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Comparative Analysis of Dividend Forecasting Methods

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Abstract

Dividend Forecasting is a technique using which the future cash flows of a dividend paying stock can be found. Dividend is that part of the profits which the company distributes amongst its investors. Dividend Forecasting is an emerging field in stock market as it allows the shareholders to make wise decisions in buying and selling the stock and also predicts the performance of the company in the near future. With algorithm trading gaining a lot of popularity these days, technology has already started to govern the most complex financial markets of the world. And that is why a variety of techniques have been used to forecast the dividends. This paper presents a comparative study of the various approaches for dividend forecasting. In this paper, experiment with various techniques of forecasting dividend yields on secondary data of Infosys was done. The statistical packages of SPSS and Microsoft Excel were used for the analysis. The results of the study reveal that HP Filter with parameter α = 3200 gave the maximum accuracy of 80.30% with other methods giving relatively closer but lesser accuracies for the chosen dataset.

1. Introduction

A dividend is a payment made by a corporation to its shareholders, usually as a distribution of profits. When a corporation earns a profit or surplus, it can either re-invest it in the business (called retained earnings), or it can distribute it to shareholders. A corporation may retain a portion of its earnings and pay the remainder as a dividend. Distribution to shareholders can be in cash (usually a deposit into a bank account) or, if the corporation has a dividend reinvestment plan, the amount can be paid by the issue of further shares or share repurchase [1].

A dividend is allocated as a fixed amount per share, with shareholders receiving a dividend in proportion to their shareholding. For the joint stock company, paying dividends is not an expense; rather, it is the division of after tax profits among shareholders. Retained earnings (profits that have not been distributed as dividends) are shown in the shareholders' equity section on the company's balance sheet - the same as its issued share capital. Public companies usually pay dividends on a fixed schedule, but may declare a dividend at any time, sometimes called a special dividend to distinguish it from the fixed schedule dividends. Cooperatives, on the other hand, allocate dividends according to members' activity, so their dividends are often considered to be a pre-tax expense.

Dividend Forecasting is therefore influenced a lot by the financial condition of the company. In order to forecast dividend yields, a deep insight into the balance sheets is required and an in-depth knowledge of the forecasting techniques fitting different kinds of datasets is indispensable.

The methods used for the study are explained below:

1.1 Principal Component Analysis (PCA) [2]

PCA is a statistical method used for dimensionality reduction primarily. PCA is mathematically defined as an orthogonal linear transformation that transforms the data to a new coordinate system such that the greatest variance by some projection of the data comes to lie on the first coordinate (called the first principal component), the second greatest variance on the second coordinate, and so on.

1.2 Factor Analysis

Factor analysis is a statistical procedure used to identify a small number of factors that can be used to represent relationships among set of interrelated variables. To apply factor analysis, a correlation matrix of the quarterly balance sheets of Infosys from 2001-2014 was obtained for all 28 factors and varimax rotation was applied on the matrix so obtained to make the factors interpretable. The scores were then computed for every factor.

NOTE: The following two tests were conducted to observe the feasibility of Factor Analysis on our dataset.

1.2.1 Bartlett's test of Sphericity

It is used to test the hypothesis that the correlation matrix is an identity matrix.

1.2.2 Kaiser Mayer Olkin Test

It is a measure of sampling adequacy and is used to compare the magnitudes of the observed correlation coefficients in relation to the magnitudes of the partial correlation coefficients. Large KMO values are good because correlation between pairs of variables (potential factors) can be explained by other variables. If the KMO is below 0.5, factor analysis is not preferred.

1.3 Linear Regression

Simple linear regression is a statistical method for approximating a straight line through a set of n data points. One assumes the presence of a straight line that describes the data, $y = \alpha + \beta x$, where the intercept α and slope β are calculated using the least squares estimator,

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$$\sum_{X}\left(\left[\hat{\alpha}x_i+\hat{\beta}-y_i\right]^2\right) \quad x_i \epsilon X, y_i \epsilon Y \tag{1}$$

Where α^ and β^ are estimators for α and β, respectively. The result is a trend line that describes the major trend in the data. A statistical hypothesis test can then be executed to determine if there is a significant linear relationship in the data,

H0: $\beta = 0$

H1: $\beta \neq 0$

$$\text{Trend} = \begin{cases} \text{Uptrend if H0 is rejected and } b > 0, \\ \text{Downtrend if H0 is rejected and } b < 0, \\ \text{No trend otherwise.} \end{cases} \tag{2}$$

Thereby determining if the data is, in fact, trending

1.4 Moving Averages [3]

In statistics, a moving average is a calculation to analyze data points by creating a series of averages of different subsets of the full data set.

