

# The Recent Stock Performances Analysis of the Airline Industry

Han Mo<sup>1,\*</sup>

<sup>1</sup> Department of Financial Technology, Central University of Finance and Economics, Beijing, 102200, China

\*Corresponding author. Email: 2019310450@email.cufe.edu.cn

## ABSTRACT

Due to the high risk of investment in the aviation industry, the airline industry market is often subject to large changes. Therefore, it is necessary to analyze the airline enterprises. This paper discusses the share price of the airline industry in recent years and how and how the portfolio is structured. As to the use of the model, this paper uses the Markowitz model and index model. After that, by synthesizing the stock prices of several American airlines in recent years, several constraints are designed to optimize the usage scenario. Finally, by calculating the minimum covariance and the maximum Sharpe ratio, a general empirical method of portfolio construction is obtained. In addition, the COVID-19 epidemic has had a great impact on the aviation industry. This paper also discusses the post-COVID-19 airline industry to a certain extent. To sum up, airline enterprises are full of risks and worth studying.

**Keywords:** Airline, Portfolio, Economy, Markowitz

## 1. INTRODUCTION

In recent years, investment activities are very popular among corporations and normal people. They'd love to invest in different industries because multiple portfolios are beneficial to disperse the risk. The airline industry, which plays an important role in the tourist industry, is always very concerned because of their abundant profit. However, some corporations, especially the HNA Group, whoever found a commercial kingdom, failed in a short time. What's more, because of the 2019-nCoV, these industries have been influenced enormously. Under the influence of the epidemic situation, the staff of many airlines around the world are also facing transformation. The airline's operation is free-falling contraction, with a multi-pronged approach of reducing shifts, grounding, layoffs, and pay cuts. The supply-demand relationship of the entire aircraft will accelerate the adjustment, and the phenomenon of excess capacity will be maintained for a long time.

Buffett, the stock god, has fallen on aviation stocks more than once. Since the outbreak of the COVID-19 epidemic in 2020, the global aviation industry has suffered an unprecedented blow. After the plunge, aviation stocks also attracted Buffett's attention. However, he suddenly bore large losses. Even 30 years ago, In 1989, Buffett purchased preferred shares of an airline called US Air. The company was the predecessor of American

Airlines AA, but the investment ended with Buffett losing money and cutting meat.

Therefore, it can be indicated that the airline industries have a more competitive environment and it is easier for them to be eliminated. Thus making research to discuss the airline portfolio is necessary and useful. Therefore, this paper will try to use the Markowitz model and the index model to analyze several stocks of airlines and find the empirical rules of this industry. Also, the impact of the 2019-nCoV can be analyzed.

Ciliberto and Tamer found a practical method to estimate the payoff functions of players' incomplete information, static, discrete games. They believe that each airline corporation influences its competitors' profits. They found the differences between the large airlines and the low-cost airlines about the competitive effects [1]. Berry and Jia present a practical and structural model to describe and estimate the enormous differences of the demand and the supply on the profitability, due to the several tremendous turmoils in past few years. They conclude that passengers hold a preference for non-stop flights in 2006 compared to that in 1996. Thus, most legacy carriers had a reduced profit [2]. B.Sobieralski collected the historical data from 1990 to 2020. Due to the time series analysis, he thinks that the historical uncertainty shocks have influenced the airline industry enormously. With the spreading of the COVID-19,

though air travel has not been completely reduced, the capacity of corporations around the world has still been shrunk enormously. Based on the historical data, B.Sobieralski finds that the airline industry has a universal problem that their capital structure would be sensitive and fluctuated due to the capital scale and the financial risk of large airlines [3].

Carter et al. did research that whether hedging influences airline firm value. They find that high jet fuel prices coincide with low industry cash flows, and industry investment is positively related to the level of jet fuel costs. Another finding is that the investors are more emphasize hedging since it can protect the investment in bad times. Also, Carter finds that airlines can use hedging and the price of the fuel to build their marketing like purchasing cut-price asset to get though the period when the price of fuel is high [4]. Colizza et al. considered the impact and cause of the SARS and discovered that air-transportation-network is the root of the heterogeneous and seemingly erratic spreading on the global scale of diseases. They set up several models to analyze the impact and find that the relation between the airline and other transportation may be so complex that long-term analysis can be more useful. Therefore, the final influence of COVID may also be unknown for airlines now [5]. Vidal reviewed the Markowitz model. They use the Markowitz model as an investment analysis tool and find that the Markowitz model can provide a better-performed portfolio than market benchmarks. They also analyze this model objectively. Though the Markowitz model provides all the mutual funds with better performance, and it is also limited with historical data, it still can be considered to be applied when doing the portfolio analysis [6].

