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Forecasting the Stock Price by using Holt's Method

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Abstract

This study proposed to develop a stock indicator that can forecast the value of a share by considering the daily closing price or opening price with the different **parameter of Holt's method**. Most of the indicator which is existing in most of the stock market which forecasted value is based on a long period forecast. But, **Holt's method will be easy to analyze the price of an individual company with maximum accuracy for short period forecasting**. The daily data, the closing price of the different company, are collected from the Dhaka Stock Exchange (DSE) for the period of 2016. The variables: level, trend, forecast as well as smoothing constant (α , β) are used for quick reaction to systematic changes in the time series. By using Holt's method, a buyer can predict, how much of a share price will be the next day. The research finds that Holt's method forecasting is better for short time then long time as evidence shows that the fourth day predicted value is closer to the actual value. In addition, the analysis discovers that for prediction the forecast value, the fifteen and seven days' data of any company are more accurate than 30 days' data. This study notices that different smoothing constant is the big factor for forecasting and suggests to use smoothing constant $\alpha = 0.5$, $\beta = 0.1$.

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1. Introduction

The stock market is always one of the most popular investments due to its high profit. The ability to predict the stock price to meet the fundamental needs of investors and market makers for gaining more financial benefits is an important subject (Abraham & Ledolter, 1986). This issue has attracted lots of audiences among the economic societies. Stock markets are influenced by many factors and this feature has created a highly unreliability in this field. Price changes is a small index of the whole market data, as financial markets are always tied with social events, by only considering price schemes we cannot reach a suitable prediction in the stock price (Box et al., 2015).

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Today, investment by purchasing stock-share constitutes the greater part of economic exchange of countries and a considerable amount of capital is exchanged through the stock markets in the whole world (Brockwell & Davis, 2016). But one of the most important problems is finding efficient ways to summarize and visualize the stock market data to individual or institutions useful information about the share price for investment decision. A stock market plays as a strong role in the industrialization and economic development of the country (Gardner, 1985). Among the developing countries, the contribution of the capital market has lately been recognized. The capital market in Bangladesh, Dhaka Stock Exchange (DSE) market is still at a developing stage. Majority of the investors of this market always try to find secret method to choose the stocks. But in reality, there are no secrets to choose good common stocks. The winning techniques are tried and true (Chatfield & Yar, 1991; Gardner, 1985), **but it's how the investors assemble and apply them that make the difference.** Information is the key (Makridakis et al., 1997). **Having the "right information about a company" and "knowing how to interpret trend line" are more important** than any of the other factors. Information is even more important than timing. When the investors find a company **that looks promising, they don't have to buy stock of that company today or even this week** (Chatfield & Yar, 1991). Good stocks tend to stay good (Wu, 1983), so they can take the time to investigate before they invest. Perhaps the smartest way to succeed in the **stock market is to invest for both growth and value.** Holt's method is very strong method to predict the future value of stock (Akaike, 1969).

There are many model for long term prediction such as Neural Network, Artificial Neural Network and Fuzzy Inference System (Chatfield, 1996; Eyden, 1996). Form the best of knowledge, there is no such model to predict with short term data. Therefore, this prediction **Holt's model with fixed parameter will be a new idea in prediction analysis.**

2. Methods

Before the last few decades people traded stocks and commodities primarily on intuition. As the level of investing and trading grew, people searched for tools and methods that would increase their gains while minimizing their risk. Statistics, technical analysis, fundamental analysis, and linear regression are all used to predict and benefit **from the market's direction** (Chatfield, 1996). None of these techniques has proven to be the consistently correct prediction tool that is desired, and many analysts argue about the usefulness of many of the approaches (Akaike, 1969).

Holt extended simple exponential smoothing to allow forecasting of data with a trend (Gardner, 1985). This method involves a forecast equation and two smoothing equations (one for the level and one for the trend):

<i>Forecast equation</i>	$F_{t,k} = L_t + k T_t$
<i>Level equation</i>	$L_t = \alpha X_t + (1 - \alpha)(L_{t-1} + T_{t-1})$
<i>Trend equation</i>	$T_t = \beta(L_t - L_{t-1}) + (1 - \beta)L_{t-1}$

where L_t denotes an estimate of the level of the series at time t , T_t denotes an estimate of the trend (slope) of the series at time t , α ($0 \leq \alpha \leq 1$) is the smoothing parameter for the level and β ($0 \leq \beta \leq 1$) is the smoothing parameter for the trend. X_t is an estimate of the period t base level from the current period. $(L_{t-1} + T_{t-1})$ is an estimate of the period t base level based on previous data. To compute T_t , a weighted average of the following two quantities are taken (Tong, 1983): 1) An estimate of trend from the current period given by the increase in the smoothed trend from period $(t-1)$ to period t . 2) T_{t-1} , which is the previous estimate of the trend.