Given a series of numbers and a fixed subset size, the first element of the moving average is obtained by taking the average of the initial fixed subset of the number series. Then the subset is modified by "shifting forward"; that is, excluding the first number of the series and including the next number following the original subset in the series. This creates a new subset of numbers, which is averaged. This process is repeated over the entire data series. The plot line connecting all the (fixed) averages is the moving average. A moving average is a set of numbers, each of which is the average of the corresponding subset of a larger set of datum points.

A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

However, as each data point is equally weighted, single data points can have a disproportionately large effect on the trend line, causing the first difference to fluctuate in intervals where the price is somewhat volatile. Moreover, given that the SMA is calculated based on the past n data points, it is apparent that the trend line generated by the SMA is delayed by a factor proportional to n. This constitutes a problem as changes in trend will only be detected with significant delay. A shorter moving average would result in a shorter delay, but then at the cost of less smoothing and more fluctuations in the first difference. Both of these problems can be mitigated, but not eliminated, by a weighted moving average. The Exponential Moving Average (EMA) is a weighted moving average where each data point xi is scaled by an exponential factor α,

$$EMA_{x_i,n} = \alpha \times x_i + (1-\alpha) \times EMA_{x_{i-1}} \tag{3}$$

Where EMA_(x_(i-1)) is typically set to x_i.

1.5 Hodrick Prescott Filter

It is a data cleaning technique that is used to remove short term fluctuations or noise in a data cycle. The Hodrick-Prescott filter assumes that any given time series X can be divided into a trend component τ_t and a cyclical component c_t and expressed by the sum x_t =τ_t + c_t (for our purpose ct could perhaps better be described as a noise component, but we choose to remain consistent with standard notation). The cyclical component can then be obtained by subtracting τ from x giving 〖c_t=x_t-τ〗_t. The cyclical component c_t and the trend component τ_t can then be isolated by solving the following minimization problem,

$$min\sum_{t=1}^{T}(x_t-\tau_t)^2+\lambda\sum_{t=2}^{T}[(\tau_{t+1}-\tau_t)-(\tau_t-\tau_{t-1})]^2 \quad x_t \epsilon X \tag{4}$$

Where the first term of the equation is the sum of squared deviation of ct and the second term is the first difference of the trend component. When solving the minimization problem the first term penalizes large values of ct (i.e., poor fit) while the second term penalizes the lack of smoothness in τ_t. The tradeoff between the two terms is controlled by the λ parameter. Consequently, higher values of λ penalizes variations in the first difference of the trend component causing a smoother trend line that is less sensitive to short-term fluctuations than long-term fluctuations (it essentially controls the degree of smoothing over short-term fluctuations). Note that as λ approaches 0 the trend component approaches the original time series, and as λ approaches infinity τ_t approaches a linear trend. The data points in X are typically scaled with the natural logarithm before calculating τ.

2. Methodology

The approach implemented in the comparative study of dividend forecasting methods includes analyzing the past data of a stable company. In our case, the financial data of Infosys from 2001 till 2014 was chosen to carry forward our study.

2.1 Factors Affecting Dividends

The boards of directors of a company have the sole right to declare dividend and decide the quantum of dividend. In addition to legal restrictions, there are many factors affecting the dividend policy of a company.

