

Testing the Residual Income Valuation Model in a Nascent Stock Market: The Case of Nairobi Securities Exchange

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Abstract

This study sought to determine the intrinsic value of the Nairobi Securities Exchange (NSE) Limited using the residual income valuation method. Data was obtained from the financial statements of companies in NSE20-share index and the Central Bank of Kenya annual report from year 1998 to year 2011. A time series regression model was used to forecast returns on equity, earnings per share and book values of equity. The intrinsic value of the index was computed and compared with the reported (market) index value. Our results show that the residual income model is capable of valuing the NSE index with a good degree of accuracy. However, the residual income model has very weak predictive power.

Key words: Intrinsic value; residual income model; security exchange.

1.0 Introduction

Finance theory suggests that rational investors make their investment decisions based on their assessment of the true value of a security relative to the security's market price. The commonly used approach of assessing the true value of a security starts from the observation that the return on an investment typically consists of end-of-period cash flows (dividends, if the security is a share of common stock) plus changes in the value of the invested capital. In the standard valuation framework, the estimated future cash flows are discounted back to the present, at the investor's appropriate risk-adjusted opportunity cost of capital, to obtain the security's intrinsic value (Bodie et al., 2002). Accordingly, if the computed intrinsic value of a particular security at a point in time exceeds its market value at that time, the stock is considered underpriced, branded a good investment, and rational investors should buy more of it. Conversely, investors should sell the security if its intrinsic value is lower than its market price at a particular point in time.

In a capital market in which investors are rational and well informed, the market price of a security should reflect the security's fair value. The fair value is the amount at which the security changes hands among willing buyers and sellers who have full knowledge of market facts (Ross *et al.*, 2002). Therefore, the standard view among financial economists is that market price of a security should be the best available proxy for the security's intrinsic value. Consequently, the reliability of a valuation model is commonly gauged against its ability to estimate values close to the security's observed market price (Ferson and Harvey, 1994; Lewellen et al., 2010). However, inferences based on this premise may be faulty: a security's intrinsic value need not converge to the market value as deviation can occur because of noise trading or even because of uninformed trading in a noisy rational expectation setting (DeLong *et al.*, 1990).

In this paper, we avoid from the standard discounted cash flows valuation techniques and determine intrinsic values using the residual valuation model (Ohlson, 1995; Feltham and Ohlson, 1995). The intrinsic value of the stock of a developing market in this case Nairobi Security Exchange (NSE) has not been determined. Previous research undertaken to test the reliability of valuation model in valuing the stock in the NSE have not identified a good valuation model. Investors and particularly foreign investors rely on the NSE -20 share index information to make investment decision. They are interested in knowing the intrinsic value of the stock so that they can compare it with the market value to enable them make an informed decision on whether or not to invest. The performance of the market (NSE) is still poor due to unavailability of this very critical information.

The proposed study aimed at determine the intrinsic value NSE-20 Share index using the residual income method and investigate the extent to which this value correlates with observed market prices over time.

1.1 Empirical Literature

Scholars have, over the years sought to investigate the practical suitability of theoretical valuation model. In a study seeking to determine the drivers of stock price movement, Long Chen and Zhao (2013), using direct cash flow forecasts, showed that stock returns have a significant cash flow news component whose importance increases with the investment horizon. The findings demonstrated cash flow as an important aspect in asset pricing.

Andrew and Liu (2004) in their study on how to discount cash flows with time-varying expected returns observed that dividend discount model ignores time-varying risk premiums and betas. They modeled value cash flows with changing risk-free rates, predictable risk premiums, and conditional betas in the context of a conditional CAPM. They concluded that constant discount rates produces large misvaluations, at short horizons, investors should be most concerned with the impact of time-varying interest rates and risk premiums for discounting cash flows whereas at long horizons, time variation in risk-free rates or beta is more important.

