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SELECTION OF SUITABLE FORECASTING METHOD FOR STOCK PRICE INDEX DATA

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ABSTRACT: Suitable forecasting method is selected by applying different forecasting models to the Stock Price Index data. The data is collected from Lahore Stock Exchange, and is comprised of daily price index values. Different smoothing methods and ARIMA models have been applied to forecast future values. These models have been compared on the basis of mean square error. The model having minimum mean square error is suggested as the best fitted model.

1. INTRODUCTION

Stock exchange is a market where buying and selling of shares and securities are carried out by Members/Brokers on behalf of their clients. Deals on the stock exchange take place by open offers and bids that reflect the prevailing flow of demand and supply in the market. The stock exchange enables the buyers and the sellers to enter into transaction without the necessity of individual hawking.

There are three stock exchanges in Pakistan

- Karachi Stock Exchange (KSE)
- Lahore Stock Exchange (LSE)
- Islamabad Stock Exchange (ISE)

Index is the most commonly used indicator of the market trend. Index is a sample of the common stock traded in the market and is composed for the purpose of comparison of stock price performance over a period of time. It is particularly designed to provide the investors a tool to judge the trend of the market. Thus, the index can be regarded as similar to other economic activity indicators such as gross national product and consumer price index.

The data we have used here is taken from Lahore Stock Exchange (LSE) and it comprises of the daily price index of the year 1999 and 2000. Data of the year 1999 is taken from the month of March to December. Data of the year 2000 is from January to October. Their graphs are given as:

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Fig 1: Index Values For The Year 1999

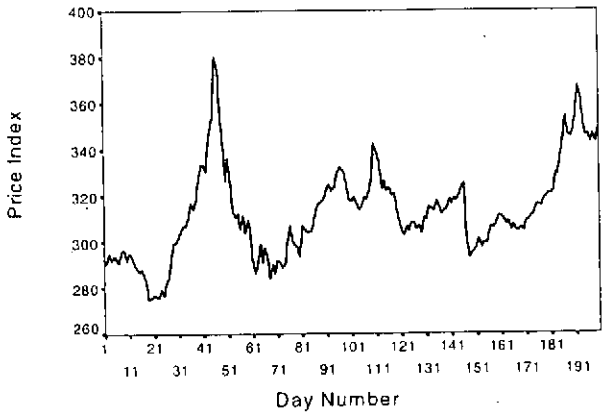
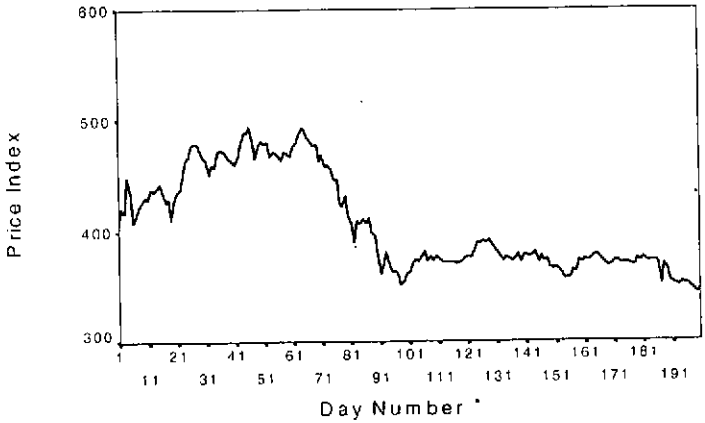


Fig 2: Index Values For The Year 2000



2. METHODOLOGY

Time series or autoregressive forecasting models will, as a result of their dependence on historical data patterns, be most useful when economic conditions can be expected to remain relatively stable.

The reliance of time series models on analysis and extrapolation of historical patterns carries several important implications with respect to technique selection.

Time series models are best applied when the time frame or horizon of interest is immediate or short term in nature.

