# Aviation Risk Management to Forecast ,Evaluate Lufthansa Airline's Share Price

**Qussay A.B Al Nuaimi,** qussay.ab2013@yahoo.com Qussay@ecomang.uodiyala.edu.iq

**Lecturer: Husham F. Abdulateef** hisham123@yahoo.com

College of Administration and Economics, University of Diyala, Iraq

## Abstract

This article describes a study that goals to provide the whole scientific basis for application of Aviation Risk Management (ARM) for Lufthansa airline. The present study has appraised the use of many instrument and pointers that would be suitable integration into ARM. Aviation Risk Management element, outcomes show that E-views statically models of forecasting are convenient outfits to help a Lufthansa to evaluate price share .The tool ARM includes processes that have been evaluated during this research: correlation coefficients, prediction, forecasting and focused on an analysis of share price of Lufthansa. Search Results showed that the share prices of the Lufthansa airline are within the confidence limits (correlation coefficient at 0.84) In other words, that prices will be stable ( next three years) in the absence of the Company's exposure to risks as a result of external disasters, the company should take precautions to meet these challenges and to maintain and raise the share prices in the capital market.

***Key word** : Lufthansa share price, Methodology predict, ARIMA of Lufthansa*

## 1.Introduction

Lufthansa large address in the airlines is not in the EU, but in all the countries of the world, they have the lines and the offices of Air in most countries of the world and provides nearly 120,000 jobs and more than 300,000,000 € return( Air Transport Association ,2009) at the end of 2015, see Fig 1. In this article, we offer a statistical model to predict the prices of shares of Lufthansa flight to assess and analyze the financial position to know the strengths and weaknesses and provide advice in the event of financial crises . The commercial airline industry has always been considered by low-profit margins, Decreasing airfares due to enlargement opposition have made air mobile a commodity market Deregulation in the world carrier industry has led to superior rivalry since the 1980s . Particularly the deregulation of the flying segment in Europe has maintained the intense growth of low-cost transporters . Unfashionable carriers in specific suffer from losing market shares(Civil Aviation Authority,2006). Investors in an effort to maximize returns are reflected in prices to predict airline stocks, which constitutes an attraction for further investment in companies profitable and stable flight and the ratio is less than the risks. Airlines companies began to employ the predict aviation risk management strategy to confront the crisis that may face air transport and shipping companies and work to attract more investors and raise the market value of airlines (Carter, Rogers, & Simkins, 2004). Moving investors to invest their money in safe aviation companies financially and thus, they are looking for a stable market for this seeking aviation risk management to analyze financial data and predict the future of the stock market to reflect the growth and stability of

the external environment( Morrell& Swan,2006). Aviation companies are working on the show's financial position in a transparent and clear, and the company's ability to achieve more profits. This great effort is through financial analysis of the data and predicted the future of airline stocks prices (Adams & Gamer, 2012). the head section generally decides centrally about the forecasting strategy Within an organization ,aviation risk management is normally managed centrally. However, to underline the significance of forecasting within the aviation industry,(Bodnar, Hayt, &Marston, 1998). With a predicted strategy the department regulates the tools over the oil spot price cycle that reflect on the price list in stock exchange(Cobs & Wolf, 2004). The question then becomes how well the price cycle can be forecasted share price .The better that aircraft companies can forecast future prices the more fruitful they will be with their predicted activities( Sturm ,2009). The profits of European Airlines estimates exceed one billion dollars annually as a result of the expectation of the external environment policy which leads to better services and the evolution in presentation. Prediction for airlines policy leads to taking precautions volatility of fuel prices on the global level, which avoids these companies bankruptcy ,enhance performance( Adams and Gemer, 2012).

The aim of this study is to create a strategic vision to enable senior management to airlines from outlining future fiscal policy lead to the stability of share prices and growth (Jorion, 1990). Previous studies indicate the importance of forecasting the future of the airline to maintain its financial position, including the hedge swings in fuel prices . We suggest further studies , predicted and financial analysis of stock prices in the capital market . studies show that the airline EU is the most predictable of US airlines by more than 22 airline study in Europe and America and that airlines in Asia are working hard to predict the stock market for the period from 2002 to 2013

Our study showed that the correlation coefficient is (0.8) to stock prices for Lufthansa, a spot of a trust, which gives a good impression to the stability of the company's shares prices in the absence of the company's exposure to potential risk to the company that requires to preparing for any emergency may occur through the department of aviation risk management. Results of the study confirm the importance of the role of risk aviation administration in predicting the future financial position of Lufthansa in collaboration with the senior management of the company and other sections. In fact the expansion and open a new routes of Lufthansa enhance the company's shares in the global capital market , which requires taking these positive changes the financial position of the airline company. The remainder of the paper is organized as follows: Section 2 Lufthansa in summary, Section 3 analyze the research methodology and the detail of the tests conducted, Section 4 presents the research's outcome study.