To initialize Holt's method, an initial estimate (call it L_0) of the level and an initial estimate (call it T_0) of the trend are needed. Here, T_0 equals to the average increase in the time series during the previous year and L_0 equals to last observation (Akaike, 1978; Anderson, 1994).

The main problem in predicting share market is that the share market is a chaos system. There are many indicators that could affect the share market directly or indirectly. There are no significant relations between the indicators and the price. There are no hard and fix rules of predicting the share price using daily or monthly data or yearly data. However, this study utilized daily data. The rationale behind choosing daily data is to get balance data. Data are collected from the DSE website.

3. Results and Discussion

In Table 1, the closing price of stock of BRAC Bank as well as its forecast values are shown. First column of the table shows date and second column shows closing price and seventh column shows forecast price. Here, smoothing constant $\alpha = 0.7$, $\beta = 0.1$ and initial level $L = 64.5$, initial trend $T = 0.1517$. From the Table 1, it is seen that forecast value after day one for day 2 is 61.29862 but actual value is 60.4. Similarly, it is seen that forecast value after day one for day 4 is 60.96 (Column 8) but actual value is 60. Forecast values are close to actual value. But the forecast value after day one for day 30 is 54.23 which vary more from actual value 64.5.

In the DSE market, it needs three days to mature a share. Buyer cannot sell that share within that day. In this case buyer can use this indicator. From the Figure 1, it is seen that when trend is linear forecast value is very close to actual value. It is also seen that after four to five days actual value and forecast value intersects that means after four to five days forecast are accurate. When forecast value is below the actual value in this situation buyer can decide to buy a share. This is very useful for short term forecasting when trend is increasing.

The data of 15 days closing stock price of BRAC bank with its forecast value are given in Table 2. Here smoothing constant $\alpha = 0.5$, $\beta = 0.1$ and initial level $L_0 = 65.7$, initial trend $T_0 = 0.413$. From the Table 2, it is seen that forecast value after day one for day 2 is 63.32 but actual value is 61. The forecast value after day one for day 7 is 65.06 which is close to actual value 65.1. The forecast value after day one for day 14 is 64.79 which is vary from actual value 66.3.

Table 1 30 Days Closing Price, Level, Trend and Forecast Value of BRAC Bank

α	0.7						
β	0.1						
L	64.5						
T	0.151724138						
Date	Closing Price	Differences	Level	Trend	K	Forecast	F (t, k)
19-10-2016	60.10	0.3	61.46552	-0.1669	0		
20-10-2016	60.40	-0.5	60.66959	-0.2298	1	61.29862	
23-10-2016	59.90	0.1	60.06194	-0.26759	2	60.43979	
24-10-2016	60.00	0	59.93831	-0.25319	3	59.79435	60.96483
25-10-2016	60.00	0.7	59.90553	-0.23115	4	59.68512	
26-10-2016	60.70	-0.3	60.39232	-0.15935	5	59.67439	
27-10-2016	60.40	-0.2	60.34989	-0.14766	6	60.23296	59.17874
30-10-2016	60.20	-0.3	60.20067	-0.14782	7	60.20223	
31-10-2016	59.90	0.4	59.94585	-0.15852	8	60.05285	
01-11-2016	60.3	0.7	60.1462	-0.12263	9	59.78734	59.9069
02-11-2016	61	2.1	60.70707	-0.05428	10	60.02357	
03-11-2016	63.1	3	62.36584	0.117024	11	60.65279	
06-11-2016	66.1	-0.3	65.01486	0.370223	12	62.48286	
07-11-2016	65.8	-0.8	65.67552	0.399268	13	65.38508	
08-11-2016	65	0.1	65.32244	0.324032	14	66.07479	
09-11-2016	65.1	0.8	65.26394	0.285779	15	65.64647	66.12553
10-11-2016	65.9	1.4	65.79492	0.310299	16	65.54972	
13-11-2016	67.3	-1.3	66.94156	0.393934	17	66.10522	
14-11-2016	66	0	66.40065	0.300449	18	67.3355	
15-11-2016	66	-0.1	66.21033	0.251372	19	66.7011	
16-11-2016	65.9	0.1	66.06851	0.212053	20	66.4617	
17-11-2016	66	0.3	66.08417	0.192414	21	66.28056	
20-11-2016	66.3	-0.6	66.29297	0.194053	22	66.27658	
21-11-2016	65.7	-0.4	65.93611	0.138961	23	66.48703	67.55018
22-11-2016	65.3	0.4	65.53252	0.084706	24	66.07507	
23-11-2016	65.7	0.1	65.67517	0.0905	25	65.61723	
24-11-2016	65.8	-0.3	65.7897	0.092903	26	65.76567	
27-11-2016	65.5	-0.5	65.61478	0.066121	27	65.8826	
28-11-2016	65	-0.5	65.20427	0.018458	28	65.6809	
29-11-2016	64.5		64.71682	-0.03213	29	65.22273	54.23519