- Time series models prove most satisfactory when the historical data contain either no systematic data pattern or when the changes are occurring very slowly or consistently.
- Costs of estimating time series models can range from a few cents for models such as a naïve model, to several hundred dollars for exponential smoothing models, to several thousand dollars for multivariate Box-Jenkins models.
- The principal limitation of time series models is their reliance on the assumption that historical data patterns will continue into the future.

The most widely used types of time series models, which are used in this research work, are outlined below:

1. Simple Average (SA)
2. Moving Average (MA)
3. Moving Average with Trend (MAT)
4. Single Exponential Smoothing (SES)
5. Single Exponential Smoothing with Trend (SEST)
6. Double Exponential Smoothing (DES)
7. Double Exponential Smoothing with Trend (DEST)
8. Adaptive Exponential Smoothing (AES)
9. Linear Regression (LR)
10. Holt Winters Additive Model (HWA)
11. Holt Winters Multiplicative Model (HWM)
12. ARIMA Model

3. ANALYSIS

Above mentioned smoothing technique has been used to forecast future values of the data for 10 working days. For analysis purpose we have used Computer packages such as SPSS and QSB. All above-mentioned models are compared on the basis of mean square error. The model having smaller mean square error is suggested to be the best fitted model. So mean square errors of all the models are compared.

Before applying ARIMA models, data are plotted to see whether it is stationary or non-stationary. The graphs showed approximately stationary pattern so we moved towards model fitting. Autocorrelations and partial autocorrelations of both data are plotted for identification of suitable ARIMA model. ARIMA (1,0,0) and ARIMA (1,1,0) are applied and their validities are checked again by plotting autocorrelations and partial autocorrelations of residuals.

Graphs of best-fitted models and actual values are plotted to make comparisons between the selected models. Mean square errors of some selected models are shown in the table for the year 1999

Table 1: Mean Square Errors of The Methods For The Year 1999

Method	MSE	Method	MSE
MA with m=2	45.2579	DEST	39.3319
MA with m=3	59.3247	SA	399.8535
MA with m=4	72.8416	AES	799.0991
MA with m=5	86.1805	LR	311.3399
MAT with m=2	56.9891	HWA with c=3	34.3021
MAT with m=3	49.2321	HWA with c=4	50.7624
MAT with m=4	52.9662	HWA with c=5	67.2903
MAT with m=5	57.6349	HWM with c=2	33.6957
SES	32.7668	HWM with c=3	50.1583
SEST	32.7668	HWM with c=4	61.4724
DES	32.8607	ARIMA (1,0,0)	32.469133

Mean square errors of some selected models are shown in the table below for the year 2000

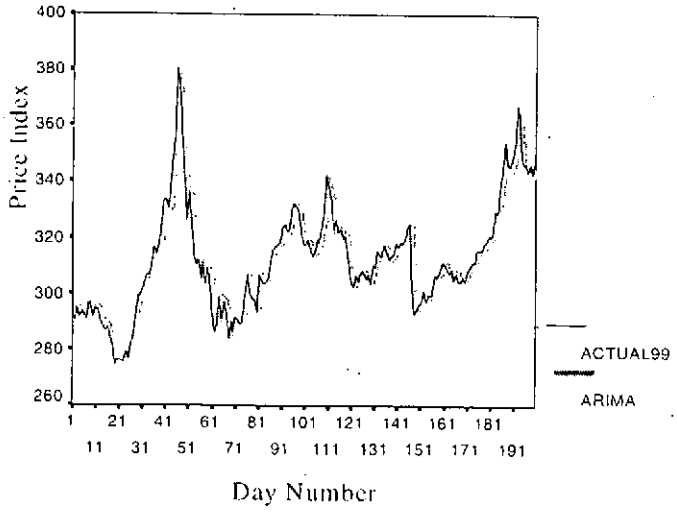
Table 2: Mean Square Errors of The Methods For The Year 2000