Fig.1.Goal Lufthansa:

## 2. Lufthansa share price

According to the annual report of Lufthansa at the end of 2015, the share price rises 5.3 per cent following volatile presentation over the course of the year, dividend of EUR 0.50 per share . Lufthansa share price up moderately in 2015 The Deutsche Lufthansa AG share gained 5.3 per cent over the course of 2015 to close the year at EUR 14.57. This was less than the DAX index, which rose by 9.6 per cent. The share price was subject to significant instabilities in the aspect of 2015. Having fallen by 16.4 per cent in the first half of the year, the Lufthansa share recovered by 7.4 per cent in the third quarter. In the last quarter, the share price then climbed by 17.2 per cent. The share reached its high for the year on 26 January at EUR 15.35, followed by the low for the year on 24 August at EUR 10.48. See table.1

Table.1. Operating Cash flow in EUR m

| | | 2015 | 2014 | 2013 | 2012 | 2011 |
|---|---|---|---|---|---|---|
| Year-end share price | € | 14.57 | 13.83 | 15.42 | 14.24 | 9.19 |
| Highest share price | € | 15.35 | 20.26 | 17.10 | 14.47 | 17.39 |
| Lowest share price | € | 10.48 | 10.88 | 12.93 | 8.02 | 8.35 |
| Number of shares | millions | 464.5 | 462.8 | 461.1 | 459.9 | 457.9 |
| Market capitalisation (at year-end) | €bn | 6.7 | 6.4 | 7.1 | 6.5 | 4.2 |
| Earnings per share | € | 3.67 | 0.12 | 0.68 | 2.68 | −0.03 |
| Cash flow from operating activities per share | € | 7.30 | 4.27 | 7.15 | 6.20 | 5.14 |
| Dividend per share | € | 0.50 | – | 0.45 | – | 0.25 |
| Dividend yield (gross) | % | 3.4 | – | 2.9 | – | 2.7 |
| Dividend | €m | 232.3 | – | 207.5 | – | 114.5 |
| Total shareholder return | % | 5.3 | −7.4 | 8.3 | 57.7 | −40.2 |

## 3. Methodology

We begin the analysis of prices for Lufthansa listed in international stock markets by using the model of the correlation coefficient to see the power of coherence among the listed

prices. The test result of this Model is limited between (+1,-1). The test result is near (1) refers to the strength of the association between the stocks listed rates, as the result was near (-1) refers to the weak correlation between the prices listed. we obtained Lufthansa database by website(https://Lufthansa share price.com),we obtained the result by model:

$$r = \frac{\sum_{i=1}^{n} (X_i - \overline{X})(Y_i - \overline{Y})}{(n-1)S_x S_y} \qquad (1)$$

Where :

Xi : Time test (2015-2016)

Yi : price of Lufthansa

N: numerical observation

S: stander deviation

Table. 2 . Correlation Coefficient of Lufthansa price

| | | x | y |
|---|---|---|---|
| x | Pearson Correlation | 1 | .844** |
| | Sig. (2-tailed) | | .000 |
| | N | 252 | 252 |
| y | Pearson Correlation | .844** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 252 | 252 |

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows the correlation coefficient at 0.84 which shows the strength of the thread to Lufthansa prices in the global stock exchange, the data obtained for the period (2015-2016) which represents 252 observations.

The second step determines to predict prices airlines, forecasting is a process of assessing airlines companies a future event by casting advancing past data. The past data are methodically collective in a programmed way to find the estimation of the future. Estimates and predicted are never completely exact and will always deviate from the actual value. Thus, the key target is to reduce as much as possible the associated error of the time series forecast. the reason for presenting a wide range of forecast evaluators is the fact that each task emphasizes specific features of the gained values and observing functions may help determine a neural network had a good performed or not.

