

POST-GRADUATE STUDENT RESEARCH PROJECT

Estimating the Cost of Capital of CNX Nifty

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Abstract

This paper calculates the cost of capital of the CNX Nifty 50 Stock Index. It explores the possibility of establishing a new benchmark, the cost of capital of stock index, in the context of capital markets. The weighted average cost of capital (WaCC) of the Nifty 50 Stock Index is computed. The WaCC computed can form a new benchmark against which companies can compare their own cost of capital. Usually, companies raise a combination of debt and equity to finance their business. A new company can use this benchmark as a reference to choose the perfect combination of debt and equity to reduce its overall weighted average cost of capital. The methodology computes the cost of capital for the index by including each of the fifty companies of the Nifty index. An aggregate cost of capital is then calculated for all the companies, leading to a new benchmark called the cost of capital of the Nifty 50 stocks.

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I. Introduction

Cost of capital (CoC) for a company is the cost of its funds. (Modigliani, F. & Miller, M. H., 1958) Funds include debt as well as equity capital. The CoC figures are important from the perspective of an investor—CoC is the minimum rate of return that an investor expects after making an investment in the company's funds. It serves as a benchmark to compare the worthiness of the investment made. The expected return on the capital invested by an investor should be at least equal to or more than the CoC. In other words, the CoC is the rate at which the investment made could earn from an alternative investment of equivalent risk.

There are two main theories about the capital structure of companies. According to the trade-off theory, there is an optimal capital structure (Bradley et al., 1984). According to the pecking order theory, there is no optimal capital structure for every firm (Myers, 1984; Myers and Majluf, 1984); there is only a hierarchy of financial instruments with increased information asymmetry via which a firm finances its business activities. Only when all the internal modes of financing are exhausted does the firm opt for external financing in terms of debt followed by equity. Some other comparatively recent theories have been proposed as alternatives/extensions to these theories, such as the life cycle theory of firm financing and the market timing theory, which are the latest additions to the capital structure literature. This paper is based on the static trade-off theory, and therefore, assumes that an optimal capital structure exists for every firm.

The direct implication of CoC emerges when an investor wants to value an investment, say an investment in a project. The CoC serves as the minimum rate of return that the investor wants to earn from that particular project. However, capital comprises both debt as well as equity. Thus, in order to determine the CoC, both the cost of debt (CoD) as well as the cost of equity (CoE) has to be calculated.

The cost of debt is calculated based on the interest obligation of a company. Interest rate calculation differs from company to company depending on their business and credit rating. Theoretically, interest

rate is the risk-free rate added to the risk premium that is adjusted to the default probability and recovery rate.

There are various methods for calculating the cost of equity. For instance, the dividend discount model can be used to calculate the cost of equity. However, this approach requires the estimation of the growth rate of future dividends, which can differ significantly from the actual growth rate achieved, leading to significant deviation in the calculated and observed results. Therefore, this study used the capital asset pricing model for the calculation of the cost of equity, which is described in the following section.

Another important aspect is the capital structure that the company uses while raising funds; this capital structure governs the CoC. The overall cost of capital or weighted average cost of capital (WACC) is the weighted average of the cost of debt and the cost of equity.

The primary objective of this study is to find out whether CoC can be established as a benchmark and to determine whether CoC along with its constituent component lines (CoE and CoD) behaves in a characteristic way during certain times of the economy. This paper attempts to study the different patterns these lines make and relate probable causes over a period of time (2001–2012). The Indian economy has gone through different phases during the last 12 years. The present study primarily examines whether the CoC along with CoD and CoE of the index and of the different segments has changed significantly or has exhibited immunity during these volatile times.

II. Methodology and Data

For our study, the fifty companies forming the Nifty Index were classified into two segments (cyclic or non-cyclic) depending on how their business is affected by the business cycle. The CoC line for financial institutions was computed separately to study their behaviour over the same period. Before delving into the methodology that is adopted for computing the cost of capital (CoC) of the stock index, it is necessary to understand the capital asset pricing formula (Treynor, 1961, 1962; Sharpe, 1964; Lintner, 1965a, 1965b; Mossin, 1966). This formula is used to find out the theoretical required rate of return of an asset.

This model takes into account the asset's sensitivity to non-diversifiable market risk represented by beta. It also requires the expected return on market. The formula is explained in detail in the subsequent sections.

The steps described below were carried out individually for each of the fifty companies that constitute the CNX Nifty 50 Index. The balance sheet of the companies was used to collect the necessary financial data. The cost of capital (CoC) of a particular company is the weighted average of the cost of the individual components of the capital structure, namely, debt and equity capital. The following steps were used to calculate the weighted average cost of capital (WACC).²

Step 1: Identifying the risk-free rate

An investor invests in any financial asset with the incentive to earn back some amount on his/her investment. This is known as the return on investment (ROI). The rate of ROI depends on how risk-bearing the financial asset is. The common notion holds that the riskier the financial asset, the higher is the rate of return. Risk-free rate of return is the return expected by an investor when he/she invests in any financial asset that theoretically has zero probability of default. Generally, return on government bonds, interest rates on fixed deposits for one year, 365-day T-Bills, and so on serve as a good proxy for the risk-free rate prevailing in the market. For the purpose of computation in the present study, risk-free rate was used as one of the inputs to the capital asset pricing formula. The one-year term deposit rate of the State Bank of India (SBI) was used as a proxy for the risk-free rate. Figure 1 shows how the SBI 1-year term deposit rate has fared since 1997.