Wang and Xu (2004) in a study of the Chinese equity market found that beta did not account for return differences among individual stocks, book to market ratio is useless in explaining cross sectional differences in equity returns and that size effect was useful although somewhat weak. Finally, they identified another variable – free float – which, they argued, served as a signal of corporate governance quality in a Chinese company.

Olweny (2011) conducted a study to establish the reliability of dividend discount model on the valuation of stocks at the Nairobi stock exchange. Of the eighteen firms studied only three companies showed that the difference was significant and he therefore concluded that dividend discount model cannot be relied on by the companies in the NSE in the valuation of common stock. Further, Nawalkha *et al.*, (2011) undermines the model stating that stock valuation is a function of the firm's investment policy and not the financing policy related to its dividend.

Given the failure of the dividend discount model to explain volatility in stock prices researchers have shifted their attention to suggest a better model, in this case residual income valuation model. The model has been empirically investigated in recent years with focus largely on its ability to predict cross-sectional prices and expected returns. Xiaoquan and Bon-Soo (2005) tested the empirical validity of the accounting-based residual income model, in regard to price volatility relative to fundamentals and the model's dynamic implications by cross equation restrictions. He found that, for stock valuation, book values and accounting earnings in the model contain more useful information than dividends alone.

Qiang (2005), investigated the determinants of residual income scaled by book value of equity, he relied on economic theories to characterize economic rents and develop an empirical measure to capture the effect of conservative accounting. It was observed that, industry abnormal return on equity increases with industry concentration, industry-level barriers to entry, and industry conservative accounting factors, moreover, the difference between firm and industry abnormal ROE increases with market share, firm size, firm-level barriers to entry, and firm conservative accounting factors. He concluded that when these determinants are integrated into the residual income model they significantly increase its explanatory power for the variation in the market-to-book ratio.

On a time series context, residual income model has not attracted a lot of empirical investigations. A study by Lee *et al.* (1999) that sought to determine the extent to which residual model can be used to predict future returns on Dow stocks stands out. The study models the time series relation between price and value as a co integrated system and using time-varying interest rates over a period of 12 years, the study shows that the intrinsic value obtained from this model possesses a high tracking power and predictive ability even when the market is reasonably efficient.

Tsay *et al.*, (2008), in a research on residual income, value-relevant information and equity valuation compared the relative predictability of the simultaneous model for stock price (proposed by ohlson) with a traditional single equation model used by the previous studies. They further explored how residual income and value-relevant information affect firms' equity price.

Their findings suggested that predictive ability and estimation efficiency of the simultaneous models in explaining stock prices are better than those of the traditional single models. Moreover, the study observed that investors use the value-relevant information beyond accounting earnings such as analysts' earnings forecasts, bankruptcy cost and agency cost, in equity valuation to make decision.

Lee *et al.*, (2012) examined the long-run relationship between market value, book value, and residual income in the Ohlson model. A test was done to ascertain whether market value is co integrated with book value and residual income in light of their non-stationary behaviors. It was observed that co integration applied only to 51 % of the sample firms, which raised doubt as to whether book value and residual income alone are adequate in tracking variations in market value, yet they also found that market value is fractional co integrated with book value and residual income for 89 % of the sample firms. The findings supported Ohlson model.

Higgins (2011), using analyst earnings forecast demonstrated a method for forecasting stock price which is based on residual income model with an adjustment for autocorrelation. The study showed how to implement the residual income model for forecasting and how to address autocorrelation to improve forecast accuracy; overall it provided a forecasting stock price method.

Several commonalities exist in these studies, first that the residual income model has been tested in developed market and proved to be applicable, none has been done in developing market, they all use historical data i.e. earnings and dividend which have proved to be inadequate proxies of future performance as they highly depend on interest rate to discount them and finally stationary implicitly assumed in the time series data employed. The proposed study aims at filling the research gap and deals with these shortcoming by using forecasted information which is less sensitive, employing capital asset pricing model as a way of improving discount rate and finally by dropping that unrealistic assumption of stationary.

