IDENTIFYING DRIVERS OF SHORT RUN UNDERPRICING IN INFRASTRUCTURE SECTOR IPO'S IN INDIA

By

ABHISHEK SINHA
SAP ID - 500043121

SCHOOL OF BUSINESS

DEPARTMENT OF ENERGY MANAGEMENT

SUBMITTED

IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE DEGREE OF DOCTOR OF PHILOSOPHY

TO

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN
DECEMBER 2018

UNDER THE GUIDANCE OF

INTERNAL GUIDE
DR. ANKUR MITTAL, ASSOCIATE PROFESSOR
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DR. K NARENDRANATH MENON, PROFESSOR
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This is to certify that the thesis on "Identifying Drivers of Short Run Underpricing in Infrastructure Sector IPOs in India" by Abhishek Sinha in partial completion of the requirements for the award of the Degree of Doctor of Philosophy (Management) is an original work carried out by him under my supervision and guidance.

It is certified that the work has not been submitted anywhere else for the award of any other diploma or degree of this or any other University.

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DECLARATION

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text."

Abhishek Sinha

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ACKNOWLEDGEMENTS

I am extremely grateful to my supervisors, Dr. Ankur Mittal, and Dr. Narendranath Menon, for being my friend, philosopher, and guide during the whole journey.

Very special thanks to UPES, Dehradun for giving me the opportunity to carry out my doctoral research. My sincere gratitude is reserved for Dr. T. Joji Rao, Associate Professor, UPES for his invaluable insights and suggestions. I really appreciate his willingness to meet me at short notice every time and review the several drafts I submitted. I would also like to thank the FRC members for their valuable suggestions. I would also like to thank the external examiners for their constructive criticism that added value to the research.

I would like to thank all my colleagues at Vignana Jyothi Institute of Management for providing me with the moral and intellectual support that proved to be a lifeline for me during the whole journey. I would also like to take this opportunity to thank Dr. Ch. Durga Prasad, Director, Vignana Jyothi Institute of Management for tolerating the idiosyncrasy of a researcher going through the troughs and crests of the process. If it was not for his encouragement, I would not have made it.

Words cannot express the feelings I have for my mother, my sister and my in-laws for their constant unconditional support. My father's thoughts and ideology were the main guiding force in this journey. I would like to acknowledge the most important persons in my life – my wife Smita and my son Aadi. My wife has been a constant source of strength and inspiration. There were times during the past four years when everything seemed hopeless and I didn't believe the thesis would see its logical end. I can honestly say that it was only her determination and constant encouragement that ultimately made it possible for me to see this project through to the end.

Finally, I would like to dedicate this thesis to Ashish Sinha and Ajit Sinha my brothers with whom I learned to dream. Even though they are no more they will always live in all my aspirations and achievements.

EXECUTIVE SUMMARY

The infrastructure sector determines the growth of the economy. In India, the present government is laying emphasis on improving infrastructure both in urban and rural areas. The government aims at increasing the number of smart cities in urban areas, whereas in rural areas the government aims at creating more hospitals and schools. However, this requires huge funding. The government alone would not be able to fund the projects. The private-public participation seems to be a solution to the problem. The private firms primarily use two sources of funding - debt and equity.

With debt drying up in India due to increasing non-performing assets (NPAs), equity has become an important source of funding. However, equity investing globally suffers from the problem of underpricing. The promoter who is raising the money and is selling his stakes, is not able to maximize his returns, as the stock markets increase by 25%-30% on the first day of trading. Thus, the benefit is transferred to the individual who buys the stock in the primary market and sells it in the secondary market in the short run. This could dissuade the promoter from raising funds from stock markets. Moreover, the level of underpricing is sector specific and country specific, Hence, there is a need to identify the drivers of underpricing in India in the infrastructure sector.

Studies on underpricing date back to the 1970s and there are no dearth of data and research on underpricing globally. However, the causes of underpricing have not been conclusively determined. Moreover, there are very few studies on underpricing in infrastructure sector IPOs globally. None of these studies look at the impact of macroeconomic and fundamental variables.

The researcher has first identified those variables that play an important role in determining the levels of underpricing through secondary research by conducting

an exhaustive literature review. Furthermore, none of the research has vetted the variables from industry experts. As this industry is unique and has a higher level of risk the opinion of industry experts, does make a difference.

Fundamental variables and macroeconomic variables are ignored in existing studies in infrastructure sector IPOs. However, there is a lot of importance of fundamental and macroeconomic variables in the case of the infrastructure sector. This sector is unique in terms of huge capital requirement and the long gestation period of projects. The growth of the infrastructure sector is dependent on the growth of the economy of the country.

In this research, the researcher has combined agency problem approach with the fundamental and macroeconomic approach to identify drivers of underpricing. The agency problem approach looks at the agency relationship between the underwriter and the promoter as the cause of underpricing. On the other hand, macroeconomic and fundamental approach attributes macroeconomic and fundamental variables for underpricing.

Firstly, the variables which impact underpricing were identified from existing literature. After the variables were identified the researcher has conducted an expert opinion by contacting ten industry experts to vet the significance of the variables that had been identified. This approach has been followed because the sector is unique and the total numbers of variables that can impact the stock markets are numerous. The challenge faced here is to ensure both parsimony and completeness of the model. The experts have then added two variables and removed one variable to make the model robust.

The data for this research consists of stocks listed in both the NSE and BSE in the period 2003 to April 2015. There are 401 companies whose data is available on the Prime Database. Out of the 401 companies, 179 are infrastructure companies. To understand the uniqueness of the sector, the researcher has first

identified the level of underpricing in all sectors, followed by underpricing in the infrastructure sector specifically.

Three approaches to identifying drivers for underpricing that were adopted are Multivariate regression after BoxCox Transformation, Principal Component Analysis followed by Stepwise Regression and Advance Neural Network (ANN). In multivariate regression after BoxCox Transformation, it was found that all variables do not contribute to the study. Advanced Neural Network (ANN) produced a very low r-square and hence could not be used to arrive at the conclusion. Therefore, the most reliable results were produced through Principal Component Analysis followed by Stepwise Regression as multicollinearity was removed and the principle of parsimony was also followed.

Based on the empirical study carried in Chapter 4 the researcher has identified 5 variables that impact the underpricing of IPO in India. The period for the study is from April 2003 to 2015.

Following are the variables which have been identified as drivers for all sectors:

a. Nifty Price movement - indicates percentage change in Nifty from the date of issue of IPO to the listing date. This driver can be interpreted as an indicator of market sentiments.

b. Macro-Economic Factors - consists of following variables that have been bundled up together during Principal Component Analysis (PCA) - Forex reserves, Nifty, M1, M2-M1, M3-M2, and M4 -M3 highlighting that money supply at the time of issue strongly influences the underpricing of IPO.

c. Nifty P/E - is another key driver in indicating the underpricing of an IPO. Nifty P/E also captures the sentiments of the market. Nifty P/E necessarily captures the price that an investor is ready to pay for the index. A higher Nifty P/E at the date of listing leads to higher level of underpricing.

d. Core Infrastructure - A positive coefficient indicates that companies in core infrastructure sector are highly underpriced compared to other infrastructure sectors as well as non-infrastructure sectors. This can be attributed to the factor that most of these companies have higher visibility in their revenue.

e. Issue Size - It indicates the influence of the size of the issue on the underpricing of the IPO. When the issue size is larger, the level of information on the stock is more as there are more analysts covering the stock and thus it leads to a lower level of underpricing.

On the other hand, the following are the drivers of underpricing of the infrastructure sector:

1. The Duration of Opening and Closing of Issue and Time Gap between Issue and Listing

The duration between the opening and closing of the issue and time gap between issue and listing determines the period for which the money of the investor would be locked with the primary issuer. This implies that the investor would not be getting any return on the investment for the given period.

2. M1 and Change in Money Supply

Money supply determines liquidity in the market. For a stock market, liquidity at the time of issue of stocks is an important driver for determining the level of underpricing. They impact underpricing negatively; a buoyant economy may lead to promoters and underwriters over-valuing the stocks due to a higher level of confidence leading to lower underpricing.

3. Nifty Value

Nifty 50 refers to the index which captures the movement of stocks listed on National Stock Exchange (NSE), Mumbai. High levels of Nifty 50 leads to hot periods.

4. Total Asset

It refers to the balance sheet size of the company. Furthermore, it is an indication of how capital intensive the industry is. In the case of the infrastructure sector, capital expenditure is high.

5. Asset Turnover

Total asset turnover is an important fundamental factor which identifies the efficiency of utilization of asset vis-a-vis the total revenue that the company earns. For a capital-intensive industry such as the infrastructure sector, the demand for the stock increases when the company utilizes its assets better.

6. Offer Price

Offer price refers to the price at which the stock is offered to the investors who subscribe for the stock. Higher offer price leads to lower level of underpricing due to the possibility to split the stock in the future.

7. Core Infrastructure Versus Non-core Infrastructure Versus Economic drivers

The level of underpricing in the sub-segments of the infrastructure sector is gauged by using dummy variables and it can be concluded that non-core infrastructure witnesses' lower level of underpricing compared to the other two sub-segments.

8. FV Rs. 5, FV Rs. 10

Face value is the nominal value of shares. The lower the face value, lesser is the chance of splitting the shares in the future. Hence, it is observed that shares with lower face value lead to a lower level of underpricing, due to lower levels of latent supply.

9. Nifty Returns from Date of Issue to the Date of Listing; Nifty Returns from the Date of Opening to Closing Date

It indicates whether the stock markets are enjoying a hot period or cold period. If the stock markets are enjoying a hot period, the markets would see higher underpricing. On the other hand, if the markets are going through a cold period it would see a lower level of underpricing.

10. Issue Size - Indicates the influence of the size of the issue on the underpricing of the IPO. When the issue size is larger, the level of information on the stock is more, as there are more analysts covering the stock and thus it leads to a lower level of underpricing.

The contribution of the study to the existing literature is as follows:

1. It has identified infrastructure sector specific fundamental variables (total asset and assets turnover) impact on underpricing.

2. It determines the significance of underpricing among the sub-sectors of infrastructure and hence lays down the ground for further study on underpricing in the infrastructure sector.

3. The study determines empirically that the size of the company matters more than the profitability as a determinant of underpricing of the stocks for the infrastructure sector at the time of IPO listing in the short run.

4. The study has established the impact of macroeconomic variables such as money supply impact on IPO underpricing in India in the short run.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO THE STUDY

This section introduces the study and aims to emphasize the importance and significance of this research. Furthermore, it outlines the approach used by the researcher to carry out the research.

The Indian GDP was growing at a rate of 7.6% as of June 2016, making India one of the fastest growing economies in the world [3]. Its economy is one of the largest contributors to global growth over the last decade, accounting for about one-tenth of the pecuniary activity since 2005, while GDP per capita in purchasing power parity (PPP) terms in March 2017 is three times as high as it was in the financial year 2000 [2].

To sustain the growth level, the government needs to attract foreign investments. Infrastructural facilities are one of the major bottlenecks in India when it comes to attracting foreign investment according to the Economic Survey 2015. In May 2015, the total funding to the infrastructure sector by the government had dropped by 12% in India.

As institutional lenders such as banks and non-banking financial companies have a high exposure to stressed assets and with the Indian government not having enough funds to meet the burgeoning infrastructural needs, equity markets are an important source of raising money.

Traditionally, primary equity markets tend to face a unique phenomenon across the globe. On the day of listing, a stock might see a return of 20% - 30%. In other words, the promoters of the stock are unable to maximize their returns as they end up leaving money on the table even though they are party to fixing the issue price of these stocks and could have earned the additional 20% - 30%. This is known as underpricing in the short run [66].

There is an indirect cost in terms of underpricing of stocks. Companies that fix the price should ideally avoid underpricing the issue as the main objective of corporate finance is to maximize the wealth of the investor and underpricing prevents investors from maximizing their wealth.

The basic assumption on which assets are priced is known as “the law of one price”. The theory behind this law states that every asset has only one true price and it assumes that the market price will converge with the true price sooner or later. This price is equivalent to the intrinsic value of the asset that is being valued [25].

One of the obvious anomalies in pricing is the Initial Public Offer (IPO) pricing. The basic framework for fixing the IPO price is determined by the issuer in consultation with the investment banker. However, even though they have more information than the investors in the primary market, the price on the day of listing is more than the price that the promoters get for the shares that they have divested.

The question, therefore, arises as to why the promoters and the private equity investors are unable, or unwilling to maximize their returns, at the time of issue of the IPO itself, rather than lose 20% - 30% due to underpricing of the primary issue.

Financial theory is based on the belief that the law of one price holds good [25]. The basic premise for this assumption is that all the investors are fully rational optimizing investors [27]. Therefore, it can be assumed that there must be specific reasons that seem to be making the investors irrational.

1.2 OUTLINE OF THE STUDY

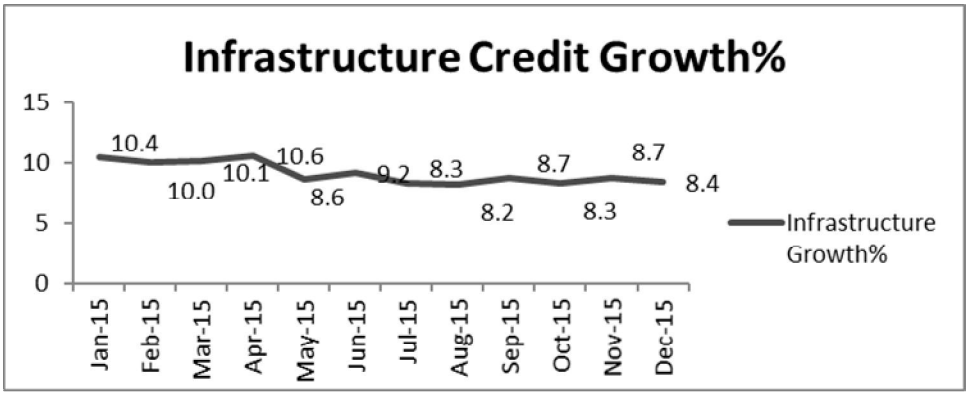
Chapter 1 introduces the study, defines the business problem and states the research objective and approach adopted to attain research objectives. It furthermore states the need for the study and contribution of the study to existing literature. Chapter 2 entails the definition of the infrastructural sector and the sub-sectors. It also gives a brief overview of the sub-sectors. It captures the financing needs and compares in detail the sources of financing available for the infrastructure sector. It also outlines an overview of the financial markets. Chapter 3 gives a detailed literature review on infrastructure financing and underpricing both in global and Indian contexts. The chapter further identifies the research gap. The research methodology is detailed in chapter 4. The data analysis and interpretation are captured in Chapter 5. Chapter 6 elaborates the findings, conclusions, limitations, suggestions along with scope for further study.

1.3 NEED FOR THE STUDY

The infrastructure sector has traditionally sustained financially through government funding. Furthermore, the Indian government has announced that it would spend Rs. 2.21 lakh crore for infrastructural development, during the financial year 2015- 16, which in most likelihood might be insufficient to meet the infrastructural need [9].

With central and state governments, being unable to support the funding of infrastructure by themselves, the dependence on the private sector has increased

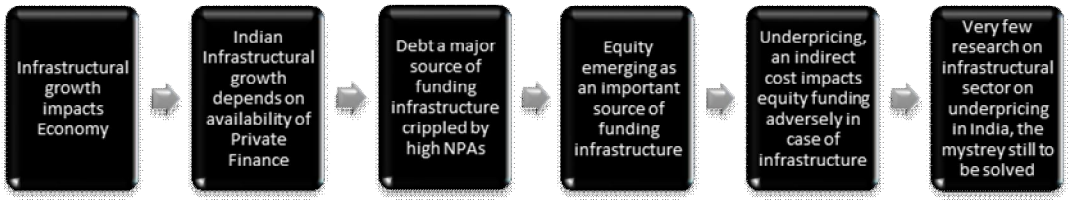
over the years. On one hand, the infrastructural growth in India is slow, while on the other hand, the percentage of abandoned projects is high. This increases the risk of investing in this sector, which is already a highly risky sector with a long gestation period, making it less attractive for lenders.



Source: CMIE

Fig. 1.1: Infrastructural Credit Growth %

As can be seen in Figure 1.1, growth in loans to the infrastructure sector has declined from 10.4% in January 2015 to 8.4% in December 2015 in India. On the other hand, the funding needs of the infrastructure sector have increased manifold [9]. It is estimated that emerging markets and low-income countries face a gap of up to $1.5 trillion dollars a year in infrastructure finance as deficits. This has led to equity emerging as an important source of funding. Equity listings in primary markets suffer from underpricing. The need for research can be deduced from Figure 1.2.



Source: Researcher

Fig. 1.2: Need for Research

IPO Underpricing is one of the most highly researched areas in the field of pricing and valuations. However, the problem is far from being solved. Researchers have used various existing theories such as agency problem, information asymmetry, and signaling, theory to try and unravel the mystery. As the previous theories have not been able to identify the causes of underpricing, it is important to develop a combined theory that can help build a model to solve the underpricing riddle [118].

The infrastructure sector is unique in many ways. It is linked with the economic growth of the country. The fundamental variables for the sector also play a crucial role as the sector is capital intensive.

Underpricing challenges the one price theory as it leads to mis-valuation of infrastructure sector stocks at the time of listing in the stock markets. Hence research on the same is required to promote equity investment in infrastructure sector in India to increase market efficiency and reinforce the faith of early-stage investors and promoters.

The change in the fundraising environment has led to more emphasis on equity funding. The money left on the table syndrome prevents wealth maximization of promoters and early-stage investors, therefore, further research is required.

Sector-specific fundamentals also play an important role in determining the level of underpricing [99]. For a sector, such as an infrastructure sector, macroeconomic variables play a critical role as the infrastructure policies of the government is contingent on its regulatory policies.

The agency problem approach has not been able to solve the underpricing problem. Hence, it is important to combine it with the fundamental and macroeconomic approach to unravel the underpricing mystery. The reasons for combining fundamental and macroeconomic approach in the study are:

- Macro-Economic Variables play an important role in determining the level of infrastructural development. It should be noted that infrastructural development attracts huge government funding.
- Furthermore, the sector is different from other sectors as it is capital intensive and balance sheet size and asset turnover ratios become important indicators of the performance of the company.

1.4 BUSINESS PROBLEM STATEMENT

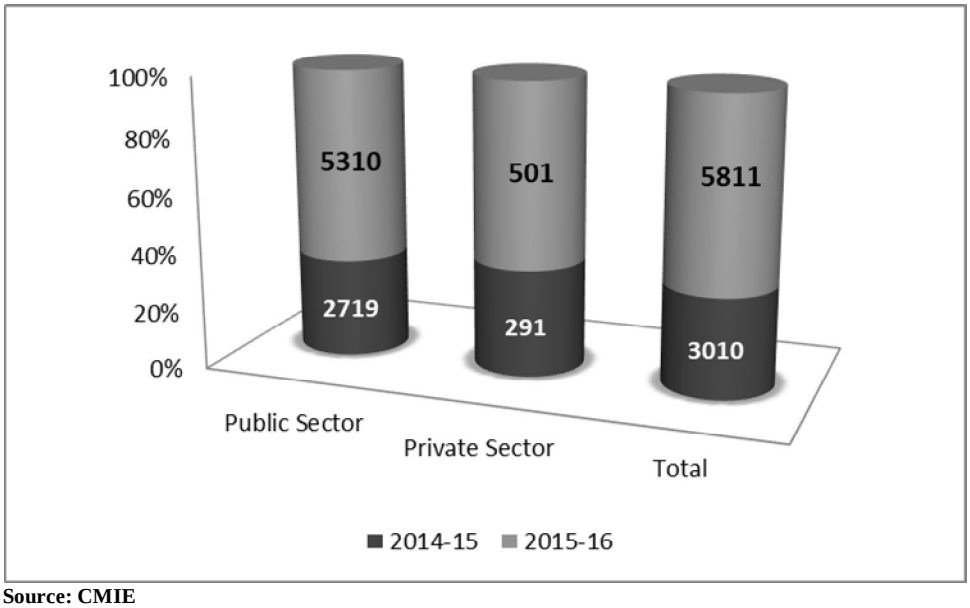
"The infrastructure sector in India is facing underpricing in the short run at the time of listing in the stock markets, which is leading to losses in terms of wealth maximization."

BUSINESS PROBLEM

On an average 30% of the existing shares of the promoters were divested at the time of IPO for the period 2003 - April 2015 for infrastructure sector stocks. The wealth loss of promoters and private equity players who were looking to exit because of underpricing is estimated to be an average amount of Rs. 110 Cr. for promoters and private equity investors in the same period based on data collated by the researcher from Prime Database.

The report by the World Bank [2] identifies that the governments of emerging countries along with private sector players required more than $830 billion for the period 2014-2020 for new projects. India spent 5% of its GDP on infrastructure during FY 2012 however it must achieve a targeted expenditure of 10% on GDP to reach a targeted GDP growth rate of 10%. To achieve targeted growth, India requires at least Rs 31 trillion as capital expenditure on infrastructure growth in the period 2016-2021 [10].

According to CMIE, in FY 2015- 2016, India Inc. was highly dependent on debts as it accounted for more than four-fifths of the total funding. However, the level of stress due to bad debts was also increasing in the banking system. Figure 1.3 captures the level of stressed assets in Rs. Lakh Crores for the banking sector in 2014-15 and 2015-16.



Source: CMIE

Fig. 1.3: Stress Level in Banks (In Rs. Lakh Cr.)

Hence, companies would now have to look at equity as a fund-raising tool. The problem which companies face globally is that they are not able to maximize the funds raised through IPOs.

1.5 RESEARCH PROBLEM STATEMENT

Underpricing in infrastructure sector stocks leads to implicit cost, in form of wealth erosion for promoters and private investors, looking for an exit due to mis-valuation and the cause of the same needs to be investigated.

1.6 RESEARCH QUESTIONS

Research questions which help define the research objectives and lays down the framework for research are as follows:

1.6.1 Research Question 1

What makes infrastructure development important and what are the modes of financing the infrastructure sector?

1.6.2 Research Question 2

What has the performance of IPOs been in the short run across countries and across time?

1.6.3 Research Question 3

What are the drivers of aggregate underpricing in stock markets in the short run across sectors?

1.6.4 Research Question 4

What are the drivers of underpricing in the short run in stock markets specifically for infrastructure sector leading to loss of wealth for private equity investors and promoters leading to mis-valuation?

1.6.5 Research Question 5

What are the steps promoters and initial stage investors may take to reduce the level of underpricing?

1.7 RESEARCH OBJECTIVES

Research objectives that have been derived from the research questions are as follows:

1.7.1 Research Objective 1

To develop an understanding of the infrastructure sector and evaluate various sources of financing the infrastructure sector.

1.7.2 Research Objective 2

To critically examine the performance of IPOs in the short run across countries and across time.

1.7.3 Research Objective 3

To identify drivers of aggregate underpricing in India across sectors in the short run.

1.7.4 Research Objective 4

To identify drivers specifically of underpricing of infrastructure sector stocks in India, leading to a loss of wealth for private equity investors and promoters due to mis-valuation.

1.7.5 Research Objective 5

To suggest methods for improving wealth maximization by reducing underpricing of promoters and initial stage investors.

1.8 APPROACHES TO RESEARCH OBJECTIVES

Following are the approaches that have been followed for the research objectives stated in section 1.7.

RESEARCH OBJECTIVE 1 – To Develop an Understanding of the Infrastructure Sector and Evaluate Various Sources of Financing the infrastructure Sector.

For Objective 1, an exhaustive literature review was conducted to develop an understanding of the infrastructure sector. Furthermore, deep understanding of modes of financing the infrastructure sector and the pros and cons of each of the different sources of financing were compared. Literature review on the infrastructure sector, its definitions, its impact on the economy and inequality was reviewed thoroughly. Furthermore, the extant literature on the financing of infrastructure was also reviewed. The same has been detailed in chapter 2 and chapter 3 (3.2 -3.6).

RESEARCH OBJECTIVE 2 - To Examine the Performance of IPOs in the Short Run Across Countries and Across Time.

For Objective 2 exhaustive literature review was conducted to identify the level of IPO underpricing across time and across countries. The research entails underpricing levels in both developed and developing countries. The scope of the study limits the study of stock returns in the short run only. The same has been dealt with in detail in chapter 3 (3.7-3.9).

RESEARCH OBJECTIVE 3 - Finding drivers of IPO underpricing across sectors

The researcher aims to identify drivers of IPO underpricing that may impact all the sectors. The method used for identifying drivers of underpricing is explained in detail here. Chapter 4 entails the method in detail while chapter 5 captures the results and analysis.

Step 1: Run Regression Model after Box-Cox Transformation

A regression model is developed for all IPOs, after removing outliers by conducting BoxCox Transformation using 383 stocks listed. When the data is non-linear it is imperative to convert the data to linear form to use linear regression. It is important that the data is transformed using a robust method for transforming data. In this case, the method used is the Box-Cox Transformation.
However, the challenge which the researcher faces when he has identified more than 10 variables is to make sure that he is using only those variables which are significant predictors. Otherwise, he runs the risk of decreasing "the precision of estimated values and coefficients". As few variables are contributing to the underpricing and hence it is planned to use the stepwise linear regression model to

improvise on the above model so that only the significant variables will be retained, and others would be omitted from the model.