A total of 28 factors from the quarterly balance sheets of Infosys were used for the analysis. These factors are listed below:

Stock price vs Industry(%), Current ratio vs Industry(%), Return on equity vs Industry(%), Leverage Ratio vs Industry(%), Asset Turnover vs Industry(%), Quick Ratio, Current Ratio, Leverage Ratio, Return on Stock Equity(%), Return on Assets(%), Working Capital to Price(%), Working Capital to Equity(%),Revenue per Cash, Cash per Share, Revenue to Assets, Revenue per Common Equity, Price to Tangible Ratio, Book Value per share, Total Assets per Share, Current Assets per Share, Current Liabilities per Share, Cash to Revenue(%)Revenue per Receivables, Total Liabilities to Total Assets(%),Dividend Yield Ratio(Face Value),Dividend Yield Ratio(Market Value),Dividend Payout Ratio, Earnings per Share(EPS).

Table: 1. Sample Dataset for various Factors affecting Dividends

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	stock_price_vs_industry	current_ratio_vs_industry	return_on_equity	leverage_ratio_vs_industry	asset_turnover_vs_industry	current_ratio	quick_ratio	leverage_ra...	return_on_stock	return_on_assets	working_capital_to_price	working_capital_to_equity	revenue_per_cash	cash_per_share	revenue_to_assets
1	5.70	285.00	203.60	70.60	120.00	5.70	5.50	1.20	28.30	23.90	3.30	75.50	2.39	.83	.90
2	5.00	250.00	250.30	75.00	130.00	5.00	4.60	1.20	36.30	30.10	2.30	70.10	4.11	.53	1.20
3	5.00	250.00	224.70	75.00	130.00	5.00	4.60	1.20	35.50	29.50	4.30	70.10	3.86	.63	1.20
4	5.20	260.00	203.60	75.00	144.40	5.20	5.00	1.20	33.60	28.30	4.10	69.50	3.70	.72	1.10
5	6.10	321.10	242.00	70.60	171.40	6.10	5.80	1.20	33.40	28.80	4.40	70.60	3.88	.76	1.10
6	6.40	278.30	276.90	68.80	200.00	6.40	6.00	1.10	33.50	29.40	4.50	68.70	3.90	.82	1.10
7	6.60	314.30	265.90	68.80	185.70	6.60	6.40	1.10	32.70	28.80	5.30	69.40	5.62	.61	1.10
8	6.60	314.30	250.40	68.80	162.50	6.60	6.40	1.10	32.30	28.50	5.20	70.20	4.22	.87	1.10
9	7.20	378.90	201.30	61.10	150.00	7.20	7.00	1.10	30.20	26.90	6.10	70.80	2.42	1.61	1.00
10	6.20	295.20	208.30	64.70	162.50	6.20	5.90	1.10	35.20	31.30	6.50	61.60	5.96	.71	1.20
11	5.90	281.00	191.10	64.70	162.50	5.90	5.70	1.10	34.20	30.10	4.80	64.70	7.80	.59	1.20
12	5.90	268.20	203.00	68.80	162.50	5.90	5.60	1.10	33.50	29.50	4.70	64.50	4.79	1.06	1.10
13	5.90	281.00	184.10	68.80	171.40	5.90	5.80	1.10	31.30	27.70	6.10	64.10	2.20	2.46	1.00
14	6.30	286.40	192.50	68.80	185.70	6.30	6.10	1.10	30.80	27.50	6.90	65.10	2.12	2.78	1.00
15	5.30	252.40	192.30	68.80	171.40	5.30	5.10	1.10	29.80	25.90	7.90	64.00	1.98	3.22	.90
16	5.70	259.10	224.30	68.80	171.40	5.70	5.60	1.10	30.30	26.60	9.10	65.20	1.97	3.46	.90
17	5.50	250.00	1843.80	64.70	157.10	5.50	5.30	1.10	29.50	25.70	12.50	65.40	2.03	3.60	.90
18	4.80	200.00	5666.70	75.00	171.40	4.80	4.30	1.20	34.00	28.90	9.00	63.30	2.56	3.01	1.10
19	4.90	204.20	.00	75.00	157.10	4.90	4.80	1.20	35.30	30.00	12.10	65.20	2.44	3.29	1.10
20	5.00	208.30	.00	75.00	157.10	5.00	4.80	1.20	35.30	30.20	16.80	65.70	2.40	3.40	1.10
21	5.80	252.20	287.30	75.00	137.50	5.80	5.70	1.20	33.90	29.30	16.90	68.30	2.15	3.78	1.10

