# Analyzing the Impact of Crude Oil Price Changes on Airlines' Stock Prices in the Indian Aviation Industry

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**Abstract**

The study examined the connection between airline stock prices and crude oil prices. It focused on five airlines - Air India,, IndiGo, Jet Lite,,Jet Airways, and Spice Jet - as well as three types of crude oil markets based on their market capitalization: WTI-West Texas Intermediate and Texas Light Sweet; Brent-North Sea Brent Crude; and Dubai-Dubai Crude. The results revealed that changes in crude oil prices influenced most of the airline stock returns. Specifically, Air India, IndiGo, Jet Airways, and Spice Jet showed significant correlations between their stock returns and crude oil prices during the study period from January 1,,2007 to November 30, 2018. These findings have implications for individual investors, institutional investors, and policymakers.

**Keywords:** Crude Oil Price, Airline Stock Return, Descriptive Statistics, Unit Root Test, Correlation Matrix, Granger Causality Test

## 1. INTRODUCTION

Crude oil is essential for developing countries in the 21st century, such as India and China, where there has been a substantial increase in its consumption . In the coming years, there is an expected rise in crude oil consumption by China and India. Table 1 outlines the increase in crude oil usage over a 10-year period from 2007 to 2017 for various sample countries. The data indicates a significant surge in crude oil consumption in developing South Asian nations, particularly India and China. Notably, during the period of 2007-2017, China saw a consumption increase of 122.5% while India's rose by 90.0%. Crude oil is considered as an important economic indicator according to this information (Maitra, 2023)(Faccini et al., 2021). The majority of prior research also found that fluctuations in crude oil prices had a significant impact on economic activities, but with a negative effect(Hamilton, 2003), (Cuñado & Gracia, 2005)and (Hamilton, 2003). The fluctuations in the price of crude oil had a substantial effect on developing nations worldwide. For instance, in 1973, OPEC raised the price of crude oil from $3 per barrel to $13 per barrel, causing economic difficulties for developing countries due to increased import expenses (Shaeri et al., 2016).

### 1.1. Fluctuations in the Stock Market and Crude Oil Prices

The efficient market hypothesis theory suggests that the price of stocks is influenced by all accessible public and private information (Maitra, 2023)The fluctuations in crude oil prices were found to have a detrimental effect on the stock price But (Nandha & Faff, 2008) discovered that fluctuations in crude oil prices affected the stock price of individual companies in the crude oil sector, but had minimal impact on

broader stock market indices. The price of crude oil could impact stock prices in three distinct ways as outlined below. Changes in production costs and anticipated cash flows driven by fluctuating crude oil prices would consequently influence stock prices through cash flows (Maitra, 2023)

Changes in crude oil prices can potentially cause inflation, leading to higher interest rates. Increased interest rates would result in a rise in discount rates, which could impact the stock price of a specific company (Maitra, 2023)

Changes in crude oil prices can impact the prices of commodities for a specific business, and may also affect the stock price of a company involved in commodity trading (Edelstein & Kilian, 2009). Figure 1 illustrates the various ways in which fluctuations in crude oil prices can impact the stock market.

## 1.2. Indian Aviation Industry

The Indian aviation sector has a lengthy history, and India holds the 9th position globally based on industry size. Indigo led the market with a 38% share, followed by Jet Airways at 15.9%. Spice Jet held the 3rd spot with a 14% share, while Air India came in at 4th with 13.2%. Following behind was Jet Lite, which captured a market share of 2.4%. Although there were other players in the industry, their shares were quite low.

**Table 1: Percentage of increase of crude oil consumption by the selected countries**

| Countries | % Change |
|---|---|
| Brazil | 39 |
| China | 122.5 |
| India | 90.9 |
| Indonesia | 58.6 |
| Japan | -9 |
| Malaysia | 45.5 |
| Pakistan | 2.9 |
| Russia | -31.2 |
| Thailand | 57.4 |
| United States | 25.8 |