Step 2: Checking for Multicollinearity

It was verified if the model could be improved further by removing multicollinearity. Multicollinearity needs to be removed as it could lead to an increase in the variance of the coefficient estimates thus making the model highly sensitive to minor changes in the model. A test for multicollinearity is carried out. Closely observing the correlations, it is observed that there exists a strong relationship between a few variables. (For e.g. correlation between forex rupees and the Money supply variables is above 0.9, similarly between Nifty and Money supply variables etc.)

Hence, it is decided to go with principal component analysis to fine tune the variables before they can be used for predicting the underpricing.

Step 3: Using Principal Component Analysis to Group Factors Before Regression

It is possible that multicollinearity has impacted the result of Stepwise Linear Regression. Principal component analysis (PCA) could be used to remove collinearity between the given variables as shown in table 5.7. Before using the PCA method, sampling adequacy needs to be checked. This is done by the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test as shown in table 5.8. In the KMO Test, the possible values from the test vary from 0 to 1.

Step 4: Developing a Stepwise Regression Model Based on PCA Analysis

The regression model is developed to identify if the drivers of the infrastructure sector are the same as the drivers for IPO in general as shown in table 5.10. Here,

factors after the Principal Component Analysis have been used for deriving the result.

Step 5: Developing an Alternative Artificial Neural Network

An artificial neural network (ANN) is derived from neurons which are nodes that are connected among themselves. These are arranged into an input layer, a hidden layer, and an output layer. The input nodes are the number of features the researcher adds to the ANN and the number of output nodes corresponding to the number of variables the researcher wants to predict. At the heart of a neural network is the neuron.

Backpropagation Algorithm

The network is presented with input attributes and the target outcome. The output of the network is compared to the known target outcome. They are adjusted by a factor based on the derivative of the activation function, the differences between the network output and the actual target outcome and the neuron outputs. There are no fixed rules as to how many nodes to include in the hidden layer.
A neural network with resilient backpropagation and backtracking can be estimated using the package neural net with the neural net function.

RESEARCH OBJECTIVE 4 - Finding Drivers of IPO Underpricing Specifically in the Infrastructure sector

The researcher here uses three models to identify the drivers for underpricing in the infrastructure sector.

Step 1: Develop a Regression Model after BoxCox Transformation

A regression model is developed for identifying drivers of infrastructure sector stocks, after removing outliers using 179 stocks listed from January 2003 to May

2015 using 24 variables. These 179 stocks have been subjected to the Box-Cox transformation. This is followed by linear regression. However, the challenge which the researcher faces, when he has identified more than 10 variables is to make sure that he is using only those variables which are significant predictors. Otherwise, he runs the risk of decreasing "the precision of estimated values and coefficients". There are only a few variables are contributing to the underpricing and hence it is planned to use PCA followed by stepwise linear regression model to improvise on the above model so that only the significant variables will be retained, and others would be omitted from the model.

Step 2: Checking for Multicollinearity

It was checked if the model could be improved further by removing multicollinearity. Multicollinearity needs to be removed as it could lead to an increment in the variance of the coefficient estimates and make the estimates very sensitive to minor changes in the model.

A test for multicollinearity is carried out by using the variance inflation factor (VIF). VIF helps quantify the degree of multicollinearity in the regression model. It should be noted that multicollinearity table is only able to identify the relationship between two variables. It is not able to identify, three-way multicollinearity between variables which VIF is able to capture.

The VIF table 5.16 shows the degree of multicollinearity that exists. Hence, it is decided to go with principal component analysis to convert the variables into a set of the linearly uncorrelated set before they can be used for predicting the underpricing.

Step 3: Using Principal Component Analysis to Group Factors Before Stepwise Regression

It is possible that multicollinearity has impacted the result of Linear Regression. Principal component analysis (PCA) uses right angled transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. Before using the PCA method, sampling adequacy needs to be checked.

This is done by the Kaiser-Meyer-Olkin (KMO) and Bartlett's test as shown in table 5.15. In the KMO test, the possible values from the test vary from 0 to 1. The minimum acceptable value is 0.6 and closer the value is to 1 the better it is. The Bartlett's Test of Sphericity is used to test if samples have equal variance. Taking this into consideration, these tests provide the minimum standard to proceed to further test.

Step 4: Using Stepwise Linear Regression Model

Literature review and expert opinion give only general direction as to which of the variables should be included in the regression model. It should be noted that as all variables do not contribute to the result those variables which do not contribute can be removed. The actual set of predictor variables used in the final regression model must be determined by analysis of the data. At times all the variables do not contribute to the model.

Determining variables which should be considered to build a model is called the variable selection problem. There are two objectives to be kept in mind while choosing the variables. First, the regression model needs to be as complete and accurate as far as possible. Thus, all variables which impact the underpricing should be included in the model.

On the other hand, we want to include as few variables as possible because each irrelevant variable decreases the accuracy of the model. Furthermore, the presence of extra variables increases the complexity of data collection and model maintenance.

The goal of variable selection hence is all about having a fine balance between several variables and the accuracy of the model. Stepwise regression is a combination of the forward and backward selection techniques. Table 5.15 gives the results of the stepwise regression.

RESEARCH OBJECTIVE 5 - To Suggest Methods for Improving Wealth Maximization by Reducing Underpricing of Promoters and Initial Stage Investors

This objective aims at suggesting methods for reducing underpricing based on the conclusion of objective 4. It is not only important to identify the variables, but also to suggest ways of reducing underpricing using these variables. The drivers have been categorized into groups to facilitate decision making.

1.9 CONTRIBUTION TO EXISTING LITERATURE

To the best of knowledge of the researcher, this is the most comprehensive research that empirically tests the impact of sector-specific fundamental variables and macroeconomic related variables on the underpricing of infrastructural IPO in the short run. There are 179 infrastructure stocks that have been listed in the given period. The previous study looked at 50 stocks only. Furthermore, the study would help infrastructure companies time the market better at the time of issuing shares.

The contribution of the study to the existing literature is as follows:

1. It has identified infrastructure sector specific fundamental variables (total asset and assets turnover) impact on underpricing.

2. It is the first study that determines the significance of underpricing among the sub-sectors of infrastructure and hence lays down the ground for further study on underpricing in the infrastructure sector.

3. The study determines conclusively for the first time that the size of the company matters more than the profitability as a determinant of underpricing of the stocks for infrastructure sector at the time of IPO listing in the short run.

4. The study has for the first time established macroeconomic variables such as money supply impact on IPO underpricing in India.

CHAPTER 2

FINANCING OF INFRASTRUCTURE SECTOR

2.1 OVERVIEW

This chapter defines the infrastructure sector and its sub-sector as relevant for this study. It entails the size of the sector and identifies the various risks that the sector faces. It is imperative that an understanding of the infrastructure sector is first developed as the infrastructure sector is unique in many ways. Furthermore, different modes of financing the infrastructure sector are explored.

The infrastructure sector acts as a catalyst for economic development. Globally a lot of impetus is being laid on the development of the infrastructural sector. In India also, the focus on infrastructure sector has gained momentum. The positive correlation between infrastructure and economic development has furthermore been established in academic literature [1].

The focus is on creating state of the art infrastructure while adhering strictly to the given timelines. The researchers also have different views on how the sectors should be sub-grouped [5].

For this research, the infrastructure sector has been divided into three sub-groups - economic infrastructure, core, and non-core infrastructure.

2.2 DEFINITION OF INFRASTRUCTURE SECTOR

There is no consensus on the definition of infrastructure in academic research. For this research, the researcher has used the definition as stated by Singhal [6]. Plant,

Property, and Equipment (PP&E) and networks created to provide economic and socially relevant goods and services to the public on a continuous basis is defined as infrastructure.

The Reserve Bank of India also gives a similar definition as stated in [7]. Reserve Bank of India includes the following sectors in its definition of infrastructure as stated in circular RBI/2013-14/172 DNBS.PD.CC. No. 354/03.10.001/2013-14 dated 2nd August 2013.

- **Transport**
  - Connecting places through land
- **Energy**
  - Generation, transmission, and distribution of electricity, oil and gas pipelines, storage facility
- **Water and Sanitation**
  - Infrastructure for providing water and help maintain sanitation of a place.
- **Communication**
  - Telecommunication (Fixed network), Telecommunication towers and
  - Telecommunication & Telecom Services
- **Social and Commercial Infrastructure**
  - Schools and Colleges, Healthcare Facilities, Hotels, infrastructure for companies – manufacturing and service sector, tourism, storage facilities, infrastructure for agri-based business.

2.3 SUBSECTORS OF INFRASTRUCTURE – AN OVERVIEW

Economic Infrastructure

Economic infrastructure includes those sectors that are essential for conducting economic activities and provide support for growth and are considered public goods. They include building roads, highways, ports, railway network, drainage systems, telecommunications, administrative blocks, police stations etc.

It should be noted that in emerging economies future GDP growth rate is determined by the quality of economic infrastructure. However, the development of economic infrastructure requires huge capital and the gestation period is also long. Moreover, cost overruns due to extraneous factors are on the higher side in this sector.

- **Roads and Highways**

India with more than 4.70 million kilometers of roads has the second largest network of roads in the world. The network is used for carrying more than three-fifths of tangible products and more than four-fifths of total individuals travelling in India. According to IBEF.org by 2017, the roads and bridge infrastructure industry are expected to touch almost US$ 20 billion. Around 2 percent of the roads are highways in India and the government plans to increase the proportion of the same to improve connectivity.

With this goal in mind, the government of India is implementing a seven-staged scheme to increase the total national highway in India. Road infrastructure in India has seen growth due to the involvement of private players. To further increase participation of these private players, 100% foreign direct investment in the road sector has been allowed [10].

- **Ports**

The country has approximately 200 ports out of which 10 percent are non-major ports. The major ports account for almost 55% of the total cargo carried by the ports according to FY 2015 data were with total cargo being carried amounting to 1,054 million tons. Less than one-fifth of the total trade volumes are not handled by ports in India [11]. Hence, ports have an important role to play in the overall logistics management of the country. According to the India Brand Equity Foundation (IBEF) estimates cargo capacity in India will reach almost 2,500 million tons in 2017. This capacity growth would be fueled by capacity growth in both major and non-major ports.

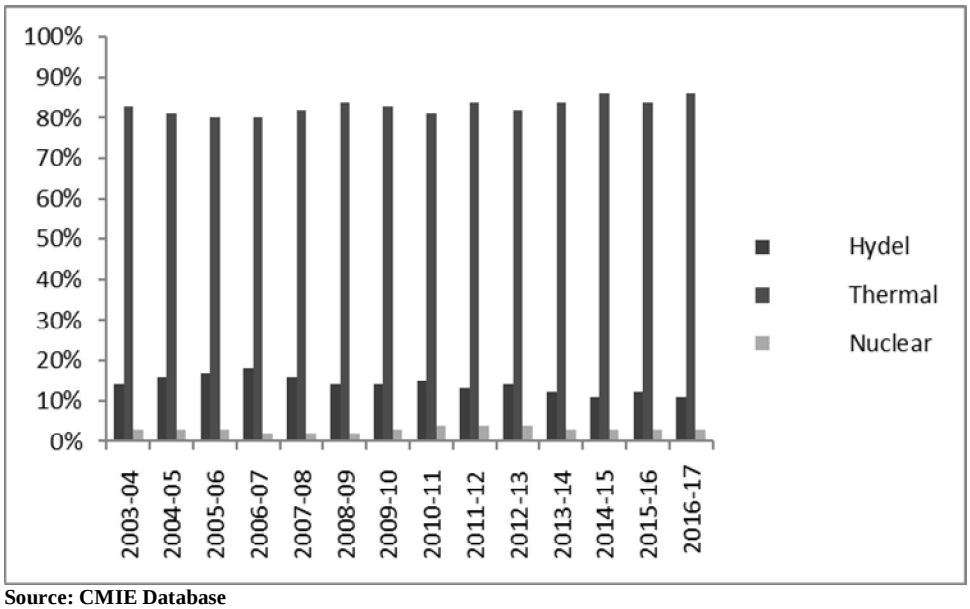
This would require an increase in the proportion of investment by private players and hence FDI of 100 percent under the automatic route for projects related to the construction and maintenance of ports and harbors has been allowed for the companies. Furthermore, no tax would be charged for 10 years for companies in the business of port maintenance.

Core Supporting Infrastructure

Core supporting infrastructure includes those businesses which support industrial growth. In other words, the overall growth of the economy would be impacted if we do not have these companies. The core supporting sector includes power, oil & gas, steel, non-ferrous industries, cement etc. [8].

Electricity generation for the capital-intensive sector is an important supporting industry that determines the growth of other industries. India is dependent on thermal power for the generation of electricity. Hydel power in the period 1993-1994 to 2015-2016 has grown from 82,496 million kWh to 121,377 KWh at a CAGR of 1.63% [9]. On the other hand, thermal Power has grown from 262,868 Million KWh to 943,788 Million KWh at a CAGR of 5.76% in the same period

[9]. Furthermore, nuclear energy as a source of power has grown at a CAGR of 8.4% in the given period. The hydel power which accounted for one-fourth of the total electricity generated in 1993-1994, in 2015-16 accounts for approximately one-tenth of the total electricity generated. On the other hand, thermal power has increased its share to more than 85% from 80% in the given period [9]. The same has been captured in Figure 2.1.



Source: CMIE Database

Fig. 2.1: Proportion of Power Generation

Table 2.1: Proportion of Power Generation

Source	Hydel	Thermal	Nuclear
2003 – 2004	0.14	0.83	0.03
2004 – 2005	0.16	0.81	0.03
2005 – 2006	0.17	0.8	0.03
2006 – 2007	0.18	0.8	0.02
2007 – 2008	0.16	0.82	0.02
2008 – 2009	0.14	0.84	0.02
2009 – 2010	0.14	0.83	0.03
2010 – 2011	0.15	0.81	0.04
2011 – 2012	0.13	0.84	0.04
2012 – 2013	0.14	0.82	0.04
2013 – 2014	0.12	0.84	0.03
2014 – 2015	0.11	0.86	0.03

Source: CMIE Database

Non-Core Infrastructure

The non-core sector aims at satisfying the socio-cultural needs of the citizens of the country [4]. This includes the education sector, hospital, and healthcare, malls, cinema, and entertainment sector. In India, at present most of the capital expenditure pertaining to these sectors is being incurred by the private sectors. Even in the education sector and the health sector, there are a lot of private players who are delivering quality and hence are finding it easy to raise money.

The segment is primarily driven by the healthcare sector which has attracted a sizeable amount of investment from private players. It has grown to become one of the largest sectors in terms of both turnover and people employed.

The market size of the Indian healthcare sector is approximated at US$ 100 billion in Financial Year 2016 and it is expected that the market will almost triple to US$ 280 billion in the next four years. The industry is thus growing at more than 20% per annum. This growth comes 65% from healthcare delivery [12].

The sector consists of:

- Hospitals
- Medical Devices
- Clinical Trials
- Medical Transcript
- Telemedicine
- Medical Tourism
- Health Insurance

The reason which is attributed to the growth of the segment includes government support, increasing population, increasing income and increasing size of the affluent class who can afford the cost of private treatment.

The government sector in India focuses on providing services to rural areas with limited coverage in urban areas. In the case of private sector companies, they provide healthcare services in Tier I, II and III cities. These services come at a very high price [12].

Source: Researcher

Fig. 2.2: Growth of Indian Healthcare

Hence, the sudden growth in the Indian healthcare sector may be attributed to the quality of medical care, at a reasonable cost thus leading to India emerging as a destination for medical tourism.

It is estimated that around 2, 50,000 people come to India every year for treatment from overseas and total revenue thus generated by the company is equivalent to $3 billion in 2014. It is expected that in the next 5 years the industry has the potential to double its revenue. India is also a hub for alternative medicines with Kerala emerging as the hub for the same. Ayurvedic and other Indian forms of medicines attract people from the Middle East, US, Europe, Japan, and China. There were more than 25,000 dispensaries in India that offer AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy) treatment. To add to this there are 3,500 hospitals providing similar treatment.

Table 2.2: The Three Components of the Infrastructure Sector

Economic Sector	**Non-Core Infrastructure**	**Supporting Structure**
Roads	Hospitals and Healthcare	Steel /Ferrous Metals
Highways	Education	Mining (Coal, Aluminum, Bauxite etc.)
Water Works	Hotels and Resorts	
	Non-Ferrous Metals	
Airports	Cineplexes and Malls	Crude Oil
Housing /Civil Construction	Entertainment and Media	Construction Equipment
Water Resources	Amusement Parks	Cement
Railways		Power Generations
Telecommunications		Engineering and Chemical

Source: Researcher

2.4 RISK LEVELS IMPACTS INFRASTRUCTURE SECTOR

By nature, infrastructural projects are risky; moreover, infrastructure projects in developing countries are fraught with higher levels of risk due to uncertainty in regulation and greater cost overruns due to poor project planning. This acts as an impediment in the way of finding financers and sponsors for the project. To add to it, most of the projects work as Build Own Transfer (BOT) or Build Own Operate (BOO) basis. They are Special Purpose Vehicles (SPV) hence entities and individuals who invest in the business has a right to recourse to the assets of the project only. In other words, the revenue generated through the project can only be used to service the loans. This further increases the level of risk. The risk appetite of an equity holder is higher than the risk appetite of a lender. The ability to wait

to get returns is also higher for an equity holder. Following are some of the risks that the infrastructure projects face which makes returns highly uncertain.

Construction Risk

This risk pertains to cost overruns due to the occurrence of unpredictable or unexpected events at the time of execution of the project. Sectors which have higher construction risk include metro, road, port, and railway. On the other hand, the project which has lower risk include sectors such as telecommunication. Case in the point is risk associated with L&T Metro project in Hyderabad where the formation of new state Telangana and change in government policies led to change in construction plans which resulted in higher levels of cost overruns.

Operating Risk

The ability to execute and operate a project is contingent upon the technological competencies of the team which is executing the project. Many times, the lack of technical expertise lead to roadblocks in executing the project. In the case of power plants, dams, and roads where the technology is prevalent from a long period of time the operational risk is lower, than telecommunications projects and metro projects where the unpredictability is higher due to the adoption of latest technologies. If the technical performance does not meet the specified standard, then the project faces the peril of being derailed. Hence, the quality of trained technical personnel determines the level of risk the company faces. The technical performance of the project during its operational phase can fall below the levels projected by investors for several reasons.

Operating risks can be reduced substantially by hiring and training technical employees to increase their level of competencies. At times companies enter into

contracts with contractors and sub-contractors to transfer the risk to these parties. Further, some of the operating risks are insurable.

Most of the infrastructural sector projects are power intensive, hence they require an uninterrupted supply of power. Fluctuation in the supply and price of fuel many times leads to increased operational risk. Thus, companies many a time outsource the power supply to the third party who ensures regular uninterrupted supply of power. Terms and conditions need to be negotiated so that the companies can demand a penalty if the risk is not mitigated.

Market Risk

Market risk refers to the risk that is a result of faulty demand predictions or change in market conditions leading to lower than anticipated demand. Infrastructure expansion relating to real estate and an increase in capacity of manufacturing plants are often impacted by market risk. For example, when all cement companies augment their capacity with the expectation of capturing unmet demand in north India at the same time, the supply will soon outstrip demand. This change in the demand-supply relationship will increase market risk. The same can be seen in real estate when prices go up a lot of new projects start simultaneously. This increase in the number of real estate projects leads to increased profitability.

In the case of utilities, the market risk is transferred to the third party. The third party who takes the risk guarantees a certain minimum amount that they would pay for the water or power supply.

Interest Rate Risk

Most of the infrastructural projects consider both loan and equity for funding projects. The projects are generally long term. During the duration of the project, the interest rates may fluctuate. If the loan has been taken at a floating rate of

interest than any increase in the interest rate will have an adverse impact on the profitability of the project. The long gestation period of the project and the huge amount of capital required for infrastructural projects leads to high-interest rate risks. At times, companies issue convertible bonds with the objective that the success of the project would lead to investors converting the bond into equities. However, if there are recessionary pressure it leads to credit defaults. Real estate companies many times pass the interest rate risk to the consumer through an agreement at the time of passage of contract.

Exchange Rate Risk

The exchange rate risk arises when the input or raw materials are sourced from overseas at market rates over a given period. In such cases, volatility in the prices would lead to volatility in cost structure when the revenue structure remains stable. This increases the volatility in profitability and hence leads to higher risks. This risk can be hedged by using foreign exchange derivatives.

When the tariffs are fixed in foreign currency, the revenue of the company becomes volatile and it leads to volatility in profit. A few companies hedge this risk by charging variable price depending on the currency fluctuation.

Regulatory Risk

In the case of infrastructure projects, it is essential to take clearances and permission from various departments. In case the company is unable to get the clearances after getting the contract it faces the risk of huge losses. There have been cases where companies are accused of charging exorbitant tariffs in the beginning. In India, a lot of projects do not get environmental clearances. For those who get clearances also there is a long wait. There has been an attempt by the successive governments to simplify the process of environmental clearances.

As regulatory systems are still evolving in the country infrastructural bottlenecks still exist.

Political Risk

Infrastructural projects both core and non-core projects have high visibility as they directly impact the business and social needs of a country. Hence, there is a great risk of reversing policies under pressures. For example, after allotting land for the dam, the government may take it back due to pressure from NGO's and opposition parties. At time political pressure may lead to revoking of license. This revoking of the license could further lead to a private sector company being converted into a public-sector company. Thus, infrastructural companies go for insurance through the Multilateral Investment Guarantee Agency.

The Process of Mitigating Risk

It should be noted that the process of mitigating risk is not the same for all the projects. This is because the level of risk and the category of risk is different for each project. It depends on the kind of project and the location of the project. For instance, projects involving connecting two places through highways may face high construction and market risk and low operating risk. The realization of risk is contingent on various factors. Hence methods of reducing these risks are generally quite complex and cumbersome. It requires several legal contracts and innovative tool to reduce the risk levels.

2.5 FINANCING OF INFRASTRUCTURE SECTOR

This section details the financing of the infrastructure sector in India. It compares the various investment opportunities available in the country. According to Mckinsey, a leading consultancy and advisory firm, the global investment on infrastructure is $2.5 trillion a year in 2015, however this is not enough to meet

the burgeoning need of infrastructure sector, leaving developing countries and developed countries from satisfying basic social and basic needs of the citizen of the country [13].

Furthermore, the 2015 World Bank Report states that emerging countries along with private sector players required more than $830 billion for the period 2016-2020 for new projects [2]. The situation in India is no different. According to [14], India spent 5% of its GDP on infrastructure as in FY 2012, however, it must achieve a targeted spent of 10% on GDP to reach a targeted GDP growth rate of 10%. To achieve targeted growth according to IBEF [3], India requires at least Rs 31 trillion as capital expenditure on infrastructure growth in the period 2016-2021. Approximately 70 percent of the amount would be spent on core sector [3].

2.6 DEMAND SIDE ANALYSIS

Infrastructure spending in India is increasing. Following are infrastructural sectors which would need a huge infrastructural budget:

- Power Sector
- Railways
- Roads and Highways
- Waterways
- Shipping

The power sector is one sector which needs huge investment to help sustain GDP growth. According to Mr. Piyush Goyal, Union Minister of Coal, Power, and Renewable Energy in the period 2016-2021, the sector would need around $ 250 billion [3].

The Indian construction equipment industry which was seeing a cyclical slump in period 2011-2015 is back on growth path and is expected to almost double in size

from $2.8 billion to $5 billion according to Indian Construction Equipment Manufacturers' Association (ICEMA) reviving after a gap of four years and is expected to grow to $5 billion by FY2019-20 [3].

The development of the economy depends on the quality of infrastructure which connects places. These comprise mainly of - Indian Railways, Aviation, Road Construction, and Port sectors.

Indian Railways according to Mr. Suresh Prabhu, the Indian Railway Minister needs an investment of $140 billion for its expansion. The aviation sector is one of the largest and fastest growing sectors in India. India needs to spend a huge amount of money on restructuring the aviation infrastructure by upgrading airports. The planned outlay of the Government $12.1 billion in the airport sector during the 12th Five-Year Plan period might not be sufficient to meet the needs of modernizing airports in India.

Two third of the total expenditure would be met by the government of India while the rest needs to be financed through private participation.

According to the budget document for FY 2016-17, the government of India plans to build roads of 47 km every-day. This requires doubling the rate at which roads are being constructed in India. In the FY 2015, the total road constructed was 6,000 km, the NHAI targets to increase it to 15,000 km. Hence funding requirements for the sector are also expected to increase.

Further to help support road transport, the Road Ministry in June 2016 has announced that the ministry plans to set up 15 multimodal parks in those zones where there is more movement of commercial goods. The total investment required is Rs. 330 billion [3].

