Performance of Technical Analysis

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***Index Terms*—Trend Analysis, Quadratic Trend, Indian Stock markets, Sensex, Technical Analysis.**

***Abstract*—In this report I examine the performance of trend analysis techniques on various indices. It has been a long held belief that random walk model is the best model and anything better than this is impossible. Evidence shows that in the absence of exogenous shocks superior profits can be made in the short run using the quadratic trend analysis.**

I. Introduction

TECHNICAL analysis has long been crticized on the grounds that the markets are efficient and historical prices cannot be used to generate subnormal profits. In this section we examine the performance of some of the simplest techniques and compare them with other techniques to find out how far can technical analysis help the investors. It must be pointed out that techniques such as decomposition, smoothing and decomposition assume that observations in various time periods are statistically independent. This may not always be the case, and it is quite possible that the series is not independent. The ARIMA models infact take care of this dependency better.

Traditional time series decomposition involves analyzing various components of the time series. The time series is decomposed into trend, cyclicality, seasonality and the irregular component. A time series can be additive or multiplicative. In an additive time series, these components are added to make the original time series, whereas in a multiplicative series these components are multiplied to obtain the original time series. A multiplicative component model works best when the variability increases with time. This is indeed the case with the sensex time series. Hence, in this report a multiplicative model is used. A number of technical analysts rely heavily on one of the components of the time series - trend. There are a number of reasons for this choice. For one, this is the easiest component to identify. This component also governs the future movements of the indices in the short-run. Therefore, a lot of analysts are dependend on identifying trends with a hope to make superior profits.

The autocorrelation function is

$$\rho(k) = \frac{Cov(r_t, r_{t+k})}{\sqrt{Var(r_t) * Var(r_{t+k})}} \tag{1}$$

Another rationale for using technical analysis can be seen from the graph below. There seems to be strong autocorrelation in the daily prices of various indices even at lags of upto 200. The autocorrelation functions have been analyzed at 95% confidence level. This is an indication that using the past prices one can infer about future prices.

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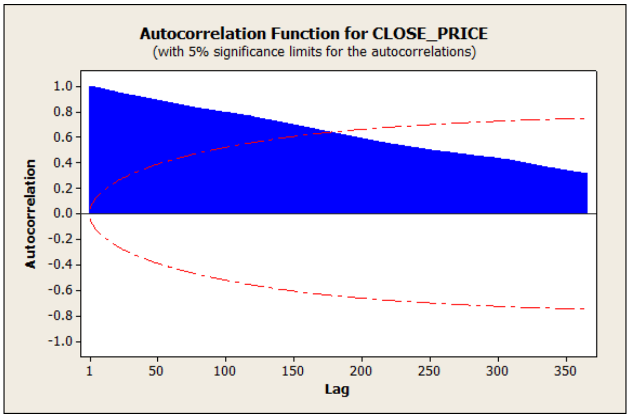

Figure 1. Autocorrelation of close prices of sensex

II. Linear Trend Analysis of Some of the Indices

Linear trend is the simplest kind of trend analysis. Perhaps, it is too simplistic to be able to give the investors any oppurtunity of making superior profits. But its simplicity is its selling point. Linear trend analysis can help uncover the general direction of the time series. When applied over a long period, it can give a sense of the general movements. In the first experiment, I applied linear trend analysis for daily data of sensex during ten years from July 1997 to August 2007. The figure below shows the linear trend analysis for the sensex during this long duration.

The fitted equation is $Y_t = 1300.9 + 4.11 * t$ .As is evident from the graph, the fitted line has lost track of the sensex over the later portions. This would mean that a linear trend analysis is perhaps not a good tool for making investment decisions. The quality of forecasts is expected to be low. On the other hand, linear trend analysis is good tool for exploratory data analysis.