## 2. REVIEW OF LITERATURE

Numerous research has been conducted on the correlation between crude oil prices and stock market returns, with most studies focusing on developed countries The study examined how macroeconomic factors affect changes in stock prices. However, it did not discover any supporting evidence for its findings (Hamao, 1988); (Kaneko & Lee, 1995) I tried to locate proof in Japanese stock data but was unable to find any evidence (Bekaert & Harvey, 1995) Previous research indicates that the price of crude oil had a statistically significant effect on the returns of 18 equity markets throughout the study period (Maitra, 2023) examined the connections between fluctuations in crude oil prices and U.S. stock returns, and discovered that changes in crude oil prices did affect the volatility of the petroleum stock index (Nandha & Faff, 2008) studied the correlation between Australian stock returns and the factor of oil prices, analyzing monthly data spanning from 1983 to 1996. The research revealed a favorable influence of crude oil prices on various sectors, including Oil and Gas, paper and packaging, as well as transportation industries. (Mohanty et al., 2014) studied how the fluctuations in crude oil prices affected key US sectors

such as airlines, hotels, restaurants, and travel and tourism. The analysis revealed that the airline industry experienced a decrease in stock price returns due to changes in crude oil prices between 2008-2009 (Shaeri et al., 2016) research shows that the price of crude oil has a greater impact on the stock price of airlines compared to other industries. According to (Yashodha et al., 2017), The drop in crude oil prices had a detrimental effect on Cathay Pacific Airways Limited and China Airlines (Kristjanpoller & Concha, 2016) also discovered a positive impact on 56 airline companies (Horobeț et al., 2022) reported that the crude oil price had an effect on five US airlines. (Xiao & Yoon, 2019) I studied the influence of three different crude oil prices on the stock prices of four airlines using VAR-GARCH. There was an inverse correlation between crude oil prices and the stock prices of the airlines.

**Figure 1: Impact of crude oil price on the stock market**
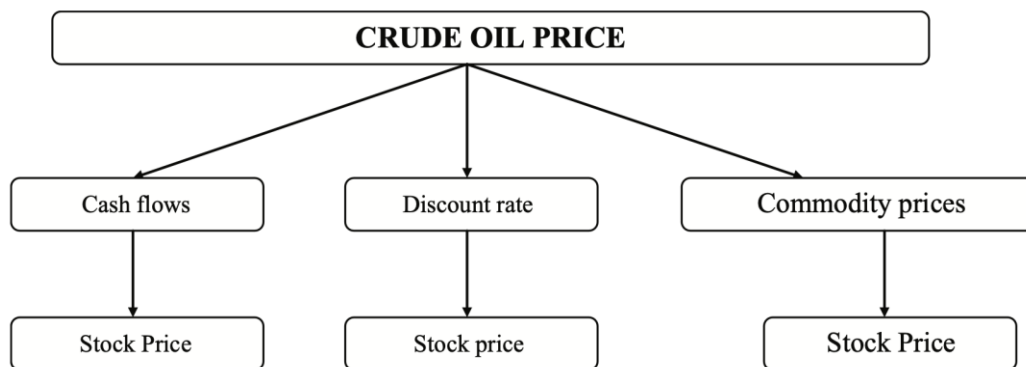


The current research aimed to examine the connections between fluctuations in crude oil prices and the stock prices of airlines in India. While most previous studies have concentrated on developed nations such as the United States and European countries, there has been a lack of focus on developing countries like India. Therefore, this study addresses this gap.

## 3. OBJECTIVES OF THE STUDY

The present research undertook a comprehensive examination into the interrelationships and correlations among three distinct categories of crude oil prices and the stock prices of five prominent airlines over a defined period within the Indian market context. Through rigorous analysis and data exploration, the study sought to uncover the intricate dynamics and potential linkages existing between fluctuations in various crude oil benchmarks and the performance of airline stocks in the Indian aviation sector. By delving into this nuanced relationship, the research aimed to provide valuable insights into the factors influencing airline stock prices amidst the backdrop of fluctuating crude oil markets, thereby contributing to a deeper understanding of the dynamics shaping the Indian aviation industry's financial landscape.

## 4. HYPOTHESES OF THE STUDY

A. The returns of crude oil price and Airlines Stock Price in India do not follow a normal distribution.
B. There is no stationarity observed among the returns of crude oil price and Airlines Stock Price in India.
C. No correlation exists between the returns of crude oil price and Airlines Stock Price in India.
D. There is no causal relationship identified among the returns of crude oil price and Airlines Stock Price in India.

