accurate and effective. Lee developed a demand forecasting and price optimization model that considers substitution effects between products within the supply chain [17]. They evaluated the impact of supply adjustments on demand using Gradient Boosting Machine and Random Forest methods. Their study demonstrated that quantitatively analyzing supply-demand interactions and incorporating substitution effects and pricing strategies into demand forecasting models leads to more accurate and effective results. Birolini developed a supply-demand interaction model that integrates airline schedule design, fleet assignment, and pricing [1]. Their study quantitatively analyzed the interaction between supply and demand and emphasized the importance of an integrated decision-making model that enhances airline operational efficiency and profitability.

Unlike the majority of existing academic research, which focuses primarily on demand forecasting, our study aims to analyze the relationship between supply and demand from the perspective of mutual causality.

Bayesian Networks (BN) have been continuously utilized in demand forecasting as a methodology for effectively handling uncertainty while considering the influence of various external factors. Lee developed a Bayesian Update-based model for forecasting demand for new technologies

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[18]. They proposed a method to improve demand forecasting accuracy by integrating stated preferences (SP) and revealed preferences (RP), which combine consumer survey data with actual behavioral data. Bassamzadeh applied a combination of a multiscale stochastic model and a Bayesian Network (BN) to predict electricity demand in a smart grid environment [19]. Their study confirmed that BN-based models exhibit high predictive performance across different time resolutions, such as 15-minute and hourly intervals. Additionally, they demonstrated that BN models outperform conventional regression-based models by incorporating the impact of real-time electricity price fluctuations on demand patterns. Hu proposed a product demand forecasting model that integrates Bayesian Networks (BN) with a modified particle swarm optimization algorithm (MPSO) [20]. Their study introduced Bayesian inference techniques to enhance the accuracy of forecasting highly volatile demand data, outperforming traditional time series models such as ARIMA. Bhuwalka developed a hierarchical Bayesian regression model to reduce regional and industry-specific uncertainties in material demand forecasting [21]. Compared to non-hierarchical regression models, their approach reduced the uncertainty in price elasticity and income elasticity by 2.3 times and 1.6 times, respectively. Furthermore, in a 25-year forecasting scenario, uncertainty was reduced by more than tenfold. Jiangming developed a Bayesian Network (BN)-based forecasting model for predicting key material supply in uncertain environments [22]. Their study demonstrated that even in cases where historical supply data is limited, BN models can leverage existing patterns to improve supply forecasting. Compared to conventional regression-based models, BN models exhibited more stable performance in volatile environments, highlighting their potential applications in supply chain management.

As a means of analyzing how the mutual causality between supply and demand factors interacts with economic factors, we employ the BN methodology, whose validity has been demonstrated in previous research.

3. Methodology

3.1. Overall Research Landscape

In this study, we analyze the dynamic equilibrium process between demand factors and airline supply factors in the aviation market by conducting a Granger causality analysis and constructing Bayesian Networks (BN) based on past international airline market performance and economic indicators in South Korea. The supply variables considered are the number of operations, available seat capacity, and load factor, while the demand variable is the number of revenue passengers. The international airline market is segmented based on market segmentation, time window, and time lag. The market is classified into full-service carriers (FSCs) and low-cost carriers (LCCs), as well as foreign and flag carriers. The time window is divided into monthly, quarterly, and annual units, while the time lag is set with the minimum unit being the time window itself and the maximum unit determined based on data constraints.

Through Granger causality analysis, we test whether there is a time-lagged mutual relationship between supply and demand factors. Additionally, we construct a Bayesian Network from a total monthly demand perspective that incorporates economic factors affecting demand, as suggested in previous research [23]. This allows us to examine changes in the interrelationship between supply and demand and to provide illustrative insights into the dynamic equilibrium pathways when economic factors are introduced.

In this study, the time lag is set as follows: for monthly data, from 1 month to 36 months; for quarterly data, from 1 quarter to 12 quarters; and for annual data, from 1 year to 10 years. The time-lag settings for each data segmentation are presented in the following table, reflecting seasonal patterns and periodicity. Particularly, the Granger causality analysis conducted in this study enables us to examine how past data influences future values, allowing for the establishment of diverse scenario-based time-lag settings. Table 1 presents the data segmentation categorized by time, while Table 2 delineates the configuration values for the classification of variable codes based on data types.

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Table 1. Time-Lag Settings by Data Segmentation.

Category	Time-Lag Settings
Monthly (Month)	1, 3, 6, 12, 18, 24, 36
Quarterly (Quarter)	1, 2, 3, 4, 6, 8, 12
Yearly (Year)	1, 2, 3, 5, 10

Table 2. Classification of Variable Codes by Data Type.

Type		Code
Time Window	Month	M
	Quarter	Q
	Year	Y
Supply Variable	Frequency	F
	Seats	S
	Load Factor	LF
Demand Variable	Passenger	Pax
Market	Total	Total
	Flag Carrier	Flag
	Foreign Airline	FA
	Full-Service Carrier	FSC
	Low-Cost Carrier	LCC

3.2. Granger Causality Analysis

Granger causality is a statistical method used to test whether one variable provides significant information for predicting the future values of another variable. In other words, if the past values of X have explanatory power for the present or future values of Y, then X is said to Granger-cause Y [24]. To test for Granger causality, two regression equations must be established [25].

(1) Restricted Model

$$\boldsymbol{Y_t} = \boldsymbol{a_0} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{R}} \boldsymbol{\beta_i Y_{t-i}} + \boldsymbol{\varepsilon_t}$$

(2) Unrestricted Model

$$\boldsymbol{Y_t} = \boldsymbol{a_0} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{R}} \boldsymbol{\beta_i Y_{t-i}} + \sum_{\boldsymbol{j=1}}^{\boldsymbol{R}} \boldsymbol{\gamma_i X_{t-j}} + \boldsymbol{\varepsilon_t}$$

$\boldsymbol{Y_t}$: Dependent variable at time t

$\boldsymbol{X_t}$: Independent variable at time t

$\boldsymbol{p}$: Number of lags

$\boldsymbol{\beta_i \gamma_j}$: Regression coefficient

$\boldsymbol{\varepsilon_t}$: Error term

By comparing the restricted model and the full model, we test whether the inclusion of X significantly improves the predictive power for Y. To conduct the Granger causality test, the F-statistic is used to establish the null and alternative hypotheses [25].

$$H_0 : \gamma_1 = \gamma_2 = \cdots = \gamma_p$$

That is, the past values of X do not affect the future values of Y.

(3) Calculation of the F-statistic

In the case of Granger causality analysis, the method for calculating the **F-statistic** using the sum of squared residuals of the restricted model and the full model is as follows [25].

$$F = \frac{(RSS_R - RSS_U)/p}{RSS_R/(T - 2p - 1)}$$

$\boldsymbol{RSS_R}$: Residual Sum of Squares of the restricted model

$\boldsymbol{RSS_U}$: Residual Sum of Squares of the full model

$\boldsymbol{T}$: Sample size

$\boldsymbol{p}$: Number of lags

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If the calculated F-value is greater than the critical value at a given significance level, the null hypothesis is rejected, and X is determined to be the Granger cause of Y [26].

3.3. Bayesian Network Analysis

A Bayesian Network (BN) is a probabilistic graphical model based on conditional independence among random variables. It is widely used for probabilistic decision-making, causal analysis, and predictive modeling. A Bayesian Network is represented as a Directed Acyclic Graph (DAG), where each node represents a random variable, and each edge denotes a conditional dependency between variables. A Bayesian Network consists of nodes that represent random variables, edges that indicate conditional dependencies between nodes, and conditional probability distributions, which define the probability distribution of a dependent node given the values of its parent nodes. In a Bayesian Network, relationships between variables are calculated using Bayes' theorem, and the formula is expressed as follows [27].

$$P(\mathrm{A}|\mathrm{B}) = \frac{P(\mathrm{B}|\mathrm{A})P(\mathrm{A})}{P(\mathrm{B})}$$

$\boldsymbol{P(\mathbf{A}|\mathbf{B})}$: The probability of event A occurring given that event B has occurred (Posterior Probability)

$\boldsymbol{P(\mathbf{B}|\mathbf{A})}$: The probability of event B occurring given that event A has occurred (Likelihood)

$\boldsymbol{P(\mathbf{A})}$: The prior probability of event A (Prior Probability)

$\boldsymbol{P(\mathbf{B})}$: The total probability of event B (Marginal Probability)

In a Bayesian Network, a Conditional Probability Table (CPT) is generated for each node to quantify the relationships between variables. For example, if two variables X and Y exist, and Y is assumed to be the parent node of X, the following CPT can be set. Inference in a Bayesian Network is the process of updating the probability of a specific variable based on observed data. It is classified into Exact Inference, which calculates accurate probabilities using Variable Elimination or Dynamic Programming, and Approximate Inference, which estimates probabilities using sampling-based algorithms. Additionally, to evaluate the performance of a Bayesian Network model, Log-Likelihood (LL), Kullback-Leibler Divergence (KL-divergence), and Structural Learning Accuracy can generally be used as evaluation metrics [28].

4. Result

4.1. Basic Analysis Results

We divided the basic statistics of the utilized data into monthly, quarterly, and yearly time series for basic analysis. Additionally, we compared the average growth rate, range, and trends in the number of passengers per unit of supply. The summarized basic statistical results for each dataset are provided in the Appendix A.

Table 3. Basic Analysis Results by Utilized Data (Average Growth Rate, Count, Standard Deviation).

Type	Average Growth Rate(%)			Count			Standard Deviation		
	Month	Quarter	Year	Month	Quarter	Year	Month	Quarter	Year
Total_Pax	2.593	10.215	26.414	132	44	32	2,542,443	7,519,740	24,023,380
Flag_Pax	2.677	10.571	30.197	132	44	32	1,725,968	5,107,447	16,302,388
FA_Pax	2.559	10.018	21.107	132	44	32	829,698	2,450,270	7,804,372
FSC_Pax	1.770	7.027	19.506	132	44	32	1,035,209	3,076,083	9,675,428
LCC_Pax	6.500	27.860	795.323	132	44	17	836,870	2,474,587	9,715,016
Total_S	1.845	6.949	14.178	132	44	32	2,930,379	8,689,327	27,934,005
Flag_S	1.948	7.049	15.789	132	44	32	1,976,027	5,858,291	18,997,255
FA_S	1.754	7.010	11.886	132	44	32	967,740	2,868,956	9,056,260
FSC_S	1.087	3.910	9.375	132	44	32	1,199,578	3,574,850	11,576,203
LCC_S	5.713	22.666	864.268	132	44	17	970,195	2,873,882	11,295,685

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Total_LF	0.514	1.757	5.538	132	44	32	18.231	18.054	10.674
Flag_LF	0.531	1.100	4.682	132	44	32	16.419	16.065	10.243
FA_LF	0.592	1.956	5.885	132	44	32	18.427	18.259	10.828
FSC_LF	0.855	1.364	3.427	132	44	32	15.430	15.090	8.154
LCC_LF	0.574	0.860	7.369	132	44	17	17.823	17.377	13.300

The average growth rate showed an increasing trend from monthly to yearly data, with the LCC group exhibiting the highest growth rate and the FSC group showing the lowest. Regarding standard deviation, foreign airlines (FA) recorded the lowest value, which suggests potential implications for data consistency and pattern analysis. In the market-specific trends of monthly data, the differences between FSC and LCC were more pronounced compared to the total (overall market). For FSCs, which entered an existing market, the fluctuations in supply variables and demand trends were relatively large. In contrast, LCCs, as new market entrants, exhibited a steep upward trend, with supply variables following a pattern similar to demand, more so than in other market segments.