In India, the healthcare sector needs to grow to cater to rural demand. In rural India, the gestation period for the hospital is longer as per capita income is lower. [3]

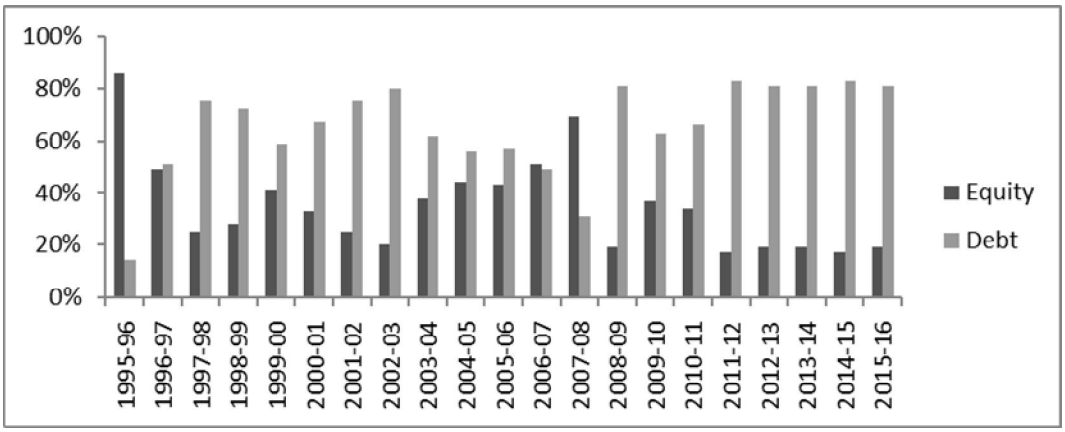
The quality of the healthcare sector is bound to improve considering that healthcare spending both by the private sector and the government is increasing. The demand from villages in India is bound to increase too as a potential demand source in the recent future. According to IBEF.org, India needs to build 600,000 beds in the period 2014-2019. This would require an investment of US$ 30 billion [12].

2.7 FUNDING OF INFRASTRUCTURE SECTOR

Government funding is traditionally the most important source of the funding infrastructure sector. Multilateral organizations also play an important role in raising funds for these organizations. However, it should be noted that the government and funding by organizations such as the World Bank and Asian Development Bank [ADB] may not be enough to meet the needs of the infrastructure sector in India. Hence private sector investment needs to be given importance.

In India equity was the main source of financing non-government companies before the Harshad Mehta scam (as can be seen in figure.2.3).

However, after tightening of the markets there has been increased dependence on debt. In 2008-09, also there was an increase in the proportion of equity. This was attributed to the bullish trend in the stock market. Thus, the pricing of stocks plays an important role in determining the amount of investment in the stock market.



Source: CMIE

Fig. 2.3: Changes in Proportion of Debt to Equity in India

Table 2.3: Change in Proportion of Debt to Equity in India

Year	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**
Equity	86%	49%	25%	28%	41%	33%	25%	20%	38%	44%
Debt	14%	51%	75%	72%	59%	67%	75%	80%	62%	56%

Year	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Equity	43%	51%	69%	19%	37%	34%	17%	19%	19%	17%	19%
Debt	57%	49%	31%	81%	63%	66%	83%	81%	81%	83%	81%

As already mentioned here are two major sources of funding - debts, and equity as can be seen in Figure 2.3, the proportion of debt has increased in the total capital raised in India in the last 21 years. Equity including promoter's investment accounted for four-fifths of the total capital raised for businesses. However, reliance on debt has increased to more than 80%. This increases the level of risk involved in running the business in India as interest reduces the bottom line.

The infrastructure sector in India requires a large amount of funding to support the exponential rate at which the economy is growing, and urbanization is

happening. Debt and equity are two major sources of funding. However, for sectors such as infrastructure which is capital intensive, there are other sources such as hybrid instruments, multilateral agency funding, and government funding.

Table 2.4: Advantages and Challenges of Various Sources of funds

Mode of Funding	Advantages	Challenges
Government	The government does not look at the return and hence can invest in projects with long gestation period.	The government of developing countries has a resource constraint.
Multilateral Agencies - World Bank, ADB etc.	These loans are soft loans and carry a low rate of interest.	They are not enough to meet the requirements of the company.
Debt	Debtholders want regular returns; hence they act as a watchdog and help control cost overrun.	The exposure of banks and financing institutions are very high hence the increase in leverage is not possible.
Private Equity	Private Equity players are ready to support unconventional technological supported businesses.	Return from infrastructure sector may take very long.

Source: Researcher

2.8 FUNDING THROUGH GOVERNMENT PROJECTS

The successive governments in India have acknowledged that economic growth cannot happen without solving the bottle-necks pertaining to infrastructural development. There are several steps being taken by the government to ensure that there is no financing and regulatory bottleneck in the process of infrastructural growth.

The government is laying impetus on infrastructural growth through certain projects such as Swachh Bharat Abhiyan, Make in India, Smart Cities, and Digital

India. Following are some of the steps the Government of India has taken to ensure that there is an overall growth in the economy.

- A new and innovative method of investing includes raising funds from governments of developed countries for infrastructural activities in the country.
    - Japan International Cooperation Agency (JICA), in 2016 had agreed in principle to provide a loan of approximately $160 million to India at a very low-interest rate of 0.3%. This loan is towards cleaning of rivers in Maharashtra under the National River Conversation plan [16].

- In January 2016, the government of India had approved hybrid-annuity model for the increasing rate of road development in the country. These projects would come under the PPP model and approximately 40 percent of the cost would be borne by the government, while the rest would be borne by private players. These projects would replace the Build Operate Transfer (BOT) plans. It will also help railway projects in India, which are strapped for funds. Moreover, the Budgetary allocation for Roads and Railways in the Union Budget 2016 has been increased to more than US$ 30 billion to accelerate the pace of infrastructural sector growth in India [17].

- To improve logistics infrastructure in the country, the government in February 2016 planned five expressways. These expressways will help increase connectivity leading to improved infrastructure and fuel economic growth [10].

- More than $70 million has been approved by the government for improving water supply. The fund will also be utilized for improving the drainage

system, increasing greenery, and strengthening the public transport system in around 13 smart cities in India [10].

- The government has recognized that restarting struck projects should be the priority of the government. The value of the projects which has been restarted in the period June 2015 to November 2015 is approximately Rs. 60 cr. The Union Cabinet has allowed NHAI to rebate for longer periods for the build-operate-transfer model [18].

  To recycle waste, the government has allowed in 2015, the use of one-fifth of construction and demolition waste. This would lead to increased reuse of waste product under Swachh Abhiyan. To help water transportation and strengthen logistics, the central government has ratified changes to 'The National Waterways Bill, 2015'. This has led to the creation of 106 additional inland waterways, as the national waterways [18].

  In the construction sector, the Reserve Bank of India (RBI) had notified 100 percent foreign direct investment (FDI), under automatic route from 2014 December.

  The Government of India has relaxed rules for FDI in the construction sector by reducing the area requirement as well as fund requirement.

  Sovereign Funds attracted by State Governments

  Most of the state government realizes that they need to upgrade the infrastructural facilities in their state to attract investments from abroad.

  The total budget has been increasing for state government and thus their deficits are also increasing at an increasing rate. For example, Maharashtra is not able to create new infrastructure because it already has a debt of Rs. 3.3

lakh Cr. as on 31st March 2015. Hence, states such as Maharashtra are creating Infra Funds inviting sovereign funds from countries such as Singapore, Japan, Canada, Germany, and Israel to invest in their infrastructural development.

Creating infra fund is an attempt to raise funds through alternative means, as debts have become costlier and are not easily available due to an increase in the riskiness of infrastructure project with a long gestation period. The move to create this Infra Fund comes from many countries such as Saudi Arabia and Canada expressed a keen interest in investing in Indian states.

It is impossible for the government to support the growth of the infrastructure sector alone according to the Montek Singh Ahluwalia, an economist and the former Deputy Chairman of Planning Commission [15]. According to certain estimates, the total requirement was $1 trillion in the period 2011-2016. [14]. However, the Indian government was able to provide funding of Rs 70,000 Cr. only for infrastructural expansion including capital expenditure in the financial year 2015-2016 through the budget. Thus, private players must step in and fill the gap.

2.9 PUBLIC-PRIVATE PARTNERSHIP (PPP)

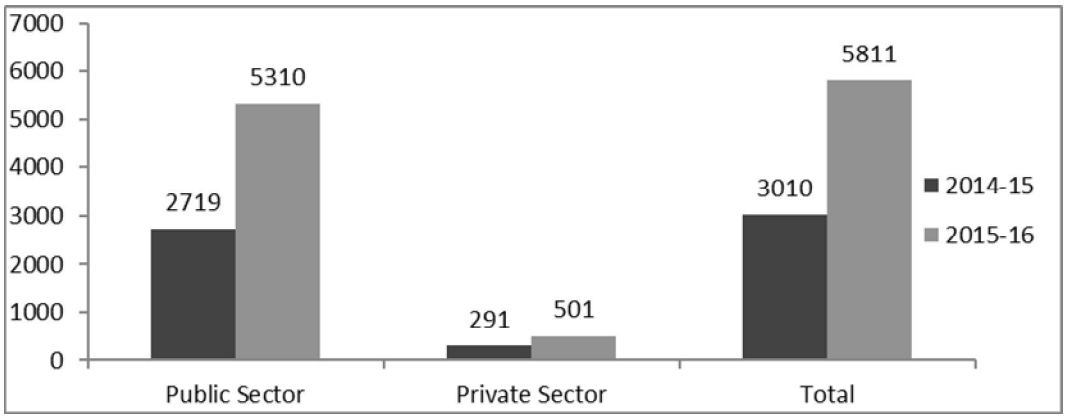
One of the major sources of funding infrastructure in India is the public-private partnership as the government promotes partnership with the private companies to take the benefit of the efficiency of private companies.

Funding for PPP Projects

There are two major sources of funding PPP projects. They are debt and equity.

Funding through Debts

Debts from banks and bonds have been an important source of funding infrastructure for years. However, India is facing an unenviable position in terms of rising bad debts. Figure 2.4 below captures the level of bad debts in the Indian banking system on 31st March 2016. The level of bad debts has almost doubled. Public Sector Banks have a higher level of stressed assets than private sectors.



Source: RBI

Fig. 2.4: Level of NPA's in the Banking Sector in India (in Rs. Lakh Crores)

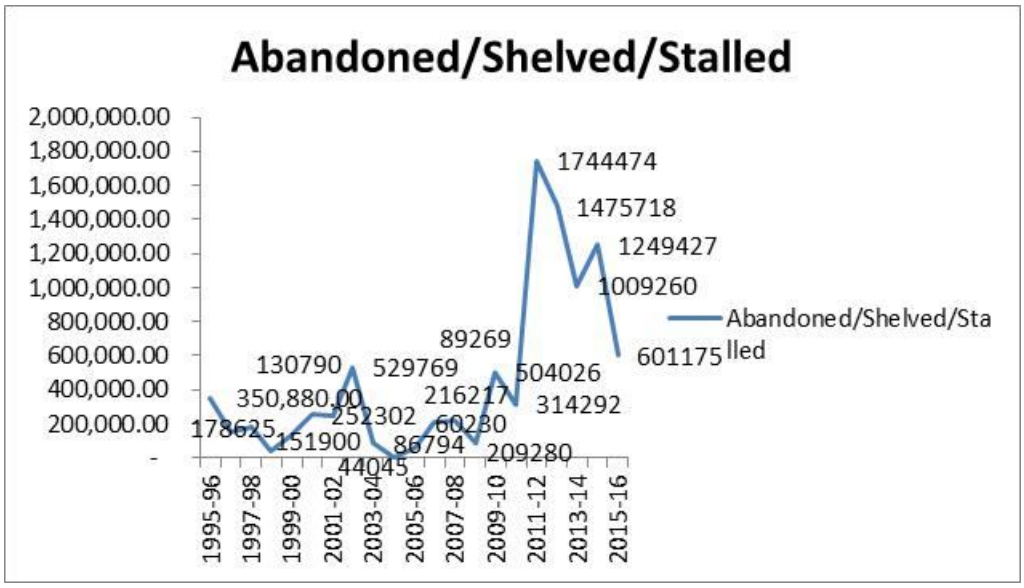
As mentioned earlier, the infrastructure sector is a risky sector. Hence, with high levels of bad debts getting loans for this sector would be tough. As can be seen from Figure 2.4, public sector banks have higher levels of bad debts. The exposure of public sector bank is also higher than private sector banks to sensitive sectors such as agriculture and infrastructure.

Approximately 20 percent of the sector's exposure is to real estate and the exposure to real estate has increased exponentially. Infrastructural loans account for 10%. In value terms, the total exposure to real estates and the housing sector has increased from a meager Rs. 320,000 Cr in 2007-08 to Rs. 1,380,000 Cr in 2015-16; infrastructure exposure has more than doubled to Rs

8,40,000 crore in the same period. With the infrastructural sector facing a huge debt burden the level *of* stressed assets in the sector is on the rise [9].

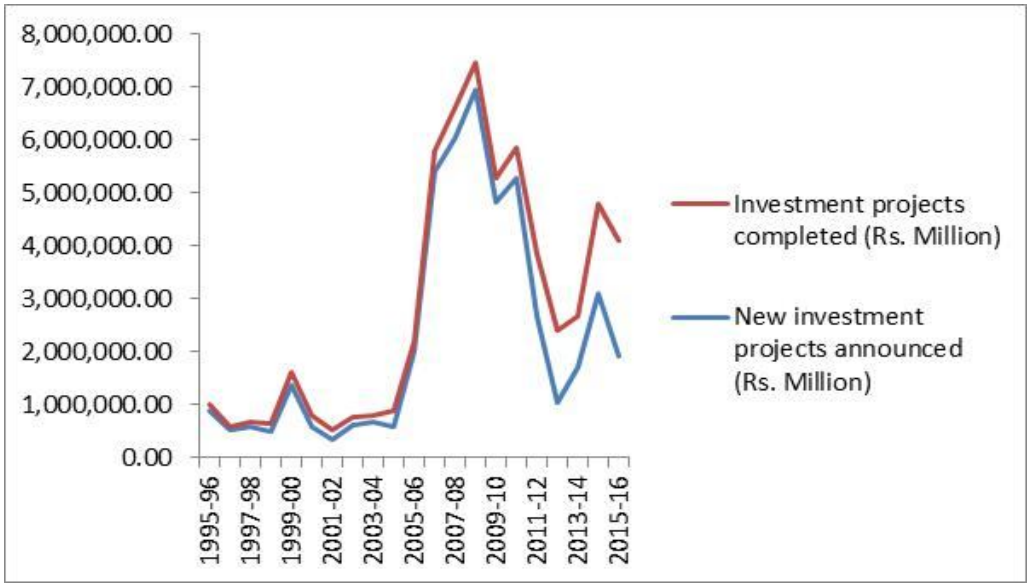
Sectors that experienced declining interest coverage ratio included core and economic sub-sectors of infrastructure sector [20]. India also has a debt market which lacks depth. However, the government of India consistently takes steps to help increase the participation of individuals in this market [21]. Some of the infra loans extended by banks in the last couple of years have already become stressed assets and even non-performing assets.

India saw a lot of infrastructural development take place in the period 2000-2012. Most of these projects were financed by private companies through banks. The challenge with debt financing of the infrastructure sector is that there is a high probability of the projects getting stalled. In India, at present, there are almost 300 projects which have stopped due to various reasons. According to the Finance Ministry as per a report released in March 2015, the total value of the stalled project is Rs. 18.13 billion [22]. Figure 2.5 depicts the number of abandoned, shelved or stalled projects. It can be seen in Figure 2.5 that there is a sharp fall in the abandoned and stalled projects in 2015-16. This augurs well for the infrastructure sector.



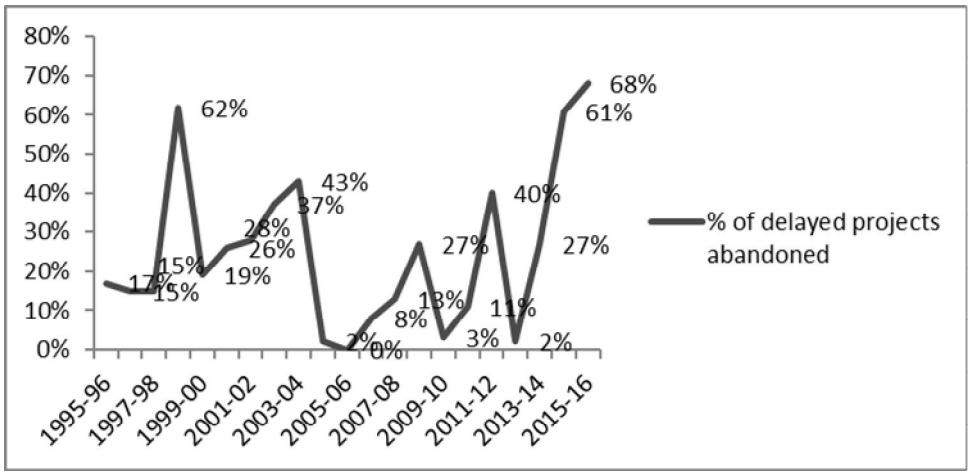
Source: CMIE

Fig. 2.5: Abandoned and Stalled Projects



Source: CMIE

Fig. 2.6: Investment Projects Completed and Announced



Source: CMIE

Fig. 2.7: Percentage of Projects Abandoned

Figure 2.7 captures % of delayed projects that have been abandoned. The % of delayed projects that have been abandoned is at abysmally high levels of approximately 67% in 2016.

In 2013, bad debt held by Indian banks grew exponentially, as the economy was impacted by recessionary pressure. In 12 months ending December 2013, it almost doubled.

The major problem for banks in 2016 is their asset-liability mismatch. The lending and fundraising pattern of such projects by banks were to be blamed for this mismatch. The banks have lent long-term loans for infrastructural projects by borrowing for a shorter period. In other words, long-term loans have been refinanced by short-term loans.

More than 35% of the companies in 2016 had an interest coverage ratio of less than one [9]. Hence, 35% of the 500 infrastructure companies do not have enough operating profit to cover the losses. 25% of the total exposure of the companies which amounts to Rs. 8.1 trillion has been written off according to CMIE. Statistics available with the Corporate Debt Restructuring (CDR) Cell

of banks reveal the level of stressed assets in the infrastructure sector is rising. In FY 2015 the value of total loan being restructured pertaining to the infrastructure sector is approximately Rs. 90,000 Cr. invested in 47 projects, out of which approximately Rs. 50,000 Cr. is attributed to the core sector. In other words, approximately 55% of the total stressed loan is attributed to the infrastructure sector. These stressed assets can be attributed to 21 projects [9].

To help support the funding of infrastructure sector for projects where the gestation period is long in December 2014, the Reserve Bank of India brought existing infrastructural projects in the 5:25 scheme to support their growth. Under this scheme, the projects whose gestation period is long can be allowed tenure of 20-25 years. On the other hand, these projects would be refinanced every 5 years. The normal duration of the loan before the scheme came into existence was just 12 years. As these projects have a long gestation period, their cash flows are impacted negatively if the duration of the loan is long [21]. According to the leading credit rating agency, CRISIL the scheme has the potential of camouflaging approximately Rs. 80,000 Cr. worth of risky assets. Hence, there is a risk of increasing NPAs for banks in the long run.

In April 2014, the Reserve Bank of India had started a Joint Lenders Forum for protecting the interest of the banks. In case an infrastructure company does not pay interest for a period of 60 days the consortium of banks can get together and decide on the way of settling the loan. The FY 2015-16 has also been a happening year for the debt market. Investor risk appetite seemed to be higher with an increase in investment on the demand side.

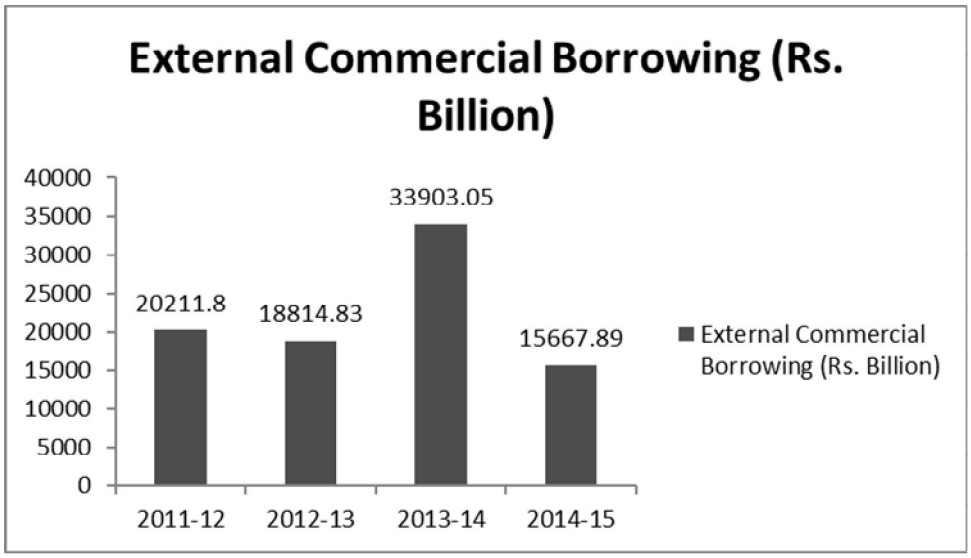


Fig. 2.8: Infrastructure Funding through ECB

External Commercial Borrowings

Table 2.5: Companies Funding through External Commercial Borrowing

Company name	**Particulars**
SREI Infrastructure Finance Ltd.	Raised Rs. 1,000 cr. through Non- Convertible Debenture in 2015.
Tata Power Ltd.	Raised Rs. 500 cr. through non-redeemable unsecured non-convertible bond
Delhi International Airport Ltd.	First PPP fundraising model where GMR has raised Rs. 250 million through USD Bonds
Reliance Power Ltd.	In March 2016 Reliance Power Ltd. raised Rs. 1000 cr. through Non-Convertible Bonds.

Source: Indian Infrastructure December 2016

Power, Telecommunication, and Oil & Gas are three sectors that have been able to raise funds effectively through commercial borrowing. Around 70% of

the funds are raised in these three sectors effectively. It should also be noted that the total funds raised are a function of the global macroeconomic factor. Hence, the total money raised through this route is difficult to estimate.

The growth of global capital markets can be attributed to the interest of investors in emerging markets coupled with increased private equity flow to the developing Asian countries such as India, Indonesia, and China. However, to attract the underlined investment it is essential that the projects in which the investments are made have commercial viability. It is expected that a lot of international players could show interest in investing in India if we are able to provide them with the ease of doing business and local partners in form of indigenous promoters who are able to understand and help them in performing in Indian climate.

There exist local players such as L&T Ltd. which enjoy an impeccable reputation even in the international market. L&T has got the contract to build and renovate the football stadium at Doha, Qatar in the run-up to the 2022 World Cup.

In the western countries project sponsors and private equity investors contribute a large proportion to total equity. However, in India their contribution is limited. Less than one-third of the companies are listed in the stock market, hence stocks markets are underpenetrated.

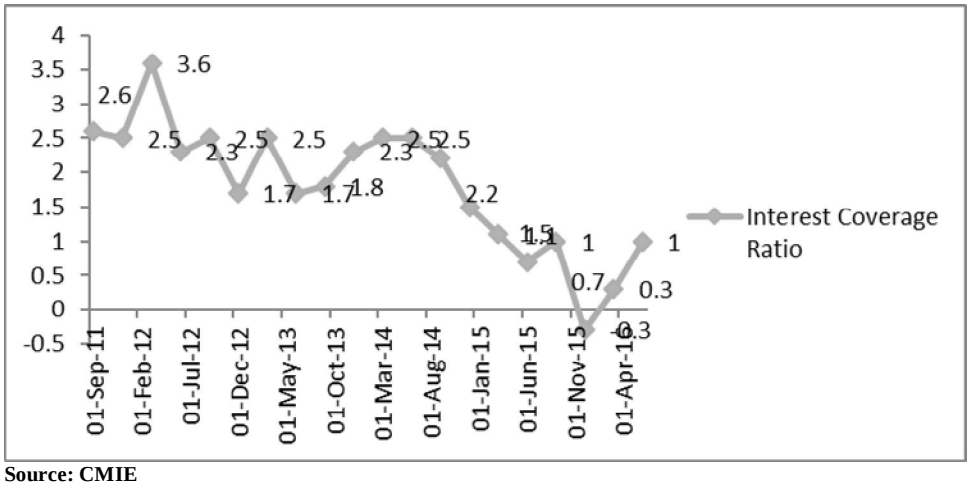
Private Equity as a Source of Funding Infrastructure

Sectors such as healthcare and education have been able to attract Private Equity investment. In 2014, health care emerged as the third largest private equity investment destination in India and was able to attract approximately $300 million with more than 50 deals in the sector.

The trend continued in 2015 with the first 9 months of the financial year being able to attract more than $12 billion. The firms which were already invested exited raking more than $5 billion. Investments also boomed to $13.8 billion in the first 3 quarters of 2015. It should be noted that this was the highest that any sector had earned through the exit [9].