Method	MSE	Method	MSE
MA with m=2	64.2181	DEST	63.8245
MA with m=3	79.0437	SA	2045.63
MA with m=4	89.1314	AES	2023.084
MA with m=5	104.7386	LR	733.3931
MAT with m=2	118.0462	HWA with c=3	2989.873
MAT with m=3	84.5771	HWA with c=4	79.7354
MAT with m=4	75.0645	HWA with c=5	224.4142
MAT with m=5	75.2482	HWM with c=3	367.0334
SES	54.8556	HWM with c=4	79.982
SEST	54.8556	HWM with c=5	226.1089
DES	54.8569	ARIMA (1,0,0)	55.252994

Now comparing all applied models for the year 1999 we conclude that ARIMA (1,0,0) is the best-fitted model similarly for the year 2000 we conclude that SES and SEST are the best -fitted models. The graphs of actual values and best-fitted models are shown below:

For the year 1999

Fig 3: Actual Values And ARIMA (1,0,0)



Now graph of autocorrelations and partial autocorrelations of errors to check the validity are shown as below:

Fig 4: Autocorrelations Of Error Of ARIMA (1;0,0) For The Year 1999

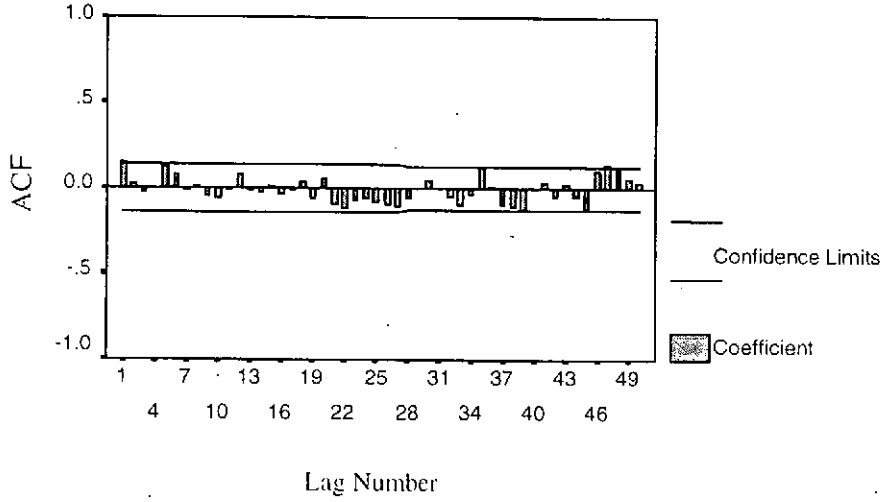


Fig 5: Partial Autocorrelations Of Error Of ARIMA (1,0,0) For The 1999

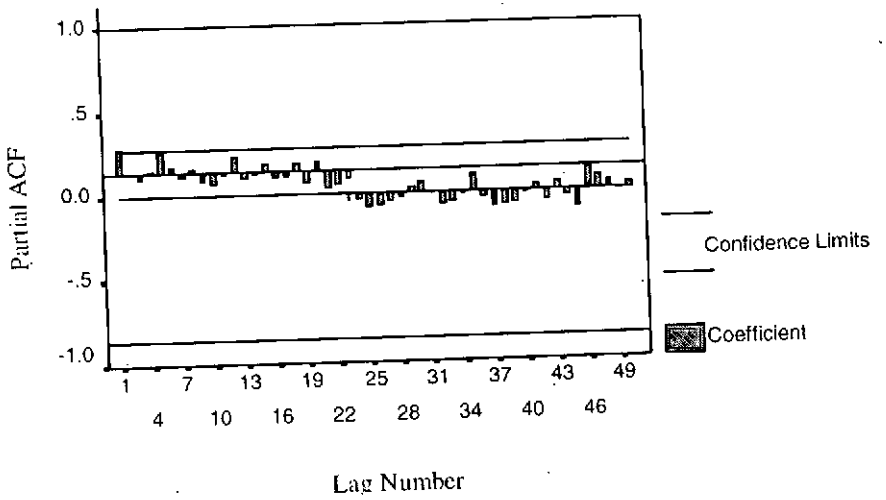


Fig 6: Actual Values And Single Exponential Smoothing for 2000

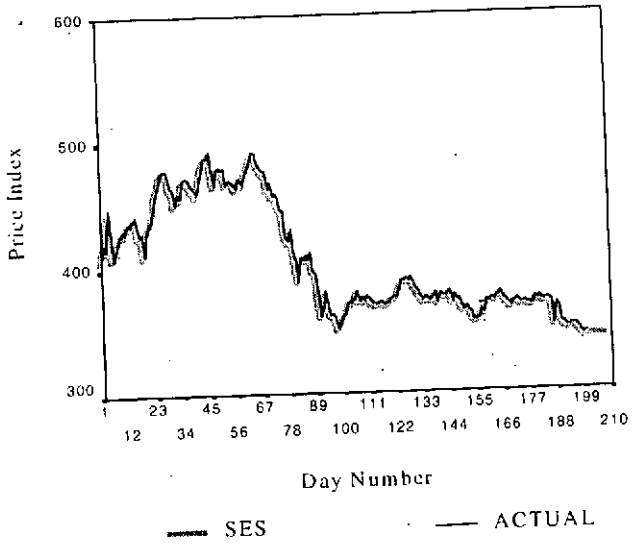
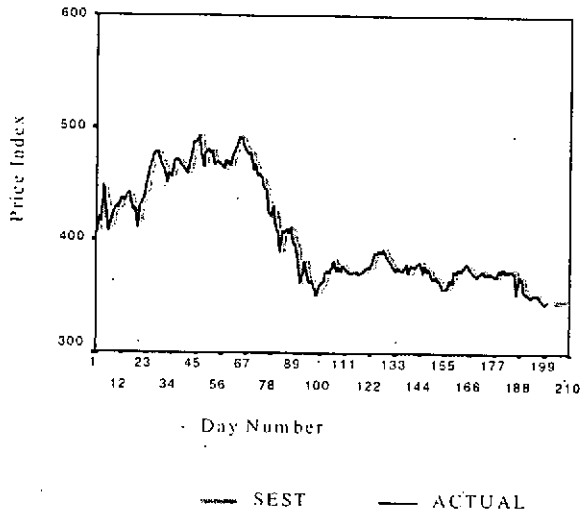


Fig 7: Actual Values And Single Exponential Smoothing With Trend



4. SUMMARY AND CONCLUSIONS

The aim of this research work is Selection of Suitable Forecasting Method for Stock Price Index Data. For this purpose data is collected from Lahore Stock Exchange (LSE). Data comprise of daily price index of two years 1999 and 2000.