4.2. Overview of Causality Analysis Results

The Granger causality analysis was conducted on the combination groups formed based on variables, time windows, and time lags. The results show that evidence of a mutual causal relationship between airline supply and air travel demand was found more than four times as often as cases where no such evidence was identified. As shown in Figure 1, out of 90 total combinations, only 15 cases (17%) did not provide evidence of causality. Regarding the direction of causality between supply and demand, it was more difficult to find evidence that supply causes demand than the reverse. Among the cases analyzed, there were 5 instances where no evidence was found that demand causes supply, while there were 10 instances where no evidence was found that supply causes demand. In the South Korean market examined in this study, the hypothesis that a mutual causal relationship exists between supply and demand is supported, with demand more frequently acting as a cause of supply than the other way around.

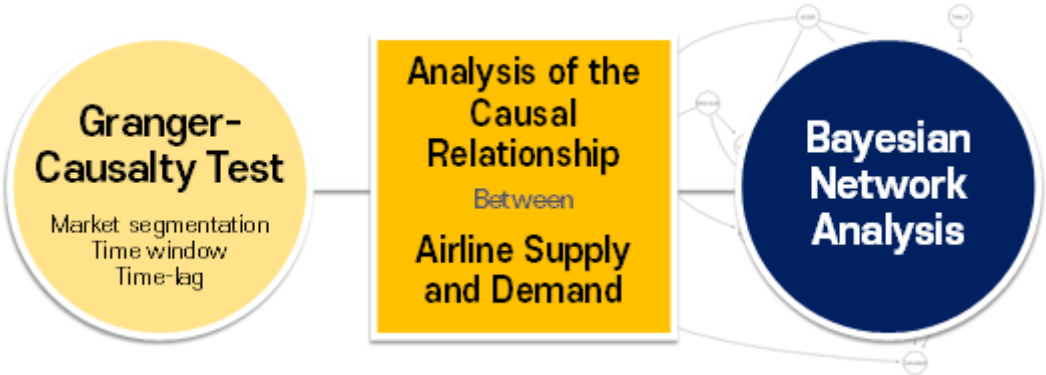

Figure 1. Overall Research Landscape.

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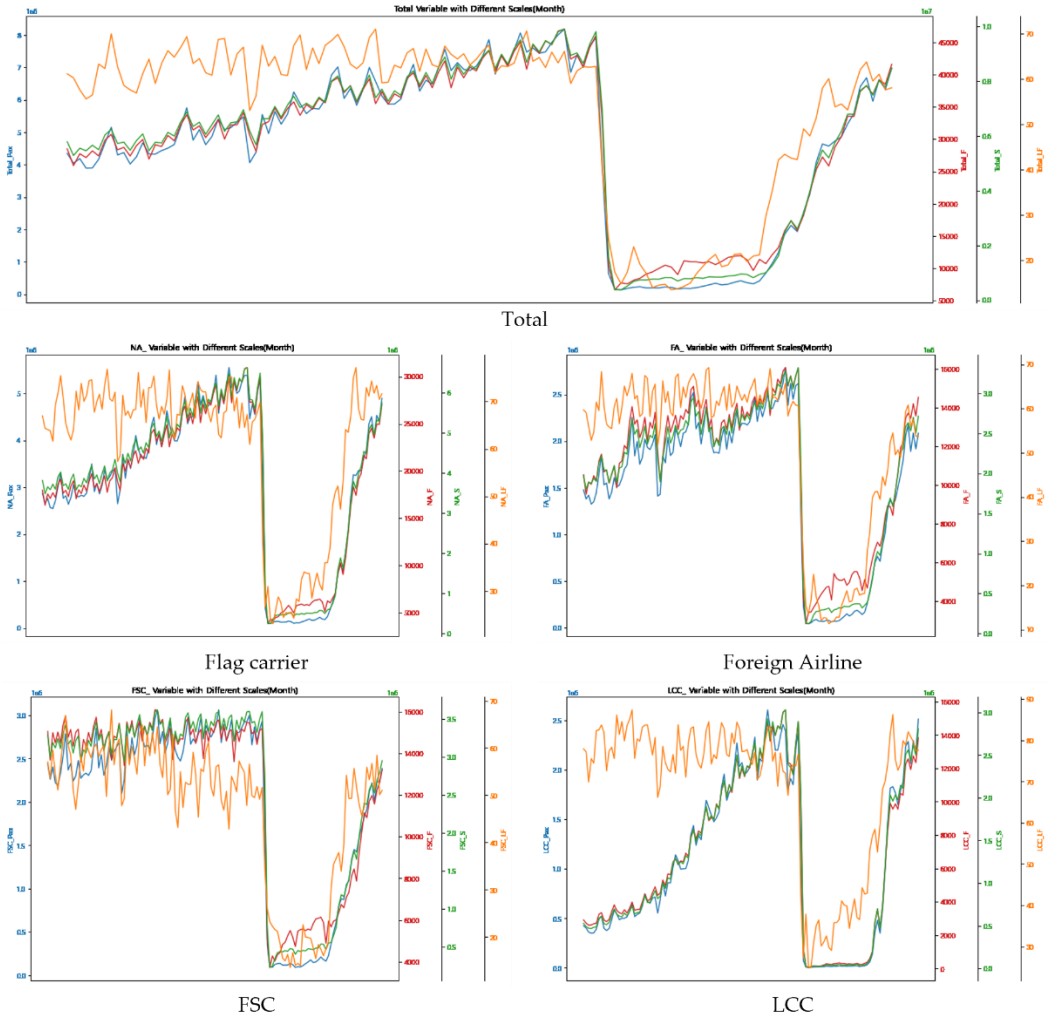

Figure 2. Basic Analysis of Monthly Data Time Series Trends (by Market).

From a time window perspective, all monthly cases showed mutual causality, except for the combination of low-cost carriers (LCC) passengers and load factor. Conversely, cases where causality was not supported were most frequently observed in the yearly time window, indicating that larger time windows make it more difficult to detect causality. Furthermore, in all combinations of supply variables set as frequency, available seats, and load factor, there were no cases where demand and supply lacked causality. This strongly supports the hypothesis that a mutual causal relationship exists between supply and demand.

Time lag and complexity varied depending on the time window unit and the causality direction between supply and demand (Appendix A, Table A1). The impact of demand on supply lasted for both short and extended durations in more combinations than the impact of supply on demand. Among the combinations where causality was observed, there were no cases where supply started influencing demand before the reverse was observed. However, in some cases, the effect of supply on demand persisted longer. In certain cases, the impact might extend beyond the predefined time lag limit due to data constraints. This phenomenon further supports the hypothesis that the influence of demand on supply is stronger than that of supply on demand.

From a market segmentation perspective, causality was less frequently observed in FSCs compared to LCCs and in foreign airlines compared to flag carriers. Regarding the impact of demand on supply, causality was observed in all possible cases for LCCs and flag airlines. In contrast, cases where causality was not observed for supply impacting demand were found primarily in FSCs and foreign airlines, except for LCC load factor & LCC demand and flag airline load factor & flag airline demand.

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Table 4. Cases Where No Evidence of Causality Was Found (Based on Granger Causality Analysis).

Causality	Demand Variable	Supply Variable	Time Window
Demand Causes Supply	Total Passenger	Total Available Seats	Year
	FSC Passenger	FSC Frequency	Quarter
	FSC Passenger	FSC Available Seats	Year
	Foreign Airrline Passenger	Foreign Airline Frequency	Quarter
	Foreign Airrline Passenger	Foreign Airline Available Seats	Year
Supply Causes Demand	Total_Passenger	Total Load Factorr	Year
	Total_Passenger	Total Available Seats	Year
	FSC Passenger	FSC Frequency	Quarter
	FSC Passenger	FSC Load Factor	Year
	FSC Passenger	FSC Available Seats	Quarter, Year
	LCC Passenger	LCC Load Factor	Month, Year
	Flag Airline Passengerr	Flag Airline Load Factor	Year
	Foreign Airrline Passenger	Foreign Airline Frequency	Quarter
	Foreign Airrline Passenger	Foreign Airline Load Factor	Year
	Foreign Airrline Passenger	Foreign Airline Available Seats	Year

4.3. Causality Analysis Results by Market

The market-specific causality analysis examines the time lag in the relationship between supply and demand by analyzing the minimum and maximum values of the time lag for each supply variable. Since using the average may distort the interpretation of the time lag in the supply-demand relationship, we apply the min-min and max-max methodology, which selects one of the three variables based on the minimum of the minimum values and the maximum of the maximum values.

4.3.1. FSC vs. LCC

Based on the monthly time window, FSC supply was found to influence demand from 3 months to 36 months prior (the study's time limit), while total demand was affected by supply from 6 months to 36 months prior. In all other cases, supply and demand continuously influenced each other from 1 month to 36 months prior. This suggests that, on a monthly basis, demand responds to supply with a greater lag in FSC compared to LCC.

In the quarterly time window, the time lag patterns for FSC and LCC supply and demand were found to be different. For FSCs, demand influenced supply from 1 quarter to 8 quarters prior, while supply influenced demand from 1 quarter to 12 quarters prior. This suggests that supply has a longer-lasting effect on demand. In contrast, for LCCs, the opposite pattern was observed: demand influenced supply from 1 quarter to 12 quarters prior, while supply influenced demand from 1 quarter to 8 quarters prior. These findings indicate that the causal relationship between supply and demand differs between FSCs and LCCs when viewed on a quarterly basis.

For the yearly time window, FSCs showed a mutual influence between supply and demand from 2 years to 5 years prior. In contrast, LCC demand influenced supply from 1 year to 3 years prior, while supply had a 3-year lag before influencing demand. This suggests that, even on a yearly basis, the mutual causality between supply and demand differs between FSCs and LCCs, supporting the hypothesis that the two market segments exhibit distinct causal patterns.

Table 5. Comparison of FSC and LCC Time Lag (Based on Minimum and Maximum Values).

Variable		Time Window	Causality	Time lag	
Demand	Supply			Min	Max
Total_P	Min-Max	Month	Demand Causes Supply	1	36

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Total_P	Min-Max	Month	Supply Causes Demand	6	36
FSC_P	Min-Max	Month	Demand Causes Supply	1	36
FSC_P	Min-Max	Month	Supply Causes Demand	3	36
LCC_P	Min-Max	Month	Demand Causes Supply	1	36
LCC_P	Min-Max	Month	Supply Causes Demand	1	36
Total_P	Min-Max	Quarter	Demand Causes Supply	1	8
Total_P	Min-Max	Quarter	Supply Causes Demand	1	6
FSC_P	Min-Max	Quarter	Demand Causes Supply	1	8
FSC_P	Min-Max	Quarter	Supply Causes Demand	1	12
LCC_P	Min-Max	Quarter	Demand Causes Supply	1	12
LCC_P	Min-Max	Quarter	Supply Causes Demand	1	8
Total_P	Min-Max	Year	Demand Causes Supply	2	5
Total_P	Min-Max	Year	Supply Causes Demand	2	3
FSC_P	Min-Max	Year	Demand Causes Supply	2	5
FSC_P	Min-Max	Year	Supply Causes Demand	2	5
LCC_P	Min-Max	Year	Demand Causes Supply	1	3
LCC_P	Min-Max	Year	Supply Causes Demand	3	3

4.3.2. NA vs. FA

Based on the monthly time window, supply and demand were found to have a mutual causal relationship from 1 month to 36 months prior, regardless of whether the airline was a national carrier or a foreign airline. However, in terms of total demand, supply influenced demand from 6 months to 36 months prior, suggesting that the combined analysis of national and foreign carriers produces different interpretations. This phenomenon is attributed to the significant performance differences between national and foreign carriers in terms of supply and demand.

For the quarterly time window, national and foreign carriers generally exhibited mutual influence from 1 quarter to 12 quarters prior, except in the case of flag carriers, where supply influenced demand only from 1 quarter to 6 quarters prior. However, total demand showed slightly different results, similar to those observed in the monthly time window analysis. In terms of demand's influence on supply, total demand followed a pattern similar to flag carriers, where past performance from 1 quarter to 6 quarters prior affected current supply. However, in terms of supply's influence on demand, the time lag was found to be from 1 quarter to 8 quarters prior, exhibiting a different pattern from both national and foreign carriers.