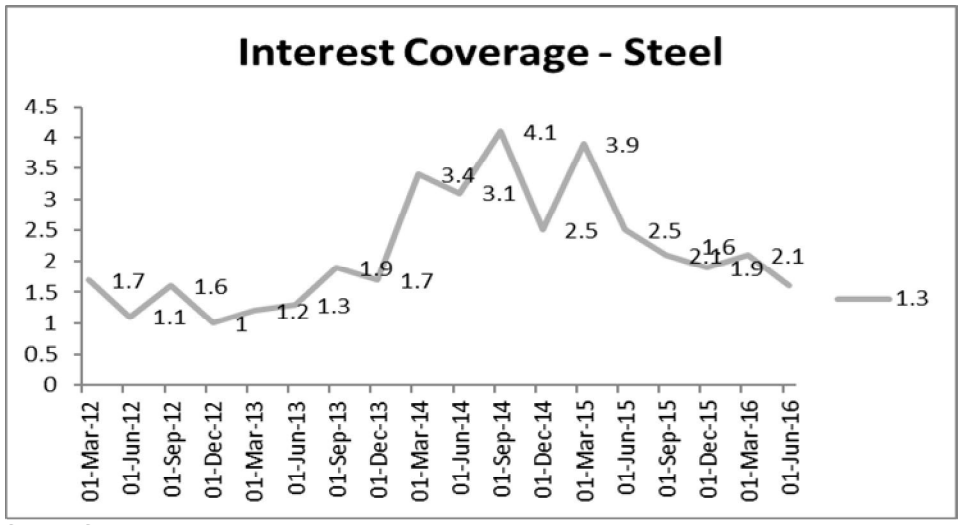
The interest coverage ratios of infrastructure sector companies are decreasing consistently. This has led to a lot of pressure on the infrastructure companies in the country. They are hence, not in a position to increase debt. Figure 2.9 gives the interest coverage ratio of industrial and infrastructure construction industry. The companies seem to be facing a lot of problem in servicing their loans. Hence, under the given circumstances' debt does not seem to be a viable mode of raising funds.

Figure 2.10 and 2.11 show that the interest coverage ratio is declining for Steel and Telecommunication sector also. In other words, their ability to pay interest is also declining.



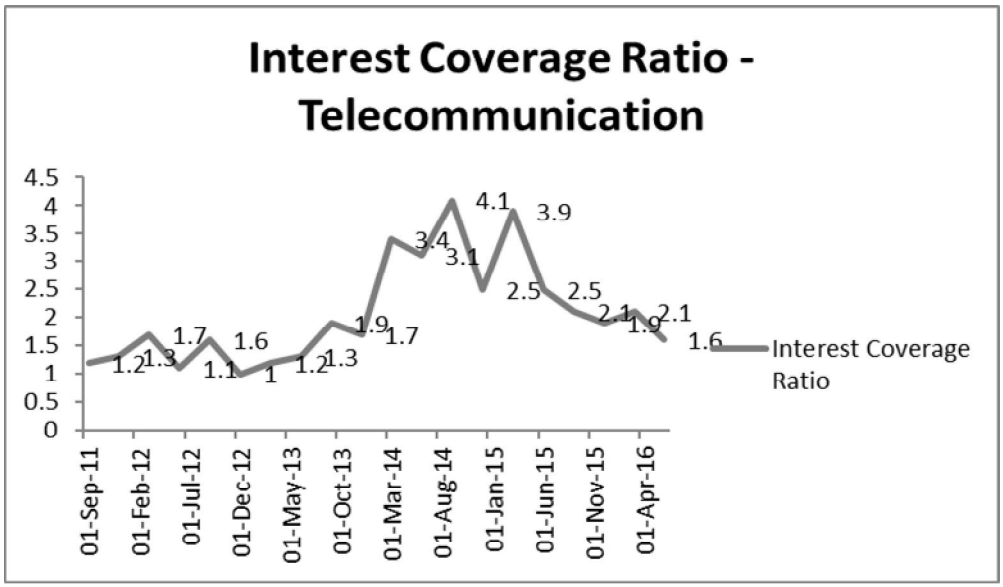
Source: CMIE

Fig. 2.9: Interest Coverage Ratio for Infrastructure Companies



Source: CMIE

Fig. 2.10: Interest Coverage Ratio for Steel

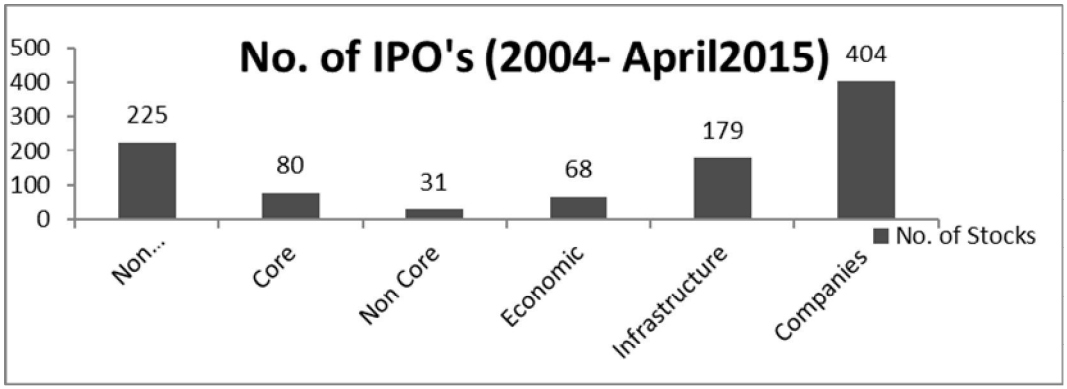


Source: CMIE

Fig. 2.11: Interest Coverage Ratio for Telecommunication Sector

Hence, this has led to stressed balance sheets of banks. Thus, banks are not willing to increase exposure to the infrastructure sector. According to Mr. Raghu Ram Rajan, the ex-governor of RBI, the banks should not fuel growth at the risk of financial stability.

Equity seems to be a viable alternative for raising funds. Globally long-term investors have increased their exposure to the infrastructure sector because they believe it suits their risk appetite [23].



Source: CRISIL

Fig. 2.12: Number of IPOs

In the period 2003 - April 2015 there were more than 445 companies that raised funds through equity. Out of this, 404 companies' data were available on Prime Database. 179 companies that raised funds were infrastructural companies. The rest was non-infrastructure companies. 80 companies belonged to the core sector, while 68 companies could be termed as economic sector companies and 31 companies were non-core sector companies. The definitions for each of the sub-sector are given in Section 2.3.

Alternative Sources of Funding

Government is also making attempts to find new and viable sources of funding infrastructure. Here are some of the new sources the government is looking at:

IIFCL: Vehicle for Fuel Financial Growth

In 2006, the government of India launched India Infrastructure Finance Company Limited (IIFCL) as a Non-Banking Financial Corporation (NBFC)

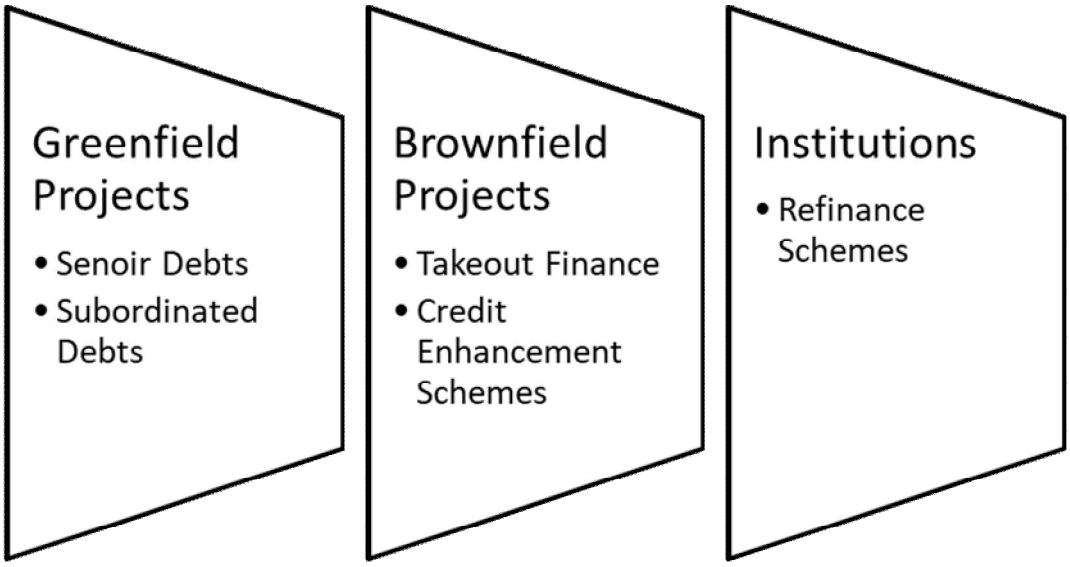
for financing infrastructural spending. The aim of the vehicle was to help reduce red-tapes in the process of raising funds for the infrastructural sector.

India Infrastructure Finance Company (IIFCL) raised funds from banks and multilateral agencies at an economical rate and then lent it to the PPP while charging minimum margins required for its sustenance. To reduce the borrowing cost and keep it at a minimum level the government of India guaranteed to pay back on loans. The sovereign guarantee by the government reduced the cost of borrowing. IIFCL raised funds from the central government.

IIFCL meets the funding needs of people through different sources. The debt includes loans, syndicated debt, subordinated bonds, and refinancing. To keep risk levels under control, the vehicle limited their liability to 30% of the project cost and one-fifth of the project costs. The rest 70% of the project was to be financed by banks. Hence, the onus of valuing the company would fall on the banks and other financing companies that were involved in the process of raising money.

The guidelines also provide that lending could be up to 50% in form of subordinated debt. It should also be noted that in the case of PPP projects in India, the government guarantees to pay back the money in case the private players are not able to pay as the infrastructure projects cannot stop abruptly.

IIFCL can negotiate a longer duration for loans. This is of paramount importance because infrastructure projects have longer gestation period and hence the level of riskiness increases considerably.



Source: Researcher

Fig. 2.13: Types of Loans Given by IIFCL

Funding by IIFCL

IIFCL primarily provides loans for green-field projects, brownfield projects, and institutions.

Greenfield Projects - refers to new projects which are starting from scratch. For a greenfield project, the returns will take more time.

Most of the lending done for green-field projects is direct lending. IIFCL has a total exposure of Rs. 65,300 Cr. in 370 projects and has made cumulative disbursement of 28600 Cr. as on 31st December 2015 in form of direct lending, according to IIFCL. Following are the two instruments that are generally used:

Senior Debt – refers to the debt which will provide a lender with the right to be paid before other borrowers are paid. IIFCL loan duration as already mentioned is longer than the duration of the other loans. Hence, IIFCL may remain the only lender after the accounts of others are settled.

Subordinated Debt – are loans which are paid after paying the other debt holders. Hence, they are riskier than the senior debts and IIFCL issues approximately 10% of the total liability in case of subordinated debt. They are treated as quasi-equity.

For Brownfield Projects

Brownfield projects refer to existing projects which are looking for funds for expansion, modernization, renovation etc. IIFCL generally provides takeout finance for such projects.

Takeout Finance

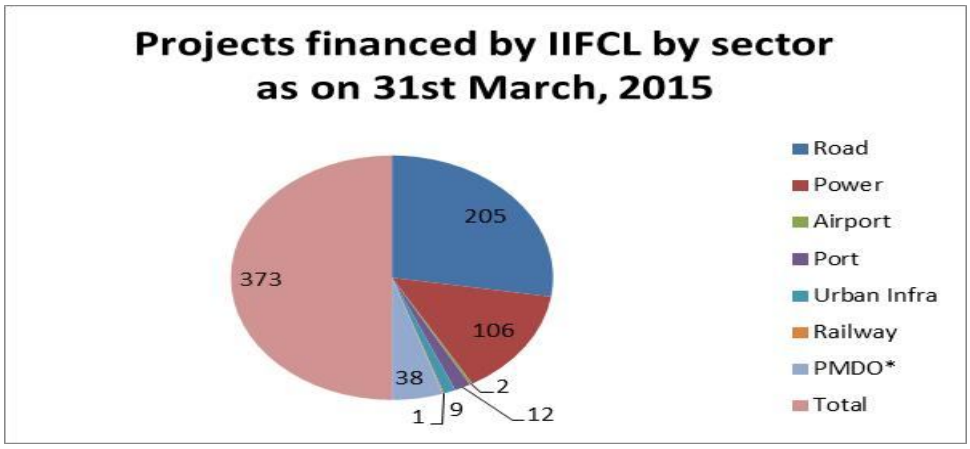
Takeout Finance Schemes of IIFCL is aimed at transferring loans from banks to IIFCL for existing projects. The aim of this project is to help banks improve their asset liability position by reducing the asset-liability mismatch. This helps banks to free up their funds for investing in newer infrastructure projects. The Takeout Finance Schemes takes place one year after the rolling of the scheme. Under the takeout finance scheme up to 31st December 2015, IIFCL has made cumulative sanctions of Rs. 14100 cr. in 60 projects out of which Rs. 12000 cr. has been disbursed.

Credit Enhancement Scheme

To improve the credit rating of the company, IIFCL provides partial debt guarantee. This leads to a high credit rating of AA, which enables infrastructure companies to reduce their cost of debt. The credit enhancement provided by IIFCL is limited to one-fifth of total project cost and one-half of total bonds that were used to generate fund for the project. Credit enhancement has helped long-term investors such as pension funds and insurance companies to invest in this sector.

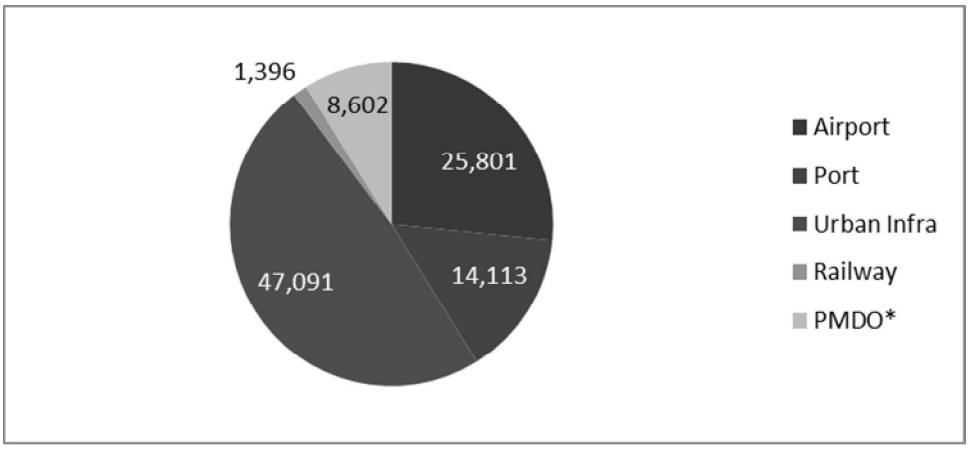
Refinance Scheme

To raise funds for infrastructural projects banks and non-banking financial corporations which have the permission of the RBI can approach IIFCL for refinancing these loans. The total amount raised by banks amount to Rs. 6,200 cr. through refinancing as on 31st December 2015.



Source: IIFCL Website

Fig. 2.14: No. of Projects Financed by IIFCL



Source: IIFCL Website

Fig. 2.15: Sector-Wise Exposure to IIFCL (in Rs. Cr.)

Table 2.6: Key Financials of IIFCL (in Rs Crore)

Particulars	**FY Ended Mar 2013**	**FY Ended Mar 2014**	**FY Ended Mar 2015**	**Q3 Ending Dec 2015**
Total Assets	34,880	38,756	39,064	40,800
Net Worth (as on 31st March of FY)	4,858	5,782	6,796	7,147
Net Profit	1,047	521	753	350
Infrastructure Loans	24,152	23,881	26,995	31,562

Source: IIFCL Website

- Infrastructure sector including real estate accounts for one-fourth of the total debt exposure of loans to corporates. One-tenth of the exposure is accounted for by real estate only.

Table 2.7: Bonds Funding in India

Company	Funds Raised
Bharti Airtel	Bharti Airtel to meet its capital expenditure has raised Rs. 6400 cr. by selling bonds to global investors.
Saproonji Pallonji	In August 2015 raised Rs. 2500 cr. through bond markets to refinance an existing bank loan for a highway project.
Adani Ports	In June 2015, Adani Ports raised more than $600 million through USD denominated Bonds
Vodafone India Ltd.	Raised more than Rs. 7700 cr. through bond sales in June 2015

Source: Indian Infrastructure, December 2015, Company websites

New Sources of Funding Infrastructure

Following are some of the new sources of financing for private players:

Infrastructure Investment Trust was set up in September 2014, with an objective of providing investments for infrastructural companies with long gestation period by the Security Exchange Board of India (SEBI). In May 2016 SEBI allowed two Indian players to function as Infrastructure Investment Trust. When the fund was formed the minimum commitment was 25%. This was reduced to 10%.

The regulatory body SEBI has also proposed certain amendments to provide tax rebate on investment in form of rebates in Minimum Alternate Tax (MAT) and Capital Gain Tax.

National Investment & Infrastructure Fund (NIIF)

In 2015-16 budgets, the finance minister Mr. Arun Jaitely introduced a new source of funding projects in form of NIIF. The NIIF would be raising funds in the form of debts. They would then be invested as equity in Infrastructure Finance Companies (IFC). These companies include the National Housing Board (NHB). The fund will aim at financing projects that are cash-strapped and have been stalled. On the other hand, new infrastructure projects would also be funded by NIIF.

The NIIF would be financed partly by the central government and partly by public sector companies. Approximately, 49% of the funds would be provided by the government and the remaining funds would be arranged by government-backed public-sector companies. The total authorized capital is around Rs. 200 billion for the fund.

Asian Infrastructure Investment Bank (AIIB) and National Development Bank (NDB)

To help finance projects in developing countries, there are two funds that have been formed off late. These are the Asian Infrastructure Investment Bank (AIIB) and National Development Bank (NDB). AIIB is China sponsored fund which aims at raising $ 8 trillion for developing infrastructural activities in Asia. India is an important member of the group as it has approximately 8% stake in the multilateral bank.

On the other hand, NDB the banking arm of BRICS plans to provide funds for the infrastructural project. The NDB which was formed in 2014 has commenced operations in 2016. The bank plans to issue bonds in the BRICS countries to help manage infrastructural financing.

Long-term Funds such as Insurance and Pension Funds

Insurance funds and pension funds are funds in which investor invest for long term. Infrastructural projects are long-term projects hence they ideally need investment from long-term funds.

The total investment by life insurance investors is approximately Rs. 15,000 billion. Out of this, 10% fund is invested in infrastructure and housing projects. On the other hand, non-life insurance companies invest approximately 17% of equity shares in 2015.

The sector also witnessed an increased risk-taking capacity as the underwriting activities increased. There has been a technological disruption caused by PE-backed companies such as Practo Pvt. Ltd. Thus, the Private Equity firms do not support only traditional businesses they have a higher appetite for risk and hence support non-conventional businesses also.

Banks and multilateral agencies may not be the best solution when it comes to financing long-term funds. The government-sponsored NIIF and Investment Trust appear to be the better source for such funding. Pension Funds and insurance sector are important sources of funding investment horizon which suites real estate and infrastructure projects as these investors have long-term investment horizon.

2.10 FINANCIAL MARKETS OVERVIEW

In this section, the emphasis has been laid on detailing the functioning of financial markets in India. For a developing country which is in expansion mode, it is important to have a financial system that can provide the liquidity required to propel this growth. The strength of the financial system is contingent on the strength of the economic system. The financial system helps transfer wealth from

individuals who have a surplus of it to the institution who can gainfully employ and thus help the GDP growth.

To attain the broad objectives that the government envisages, the finance system needs to function smoothly and should also be able to mitigate and manage the risk in the system. How well an economy functions is dependent on the effectiveness with which the financial system transfers wealth from the area of surplus to the area of deficit.

Following are the main constituents of the financial system:

- Financial Institutions
- Financial Markets
- Regulators
- Fund Managers
- Investors
- Market Intermediaries

The primary function of the financial system is to mobilize saving and gainfully invest it in those projects which would help create wealth and hence enable growth. The strength of the constituents and their inter-relationship would determine the future strength of the economy.

Financial systems provide services that are essential and crucial in a modern economy. The stability in the value of the currency is also determined by the strength of the financial system. This, in turn, plays a role in reducing the overall cost of borrowing as the level of risk in the system is reduced.

A strong financial system also ensures financial assets, which multiplies investor wealth, encouraging others to invest in the market. The strong regulators and a

transparent exchange ensure an efficient market which would attract investment from foreign investors.

The financial system, on one hand, offers several investment opportunities based on the risk appetite and on the other hand, monitors the way the borrowers and companies utilize the funds to protect the interest of the investors.

The financial system provides opportunities for investors to aggregate and bundle their investments to optimize price and reduce the risk of their investment. The efficient tradeoff between investments, savings, and risks help in developing matured financial markets which is robust. Foreign investors also invest in countries where the financial system ensures all of the above.

2.11 FINANCIAL PLAYERS

The success of the financial system is hinged on the intermediary players such as:

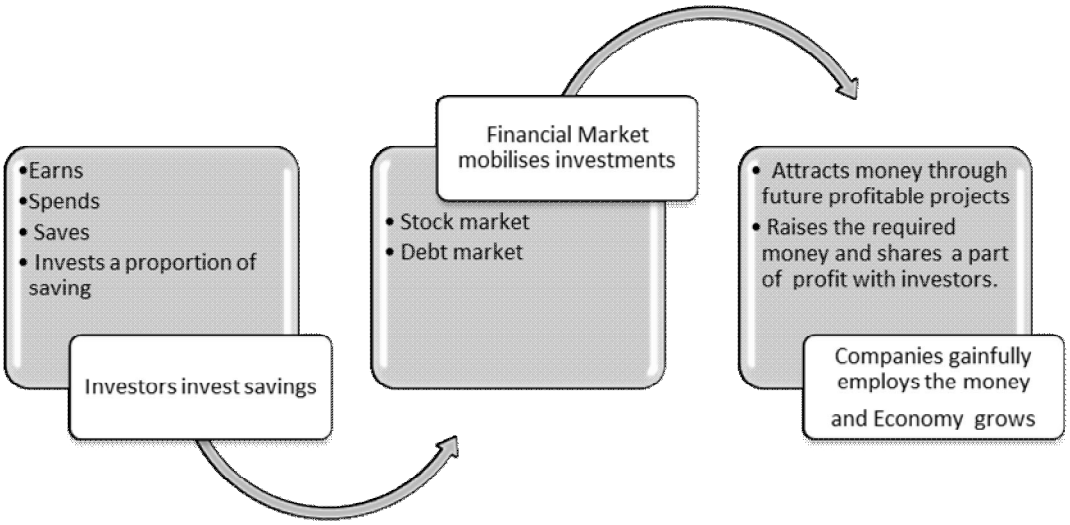
1. **Mutual Funds** – is a financial instrument which pools investments from investors and invests in financial assets which have the risk and return profile that matches with the objectives of the company.

   In the case of investors who do not possess the knowledge or the time to invest in stocks or other financial assets directly the mutual funds is an important tool to protect the interest of the investors.

2. **Brokers -** are middlemen who for a commission absorb risk involved in entering into a transaction. Brokers have a very important role to play in the financial system because they provide a channel for investors to invest in the stock market, commodity futures, debt market etc.

3. **Analysts** – provide advice to the investor on whether the asset is valued correctly. These analysts value the stock based on the fundamental or technical basis. This helps the investors leverage the knowledge of investors and make money.

4. **Portfolio Managers and Hedge Funds** – The portfolio managers and hedge fund managers manage the money privately. They use their expertise in investment to guide investors to invest their money intelligently.



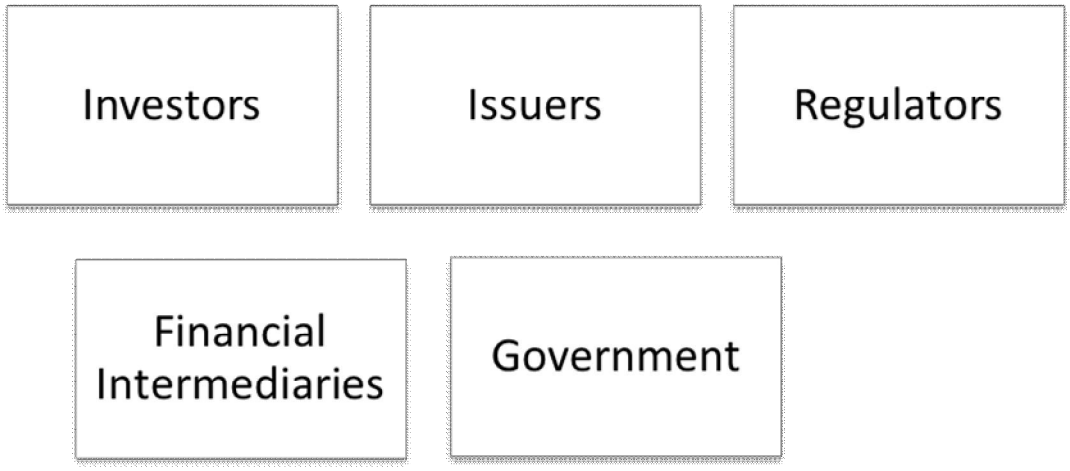
Source: Researcher

Fig. 2.16: Mobilization of Financial Markets

5. Mobilization of Financial Markets:

It is important that funds flow from investors who have an excess of it to companies who can gainfully employ the money to help the economy grows. Intermediaries such as banks, financial markets, and exchanges provide a channel for mobilizing funds for productive activities.

Market intermediaries such as brokers, mutual funds, leasing and finance companies, etc. provide the necessary link between these two groups. Hence financial system plays an important role in ensuring that money flow from the suppliers to the companies who can gainfully employ it. The success of the financial system depends on the five major components of the financial system. The relationship between the five depends on the robustness and resilience of the financial system. A country which has investors and however does not have regulators in place will have investors investing abroad. Similarly, regulators without investors will also not make financial system effectively.