## 5. DATA AND METHODOLOGY

### 5.1. Sample Collection and Acquisition of Data

To explore the correlation between Indian airlines' stock prices and global crude oil price fluctuations, five significant Indian air transport companies were chosen. The analysis focused on the stock prices of IndiGo, Jet Lite, Jet Airways, and Spice Jet in India as well as three internationally recognized crude markets: WTI-West Texas Intermediate and Texas Light Sweet Market, Brent-North Sea Brent Crude Market, and Dubai-Dubai Crude Market. Data on daily closing stock prices for each airline company was gathered from Yahoo Finance database (www.finance.yahoo.com) and the website of the national stock exchange. The crude oil price data was obtained from the U.S. Energy Information Administration (https://www.eia.gov/). For this study, daily return data was transformed using natural logarithm of the raw values. In this research project, the independent variable was considered to be crude oil price while Indian aviation share price served as dependent variables.

### 5.2. Period of Study

The study examined the correlation between airline stock prices and crude oil prices over an 11-year period from January 1, 2007 to November 30, 2018.

### 5.3. Tools used for the Analysis

In this study, various methods were employed to investigate the relationship between crude oil prices and airline stock prices in India. Descriptive statistics were utilized to examine the normal distribution among returns of crude oil price and airline stock price. Additionally, a unit root test was conducted to evaluate the stationarity of the normal distribution among returns of crude oil price and airline stock price. A correlation matrix was employed to identify the correlation between the normal distribution among returns of crude oil price and airline stock price in India. Furthermore, Granger causality test was utilized to assess the linkage among the normal distribution among returns of crude oil price and airline stock price in India.

### 5.4. Limitation of the Study

This current research had the following constraints:

- The investigation was restricted to just five Indian airlines.
- Only secondary data was used for this study.
- Any limitations related to different statistical tools could also be applicable to this study.

## 6. ANALYSIS AND EMPIRICAL RESULTS

### 6.1. Assessing the normal distribution of crude oil price and airlines stock returns in India

Table 2 presents the findings of basic statistical measures (Average, Middle value, Maximum, Minimum, Variability, Asymmetry, Shape and Jarque Bera Test) for the performance of three types of crude oil as well as five airline stocks (Air India, IndiGo Jet Lite, Jet Airways and Spice Jet) in India from January 1st ,2007 to November 30th ,2018. It should be noted that the average values for the returns of the aforementioned thee crude oil types (Brent, Dubai and WTI) and five airline stock prices showed negative trends. Brent and Spice Jet had the highest standard deviations at 2.90 and 3.46, while Dubai and Air India had the lowest standard deviations at 2.44 and 1.77 respectively, indicating market risk. The skewness test revealed that out of three crude oil prices, only WTI (-0.04) was negative, while out of five airline stocks, only Air India (-0.28) and IndiGo (-0.48) were in the negatives during the study period.

It's worth noting that all crude oil prices and airlines stocks exhibited kurtosis values greater than three, making them leptokurtic; however, JB values for both samples indicated normal distribution within their return data sets. In conclusion, the distribution of the three crude oil price returns and five airline stock

price returns was found to be normally distributed throughout this study period as evidenced by rejecting Null Hypothesis, which suggested no normal distribution among these assets' returns in India.

## 6.2. Examining the stationarity of crude oil price and airlines stock returns in India

The results of augmented dickey fuller (ADF) test, for the returns of three crude oil price (Brent, Dubai and WTI) and five airlines stock price (Air India, IndiGo, Jet Lite, Jet Airways and Spice Jet) in India during the study period from January 1, 2007 to November 30, 2018, are displayed in Table 3. It is to be noted that test critical values for three crude oil price and five airlines stock price return data were calculated at significant level of 1%, 5% and 10%. The probability values (P-value), for three crude oil price and five airlines stock price return data were zero. According to the Table, the statistical values for all samples were −54.9615 (Brent), −54.873 (Dubai), −52.6556 (WTI), −47.4837 (Air India), −48.2857 (IndiGo), −51.4379 (Jet Lite), −54.9615 (Jet Airways), −47.4837 (Spice Jet), during the study period. It is important to note that the statistical values for three crude oil price (Brent, Dubai and WTI) and five airlines stock price (Air India, IndiGo, Jet Lite, Jet Airways and Spice Jet) were less than that of test critical values at 1%, 5% and 10% level of significance. The results of Unit Root Test indicated that the returns data of three crude oil price and five airlines stock price attained stationarity during the study period. Hence the Null Hypothesis (NH2), There is no stationarity among the returns of Crude oil price and Airlines Stock Price in India, was rejected and the alternate hypothesis, namely, there is stationarity among the returns of crude oil price and airlines stock price in India, was accepted.