For the yearly time window, flag carriers showed mutual causality between supply and demand from 2 years to 5 years prior. In contrast, foreign carriers exhibited a pattern where demand influenced supply from 1 year to 3 years prior, while supply influenced demand with a lag of 2 to 3 years. In terms of total demand, demand's influence on supply followed the pattern of flag carriers, while supply's influence on demand followed the pattern of foreign carriers. The yearly analysis results suggest that the mutual relationship between supply and demand is significantly influenced by whether an airline is a national or foreign carrier.

Table 6. Comparison of Time Lag Between National and Foreign Carriers (Based on Minimum and Maximum Values).

Variable		Time Window	Causality	Time lag	
Demand	Supply			Min	Max
Total_P	Min-Max	Month	Demand Causes Supply	1	36
Total_P	Min-Max	Month	Supply Causes Demand	6	36
Flag_P	Min-Max	Month	Demand Causes Supply	1	36
Flag_P	Min-Max	Month	Supply Causes Demand	1	36
FA_P	Min-Max	Month	Demand Causes Supply	1	36
FA_P	Min-Max	Month	Supply Causes Demand	1	36

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Total_P	Min-Max	Quarter	Demand Causes Supply	1	8
Total_P	Min-Max	Quarter	Supply Causes Demand	1	6
Flag_P	Min-Max	Quarter	Demand Causes Supply	1	12
Flag_P	Min-Max	Quarter	Supply Causes Demand	1	6
FA_P	Min-Max	Quarter	Demand Causes Supply	1	12
FA_P	Min-Max	Quarter	Supply Causes Demand	1	12
Total_P	Min-Max	Year	Demand Causes Supply	2	5
Total_P	Min-Max	Year	Supply Causes Demand	2	3
Flag_P	Min-Max	Year	Demand Causes Supply	2	5
Flag_P	Min-Max	Year	Supply Causes Demand	2	5
FA_P	Min-Max	Year	Demand Causes Supply	1	3
FA_P	Min-Max	Year	Supply Causes Demand	2	3

4.4. Bayesian Network Analysis Results

We represented the relationship between demand and supply concerning the total monthly demand and economic indicators using a Bayesian Network. The Bayesian Network was utilized to integrate economic factors and the demand-supply relationship derived from Granger causality. Socioeconomic indicators were incorporated into the model based on the findings of a previous study (Song, K.H. et al., 2023). The model included the number of flights and available seat capacity from one month prior, the number of flights six months later, the available seat capacity twelve months later, and the current total international demand. A static model was constructed to examine whether the independent relationship between demand and supply changes when economic factors are introduced and to conceptually observe the interconnection with economic factors. To align with the study's objectives, the continuous mutual influence between demand and supply was excluded, as was the Load Factor derived from their interaction.

The results of the Bayesian Network construction are shown in Figure 3, with detailed parameters presented in Appendix A Table A2. The impact of economic indicators on demand is reflected in two aspects: economic conditions and exchange rates. The findings confirm previous research [23], which suggested that monthly air travel demand, as a short-term demand indicator, can be influenced by exchange rates. The direction of changes in demand and supply derived from the Granger causality analysis was found to remain consistent regardless of the presence of economic indicators. However, the model suggested that the supply indicator from one month prior affects economic indicators, despite the lack of a clear direct relationship. This appears to represent a hidden relationship rather than a true causal effect, where the supply indicator acts as a proxy reflecting the impact of economic indicators from one or more months earlier, which in turn influences current economic indicators.

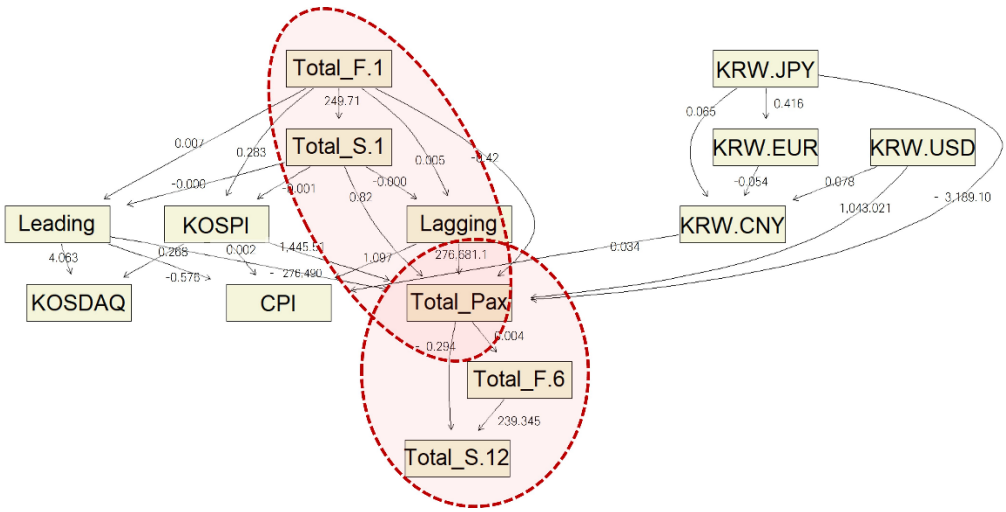

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Figure 3. Bayesian Network Results (Including Link Coefficients).

The Bayesian Network analysis revealed additional relationships not identified in the Granger causality analysis. Specifically, the number of flights was found to influence the available seat capacity, and both supply factors were found to impact demand. This result supports the logical assumption that an increase in the number of flights leads to an increase in available seat capacity. Additionally, the fact that both factors simultaneously affect demand suggests that variations in fleet composition, which influence seat capacity but are not directly reflected in flight frequency, also play a role in shaping demand. The previously mentioned relationships also hold in patterns where current demand influences future supply. This indicates that airlines adjust their future flight frequencies and seat capacities based on current demand trends.

5. Discussion & Conclusion

We have found that considering both cross-sectional and time-series market segmentation is crucial in studying the international airline market. Our analysis of the South Korean international airline market confirmed that the causal relationship between demand and supply varies depending on the time window, time lag, and market segmentation. Evidence suggests that the dynamic equilibrium between supply and demand in the international airline market follows different pathway patterns based on market segmentation, time lags in influence, and the persistence of these effects. This implies that in addition to cross-sectional market segmentation, it is also necessary to account for dynamic phenomena considering both time windows and time lags. Furthermore, from a market and dynamic perspective, the impact of past demand and supply on subsequent trends differs between the short and long term, adding complexity that must be considered in future research on airline market demand and supply.

We also identified that the causal relationship patterns between demand and supply in South Korea's international airline market differ depending on airline business models. Specifically, we found that the demand-supply relationship for full-service carriers (FSCs) exhibits a longer time lag than that of low-cost carriers (LCCs). We inferred that this is because LCCs respond more sensitively to short-term demand fluctuations and employ flexible fleet mix through standardized aircraft types. In particular, since South Korea's international airline market consists of multiple flag LCCs with overlapping market coverage, intensified competition among carriers results in a faster and more short-term interaction between supply and demand compared to FSCs. Given that Korean Air and Asiana Airlines are being integrated into a mega-carrier, the ongoing transformation of South Korea's international airline market may lead to structural disruptions, introducing significant uncertainty. Therefore, to understand and forecast South Korea's international airline market more accurately, it is essential to closely monitor the evolving relationship between airline supply factors and air travel demand factors in response to changes in airline business models.

We discovered that the interaction between domestic and foreign airlines may have a different impact on overall demand patterns rather than the mere distinction between South Korean flag carriers and foreign airlines. When markets of different sizes and target demands, such as domestic and foreign airlines, are combined, the uncertainty in the mutual influence of supply and demand increases from the perspective of total demand. Since this study focuses on the South Korean international airline market, it is evident that South Korean flag carriers primarily target outbound passengers, and their operational patterns are largely dependent on this demand. In contrast, foreign airlines have more flexibility in adjusting supply, often cater to their own nationals as primary customers, and account for a smaller share of the total market. When markets of different scales and characteristics are combined, the aggregated market may exhibit variations in the mutual relationship between supply and demand depending on the influence of each constituent market. This finding suggests that determining the causal relationship between supply and demand based solely on the patterns of either domestic or foreign airlines may lead to inaccurate conclusions regarding total demand.

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In a basic Bayesian Network model, assuming a minimal monthly time lag while incorporating economic factors, we confirmed that economic factors, supply, and demand factors could interact without altering the causal relationship between supply and demand derived from the Granger causality analysis. While the simplification of the model presents limitations in generalizing the results, we argue that it is feasible to analyze supply and demand factors separately from economic factors. Conversely, since supply and demand factors can also be considered in a complex relationship with economic factors, we conclude that economic, supply, and demand factors should be examined simultaneously to understand the airline market more comprehensively. Although existing models, such as simultaneous equations that consider both exogeneity and endogeneity, are available, our findings suggest that alternative studies employing models capable of expressing complex interactions, such as Bayesian Networks, should continue for a deeper understanding of market mechanisms.

This study contributes to the literature by empirically identifying the relationship between supply and demand in the airline market, reinforcing existing research claims regarding their interdependence, while also presenting different patterns of mutual causality. By conducting an exploratory study on market segmentation, time windows, and time lags, we examined the practical applicability of supply and demand theories in real-world scenarios. From an academic perspective, we hope that our findings and applied methodologies will be utilized in subsequent research, such as market analysis and demand forecasting, and ultimately serve as a best practice for understanding the airline market.

Author Contributions: Conceptualization, K.H.S.; methodology, K.H.S. and S.C.; software, K.H.S. and S.C.; investigation, S.C.; resources, S.C.; formal analysis, K.H.S. and S.C.; data curation, S.C.; writing—original draft preparation, S.C. and K.H.S.; writing—review and editing, K.H.S. and S.C.; supervision, K.H.S.; project administration K.H.S. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest

Appendix A

Table A1. Results of Granger Causality Analysis Between FA and NA.

Variable		Time Window	Causality	Time lag	
Demand	Supply		Causality	Min	Max
Total_P	Total_F	Month	Demand Causes Supply	1	36
Total_P	Total_LF	Month	Demand Causes Supply	3	12
Total_P	Total_S	Month	Demand Causes Supply	1	36
Total_P	Min-Max	Month	Demand Causes Supply	1	36
Total_P	Total_F	Month	Supply Causes Demand	6	36
Total_P	Total_LF	Month	Supply Causes Demand	12	12
Total_P	Total_S	Month	Supply Causes Demand	12	36
Total_P	Min-Max	Month	Supply Causes Demand	6	36
Flag_P	Flag_F	Month	Demand Causes Supply	1	36
Flag_P	Flag_LF	Month	Demand Causes Supply	3	18
Flag_P	Flag_S	Month	Demand Causes Supply	1	36
Flag_P	Min-Max	Month	Demand Causes Supply	1	36
Flag_P	Flag_F	Month	Supply Causes Demand	1	36
Flag_P	Flag_LF	Month	Supply Causes Demand	1	12
Flag_P	Flag_S	Month	Supply Causes Demand	1	36
Flag_P	Min-Max	Month	Supply Causes Demand	1	36
FA_P	FA_F	Month	Demand Causes Supply	1	36
FA_P	FA_LF	Month	Demand Causes Supply	3	36
FA_P	FA_S	Month	Demand Causes Supply	1	36
FA_P	Min-Max	Month	Demand Causes Supply	1	36