Figure 1: SBI 1-year Term Deposit Rate

The SBI 1-year term deposit rate was around 10–11% in 1997. It gradually decreased until 2004 and reached 5.05%. Since 2004, it has increased (barring 2009 and 2010). The lower trend in 2009 and 2010 is co-relatable to the poor investment sentiments that prevailed during this period.

² Unless mentioned otherwise, all data was obtained from the Bloomberg Terminal.

Step 2: Calculating the beta value

A market portfolio is defined as the collection of all assets available for investment, such as stocks, gold, mutual funds, land, and so on. The stock market index was considered as a proxy for the market portfolio for the security analysis. Since it is a systematic factor that affects every stock in the market portfolio, there is bound to be some correlation of the stocks with the market index. This correlation is captured by the beta value, which also serves as input to the capital asset pricing formula. The daily beta value of a company from 1997 till date was captured from the Bloomberg Terminal and an average beta for the year was calculated. This process was repeated for all the 50 companies. Bloomberg defines beta as follows:

Beta measures the volatility of the stock price relative to the volatility in the market index. Beta is the percent change in the price of the stock given a 1% change in the market index. These beta values are unlevered using the company's Effective Tax Rate and Total Debt to Total Equity ratio.

Unlevered BETA = Linear Beta / [1 + (1-t) (D/E)]

where t = tax rate

D/E = Debt to Equity ratio

Both are used in their decimal form as opposed to percent values. This field requires a minimum of three data points for it to work.

Step 3: Calculating the return on market

The market rate of return is the return that an investor expects from an investment in a market portfolio. The annualized rate of return of the market over the years can be calculated in several ways. The following procedure was used in this study.

The daily closing price from 1 January, 1997 till date was taken and the logarithmic scale was used to get the daily rate of return. This is exemplified in Table 1.

Table 1: Sample calculation of daily rate of return

Date	Closing Price of Nifty Index	Daily Rate of Return = $\log\left(\frac{D2}{D1}\right)$
1 January, 1997	939.55	
2 January, 1997	927.05	-1.34%

Column 3 of Table 1 gives the daily rate of return for all the days under consideration. The average of this value provides the average daily rate of return; multiplying this with 365 yields the average yearly rate of return. The average rate of return (annual) was about 17.17% over the period 1997 to 1 October, 2012.

Step 4: Calculating the cost of equity capital

The cost of capital for equity can be calculated using the capital asset pricing model (CAPM). As per this model, a shareholder will expect a minimum return equal to the risk-free rate of investment plus an extra rate for bearing the equity risk (risk premium). The beta values of the company (calculated according to Step 2) were used to find the extra risk premium. The following CAPM formula was used to calculate the total cost of equity capital:

$$\text{Cost of Equity} = R_f + \beta \times (R_m - R_f)$$

where R_f = risk-free rate for the corresponding year; R_m = market return rate; and β = beta value of the company for the corresponding year.

Step 5: Calculating the cost of debt capital

The cost of debt capital is equivalent to the imputed interest that the company is liable to pay on account of its debt. While calculating the WaCC, this value is adjusted for the tax-deductibility of the interest expenses paid by the company. In this context, debt includes long- as well as short-term debts. The value

of the cost of debt (CoD) for each company was taken from the Bloomberg Terminal. Bloomberg defines CoD as follows:

Weighted average cost of debt for the security, calculated using government bond rates, a debt adjustment factor, and the proportions of short and long term debt to total debt. The debt adjustment factor represents the average yield above government bonds for a given rating class. The lower the rating, the higher the adjustment factor. The debt adjustment factor (AF) is only used when a company does not have a fair market curve (FMC). When a company does not have a credit rating, an assumed rate of 1.38 (the equivalent rate of a BBB+ Standard & Poor's long term currency issuer rating) is used. The exact calculation of the debt adjustment factor is a Bloomberg proprietary calculation.

$$\text{Cost of Debt} = [[(SD/TD) * (CS * AF)] + [(LD/TD) * (CL * AF)]] * [1-TR]$$

where:

SD = Short Term Debt

TD = Total Debt

CS = Pre-Tax Cost of Short Term Debt

AF = Debt Adjustment Factor

LD = Long Term Debt

CL = Pre-Tax Cost of Long Term Debt

TR = Effective Tax Rate

Step 6: Calculating the weighted average cost of capital for a security

The market values of the total debt and equity were used to calculate the capital structure and the proportion in which it is constituted. These proportions serve as the weights for each kind of capital that constitutes the capital structure. The following formula was used to calculate the weighted average cost of capital (WaCC) for a particular company:

$$WaCC = \frac{\text{Total Debt}}{\text{Total Capital}} \times K_d \times (1 - \text{Tax Rate}) + \frac{\text{Total Equity}}{\text{Total Capital}} \times K_e$$

where K_d = cost of debt; and K_e = cost of equity as calculated for the particular company using the CAPM. The values obtained from the Bloomberg Terminal were tax adjusted; therefore, the adjustment factor (1 – Tax Rate) was implicitly multiplied to the cost of debt.