We utilize a two-step procedure to estimate of a prediction, let us assume the time series goal value

$$SSE = \sum_{i=1}^{n} (y(t) - y_f(t))^2 \qquad (2)$$

Where :

*y(t)* is predicted value of share price Lufthansa

$y_f(t)$ is a series of length n of share price Lufthansa

The difference between the sum of the squared deviations (SSE) of the forecasted value compared to the target value, Thus, a time series with more terms implicitly has a bigger error and a comparison of the quality of different time series forecasts is not feasible. To overcome this situation, one can use the mean value of this error:

$$MSE = \frac{1}{y_{max} - y_{min}} \frac{\sum_{i=1}^{n} (y(t) - y_f(t))^2}{n} \qquad (3)$$

Where:

$y_{max}$ is max share price of Lufthansa

$y_{min}$ is min share price of Lufthansa

Fig (2) provides the time series for the price of Lufthansa in the global stock markets in the year 2015-2016 . The first step in the time-series analysis is to draw the series to determine the direction , stability and using software Eiews was obtained on the graph to the variable (price) which demonstrates the time series to take a variable price trend to rise and then fall, which indicates a lack of stability that should test autocorrelation function to see the power of the link between the variables Prices.

Note: the price Lufthansa (€ 10.24 in 2016-10, € 13.34 in 2015-10).

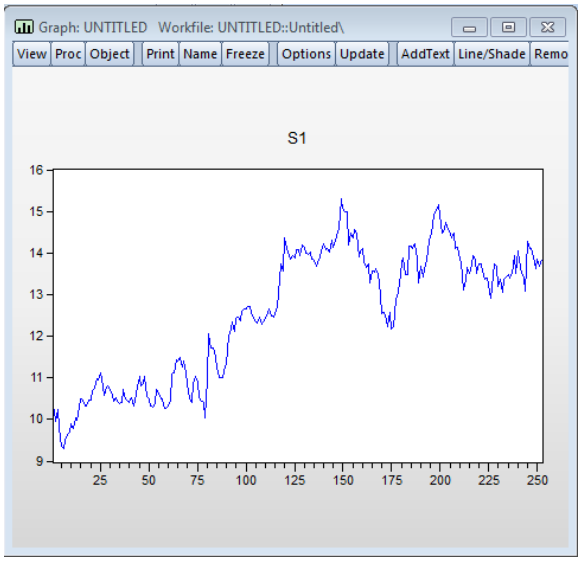
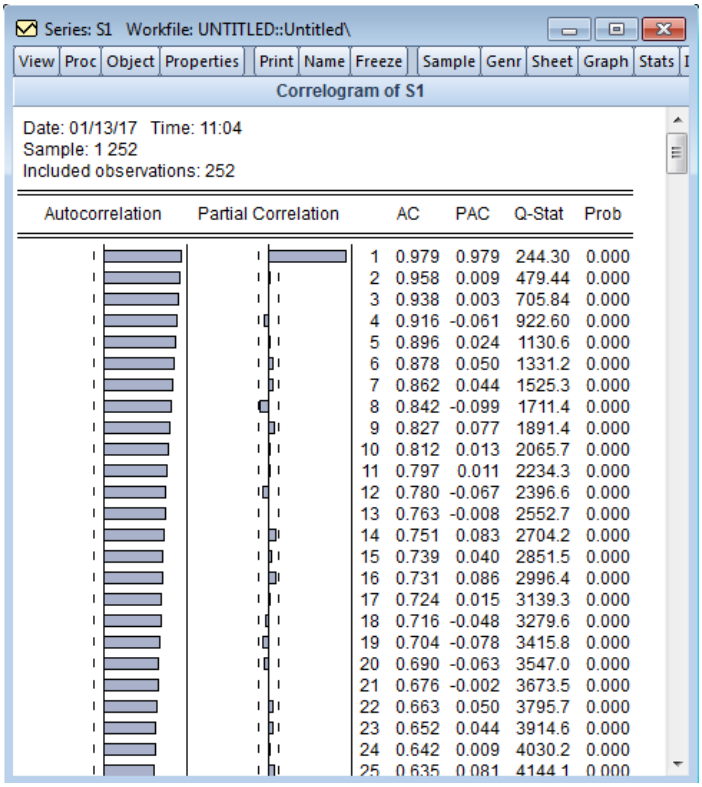



Fig.2. time series of Lufthansa

Table (3) presented autocorrelation for the price Lufthansa listed on stock exchanges, which contains 252 observation( price) for the year 2015_2016, which refers to the price exceeded the limits of confidence and the portability of a test (Q-start) values are below the level of significance which refers to the acceptance of the null hypothesis, which supports the instability of the time series in other words, that the price of Lufthansa wobbling during the probationary period.