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FA_P	FA_F	Month	Supply Causes Demand	12	36
FA_P	FA_LF	Month	Supply Causes Demand	1	24
FA_P	FA_S	Month	Supply Causes Demand	12	24
FA_P	Min-Max	Month	Supply Causes Demand	1	36
Total_P	Total_F	Quarter	Demand Causes Supply	1	8
Total_P	Total_LF	Quarter	Demand Causes Supply	1	8
Total_P	Total_S	Quarter	Demand Causes Supply	1	8
Total_P	Min-Max	Quarter	Demand Causes Supply	1	8
Total_P	Total_F	Quarter	Supply Causes Demand	1	6
Total_P	Total_LF	Quarter	Supply Causes Demand	1	1
Total_P	Total_S	Quarter	Supply Causes Demand	1	1
Total_P	Min-Max	Quarter	Supply Causes Demand	1	6
Flag_P	Flag_F	Quarter	Demand Causes Supply	1	12
Flag_P	Flag_LF	Quarter	Demand Causes Supply	1	8
Flag_P	Flag_S	Quarter	Demand Causes Supply	1	8
Flag_P	Min-Max	Quarter	Demand Causes Supply	1	12
Flag_P	Flag_F	Quarter	Supply Causes Demand	1	6
Flag_P	Flag_LF	Quarter	Supply Causes Demand	1	1
Flag_P	Flag_S	Quarter	Supply Causes Demand	1	6
Flag_P	Min-Max	Quarter	Supply Causes Demand	1	6
FA_P	FA_F	Quarter	Demand Causes Supply	N/A	N/A
FA_P	FA_LF	Quarter	Demand Causes Supply	1	12
FA_P	FA_S	Quarter	Demand Causes Supply	1	4
FA_P	Min-Max	Quarter	Demand Causes Supply	1	12
FA_P	FA_F	Quarter	Supply Causes Demand	N/A	N/A
FA_P	FA_LF	Quarter	Supply Causes Demand	1	12
FA_P	FA_S	Quarter	Supply Causes Demand	1	1
FA_P	Min-Max	Quarter	Supply Causes Demand	1	12
Total_P	Total_F	Year	Demand Causes Supply	2	3
Total_P	Total_LF	Year	Demand Causes Supply	2	5
Total_P	Total_S	Year	Demand Causes Supply	N/A	N/A
Total_P	Min-Max	Year	Demand Causes Supply	2	5
Total_P	Total_F	Year	Supply Causes Demand	2	3
Total_P	Total_LF	Year	Supply Causes Demand	N/A	N/A
Total_P	Total_S	Year	Supply Causes Demand	N/A	N/A
Total_P	Min-Max	Year	Supply Causes Demand	2	3
Flag_P	Flag_F	Year	Demand Causes Supply	2	5
Flag_P	Flag_LF	Year	Demand Causes Supply	2	5
Flag_P	Flag_S	Year	Demand Causes Supply	2	2
Flag_P	Min-Max	Year	Demand Causes Supply	2	5
Flag_P	Flag_F	Year	Supply Causes Demand	2	5
Flag_P	Flag_LF	Year	Supply Causes Demand	N/A	N/A
Flag_P	Flag_S	Year	Supply Causes Demand	2	2
Flag_P	Min-Max	Year	Supply Causes Demand	2	5
FA_P	FA_F	Year	Demand Causes Supply	1	3
FA_P	FA_LF	Year	Demand Causes Supply	3	3
FA_P	FA_S	Year	Demand Causes Supply	N/A	N/A
FA_P	Min-Max	Year	Demand Causes Supply	1	3
FA_P	FA_F	Year	Supply Causes Demand	2	3
FA_P	FA_LF	Year	Supply Causes Demand	N/A	N/A
FA_P	FA_S	Year	Supply Causes Demand	N/A	N/A

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FA_P	Min-Max	Year	Supply Causes Demand	2	3

Table A2. Descriptive Statistics of the Data Used in This Study.

Type		count	mean	std	Min	25%	50%	75%	max
Month	Total_Pax	132	4,578,753	2,542,443	138,447	3,695,503	5,156,361	6,620,419	8,183,084
	Total_F	132	29,602	11,743	6,668	24,402	32,255	38,618	47,052
	Total_S	132	5,800,955	2,930,379	377,072	4,662,538	6,576,266	8,013,506	9,906,387
	Total_LF	132	53	18	13	49	62	65	71
	Flag_Pax	132	3,038,372	1,725,968	94,270	2,431,483	3,347,149	4,494,610	5,554,512
	Flag_F	132	18,640	8,052	3,835	15,601	19,604	24,943	30,960
	Flag_S	132	3,817,058	1,976,027	247,354	3,123,471	4,175,361	5,335,772	6,629,883
	Flag_LF	132	60	16	23	58	67	71	77
	FA_Pax	132	1,540,381	829,698	44,177	1,200,252	1,845,991	2,148,191	2,789,050
	FA_F	132	10,963	3,783	2,833	8,423	12,449	13,751	16,092
	FA_S	132	1,983,896	967,740	122,982	1,537,647	2,371,190	2,668,991	3,323,130
	FA_LF	132	51	18	11	44	60	63	69
	FSC_Pax	132	1,975,911	1,035,209	88,478	1,268,276	2,443,112	2,734,606	3,063,729
	FSC_F	132	12,134	4,119	3,719	7,729	14,558	15,109	16,081
	FSC_S	132	2,548,361	1,199,578	228,625	1,565,565	3,218,480	3,419,026	3,619,782
	FSC_LF	132	47	15	14	43	52	58	68
	LCC_Pax	132	1,062,461	836,870	3,838	372,569	864,407	1,834,945	2,604,075
	LCC_F	132	6,506	4,853	62	2,715	5,643	11,069	15,500
	LCC_S	132	1,268,697	970,195	10,605	488,348	1,054,189	2,164,598	3,029,180
	LCC_LF	132	68	18	25	67	76	80	87
Quarter	Total_Pax	44	13,736,258	7,519,740	476,095	11,396,867	15,266,181	19,853,496	23,135,158
	Total_F	44	88,807	34,691	22,005	77,739	96,083	116,193	136,202
	Total_S	44	17,402,864	8,689,327	1,274,581	15,350,270	19,540,702	23,945,761	28,662,455
	Total_LF	44	53	18	14	48	62	65	68
	Flag_Pax	44	9,115,116	5,107,447	331,057	7,508,116	9,811,900	13,302,567	15,923,755
	Flag_F	44	55,919	23,806	12,311	49,093	58,608	73,403	89,071
	Flag_S	44	11,451,175	5,858,291	866,025	10,157,971	12,361,445	15,657,495	19,064,335
	Flag_LF	44	60	16	25	60	67	71	74
	FA_Pax	44	4,621,142	2,450,270	145,038	3,842,645	5,515,360	6,330,792	7,794,001
	FA_F	44	32,888	11,145	9,694	26,427	37,543	40,874	47,131
	FA_S	44	5,951,689	2,868,956	408,556	4,822,021	7,181,565	7,914,461	9,598,120
	FA_LF	44	51	18	12	44	60	63	67
	FSC_Pax	44	5,927,732	3,076,083	305,611	4,215,156	7,348,266	8,292,799	8,694,700
	FSC_F	44	36,401	12,241	12,021	24,802	43,858	44,820	47,565
	FSC_S	44	7,645,083	3,574,850	819,954	5,106,551	9,601,273	10,221,865	10,643,440
	FSC_LF	44	47	15	15	45	53	57	63
	LCC_Pax	44	3,187,384	2,474,587	17,661	1,191,550	2,899,568	5,509,519	7,464,709
	LCC_F	44	19,517	14,369	290	8,644	17,872	32,441	43,198
	LCC_S	44	3,806,092	2,873,882	46,071	1,626,798	3,481,399	6,352,779	8,502,077
	LCC_LF	44	68	17	29	67	75	80	83
Year	Total_Pax	32	35,356,052	24,023,380	3,235,646	16,592,752	28,437,881	48,792,711	90,900,322
	Total_F	32	227,754	136,768	68,208	109,330	184,584	320,056	528,243
	Total_S	32	47,309,604	27,934,005	9,989,680	24,887,897	39,609,118	64,938,395	111,155,032
	Total_LF	32	44	11	13	38	41	53	62
	Flag_Pax	32	23,047,358	16,302,388	1,860,886	10,716,426	17,868,504	32,351,070	60,858,450
	Flag_F	32	140,699	89,460	38,598	68,217	106,313	203,369	345,494
	Flag_S	32	30,343,292	18,997,255	6,048,948	15,881,749	24,140,406	42,980,375	74,078,483

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Flag_LF	32	52	10	20	47	50	60	68
FA_Pax	32	12,308,693	7,804,372	1,374,760	5,670,160	10,569,377	16,441,642	30,041,872
FA_F	32	87,055	48,190	27,674	41,112	78,271	118,279	182,749
FA_S	32	16,966,312	9,056,260	3,940,732	9,341,231	15,462,978	22,329,350	37,076,549
FA_LF	32	35	11	9	28	33	41	54
FSC_Pax	32	18,459,391	9,675,428	1,652,260	10,229,888	17,868,504	26,916,362	34,038,673
FSC_F	32	112,356	50,581	38,598	67,551	102,896	165,832	183,488
FSC_S	32	24,840,446	11,576,203	5,572,367	14,668,928	24,140,406	35,946,870	41,525,089
FSC_LF	32	48	8	16	46	50	54	59
LCC_Pax	17	8,636,174	9,715,016	138	933,374	4,536,890	14,447,451	26,819,777
LCC_F	17	53,353	56,809	4	6,825	29,673	88,584	166,443
LCC_S	17	10,358,299	11,295,685	148	1,209,552	5,783,670	17,101,155	32,553,394
LCC_LF	17	71	13	33	70	76	79	83

Table A3. The Full Results of the Granger Causality Test.

Type	Dependent Variable	Independent Variable	F-Stat	Result	Lag Length	Result
Month	Total_Pax	Total_F	2.0232	0.1573	1	No Relationship
Month	Total_Pax	Total_S	2.5783	0.1108	1	No Relationship
Month	Total_Pax	Total_LF	3.9071	0.0502	1	No Relationship
Month	NA_Pax	NA_F	6.5152	0.0119	1	Supply Causes Demand
Month	NA_Pax	NA_S	4.8856	0.0289	1	Supply Causes Demand
Month	NA_Pax	NA_LF	7.0455	0.0090	1	Supply Causes Demand
Month	FA_Pax	FA_F	0.4566	0.5004	1	No Relationship
Month	FA_Pax	FA_S	0.0892	0.7657	1	No Relationship
Month	FA_Pax	FA_LF	4.7978	0.0303	1	Supply Causes Demand
Month	FSC_Pax	FSC_F	0.0034	0.9533	1	No Relationship
Month	FSC_Pax	FSC_S	0.0268	0.8703	1	No Relationship
Month	FSC_Pax	FSC_LF	2.3711	0.1261	1	No Relationship
Month	LCC_Pax	LCC_F	11.0634	0.0011	1	Supply Causes Demand
Month	LCC_Pax	LCC_S	11.2982	0.0010	1	Supply Causes Demand
Month	LCC_Pax	LCC_LF	2.4551	0.1196	1	No Relationship
Quarter	Total_Pax	Total_F	4.7913	0.0345	1	Supply Causes Demand
Quarter	Total_Pax	Total_S	7.0133	0.0115	1	Supply Causes Demand
Quarter	Total_Pax	Total_LF	5.0280	0.0306	1	Supply Causes Demand
Quarter	NA_Pax	NA_F	8.7066	0.0053	1	Supply Causes Demand
Quarter	NA_Pax	NA_S	7.4757	0.0093	1	Supply Causes Demand
Quarter	NA_Pax	NA_LF	7.7065	0.0083	1	Supply Causes Demand
Quarter	FA_Pax	FA_F	0.2669	0.6083	1	No Relationship
Quarter	FA_Pax	FA_S	4.4525	0.0412	1	Supply Causes Demand
Quarter	FA_Pax	FA_LF	7.6858	0.0084	1	Supply Causes Demand
Quarter	FSC_Pax	FSC_F	0.0065	0.9360	1	No Relationship
Quarter	FSC_Pax	FSC_S	1.0483	0.3121	1	No Relationship
Quarter	FSC_Pax	FSC_LF	6.4616	0.0150	1	Supply Causes Demand
Quarter	LCC_Pax	LCC_F	8.1957	0.0067	1	Supply Causes Demand
Quarter	LCC_Pax	LCC_S	7.3460	0.0099	1	Supply Causes Demand
Quarter	LCC_Pax	LCC_LF	2.2770	0.1392	1	No Relationship
Year	Total_Pax	Total_F	2.4002	0.1325	1	No Relationship
Year	Total_Pax	Total_S	0.1207	0.7309	1	No Relationship
Year	Total_Pax	Total_LF	0.2039	0.6551	1	No Relationship
Year	NA_Pax	NA_F	1.4217	0.2431	1	No Relationship
Year	NA_Pax	NA_S	0.0122	0.9130	1	No Relationship