1.2 Residual income valuation model

The paper focuses on residual income model and its applicability in determining the intrinsic value in the developing market such as Nairobi Securities Exchange. The model is attributed to Edward and Bell (1961) and Ohlson (1990, 1991, 1995). According to Beynon and Clatworthy (2013) theorem this fundamental value is a function of current book value of equity plus the sum of discounted expected residual income thus the model is expressed in terms of accounting numbers. The stock valuation model is expressed as follows,

$$V_t = B_t + \sum_{t=1}^{\infty} E_t [ROE_t - re] B_t / (1 + re)^i \quad (1)$$

Where B_t is the book value at time t , E is the expectation based on information available at time t , re is the cost of equity capital and ROE_t is the after tax return on equity for the period t .

Elsner *et al.*, (2012) observed that the firm's value can be determined either on the basis of cash flows between the firm and its owners or by using residual incomes, provided that cash flows and residual incomes are derived from an accounting data that fulfills certain regulation. The value of the firm is split into two components; a measure of the capital invested (Book value) and a measure of the present value of all future residual income (the infinite sum). The model is very attractive to finance researchers and practitioner due to the following reasons; Consideration such as availability of earnings forecasts make the model easier to implement, it is applicable to both dividend and non dividend paying companies, incorporates clean surplus accounting and finally the model focuses on wealth creation (book value and abnormal earnings).

1.3 Capital asset pricing method

Under a restrictive set of assumptions relating to the behavior of investors and capital markets, a theory of asset pricing, known generally as the CAPM, was developed almost simultaneously by three researchers Sharpe (1964), Lintner (1965) and Mossin (1966) working independently. The total risk of any asset is divided into two, that is systematic risk and unsystematic. While unsystematic risk is unique to the asset itself and can be eliminated through diversification, systematic risk is non diversifiable hence the market offers premium to investors for bearing this risk. Debate on the empirical performance of the Capital Asset Pricing Model (CAPM) has broadened the scholars' and practitioners' understanding of important asset pricing factors.

In practice, the Fama and French (1992) three factor model, which includes the market factor, a size proxy and a proxy for book value of equity to market value of equity (BV/MV), is now widely considered to be state of the art. But despite success of the model in empirical studies of mature equity markets, analysts know little about the results of applying the model to emerging capital markets.

2.0 Methodology

A causal research design was employed in this study. The target population comprised of financial statement data of firms in the Nairobi Securities Exchange-20 share index and Central Bank Annual Report from year 1998 to year 2011. The years were selected from 1998 because it corresponds to the period when liberalization of financial system took place and year 2011 was selected to ensure current information availability. This period was considered long enough to provide sufficient data to assist in estimating a reliable regression models for the study. Purposive sampling was used where by NSE-20 Share index was selected from the Nairobi Security Exchange thereafter a census study was done for all the firms in the NSE-20 share index from year 1998 to year 2011. This was because the target population was small and therefore the probability of drawing a representative sample was very minimal. The sample size was made up of twenty firms that make up the NSE-20 share index. Secondary data was collected from Nairobi Securities Exchange and Central Bank of Kenya. Annual data obtained from the financial statements of the firms in NSE-20 Share index included accounting information yielding the book value of equity, earning per share, book value per share, number of shares outstanding, market price per share and cost of equity capital.

2.1 Data analysis

Residual income valuation model was used to determine the intrinsic values. Time series regression model was run to forecast return on equity, earning per share and book values of equity. Cost of equity capital was determined and terminal values were forecasted at time t=3 and t=12 as shown in equation (3). These values were used as inputs in equation (2) and relevant intrinsic values were obtained. Consistent with Lee et al. (1999), the following equation was used to compute the intrinsic value estimate for each of the firm on NSE -20 share index.

$$V_t = B_t + \frac{(FROE_{t+1}-re)}{(1+re)} B_t + \frac{(FROE_{t+2}-re)}{(1+re)^2} B_{t+1} + TV \tag{2}$$

Where:

B_t = Book value from the most recent financial statement divided by the number of shares outstanding in the current month.

re = Cost of equity capital.