For reasons of simplicity, total capital was assumed to be composed of total debt and total equity for all the companies. This assumption did not lead to any significant variation in the computation of the following ratio.

$$\frac{\text{Total Equity}}{\text{Total Capital}} = 1 - \frac{\text{Total Debt}}{\text{Total Capital}}$$

Step 7: Calculating the market cap

The market cap of the index on a yearly basis was calculated by aggregating the market capitalisation values of each of the companies³ forming the index.

Step 8: Computation of WaCC of the stock index

Depending on the availability of the values from the Bloomberg Terminal, the yearly weighted average cost of capital (WaCC) of each company was calculated from 1997 to 2012. The following formula was used for computation:

$$WaCC \text{ of the Stock Index}_y = \sum_i \text{Market Cap. of security}_i \times \frac{WaCC \text{ of Security}_i}{\text{Total Market Cap}_y}$$

where $WaCC \text{ of the Stock Index}_y$ = WaCC for the y^{th} year; i = individual security forming the stock index; and $WaCC \text{ of Security}_i$ = WaCC of security i for the y^{th} year.

An aggregate of the weighted values of the WaCC of the individual securities was taken to calculate the WaCC of the stock index. The weight in the above formula is given by the ratio of market cap of the company with respect to that of the index. This weight is assumed to give the corresponding contribution of a company's WaCC to the WaCC of the stock index.

A similar process was used to compute the cost of equity (CoE) of the stock index and the cost of debt (CoD) of the stock index on a yearly basis.

³ The market capitalisation values obtained from the Bloomberg Terminal were as per the last day of the financial year.

$$CoE \text{ of the Stock Index}_y = \sum_i \text{Market Cap. of security}_i \times \frac{CoE \text{ of Security}_i}{\text{Total Market Cap}_y}$$

where *CoE of the Stock Index_y* = CoE for the yth year; *i* = individual security forming the stock index; and *CoE of Security_i* = CoE of security *i* for the yth year.

$$CoD \text{ of the Stock Index}_y = \sum_i \text{Market Cap. of security}_i \times \frac{CoD \text{ of Security}_i}{\text{Total Market Cap}_y}$$

where *CoD of the Stock Index_y* = CoD for the yth year; *i* = individual security forming the stock index; and *CoD of Security_i* = CoD of security *i* for the yth year.

For calculating the CoE and CoD of the stock index, the ratio of market capitalisation of the security to the ratio of the market capitalisation of the index was assumed to give the security's contribution to the CoE/CoD of the stock index.

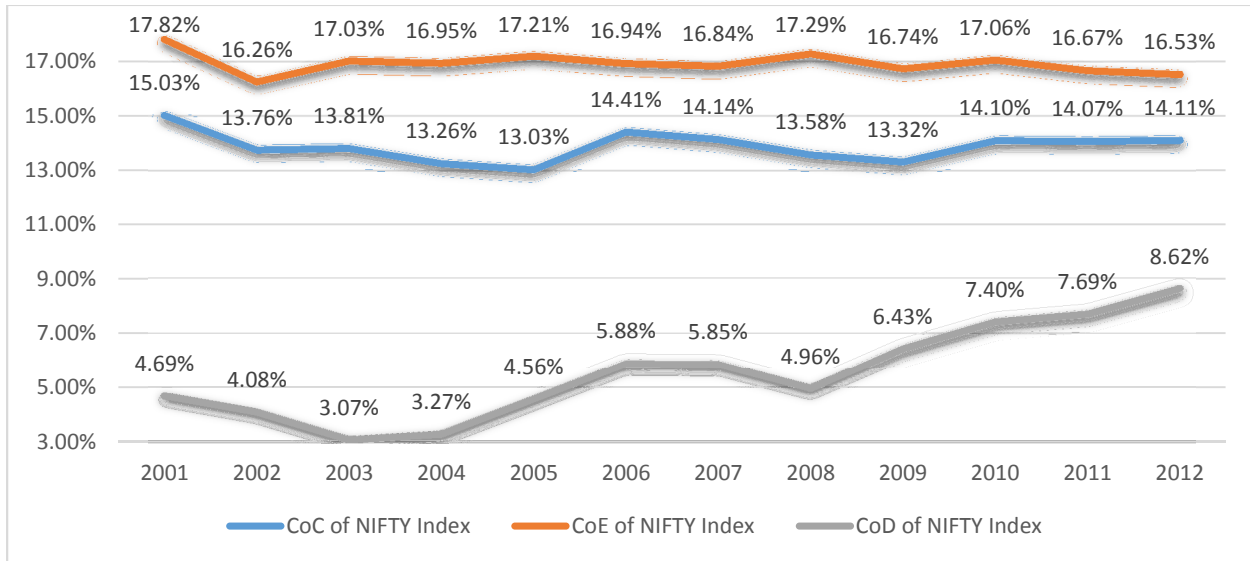
III. Results

Figure 2 plots the graph of the cost of debt (CoD), cost of equity (CoE), and the cost of capital (CoC) of the CNX Nifty 50 Index from 2001 to 2012. The proximity of the CoC (blue line) to the CoE (orange line) indicates the inclination of the capital structure of the companies towards equity financing even though it bears a higher opportunity cost. The CoE peaked at 17.82% in 2001 and dipped to 16.26% in 2002. The variation of CoE during this period was about 200 basis points. However, CoD was 3.07% in 2003 and peaked to 8.62% in 2012. The variation of CoD during this period was about 555 basis points. This huge variation reflects the volatility of interest rates in India over the last twelve years. A qualitative analysis of this variation could reveal the monetary policies adopted by the regulatory authority for controlling inflation, and thereby, its impact on the cost of debt financing.