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Year	NA_Pax	NA_LF	0.9320	0.3426	1	No Relationship
Year	FA_Pax	FA_F	3.6099	0.0678	1	No Relationship
Year	FA_Pax	FA_S	0.3469	0.5606	1	No Relationship
Year	FA_Pax	FA_LF	0.1354	0.7157	1	No Relationship
Year	FSC_Pax	FSC_F	3.1440	0.0871	1	No Relationship
Year	FSC_Pax	FSC_S	1.5554	0.2227	1	No Relationship
Year	FSC_Pax	FSC_LF	0.0273	0.8699	1	No Relationship
Year	LCC_PAX	LCC_F	2.8414	0.1177	1	No Relationship
Year	LCC_PAX	LCC_S	4.2122	0.0626	1	No Relationship
Year	LCC_PAX	LCC_LF	0.0873	0.7727	1	No Relationship
Quarter	Total_Pax	Total_F	3.5187	0.0399	2	Supply Causes Demand
Quarter	Total_Pax	Total_S	1.5066	0.2349	2	No Relationship
Quarter	Total_Pax	Total_LF	2.2853	0.1159	2	No Relationship
Quarter	NA_Pax	NA_F	5.1940	0.0103	2	Supply Causes Demand
Quarter	NA_Pax	NA_S	1.8399	0.1731	2	No Relationship
Quarter	NA_Pax	NA_LF	1.4853	0.2396	2	No Relationship
Quarter	FA_Pax	FA_F	0.7549	0.4772	2	No Relationship
Quarter	FA_Pax	FA_S	0.7408	0.4837	2	No Relationship
Quarter	FA_Pax	FA_LF	4.9743	0.0122	2	Supply Causes Demand
Quarter	FSC_Pax	FSC_F	0.2096	0.8119	2	No Relationship
Quarter	FSC_Pax	FSC_S	0.0153	0.9848	2	No Relationship
Quarter	FSC_Pax	FSC_LF	1.9882	0.1513	2	No Relationship
Quarter	LCC_Pax	LCC_F	2.6396	0.0848	2	No Relationship
Quarter	LCC_Pax	LCC_S	2.0974	0.1371	2	No Relationship
Quarter	LCC_Pax	LCC_LF	0.1538	0.8580	2	No Relationship
Year	Total_Pax	Total_F	8.7337	0.0013	2	Supply Causes Demand
Year	Total_Pax	Total_S	2.6642	0.0894	2	No Relationship
Year	Total_Pax	Total_LF	0.3538	0.7055	2	No Relationship
Year	NA_Pax	NA_F	9.8771	0.0007	2	Supply Causes Demand
Year	NA_Pax	NA_S	3.7228	0.0384	2	Supply Causes Demand
Year	NA_Pax	NA_LF	0.5902	0.5618	2	No Relationship
Year	FA_Pax	FA_F	5.1930	0.0130	2	Supply Causes Demand
Year	FA_Pax	FA_S	0.7845	0.4673	2	No Relationship
Year	FA_Pax	FA_LF	0.2414	0.7873	2	No Relationship
Year	FSC_Pax	FSC_F	5.9874	0.0075	2	Supply Causes Demand
Year	FSC_Pax	FSC_S	2.9313	0.0718	2	No Relationship
Year	FSC_Pax	FSC_LF	0.7506	0.4824	2	No Relationship
Year	LCC_PAX	LCC_F	3.1532	0.0917	2	No Relationship
Year	LCC_PAX	LCC_S	1.6647	0.2426	2	No Relationship
Year	LCC_PAX	LCC_LF	1.0839	0.3787	2	No Relationship
Month	Total_Pax	Total_F	0.3463	0.7919	3	No Relationship
Month	Total_Pax	Total_S	0.3443	0.7933	3	No Relationship
Month	Total_Pax	Total_LF	1.5289	0.2104	3	No Relationship
Month	NA_Pax	NA_F	1.0288	0.3824	3	No Relationship
Month	NA_Pax	NA_S	0.5388	0.6566	3	No Relationship
Month	NA_Pax	NA_LF	2.7730	0.0444	3	Supply Causes Demand
Month	FA_Pax	FA_F	1.2043	0.3112	3	No Relationship
Month	FA_Pax	FA_S	1.3688	0.2556	3	No Relationship
Month	FA_Pax	FA_LF	2.3229	0.0784	3	No Relationship
Month	FSC_Pax	FSC_F	0.1686	0.9174	3	No Relationship
Month	FSC_Pax	FSC_S	0.4120	0.7446	3	No Relationship
Month	FSC_Pax	FSC_LF	3.3515	0.0213	3	Supply Causes Demand
Month	LCC_Pax	LCC_F	2.1957	0.0920	3	No Relationship

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Month	LCC_Pax	LCC_S	2.2243	0.0888	3	No Relationship
Month	LCC_Pax	LCC_LF	2.0075	0.1164	3	No Relationship
Quarter	Total_Pax	Total_F	2.4674	0.0788	3	No Relationship
Quarter	Total_Pax	Total_S	2.0748	0.1219	3	No Relationship
Quarter	Total_Pax	Total_LF	1.0661	0.3763	3	No Relationship
Quarter	NA_Pax	NA_F	3.6993	0.0209	3	Supply Causes Demand
Quarter	NA_Pax	NA_S	1.8986	0.1484	3	No Relationship
Quarter	NA_Pax	NA_LF	0.9892	0.4095	3	No Relationship
Quarter	FA_Pax	FA_F	0.7571	0.5260	3	No Relationship
Quarter	FA_Pax	FA_S	1.1709	0.3352	3	No Relationship
Quarter	FA_Pax	FA_LF	2.7628	0.0570	3	No Relationship
Quarter	FSC_Pax	FSC_F	1.1060	0.3601	3	No Relationship
Quarter	FSC_Pax	FSC_S	1.5424	0.2213	3	No Relationship
Quarter	FSC_Pax	FSC_LF	1.0008	0.4044	3	No Relationship
Quarter	LCC_Pax	LCC_F	1.8098	0.1640	3	No Relationship
Quarter	LCC_Pax	LCC_S	1.6407	0.1982	3	No Relationship
Quarter	LCC_Pax	LCC_LF	0.8992	0.4517	3	No Relationship
Year	Total_Pax	Total_F	5.3724	0.0063	3	Supply Causes Demand
Year	Total_Pax	Total_S	1.6705	0.2024	3	No Relationship
Year	Total_Pax	Total_LF	1.8954	0.1599	3	No Relationship
Year	NA_Pax	NA_F	6.3032	0.0030	3	Supply Causes Demand
Year	NA_Pax	NA_S	2.8006	0.0638	3	No Relationship
Year	NA_Pax	NA_LF	2.3065	0.1047	3	No Relationship
Year	FA_Pax	FA_F	3.2107	0.0428	3	Supply Causes Demand
Year	FA_Pax	FA_S	0.3863	0.7639	3	No Relationship
Year	FA_Pax	FA_LF	1.5740	0.2240	3	No Relationship
Year	FSC_Pax	FSC_F	4.3426	0.0151	3	Supply Causes Demand
Year	FSC_Pax	FSC_S	1.9360	0.1533	3	No Relationship
Year	FSC_Pax	FSC_LF	0.3971	0.7564	3	No Relationship
Year	LCC_PAX	LCC_F	8.5521	0.0138	3	Supply Causes Demand
Year	LCC_PAX	LCC_S	8.6427	0.0135	3	Supply Causes Demand
Year	LCC_PAX	LCC_LF	0.5943	0.6414	3	No Relationship
Quarter	Total_Pax	Total_F	1.7769	0.1587	4	No Relationship
Quarter	Total_Pax	Total_S	1.2860	0.2968	4	No Relationship
Quarter	Total_Pax	Total_LF	0.9632	0.4415	4	No Relationship
Quarter	NA_Pax	NA_F	2.8428	0.0407	4	Supply Causes Demand
Quarter	NA_Pax	NA_S	1.1770	0.3401	4	No Relationship
Quarter	NA_Pax	NA_LF	1.0847	0.3811	4	No Relationship
Quarter	FA_Pax	FA_F	0.5490	0.7011	4	No Relationship
Quarter	FA_Pax	FA_S	0.9084	0.4712	4	No Relationship
Quarter	FA_Pax	FA_LF	2.6608	0.0511	4	No Relationship
Quarter	FSC_Pax	FSC_F	0.8441	0.5080	4	No Relationship
Quarter	FSC_Pax	FSC_S	1.1580	0.3482	4	No Relationship
Quarter	FSC_Pax	FSC_LF	1.0219	0.4114	4	No Relationship
Quarter	LCC_Pax	LCC_F	1.6909	0.1772	4	No Relationship
Quarter	LCC_Pax	LCC_S	1.5429	0.2143	4	No Relationship
Quarter	LCC_Pax	LCC_LF	0.6509	0.6306	4	No Relationship
Year	Total_Pax	Total_F	1.7409	0.1824	5	No Relationship
Year	Total_Pax	Total_S	1.0694	0.4133	5	No Relationship
Year	Total_Pax	Total_LF	1.0278	0.4344	5	No Relationship
Year	NA_Pax	NA_F	3.9215	0.0164	5	Supply Causes Demand
Year	NA_Pax	NA_S	1.4979	0.2454	5	No Relationship
Year	NA_Pax	NA_LF	1.9365	0.1440	5	No Relationship