$FROE_{t+1}$ = Forecasted return on equity period t+1.

B_{t+1} = Forecasted book value of equity computed using the following mathematical relationship. $B_{t+1} = B_{t+i-1} + FEPS_{t+1} - FDPS_{t+1}$. Forecasted dividend per share for year (t+1) was determined using this model.

$FDPS_{t+i} = FEPS_{t+i} * k$ (Where a constant payout ratio of year 2011 (k) was assumed in determining the FDPS).

Terminal value was estimated using the two different forecast horizons.

$$T = 3, TV = \frac{(FROE_{t+3}-re)}{(1+re)^2 re} B_{t+2};$$

$$T = 12, TV = \sum \frac{(FROE_{t+i}-re)}{(1+re)^i} B_{t+1-i} + \frac{(FROE_{t+12}-re)}{(1+re)^{11} re} B_{t+11} \tag{3}$$

The variables captured by residual income model included book value of equity, forecasted return on equity, cost of equity capital, forecasted book value of equity and terminal value. Actual Return on equity for all the NSE 20 companies was computed by dividing the earning per share with the book value per share. Forecasted return on equity was estimated by fitting regression model on the actual return on equity computed. The following regression equation was used.

$$FROE_{i,t} = \alpha + \beta ROE_{i,t-1} + \mathcal{E} \tag{4}$$

Where: α is the intercept, whereas β denotes the x variable (slope).

Alpha and beta values obtained were used to estimate forecasted return on equity for the next twelve years. Assumption was made that year 2011 was our recent actual ROE which represented time t, thus forecasted ROE started from year 2012. That is: t=2011, t+1=2012, t+2=2013....., t+12 =2023. Regression was run for all the firms in the NSE-20 Share index.

Book value is the intrinsic net worth of a company. The formula below was used to determine the book value of equity for all the firms in NSE -20 share index.

$$\text{Bookvalueofequity} = \frac{(\text{Netasset} - \text{Currentliability} - \text{Preferenceshares})}{\text{outstandingshares}} \quad (5)$$

To determine the cost of equity capital, the following mathematical relationship was used.

$$R_{i,t} = R_f + \beta_{i,t}(R_{m,t} - R_{f,t}) \quad (6)$$

Where $R_{i,t}$ = the required rate of return on security I over period t

R_f = the risk free rate of return over period t

$\beta_{i,t}$ = the measure of systematic risk for security I during period t

$R_{m,t}$ = is the rate of return on the market portfolio over period t.

CAPM was used to estimate the required rate of return on the stock since the focus of the study was on the time-series properties of the valuation model, the required rate of return was computed as the sum of a time-varying risk-free rate and a consistent risk premium above the risk-free rate. Market return series was computed from the series of the NSE-20 share index values. The NSE-20 index values for January and December were picked and the formula below used to determine the market return.

$$\text{Returns} = \frac{P_1 - P_0}{P_0}, \text{ where } P_1 = \text{ending values, } P_0 = \text{beginning value.} \quad (7)$$

The beta value of each of the firm in the NSE -20 index was obtained by regressing the firms return series (which was computed from its stock prices) against the NSE- share return series. The regression equation used for the computation beta is as follows.

$$R_{it} = a + bM_{it} + \varepsilon_{it} \quad (8)$$

Averaged Treasury bill rate (91days) was used to represent the risk free rate for duration of 1998 to 2011. Presentation was done using graph.

3.0 Results and discussion

3.1 Intrinsic value of the stock

The intrinsic values and the reported market values of firm's stock in the NSE 20 for year 2010 and 2011 are presented in figure 1 and 2 respectively. From the graph in year 2011, the computed intrinsic value of stocks of six firms in the Nairobi Security Exchange exceeded the market value. Rea Vipingo had an intrinsic value of 24.43 against a market value of 14.74, Equity Bank had an intrinsic value of 55.24 against the market value of 55, Centum Investment had an intrinsic value of 22.21 against a market value of 15.60, British American Tobacco had an intrinsic value of 326.94 against a market value of 246, East African cables had an intrinsic value of 11.38 against a market value of 10.55 and lastly Safaricom had an intrinsic value of 6.62 against a market value 3.80. These stocks are undervalued and thus considered good for investment purpose.