Figure 1 30 Days Closing Price and Forecast Value of BRAC Bank

Table 2 15 Days Closing Price, Level, Trend and Forecast Value of BRAC Bank

α	0.5						
β	0.1						
L	65.7						
T	0.413						
Date	Closing Price	Differences	Level	Trend	K	Forecast	F (t, k)
01-11-2016	60.3	0.7	63.2065	0.12235	0		
02-11-2016	61	2.1	62.16443	0.005907	1	63.32885	
03-11-2016	63.1	3	62.63517	0.052391	2	62.17033	
06-11-2016	66.1	-0.3	64.39378	0.223013	3	62.68756	63.57355
07-11-2016	65.8	-0.8	65.2084	0.282173	4	64.61679	
08-11-2016	65	0.1	65.24528	0.257645	5	65.49057	
09-11-2016	65.1	0.8	65.30146	0.237498	6	65.50293	65.06282
10-11-2016	65.9	1.4	65.71948	0.25555	7	65.53896	
13-11-2016	67.3	-1.3	66.63752	0.321799	8	65.97503	66.33709
14-11-2016	66	0	66.47966	0.273833	9	66.95931	
15-11-2016	66	-0.1	66.37675	0.236158	10	66.75349	
16-11-2016	65.9	0.1	66.25645	0.200513	11	66.6129	
17-11-2016	66	0.3	66.22848	0.177665	12	66.45697	
20-11-2016	66.3	-0.6	66.35307	0.172358	13	66.40615	64.79705
21-11-2016	65.7		66.11272	0.131086	14	66.52514

Figure 2 15 Days Closing Price and Forecast Value of BRAC Bank

From the Figure 2, it clear that after three to five days forecast value is close to actual value. At the middle of month market is more stable then beginning of month that means forecasting is more accurate than beginning of a month. This is very useful for short term forecasting when trend is increasing.

Here, the Table 3 of 7 days closing stock price of BRAC bank is given below with its forecast value. Here smoothing constant $\alpha = 0.5$, $\beta = 0.1$ and initial level $L_0 = 65.4$, initial trend $T_0 = 0.85$. From the Table 3, it is seen that forecast value after day one for day 2 is 63.82 but actual value is 65.7. The forecast value after day one for day 5 is 65.48 which is close to actual value. But, the forecast value after day one for day 7 is 66.59 which is vary from actual value 65.4.

Table 3 7 Days Closing Price, Level, Trend and Forecast Value of BRAC Bank

α	0.5						
β	0.1						
L	65.4						
T	0.85						
Date	Closing Price	Differences	Level	Trend	K	Forecast	F (t, k)
01-11-2016	60.3	5.4	63.275	0.5525	0		
23-11-2016	65.7	0.1	65.975	0.76725	1	63.8275	
24-11-2016	65.8	-0.3	66.025	0.695525	2	66.74225	
27-11-2016	65.5	-0.5	65.875	0.610973	3	66.72053	
28-11-2016	65	-0.5	65.625	0.524875	4	66.48597	65.485
29-11-2016	64.5	0.9	65.375	0.447388	5	66.14988	
30-11-2016	65.4		65.825	0.447649	6	65.82239	66.59

Figure 3 7 Days Closing Price and Forecast Value of BRAC Bank

In the Figure 3, the 7 days closing price and forecast value of BRAC bank are shown. From the Figure 3, it is seen that if anyone wants to forecast for day 23 by knowing day 1 price then forecasting value is varying more than actual value. On the other hand, by knowing day 24 if anyone wants to forecast day 30 then forecast value is close to actual value.