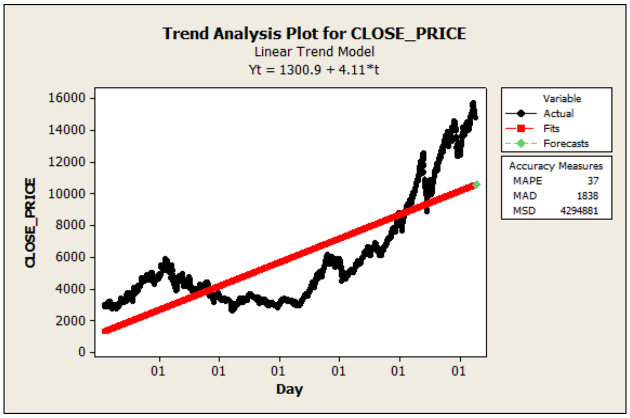

Figure 2. Linear trend analysis of Sensex

One of the simple modifications to improve the performance of the linear trend analysis is to apply the trend on a smaller time period. This discards old data and takes into account only the recent trends. Not only does this help to bring down the confusion but also allows recent trends to have a better effect. In the modification I consider only the data from January 2007 to August 2007. As is evident from the graph, the fit is not excellent, but is nevertheless better than older one. The fitted equation now is $Y_t = 13476.8 + 6.20045 * t$.

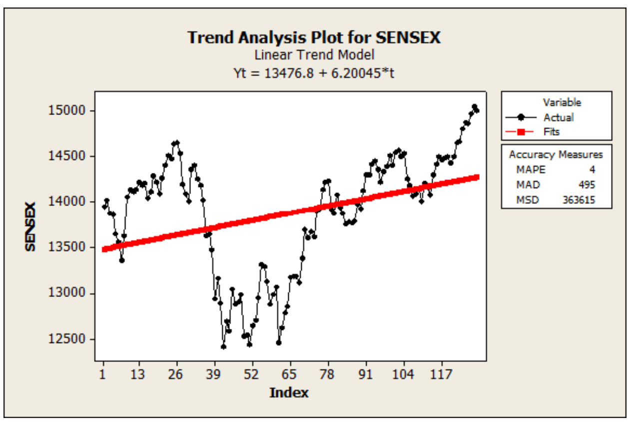

Figure 3. Linear trend analysis for sensex on shorter duration of data

III. Quadratic Trend Analysis of Some of the Indices

Quadratic trend analysis tries to fit in a parabola to the prices. The logic behind trying to do this for sensex is quite simple. The phenomenal increase in the sensex prices over the past sometime indicates that the sensex may be growing at quadratic rate or may be even faster. This intuition is further supported by the failure of linear trend analysis to fully explain and fit the movements of the sensex. Here we try to fit quadratic trend on ten year daily data and over a six month data. The figures below show the fitted equation and a comparison of these two approaches.

A look at the quadratic trends reveals that there seems to be a greater explantory power in these trends as compared with the linear trend analysis. Both these graphs reveal that there is a bigger fit at the last end of the graph. This may mean

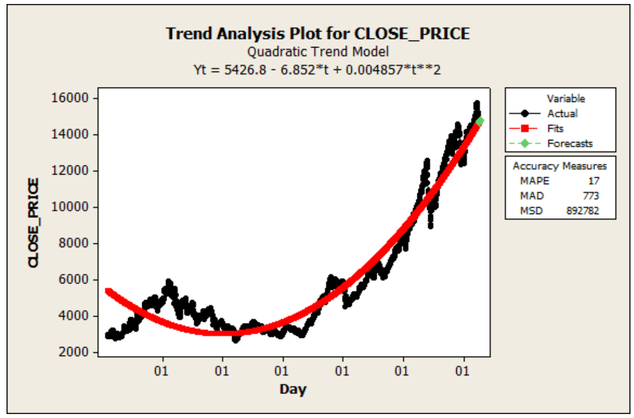

Figure 4. Quadratic trend analysis on ten year daya

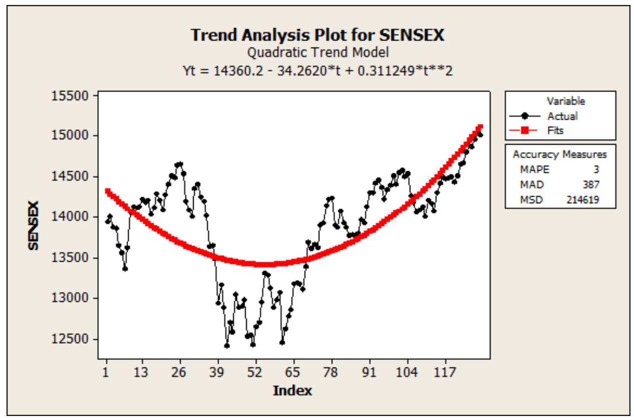

Figure 5. Quadratic trend analysis for a six month data

that by using quadratic trend analysis, superior profits may be gained.

