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Forecasting Stock Index Movement Direction by Using Individual Forecasting Methods and Combining Forecasting Method

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Abstract

A better forecasting accuracy helps the investors and managers to provide relevant and reliable information about present and future events in stock market. Important decisions can be given confidently by managers if forecasting provides information about the potential future events and their consequences for possible stock market movements. A better forecasting method reduces the level of uncertainty for the investors and managers. The index movement direction is forecasted by using eight time series forecasting and naïve model and combination of these models which are more than five hundred. The data is taken as Istanbul Stock Exchange National 100 index between the period of 2006 and 2012.

Keywords: combining forecasting method, index movement direction, Istanbul Stock Exchange National 100 Index, naïve model, time series forecasting
JEL: C13, C58

Introduction

Forecasting is the process that helping management in risk and uncertainty for the statements which have not yet been observed. Forecasting is widely used in finance, business, and economics. Forecasting is also very important for stock markets since it defines the amount of the profit. The literature is about forecasting stock prices and stock market indices very huge. The stock price value or stock market index values are the objectives of the study in researches. Despite the plenty of these kinds of studies exist in the field, forecasting stock index movement is not considered and there are not many researches to make forecast for direction of the stock price or stock index. The literature for the big market such as US contains studies that focus index movement direction. Lunga and Marwala (2006) implemented forecasting model to make forecast for the daily movement direction of Dow Jones. However for the case of daily Istanbul Stock Exchange National Index, it is observed that there is a quite difference situation. Smith and Ryoo (2003), Yumlu, Gurgen, and Okay (2004), Tursoy, Gunsel, and Rjoub (2008), Asarkaya (2010) all focused on the predictability of the index or stock price value.

Traded annual value of Istanbul Stock Exchange was 6 US $ billion in 1990 and it reached the value of 300 US $ billion in 2010. The success of Istanbul Stock Exchange increases the importance of the forecasting techniques that produce more accurate forecasts. The objective of this study to evaluate the performance of the individual forecasting models and the combination of these models to forecast stock index movement direction as a case study of daily Istanbul Stock Exchange National 100 index during the period of 2006 and 2012. Forecasting the direction of the index or stock price for the next day is very important especially for speculators and investors who want to get profit from even very small changes in prices or in index.

Methodology

Data and Sample Size

Sample size is 6-years daily data for ISE100 index values between the period of 2006 and 2012 in this study. Data is taken from tr.investing.com which is founded in 2007 and is definitive source for tools and information relating to the financial markets.

The sample size adjustment formula (Mitchell et al., 1996) for time series analysis is done by using the following formula:

$\overline{S}=S\frac{(1-\rho_1)}{(1+\rho_1)}$ where $\overline{S}$ is the adjusted sample size, S is the sample size, and ρ_1 is the first-order autocorrelation coefficient.

ρ_1 is calculated by using error terms ε_t.

$\varepsilon_t = c + \rho_1 \varepsilon_{t-1}$.

ρ_1 can also be estimated by this equation:

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$\rho_1 = 1 - d/2$ where d is the Durbin-Watson statistics. The Durbin-Watson statistics will be given in the forecasting models.

Individual forecasting models and their combinations

Eight different time series models and Naïve model are chosen to perform to make forecast ISE100 index. These models are ARIMA(1,1,1), ARIMA(0,1,1), ARIMA(1,1,0), GARCH(1,1), EGARCH(1,1), GARCH(var)(1,1), GARCH(std)(1,1), GARCH(log(var))(1,1), and Naïve model.

Table 1
The Time Series Forecasting Models and Their Durbin-Watson Statistics

Model Name	Durbin-Watson Statistics
ARIMA(1,1,1)	1.964748
ARIMA(0,1,1)	1.964748
ARIMA(1,1,0)	2.000145
GARCH(1,1)	1.949605
EGARCH(1,1)	1.951457
GARCH(var)(1,1)	1.954859
GARCH(std)(1,1)	1.955194
GARCH(log(var))(1,1)	1.955323

Since Durbin-Watson statistics is very close to two then it implies that sample size is effective sample size for the forecasting models.

F1, F2,…,Fn are separate forecasting methods and F1,i denotes a vector of time series forecasts up to time t for $F1,i,F2,i,\ldots,Fn,i$ respectively where i=1,2,…t. Combining forecasting (CF) formed by simple mean is shown mathematically as follow:

$$CF = \frac{\mathrm{F1,i,+F2,i+\ldots+Fn,i}}{n}$$

Combinations of the models with containing 2, 3, 4, 5, 6, 7, 8 and 9 models are formed. . The number of the combinations that formed from individual forecasting method is more than five hundred. The performance of combinations of the models to forecast stock index movement direction is calculated by evaluating the simple mean of the models that formed by using 2, 3, 4, 5, 6, 7, 8 and 9 models.

Evaluation of the Performance of the Models to Forecast Stock Index Movement Direction

Performance of the separate and combined models is going to be evaluated to make forecast for index movement direction in this study. The following method is used to make forecast direction:

At: Actual value of the index at time t.