The intrinsic values of Nation Media Group, Bamburi Cement and Athi River Mining were below the market value by a big margin. For example Athi River mining had an intrinsic value of 56.87 and a market value of 158. This was due to the fact that the company was highly indebted thus the long term liability reduces the book value of equity of the company, moreover, the company has large number of shares outstanding further reducing the book value of equity. This is because intrinsic value of a given security using the residual income model depends on the book value of equity and earnings prospects of the company which in turn are related to economic and political factors some of which are peculiar to this company and some of which affect other companies as well. The same explanation applies to Nation Media Group and Bamburi Cement.

The intrinsic values of the other companies were below the market price meaning that the stocks of this firm were overvalued; however, the difference between the computed and the reported market values was not significantly different. These companies included Mumias, Express Kenya, Sasini, Kenya, Airways, Barclays Bank, Kengen, Kenya Commercial Bank, Kenya Power and Lighting Company, East African Breweries and Standard Chartered Bank.

For example Kenya Commercial Bank had an intrinsic value of 15.41 against a reported value of 16.85 in year 2011. The companies that had their stocks undervalued in year 2011 still had their stock undervalued in year 2010 this showed that there was consistency in the result obtained. From the beginning we stressed that reported market prices need not correspond to intrinsic values of the stock. In a world of uncertainty intrinsic values are not known exactly.

According to work done by Shiller (1984) and DeLong *et al.* (1990), deviations can occur either because of noise trading or even because of uninformed trading in a noisy rational expectation setting. In the research findings the computed intrinsic values of NSE stock were different from the reported market values for all the companies. This showed that firms stocks were either undervalued or overvalued but not price equivalent to the intrinsic value.

According to Lee *et al.*, 1999, the magnitude and duration of the deviations between the computed intrinsic value and market price depend on the costs of arbitrage. Market values and intrinsic values converge in the long run due to arbitrage forces but in the short run the cost of arbitrage may not be sufficiently small to cause convergence to occur immediately. The intrinsic values reflect the true value of the stock and it need not converge to the market prices of the stock. This is because market prices of the stock are affected by many factors. Hinaunye 2011, in his study to analyze the determinant of stock prices concluded that stock prices are determined by economic activity, exchange rate, inflation, interest rate, money supply and exchange rate. Other factors that influence the stock prices include dividend policy, demand and supply, earning per share, investor confidence, news, directors influences performance of the industry e.t.c. These are just but a few factors that influence the market prices of the share thus they can make the price to increase or decrease randomly.

Fama, 1995 in his research indicated that computed intrinsic values can change across time as a result of new information which may concern with such thing as the success of current research and development project, change in management, a tariff imposed on the industry's product by a foreign country among others. This is in line with the findings where it was observed that the computed intrinsic values of the NSE stocks in year 2010 and 2011 were different though the deviations were not large. For example Centum had an intrinsic value of 19.30 in 2010 and 22.21 in year 2011; East African Cables had an intrinsic value of 13.01 and 11.38 in years 2010 and 2011 respectively. This was exhibited by almost all the companies.

4.3 Intrinsic value of the NSE -20 Share Index

Intrinsic values and reported values of NSE-20 Share Index Year 2010 and 2011 are presented in Figure 3. From the figure the intrinsic value of the index in year 2010 was 4818.97 while the reported market value was 4432.60, whereas in year 2011 the intrinsic value and reported market value were 3595.85 and 3205 respectively. This means that the indices were undervalued since the intrinsic values were above the reported market values in both years. However, deviations between the computed values and the reported values were not significantly different thus conclusion was made that the model is better able to value the index.