Note: The level of significance is 0.05 and table refers to less than 0.05(prob:0.00) which it explains that the price of Lufthansa instability.

Table. 3. autocorrelation share price Lufthansa




| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| | | 1 | 0.979 | 0.979 | 244.30 | 0.000 |
| | | 2 | 0.958 | 0.009 | 479.44 | 0.000 |
| | | 3 | 0.938 | 0.003 | 705.84 | 0.000 |
| | | 4 | 0.916 | -0.061 | 922.60 | 0.000 |
| | | 5 | 0.896 | 0.024 | 1130.6 | 0.000 |
| | | 6 | 0.878 | 0.050 | 1331.2 | 0.000 |
| | | 7 | 0.862 | 0.044 | 1525.3 | 0.000 |
| | | 8 | 0.842 | -0.099 | 1711.4 | 0.000 |
| | | 9 | 0.827 | 0.077 | 1891.4 | 0.000 |
| | | 10 | 0.812 | 0.013 | 2065.7 | 0.000 |
| | | 11 | 0.797 | 0.011 | 2234.3 | 0.000 |
| | | 12 | 0.780 | -0.067 | 2396.6 | 0.000 |
| | | 13 | 0.763 | -0.008 | 2552.7 | 0.000 |
| | | 14 | 0.751 | 0.083 | 2704.2 | 0.000 |
| | | 15 | 0.739 | 0.040 | 2851.5 | 0.000 |
| | | 16 | 0.731 | 0.086 | 2996.4 | 0.000 |
| | | 17 | 0.724 | 0.015 | 3139.3 | 0.000 |
| | | 18 | 0.716 | -0.048 | 3279.6 | 0.000 |
| | | 19 | 0.704 | -0.078 | 3415.8 | 0.000 |
| | | 20 | 0.690 | -0.063 | 3547.0 | 0.000 |
| | | 21 | 0.676 | -0.002 | 3673.5 | 0.000 |
| | | 22 | 0.663 | 0.050 | 3795.7 | 0.000 |
| | | 23 | 0.652 | 0.044 | 3914.6 | 0.000 |
| | | 24 | 0.642 | 0.009 | 4030.2 | 0.000 |
| | | 25 | 0.635 | 0.081 | 4144.1 | 0.000 |

In this study, we do more exam to ensure that the series time of Lufthansa(price list) stable or not, because we cannot predict the prices list for the future when the time series is not stable, so we test the unit root by Dickey - Fuller expanded Augmented statistic technology . The result from Dickey test results - Fuller expanded in (4) that the potential value of the test has been reached (0.8442) which is greater than the level of significance Significant level (0.05) this means accepting the null hypothesis that the series contains a unit root, this means that the series is unstable, for that the analysis of time series (price) requires should be stable.

**Table. 4. unit root Dickey - Fuller expanded Augmented of price Lufthansa**

Series: S1 Workfile: UNTITLED::Untitled\

View | Proc | Object | Properties | Print | Name | Freeze | Sample | Genr | Sheet | Graph | Stats

Augmented Dickey-Fuller Unit Root Test on S1

Null Hypothesis: S1 has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | 0.594396 | 0.8442 |
| Test critical values: | 1% level | -2.574208 | |
| | 5% level | -1.942094 | |
| | 10% level | -1.615856 | |

*MacKinnon (1996) one-sided p-values.

The next test, we use the model of Dickey - Fuller Expanded Augment to demonstrate the stability of the series time or not. In table(5) Notes of the test results from Dickey - Fuller expanded that probability value for testing the (0.000) is less than the level of significance (0.05) and this means rejecting the null hypothesis that the series has the root of any unit that is stable series that lead to use forecast model by Box-Genkinz methodology .