## 6.3. Calculating Pearson correlation between crude oil price and airlines stock returns in India

Table 5 displays the findings of Pearson Correlation, showing the relationship between the returns of three types of crude oil price and five different airline stock prices. The study period ranged from January 1, 2007 to November 30,,2018. The Pearson correlation values for the five airlines' stock prices varied from −0.0190 to 0.0260 in relation to Brent; from −0.0200 to 0.0320 concerning Dubai; and from −0.0180 to 00 , in respect of WTI during that time frame. According to Table 5, the Pearson correlation values for the returns of three different crude oil prices and five airlines' stock prices were found to be below the significant level during the study period. The analysis clearly showed no correlation between the three crude oil prices and the stock prices of five airlines (Air India, IndiGo, Jet Lite, Jet Airways, and Spice Jet) in India. As a result, it was concluded that there is no correlation between returns of crude oil price and airlines stock price in India based on Null Hypothesis. According to the Pearson correlation results, it was found that there was no significant influence of three crude oil prices and five airline stock prices on the sample airline during the study period. Therefore, a further analysis of these three crude oil prices and five airline stock prices was conducted using the Granger Causality Test.

**Table 2: Results of descriptive statistics of the three crude oil price and five airlines stock price from January 1, 2007 to November 30, 2018**

| Descriptive statistics | Crude oil | | | Airlines company | | | | |
|---|---|---|---|---|---|---|---|---|
| | Brent | Dubai | WTI | Air India | IndiGo | Jet Lite | Jet Airways | Spice Jet |
| Mean | -0.02 | -0.01 | -0.06 | -0.03 | -0.01 | -0.03 | -0.03 | -0.02 |
| Median | 0.04 | 0 | 0 | 0.03 | -0.01 | 0 | 0 | 0 |
| Max. | 42.1 | 19.7 | 15.9 | 10.4 | 9.8 | 26.1 | 20.4 | 34.02 |
| Min. | -21.4 | -18.9 | -15.4 | -11.2 | -10.2 | -16.2 | -15.9 | -26.8 |
| Std. Dev. | 2.9 | 2.44 | 2.45 | 1.77 | 1.93 | 2.88 | 2.79 | 3.46 |
| Skewness | 1.16 | 0.08 | -0.04 | -0.28 | -0.48 | 0.312 | 0.33 | 0.32 |
| Kurtosis | 29.5 | 9.89 | 9.26 | 6.54 | 6.97 | 10.2 | 9.33 | 12.3 |
| J-B | 6050 | 4049 | 3336 | 1188 | 1335 | 4451 | 3452 | 7360 |

**Table 3: Results of ADF of the returns of three Crude oil price and five Airlines Stock Price from January 1, 2007 to November 30, 2018**

| Company name | Statistical Value | Test critical value | | | P-value |
|---|---|---|---|---|---|
| | | 1% | 5% | 10% | |
| **Crude Markets** | | | | | |
| Brent | -54.9615 | -3.4323 | -2.86327 | -2.5677 | 0.0001 |
| Dubai | -54.873 | -3.43454 | -2.86327 | -2.5677 | 0 |
| WTI | -54.873 | -3.43454 | -2.86327 | -2.5677 | 0 |
| **Airlines Company** | | | | | |
| Air India | -47.4837 | -3.43454 | -2.86327 | -2.5677 | 0.0001 |
| IndiGo | -48.2857 | -3.43454 | -2.86327 | -2.5677 | 0 |
| Jet Lite | -51.4379 | -3.43454 | -2.86327 | -2.5677 | 0.0001 |
| Jet Airways | -54.9615 | -3.43454 | -2.86327 | -2.5677 | 0 |
| Spice Jet | -47.4837 | -3.43454 | -2.86327 | -2.5677 | 0 |

## 6.4. Analyzing Granger causality between crude oil price and airlines stock returns in India

This section suggests conducting a Granger Causality test for the fluctuations in three types of crude oil prices and five airline stock prices (Air India, IndiGo, Jet Lite, Jet Airways, and Spice Jet). Each type of crude oil price was evaluated independently against the five airline stock prices.