In year 2010 the computed intrinsic value of NSE -20 Shares index was up and this was also reflected in the reported value of the index. This was generally attributed to higher investment in public infrastructure, rising market confidence since the adoption of a new constitution and economies of scale arising from the East African Community integration, reduced Inflation which came in response to the overhaul of the consumer price index (CPI) by the Kenya National Bureau of Statistics including the introduction of new weightings and a new basket in February 2010, reduction in the cost of telecom tariffs and good rains during the year. Central Bank of Kenya continued with its policy of monetary loosening, cutting the Central Bank Rate (CBR) by 75 basis points to 6 percent and this led to a decreased interest rate (NSE Annual Report, 2010).

The NSE-20 Share Index intrinsic value declined in year 2011 attaining a value of 3595.85, this was also exhibited by the reported market value whose value was down by 27.7% closing at 3205.02 points at the end of year 2011 down from 4433 points reported at the end of December 2010. The major factors that contributed to poor performance of the market included drought, rising inflation in the second half of the year, higher and volatile interest rates, volatility of the shilling against major currencies and Kenya's pursuit of Al-Shabaab terrorists based in Somalia (NSE Annual Report, 2011).

4.4 Predictive ability of the Residual Income model.

Finally the ability of the model to predict the future was determined. Past information of individual firms in the Nairobi Security Exchange - 20 Share index was used to predict the intrinsic values. Fama, 1995 observed that historical information of stock price can be used to make meaningful prediction of the stock's future price. This has also been supported by the chartist theory whose main assumption is that security's price past behavior is a rich information concerning the future behavior. The forecasted intrinsic value of the NSE-20 share index is shown in Figure 4.

The NSE-20 share index was ranging between 4900 to 5000 points as at June 2013, this was compared with the predicted intrinsic values result which ranged from 5797.85 to 5653.94 points in years 2013 and 2023 respectively and the conclusion was intrinsic value computed using the residual income model showed little predictive ability. These results are consistent with prior studies. For example, Macbeth and Emanuel (1993) tested the predictability of DJBM and DJDP using residual income model and found it had little predictive power. Using more extensive annual data, Kothari and Shanken (1997) showed that DJBM and DJDP have some predictive power for overall market returns. Residual income valuation method proved to be a suitable model of determining the intrinsic value contrary to past research which concluded that none of the valuation model is applicable in predicting the market as it is highly inefficient (Omondi 2003, Olweny 2011, and Mwangi 1997). Signs of market efficiency such as active trading, liquidity and improved investor protection laws and regulation are evident in the NSE though its efficiency status has not been concluded.

The study assumed that value of the stock is determined by variable such as book value of equity discounted residual income and the results compared very well with the accepted view in the academic circles that stock value is dependent on many factors such as earning power, cost of equity capital, book value, dividend policy e.t.c, further proving unreliability of dividend discount model in share price prediction since its main assumption is that prices are determined by expected dividend per share.

5.0 Conclusion

Our results show that the residual income model is capable of valuing the NSE index with a good degree of accuracy than the traditional model. However, the residual income model has very weak predictive power.

5.1 Policy implications

This paper contributes to the valuation literature by testing the ability of residual income valuation model to determine intrinsic value of a new and developing market. The analyses highlight the importance of book value of equity and return on equity in predicting the value of common stock. The results are important for studies relying on the residual income model valuation framework because they have highlighted accounting variables that capture both the cross sectional and time series variation of firm's value.

5.2 Suggestion for further research

The practical applicability of the Residual Income Valuation Model has not been empirically investigated in developing financial markets. It would be therefore be interesting and more practical for one to conduct further research on the residual income model with another asset pricing model such as arbitrage pricing models, zero-beta Capm, e.t.c in various developing markets.