Another immediate observation is that post the sub-prime crisis of 2008, the CoD gradually increased (Figure 2). This could indicate the tighter measures adopted by the regulator in the context of debt

financing, making it costlier than before. Costlier debt ensures tighter vigil on the utilisation of funds and better risk management measures.

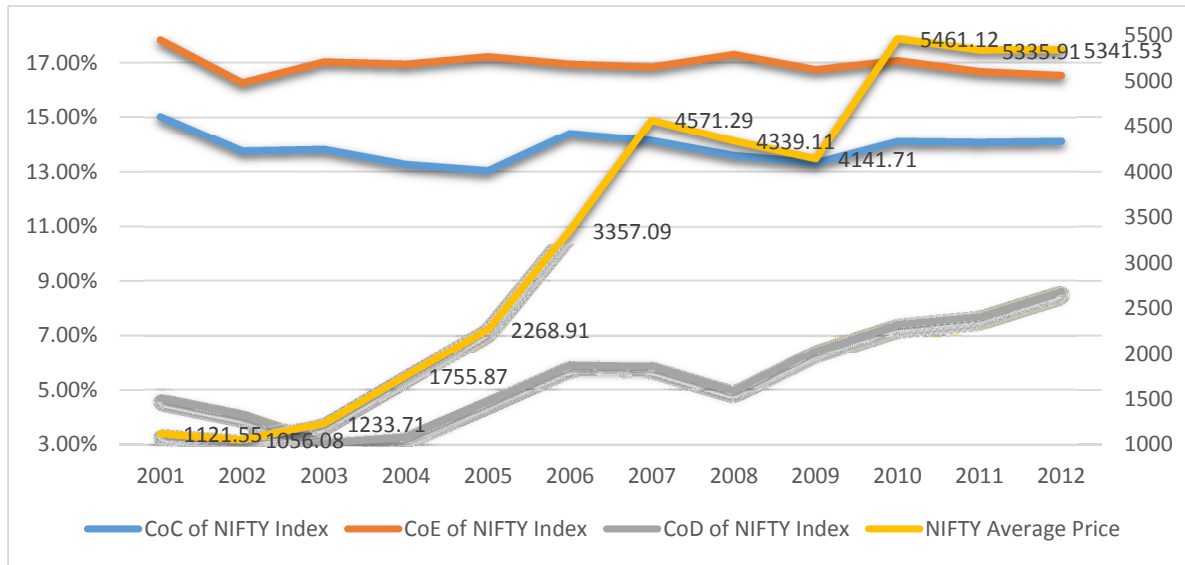
Figure 2: Trend lines of CoE, CoC, and CoD from 2001 to 2012



The trend lines for 2007–2008 in Figure 2 indicate that the CoE figures went up and CoD went down. The CoE went up by 45 basis points and the CoD went down by almost 89 basis points only during this period. This indicates that lucrative cheaper debt financing was available during this period. Moreover, the trend of the CoC line (blue line) followed the CoD line (grey line), signifying changes in the capital structure as well as the inclination of the companies towards debt financing during this particular period.

Another plot comparing the trend lines in Figure 2 with the Nifty Index was drawn (Figure 3). However, none of the three trend lines could be considered as an absolute proxy of the behaviour of the Nifty average price. The Nifty price increased significantly from 2003 to 2007. Subsequently, it suffered a fall until 2009 before picking up again. Its exponential momentum was checked, and since 2010, it exhibited a flat behaviour. The CoD line could be used to marginally predict the Nifty graph; however, it would fail if it were used to estimate the quantum of change. Thus, none of these three trend lines can serve as a perfect proxy in predicting the behaviour of the Nifty Index.