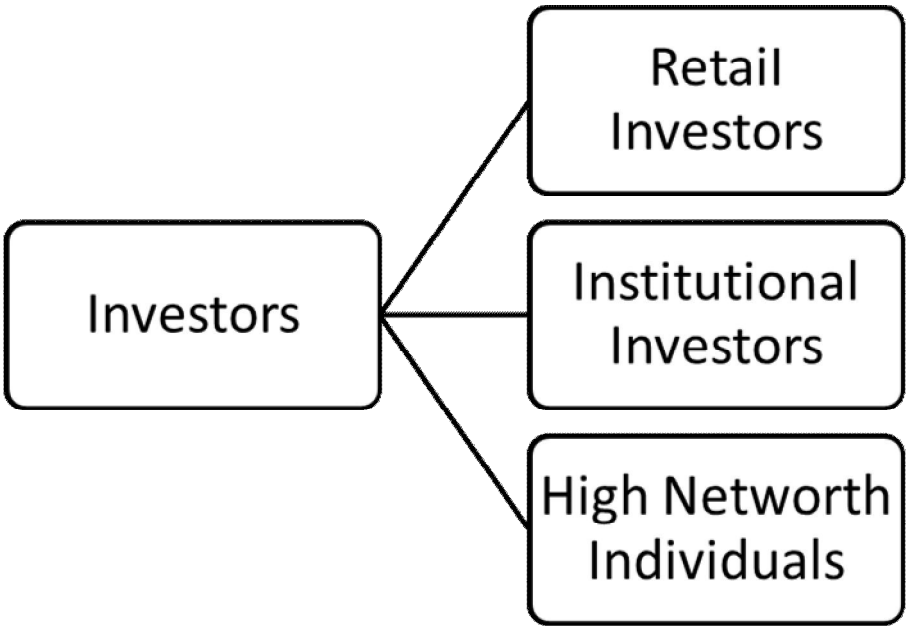
Source: Researcher

Fig. 2.17: Major Players in the Financial Market

a. The Investors:

Investors are individuals or institutions who have excess cash and are ready to plow it into the business. The instrument through which they invest depends on the level of risk they are ready to take. If an investor is aggressive and has a high-risk appetite, he invests in the stock markets. The lenders, on the other hand, have their risk limited to the amount of money they lend and the interest they receive.

Investors thus contribute funds by subscribing to these securities or by investing in alternative investment avenues. Investors broadly fall into three categories:



Source: Researcher

Fig. 2.18: Types of Investors

a Retail Investors - Investors who invest their personal wealth.

b. Institutional Investors - on the other hand, include NBFCs, companies, mutual funds, insurance corporations, pension funds etc., REIT's or such other groups that have large amounts of money or assets to invest.

c. High Networth Individuals - are individuals who invest more than a stipulated amount. In 2017, the minimum investment level is Rs.1 Cr.

It should be noted that High Networth Individuals and Institutional Investors have more financial power than retail investors; hence they are able to generate higher returns.

b. The Issuers:

The Issuers or the Corporates refer to companies which have projects in hand in which they can gainfully employ the funds of the investors. The success of the fundraising activity depends on various factors such as the age of the company, industry, the issue size, risk factors related with the project for which the money is being raised by the company. The issuers could use one or more than one method of raising funds as the company would like to attract investors with different risk appetite.

Funds generated from the investment are then used for further growth or is distributed back to the investors. In the case of debt holders, it is important for the company to pay interest on a regular basis. On the other hand, in the case of equity holders' dividends may or may not be paid regularly. However, most companies these days have a stable dividend policy.

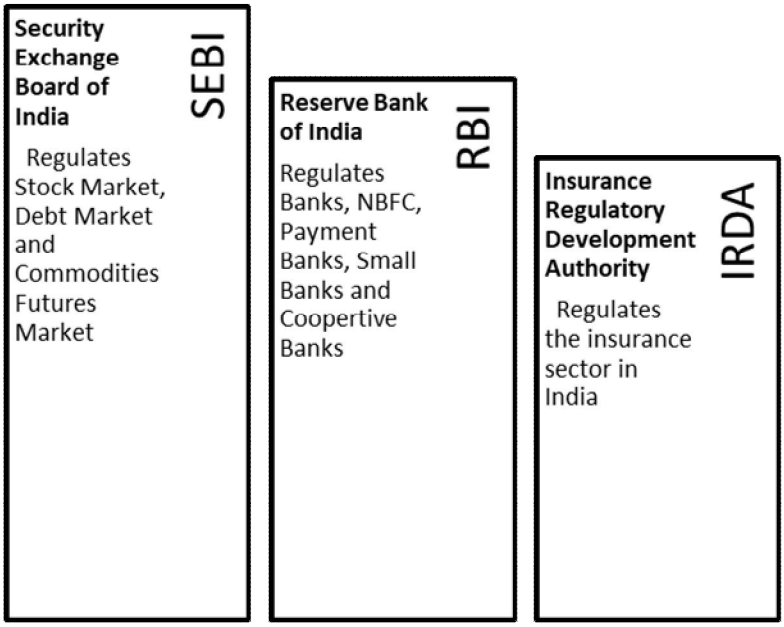
c. Government:

Government is issuers in both the debt and equity market. At times Government divests their shares in public sector companies such as BHEL, HPCL, Coal India Ltd. etc.

They also raise money through the issue of government securities. Government Securities are fixed interest-bearing instruments. As the rate of default on government securities are low-interest rates are low and they are considered safe. State Government and other local authorities may also raise funds from time to time through bonds

d. Regulators:

In India, there are multiple bodies that regulate the financial system. The role of the regulators is to ensure market efficiency by coordinating with other market participants, ensuring an unbiased and transparent trading system. The liquidity in the market is also regulated by the players. There are three basic regulators in the Indian financial system.



Source: Researcher

Fig. 2.19: Regulators of Financial Markets

The liquidity in the money market is maintained by RBI. It is the Central Bank of the country and controls the impact of the flow of cash on the economy. The Government bonds are sold by the Reserve Bank of India. It

also formulates rules and regulations required to manage risk in the financial system.

SEBI has the primary responsibility for regulating and supervising the capital market, commodity futures market and the debt market of the country. SEBI promulgates rules and regulations required for regulating the capital market and protecting the interest of the investors.

Insurance Regulatory and Development Authority of India (IRDA) is an independent regulatory body whose job is to frame rules for regulating and enabling the insurance industry to grow in India.

Financial Intermediaries:

The financial system needs people and institution with specialized knowledge and the ability to absorb risk in the environment. The financial intermediaries play the role of risk absorbers and mitigators to prevent the capital erosion of investors. Hence, financial intermediaries are an important source of risk mitigation.

The financial intermediaries who act as a bridge between the investor and the issuer help ensuring that there exists a robust system which can absorb risk and decrease uncertainty in the system. They establish a link between the investors and the users of funds.

Issuers such as corporations and government use financial intermediaries to reach the investor. The reputation of the issuer is also hinged to the reputation of the financial intermediaries. The process of fixing the price of the security involves merchant bankers and investment bankers. Raising money from private players through private placements involves financial intermediaries such as venture capital and private equity players. Selling stocks in the secondary market involves availing advice from the broker and selling through the broker.

Investors also depend on the financial intermediaries for ascertaining the value of the asset. Banks also play the role intermediation by providing advice on which stocks to buy and which to sell. Bankers develop a personal relationship with their clients and hence clients depend on them for advice. Investors may or may not have the requisite financial knowledge required to invest. Hence, they should depend on the financial intermediaries for their advice.

Lenders suffer from lack of information and are a victim of the agency problem. In other words, it is very difficult for them to determine the credit quality of funds raised by the issuer. To ensure the credit quality, the investors look at the credit ratings of the company. Higher the credit rating; lower would be the probability of default. Their role is crucial in enabling financial stability. There are several financial intermediaries or merchant bankers, operating in the financial system. They establish a link between the investors and the users of funds.

In a financial system, the role of players who provide the ancillary support is important for the smooth running of the stock markets. The role of financial market infrastructures (FMIs) includes clearing the transactions, facilitating settlement, and recording transactions. Some of the infrastructure providers are:

• **Stock Exchanges**

In India, the bulk of securities trade occurs at the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE). Of the two BSE is the older stock exchange having been formed in 1875. In 2016 more than 5,500 stocks traded on BSE. After the Harshad Mehta scam in 1992, India got its first demutualized stock exchange in form of NSE. There are approximately 1,600 stocks listed in the NSE in 2016. Both exchanges now follow the same trading mechanism, trading hours, settlement process, etc. Both the stock markets together attract huge investment from domestic and global investors. The market capitalization of

the BSE in 2015-16 was Rs. 94,75,328.34 Cr. On the other hand, the market capitalization of NSE was Rs 43, 08,828 Cr. in March 2016.

• **Depositories**

Depository refers to an entity which acts as a custodian for securities being bought and sold in the stock market. They hold the securities for all forms of transactions including shares, debts, commodity futures etc. Hence, they play the role the bank plays in the case of storing cash. In India, there are two depositories. They are National Securities Depository Limited (NSDL) Central Depository Service (India) Limited (CDSL). All depositories Participant (DP) - are registered either with CDSL or NDSL.

• **Clearing House**

The clearing house is a business entity which is responsible for settling transactions between the two parties, who are buying and selling the securities being traded on the market. National Securities Clearing Corporation Ltd (NSCCL), Indian Clearing Corporation Ltd (ICCL) is the two active clearing houses in the country.

• **Credit Rating Agencies**

Credit rating agencies are responsible for rating the credit tranches of companies who take a loan from banks and other investors. In other words, credit rating companies are involved in deciding the creditworthiness of listed companies.

The credit rating market in India began to grow after the government of India made it mandatory for companies who were issuing debts of maturity of more than 18 months to get it rated by credit rating agencies. The leading credit rating agencies in India include CRISIL, CARE, ICRA, and ONICRA.

- **Securities Market**

In India after the demutualization of stock markets at the beginning of the 1990s, the stock market has seen an increase in investment from both Indian investors and foreign investment.

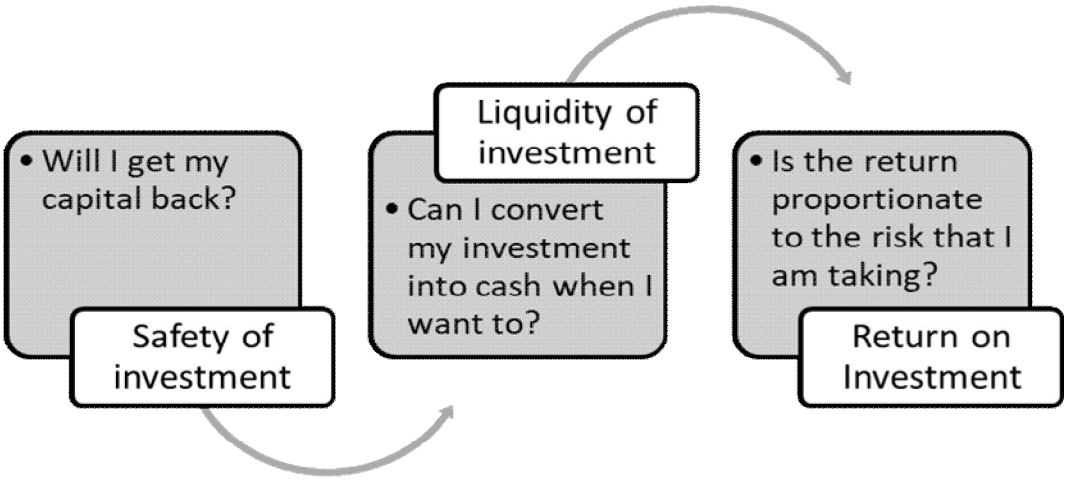
The number of listed stocks has also increased considerably. The Indian stock market is one of the largest stock markets in the world with a 10th largest market capitalization in the world.

To attract investment from both Indian and foreign investors it is important that the company mobilizes saving from these investors to help improve the investment climate. To channelize savings into investment, the stock market of the country needs to be vibrant and have a considerable amount of investments from both domestic and overseas investors.

The role of institutional investors such as mutual funds, insurance companies and pension fund in making the markets more efficient cannot be ruled out. The absence of an efficient and vibrant capital market would lead to a lack of utilization of funds available in the country.

Indian securities markets are one of the best-performing markets in the world. Fueled by strong economic growth and development, the Indian stock market indices have brought in unprecedented growth in the last one and a half decades.

It should always be kept in mind that investors in the stock market are a group of investors who have a varied demographic profile and risk profile. However, most of the investors in the markets are concerned about three basic factors:



Source: Researcher

Fig. 2.20: Investment Cycle

For a market to mobilize funds it is important it tries to satisfy the above criteria. Raising funds is not possible through equity unless the above objectives of investors are safeguarded, and their interests protected. An efficient capital market should, therefore, provide a mechanism for efficient capital raising and have adequate safeguards to protect the interests of the investors.

2.12 PRIMARY MARKET AND THE SECONDARY MARKET

Initial Public Offer refers to the process of raising money from the stock market for the first time. When a company gets listed on the stock market it invites investors to invest in the stock market through a prospectus. As the stock is being listed in the market for the first time, most of these stocks do not have pricing history. The median age of the 401 companies at the time they got listed in the period January 2003 to April 2015 was 12 years [25]. This shows that the relative age of the company is relatively less. The process of valuation of the company

depends on its ability to execute its plan in the future. The company is yet to prove its ability to execute large projects in most of the cases. Hence, the impetus is on pricing the issue. This process is highly complex and time-consuming. Further, the role of issuers, investment bankers and anchor investors in fixing the price are very important. Their role in marketing the IPO through road shows adds to the uncertainty of the whole process. Further, external factors such as hot and cold period also act to the vagaries of pricing.

The hot period is one when the stock markets see a surge in volumes; while the cold period is one which sees a fall in demand due to recessionary prices. The aim of the promoters is to maximize the returns from listing. However, it has been observed often that the trading on day 1 sees stock prices increase by a considerable amount. There are a lot of reasons which can be attributed to the growth.

1. **Introduction of T+2 Rolling Settlement Style**

In India, clearing corporations generally settle transactions based on a T+2 rolling settlement cycles. For example, for all trades which took place on Monday NSCCL calculates the aggregate liability of each member on Tuesday and then inform the Clearing Members (CMs) through internet messaging.

On Wednesday the transactions are to be finally settled. In the case of short delivery, stocks must be bought from the auction segment and settlement needs to be done by Thursday. This method of settling security market transaction is known as T+2 day.

2. Streamlining of the Functioning of Stock Exchanges and Intermediaries

In India, the Bombay Stock Exchange at the time of Harshad Mehta scam was highly unorganized and non-professional. However, with the formation of SEBI, the functioning of the stock market and the intermediaries has now become

streamlined. The use of technology and electronic mode of dissemination of information has increased transparency and market efficiency.

3. Increase in Capital Markets in India

Indian Securities Market has seen rapid expansion since the decade of the nineties. Growth in terms of the number of stock exchanges and intermediaries, T+2 rolling settlement cycle is highly in line with global markets trading volumes, increase in the amount of capital raised from the primary market, rise in investor population, surging trading volumes and large market capitalization have all contributed to Indian stock markets to play a major role in the global arena. India now stands at number 10 position in the world in terms of market capitalization as on 31st March 2016.

4. Increase in the Stock Market Listing

Increasing the efficiency of market and transparency has led to an increase in several companies listing in the stock markets. The number of listing has increased in the bourses to touch the highest levels in the last 5 years. Furthermore, BSE is ranked among the top 6 exchanges to raise funds according to Ernst and Young report 2016. There were 8 large deals in the market which aggregated to almost $200 million.

5. Increasing Interest Among Retail Investors

With the growth of the service sector, which has led to an increase in the young working class in India, investments in the stock market have more than quadrupled. The service sectors such as Information Technology and Knowledge Process Outsourcing (KPO) industry, which led the service sector explosion created a breed of knowledge workers who had a high disposable income and

high-risk appetite. This has led to a higher level of equity investment in mutual funds and stock markets.

6. The Resilience of the Indian Stock Market

The Indian stock market is highly resilient and less volatile than the global stock markets according to the Economic Survey of India 2015-16. The Indian stock markets can bounce back in lesser time as compared to other emerging markets. The effectiveness of the regulatory system plays an important role in bringing the market back on track whenever there is a bearish trend. SEBI proactively warns the investor if he believes that the market is unduly high. The technological advancements and the attempt of the SEBI to create a level playing field is the main reason for the growth of the Indian markets.

This has led to increased interest among FII's. However, the challenge that persists is finding those investors who would like to invest in the stock markets for a long term. As of now, most of the FII's investing in Indian markets are hedge funds with short-term investment perspective. There is a lacuna of long-term investors such as Pension Funds and Insurance Companies from foreign countries.

7. Robust Risk Management System -

After the Harshad Mehta scam and Ketan Parekh scam, care has been taken to strengthen the risk management mechanism in India. A strong risk management system has evolved in India. The efficiency and efficacy of the risk management system enable improve investor's confidence in the system. The financial institutions in any country are categorized as an institution that helps mobilize savings and increase investments and banks that help achieve social objectives such as financing infrastructure and social sector of the country. Institutions that help in mobilizing funds have grown exponentially in India with the opening of the economy in 1991. These include investment banks, mutual funds and

insurance companies which have operations in more than one country. This has also helped strengthen the financial system as the best practices from developed countries in being followed in India by the multinationals hence helping to streamline the system. Thus, the investors' confidence in the Indian financial system and the stock market has also increased over the years.

The financial market may further be classified into investing institutions and development banks based on the nature of their activities. Investing institutions consists of financial institutions which gather the savings of the people by offering their own shares and stocks and which provide long-term funds. These institutions include investment banks, merchant banks, investment companies, mutual funds, and insurance companies.

2.13 FUNCTIONING OF INDIAN STOCK MARKET

Traditionally, exchanges can be categorized into five silos: stock market, commodity futures, stock and indices derivatives market, currency futures and debt market. Companies such as infrastructural sector companies raise money from the stock market. The stock market is further divided into two parts. The primary market is where companies raise funds for future transactions and secondary market is where stocks are sold by one investor to another. The primary market is an important source for mobilizing funds from investors who believe in the growth story of the company and are ready to share the profits in forms of dividends. These investors have primarily higher risk appetite than the lenders. The investment in the primary market depends on various factors such as:

1. The Economic Cycle

The economic cycle plays an instrumental role in determining the level of investment in the stock market. When the GDP is growing at a rate higher than

that of competing emerging economies investors are interested in investing in the Indian stock market.

2. The Effectiveness of Regulatory Bodies and Watchdogs

The regulatory bodies play an important role in ascertaining the protection of the interest of the stock market investors. In India, the regulatory bodies that control investment flow into markets are Reserve Bank of India and Securities Exchange Board of India. Both the regulators have strong teeth and have efficiently regulated the markets. The efficiency of the Indian stock markets improved because of the merger of the Securities Exchange Board of India with the Forward Market Commission. This helped improve the shareholder's confidence in the Indian investors.

3. The Industry Performance

The performance of the stocks of the industry in which the company operates also plays an important role in determining an investor's interest in a stock. Generally, the sunrise industries get a higher valuation than the stocks in traditional sectors. The traditional industries are said to be less risky as their revenue stream is highly predictable. On the other hand, investors with higher risk appetite prefer investing in sunrise industries stocks.

4. The Purpose for which the Funds are Raised

The prospectus of the company mentions the purpose for which the fund would be utilized. It should be noted that companies generally use funds for expansion of business or to repay debts. In case the company repays the loan using equity, the debt-equity ratio improves. However, at times existing shareholders are not happy with issuing of new shares because it often leads to lower earnings per share which mean a dilution of existing stock owner's percentage holdings.

Securities issued for the first time by public limited companies and by government agencies comprise the primary market. Follow-up Public Issues is also a part of the stock market. There are two major types of issuers of securities—corporate entities, which raise money for future projects and government which divest their share in stock markets. For infrastructural companies raising funds through Initial Public offer can be a viable method of raising funds.

CHAPTER 3

LITERATURE REVIEW

3.1 OVERVIEW

This section would aim at dissecting review of literature from the research paper, books, government reports, and research reports by multilateral organizations such as World Bank, IMF etc. to get a fair understanding of research done in this area.

The aim of this section is to help develop a research design, by identifying the research gap, by reviewing the existing literature on the topic and developing a research problem out of the existing business problem.

Table 3.1: Relating Business Problem to Literature Review

Business Problem	Segments of the literature review
"Infrastructure sector in India is facing a short run underpricing at the time of listing in the stock markets which is leading to losses in terms of wealth maximization."	Infrastructure sector leads to economic growth and removes inequality
	Modes of Financing
	Underpricing in India and abroad
	Infrastructural sector underpricing

Source: Researcher

The relationship between infrastructure and growth has been established by various studies. There are several studies in infrastructure financing, equity markets, and IPO underpricing with respect to India, developing countries, and developed countries.

Special emphasis has been given to literature dealing with the Indian Infrastructure financing and Indian IPO markets. Underpricing of stocks is an observed phenomenon globally and in India. The same has been researched thoroughly.

3.2 INFRASTRUCTURE DEVELOPMENT AND GDP GROWTH

The relationship between infrastructural spending and growth has been the subject of study by a lot of researchers. The studies can be divided into two categories. The first category consists of generic studies, which have established that there exists a positive relationship between the two variables across geographies.

Aschauer in 1989 in his seminal paper first established that infrastructural growth leads to GDP growth in the United States [8]. Dash and Sahoo empirically tested the impact of infrastructure spending on growth during the thirty-six-year period (1970–2006) based on the empirical framework developed by Aschauer. The research established that there exists a positive relationship between infrastructure spending and economic growth in India [31]. Furthermore, it was established by Caledron et al that there exists a relationship between development and infrastructure in Latin America. According to the study, infrastructural development leads to an increase in the marginal productivity compared to other factors. The study attributed the fall in infrastructural spending in Latin America as the cause for the gap between the output of East Asia and the given region in the twenty-year period starting from 1980 [32]. A similar study was conducted by Demetirades using the Organization for Economic Co-operation and Development

(OECD) data from 12 countries. The study established that there exists a relationship between infrastructure input and economic development in the long run. However, their study concluded that there exists no relationship between infrastructural spending and economic development in the short run [33]. Teklebirhan established that in underdeveloped countries such as Ethiopia, the impact of infrastructural spending by the government on overall development is positive [34]. However, in 1995 Canning established that the extent of relationship differed from country to country and sector to sector. This is one of the most exhaustive studies in the area [35]. Furthermore, Seneviratne et al in 2013 proved that in ASEAN countries there exists a relationship between infrastructural growth and development [30].

The second category consists of sector-specific studies. Roller established that there exists a relationship between telecommunication sector and output in the US [36]. Furthermore, in 1999 Fernald covered only the road sector and came to the same conclusion using industry data for the U.S. [37]. In 2003, it was proved that a similar relationship existed between the education sector and economic growth [38].

There was a study conducted by Easterly, which established a relationship between telecommunication density and growth of developing countries [41]. India, for example, has seen a high growth rate after the telecommunication revolution brought about in the 1980s.

Academic research hence proves that there exists a relationship between infrastructure development and economic development of the country. Thus, infrastructure sector growth is inevitable for the future growth of the economy.

3.3 INFRASTRUCTURE DEVELOPMENT AND INEQUALITY

There exists a positive relationship between infrastructural growth and inequality [38]. In 2004, Estache established that rural infrastructure sector plays a key role in decreasing the level of inequality that exists in any country. Hence, rural inequality can be removed through infrastructural development. The research was carried out in Argentina and Brazil [42].

Inequality in India is related to the infrastructural development and infrastructural development is regionally unbalanced leading to different levels of inequality in India according to Chatterjee [44].

Thus, the relationship between infrastructural growth and inequality has been established through academic research.

3.4 FUNDING OF INFRASTRUCTURE PROJECTS

In the last two sections, it has been established that there exists a relationship between infrastructure growth and the economy. According to Estache, developing countries need 5% to 7% of their GDP as financing need. Government funds might not be sufficient to fund infrastructural growth [42]. The infrastructure spending by private firms in developing countries is low compared to developed countries according to Birceno [45]. Hence, according to Purohit in India, financing needs require proper funding strategies as the requirements are huge [46].

In India, public financing of infrastructure is significant due to policy decisions. According to the traditional approach stated by Savas, the government is held responsible for developing infrastructural facilities to prevent market failures [49]. According to Sahoo, when the risks level is high, the government provides

support to private companies which can be provided as subsidies or favorable government policies [31].

According to Winch in 2011, the Public-Private Partnership is a means through which government can bridge the gap in investment by raising funds [48]. According to Savas, the private sector has better managerial skills, which enable organizations to reduce cost and increase profitability. Thus, it makes an investment in the infrastructural sector highly attractive [48]. Furthermore, according to Savas, it helps to maximize the value for money of infrastructure provisions. However, the source of financing a project is contingent upon the method of financing used [49]. Furthermore, according to Estache the 20 years of private sector investment in core sectors such as water, energy or logistics, has not yielded desired results; hence companies may not continue to invest in these sectors [50]. Revenue share cap has a binding impact on the PPP contracts and hence impacts private-public relationship adversely according to Engel [51]. Government investment leads to a higher disparity in income levels over time. The same is not impacted by the mode of raising funds for the project. Hence, investment from private companies is a must [15].