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Year	FA_Pax	FA_F	1.5739	0.2236	5	No Relationship
Year	FA_Pax	FA_S	0.5516	0.7351	5	No Relationship
Year	FA_Pax	FA_LF	1.6004	0.2165	5	No Relationship
Year	FSC_Pax	FSC_F	3.0829	0.0389	5	Supply Causes Demand
Year	FSC_Pax	FSC_S	1.7161	0.1880	5	No Relationship
Year	FSC_Pax	FSC_LF	0.2876	0.9130	5	No Relationship
Month	Total_Pax	Total_F	2.7288	0.0163	6	Supply Causes Demand
Month	Total_Pax	Total_S	2.1055	0.0580	6	No Relationship
Month	Total_Pax	Total_LF	1.7454	0.1169	6	No Relationship
Month	NA_Pax	NA_F	3.6111	0.0026	6	Supply Causes Demand
Month	NA_Pax	NA_S	2.5483	0.0237	6	Supply Causes Demand
Month	NA_Pax	NA_LF	1.7597	0.1137	6	No Relationship
Month	FA_Pax	FA_F	1.6526	0.1392	6	No Relationship
Month	FA_Pax	FA_S	1.7675	0.1120	6	No Relationship
Month	FA_Pax	FA_LF	2.1240	0.0559	6	No Relationship
Month	FSC_Pax	FSC_F	0.7613	0.6019	6	No Relationship
Month	FSC_Pax	FSC_S	0.9585	0.4567	6	No Relationship
Month	FSC_Pax	FSC_LF	1.5874	0.1572	6	No Relationship
Month	LCC_Pax	LCC_F	6.1755	0.0000	6	Supply Causes Demand
Month	LCC_Pax	LCC_S	5.3841	0.0001	6	Supply Causes Demand
Month	LCC_Pax	LCC_LF	1.5360	0.1728	6	No Relationship
Quarter	Total_Pax	Total_F	2.9378	0.0261	6	Supply Causes Demand
Quarter	Total_Pax	Total_S	2.0034	0.1031	6	No Relationship
Quarter	Total_Pax	Total_LF	0.7047	0.6486	6	No Relationship
Quarter	NA_Pax	NA_F	3.9444	0.0065	6	Supply Causes Demand
Quarter	NA_Pax	NA_S	2.7071	0.0364	6	Supply Causes Demand
Quarter	NA_Pax	NA_LF	1.9608	0.1099	6	No Relationship
Quarter	FA_Pax	FA_F	0.7367	0.6250	6	No Relationship
Quarter	FA_Pax	FA_S	0.7909	0.5856	6	No Relationship
Quarter	FA_Pax	FA_LF	1.6643	0.1714	6	No Relationship
Quarter	FSC_Pax	FSC_F	0.7363	0.6253	6	No Relationship
Quarter	FSC_Pax	FSC_S	1.0290	0.4299	6	No Relationship
Quarter	FSC_Pax	FSC_LF	0.9846	0.4565	6	No Relationship
Quarter	LCC_Pax	LCC_F	2.9016	0.0275	6	Supply Causes Demand
Quarter	LCC_Pax	LCC_S	3.3438	0.0147	6	Supply Causes Demand
Quarter	LCC_Pax	LCC_LF	1.1582	0.3594	6	No Relationship
Quarter	Total_Pax	Total_F	1.8143	0.1366	8	No Relationship
Quarter	Total_Pax	Total_S	1.8737	0.1247	8	No Relationship
Quarter	Total_Pax	Total_LF	1.2860	0.3078	8	No Relationship
Quarter	NA_Pax	NA_F	2.2799	0.0671	8	No Relationship
Quarter	NA_Pax	NA_S	2.4694	0.0505	8	No Relationship
Quarter	NA_Pax	NA_LF	2.2936	0.0657	8	No Relationship
Quarter	FA_Pax	FA_F	0.8747	0.5542	8	No Relationship
Quarter	FA_Pax	FA_S	0.7731	0.6307	8	No Relationship
Quarter	FA_Pax	FA_LF	1.8467	0.1300	8	No Relationship
Quarter	FSC_Pax	FSC_F	0.9330	0.5127	8	No Relationship
Quarter	FSC_Pax	FSC_S	1.0430	0.4399	8	No Relationship
Quarter	FSC_Pax	FSC_LF	1.2797	0.3107	8	No Relationship
Quarter	LCC_Pax	LCC_F	2.3137	0.0638	8	No Relationship
Quarter	LCC_Pax	LCC_S	2.3886	0.0570	8	No Relationship
Quarter	LCC_Pax	LCC_LF	2.7498	0.0336	8	Supply Causes Demand
Year	Total_Pax	Total_F	3.7930	0.3812	10	No Relationship
Year	Total_Pax	Total_S	4.4956	0.3527	10	No Relationship

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Year	Total_Pax	Total_LF	2.6715	0.4457	10	No Relationship
Year	NA_Pax	NA_F	12.4701	0.2172	10	No Relationship
Year	NA_Pax	NA_S	11.0677	0.2301	10	No Relationship
Year	NA_Pax	NA_LF	32.0956	0.1366	10	No Relationship
Year	FA_Pax	FA_F	2.9489	0.4268	10	No Relationship
Year	FA_Pax	FA_S	65.2036	0.0961	10	No Relationship
Year	FA_Pax	FA_LF	2.3923	0.4675	10	No Relationship
Year	FSC_Pax	FSC_F	12.8790	0.2138	10	No Relationship
Year	FSC_Pax	FSC_S	5.2578	0.3280	10	No Relationship
Year	FSC_Pax	FSC_LF	3.7782	0.3819	10	No Relationship
Month	Total_Pax	Total_F	5.1837	0.0000	12	Supply Causes Demand
Month	Total_Pax	Total_S	4.0136	0.0001	12	Supply Causes Demand
Month	Total_Pax	Total_LF	2.9237	0.0017	12	Supply Causes Demand
Month	NA_Pax	NA_F	3.7254	0.0001	12	Supply Causes Demand
Month	NA_Pax	NA_S	2.6968	0.0036	12	Supply Causes Demand
Month	NA_Pax	NA_LF	1.9802	0.0344	12	Supply Causes Demand
Month	FA_Pax	FA_F	6.7787	0.0000	12	Supply Causes Demand
Month	FA_Pax	FA_S	6.9665	0.0000	12	Supply Causes Demand
Month	FA_Pax	FA_LF	3.1477	0.0008	12	Supply Causes Demand
Month	FSC_Pax	FSC_F	3.5382	0.0002	12	Supply Causes Demand
Month	FSC_Pax	FSC_S	2.8342	0.0023	12	Supply Causes Demand
Month	FSC_Pax	FSC_LF	1.5792	0.1108	12	No Relationship
Month	LCC_Pax	LCC_F	3.6078	0.0002	12	Supply Causes Demand
Month	LCC_Pax	LCC_S	3.4091	0.0004	12	Supply Causes Demand
Month	LCC_Pax	LCC_LF	1.0888	0.3784	12	No Relationship
Quarter	Total_Pax	Total_F	1.0952	0.4716	12	No Relationship
Quarter	Total_Pax	Total_S	0.7766	0.6662	12	No Relationship
Quarter	Total_Pax	Total_LF	2.0272	0.1777	12	No Relationship
Quarter	NA_Pax	NA_F	2.8375	0.0870	12	No Relationship
Quarter	NA_Pax	NA_S	1.2397	0.4021	12	No Relationship
Quarter	NA_Pax	NA_LF	1.7968	0.2229	12	No Relationship
Quarter	FA_Pax	FA_F	2.5577	0.1098	12	No Relationship
Quarter	FA_Pax	FA_S	0.8316	0.6288	12	No Relationship
Quarter	FA_Pax	FA_LF	4.4111	0.0291	12	Supply Causes Demand
Quarter	FSC_Pax	FSC_F	1.1552	0.4413	12	No Relationship
Quarter	FSC_Pax	FSC_S	0.4589	0.8873	12	No Relationship
Quarter	FSC_Pax	FSC_LF	11.2119	0.0019	12	Supply Causes Demand
Quarter	LCC_Pax	LCC_F	1.9140	0.1984	12	No Relationship
Quarter	LCC_Pax	LCC_S	2.7366	0.0945	12	No Relationship
Quarter	LCC_Pax	LCC_LF	1.6091	0.2703	12	No Relationship
Month	Total_Pax	Total_F	3.4174	0.0001	18	Supply Causes Demand
Month	Total_Pax	Total_S	2.8625	0.0007	18	Supply Causes Demand
Month	Total_Pax	Total_LF	1.3428	0.1863	18	No Relationship
Month	NA_Pax	NA_F	3.6405	0.0000	18	Supply Causes Demand
Month	NA_Pax	NA_S	3.1803	0.0002	18	Supply Causes Demand
Month	NA_Pax	NA_LF	1.2480	0.2467	18	No Relationship
Month	FA_Pax	FA_F	2.9002	0.0006	18	Supply Causes Demand
Month	FA_Pax	FA_S	2.9657	0.0005	18	Supply Causes Demand
Month	FA_Pax	FA_LF	1.7395	0.0500	18	Supply Causes Demand
Month	FSC_Pax	FSC_F	2.3026	0.0062	18	Supply Causes Demand
Month	FSC_Pax	FSC_S	2.1784	0.0100	18	Supply Causes Demand
Month	FSC_Pax	FSC_LF	1.3312	0.1930	18	No Relationship
Month	LCC_Pax	LCC_F	3.9983	0.0000	18	Supply Causes Demand

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Month	LCC_Pax	LCC_S	4.4914	0.0000	18	Supply Causes Demand
Month	LCC_Pax	LCC_LF	0.8068	0.6866	18	No Relationship
Month	Total_Pax	Total_F	2.2051	0.0072	24	Supply Causes Demand
Month	Total_Pax	Total_S	2.0650	0.0125	24	Supply Causes Demand
Month	Total_Pax	Total_LF	1.1871	0.2905	24	No Relationship
Month	NA_Pax	NA_F	2.3784	0.0036	24	Supply Causes Demand
Month	NA_Pax	NA_S	2.2538	0.0059	24	Supply Causes Demand
Month	NA_Pax	NA_LF	0.9699	0.5160	24	No Relationship
Month	FA_Pax	FA_F	2.1605	0.0086	24	Supply Causes Demand
Month	FA_Pax	FA_S	1.8504	0.0286	24	Supply Causes Demand
Month	FA_Pax	FA_LF	1.7561	0.0410	24	Supply Causes Demand
Month	FSC_Pax	FSC_F	1.7903	0.0360	24	Supply Causes Demand
Month	FSC_Pax	FSC_S	1.5490	0.0879	24	No Relationship
Month	FSC_Pax	FSC_LF	1.1015	0.3704	24	No Relationship
Month	LCC_Pax	LCC_F	3.0239	0.0003	24	Supply Causes Demand
Month	LCC_Pax	LCC_S	3.3318	0.0001	24	Supply Causes Demand
Month	LCC_Pax	LCC_LF	0.8575	0.6528	24	No Relationship
Month	Total_Pax	Total_F	2.5431	0.0105	36	Supply Causes Demand
Month	Total_Pax	Total_S	2.3251	0.0181	36	Supply Causes Demand
Month	Total_Pax	Total_LF	1.2464	0.2927	36	No Relationship
Month	NA_Pax	NA_F	3.2436	0.0021	36	Supply Causes Demand
Month	NA_Pax	NA_S	2.8919	0.0046	36	Supply Causes Demand
Month	NA_Pax	NA_LF	0.9865	0.5254	36	No Relationship
Month	FA_Pax	FA_F	1.9948	0.0422	36	Supply Causes Demand
Month	FA_Pax	FA_S	1.7841	0.0733	36	No Relationship
Month	FA_Pax	FA_LF	1.8946	0.0548	36	No Relationship
Month	FSC_Pax	FSC_F	1.9174	0.0516	36	No Relationship
Month	FSC_Pax	FSC_S	1.7628	0.0775	36	No Relationship
Month	FSC_Pax	FSC_LF	2.8330	0.0053	36	Supply Causes Demand
Month	LCC_Pax	LCC_F	2.5040	0.0116	36	Supply Causes Demand
Month	LCC_Pax	LCC_S	3.6849	0.0008	36	Supply Causes Demand
Month	LCC_Pax	LCC_LF	1.3734	0.2135	36	No Relationship
Month	Total_F	Total_Pax	24.8699	0.0000	1	Demand Causes Supply
Month	Total_F	Total_Pax	7.7766	0.0001	3	Demand Causes Supply
Month	Total_F	Total_Pax	6.1669	0.0000	6	Demand Causes Supply
Month	Total_F	Total_Pax	8.1958	0.0000	12	Demand Causes Supply
Month	Total_F	Total_Pax	8.9778	0.0000	18	Demand Causes Supply
Month	Total_F	Total_Pax	6.6362	0.0000	24	Demand Causes Supply
Month	Total_F	Total_Pax	5.2137	0.0000	36	Demand Causes Supply
Month	Total_S	Total_Pax	31.5030	0.0000	1	Demand Causes Supply
Month	Total_S	Total_Pax	7.6280	0.0001	3	Demand Causes Supply
Month	Total_S	Total_Pax	5.8080	0.0000	6	Demand Causes Supply
Month	Total_S	Total_Pax	6.7901	0.0000	12	Demand Causes Supply
Month	Total_S	Total_Pax	7.4549	0.0000	18	Demand Causes Supply
Month	Total_S	Total_Pax	5.7685	0.0000	24	Demand Causes Supply
Month	Total_S	Total_Pax	6.0263	0.0000	36	Demand Causes Supply
Month	Total_LF	Total_Pax	0.4751	0.4919	1	No Relationship
Month	Total_LF	Total_Pax	6.8520	0.0003	3	Demand Causes Supply
Month	Total_LF	Total_Pax	4.3857	0.0005	6	Demand Causes Supply
Month	Total_LF	Total_Pax	2.7721	0.0028	12	Demand Causes Supply
Month	Total_LF	Total_Pax	1.3157	0.2022	18	No Relationship
Month	Total_LF	Total_Pax	1.3816	0.1572	24	No Relationship
Month	Total_LF	Total_Pax	1.3923	0.2035	36	No Relationship