Figure 3: Line Graph Comparison of CoC, CoE, CoD, and Nifty Index



IV. Analysis of CoC of Companies Depending on Business Cycles

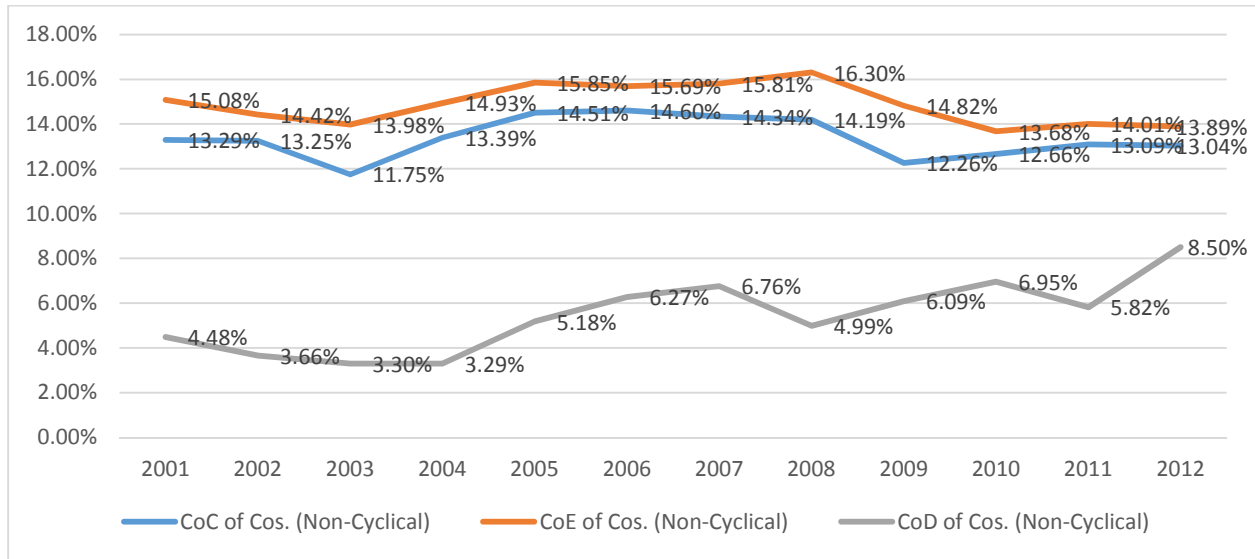
The trends exhibited by the risk-free rate show that it has changed significantly over the last 10 years; however, there has been no significant change in the cost of equity during this time. According to the CAPM, risk-free rate is an input to the calculation of the cost of equity. In order to compare the insignificance of CoE to the significant changes exhibited by the risk-free rate of market, a deeper analysis was required. All the companies forming the Nifty Index were categorised into two primary segments—one segment includes those companies that are affected by the business cycle (cyclical), and the other segment contains companies that are immune to business cycle effects (non-cyclical).⁴

A) Non-Cyclical Category: Companies categorised under the pharmaceutical sector, power sector, and the fast-moving consumer goods (FMCG) sector were observed to be relatively immune to business cycle changes of the economy. As a result, the Nifty companies falling under these sectors were included

⁴ Appendix 1 provides the list of companies classified into these two segments.

in this category. Figure 4 presents the CoC, CoE, and CoD of such non-cyclical companies over the last 12 years.

Figure 4: CoC, CoD, and CoE of Non-Cyclical Companies

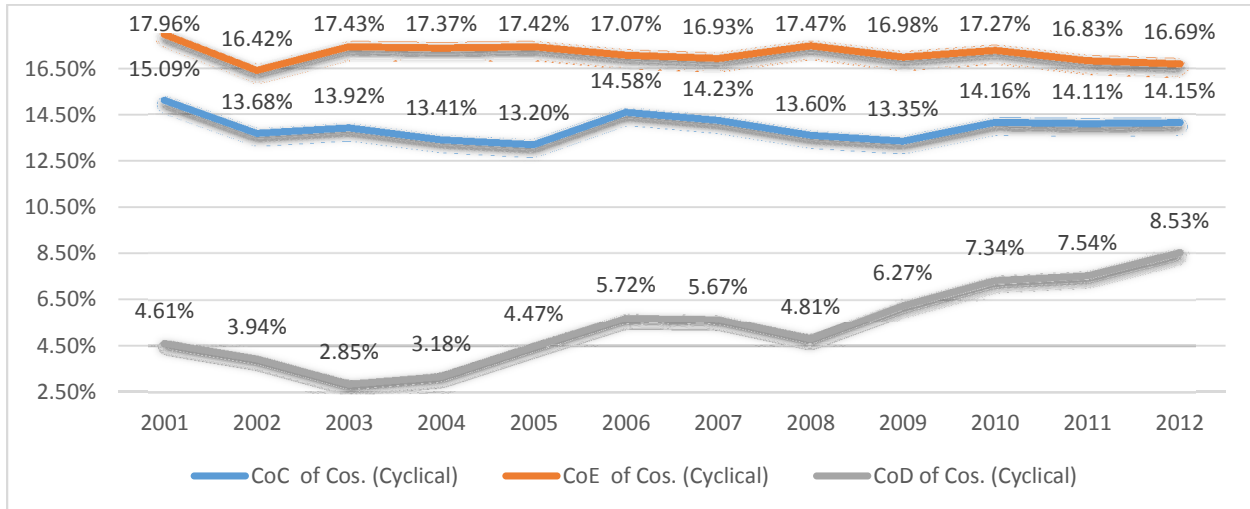


As shown by the graph in Figure 4, the CoD figures of the non-cyclical companies were very low. For most of these companies, the debt financing contribution to the capital structure was very low (zero at times). As a result, the cost of capital follows the cost of equity line. However, as the number of companies was very less, a significant conclusion could not be drawn from the trend lines.

B) Cyclical Category: Companies that are heavily affected by the state of the economy fall under this category. The CoC, CoD, and CoE trend lines of the companies falling under this segment were studied. The graph in Figure 5 shows how the trend lines fared over time.

The graph in Figure 5 significantly resembles the graph in Figure 2 (for all the companies). This is because 40 of the 50 companies fall under this category, which shows the dominance of the cyclical companies in the stock index.