3.5 FUNDING THROUGH STOCK MARKETS

Stock markets are an important source of funding growth in developing countries since the 1980s. The domestic financial sources along with the stock market play an important role in raising funds. According to El Erian, in the 1990s, stock markets emerged as an important source for mobilizing foreign capital globally [52].

An important question that has been addressed by research on IPO is why companies raise money through equities? The major reason that can be attributed to raising money through equity is that companies want to be listed publicly and

promoters and investors need a channel through which they can cash upon their holdings in the company as stated by Christian Hopp [53].

According to Arezki, investment preferences across individuals and regions vary based on individuals' preferences and the maturity of the sector in the given area. However, globally long-term investors have increased their exposure to the infrastructure in the recent past as their ability to absorb risk is higher [23]. As the gestation period of these projects is long, investors with long-term horizon find these assets attractively priced.

According to Beaty, Indian markets are one of the most active markets in terms of number of IPOs listed. In the 17-year period starting from 1988 to 2015, India had seen a listing of 2,700 IPOs while Australia had approximately 1,100 stocks listed in their stock markets in the same period [54].

3.6 RETURNS THROUGH IPO

This section aims at reviewing researches done in global as well as Indian perspective with respect to the returns promoters and initial investors would expect from IPOs at the time of listing of the stock at the bourses. IPOs are used as exit route by promoters and initial investors. The promoters and early investors generally witness the stocks being listed at a price much higher than their issue price. This means that the investors are not able to maximize their returns.

According to Ritter, underpricing can be arrived at by finding the difference between listing price and offer price and then dividing it by the offer price [57]. Academicians have studied generally two aspects of IPO underpricing – returns in short-term and returns in long run. According to Kumar, the companies generate positive returns in the beginning however they start generating negative returns in the long run [103].

According to Ritter, underpricing in the short run is the difference between the listing price of the IPO and closing price of the stock on the first day [57]. It has been observed that in the short run the stocks are generally underpriced. However, in the long run, the stocks generally show negative returns compared to the price at which they were subscribed. This phenomenon is observed across the globe [57].

According to Lim, IPO in the short run is focused on ‘money left on the table' at the time of listing of stocks [60]. It has been observed that there is a profit to be booked by individuals who bought the share by selling them immediately after listing the stock.

3.7 UNDERPRICING ACROSS COUNTRIES AND ACROSS TIME

The studies conducted on IPO underpricing show that underpricing exists in all countries and it changes over time according to Katti [125]. This section reviews the studies conducted on the performance of IPOs in different countries and across different timelines. The following table captures the underpricing levels in different countries:

Table 3.2: Underpricing in Different Countries

Country	Source	Sample Size	Period	Underpricing
India	Marissetty and Subramanyam (2005)	2,983	1990-2014	88%
US	Ibboston, Sindelar & Ritter (1994)	12,819	1960-2015	16.90%
United Kingdom	Dimson, Vismara; Levis (2013)	4,932	1959-2012	16.00%

Brazil	Aggarwal, Leal, and Hernandez; Saito; Ushisima	275	1979-2011	33.10%
China	Chen; Choi & Jiang; Jia; Xie and Zhang	2,637	1990-2014	113.50%
Indonesia	Suherman	464	1990-2014	88%
Russia	Dealogic	64	1999 -2014	3.30%

Source: Jay Ritter's Website

It should be noted that the underpricing levels in India are very high in the table, this is because it includes the period between 1990 to 1995 when the India markets were virtually unregulated, and the market was not demutualized. Thus, the levels of underpricing were higher and the number of stocks listing during the period was also high. However, for the period 2004-2009 the underpricing levels were only 24.5% according to Banerjee. [68]. Furthermore, according to Jinn, China also has a very high level of underpricing. This is attributed to the existence of more short-term traders in the country [65]. It is also observed that there is a lower level of underpricing in developed nations such as the United States and the UK [66].

This could be credited to the markets being more efficient due to better regulations, more information in the public domain, which leads to higher information level and lower information asymmetry. Increased level of analyst coverage in developed countries also leads to a lower level of underpricing as there is better coverage [64].

Research covering more than 10,000 companies getting listed from 36 countries was carried out in 2015 by Boulton et al. The study found that reducing information asymmetry played an important role in reducing the level of

underpricing that existed in the system. Furthermore, the study also established that underpricing was higher in developing economies such as India [65].

A study carried out in Latin America by Aggarwal et al established that the level of underpricing was different in the different period due to the hot and cold period [55]. According to Hopp, there is also evidence that underpricing is higher in countries where the rights of minority investors are protected, as the managers ensure underpricing is beneficial for them, in terms of controlling the affairs at the company. The promoters prefer underpricing to attract investors and to prevent any acquisition bids [66].

The difference exists in underpricing levels in different countries, which can be attributed to the difference in methods of arriving at a price. In the United Kingdom and Asian countries, the levels are higher than in other countries [67].

Furthermore, investors home country bias plays an important role in the process of differentiation in country level biases, according to Banerjee et al [68]. In Finland, there has been research to establish that underpricing is highly and positively correlated with the level of returns the stock provided in the past. The study was conducted for FPO's [74]. Furthermore, the availability of information may also differ from country to country. Ljungqvist argued in 2003, that the availability of data is a function of how developed the market is. For a developing market, the data on pricing is not available immediately [84]. Thus, this impacts the underpricing. According to Bushman, where there is lesser information available, the level of underpricing is higher [72]. The higher level of skewness also leads to wider dispersion according to Green and Hwang [73]. It was argued in 2004 by Schultz that the availability of data is a function of how developed the market is [74]. One of the prominent researchers in this field was Aggarwal. He studied the phenomena of underpricing in a lot of developing and developed countries. Kunz and Aggarwal concluded in 1994, that the Switzerland stock

markets were underpriced by approximately 35%. [55]. In 2004, Loughran and Jay Ritter conducted a study to determine whether there was a difference in underpricing based on the time horizons. It was observed that there existed a difference. Such periods are known as "hot period" [61]. Table 3.3 captures the essence of the study.

Table 3.3: Underpricing Across Time United States

Period	Underpricing
1980's	7%
1990-1998	15%
1999-2008	65%

Source: Why has IPO Underpricing Changed over Time? Jay Ritter Website (2002)

3.8 THEORIES RELATED TO REASONS FOR UNDERPRICING

Study on underpricing started way back in the 1970s and since then there are a lot of theories that have been promulgated to identify the reasons for existing underpricing. In 1977, Ibbotson stated that his paper on underpricing provides insight, however, does not solve the underpricing puzzle. Numerous papers have been written after that, however, none of the papers have been able to propound a theory which could solve the mystery of underpricing [86]. Table 3.4 captures the different theories on underpricing.

Table 3.4: Theories Related to Underpricing

Reasons of Underpricing	**Theory/ Category**	**Author**	**Year**	**Theoretical (T)/Empirical (E)**
Discount offered to attract investors	Agency; Information Asymmetry	Ibbotson and Jaffe	1975	E
Information asymmetry	Agency; Information asymmetry	Kevin Rock	1986	T
Insider holding and ability to convey intrinsic value	Agency; Signaling	Grinblatt and Hwang	1989	T
Signaling for the success of future issues	Agency; Signaling	Ivo Welch	1989	T, E
Herd behavior by investors	Cascading	Ivo Welch	1992	T

Information production and insider ownership	Agency	Thomas Chemmanur	1993	T
The reputation of the underwriter influences the price	Certification Hypothesis	Chemmanur and Fulghieri	1994	T
Analyst coverage-investors optimism	Fundamental	Rajan and Servaes	1997	E
VC backed IPOs outperform	Certification Hypothesis	Bravand Gompers	1997	E
Reputed underwriter less Underpricing	Certification Hypothesis	R.B. Carter et al,	1998	E
Underperformance after Lockup expiration	After market activity	Field and Hanka [98]	2001	E

Role of underwriter in price stabilization; executing overallotment option	Role of Intermediary	Reena Aggarwal [99]	2000	E
Money left on the table by the underwriter	Role of Intermediary	Loughran and Ritter	2002	E
Allocation bias	Role of Intermediary	Reena Aggarwal et al.	2002	E
Book building	Issue mechanism	Ann Sherman	2005	T
Pseudo Market timing	Market timing	Paul Schultz	2003	E

Managerial ownership and lockup expiration period	Agency	Rajesh Aggarwal	2002	T, E
Flipping activity by institutional investors	After market activity	Reena Aggarwal	2003	E
Auction less underpriced as compared to book building	Issue mechanism	Derrien and Womack	2003	E
Underwriter and publicly available information	Role of Intermediary	Lowry and Schwert	2004	E
IPO features and syndicate structure of underwriter	Role of Intermediary	Corwin and Schultz	2005	E

Survey of CFOs for reasons to go public and reasons for underpricing	Theory and practices	Brau and Fawcett	2006	E
The linkage between past IPO returns, investors sentiment and future oversubscription	Macroeconomic factors	Kaustia and Knupfer	2008	E
Influence of credit rating on IPO underpricing	Firm specific	An and Chan [66]	2008	E
Learning from industry peers	Macroeconomic	Colaco et al. [87]	2009	E

Source: Katti, S., & Phani, B. V. (2016). Underpricing of Initial Public Offerings: A Literature Review.

The underlying theory which is generally attributed as an explanation for underpricing of IPO is agency theory. The structure of corporate law in the United States in the 1930s enforced the separation of ownership and control because the promoter owned the company and the directors managed the business. The same structure exists even today, according to Berle [108]. Emphasis on separation of security ownership and control was laid down for the first time by Fama [109].

According to Benveniste, there is a conflict of interest between the promoter and the investment banker. The promoter does not want to leave money on the table, while the investment banker wants to presell the issue. Hence, the investment banker causes underpricing according to Benveniste. [94].

The other theory that is commonly used for explaining underpricing is the contracts theory. Contracts theory defines a company as aggregate inputs which synergize together to produce the final product. Hence, there is a conflict of interest between the investor and the manager as stated by Amihud [110]. The manager is contractually obliged to look after the interest of the company, however, the same does not always happen. He at times may find short-term profits more lucrative. This leads to an agency problem. In the case of Initial Public Offer, there are essentially three parties involved - the promoter and initial investors, the underwriter and the manager. The underwriter and the manager are agents of the promoter and investors who would gain from the existence of underpricing. This is because the increase in the price of the stocks at the time of listing would give them the visibility that would prove helpful for them. However, the promoter and the initial investors would like to optimize their returns if not maximize their returns. Other theories such as information asymmetry and signaling arise out of this theory.

Rock in 1986 propounded a theory for why stocks were underpriced. According to Rock, the underpricing of stock occurred due to the difference in the level of information between the institutional investors, who were well informed and individual investors, who were not well informed. Investors who were not informed well would end up buying those stocks that were sub-quality. Hence this led to ‘winners curse' [86]. His assumption is that the market cannot exist of only informed shareholders. There is a need for existing shareholders, who are uninformed to increase the volumes in the markets. The concept is derived from

information asymmetry, which was introduced in 1970 by Akerlof, through the example of the lemon market. Here, the pricing was determined based on the difference in information at the disposal of lemon producer and buyer of lemons [87].

Factors such as quantum of news available on the sector also impact underpricing. The level of news is directly related to volatility levels according to Arthurs [91]. The same was also established by Johnson [101]. It should be noted that underwriters can choose whom to issue the shares in case there is excess demand as stated by Sherman [88]. Promoters prefer investors who have a long-term horizon to minimize volatility in share prices. Furthermore, the discretionary power of investors provides them an opportunity to help eliminate any form of information asymmetry. Thus, Welch and Ritter conclude that there would be a level of underpricing existing however it should not be very high to ensure benefit for all the parties involved [89]. To add to this, Loughran has observed that there is a conflict of interest between the issuer and the underwriter if there is excessive underpricing [61]. The role of analysts in underpricing company cannot be marginalized. In a paper published in 2000, it was established that stocks which had been underwritten by companies which had highly reputed analysts for the given sectors had a higher level of underpricing. For his study, Dunbar used the ranking of analysts as published by Institutional Investors [92].

According to Fabrizio, the companies which believe in signaling theory, first come up with a small issue which is followed by a larger issue. The smaller issue helps build the confidence of the investors; whereas larger issues are sold at better prices to make higher profits [97].

Intention to go for mergers and acquisition could be another reason for underpricing. In 1995, Zingales provided a rationale for why companies go for IPO. According to him, companies which wanted to raise money through mergers

and acquisition were interested in increasing their share value by getting listed in the stock markets. Hence, the value of the company increases at the time of acquisition [80]. Public trading signifies that the company has a lot of information on its financial performance in the public domain. The existence of information on public domain leads to stakeholders of the company including suppliers, lenders, customers and strategic business partners of the company having more faith in the company [86].

The promoters know it is easier for the acquirers to force the promoters to agree on a lower price than stock market investors. On the other hand, there is a theory developed by Black and Gibson in 1998 which says that promoters list their companies to prevent a venture capitalist from tracking their companies [80]. This theory is contrary to the theory propounded by Zingales [79]. However, both the theories seem to be plausible reasons for raising funds.

Behavioral factors also impact stock prices. There are a lot of variables that have no impact on underpricing. In India, also sentiments impact stock prices. According to Gohil, non-institutional groups determine the price of the stocks [107]. Furthermore, institution investors flip more than non-institutional investors [108].

The stage the company is in can also impact underpricing. Early stage companies prefer to be private. On the other hand, companies which have gathered critical mass generally attract investments from individuals who have a diversified portfolio. It should be noted that a diversified portfolio helps an investor absorb a higher level of risk. Thus, the company over a given period attracts investors with different risk appetite. Hence there are different levels of underpricing every time a company comes with a new issue [83].

Ritter in his seminal paper in 1984 stated that underpricing was a function of the inherent ex- ante risk that the stocks possessed [66]. Hence in sectors which had a higher risk, the underpricing was higher. He further added that there were two factors which increased riskiness. The first was difficulty in gauging the benefits of technology and the second was pertaining to certainty with which one can determine the price. If the future revenue streams are uncertain, then determining the value of the stocks is more difficult. In the period 2000 to 2008, most of the stocks that got listed suffered from both the problem in India according to Banerjee [68].

In 2003, Ljungquivst through realignment of incentive hypothesis propounded the theory that promoters do not have any problem leaving money on the table because money left on the table acts as an incentive for others to invest in the shares. Money left on the table can be arrived at by multiplying the first-day return with the total volume of shares sold [71].

In 1982, Baron proposed a model which assumed that the underpricing of stocks was primarily due to over-dependence on investment bankers in fixation of prices of stock. When the stocks are underpriced it is easier for the investment bankers to find individuals who are willing to invest in the stock [85].

In 2006, Brau and Fawcett conducted a survey among the CFOs and found that CFOs knew that their company's stocks were being underpriced. It was also observed that more than 40% of the shareholders underpriced to ensure dispersion of ownership [99].

According to Pagano and Volpin, companies try and impact regulatory norms and enforcement through political channels to ensure dispersion among new shareholders. In the case of underpricing, a larger base of investors takes interest in the issue. Hence, under the given environment, underpricing leads to wider

dispersion of ownership. Underpricing is followed by oversubscription, which in turn gives the discretionary power of allotment to promoters in many countries [100].

3.9 SECTORAL STUDIES ON UNDERPRICING

The level of underpricing is different in different sectors and the causes for underpricing can also differ based on sectors. The quantum of a study done on different sectors also varies from region to region and country to country. There are sectors such as infrastructure where there are hardly any studies on underpricing while sectors such as information technology and biotechnology have been studied extensively. Technological companies were highly underpriced in the 2000s due to the unavailability of information on the company and their unpredictable business models [82].

Dimovski, W. finds that in Australia, infrastructural underpricing is not significantly different from 0 [114]. On the other hand, Dimovski found that the average underpricing return for Chinese infrastructure IPOs is substantially higher at 86.3%, but interestingly substantially lower than the underpricing of Chinese IPOs generally [115]. The previous studies on infrastructure sector have established beyond doubt that there exists a significant underpricing in India in infrastructure. However, as the research is conducted using only seven variables and 50 stocks for a limited period from 2004 to 2010 it leaves scope for further study. There are no fundamental and macroeconomic variables considered for the study according to Dimovski, W [113]. This leaves a research gap in the area in which the given research intends to fill.

3.10 RESEARCH GAP

This section has been drawn based on the funnel approach of identifying the research gap. IPO is an important source of raising money for meeting the working capital requirement, to raise funds for capital expenditure or to reduce existing loans [96].

There are numerous studies conducted on IPOs across geographies which aim at solving the mis-valuation mystery that leads to preventing existing promoters from maximizing their wealth. These studies have attributed various factors for underpricing including the age of the firm, gross proceeds, size of the issue, the period of the issue - hot period and cold period, number of purposes of the issue of funds, winners curse, dynamic information acquisition, signal theory, wider dispersion of ownership, dilution of ownership, sales, measuring volatility of returns through standard deviation of returns etc.

Further research has also proved that the level of underpricing is different in different countries. In developing countries such as Brazil, Russia, China, and India it is higher than in developed countries. There are various reasons for the same such as a lower level of financial literacy and a higher level of regulations, and lesser availability of information for investors which increases information asymmetry. Furthermore, there are researchers that have proved that over time there is a difference in the level of underpricing. This could be attributed to the existence of hot and cold periods. The concept of the hot and cold period has been explained in Chapter 3. Following are the research gap that emerges from the literature review:

1. There are very few sector-specific researches on infrastructure sector underpricing which have been conducted pertaining to underpricing in the short run in India. Best to the researcher's knowledge there is only one study

conducted in India by Dimovski, which covers 50 infrastructure sector stocks only and looks at only five variables for a period of 2004 to 2010 [113]. There is a need for a more exhaustive study. The present study covers 179 stocks.

2. The infrastructure sector is impacted by fundamental, macroeconomic variables and market-related factors. In literature, more emphasis has generally been paid to market-related factors. Fundamental factors such as asset turnover and total assets are very important measures of infrastructure company's performance whose contribution to underpricing has not been investigated.

3. Macroeconomic variables also have an important role to play in influencing the demand of infrastructural sector stocks, hence the underpricing of stocks could be influenced by macroeconomic variables too.

4. None of the studies have considered the opinions of the experts while identifying variables. It is important to consider the opinion of experts as there are several variables which can be impacted by underpricing and discretion should be exercised while choosing the variables.

CHAPTER 4

RESEARCH METHODOLOGY

This chapter lays down the research design. The research gap has been identified with the help of a literature review and research design is aimed at outlining the research problem and thus solving it. It also contains the methodology adopted to identify the variables which could play an important role in driving the underpricing of IPO.

4.1 RESEARCH DESIGN

A research design refers to the guiding light that guides the researcher from the data collection process to the analysis phase of the research project. It provides the framework that specifies the type of information to be collected, its sources and collection procedure.

The research design is a blueprint on which the whole research process is based. While conducting the present study, care has been taken to incorporate these concepts into the research design.

4.1.1 Sampling Design

For this research the sample design is made keeping the following points under consideration:

Type of Universe:

For developing a sample design first, one needs to define the set of objects that one needs to study. The universe can be finite or infinite. In this case, the universe is finite as it includes all IPOs listed in the infrastructure sector in India.

Target Population:

The target population is a collection of objects or elements that show some common set of characteristics. The objects or elements possess information which the researcher extracts out and about which the inferences are to be made.

In this research, the target population which needs to be surveyed for analysis is any company listed at NSE or BSE. Thus, the target population will embrace all listed companies for objective 3. While for objective 4, the target population would include all infrastructural sector stocks listed in the stock market.

Sampling Element:

A sampling element is an element about which or from which the information is desired in survey research. In this research, the sampling element comprises companies listed between 2003 and April 2015.

Sampling Unit:

A decision regarding the sampling unit needs to be taken before the selection of the actual sample. It is an element or a unit containing elements which are available for selection in the form of a respondent.

All the companies listed in the stock market and whose information is available in the Prime Database to have been considered. There is 445 companies' information available.

Extent:

Extent refers to the range the target population is geographically distributed. In this research, the extent is companies listed in India only.

Sampling Technique:

In this research for data collection availability of data for the stocks are of the prime concern. There were 401 stocks that have been listed in Prime Database in the given period 2003-April 2015 on which all required data was available. The same has been used. Hence, secondary data from the leading database has been collected. Thus, convenience sampling has been used. IPO underpricing is impacted by behavioral factors. According to George Soros, a leading trader in the stock markets, determining prices is a complex process which involves reflexive decision making. In other words, the price is impacted by factors that are not in control of the underwriter and promoter.

Furthermore, it is difficult to identify which are the likely variables that may impact underpricing as there are too many variables that could impact underpricing. To ensure both completeness and parsimony, the researchers used two-pronged strategies to identify variables impacting underpricing.

4.1.2 Variable Identification

Extensive secondary research was conducted for identifying variables through exploratory research. Altogether there were 25 variables that were identified. These variables were clubbed into three groups as stated below.

From the literature review and considering expert view the following are the variables that were identified as variables that will affect the level of underpricing in the economy in the short run.

I. Fundamental Factors - primarily captures the performance of the company

1. Sales
2. Total Assets
3. PAT
4. Total Asset turnover
5. The net profit margin of the company at the time of issue
6. Type of the company (Public vs. Private)
7. Face Value – Splitting of shares is possible if the face value is high

II. Factors related to IPO Issue – aims at identifying variables which are related to the issue of IPO

8. Percentage of owner's share divested
9. Age of the company in years before going for IPO
10. Duration of IPO in days (IPO Closing Date – IPO Opening Date)
11. Pricing method (Fixed Price vs. Book building)
12. Offer Price
13. Percentage of fresh capital issued
14. Size of the Issue
15. The time gap between IPO close date and listing date

16. Oversubscription

III. Macro-Economic Variables and Market Returns

17. Forex reserves

18. M1, M2, M3 & M4

19. Value of Nifty

20. Nifty return on that day of listing

21. Nifty returns between the date of issue and date of the listing

22. Money supply during that period measured in terms of M1, M2, M3, M4

23. Number of IPOs issued during the previous 6 months

24. Nifty P/E Ratio

25. Infrastructure versus Non-Infrastructure

Table 4.1 gives the basis of identification of variables which have been used for research.

Table 4.1: Variables Identification Table

Variable	**Significance**	**Source of Data**	**The rationale for choosing the variable**
Age of the company in Years before	Entities experience in running the business can be an important factor.	Prospectus of 401 Companies	Literature review – Ritter (1984)

going for IPO	Raising funds signals to investors company's willingness to raise funds to expand. Ability to expand depends on the company's experience in executing projects. Hence, the age of the company is an important factor for investing in IPO.	in the database	
Duration of IPO in days (IPO Closing Date – IPO Opening Date)	A lot of investors including High Networth individuals borrow money and invest. These investors are impacted by the time it takes to get the stock listed since they must pay interest.	Prime Database	Literature review – Ajay Shah (1995), a proxy for interest float.
Type of the company (Public vs. Private)	A public limited company is already listed. Hence, the experience of investors last time in terms of underpricing can be an important signal.	Prime Database	Literature Review - Ritter (1991)
Pricing	As more companies	Prime	Literature Review -

Method	come with Book Building, there is less fanfare about Fixed Price Issues and they are generally less underpriced.	Database	Francois Derrieu (2003)
Face Value	Face Value enables the company to further split shares when the share price increases.	Prime Database	Variable added by the researcher, based on expert opinion
Type of sale	Purpose of raising money can be arrived at from the type of sale – offer for sale leads to wider dispersion and lower control by promoters.	Prime Database	Literature Review – Brennan & Frank (1997); Proxy for wider dispersion
Percentage of fresh capital issued	The percentage of fresh capital issued is an indicator of the capital structure after the issue. This could impact underpricing.	Prime Database	Literature review - Stoughton and Zechner (1998)
Size of the Issue/Gross Proceeds		Prime Database	Literature Review - Ritter and Beatty (1986)
The time	It leads to an increase in	Prime	Literature review –

gap between IPO close date and listing date	interest float hence impacts underpricing.	Database, Derived by Author	Ajay Shah (1995)
Sales	Fundamentals of the company provide a signal to the investor on the strength of the company.	Prospectus of 401 Companies in the database	Literature Review – Ritter (1986)
Total Assets at the time of issue	The size of the balance sheet is an indicator of the company's performance hence has been added by the researcher	Prospectus of 401 Companies in the database	Literature Review – Ritter (1986)
PAT at the time of issue	Profit is an important indicator of the efficiency of the company's performance and it impacts the demand for shares which leads to underpricing.	Prospectus of 401 Companies in the database	According to Purnanandam (2004) EBITDA is a better parameter.
Total Asset turnover at the time of issue	It measures the efficiency of the management in utilizing the resources of the	Prospectus of 401 Companies in the	Added by the researcher, based on Ritter (1986)

	company. For an infrastructure company, the same cannot be ignored.	database	
Net profit margin at the time of issue	It measures the operating efficiency of the organization and hence could impact demand for stocks.	Prospectus of 401 Companies in the database	Ritter (1997)
Percentage of owner's share divested	Increase in wider dispersion impacts the market.	Prospectus of 401 Companies in the database	Ritter (1986)
Forex reserves	In India, there is a huge FII investment in stock markets. Thus, Foreign Reserves should be considered as a factor that impacts FII investment.	RBI Website	Added based on expert opinion
Money supply during that period measured in terms of M1, M2, M3, M4	Money Supply is an important factor that determines the level of liquidity in the system, hence impacts demand for the stock.	RBI Website	CS Kwon, TS Shin (1999) Establishes the elationship.