Zheng et al. researched the investment behavior of the airline corporation. They find that the attitude can

influence the timing of the vertical investment (investment in foreign country is used for the vertical specialization and cooperation with domestic parent country). Also, they consider the government taking part in the airline market. Finally, they find that the competition of varied corporations can develop vertical investment [7]. Wojahn discovered that recently the whole airline industry has a problem that it may be over-invested. He also finds that the over-invested situation is a certain phase of the industry. Because wars of attrition in the airline industry occur through low prices, they redistribute rents from the airlines to the consumer. Welfare losses may only occur because some profits are dissipated wastefully through duplication of fixed costs, resulting in low load factors [8]. Huang reviewed the index model. Regarding security returns as uncertain variables, the paper has introduced a risk index as alternative risk measurement. In addition, the crisp forms of the model have also been provided [9].

Therefore, this paper will try to use the Markowitz model and the index model to analyze several stocks of airlines and find the empirical rules of this industry. Also, the impact of the 2019-nCoV can be analyzed.

**2. METHOD**

**2.1 Data**

This paper is trying to investigate portfolio performance in the airline industry. In particular, it chooses Southwest Airlines (LUV), Alaska Airlines (ALK), and Hawaiian Airlines(HA). What's more, this study also uses the S&P 500 Index(SPX) to calculate for more correlation.

**Table1.** Stock price information

Stock	SPX	LUV	ALK	HA
Annualized Average Return	7.542%	9.849%	17.431%	26.872%
Annualized StDev	14.850%	31.796%	37.734%	62.074%
beta	1	1.149596706	1.17790436	1.629275842
alpha	0	0.011782145	0.085471429	0.145831394
Residual StDev	0	0.268236758	0.334347787	0.571640413

Note: SPX is a stock to be included in calculation for more data and correlation, and this paper would set several constraints to improve the results

**Table2.** Stock Price Correlation

Stock	SPX	LUV	ALK	HA
SPX	1	0.536926117	0.46356598	0.389783091
LUV	0.536926117	1	0.519096214	0.421536017
ALK	0.46356598	0.519096214	1	0.404217057
HA	0.389783091	0.421536017	0.404217057	1

**2.2 Model**

To research the portfolio of these airline corporations, it chooses the Markowitz Model and the Index Model to complete the mission. Here's the basic equation of this method (w refers to the weight of certain stock on the portfolio).

$$\text{Portfolio} = w(\text{SPX}) * \text{stock}(\text{SPX}) + w(\text{LUV}) * \text{stock}(\text{LUV}) + w(\text{ALK}) * \text{stock}(\text{ALK}) + w(\text{HA}) * \text{stock}(\text{HA}) \quad (\sum w = 1) \quad (1)$$

**2.2.1 Markowitz model**

Markowitz model was been presented by the H.M.Markowitz in 1952. He tries to uses the return fluctuation of the portfolio to describe the risk. He thinks investors would rather want the highest return under a given risk and the lowest uncertain risk under a given return. So investors should allocate their capital into different stocks, funds, and bonds, to reach an ideal rate of return and risk. Markowitz's model is based on several assumptions. Firstly, investors would make decisions according to the probability distribution of return at a certain time when taking a position. Secondly, investors would use the standard deviation to describe the risk of certain security. Thirdly, investors only decide the return and the risk of certain security. Finally, investors hope for the lowest risk under a given return and the highest return under a given risk [1].

There is the equation of Markowitz model.

$$\text{Return}(R_i) = \sum_{i=0}^3 (w_i * R_i) \quad (2)$$

$$\text{Variance}(R_i) = \sum_{i,j=0,3} (w_i * S_i) \square \text{Corr}(i,j) \square (w_j S_j) \quad (3)$$

What's more, there are also 5 constraints to be considered, which represented 5 different ways of investors to calculated the risk. And first there is a benchmark to be compared. Next, there are also 4 constraints.

$$\sum_{i=0,3} (|w_i| \leq 2) \quad (4)$$

This constraint shows that investors take the absolute value.

$$|w_i| \leq 1, \text{ for } \square i \quad (5)$$

This constraint is allowed the holder to do the issue of a short sale.

$$w_i \geq 0, \text{ for } \square i \quad (6)$$

This constraint doesn't allow the holder to do the short sale.

$$w(\text{SPX}) = 0 \quad (7)$$

This constraint means that the holder doesn't consider the SPX.

**2.2.2 Index model**

However, the methods above don't consider all the factors, the risk, and the return. So we use the Index Model to improve. Most of the steps between the Index Model and the Markowitz Model are the same, except that we need the corresponding return and standard deviation under the Index Model. And the Index model uses an index to analyze the data because of the convenience, and it is also supported four assumptions:

Firstly, most of the stocks have a positive co-variation, since they react like the macroscopic issues. Secondly, beta control the sensitivity of these stocks. Thirdly, the difference o sensitivity of stocks refers to the different reactions to certain macroscopic issues. Finally, the equation is that [10]:

$$\text{Cov}(R_i, R_k) = \beta_i \beta_k \sigma^2 \quad (8)$$

**3. RESULT**

This paper first uses the Markowitz model to calculate the portfolio. So in the beginning, the "max variance" and the "max Sharpe" are necessary. This paper uses the tool which is called "solver" in Excel to calculate them. For comparison, the index model would use the same tool to calculate. After calculating each constraint, these tables are formed.