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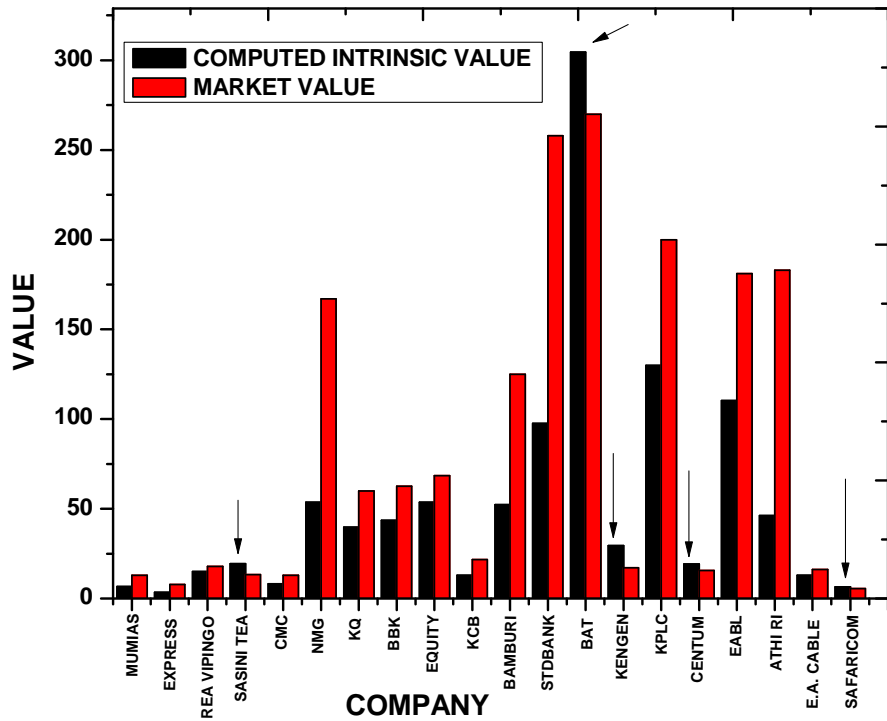


Figure 1. Intrinsic value and reported value of stocks in the NSE 20 share year 2010. Arrows indicate intrinsic values > market value

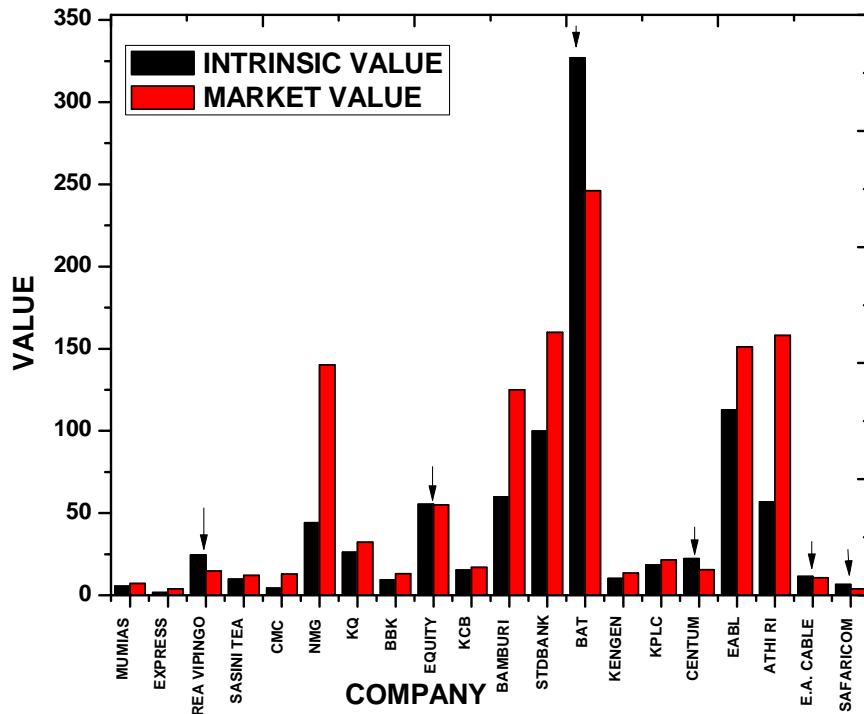


Figure 2. Intrinsic value and reported value of stocks in the NSE-20 share year 2011. Arrows indicate intrinsic values > market value