**Table.(5) Dickey - Fuller expanded Augmented of Lufthansa**

Series: S2 Workfile: UNTITLED::Untitled\

View | Proc | Object | Properties | Print | Name | Freeze | Default | Sort | Edit+/- | Smpl+

S2

Last updated: 01/13/17 - 11:22
Modified: 1 252 // s2=d(s1)

| | |
|---|---|
| 1 | NA |
| 2 | -0.300000 |
| 3 | 0.300000 |
| 4 | -0.430000 |
| 5 | -0.460000 |
| 6 | -0.050000 |
| 7 | 0.200000 |
| 8 | 0.140000 |
| 9 | 0.060000 |
| 10 | 0.210000 |
| 11 | -0.130000 |
| 12 | 0.270000 |
| 13 | -0.080000 |
| 14 | 0.320000 |
| 15 | 0.200000 |
| 16 | -0.030000 |
| 17 | -0.140000 |
| 18 | 0.010000 |
| 19 | 0.140000 |
| 20 | -0.010000 |
| 21 | 0.220000 |
| 22 | 0.070000 |
| 23 | 0.220000 |
| 24 | |

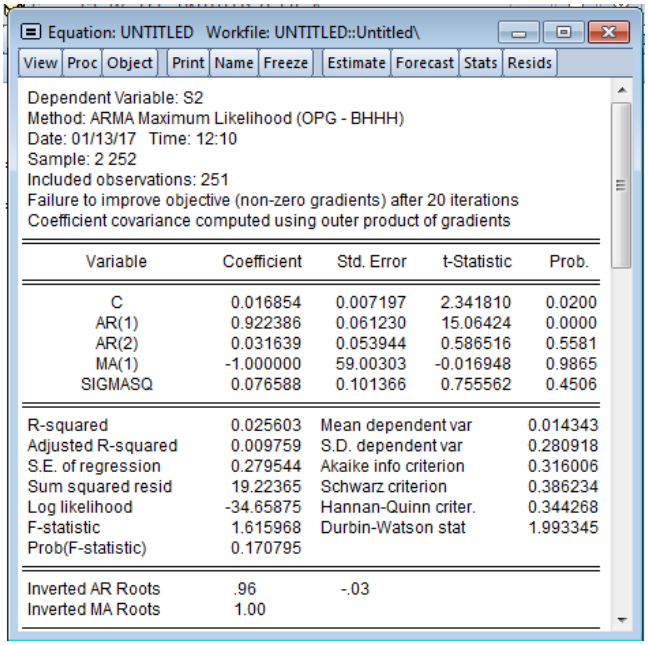
The determination of this test is to apply the Box-Jenkins methodology to ARIMA template and define the reasons why in practical check the price list of Lufthansa is found that the post-sample forecasting the accuracy of such typical is The main problem is the way of making the series stationary in its mean. If substitute methods are utilized to remove and extrapolate the tendency in the data, ARMA methodology beat the typical picked through Box-Jenkins style and presented that using ARMA methodology adjusted data of Lufthansa share price improves post-sample precision while simplifying the use of ARMA models, that conversions progress post-sample estimating accuracy, mainly for long predicting.

**Table.6. type model ARIMA of Lufthansa's price**

| Type Model | Akaike criterion | Schwarz criterion |
|---|---|---|
| ARIMA(1,1,1) | 0.323 | 0.3796 |
| ARIMA(1,1,2) | 0.3314 | 0.402 |
| ARIMA(2,1,1) | 0.136 | 0.386 |
| ARIMA(2,1,2) | 0.309 | 0.393 |
| ARIMA(1,1,0) | 0.316 | 0.358 |
| ARIMA(0,1,1) | 0.316 | 0.358 |

Table (6)presented the results that best model is the ARIMA (2,1,1) containing less Akaike criterion and Schwarz criterion values where the estimated model, in table(7)Findings estimate that the explanatory power of the model is estimated have reached (0.25) and that the marginal propensity to self-regression model moral value due to the fact that the potential value of the test is less than (0.05).

**Table .7. method ARMA Max of Lufthansa's price**


Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: S2
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 01/13/17 Time: 12:10
Sample: 2 252
Included observations: 251
Failure to improve objective (non-zero gradients) after 20 iterations
Coefficient covariance computed using outer product of gradients