IV. Exponential Trend Analysis of Some of the Indices

Just to take the analysis further, I try to fit in an exponential curve. This is quite logical because the indices have been moving up at an amazing rate. The figures below show the performance exponential fit for a ten year data and six month data.

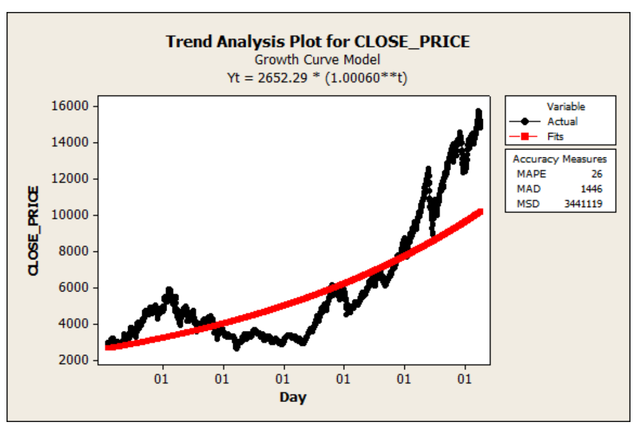

Figure 6. Exponential trend analysis for sensex

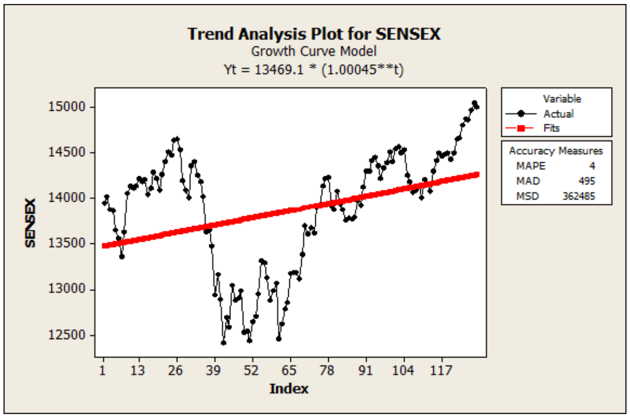

Figure 7. Exponential trend analysis on six month data

The performance of exponential trend analysis fall short of expectations. The fit in the last part of the data is not good. Hence, this technique might not be a good tool for forecasting.

V. Performance of various trends for short term forecasting

In the above sections, I compared the various fitted trend on the ten year and six month sensex data. Here, I compare the performance of each of these techniques with the random walk model. For the purposes of forecasting, I have taken a holdout sample of 24 days, which roughly represents the data for around a month. The holdout sample has intentionally been taken small because trend analysis needs repeated updates and changes in trend should be accounted for in the model as soon as possible. The graph below brings out the performance of various trend analysis and that of random walk.

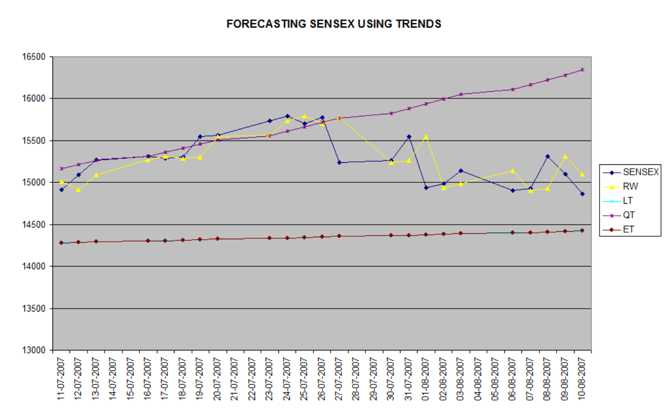

Figure 8. Performance of random walk and various trending techniques on sensex

As expected, the linear and exponential trending techniques perform miserably bad. The quadratic trend on the other hand, is actually quite near the actual values especially in the earlier part. During the latter, the quadratic trend loses all its power indicating the need of repeatedly updating the model. Keeping this in mind, I calculated the error measure of Mean Absoulte deviation for a period of five days into the future. There is a little advantage of doing these calculations for linear and exponential trends because it is now clear that they can only be used for exploratory data analysis and not for forecasting.