Forecast values of Reliance Insurance Limited for 30 days are given in Table 4. The smoothing constant $\alpha = 0.5$, $\beta = 0.1$ and initial level $L_0 = 47$, initial trend $T_0 = 0.062$. From the Table 4, it is seen that forecast value after day one for day 2 is 46.099 but actual value is 45.9. The forecast value after day one for day 17 is 45.17 which is close to actual value 45.3. Moreover, the forecast value after day one for day 30 is 45.22 which is vary from actual value 47.

Forecast values of Reliance Insurance Limited for 15 days are given in Table 5. Here smoothing constant $\alpha = 0.5$, $\beta = 0.1$ and initial level $L_0 = 45.9$, initial trend $T_0 = 0.107$. From the Table 5, it is seen that forecast value after day one for day 2 is 45.23 but actual value is 45. Moreover, forecast value after day one for day 15 is 45.57 which is close to actual value 45.99.

Table 4 30 Days Closing Price, Level, Trend and Forecast Value of Reliance Insurance Limited

α	0.5						
β	0.1						
L	47						
T	0.062						
Date	Closing Price	Differences	Level	trend	K	Forecast	F (t, k)
19-10-2016	45.20	0.7	46.131	-0.0311	0		
20-10-2016	45.90	-0.1	45.99995	-0.0411	1	46.0999	
23-10-2016	45.80	0.1	45.87943	-0.04904	2	45.95886	
24-10-2016	45.90	-1.4	45.86519	-0.04556	3	45.83039	46.0377
25-10-2016	44.50	-0.5	45.15982	-0.11154	4	45.81964	
26-10-2016	44.00	0	44.52414	-0.16395	5	45.04828	
27-10-2016	44.00	1.2	44.18009	-0.18196	6	44.36019	
30-10-2016	45.20	-0.6	44.59907	-0.12187	7	43.99813	
31-10-2016	44.60	-0.2	44.5386	-0.11573	8	44.4772	
01-11-2016	44.4	0.6	44.41143	-0.11687	9	44.42287	
02-11-2016	45	0.2	44.64728	-0.0816	10	44.29456	44.2334585
03-11-2016	45.2	0.4	44.88284	-0.04988	11	44.56568	
06-11-2016	45.6	0.8	45.21648	-0.01153	12	44.83296	
07-11-2016	46.4	-0.1	45.80247	0.04822	13	45.20495	
08-11-2016	46.3	-1.2	46.07535	0.070686	14	45.85069	
09-11-2016	45.1	0.2	45.62302	0.018384	15	46.14603	
10-11-2016	45.3	0.9	45.4707	0.001314	16	45.6414	45.17034901
13-11-2016	46.2	-0.7	45.83601	0.037713	17	45.47201	
14-11-2016	45.5	0	45.68686	0.019027	18	45.87372	
15-11-2016	45.5	0.9	45.60294	0.008733	19	45.70589	
16-11-2016	46.4	-0.2	46.00584	0.048149	20	45.61168	
17-11-2016	46.2	-0.2	46.12699	0.05545	21	46.05399	45.477271
20-11-2016	46	-0.1	46.09122	0.046328	22	46.18244	
21-11-2016	45.9	0.7	46.01877	0.03445	23	46.13755	
22-11-2016	46.6	-0.5	46.32661	0.061789	24	46.05322	
23-11-2016	46.1	1.5	46.2442	0.047369	25	46.3884	
24-11-2016	47.6	-0.3	46.94578	0.11279	26	46.29157	
27-11-2016	47.3	-0.6	47.17929	0.124862	27	47.05858	
28-11-2016	46.7	0.3	47.00207	0.094654	28	47.30415	
29-11-2016	47		47.04836	0.089818	29	47.09673	45.2291