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.016854 | 0.007197 | 2.341810 | 0.0200 |
| AR(1) | 0.922386 | 0.061230 | 15.06424 | 0.0000 |
| AR(2) | 0.031639 | 0.053944 | 0.586516 | 0.5581 |
| MA(1) | -1.000000 | 59.00303 | -0.016948 | 0.9865 |
| SIGMASQ | 0.076588 | 0.101366 | 0.755562 | 0.4506 |

| | | | |
|---|---|---|---|
| R-squared | 0.025603 | Mean dependent var | 0.014343 |
| Adjusted R-squared | 0.009759 | S.D. dependent var | 0.280918 |
| S.E. of regression | 0.279544 | Akaike info criterion | 0.316006 |
| Sum squared resid | 19.22365 | Schwarz criterion | 0.386234 |
| Log likelihood | -34.65875 | Hannan-Quinn criter. | 0.344268 |
| F-statistic | 1.615968 | Durbin-Watson stat | 1.993345 |
| Prob(F-statistic) | 0.170795 | | |

| | | |
|---|---|---|
| Inverted AR Roots | .96 | -.03 |
| Inverted MA Roots | 1.00 | |

Finally, we test Box-Jenkins methodology by the unit circle to make sure that the model ARIMA (2,1,1) appropriate in Fig .3 we note that the value inverse roots of share price Lufthansa airline estimated model is located inside the unit circle, and this shows that the model adequately. So you will use this model to predict.

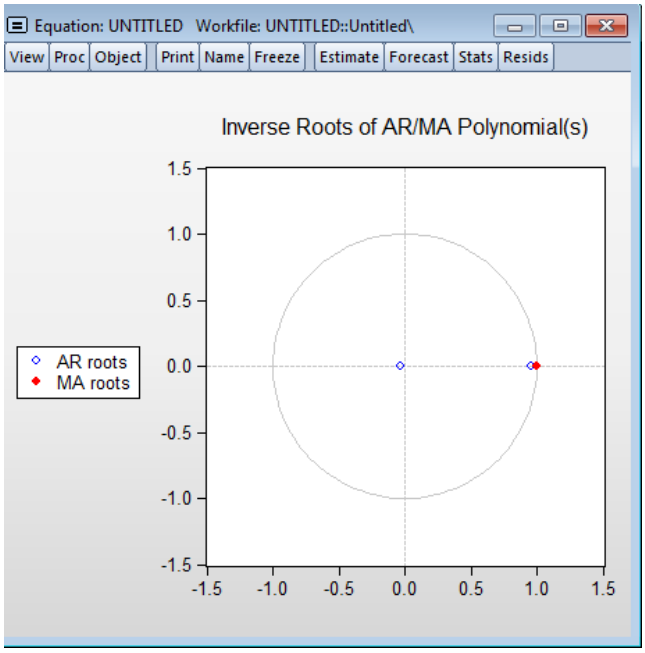



Fig. 3. inverse roots of share price Lufthansa

Table.8 shows the price of Lufthansa prediction for the next three years (2018,2019,2020) by Eviews software by applying Box-Jenkins methodology.

**Table.9. Average share price of Lufthansa in next three years**

| Date | Average share price of Lufthansa |
|---|---|
| from 2018.1.1 to 2018.6.1 | Around 16.44 € |
| from 2018.6.2 to 2018.12.31 | Around 16.34 € |
| from 2019.1.1 to 2019.6.1 | Around 17.23 € |
| from2019.6.2 to 2019.12.31 | Around 17.11 € |
| from 2020 .1.1 to 2020.6.1 | Around 17.21 € |
| from 2020.6.2 to 2020.12.31 | Around 17.56 € |

Note: Was obtained 400 observations share price Lufthansa represent for three years has been taking the average price for each six months at a shortcut.

Fig. (4) presented blue curved display the true values for the price of Lufthansa, red color indicates the probability values price of this airline company. The predictive value for the price of Lufthansa parallel with the true values that the convergence of parallel real values with the values and confirm this results by the finding as follows: Root Mean Squared

Error 0.88,Mean Absolute Error 0.70, Theil Inequality Coefficient 0.03,Bias Proportion 0.06,Varince Proportion 0.16,Covariance Proportion 0.77. The statistical probability that the results have been accessed by software E-views indicate values without number one which shows the convergence and accuracy to predict with real values Lufthansa.