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Month	NA_F	NA_Pax	38.7846	0.0000	1	Demand Causes Supply
Month	NA_F	NA_Pax	11.6356	0.0000	3	Demand Causes Supply
Month	NA_F	NA_Pax	8.7512	0.0000	6	Demand Causes Supply
Month	NA_F	NA_Pax	7.5283	0.0000	12	Demand Causes Supply
Month	NA_F	NA_Pax	9.6543	0.0000	18	Demand Causes Supply
Month	NA_F	NA_Pax	6.8772	0.0000	24	Demand Causes Supply
Month	NA_F	NA_Pax	5.4799	0.0000	36	Demand Causes Supply
Month	NA_S	NA_Pax	38.4168	0.0000	1	Demand Causes Supply
Month	NA_S	NA_Pax	10.2888	0.0000	3	Demand Causes Supply
Month	NA_S	NA_Pax	7.8972	0.0000	6	Demand Causes Supply
Month	NA_S	NA_Pax	6.5264	0.0000	12	Demand Causes Supply
Month	NA_S	NA_Pax	8.5206	0.0000	18	Demand Causes Supply
Month	NA_S	NA_Pax	6.5174	0.0000	24	Demand Causes Supply
Month	NA_S	NA_Pax	7.0542	0.0000	36	Demand Causes Supply
Month	NA_LF	NA_Pax	0.0634	0.8016	1	No Relationship
Month	NA_LF	NA_Pax	6.3410	0.0005	3	Demand Causes Supply
Month	NA_LF	NA_Pax	4.1831	0.0008	6	Demand Causes Supply
Month	NA_LF	NA_Pax	2.8375	0.0023	12	Demand Causes Supply
Month	NA_LF	NA_Pax	1.8677	0.0316	18	Demand Causes Supply
Month	NA_LF	NA_Pax	1.5268	0.0952	24	No Relationship
Month	NA_LF	NA_Pax	1.3568	0.2227	36	No Relationship
Month	FA_F	FA_Pax	6.6340	0.0111	1	Demand Causes Supply
Month	FA_F	FA_Pax	3.5033	0.0176	3	Demand Causes Supply
Month	FA_F	FA_Pax	3.1221	0.0072	6	Demand Causes Supply
Month	FA_F	FA_Pax	7.5468	0.0000	12	Demand Causes Supply
Month	FA_F	FA_Pax	3.7873	0.0000	18	Demand Causes Supply
Month	FA_F	FA_Pax	2.9000	0.0005	24	Demand Causes Supply
Month	FA_F	FA_Pax	2.4759	0.0124	36	Demand Causes Supply
Month	FA_S	FA_Pax	17.2056	0.0001	1	Demand Causes Supply
Month	FA_S	FA_Pax	3.8330	0.0115	3	Demand Causes Supply
Month	FA_S	FA_Pax	2.8939	0.0116	6	Demand Causes Supply
Month	FA_S	FA_Pax	7.5489	0.0000	12	Demand Causes Supply
Month	FA_S	FA_Pax	4.7995	0.0000	18	Demand Causes Supply
Month	FA_S	FA_Pax	3.1108	0.0002	24	Demand Causes Supply
Month	FA_S	FA_Pax	3.3916	0.0015	36	Demand Causes Supply
Month	FA_LF	FA_Pax	0.3050	0.5817	1	No Relationship
Month	FA_LF	FA_Pax	6.0655	0.0007	3	Demand Causes Supply
Month	FA_LF	FA_Pax	4.3795	0.0005	6	Demand Causes Supply
Month	FA_LF	FA_Pax	2.7520	0.0030	12	Demand Causes Supply
Month	FA_LF	FA_Pax	1.4074	0.1525	18	No Relationship
Month	FA_LF	FA_Pax	1.5333	0.0930	24	No Relationship
Month	FA_LF	FA_Pax	2.5401	0.0106	36	Demand Causes Supply
Month	FSC_F	FSC_Pax	5.0828	0.0259	1	Demand Causes Supply
Month	FSC_F	FSC_Pax	4.5180	0.0048	3	Demand Causes Supply
Month	FSC_F	FSC_Pax	2.9565	0.0102	6	Demand Causes Supply
Month	FSC_F	FSC_Pax	5.2712	0.0000	12	Demand Causes Supply
Month	FSC_F	FSC_Pax	5.7783	0.0000	18	Demand Causes Supply
Month	FSC_F	FSC_Pax	5.0121	0.0000	24	Demand Causes Supply
Month	FSC_F	FSC_Pax	3.2516	0.0020	36	Demand Causes Supply
Month	FSC_S	FSC_Pax	14.6503	0.0002	1	Demand Causes Supply
Month	FSC_S	FSC_Pax	5.5636	0.0013	3	Demand Causes Supply
Month	FSC_S	FSC_Pax	3.7182	0.0021	6	Demand Causes Supply
Month	FSC_S	FSC_Pax	5.1929	0.0000	12	Demand Causes Supply

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Month	FSC_S	FSC_Pax	6.2689	0.0000	18	Demand Causes Supply
Month	FSC_S	FSC_Pax	5.0129	0.0000	24	Demand Causes Supply
Month	FSC_S	FSC_Pax	3.9838	0.0004	36	Demand Causes Supply
Month	FSC_LF	FSC_Pax	8.0479	0.0053	1	Demand Causes Supply
Month	FSC_LF	FSC_Pax	7.6179	0.0001	3	Demand Causes Supply
Month	FSC_LF	FSC_Pax	4.0412	0.0010	6	Demand Causes Supply
Month	FSC_LF	FSC_Pax	2.7261	0.0033	12	Demand Causes Supply
Month	FSC_LF	FSC_Pax	1.8078	0.0392	18	Demand Causes Supply
Month	FSC_LF	FSC_Pax	1.6583	0.0591	24	No Relationship
Month	FSC_LF	FSC_Pax	0.8400	0.6874	36	No Relationship
Month	LCC_F	LCC_Pax	44.6758	0.0000	1	Demand Causes Supply
Month	LCC_F	LCC_Pax	15.1359	0.0000	3	Demand Causes Supply
Month	LCC_F	LCC_Pax	13.5815	0.0000	6	Demand Causes Supply
Month	LCC_F	LCC_Pax	8.6898	0.0000	12	Demand Causes Supply
Month	LCC_F	LCC_Pax	7.7904	0.0000	18	Demand Causes Supply
Month	LCC_F	LCC_Pax	6.5156	0.0000	24	Demand Causes Supply
Month	LCC_F	LCC_Pax	4.6554	0.0001	36	Demand Causes Supply
Month	LCC_S	LCC_Pax	49.3545	0.0000	1	Demand Causes Supply
Month	LCC_S	LCC_Pax	15.5226	0.0000	3	Demand Causes Supply
Month	LCC_S	LCC_Pax	13.6239	0.0000	6	Demand Causes Supply
Month	LCC_S	LCC_Pax	8.7105	0.0000	12	Demand Causes Supply
Month	LCC_S	LCC_Pax	8.8430	0.0000	18	Demand Causes Supply
Month	LCC_S	LCC_Pax	7.3405	0.0000	24	Demand Causes Supply
Month	LCC_S	LCC_Pax	8.2225	0.0000	36	Demand Causes Supply
Month	LCC_LF	LCC_Pax	0.5126	0.4753	1	No Relationship
Month	LCC_LF	LCC_Pax	5.8663	0.0009	3	Demand Causes Supply
Month	LCC_LF	LCC_Pax	3.7992	0.0017	6	Demand Causes Supply
Month	LCC_LF	LCC_Pax	2.0434	0.0284	12	Demand Causes Supply
Month	LCC_LF	LCC_Pax	1.5462	0.0972	18	No Relationship
Month	LCC_LF	LCC_Pax	1.2264	0.2583	24	No Relationship
Month	LCC_LF	LCC_Pax	2.5790	0.0096	36	Demand Causes Supply
Quarter	Total_F	Total_Pax	11.4285	0.0016	1	Demand Causes Supply
Quarter	Total_F	Total_Pax	6.5598	0.0036	2	Demand Causes Supply
Quarter	Total_F	Total_Pax	4.5732	0.0085	3	Demand Causes Supply
Quarter	Total_F	Total_Pax	3.4561	0.0190	4	Demand Causes Supply
Quarter	Total_F	Total_Pax	5.4616	0.0010	6	Demand Causes Supply
Quarter	Total_F	Total_Pax	3.4667	0.0124	8	Demand Causes Supply
Quarter	Total_F	Total_Pax	1.9595	0.1897	12	No Relationship
Quarter	Total_S	Total_Pax	16.7228	0.0002	1	Demand Causes Supply
Quarter	Total_S	Total_Pax	6.0887	0.0052	2	Demand Causes Supply
Quarter	Total_S	Total_Pax	5.7491	0.0027	3	Demand Causes Supply
Quarter	Total_S	Total_Pax	3.8865	0.0113	4	Demand Causes Supply
Quarter	Total_S	Total_Pax	4.5842	0.0029	6	Demand Causes Supply
Quarter	Total_S	Total_Pax	4.1642	0.0051	8	Demand Causes Supply
Quarter	Total_S	Total_Pax	1.7436	0.2353	12	No Relationship
Quarter	Total_LF	Total_Pax	4.4111	0.0421	1	Demand Causes Supply
Quarter	Total_LF	Total_Pax	4.0809	0.0250	2	Demand Causes Supply
Quarter	Total_LF	Total_Pax	1.9387	0.1419	3	No Relationship
Quarter	Total_LF	Total_Pax	1.4762	0.2333	4	No Relationship
Quarter	Total_LF	Total_Pax	1.0518	0.4167	6	No Relationship
Quarter	Total_LF	Total_Pax	2.6412	0.0393	8	Demand Causes Supply
Quarter	Total_LF	Total_Pax	2.9164	0.0817	12	No Relationship
Quarter	NA_F	NA_Pax	20.0457	0.0001	1	Demand Causes Supply