Time series models are applied to forecast future values for 10 working days. These models includes smoothing methods such as simple average (SA), moving average (MA), moving average with trend (MAT), single exponential smoothing with trend (SEST), single exponential smoothing (SES), double exponential smoothing (DES), double exponential smoothing with trend (DEST), adaptive exponential smoothing (AES), linear regression (LR), Holt Winters additive model (HWA), Holt Winters multiplicative model (HWM) and ARIMA models.

For the calculations, of the above models computer packages like SPSS (Statistical Package for Social Sciences) and QSB are used.

All above-mentioned models are compared on the basis of mean square error. The model having smaller mean square error is suggested to be the best fitted model. So mean square errors of all the models are compared.

Before applying ARIMA models, data are plotted to see whether it is stationary or non-stationary. The graphs showed approximately stationary

pattern so we moved towards model fitting. Autocorrelations and partial autocorrelations of both data are plotted for identification of suitable ARIMA model. ARIMA (1,0,0) and ARIMA (1,1,0) are applied and their validities are checked again by plotting autocorrelations and partial autocorrelations of residuals.

By comparing all the models applied on the data of the year 1999 we conclude that ARIMA (1,0,0) is the best-fitted model similarly for the year 2000 we conclude that SES and SEST are the best -fitted models. Graphs of best-fitted models and actual values are plotted to make comparisons between the selected models.

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