Figure 4 30 Days Closing Price and Forecast Value of Reliance Insurance Limited

Table 5 15 Days Closing Price, Level, Trend and Forecast Value of Reliance Insurance Limited

α	0.5						
β	0.1						
L	45.9						
T	0.107						
Date	Closing Price	Differences	Level	Trend	K	Forecast	F (t, k)
01-11-2016	44.4	0.6	45.2035	0.02665	0		
02-11-2016	45	0.2	45.115075	0.0151425	1	45.23015	
03-11-2016	45.2	0.4	45.17906525	0.0200273	2	45.13022	
06-11-2016	45.6	0.8	45.47972776	0.0480908	3	45.19909	45.28345
07-11-2016	46.4	-0.1	46.13834557	0.1091435	4	45.52782	
08-11-2016	46.3	-1.2	46.28424672	0.1128193	5	46.24749	
09-11-2016	45.1	0.2	45.4891198	0.0220246	6	46.39707	45.624
10-11-2016	45.3	0.9	45.36334333	0.0072445	7	45.51114	
13-11-2016	46.2	-0.7	45.95117636	0.0653034	8	45.37059	
14-11-2016	45.5	0	45.65494392	0.0291498	9	46.01648	
15-11-2016	45.5	0.9	45.55522812	0.0162632	10	45.68409	
16-11-2016	46.4	-0.2	46.15144741	0.0742588	11	45.57149	
17-11-2016	46.2	-0.2	46.20771188	0.0724594	12	46.22571	
20-11-2016	46	-0.1	46.08405139	0.0528474	13	46.28017	
21-11-2016	45.9		45.97106964	0.0362645	14	46.1369	45.5766

Figure 5 15 Days Closing Price and Forecast Value of Reliance Insurance Limited

In Figure 5, it can be seen that after four to five days forecasting values are close to actual value. At the beginning of a month price is more fluctuating than the end of a month.

Forecast values of Reliance Insurance Limited for 7 days are given in Table 6. Here **smoothing constant $\alpha = 0.5$, $\beta=0.1$ and initial level $L_0 = 47.4$, initial trend $T_0 = 0.4285$** . From the Table 6, it is seen that forecast value after day one for day 2 is 46.37 but actual value is 46.1. Again, forecast value after day one for day 7 is 48.21 which is vary from actual value 47.4.

In the Figure 6, it is clear that first forecasting value is coincident to closing price and due to the more distance of forecasting middle forecasting values are fluctuating and due to lowest time gap ending forecasting values are closely related to actual closing prices.

Table 6 7 Days Closing Price, Level, Trend and Forecast Value of Reliance Insurance Limited

α	0.5						
β	0.1						
L	47.4						
T	0.4285						
Date	Closing Price	Differences	Level	Trend	K	Forecast	F (t, k)
01-11-2016	44.40	1.7	46.11425	0.257075	0		
23-11-2016	46.1	1.5	46.23566	0.243509	1	46.37133	
24-11-2016	47.6	-0.3	47.03959	0.29955	2	46.47917	
27-11-2016	47.3	-0.6	47.31957	0.297593	3	47.33914	46.88548
28-11-2016	46.7	0.3	47.15858	0.251735	4	47.61716	
29-11-2016	47	0.4	47.20516	0.23122	5	47.41032	
30-11-2016	47.4		47.41819	0.229401	6	47.43638	48.21235

Figure 6 7 Days Closing Price and Forecast Value of Reliance Insurance Limited

This paper is about stock market which is full of ambiguity and affected by many factors. Therefore, the process of predicting about stock market is one of the important actions in finance and business (Gao, 1997). **By using Holt's method, a buyer can predict**, how much of a share will be. This study notices that different smoothing constant is the big factor for forecasting and suggests to use smoothing constant $\alpha = 0.5$, $\beta = 0.1$.

4. Conclusion

Holt's method is not based on buying a stock one day and selling it the next. It does not depend on our ability to predict the direction of the economy or even the direction of the stock market. It does depend on closing price. The investor can use this method for short term prediction. This study is conscious that this is the sole empirical measure that uses market data of few financial companies' listed in DSE to measure accuracy of predicted value measured by Holt's method. In future study this result also can justified by comparing different forecasting model such as Neural Network.

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