Table I
Comparison of performance of Random walk with that of Quadratic Trend Analysis

Technique	MAPE	MSE	MAD
Random Walk	0.69%	15441.6	104
Quadratic Trend	0.61%	16921.23	91.69

It can be seen from the table above that quadratic trend analysis has a better performance than random walk model on at least two of the measures and is slightly bad on the Mean Square error count. It must be pointed here that the performance of quadratic trend was particulary bad on the last day, indicating clearly the need for updating the model. The square error on this particular day was quite high and contributed heavily to increasing the mean square error. It is quite possible that an updated model may have outperformed the random walk model.

VI. Conclusions

Without getting into the debate of efficiencies of the market and efficient market hypothesis, there seems to be a strong indication that quadratic trend analysis can yield superior profits to the investors. The statement is further substantiated by evidences from other stock market indices of India. It must be noted here that once this article is read by a large number of investors the quadratic trends may fail to deliver superior results. Till that time at least, we can do better than random walk by capitalizing on quadratic trends. It must also be borne in mind that the quadratic model needs to be updated quite frequently otherwise random walk model which has the property of closely following the prices will perform better.

Appendix

Since Quadratic trends have shown a better performance, it is worthwhile to compare the performance of this technique on other indices as well. In this section I compare the performance of Quadratic Trend Analysis with the performance of random walk on other indices - Nifty Fifty, BSE 100, CNX Nifty 500 and Nifty Junior. Except for BSE 100, the quadratic trend analysis is a sure winner.

Table II
Comparison of Random walk and Quadratic Trend on Nifty

Technique	MAPE	MSE	MAD
Random Walk	0.71%	1507.98	31.84
Quadratic Trend	0.67%	1414.98	29.64

It can be seen that on Nifty also, Quadratic trend analysis does better than random walk model.