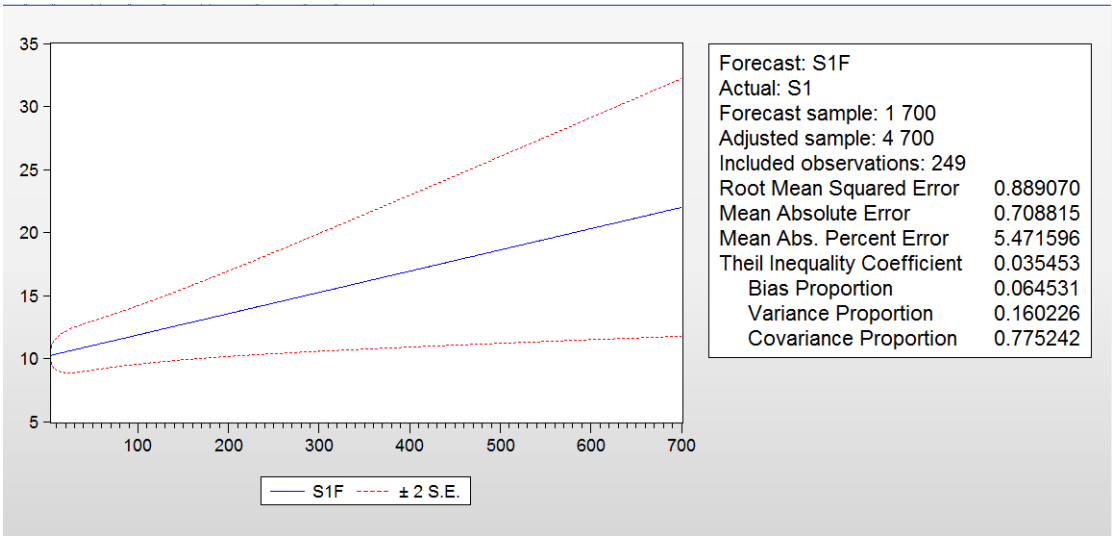



**Fig.4 true value share price of Lufthansa**

**4. CONCLUSIONS**

This research provides a valuation model and predicts using Eviews software by applying the Box- Jenkins methodology to Lufthansa airline to help aviation risk management to help Aviation Risk Management a provide a vision of the reality of shares prices of Lufthansa in future strategy. When tendency in the database(share price) is recognized and extrapolated using the identical procedure as in other approaches that have been found to be further precise in observed studies than ARMA methodology models accomplish steadily better than the typical choice through the Box-Jenkins model, it was finding that using adjusted database increases post-sample reliability in a small but compatible method, that log and power transformations also contributed to small amelioration in post-sample reliability, accuracies and more declared for extended predicting. we used ARMA methodology the typical picked through Box-Jenkins style and presented that using ARMA method adjusted data of Lufthansa share price develops post-sample precision however simplifying the use of ARMA style presented the results that the best model is the ARIMA (2,1,1) containing less Akaike criterion and Schwarz criterion values where the estimated model, reached (0.25). Finally, the prediction by Eviews software depends on the time series for the share price of Lufthansa but it must hedge against changes that occur only internal and external environment. For example, financial crisis, aviation accidents, economic activity and political variables on this basis should the aviation risk management took the precaution of these factors that affect the performance of Lufthansa in order to maintain the company's share price in the stock market and strengthen it.

**References**

1- Air Transport Association (2015). Economic Report.

2- Civil Aviation Authority (2006). No-frills carriers: evolution? A study by the Civil Aviation Authority.

3- Carter, D. A., & Simkins, B. J. (2004). The market's reaction to unexpected, catastrophic events: The case of airline stock returns and the September 11th attacks.
4- Morrell, P., & Swan, W. (2006). Airline jet fuel hedging: Theory and practice. Transport Reviews, 14(5), 615–625.
5- Adams, Z., & Gerner, M. (2012). Cross hedging jet-fuel . Energy Economics, 32(4), 1299–1277.
6- Bodnar, Hayt, & Marston, R. C. (1996). 1995 Wharton survey of derivatives usage by US non-financial company. 24, 120–133.
7- Cobs, R., & Wolf, A. (2004). Jet fuel hedging strategies: Options available for aircraft and a survey: Working paper. (Finance 345).
8- Sturm, R. (2009). selective hedging add value to airlines? The case of crude oil futures. International Review of Applied Financial and Economics, 140–145.
9- Jorion, P. (1990). The risk exchange-rate of U.S. multinationals. Journal of finance Management, 222–230.

Correspondence: Qussay A.B Al Nuaimi, College of Administration and Economics, University of Diyala, Iraq
Email: qussay.ab2013@yahoo.com
Email: Qussay@ecomang.uodiyala.edu.iq