At-1: Actual value of the index at time t-1.

Ft: Forecast value of the index at time t.

Ft-1: Forecast value of the index at time t-1.

The “IF” function in the Excel program is used by the following way:

IF((At- At-1)(Ft- Ft-1)>0;1;0)

The test is going to be applied for the following models; ARIMA(1,1,1), ARIMA(1,1,0), ARIMA(0,1,1), GARCH(1,1), GARCH-std(1,1), GARCH-var(1,1), GARCH-log(var)(1,1), EGARCH(1,1), Naïve, and the combined models that perform the best results.

Findings

Testing for Stationary

The graph of ISE National 100 index between the period of 2006 and 2012 is given. As it can be seen from the graph, ISE National 100 index follows a random path therefore it seems it is non stationary like many other financial time series. ADF test is used to state whether it is stationary or not.

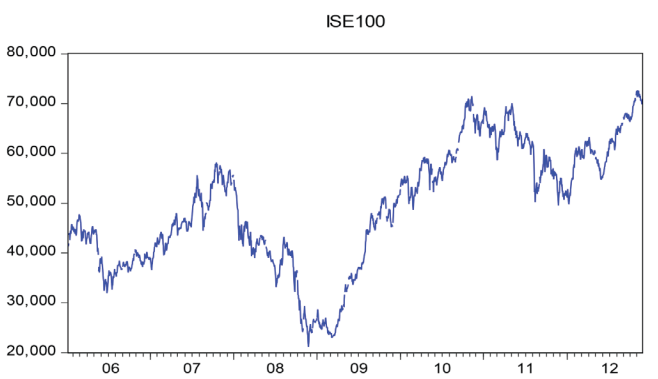

Figure 1
The graph of ISE National 100 index between the period of 2006 and 2012.

ADF test which is a version of the Dickey-Fuller test (DF) can be applied for larger and more complicated time series.

Table 2
ADF Test for ISE100

Null Hypothesis: ISE100 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.935650	0.7772
Test critical values:	1% level	-3.433920	
	5% level	-2.863004	
	10% level	-2.567597	

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ADF test results indicate that ISE100 is a non stationary time series; it means that it follows a random path. Differencing is a process used to make the series stationary. The new series graph dISE100 which is equal to ISE100t-ISE100t-1 is given.

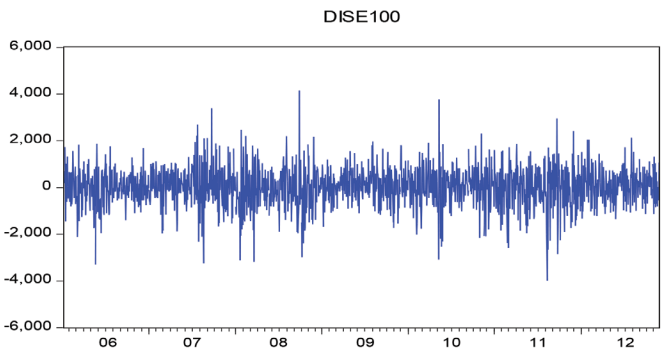

Figure 2. *The graph of dISE100.*

ADF test results also indicate that dISE100 is a stationary time series. Therefore dISE100 is integrated of order 1 I(1).

Forecasting models were applied to make forecast the daily change in stock index. The direction for the next day can be upward or downward therefore if it is predicted randomly the chance for guessing the direction of the movement is 50%. The selected models are used to forecast the direction and the results are reported in table below.

Table 3

Probability of Forecasting Stock Index Movement Direction

Model	Probability
ARIMA(1,1,1)	51.4%
ARIMA(1,1,0)	51.1%
ARIMA(0,1,1)	51.1%
GARCH(1,1)	51.1%
EGARCH(1,1)	51.5%
GARCH-std(1,1)	51.0%
GARCH-var(1,1)	51.1%
GARCH-log(var)(1,1)	51.0%
Naïve	51.1%

The results showed that there is no significant difference among the models with respect their performance of forecasting stock index movement direction. The results also indicated that the models are not successful for forecasting direction since the chance of randomly guessing direction is 50%.

Table 4

Probability of Forecasting Stock Index Movement Direction

No. of models	No. of combinations	Average performance of the model
2	36	%51
3	84	%51
4	126	%51
5	126	%51
6	84	%51
7	36	%51
8	9	%51
9	1	%51

This result shows that combining forecasting method fails in gaining accuracy in the direction of the index movement like all other individual forecasting methods.

Conclusion

The forecasting models mostly have been used to forecast the stock price or stock market index value. The researcher used the individual forecasting methods and their combinations to forecast the direction of the index movement. The study evaluated the probability of the next day index would upper or lower than previous index value. The results showed that all individual forecasting methods that used in this study and their combinations-more than five hundred- performed very poor accuracy. These results indicated that although combining forecasting method produces gains in accuracy for forecasting stock price or stock market index value, it fails gaining in accuracy for forecasting index movement direction.

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