Figure 5: CoC, CoD, and CoE of Cyclical Companies

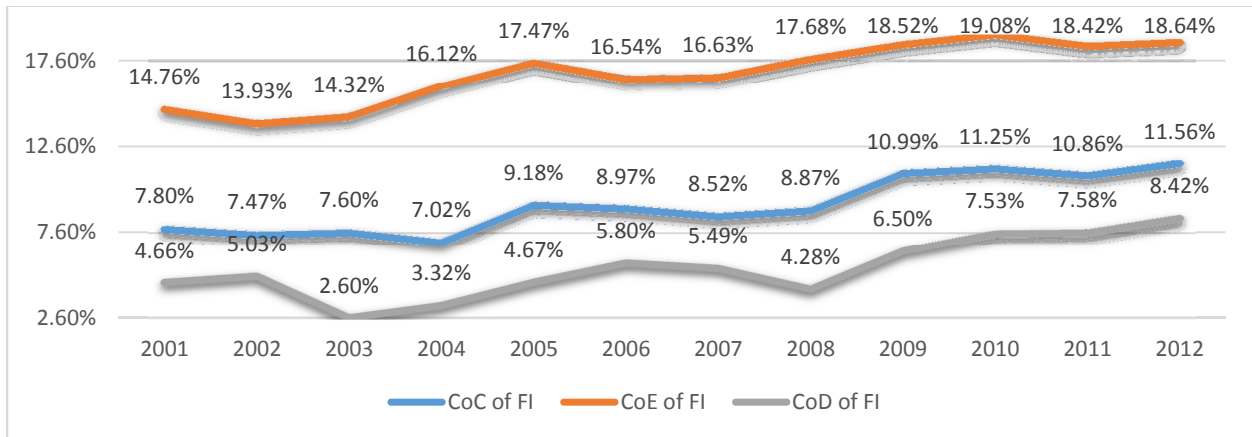


As was observed before, there is a significant climb in the cost of debt line post 2008. This could be attributed to the stronger measures taken by the regulator post the sub-prime crisis, by making debt financing costly. Such companies are vulnerable because there is a significant amount of debt financing; the obligation to pay interest adds to the vulnerability of the company.

C) Financial Institutions: The CoD, CoE, CoC trends were computed to see the effect of business cycles on financial institutions. Barring a few companies, most of the companies under this category are banking institutions. The graph in Figure 6 shows the CoC, CoD, and CoE of financial institutions.

The graph in Figure 6 shows that financial institutions, especially banks, are heavily dependent on debt as a source of capital for doing business. This debt is the demand and time liability that a bank has, as an obligation to repay to its customers. Unlike all the other graphs, the CoC line's proximity towards the CoD line proves this point. The recession in 2008 proved a bad year for investments and business. In order to promote business and encourage investments, banks reduced the deposit rates. The dip in the grey line in 2008 is a testimony to this fact. With business gradually picking up later, the deposit rates increased; hence, the grey line shows an upward trend.

Fig 6: CoC, CoD, and CoE of Financial Institutions

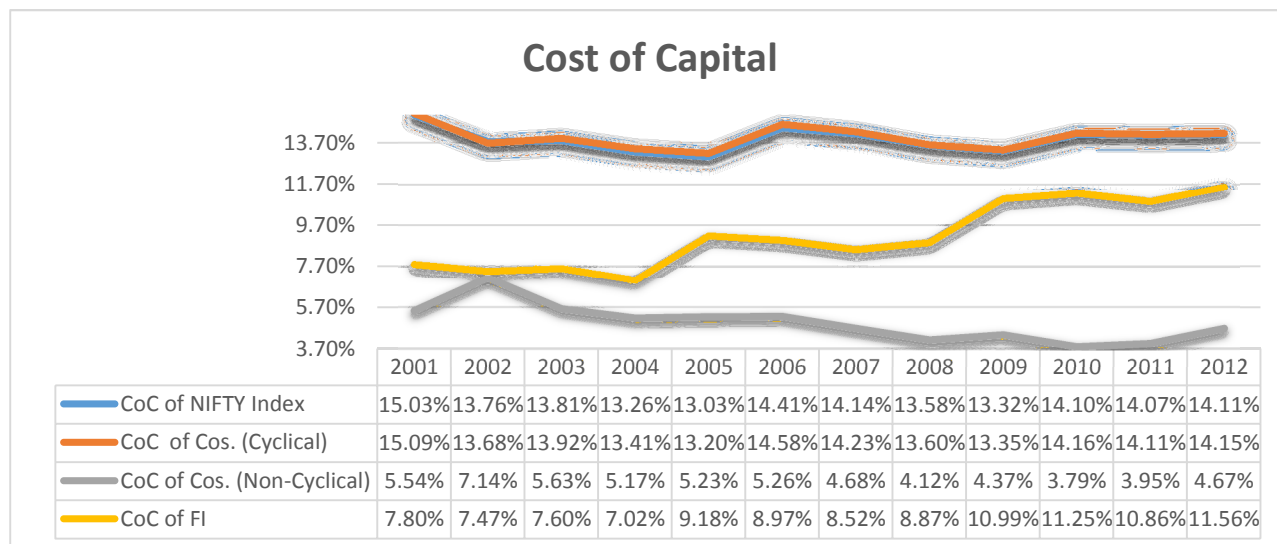


V. Consolidated Results

Cost of Capital

The graph in Figure 7 depicts the overall cost of capital (CoC) of the Nifty Index against the CoC of different companies as per the segments that were discussed earlier. The near overlap of the CoC of the Index with the CoC of cyclical companies can be explained by the fact that most of the companies forming the Nifty Index are cyclical in nature. The CoC for financial institutions was much lower than the overall CoC. However, the trend shows that it increased in value over the last six years. The CoC of non-cyclical companies remained at 3–4% throughout and exhibited a much flatter structure compared to the other CoC trends.