**Table3.** Portfolio minimal variance

Method	Markowitz model		Index model	
	return	stdev	return	stdev
Constraint benchmark	6.692%	11.747%	6.692%	13.162%
Constraint1	6.706%	11.749%	6.706%	13.122%
Constraint2	6.968%	11.792%	6.968%	13.454%
Constraint3	7.792%	14.609%	7.792%	14.609%
Constraint4	9.382%	15.451%	9.382%	18.306%

**Table4.** Portfolio maximal Sharpe ratio

Method	Markowitz model		Index model	
	return	Sharpe	return	Sharpe
Constraint benchmark	22.068%	103.452%	22.068%	77.111%
Constraint1	17.591%	99.391%	17.591%	80.538%
Constraint2	22.068%	103.452%	22.068%	77.111%
Constraint3	18.235%	73.675%	18.235%	73.612%
Constraint4	26.528%	102.107%	26.528%	76.527%

Therefore, based on the chart above, we can make the following conclusions: if it chooses the portfolio judged by the minimal variance, we choose benchmark under the Markowitz model, while we choose constraint1 ( $\sum_{i=0,3} w_i \leq 2$ ) under the index model. If choosing the portfolio judged by the maximal Sharpe ratio, we choose benchmark or constraint2 ( $|w_i| \leq 1$ , for  $\forall i$ ) under the Markowitz model, while we choose the constraint1 ( $\sum_{i=0,3} w_i \leq 2$ ) under the index model.

However, due to the 2019-nCoV, these models may have some deviations. So, if a more precise answer is needed, the comparison between the data before the epidemic and the data during the epidemic can be done.

## 4. DISCUSSION

### 4.1 The comparison between two models

These two models both have their apparent advantages and drawback. If the study gains an accurate estimation, then the results of the Markowitz model are more accurate than others. For example, the index model only expresses some important factors and ignores those seemingly unimportant factors, but not in the Markowitz model. Therefore, as long as the original data is the most accurate, the Markowitz model can give better results than the index model. However, because the Markowitz model needs to calculate the covariance and variance of all stocks, if the number of securities is large, there would be enormous work for researchers to do.

### 4.2 Constraints comparison

Short selling is not allowed on stock exchanges in some regions. Therefore, this paper considers this constraint for those persons. What's more, limited short selling would also alter the calculation updated the model, and get a different answer from the benchmark. It exactly has research value.

Next, due to the factor that the coverage of the SPX500 is too large, this paper mainly discusses the airline industry, so the paper set a new constraint  $w_1=0$ , which means that it would not consider the SPX500 in this constraint to get a closer result for the airline industry.

## 5. CONCLUSION

The study has presented the performance of airline corporation portfolios under different constraints using two models. This paper has used the Markowitz model and the index model. It has used the shape ratio and the standard deviation to analyze the profitability and the risk. Finally, the paper gets four different portfolios for different needs. When people want larger profitability, they can identify the Sharpe ratio. Instead, they can select by the deviation if they need less risk. It not only shows the experience logic when building the portfolio but also shows the recent performance of the airline industry. If there's someone wants to analyze the airline market, this paper can provide some experience. If researchers need more detailed analysis, they can also use more varied models to calculate the findings.

## REFERENCES

- [1] F. Ciliberto, Market structure and Multiple equilibria in airline markets. *Econometrica*, 2009, vol.77, no.6, pp.1791-1828, 2009. DOI: <https://EconPapers.repec.org/RePEc:ecm:emetrp:v:77:y:2009:i:6:p:1791-1828>
- [2] S. Berry, Tracing the Woes: An Empirical Analysis of the Airline Industry. *American Economic Journal*, pp.1-43, 2010, DOI: 1721.1/70929
- [3] B. Joseph, COVID-19 and airline employment: Insights from historical uncertainty shocks to the industry, 2020. DOI: 10.1016/j.trip.2020.100123
- [4] A. David. Does Hedging Affect Firm Value? Evidence from the US Airline Industry, 2014. DOI: 10.1111/J.1755-053X.2006.TB00131.X
- [5] V. Colizza. The role of the airline transportation network in the prediction and predictability of global epidemics, 2015, DOI: 10.1073/PNAS.0510525103
- [6] J. Vidal. A Note on Markowitz Model, 2019. DOI: 10.2139/SSRN.3461392

- [7] S. Zheng, Airline investments in exclusive airport facilities: Timing decisions under demand ambiguity, 2020. DOI: 10.1016/J.TRB.2020.05.004
- [8] O. W. Wojahn. Why does the airline industry over-invest?, 2012. DOI: 10.1016/J.JAIRTRAMAN.2011.11.002
- [9] X. Huang. A risk index model for portfolio selection with returns subject to experts' estimations, Springer, 2012. DOI: 10.1007/S10700-012-9125-X
- [10] E. Kong, Y. Xia. Variable selection for the single-index model, 2007, DOI: 10.1093/biomet/asm008.