## 6.4.1. Granger causality between the returns of Brent and five Airlines stock price in India

The findings of Granger Causality, which tested the linkages between the price of Brent Crude oil and five airline stocks in India from January 1, 2007 to November 30, 2018 are presented in Table 6. It is evident that only three airlines' stock prices - namely IndiGo (↔), Jet Airways (↔), and Spice Jet (↔) - showed a two-way unidirectional causal relationship with Brent crude oil price based on F-Statistics and P-value. Conversely, there was no observed causal relation between the remaining three airlines' stock prices and Brent Crude oil price. As a result,NH4,the Null Hypothesis stating that there is no causal relationship among returns of crude oil price Amd Airlines Stock Price in india partially holds true.

## 6.4.2. Granger causality between the returns of Dubai and five airlines stock price in India

Table 7 displays the findings of the Granger Causality test for the returns of Dubai Crude oil price and five Airlines Stock Price (specifically Air India,, IndiGo, Jet Lite, Jet Airways and Spice Jet) in India from January 1, 2007 to November 30, 2018. It is evident that only three out of five Airlines Stock Prices exhibited a two-way unidirectional causal relationship with Dubai Crude oil price based on F-Statistics and P-value. The remaining three airlines showed no causal relation with Dubai Crude oil price. Therefore, it can be partially concluded that there is no causal relationship among returns of crude oil price and airline stock prices in India according to Null Hypothesis NH4.

## 6.4.3. Granger causality between the returns of WTI and five Airlines stock price in India

The Granger Causality test results for the Dubai crude oil price and five Indian airlines' stock prices from January 1st, 2007 to November 30th, 2018 are displayed in Table 8. Except for two airline stocks - namely and Jet Lite - the other four airline stock prices (Air India, IndiGo; Jet Airways and Spice;Jet) indicated a one-way causal relationship with WTI crude oil price based on F-Statistics and P Value. As a result of this

observation. the Null Hypothesis, stating that there is no causal relationship among returns of Crude oil price anfd Airlines Stock Price in India had partial support.

**Table 5: Results of Pearson correlation Statistics for the returns three Crude oil price and five Airlines Stock Price from January 1, 2007 to November 30, 2018**

| Company Name | Correlation | Brent | Dubai | WTI |
|---|---|---|---|---|
| Air India | Pearson Correlation | -0.019 | -0.02 | 0.012 |
| | Sig. (2-tailed) | 0.487 | 0.2 | 0.919 |
| Indigo | Pearson Correlation | 0.02 | 0.032 | 0.013 |
| | Sig. (2-tailed) | 0.349 | 0.233 | 0.199 |
| Jet Lite | Pearson Correlation | 0.001 | 0.003 | -0.011 |
| | Sig. (2-tailed) | 0.466 | 0.412 | 0.055 |
| Jet Airways | Pearson Correlation | 0.02 | -0.002 | 0.02 |
| | Sig. (2-tailed) | 0.873 | 0.92 | 0.045 |
| Spice jet | Pearson Correlation | 0.026 | 0.003 | 0.019 |
| | Sig. (2-tailed) | 0.95 | 0.97 | 0.786 |

**Table 6: Results of granger causality for the returns of Brent Crude oil price and five Airlines Stock Price from January 1, 2007 to November 30, 2018**

| Null Hypothesis | F-Statistic | Probability | Results |
|---|---|---|---|
| Brent Does Not Granger Cause Air India | 1.1219 | 0.5931 | Reject |
| Air India Does Not Granger Cause Brent | 0.0013 | 0.5649 | Reject |
| Brent Does Not Granger Cause IndiGo | 0.2828 | 0.0145 | Reject |
| IndiGo Does Not Granger Cause Brent | 3.328 | 0.6665 | Accept |
| Brent Does Not Granger Cause Jet Lite | 3.1402 | 0.1613 | Accept |
| Jet Lite Does Not Granger Cause Brent | 1.5438 | 0.0375 | Reject |
| Brent Does Not Granger Cause Jet Airways | 1.5438 | 0.0375 | Reject |
| Jet Airways Does Not Granger Cause Brent | 0.5712 | 0.0186 | Reject |
| Brent Does Not Granger Cause Spice Jet | 0.5224 | 0.0258 | Reject |
| Spice Jet Does Not Granger Cause Brent | 0.2666 | 0.0159 | Reject |