Figure 7: Overall CoC vs. CoC across various Segments



Cost of Equity

Figure 8 shows the graph for the cost of equity (CoE). The CoE for the cyclical companies was very close to the overall CoE. One significant observation from this graph is that the CoE for financial institutions increased and was higher than the overall CoE since 2007–2008. The risk management measures adopted by banking institutions could be a possible explanation for this trend. The CoE for non-cyclical companies hovered around 3–5% during this period.

Cost of Debt

Figure 9 shows that except on a few occasions, the CoD trends of cyclical companies, financial institutions, and the overall CoD of the Nifty Index were similar in nature. They showed a positive gradient from 2003 to 2006 with a dip until 2008, and subsequently increased at a higher gradient until 2012. Although the CoD trend for non-cyclical companies followed a similar pattern, it hovered around the 1–3% mark.

Figure 8: Overall CoE vs. CoE across various Segments

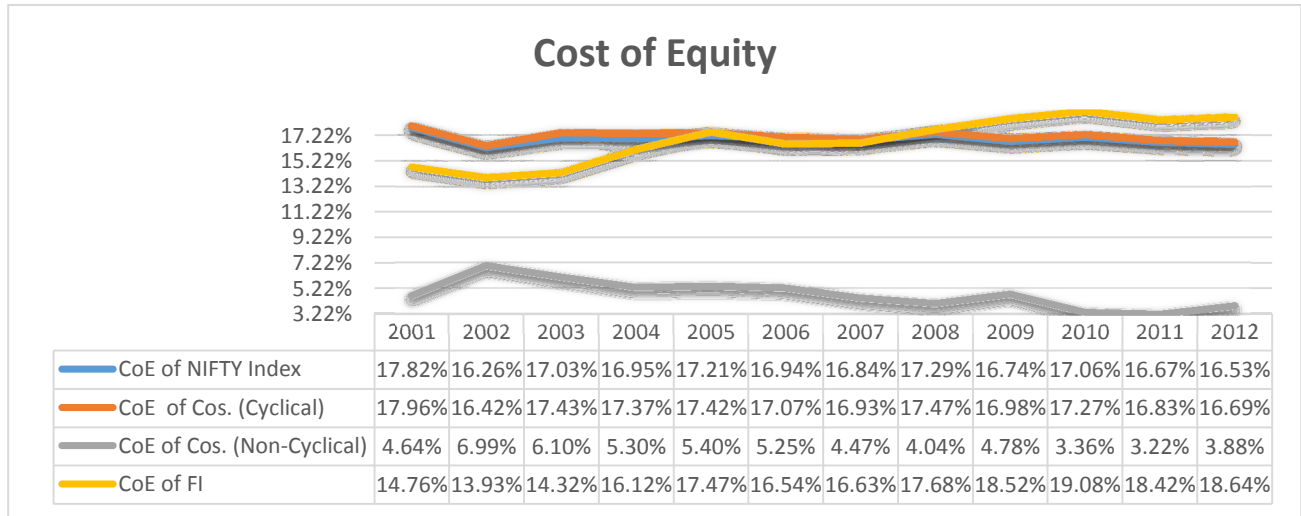
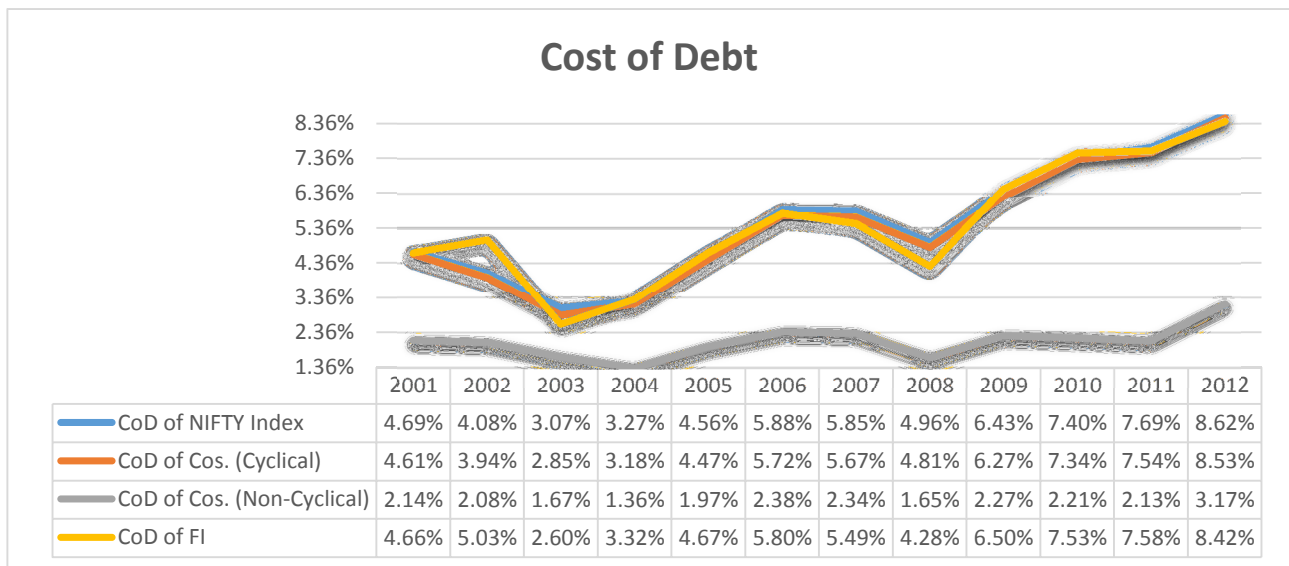