2.2 Dimensionality Reduction for the Dataset

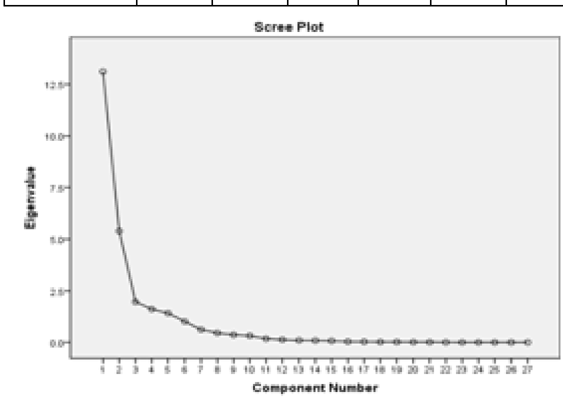
We performed PCA on our Data for Infosys using SPSS and Microsoft Excel and the following components were obtained:

Table: 2. Reduced Dimensionality from 28 to 6 After Performing PCA

FACTOR 1	FACTOR2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
Working Capital to Price (%) Book value per share Total assets per share Current assets per share Current Liabilities per share Cash per share Cash to Revenue(%)	Revenue to Assets Revenue per Common Equity(%) Return on Assets(%) Return on Stock Equity(%) Revenue per Cash	Stock Price vs Industry (%) Current Ratio Quick Ratio Current Ratio vs Industry(%)	Price to Tangible Ratio Dividend Yield Ratio(f) Dividend Payout Ratio	Leverage Ratio vs Industry(%) Asset Turnover vs Industry(%) Revenue per Receivables	Working Capital to Equity

Table: 3. Component Transformation Matrix and Scree Plot for Factor Analysis

Component	1	2	3	4	5	6
1	.739	-.593	-.230	-.024	-.163	.148
2	.029	-.319	.871	-.316	.180	.084
3	-.271	-.407	-.046	.633	.509	.315
4	.206	-.043	-.133	-.121	.651	-.707
5	.391	.285	.411	.688	-.204	-.286
6	.429	.546	-.001	-.108	.465	.539



2.3 Statistical Analysis

The methods described above were used on the reduced dataset and the errors were recorded for each technique. The values along with the obtained accuracy values have been listed in the Results section below.

3. Results and Discussions

After implementing all the techniques on our dataset, the study yielded that HP Filters with bias 3200 gave the best accuracy on our dataset. Other methods may yield better results when used with a different dataset. Accuracy levels based on various methods provide sufficient and reliable dividend forecasting for a stable stock such as Infosys.

Table: 4. Comparison of Results of various forecasting Techniques

Period	Actual Data	Reg	error	HP-1600	error	HP-3200	error	M.A.	error	E.M.A (0.35)	error
Sep-11	15	21.1167	0.4078	15.8741	0.0583	15.7001	0.0467	16.5292	0.1019	16.6354	0.1090
Mar-12	22	22.6516	0.0296	16.8108	0.2359	16.6112	0.2449	16.9129	0.2312	17.3495	0.2114
Sep-12	15	17.4581	0.1639	17.4742	0.1649	17.2759	0.1517	18.6145	0.2410	17.2393	0.1493
Mar-13	27	18.6035	0.3110	17.8792	0.3378	17.6960	0.3446	17.6509	0.3463	17.1575	0.3645
Avg error			0.22806		0.19923		0.19698		0.23010		0.20856
Accuracy(%)			77.19		80.08		80.30		76.99		79.14

NOTE: *Reg=Linear Regression
*HP-1600=HP Filters with 1600 as parameter
*HP-3200=HP Filters with 3200 as parameter
*MA=moving Average
*EMA(0.35)=Exponential Moving Average with α

4. Conclusions

At last, the researchers concluded that Dividend Forecasting for a dividend paying stock can be performed based on statistical data and financial history of the company with reliable accuracies using methods like HP Filter, Regression, Moving Averages and Exponential Moving Averages

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