Nifty	Nifty values have a psychological impact on the investors.	NSE Website	SSS Kumar (2007)
Nifty Returns on the day of listing	Nifty returns on the day are the measure of the performance of the stocks on the given day.	NSE Website	SSS Kumar (2007)
Nifty returns between the issue date and listing date	It captures the mood of the market in the given period.	NSE Website	SSS Kumar (2007)
Nifty P/E	It captures the performance of Nifty Stocks in the market.	NSE Website	SSS Kumar (2007)
Number of IPO's listed in the six months period	It captures the impact of the hot and cold period. More the IPO's listed higher would be the impact.	Prime Database	Saurabh Ghosh (2004)
Type of Company	It is being gauged how underpricing is different in each of the three sub-sector using dummy variable.	Prime Database	Added by the researcher and vetted by expert opinion.

Source: Researcher

4.1.3 Expert Opinion

The variables identified through secondary research was then shared with 10 experts. The experts for the sector include finance experts from relevant industry, analysts, and fund managers. Following is the list of experts:

Table 4.2: List of Experts

S. No.	Name	Organization
1	Rajendra Prasad Mikkilineni	Portfolio Manager, Karvy Stock Broking Ltd.
2	Ashish Mahajan CFA	CEO, Indian Reality Bytes
3	Siddharth Bothra	Senior Portfolio Manager, Motilal Oswal
4	Abraham C Mathews, ACA	Ex-Stock Market Trader and Journalist- Business World
5	Abhishek Saraf	Intrapreneur, GVK
6	Ankur Dani	Deputy Manager, Strategy, Tata Projects
7	Durgesh Pandey	Deputy AGM, Finance, Aircel
8	Bryan D'Aguair, CFA	Portfolio Manager, Ashmore

9	CA Vineet Hetmasaria, CFA	Former AVP, Investments, Bharat AXA Life Insurance
10	Abhishek Nalawaya	Head, Investors Relations, Reliance Capital

Source: Researcher

The experts believed a variable - oversubscription should not be considered. According to Ashish Mahajan, CFA, CEO Indian Reality Bytes oversubscription is captured by other variables such as money supply. Other experts also agreed and hence oversubscription was omitted. They added two variables namely Face Value and Foreign Exchange Reserves. According to Rajendra Prasad, Portfolio manager Retail Karvy Broking face value as a variable should be added. It influences the ability to split the shares in the future. According to Durgesh Pandey, Deputy AGM, Finance, Aircel, Foreign Exchange Reserves impact global markets, as it is a proxy for foreign exchange currency movements.

4.1.4 Period of Study

Data for the study includes IPOs listed from 2003 to April 2015. Following are the reasons for selecting this period:

- At the end of 2003, Standard and Poor's hailed India as one of the fastest growing markets in the world. This was post 'Ketan Parekh scam' in 2000 where the investor's faith in the market was shaken.

- This period was largely free of any large-scale stock market scams; hence it can be assumed that the markets were not rigged. The hot and cold periods can hence be attributed to economic conditions and market sentiments and not to abnormal factors.

- The period had a sufficient number of hot and cold periods, which are important to understand the phenomenon of underpricing.

- The period 2004 to 2008 is hailed as one of the longest bull periods (hot period) in India. It was marked by increasing Foreign Institutional Investment (FII) in India. This period also saw a lot of interest in infrastructural sector stocks.

- However, the global recession seemed to impact the Indian markets in 2008. It took a while for the market to recover. Hence, the hot period was followed by a cold period.

4.2 COMPETING MODELS FOR RESEARCH

To conduct quantitative research, the researcher has compared three basic models. The models used by the researcher are given below.

Multifactor Regression Analysis After Box-Cox Transformation

Multifactor regression analysis refers to creating a linear model to establish a relationship between the independent variables and dependent variables. The success of the model in identifying drivers depends on the nature of data being used for research.

The data should be normal as the tool being used is parametric. Hence, it is important to transform the data using a robust transformation tool and test subsequently whether the data is normalized.

In this research, the researcher has used BoxCox Transformation for transforming the data into consideration. BoxCox Transformation is a robust method for transformation of data. It manipulates the non-normal data and suggests the appropriate factor to change collected data into normal data. [115].

This method is appropriate in cases where the data is highly skewed. BoxCox Transformation however in itself may not ensure the transformation of the data. The same is ensured using a Box Plot Diagram.

In the study, the researcher has used 25 variables and the number of companies is 383 after removing outliers.

It should, however, be noted that multi-factor models work best when the researcher shows parsimony in choosing the variables as well as does not simplify the model too much to compromise on completeness of the model.

Moreover, the economic hypothesis is generally impacted by many variables which may be correlated with them. Therefore, it also makes sense to look at other competing models to ensure parsimony of data as well as completeness of model – stepwise regression followed by Principal Component Analysis.

Stepwise Regression

When there are independent variables which are highly correlated it is prudent to use PCA to remove the multicollinearity that exists in the data. By using principal component analysis, the variables which are similar are loaded together. The stepwise regression equation is run for removing variables that do not make any impact. This helps get better results.

This method of analysis involves finding the linear combination of a set of variables that has maximum variance and then removing its effect.

Stepwise Regression is a method of regression wherein those variables which have weak correlation coefficients are removed. This is useful in econometrics studies where all variables do not seem to be contributing to the results.

Moreover, variables which are not contributing may be correlated with each other leading to multicollinearity [117].

However, at times it is possible that multicollinearity exists even after conducting Stepwise Regression. Hence the other competing model that can be used here is principal component analysis followed by stepwise regression. There is a likelihood of improving the result through machine languages.

Artificial Neural Network

Artificial Neural Network (ANN), which is an artificial intelligence method, is generally used in a situation where the input is simple and so the output is simple however the process which relates the input to the output is complex. Hence, the ANN is used for arriving at the price when there are many decision makers.

In the case of Initial Public Offer, there are three parties involved – the promoters, the underwriters, and the investors. Each homogenous group consists of heterogeneous members which make ANN suitable for such purpose. However, in the given case the ANN has a very low r-square of 8.6% under backward propagation. Thus, it can be deduced that out of the four models "Principal Component Analysis after Step Wise Regression" is the most reliable. This is because the multicollinearity has been removed and the r –squared is also high relative to other models.

CHAPTER 5

DATA ANALYSIS AND INTERPRETATION

The following section elucidates the analysis of data based on the research methodology explained in Chapter 4 for objective 3 and 4. The findings and conclusion sections are based on the interpretation of statistical analysis carried out in the section.

5.1 IDENTIFYING DRIVERS OF UNDERPRICING FOR ALL THE SECTORS

Underpricing as a phenomenon keeps changing over time. Hence, it makes sense to understand the drivers of underpricing for all the stocks for the period 2003 to April 2015 and to compare it with underpricing of infrastructure sector only. This period also saw an increase in participation of foreign institutional investors. Hence, the market was robust and can be called relatively efficient. At the end of 2003, India was positioned as one of the most promising markets globally. It lived up to the expectations of the market being almost unidirectional and northward for more than four years up to 2008. However, it was also impacted in 2008 by a change in investor sentiment across the globe. This period saw the interlinkage between markets increasing. Hence, the importance of fundamental and macroeconomic factors became more important as investors were ready to invest in any country which was performing well.

There were 445 companies whose data was available on the prime database for the period 2003 to April 2015, however, as variables were not available for some

companies' dataset was reduced to 401. The descriptive statistics of the data is captured in table 5.1.

Table 5.1: Descriptive Statistics Table before the BoxCox transformation

Variable	Mean	SD	Median	Min	Max	Skew	Kurtosis
Age Years	15	15	12	52	108	4	16
Duration	5	3	4	2	36	5	59
Offer Price	179	190	120	10	1310	2	8
Fresh Capital	1	0	1	0	1	-3	7
Issue_Amt	3548	11566	9275	600	151994	9	89
Time_Gap	20	9	20	12	174	13	211
Underpricing	0	1	0	-1	3	2	5
Sales	4407	12887	10740	0	188712	9	111
Total Assets	1993	10322	12000	54	138490	9	95
PAT	7195	36046	926	6059	526080	11	135
TATR	1	1	1	0	16	6	47
NPM	0	1	0	-8	7	-1	109
Perc Divested	0	3	0	-57	1	-10	392
Forex Rupees	1009	3409	9380	3506	21462	0	-1
Nifty	4242	1363	4267	1002	8778	-0	-0
Nifty. Returns	0	0	0	-0	0	-1	2
Nifty Returns	0	0	0	-0	0	-1	1
IPO	29	14	27	1	58	0	-1
M1	1066	3643	9411	4532	22763	1	-0
M2.M1	210	63	188	109	464	1	2
M3.M2	2958	13800	24906	12296	81791	1	1
M4.M3	1105	151	1150	519	1716	-1	4
Neotype	20	3	20	12	28	0	-0

In table 5.1 normality check for all the variables using describe () of psych package in R is carried out.

a. As can be seen in table 5.1, it appears that majority of the variables are heavily skewed and have higher peaks, as can be seen by skewness values not within -1 and +1 limits and kurtosis values also widely differ from 0.

   Hence, instead of removing the outliers in the first step itself, it is planned to perform BoxCox Transformation on all the quantitative variables, using appropriate Lambda values for each of the columns. BoxCox. Lambda(x) from forecast package has been used to get the appropriate lambda value for each of the quantitative variables. BoxCox (x, lambda) has been used to transform the variables using lambdas generated in the previous step.
   To automate the whole process, the following function has been created and is applied to all the quantitative variables:

   AutoTransform <- function(x) {library(forecast)

   return (scale (BoxCox (x, BoxCox.lambda(x))))}

   numcols<c
   (2,7,11,13,14,16,17,19,20,21,22,23,24,27,28,29,30,31,32,33,34,35,36)

   ipo [, numcols] <-lapply (ipo [, numcols], autoTransform)

   The updated values of Skewness and Kurtosis for the transformed variables are given in table 5.2.

Table 5.2: Descriptive Statistics after the BoxCox Transformation

Variables	N	Mean	SD	Median	Min	Max	Skewness	Kurtosis
Age Years	401	0	1	0.13	-4	2.7	-0.79	**2.17**
Duration	401	0	1	0	-1.7	3.4	-0.26	-0.68
Offer Price	401	0	1	0.12	-2.8	2.1	-0.46	-0.09
Fresh_Capital_Perc	401	0	1	0.44	-3.1	0.4	-2.17	3.34
Issue_Amt	401	0	1	-0.02	-2.9	2.7	0.06	-0.09
Time_Gap	401	0	1	0.19	-2.6	3.9	-0.4	0.21
Underpricing	401	0	1	-0.01	-2.1	3.5	0.47	0.32
Sales	401	0	1	0.01	-9.7	2.4	-2.58	21.86
Total Assets	401	0	1	-0.12	-4.5	3	0.21	1.25
PAT	401	0	1	-0.24	-2	9.4	4.67	32.48
TATR	401	0	1	0.18	-4.7	2.9	-1.28	3.35
NPM	401	0	1	-0.02	-8.8	6.1	-1.67	22.58
Perc Divested	401	0	1	0.2	-13	1.5	-6.06	65.72
Forex Rupees	401	0	1	0.02	-3.3	2	-0.39	-0.64
Nifty	401	0	1	0.21	-4.1	1.9	-1.12	1.14
Nifty. Returns	401	0	1	0.04	-4.5	4.4	-0.59	2.95
Nifty Returns	401	0	1	0.2	-3.4	3.6	-0.5	1.16
IPO	401	0	1	-0.08	-2.2	1.8	-0.23	-0.74
M1	401	0	1	-0.17	-2.6	2.3	0.03	-0.77
M2.M1	401	0	1	-0.16	-3.1	2.3	0.08	-0.25
M3.M2	401	0	1	-0.02	-2.4	1.9	-0.04	-1
M4.M3	401	0	1	0.34	-5.4	2.6	-2.11	7.01
Neotype	401	0	1	-0.01	-2	2.9	0.45	0.06

Table 5.3 shows the optimal lambda values obtained for each of the variables after conducting the BoxCox Transformation. The lambda value indicates the power to which data should be raised to normalize the data.

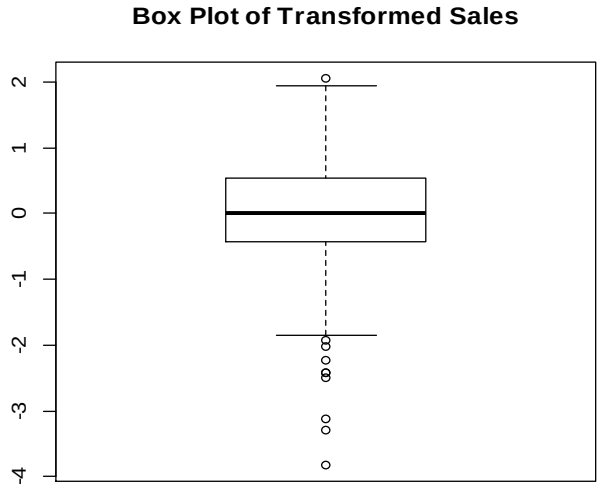
Table 5.3: Optimal Lambda Values

Particulars	Lambda
Age Years	0.851
Duration	1.005
Offer Price	1.182
Fresh_Capital_Perc	1.401
Issue_Amt	0.970
Time_Gap	0.848
Underpricing	0.865
Sales	0.866
Total Assets	0.809
PAT	0.590
TATR	0.996
NPM	0.686
Perc Divested	1.037
Forex Rupees	0.525
Nifty	0.745
Nifty. Returns	0.822
Nifty Returns	1.038
IPO	0.803
M1	0.980
M2.M1	0.840
M3.M2	0.688
M4.M3	0.531
Neotype	0.873

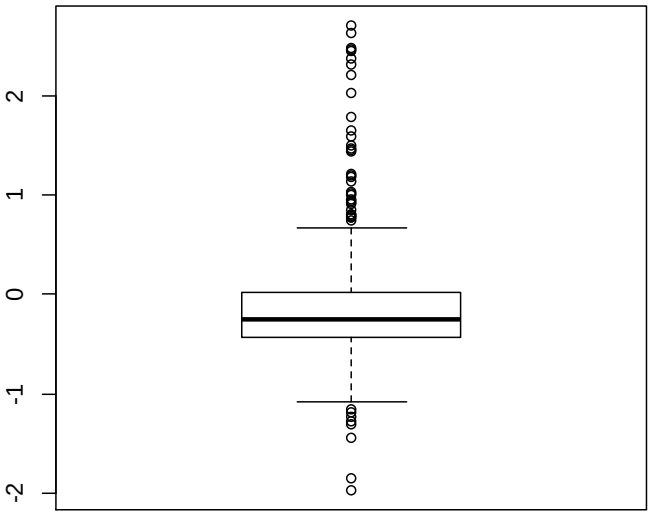
After the transformation, it appeared like skewness and kurtosis levels for most of the variables came closer to 0. However, for some of the variables, the skewness

levels are still beyond -1 and +1 levels and hence outliers from the data are removed after the transformation.

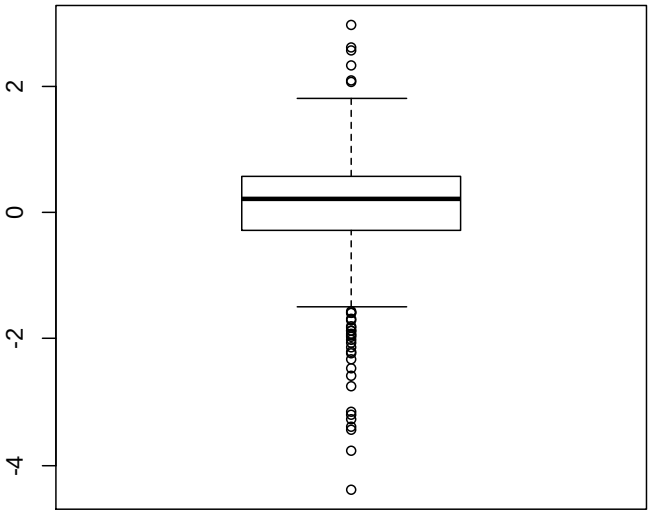
Face value is converted as a categorical variable rather than keeping it as a continuous variable. Box Plots are plotted for each of the variables which had abnormal skewness and kurtosis. Values were removed accordingly.

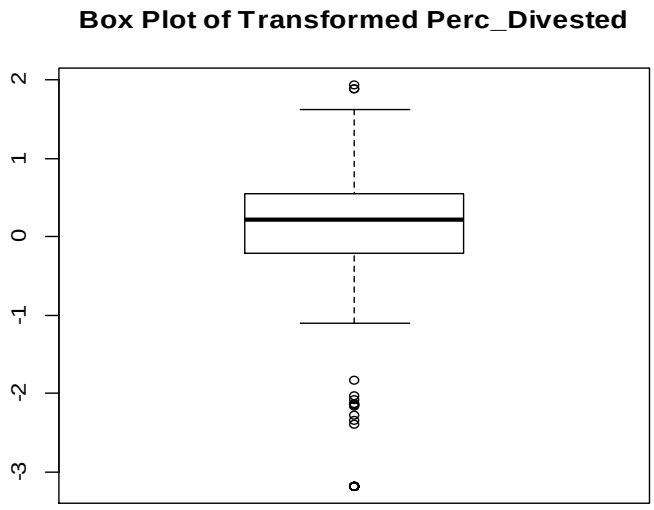


Box Plot of Transformed PAT



Box Plot of Transformed TATR





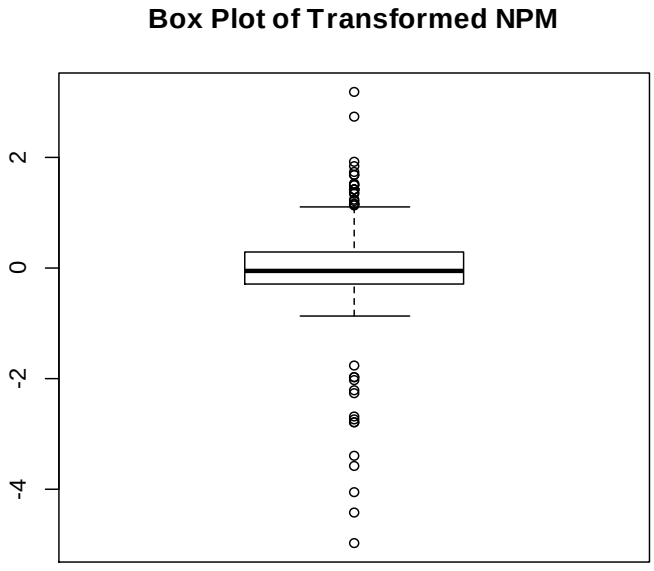


Fig. 5.1: Box Plot Diagram

Based on the box plots in Figure 5.1, it is understood that in each of the variables there are very few observations which are falling as deep outliers and hence it is planned to remove those outliers from the data. After the removal of outliers, we were left with 383 records. The descriptive statistics of the data after removing outliers is given in table 5.4.

Table 5.4: Descriptive Analysis of BoxCox Transformation

Variable	**N**	**Mean**	**SD**	**Median**	**Min**	**Max**	**Skew**	**Kurtosis**
Age Years	383	0.05	0.90	0.14	-2.98	2.65	-0.40	1.67
Duration	383	-0.01	0.99	0.00	-1.73	1.87	-0.34	-0.92
Offer Price	383	0.02	1.00	0.12	-2.80	2.13	-0.49	-0.07
Issue_Amt	383	-0.04	0.97	-0.03	-2.90	2.60	-0.04	-0.11
Time_Gap	383	0.02	1.00	0.19	-2.56	3.85	-0.40	0.21
Underpricing	383	0.00	1.01	-0.01	-2.10	3.48	0.47	0.28
Sales	383	0.04	0.78	0.01	-2.49	2.11	-0.18	0.28
Total Assets	383	- 0 . 0 1	0.91	-0.13	-3.28	3.03	0.39	0.56
PAT	383	-0.08	0.62	-0.24	-1.97	2.71	1.80	5.37
TATR	383	0.07	0.90	0.21	-3.45	2.93	-0.97	2.50
NPM	383	0.00	0.75	-0.04	-4.41	3.21	-1.34	8.93
Perc Divested	383	0.00	1.02	0.21	-12.74	1.45	-6.03	64.25
Forex Rupees	383	0.00	1.00	0.02	-3.31	2.04	-0.40	-0.60
Nifty	383	0.00	1.00	0.21	-4.14	1.93	-1.13	1.24
Nifty. Returns	383	0.00	1.01	0.04	-4.54	4.35	-0.58	2.90
Nifty Returns	383	-0.01	1.01	0.19	-3.40	3.57	-0.49	1.10
IPO	383	0.01	1.00	-0.08	-2.23	1.84	-0.24	-0.74
M1	383	0.00	1.00	-0.17	-2.61	2.28	0.04	-0.74

M2.M1	383	0.00	1.00	-0.16	-3.12	2.34	0.08	-0.21
M3.M2	383	0.00	1.00	-0.02	-2.40	1.94	-0.04	-0.98
M4.M3	383	0.00	1.01	0.34	-5.44	2.59	-2.13	7.16
Neotype	383	0.00	1.00	-0.01	-1.97	2.90	0.45	0.10

Linear Regression Model for Underpricing after BoxCox Transformation

A linear model is created with Underpricing as the dependent variable and the following variables as explanatory variables:

Age of the company in Years before going for IPO, Duration of IPO in days (IPO Closing Date – IPO Opening Date), Type of the company (Public vs. Private), Pricing method (Fixed Price vs. Book building), Face value of the share, Offer Price, Type of sale, Percentage of fresh capital issued, Size of the Issue, Time-gap between IPO close date and listing date, Sales, Total Assets, PAT, Total Asset Turnover, Net profit margin of the company at the time of issue, Percentage of owner's share divested and a few economic variables at the time of issue like (Forex reserves, Value of Nifty, Nifty return on that day of listing, Nifty returns between the date of issue and date of listing, Money supply during that period measured in terms of M1, M2, M3, M4) and number of IPOs issued during the previous 6 months.

Table 5.5 captures the result of the regression model after BoxCox Transformation. It is observed that some of the variables are only contributing significantly to the underpricing. Hence, it makes sense to use stepwise regression. Furthermore, multicollinearity should be tested and removed if required at this stage.

The following are the variables which have emerged as significant contributors – non-infrastructure sector, Offer Amount, Issue Size, economic sector, sales, Total

Assets, and Total Assets Turnover. Hence, the parsimony principle demands that the researcher should be able to reduce the variables that are not contributing to the result. Thus, the number of variables needs to be reduced further as multicollinearity exists. Principal Component Analysis may be used to load factors together. Stepwise regression could then be used to reduce the number of variables to include those variables which are significant contributors to the process of underpricing.

Table 5.5: Regression Model Output

	Estimate	**Std. error**	**T Value**	**Pr(>|t|)**
(Intercept)	2.583745	1.481751	1.744	**0.0821**
Age_Years	0.000658	0.057436	0.011	0.99087
Duration	0.047224	0.060285	0.783	0.43396
Company.TypePRIVATE	-1.52505	1.023301	-1.49	0.13705
Company.TypePUBLIC	-1.16405	1.044264	-1.115	0.26575
Pricing_MethodFIXED	-0.08464	0.198038	-0.427	0.66937
Face_Value2	-1.15268	1.154529	-0.998	0.31878
Face_Value4	-0.18764	1.376568	-0.136	0.89165
Face_Value5	-1.32314	1.002252	-1.32	0.18765
Face_Value10	-1.08249	0.952486	-1.136	0.25654
Face_Value100	-2.00876	1.342386	-1.496	0.13546
Offer_Price	0.172436	0.078057	2.209	**0.02782**
Sale_TypeONLY_FreshCapital	0.361079	0.324404	1.113	0.26645
Sale_TypeONLY_OfferForSale	-0.15925	0.386146	-0.412	0.68029
Fresh_Capital_Perc	-0.19354	0.156389	-1.238	0.21673
Issue_Amt	-0.24104	0.112365	-2.145	**0.03263**
Time_Gap	-0.05989	0.075337	-0.795	0.42715

	Estimate	**Std. error**	**T Value**	**Pr(>|t|)**
Sales	1.10884	0.627804	1.766	**0.07824**
Total_Assets	-1.05237	0.586082	-1.796	**0.07343**
PAT	0.021356	0.170102	0.126	0.90016
TATR	-0.69482	0.387381	-1.794	**0.07374**
NPM	0.037831	0.098087	0.386	0.69996
Perc_Divested	0.014278	0.053227	0.268	0.78867
Sector Economic	-0.30609	0.171111	-1.789	**0.07452**
SectorNonCore	-0.23033	0.221298	-1.041	0.2987
SectorNonInfrastructure	-0.35107	0.132975	-2.64	**0.00866**
Forex_Rupees	-0.08902	0.345217	-0.258	0.79667
Nifty	0.487858	0.431034	1.132	0.25849
Nifty.Returns	-0.03839	0.051402	-0.747	0.45562
Nifty_Returns	0.198935	0.066799	2.978	**0.0031**
IPO	-0.11807	0.087277	-1.353	0.17699
M1	-1.09938	0.723636	-1.519	0.12961
M2.M1	0.420683	0.581963	0.723	0.47025
M3.M2	0.265396	0.662142	0.401	0.6888
M4.M3	-0.24747	0.23737	-1.043	0.29788
Nifty. P/E	0.075052	0.139241	0.539	0.59023

Table 5.6 captures the correlation between the variables. As it is observed that there exists a high correlation between some of the variables it is assumed that Principal Component Analysis will play an important role in improving the result of the study.