Figure 9: Overall CoD vs. CoD across various Segments



VI. Conclusion

This paper examined the different behavioural characteristics of cost of capital (CoC), cost of debt (CoD), and cost of equity (CoE) lines over the last 12 years (2001–2012). The analysis showed how these lines fared during the recessionary phase. Companies that fall under the different segments as classified in this paper exhibited different behavioural trends in terms of CoC, CoD, and CoE lines. The average CoC for the Nifty Index stood at 13.88% over the last 12 years. The average CoE was about 16.95% and the average CoD was about 5.54%. These figures could act as a vital benchmark for investors willing to invest in the Indian economy.

These values (observed or computed) can serve as an important benchmark for an investor who is new to the Indian market. These values can be used to price his/her debt or equity. Keeping the overall weighted average cost of capital (WaCC) in mind, he/she can also proportion and organise his/her capital structure (debt and equity) to attain the desired level of WaCC for his/her company, which can be in close proximity to the overall WaCC of the stock index or the particular sector that his/her company falls under.

Although none of the CoC, CoD, or CoE lines could serve as a standalone proxy for the economic performance of the country, the companies falling under different categories showed significant characteristics in terms of these lines. These behavioural patterns were in a way characteristic to the companies falling under the same segment. This provides insight about how the CoC, CoD, and CoE of companies behaved in a particular segment and at a particular time of the economy. Such data could serve as a crucial benchmark for new investors in designing their capital structure in an optimum way, and could also give them a view of their capital costs in the event of a change in the economic performance of the country.

The CoC for a company varies across firms and industry depending on the nature of business, firm size, and so on. The basic objective of this paper was to derive an overall benchmark for the Index to serve as a point of reference. The aim was not to figure out the exact capital structure that a company should aim at.

Further research is required to arrive at suitable industry- or segment-specific factor adjustments to compute a more appropriate CoC and the desired capital structure for particular companies.

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Appendix I

For the purpose of this study, the companies that form the Nifty Index were categorised into different segments.

A) Companies that are affected by business cycle (Cyclical)

ACC Ltd.	DLF Ltd.	Infrastructure Development Finance Co. Ltd.	Sesa Goa Ltd.
Ambuja Cements Ltd.	GAIL (India) Ltd.	Jaiprakash Associates Ltd.	Siemens Ltd.
Asian Paints Ltd.	Grasim Industries Ltd.	Jindal Steel & Power Ltd.	State Bank of India
Axis Bank Ltd.	HCL Technologies Ltd.	Kotak Mahindra Bank Ltd.	Steel Authority of India Ltd.
Bajaj Auto Ltd.	HDFC Bank Ltd.	Larsen & Toubro Ltd.	Sterlite Industries (India) Ltd.
Bank of Baroda	Hero MotoCorp Ltd.	Mahindra & Mahindra Ltd.	Tata Consultancy Services Ltd.
Bharat Heavy Electricals Ltd.	Hindalco Industries Ltd.	Maruti Suzuki India Ltd.	Tata Motors Ltd.
Bharti Airtel Ltd.	Housing Development Finance Corporation Ltd.	Punjab National Bank	Tata Power Co. Ltd.
Cairn India Ltd.	ICICI Bank Ltd.	Reliance Industries Ltd.	Tata Steel Ltd.
Coal India Ltd.	Infosys Ltd.	Reliance Infrastructure Ltd.	Wipro Ltd.

B) Companies that are immune to business cycle (Non-Cyclical)

Bharat Petroleum Corporation Ltd.	NTPC Ltd.
Cipla Ltd.	Oil & Natural Gas Corporation Ltd.
Dr. Reddy's Laboratories Ltd.	Power Grid Corporation of India Ltd.
Hindustan Unilever Ltd.	Ranbaxy Laboratories Ltd.
ITC Ltd.	Sun Pharmaceutical Industries Ltd.

C) Companies categorised as financial institutions

Axis Bank Ltd.
Bank of Baroda
HDFC Bank Ltd.
Housing Development Finance Corporation Ltd.
ICICI Bank Ltd.
Infrastructure Development Finance Co. Ltd.
Kotak Mahindra Bank Ltd.
Punjab National Bank
State Bank of India