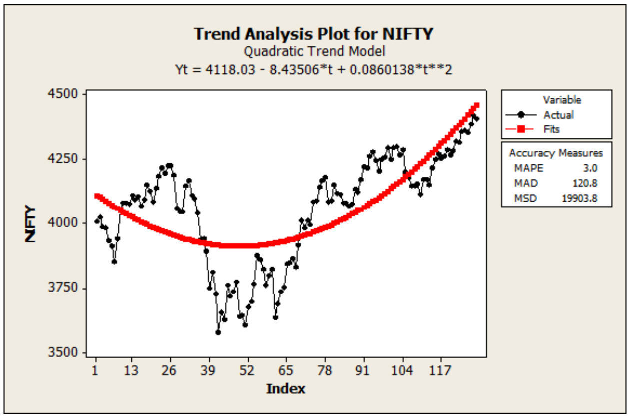

Figure 9. Quadratic trend for Nifty

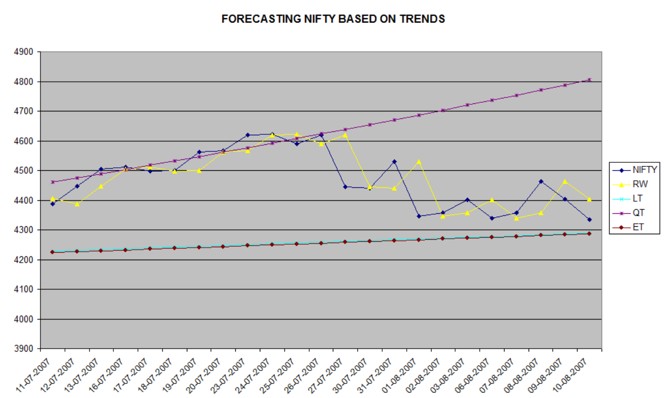

Figure 10. Forecast Comparison on Nifty

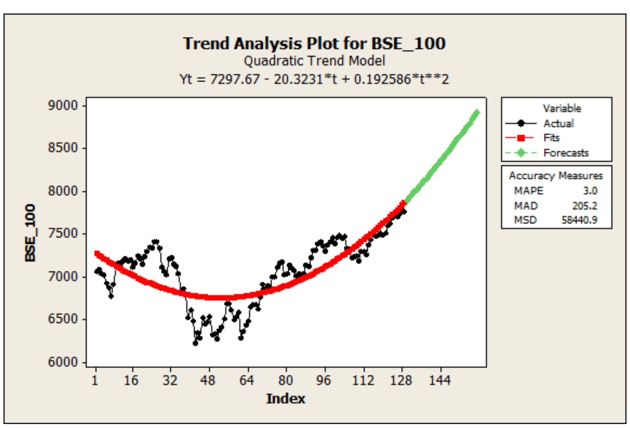

Figure 11. Quadratic Trend Analysis on BSE 100

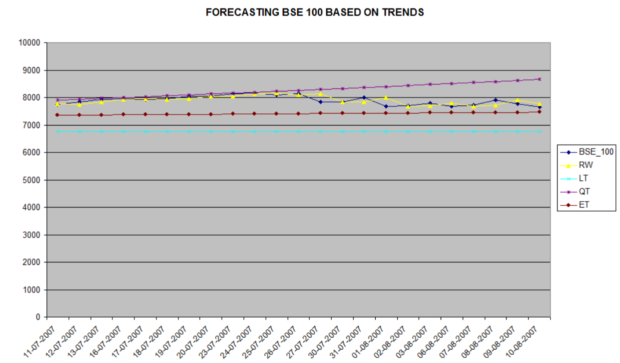

Figure 12. Comparison of forecasts on BSE 100

Table III
COMPARISON OF RANDOM WALK AND QUADRATIC TREND ON BSE 100

Technique	MAPE	MSE	MAD
Random Walk	0.67%	4223.17	53.2
Quadratic Trend	1.07%	9382.3	83.644436

On BSE 100, the quadratic trend analysis does not outperform the random walk model strongly indicating the need to update the model more frequently.

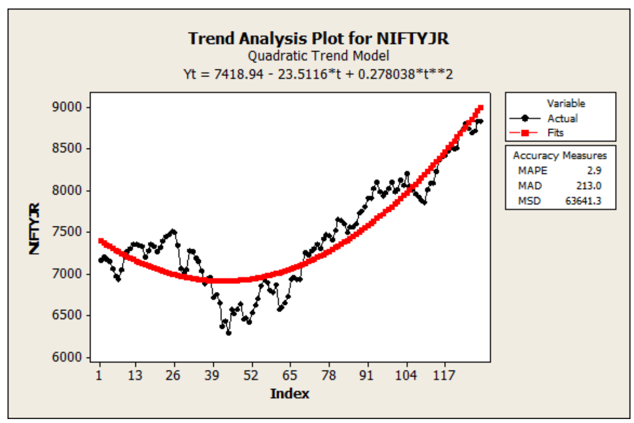

Figure 13. Quadratic Trend of Nifty Junior

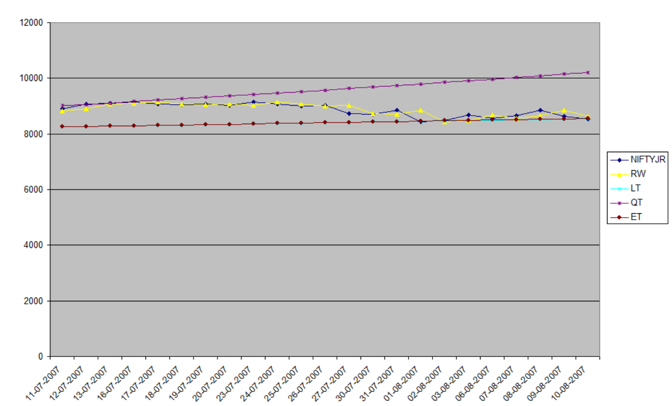

Figure 14. Forecast results on Nifty Junior

Table IV
COMPARISON OF RANDOM WALK AND QUADRATIC TREND ON BSE 100

Technique	MAPE	MSE	MAD
Random Walk	0.83%	8272.00	75
Quadratic Trend	0.63%	5735.39	56.81

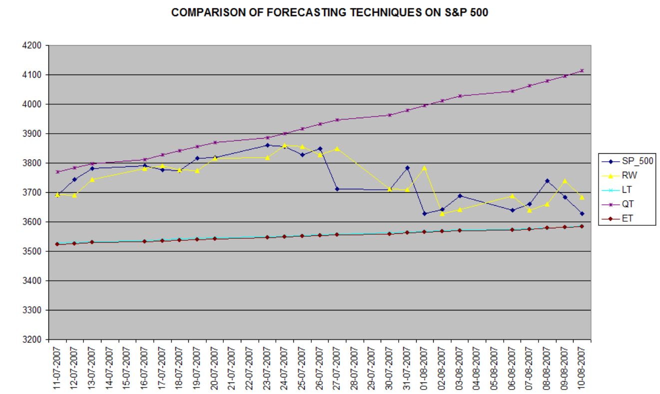

Figure 15. Forecast results for S&P 500

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