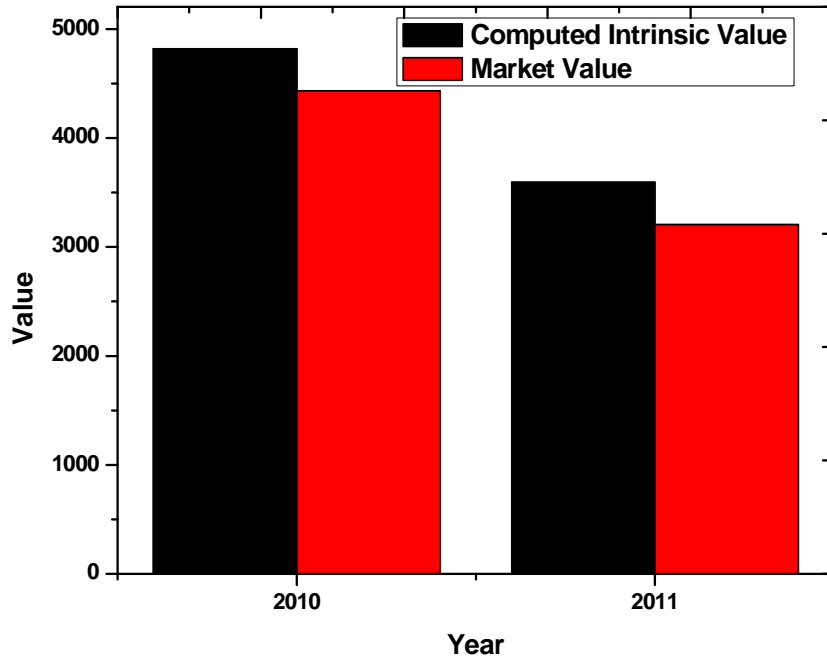


Figure 3. Intrinsic value and reported value of NSE-20 Share Index Year 2010 and 2011

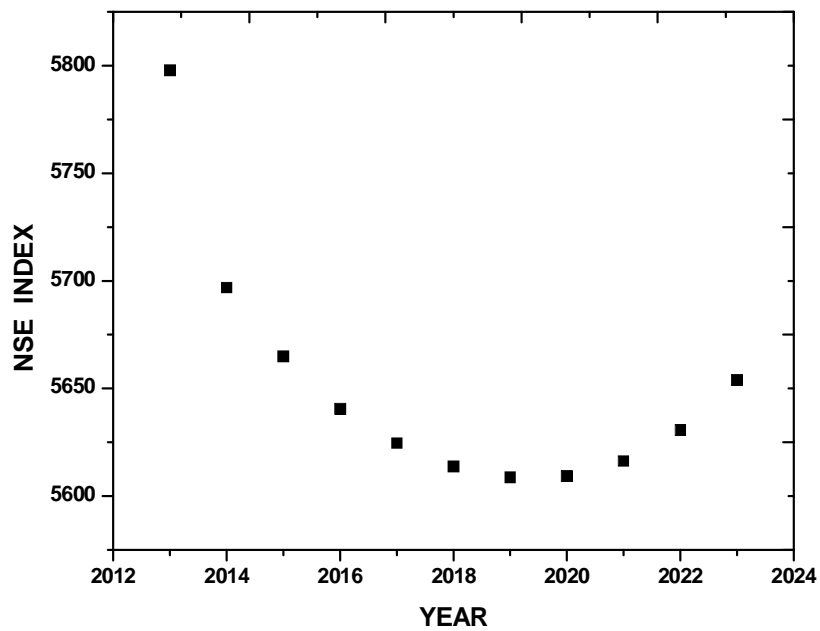


Figure 4. Forecasted intrinsic value of the NSE-20 Share Index