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Quarter	NA_F	NA_Pax	8.9043	0.0007	2	Demand Causes Supply
Quarter	NA_F	NA_Pax	6.6735	0.0012	3	Demand Causes Supply
Quarter	NA_F	NA_Pax	4.9996	0.0032	4	Demand Causes Supply
Quarter	NA_F	NA_Pax	7.9839	0.0001	6	Demand Causes Supply
Quarter	NA_F	NA_Pax	4.5437	0.0032	8	Demand Causes Supply
Quarter	NA_F	NA_Pax	7.5124	0.0064	12	Demand Causes Supply
Quarter	NA_S	NA_Pax	17.9625	0.0001	1	Demand Causes Supply
Quarter	NA_S	NA_Pax	6.2464	0.0046	2	Demand Causes Supply
Quarter	NA_S	NA_Pax	5.3445	0.0040	3	Demand Causes Supply
Quarter	NA_S	NA_Pax	3.6697	0.0147	4	Demand Causes Supply
Quarter	NA_S	NA_Pax	6.2551	0.0004	6	Demand Causes Supply
Quarter	NA_S	NA_Pax	5.6322	0.0010	8	Demand Causes Supply
Quarter	NA_S	NA_Pax	2.8083	0.0891	12	No Relationship
Quarter	NA_LF	NA_Pax	4.7383	0.0355	1	Demand Causes Supply
Quarter	NA_LF	NA_Pax	3.3731	0.0451	2	Demand Causes Supply
Quarter	NA_LF	NA_Pax	3.1612	0.0370	3	Demand Causes Supply
Quarter	NA_LF	NA_Pax	1.9414	0.1284	4	No Relationship
Quarter	NA_LF	NA_Pax	2.5099	0.0486	6	Demand Causes Supply
Quarter	NA_LF	NA_Pax	3.4508	0.0127	8	Demand Causes Supply
Quarter	NA_LF	NA_Pax	1.9427	0.1929	12	No Relationship
Quarter	FA_F	FA_Pax	1.4938	0.2288	1	No Relationship
Quarter	FA_F	FA_Pax	2.8338	0.0716	2	No Relationship
Quarter	FA_F	FA_Pax	1.6943	0.1867	3	No Relationship
Quarter	FA_F	FA_Pax	1.4219	0.2500	4	No Relationship
Quarter	FA_F	FA_Pax	1.0629	0.4104	6	No Relationship
Quarter	FA_F	FA_Pax	0.9511	0.5001	8	No Relationship
Quarter	FA_F	FA_Pax	2.5901	0.1068	12	No Relationship
Quarter	FA_S	FA_Pax	10.6499	0.0023	1	Demand Causes Supply
Quarter	FA_S	FA_Pax	4.9633	0.0123	2	Demand Causes Supply
Quarter	FA_S	FA_Pax	4.0782	0.0141	3	Demand Causes Supply
Quarter	FA_S	FA_Pax	3.1797	0.0267	4	Demand Causes Supply
Quarter	FA_S	FA_Pax	2.3692	0.0598	6	No Relationship
Quarter	FA_S	FA_Pax	1.8900	0.1216	8	No Relationship
Quarter	FA_S	FA_Pax	1.5538	0.2864	12	No Relationship
Quarter	FA_LF	FA_Pax	5.2266	0.0276	1	Demand Causes Supply
Quarter	FA_LF	FA_Pax	7.0552	0.0025	2	Demand Causes Supply
Quarter	FA_LF	FA_Pax	2.9451	0.0467	3	Demand Causes Supply
Quarter	FA_LF	FA_Pax	2.9803	0.0342	4	Demand Causes Supply
Quarter	FA_LF	FA_Pax	1.8067	0.1385	6	No Relationship
Quarter	FA_LF	FA_Pax	2.4803	0.0497	8	Demand Causes Supply
Quarter	FA_LF	FA_Pax	9.7335	0.0029	12	Demand Causes Supply
Quarter	FSC_F	FSC_Pax	0.4629	0.5002	1	No Relationship
Quarter	FSC_F	FSC_Pax	0.8862	0.4208	2	No Relationship
Quarter	FSC_F	FSC_Pax	1.1195	0.3548	3	No Relationship
Quarter	FSC_F	FSC_Pax	0.9772	0.4342	4	No Relationship
Quarter	FSC_F	FSC_Pax	0.9067	0.5060	6	No Relationship
Quarter	FSC_F	FSC_Pax	1.7380	0.1537	8	No Relationship
Quarter	FSC_F	FSC_Pax	2.0779	0.1693	12	No Relationship
Quarter	FSC_S	FSC_Pax	4.1365	0.0486	1	Demand Causes Supply
Quarter	FSC_S	FSC_Pax	3.3292	0.0468	2	Demand Causes Supply
Quarter	FSC_S	FSC_Pax	4.2698	0.0116	3	Demand Causes Supply
Quarter	FSC_S	FSC_Pax	3.2076	0.0258	4	Demand Causes Supply
Quarter	FSC_S	FSC_Pax	2.8566	0.0293	6	Demand Causes Supply

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Quarter	FSC_S	FSC_Pax	2.6454	0.0390	8	Demand Causes Supply
Quarter	FSC_S	FSC_Pax	1.0854	0.4767	12	No Relationship
Quarter	FSC_LF	FSC_Pax	0.7232	0.4001	1	No Relationship
Quarter	FSC_LF	FSC_Pax	1.8009	0.1793	2	No Relationship
Quarter	FSC_LF	FSC_Pax	1.3633	0.2705	3	No Relationship
Quarter	FSC_LF	FSC_Pax	0.9012	0.4752	4	No Relationship
Quarter	FSC_LF	FSC_Pax	1.0318	0.4283	6	No Relationship
Quarter	FSC_LF	FSC_Pax	2.5513	0.0448	8	Demand Causes Supply
Quarter	FSC_LF	FSC_Pax	2.0792	0.1691	12	No Relationship
Quarter	LCC_F	LCC_Pax	18.9688	0.0001	1	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	5.5125	0.0080	2	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	3.9186	0.0166	3	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	3.6948	0.0143	4	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	5.6165	0.0008	6	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	6.1294	0.0006	8	Demand Causes Supply
Quarter	LCC_F	LCC_Pax	2.7317	0.0949	12	No Relationship
Quarter	LCC_S	LCC_Pax	18.4574	0.0001	1	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	5.2656	0.0097	2	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	3.8058	0.0187	3	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	3.5320	0.0174	4	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	6.6745	0.0003	6	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	5.6559	0.0009	8	Demand Causes Supply
Quarter	LCC_S	LCC_Pax	7.0688	0.0077	12	Demand Causes Supply
Quarter	LCC_LF	LCC_Pax	3.4090	0.0722	1	No Relationship
Quarter	LCC_LF	LCC_Pax	2.9196	0.0665	2	No Relationship
Quarter	LCC_LF	LCC_Pax	3.2919	0.0322	3	Demand Causes Supply
Quarter	LCC_LF	LCC_Pax	1.6604	0.1843	4	No Relationship
Quarter	LCC_LF	LCC_Pax	1.5828	0.1936	6	No Relationship
Quarter	LCC_LF	LCC_Pax	3.4204	0.0132	8	Demand Causes Supply
Quarter	LCC_LF	LCC_Pax	2.2896	0.1391	12	No Relationship
Year	Total_F	Total_Pax	2.8404	0.1030	1	No Relationship
Year	Total_F	Total_Pax	8.7741	0.0013	2	Demand Causes Supply
Year	Total_F	Total_Pax	5.9531	0.0039	3	Demand Causes Supply
Year	Total_F	Total_Pax	2.6849	0.0603	5	No Relationship
Year	Total_F	Total_Pax	4.5526	0.3506	10	No Relationship
Year	Total_S	Total_Pax	0.1574	0.6946	1	No Relationship
Year	Total_S	Total_Pax	2.7724	0.0818	2	No Relationship
Year	Total_S	Total_Pax	1.7207	0.1920	3	No Relationship
Year	Total_S	Total_Pax	1.7384	0.1830	5	No Relationship
Year	Total_S	Total_Pax	5.0987	0.3327	10	No Relationship
Year	Total_LF	Total_Pax	0.4230	0.5208	1	No Relationship
Year	Total_LF	Total_Pax	6.1113	0.0069	2	Demand Causes Supply
Year	Total_LF	Total_Pax	6.7876	0.0021	3	Demand Causes Supply
Year	Total_LF	Total_Pax	5.0777	0.0056	5	Demand Causes Supply
Year	Total_LF	Total_Pax	8.8972	0.2556	10	No Relationship
Year	NA_F	NA_Pax	1.5586	0.2222	1	No Relationship
Year	NA_F	NA_Pax	9.9022	0.0007	2	Demand Causes Supply
Year	NA_F	NA_Pax	6.6502	0.0023	3	Demand Causes Supply
Year	NA_F	NA_Pax	4.0396	0.0146	5	Demand Causes Supply
Year	NA_F	NA_Pax	22.5307	0.1626	10	No Relationship
Year	NA_S	NA_Pax	0.0199	0.8888	1	No Relationship
Year	NA_S	NA_Pax	4.0742	0.0294	2	Demand Causes Supply
Year	NA_S	NA_Pax	2.9607	0.0545	3	No Relationship

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Year	NA_S	NA_Pax	1.9404	0.1433	5	No Relationship
Year	NA_S	NA_Pax	40.8824	0.1212	10	No Relationship
Year	NA_LF	NA_Pax	0.8568	0.3625	1	No Relationship
Year	NA_LF	NA_Pax	9.0955	0.0011	2	Demand Causes Supply
Year	NA_LF	NA_Pax	10.8986	0.0001	3	Demand Causes Supply
Year	NA_LF	NA_Pax	9.0204	0.0003	5	Demand Causes Supply
Year	NA_LF	NA_Pax	27.6277	0.1471	10	No Relationship
Year	FA_F	FA_Pax	4.5313	0.0422	1	Demand Causes Supply
Year	FA_F	FA_Pax	5.0507	0.0144	2	Demand Causes Supply
Year	FA_F	FA_Pax	3.9019	0.0224	3	Demand Causes Supply
Year	FA_F	FA_Pax	2.1386	0.1132	5	No Relationship
Year	FA_F	FA_Pax	3.4557	0.3976	10	No Relationship
Year	FA_S	FA_Pax	0.4638	0.5014	1	No Relationship
Year	FA_S	FA_Pax	0.8119	0.4554	2	No Relationship
Year	FA_S	FA_Pax	0.4097	0.7476	3	No Relationship
Year	FA_S	FA_Pax	0.7448	0.6015	5	No Relationship
Year	FA_S	FA_Pax	179.5791	0.0580	10	No Relationship
Year	FA_LF	FA_Pax	0.2169	0.6450	1	No Relationship
Year	FA_LF	FA_Pax	3.2980	0.0536	2	No Relationship
Year	FA_LF	FA_Pax	3.5258	0.0317	3	Demand Causes Supply
Year	FA_LF	FA_Pax	2.6178	0.0650	5	No Relationship
Year	FA_LF	FA_Pax	1.1846	0.6202	10	No Relationship
Year	FSC_F	FSC_Pax	3.3728	0.0769	1	No Relationship
Year	FSC_F	FSC_Pax	5.0699	0.0142	2	Demand Causes Supply
Year	FSC_F	FSC_Pax	5.2940	0.0067	3	Demand Causes Supply
Year	FSC_F	FSC_Pax	3.4334	0.0268	5	Demand Causes Supply
Year	FSC_F	FSC_Pax	20.2672	0.1713	10	No Relationship
Year	FSC_S	FSC_Pax	1.3966	0.2472	1	No Relationship
Year	FSC_S	FSC_Pax	3.0523	0.0652	2	No Relationship
Year	FSC_S	FSC_Pax	2.0268	0.1395	3	No Relationship
Year	FSC_S	FSC_Pax	2.1192	0.1158	5	No Relationship
Year	FSC_S	FSC_Pax	35.0319	0.1308	10	No Relationship
Year	FSC_LF	FSC_Pax	0.0797	0.7798	1	No Relationship
Year	FSC_LF	FSC_Pax	8.5874	0.0014	2	Demand Causes Supply
Year	FSC_LF	FSC_Pax	5.9085	0.0041	3	Demand Causes Supply
Year	FSC_LF	FSC_Pax	2.7585	0.0555	5	No Relationship
Year	FSC_LF	FSC_Pax	4.1545	0.3657	10	No Relationship
Year	LCC_F	LCC_PAX	3.4061	0.0898	1	No Relationship
Year	LCC_F	LCC_PAX	4.0186	0.0566	2	No Relationship
Year	LCC_F	LCC_PAX	10.0312	0.0094	3	Demand Causes Supply
Year	LCC_S	LCC_PAX	4.9217	0.0466	1	Demand Causes Supply
Year	LCC_S	LCC_PAX	2.0495	0.1847	2	No Relationship
Year	LCC_S	LCC_PAX	9.2486	0.0114	3	Demand Causes Supply
Year	LCC_LF	LCC_PAX	0.4609	0.5101	1	No Relationship
Year	LCC_LF	LCC_PAX	53.5020	0.0000	2	Demand Causes Supply
Year	LCC_LF	LCC_PAX	24.4212	0.0009	3	Demand Causes Supply

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