## 7. CONCLUSION

Limited research exists on the impact of crude oil price fluctuations on airline stock prices. This study investigates the causal relationship between crude oil prices and airline stock prices within India's aviation industry, as fluctuations in crude oil prices directly affect airlines' operating costs (Modigliani & Cohn, 1979). The fluctuation in airline expenses would impact the inflow and outflow of funds, ultimately affecting the stock market price within the industry (Apergis & Eleftheriou, 2002). The Indian economy is projected to use a growing portion of the globe's oil and expand its influence in international financial markets. In this current research, the connection between three types of crude oil prices and stock prices for five airlines was examined Jover a specific period in India. Based on the ADF findings, it was discovered that all three crude oil prices and the stock prices of these five airlines exhibited stationarity at 1%, 5%, and 10% significance levels. Amongst the five airline stock prices, most of them showed a one-

way unidirectional causal relation with crude oil price. Brent Crude displayed a strong unidirectional causal relation with Indigo, Jet Airways, and Spice Jet. Dubai crude oil price also showed a one-way causal relation with Air India, IndiGo, and Jet Airways. Lastly, WTI crude oil price revealed a one-way relational pattern with four major airline stock prices: Air India, IndiGo,  Jet Airways,and Spice Jet.Finally,it can be concluded from this study that there is evidence of causality between movements in  crude oil price and airline stock prices in India The results of the current research will serve as a valuable resource for market participants, providing important insights into the relationship between crude prices and stocks. Investors should consider developing hedging strategies to manage their risk exposure based on these findings. The study's outcomes will also hold significant relevance for major airline companies whose stocks are traded in India. Additionally, the study's conclusions can offer benefits to individuals involved in buying, selling, or holding stocks. Policymakers should similarly take note of fluctuations in crude prices.

**Table 7: Results of granger causality for the returns of Dubai Crude oil price and five Airlines stock price from January 1, 2007 to November 30, 2018**

| Null Hypothesis | F-Statistic | Probability | Results |
|---|---|---|---|
| Dubai does not granger cause Air India | 0.6513 | 0.0223 | Reject |
| Air India does not granger cause Dubai | 0.3725 | 0.0291 | Reject |
| Dubai does not granger cause IndiGo | 0.0129 | 0.0094 | Reject |
| IndiGo does not granger cause Dubai | 2.8509 | 0.0498 | Reject |
| Dubai does not granger cause Jet Lite | 0.6072 | 0.5457 | Accept |
| Jet Lite does not granger cause Dubai | 0.7184 | 0.4886 | Accept |
| Dubai does not granger cause Jet Airways | 1.7646 | 0.0036 | Reject |
| Jet Airways does not granger cause Dubai | 1.6358 | 0.017 | Reject |
| Dubai Does Not Granger Cause Spice Jet | 1.3281 | 0.2669 | Accept |
| Spice Jet Does Not Granger Cause Dubai | 0.5426 | 0.5819 | Accept |

**Table 8: Results of granger causality for the returns of WTI Crude oil price and five Airlines Stock Price from January 1,2007 to November 30, 2018**

| Null Hypothesis | F-Statistic | Probability | Results |
|---|---|---|---|
| WTI does not granger cause Air India | 1.755 | 0.0131 | Reject |
| Air India does not granger cause WTI | 0.5965 | 0.0018 | Reject |
| WTI does not granger cause IndiGo | 0.711 | 0.0412 | Reiect |
| IndiGo does not granger cause WTI | 3.3639 | 0.0348 | Reject |
| WTIt does not granger cause jet lite | 0.711 | 0.4912 | Accept |
| Jet lite does not granger cause WTI | 0.7679 | 0.0441 | Reject |
| WTI does not granger cause jet airways | 0.101 | 0.039 | Reject |
| Jet airways does not granger cause WTI | 1.6942 | 0.0139 | Reject |
| WTI does not granger cause spice Jet | 1.475 | 0.029 | Reject |
| Spice Jet does not granger cause WTI | 1.7646 | 0.0036 | Reject |

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