Table 5.6: Understanding the Correlation between the Variables

	Underpricing	Age_Years	Duration	Offer_Price	Fresh_Capital_Perc	Issue_Amt	Time_Gap	Sales	Total_Assets	PAT	TATR	NPM	Perc_Divested	Forex_Rupees	Nifty	Nifty.Returns	Nifty_Returns	IPO	M1	M2.M1	M3.M2	M4.M3	Nifty.P.E
Underpricing	1	0.06	0.15	-0	-0	-0.1	0.15	-0	-0.1	0.01	0.09	0.08	0.03	-0.3	-0.2	0.05	0.33	0	-0.3	-0.3	-0.3	-0.2	0.05
Age_Years	0.06	1	0	0.03	-0.1	0.05	0.03	0.18	0.17	0.18	-0	0.04	0.05	-0	0.03	0.01	0.08	0.05	-0	-0	-0	0.02	0.08
Duration	0.15	0	1	-0.1	0.04	-0.2	0.36	-0.1	-0.2	-0.1	0.12	0.02	0.13	-0.5	-0.5	0	0.02	0.11	-0.6	-0.6	-0.6	-0.4	-0.3
Offer_Price	-0	0.03	-0.1	1	-0.2	0.64	-0.3	0.38	0.41	0.38	-0.1	0.2	-0.3	0.19	0.24	-0	-0	0.1	0.19	0.19	0.19	0.23	0.19
Fresh_Capital_Perc	-0	-0.1	0.04	-0.2	1	-0.3	0.12	-0.3	-0.3	-0.3	0.03	-0.1	0.32	-0	0.04	-0	0.03	0.27	-0.1	-0.1	-0.1	0.05	0.06
Issue_Amt	-0.1	0.05	-0.2	0.64	-0.3	1	-0.4	0.54	0.77	0.55	-0.4	0.06	-0.3	0.21	0.25	0	-0	-0	0.23	0.24	0.23	0.21	0.22
Time_Gap	0.15	0.03	0.36	-0.3	0.12	-0.4	1	-0.2	-0.2	-0.1	0.12	-0	0.15	-0.5	-0.4	-0	0.1	0.26	-0.6	-0.6	-0.6	-0.3	-0.2
Sales	-0	0.18	-0.1	0.38	-0.3	0.54	-0.2	1	0.77	0.64	0.22	-0.1	-0.2	0.08	0.1	0.07	0.06	-0.1	0.11	0.12	0.11	0.06	0.14
Total_Assets	-0.1	0.17	-0.2	0.41	-0.3	0.77	-0.2	0.77	1	0.66	-0.5	-0	-0.2	0.14	0.15	0	-0	-0.1	0.16	0.16	0.16	0.1	0.17
PAT	0.01	0.18	-0.1	0.38	-0.3	0.55	-0.1	0.64	0.66	1	-0.1	0.47	-0.2	0.13	0.11	0.01	0.02	-0.1	0.14	0.14	0.14	0.07	0.09
TATR	0.09	-0	0.12	-0.1	0.03	-0.4	0.12	0.22	-0.5	-0.1	1	-0.1	0.07	-0.1	-0.1	0.09	0.09	0.03	-0.1	-0.1	-0.1	-0.1	-0.1
NPM	0.08	0.04	0.02	0.2	-0.1	0.06	-0	-0.1	-0	0.47	-0.1	1	-0.1	0.02	0	-0	0.03	-0	0	-0	0.01	-0	-0
Perc_Divested	0.03	0.05	0.13	-0.3	0.32	-0.3	0.15	-0.2	-0.2	-0.2	0.07	-0.1	1	-0.1	-0.1	0	0.02	0.1	-0.1	-0.2	-0.1	-0.1	-0.1
Forex_Rupees	-0.3	-0	-0.5	0.19	-0	0.21	-0.5	0.08	0.14	0.13	-0.1	0.02	-0.1	1	0.9	-0	-0.2	-0	0.96	0.94	0.98	0.84	0.48
Nifty	-0.2	0.03	-0.5	0.24	0.04	0.25	-0.4	0.1	0.15	0.11	-0.1	0	-0.1	0.9	1	0.04	-0	0.25	0.87	0.86	0.88	0.92	0.71
Nifty.Returns	0.05	0.01	0	-0	-0	0	-0	0.07	0	0.01	0.09	-0	0	-0	0.04	1	0.28	-0	0.02	0.04	0.01	0.02	0.08
Nifty_Returns	0.33	0.08	0.02	-0	0.03	-0	0.1	0.06	-0	0.02	0.09	0.03	0.02	-0.2	-0	0.28	1	-0	-0.2	-0.1	-0.2	-0.1	0.24
IPO	0	0.05	0.11	0.1	0.27	-0	0.26	-0.1	-0.1	-0.1	0.03	-0	0.1	-0	0.25	-0	-0	1	-0.1	-0.1	-0.1	0.3	0.25
M1	-0.3	-0	-0.6	0.19	-0.1	0.23	-0.6	0.11	0.16	0.14	-0.1	0	-0.1	0.96	0.87	0.02	-0.2	-0.1	1	0.99	0.99	0.81	0.46
M2.M1	-0.3	-0	-0.6	0.19	-0.1	0.24	-0.6	0.12	0.16	0.14	-0.1	-0	-0.2	0.94	0.86	0.04	-0.1	-0.1	0.99	1	0.98	0.82	0.43
M3.M2	-0.3	-0	-0.6	0.19	-0.1	0.23	-0.6	0.11	0.16	0.14	-0.1	0.01	-0.1	0.98	0.88	0.01	-0.2	-0.1	0.99	0.98	1	0.8	0.47
M4.M3	-0.2	0.02	-0.4	0.23	0.05	0.21	-0.3	0.06	0.1	0.07	-0.1	-0	-0.1	0.84	0.92	0.02	-0.1	0.3	0.81	0.82	0.8	1	0.45
Nifty.P.E	0.05	0.08	-0.3	0.19	0.06	0.22	-0.2	0.14	0.17	0.09	-0.1	-0	-0.1	0.48	0.71	0.08	0.24	0.25	0.46	0.43	0.47	0.45	1

Interpretation

Closely observing the correlations in table 5.6, it is observed that there exists a strong relationship between a few variables. (For e.g. correlation between forex rupees and the Money supply variables is above 0.9, similarly between Nifty and Money supply variables etc.) Hence, the outcome of regression might be exposed to a good amount of multi-collinearity thus impacting the predictors of underpricing. Therefore, it is decided to go with principal component analysis to fine tune the variables before they can be used for predicting the underpricing.

Principal Component Analysis

The idea of principal components analysis (PCA) is to find a small number of **linear combinations** of the variables to capture most of the variation in the data. Linear combinations where the summation of squares of the weights is equal to 1 are called standardized linear combinations. Principal components analysis finds a set of orthogonal standardized linear combinations which together explain all the variation in the original data. There are as many principal components as there are variables, but typically it is only the first few of them that explain important amounts of the total variation as shown in table 5.7.

Table 5.7: Extracted Principal Components

Components	**Standard Deviation**	**Proportion of variance**	**Cumulative Proportion**
PC1	**2.6244**	0.3131	0.3131
PC2	**1.843**	0.1544	0.4675
PC3	**1.30781**	0.07774	0.54521
PC4	**1.2128**	0.06686	0.61207
PC5	**1.10985**	0.05599	0.66805
PC6	**1.08553**	0.05356	0.72162
PC7	**1.04841**	0.04996	0.77158
PC8	0.95585	0.04153	0.81311
PC9	0.89594	0.03649	0.84959
PC10	0.84838	0.03272	0.88231
PC11	0.79074	0.02842	0.91073
PC12	0.77621	0.02739	0.93812
PC13	0.67738	0.02086	0.95897

Components	Standard Deviation	Proportion of variance	Cumulative Proportion
PC14	0.63862	0.01854	0.97751
PC15	0.42459	0.00819	0.98571
PC16	0.38304	0.00667	0.99238
PC17	0.32766	0.00488	0.99726
PC18	0.20002	0.00182	0.99907
PC19	0.09794	0.00044	0.99951
PC20	0.06381	0.00019	0.9997
PC21	0.06131	0.00017	0.99987
PC22	0.05426	0.00013	1

Interpretation

The first principal component (PC1) explains 31.3% of the total variation and only the next six (PC2–PC7) explain more than 75% of the total variation. As more than 75% of the variance is explained with seven variables they can be used. Scree Plot is showing the relative importance of first 6-7 components. The standard practice is to assume that the number of sufficient principal components needs to account for more than 75% of the total variation. In this case, the first 7 factors account for 77% of the variance. Rotated component Matrix shows that Component 1 (Macro Factors) represents a combination of Forex rupees, Nifty, Money supply M1, M2-M1, M3-M2, and M4-M3. These all can be considered as macroeconomic variables. Component 2 (Company fundamental performance) is heavily loaded on Issue Amount, Sales, Total Assets and PAT which are more associated with company specific performance elements. Component 3 symbolizes Total Asset Turnover and component 4 is more on NPM both indicating Efficiency and profitability ratios respectively

Similarly, component 5 indicates the number of IPOs in the past 6 months, Component 6 indicates offer price, Component 7 loads more on % change in Nifty from IPO issue date to list date, Component 8 indicates % divested.

Table 5.8: Sampling Adequacy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.721**
Bartlett's Test of Sphericity	Approx. Chi-Square	**10988.498**
	Df	**231**
	Sig.	**.000**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy is greater than 0.6 and hence the sample is adequate. As Bartlett's Test of Sphericity gives a significance level of 0.000 it can be assumed that there is the homogeneity of variances.

Using the Rotated Components for Regression Method

Stepwise linear regression using the transformed principal components as explanatory variables and underpricing as the dependent variable is given in table 5.9.

Table 5.9: Stepwise Regression

	Variables Entered	**Method**
1	REGR factor score 7 for analysis 1	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	REGR factor score 1 for analysis 1	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	REGR factor score 12 for analysis 2	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	REGR factor score 15 for analysis 1	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Table 5.10: Regression Coefficients

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T value**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	-.002	.050		-.031	.975
	REGR factor score 7 for analysis 2	.282	.050	.278	5.650	.000
2	(Constant)	-.002	.048		-.032	.975
	REGR factor score 7 for analysis 2	.282	.048	.278	5.863	.000
	REGR factor score 1 for analysis 2	-.264	.048	-.261	-5.494	.000
3	(Constant)	-.002	.047		-.032	.974
	REGR factor score 7 for analysis 2	.282	.048	.278	5.926	.000
	REGR factor score 1 for analysis 2	-.264	.048	-.261	-5.553	.000
	REGR factor score 12 for analysis 2	.145	.048	.143	3.042	.003
4	(Constant)	-.056	.052		-1.065	.288
	REGR factor score 7 for analysis 2	.277	.047	.273	5.848	.000

	REGR factor score 1 for analysis 2	-.266	.047	-.263	-5.641	.000
	REGR factor score 12 for analysis 2	.139	.047	.137	2.937	.004
	Core Infrastructure	.288	.121	.111	2.383	.018
5	(Constant)	-.059	.052		-1.128	.260
	REGR factor score 7 for analysis 2	.276	.047	.273	5.872	.000
	REGR factor score 1 for analysis 2	-.267	.047	-.263	-5.672	.000
	REGR factor score 12 for analysis 2	.139	.047	.137	2.945	.003
	Core Infrastructure	.305	.121	.118	2.525	.012
	REGR factor score 15 for analysis 2	-.103	.047	-.102	-2.190	.029
a. Dependent Variable: Underpricing						

Interpretation

The adjusted R-Squared of the model is 17.8% which is slightly less than the adjusted R-Squared obtained through a direct stepwise regression. The variables that are influencing the underpricing also changed a little bit through this process.

Here as the multicollinearity among the variables is eliminated, the reliability of the model is much higher compared to stepwise linear regression directly on the original variables. The ANOVA table (Sig. = 0.000 < 0.05) indicates that this model is better than a model with no parameters fitted. These four variables are expected to have a significant influence in the determination of underpricing.

Verifying the Results with Neural Networks

In cases where the input and output are simple, however, the process is complicated machine language can be used to get more reliable and better results. An artificial neural network (ANN) is constructed from several interconnected nodes known as neurons.

These are arranged into an input layer, a hidden layer, and an output layer. The input nodes correspond to the number of features you wish to feed into the ANN and the number of output nodes corresponds to the number of items we wish to predict. At the heart of a neural network is the neuron.

Backpropagation Algorithm

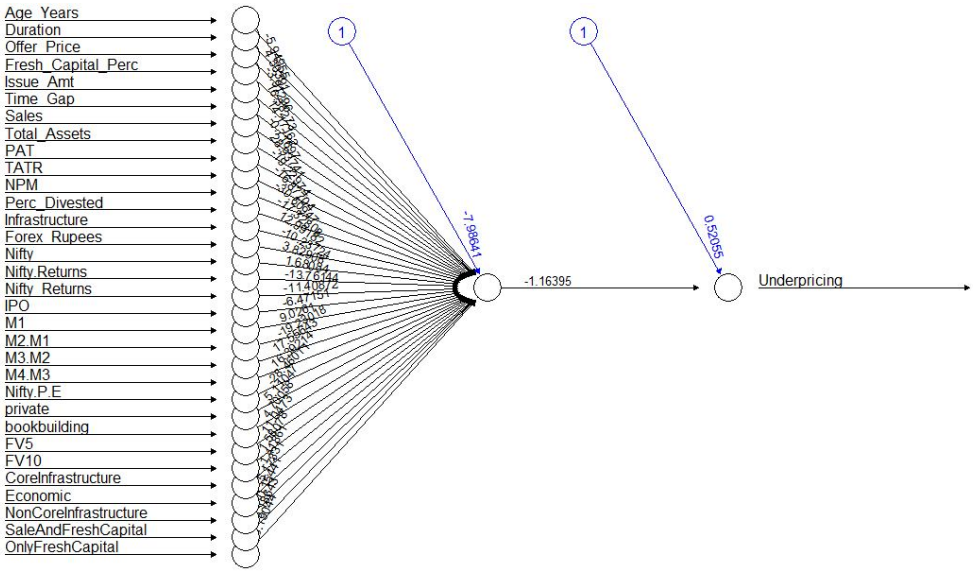
The network is presented with input attributes and the target outcome. The output of the network is compared to the known target outcome. The weights and biases of each neuron are adjusted by a factor based on the derivative of the activation function, the differences between the network output and the actual target outcome and the neuron outputs. There are no fixed rules as to how many nodes are to be included in the hidden layer. A neural network with resilient backpropagation and backtracking can be estimated using the package neural net with the neural net function.

Data Setting Process

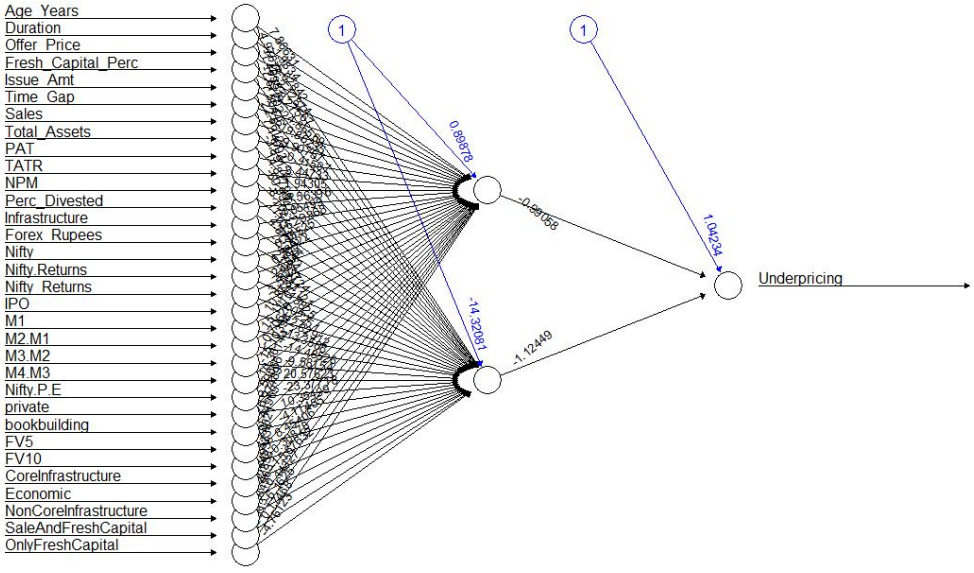
As there are 383 records, the researcher will be using approximately 70% (283 records) to build the neural network and the remaining 100 records will be used for testing purpose. 283 records used as training data is randomly selected. All the numeric variables have been scaled to reflect their z-values to eliminate the side effect of the variables. Even the categorical variables have been converted to dummy variables and are also scaled accordingly. Several hidden neurons should

be determined in relation to the needed complexity. We have used right from 1 to 6 hidden neurons and the performance evaluated from the test data. Resilient back propagation with a backtracking algorithm is initially selected for this purpose.

1 Hidden Neuron



2 Hidden Neurons



3 Hidden Neurons

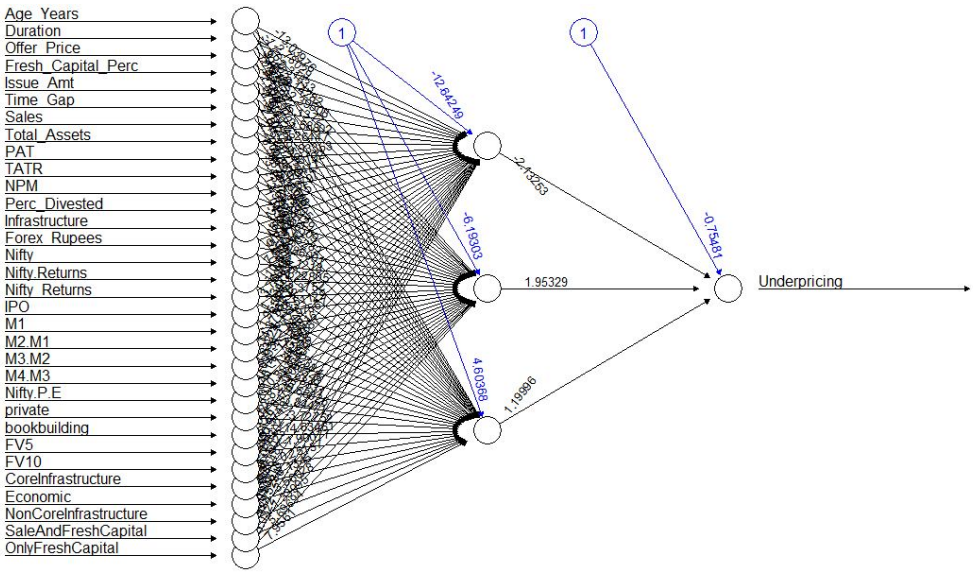


Fig. 5.2: Hidden Neurons

More and more hidden layers make the model even more complex but can be used as long as the success improves with respect to predicting the outcome of test data.

Table 5.11: ANN Model Overview

Hidden Neurons	Error	Reached Threshold	Steps
1	95.462	0.0087	5977
2	73.555	0.0099	6266
3	46.743	0.0096	11736
4	36.158	0.0096	18526
5	26.833	0.0094	10146
6	22.353	0.0099	11890

Table 5.12: Evaluation on Testing Data

Hidden Neurons	R-Squared (rprop+)	R Squared (rprop-)
1	**1.7%**	**2.6%**
2	4.7%	8.6%
3	1.9%	8.2%
4	0.2%	4.5%
5	7.2%	6.9%
6	4.7%	3.2%

5.2 IDENTIFYING DRIVERS OF UNDERPRICING OF INFRASTRUCTURE SECTOR STOCKS

To identify the drivers of underpricing of infrastructure sector stocks in India the following models were created.

Linear Regression Model for Underpricing

This is one of the most common methods used to derive the relationship between a set of variables and a dependent variable. To determine the drivers of underpricing of IPOs for infrastructure sector stocks a linear model is created with underpricing as the dependent variable and the following variables as explanatory variables:

Age of the company in Years before going for IPO, Duration of IPO in days (IPO Closing Date – IPO Opening Date), Type of the company (Public vs. Private), Pricing method (Fixed Price vs. Book building), Face value of the share, Offer Price, Type of sale, Percentage of fresh capital issued, Size of the Issue, Time-gap between IPO close date and listing date, Sales, Total Assets, PAT, Total Asset Turnover, Net profit margin of the company at the time of issue, Percentage of owner's share divested and a few economic variables at the time of issue like (Forex reserves, Value of Nifty, Nifty return on that day of listing, Nifty returns between the date of issue and date of listing, Money supply during that period measured in terms of M1, M2, M3, M4) and number of IPOs issued during the previous 6 months.

The coefficients of the model are identified using the p-value. For the coefficient to be a significant contributor the p-value should be less than 0.05. There are four variables which have been identified from table 5.13. They are the age of the company at the time of getting listed, sales, total assets, and assets turnover.

Table 5.13: Coefficients of the Regression Model

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T value**	**Sig. P-value)**
	B	**Std. Error**	**Beta**		
(Constant)	-0.25	1.188		-0.212	0.832
Age Years	**0.185**	**0.088**	**0.165**	**2.109**	**0.037**
Duration	0.083	0.087	0.085	0.951	0.343
Offer Price	0.074	0.111	0.078	0.672	0.503
Fresh_Capital_Perc	-0.11	0.205	-0.109	-0.513	0.609
Issue_Amt	-0.06	0.143	-0.059	-0.397	0.692
Time_Gap	-0.03	0.097	-0.035	-0.331	0.741
Sales	**2.03**	**0.831**	**1.56**	**2.443**	**0.016**
Total_Assets	**-2.28**	**0.802**	**-2.131**	**-2.838**	**0.005**
PAT	0.175	0.205	0.125	0.85	0.397
TATR	**-1.29**	**0.531**	**-1.261**	**-2.437**	**0.016**
NPM	-0.01	0.118	-0.004	-0.043	0.966
Perc_Divested	0.06	0.059	0.079	1.021	0.309
Forex Rupees	0.042	0.518	0.042	0.08	0.936
Nifty	0.741	0.629	0.722	1.178	0.241
Nifty. Returns	0.026	0.082	0.027	0.317	0.752
Nifty Returns	0.156	0.103	0.168	1.511	0.133
IPO	-0.29	0.131	-0.293	-2.237	**0.027**
M1	0.402	1.081	0.405	0.372	0.711
M2.M1	-0.07	0.86	-0.07	-0.08	0.936
M3.M2	-0.99	0.958	-0.997	-1.036	0.302
M4.M3	-0.33	0.331	-0.322	-0.995	0.322
Neotype	0.105	0.194	0.11	0.543	0.588
Private	-0.72	0.5	-0.128	-1.444	0.151

Book building	0.275	0.296	0.089	0.93	0.354
FV5	-0.26	0.836	-0.036	-0.312	0.756
FV10	-0.07	0.684	-0.012	-0.102	0.919
Core Infrastructure	0.232	0.169	0.119	1.376	0.171
Noncore Infrastructure	-0.02	0.23	-0.007	-0.082	0.935
SaleAndFreshCapital	0.653	0.578	0.257	1.131	0.26
OnlyFreshCapital	0.873	0.842	0.374	1.037	0.301

Interpretation

The R-Squared of the model is 0.371 and the Adjusted R-Squared is 0.232 indicating approximate 23% of the variation in the underpricing is explained by the explanatory variables taken above and the remaining 77% is unexplained by the above variables.

The difference in r-squared and adjusted r-squared can be attributed to many variables (24) and only 167 companies for the infrastructure sector. A deep look at the p-value from the table above indicates that only a few variables are contributing to the underpricing as p-value is less than 0.05 at significance level 95% only in 5 cases as observed in the above table:

- Duration
- Sales
- Total Assets
- Asset Turnover
- Only Fresh Capital

The other variables did not contribute significantly to the model and hence it is planned to check for multicollinearity. If multicollinearity exists, the same can be removed using principal component analysis.

Coefficients

The standardized coefficients are then identified from the table given here. The idea of principal components analysis (PCA) is to find a small number of **linear combinations** of the variables to capture most of the variation in the data. With many variables, it may be easier to consider a small number of combinations of the original data rather than the entire data. Linear combinations, where the summation of squares of the given weights equals 1, are called standardized linear combinations.

Principal components analysis finds a set of orthogonal standardized linear combinations which together explain all the variations in the original data. There are as many principal components as there are variables but typically it is only the first few of them that explain important amounts of the total variation.

The aim is to find linear combinations of a set of variables that maximize the variation contained within them, thereby displaying most of the original variation in fewer dimensions.

Table 5.14: Measuring Multicollinearity using VIF

Model	**Collinearity Statistics**	
	Tolerance	**VIF**
(Constant)		
Age Years	0.753	1.329
Duration	0.583	1.715
Offer Price	0.342	2.923
Fresh_Capital_Perc	0.102	9.801
Issue_Amt	0.212	4.718
Time_Gap	0.407	2.458
Sales	**0.011**	**88.226**
Total_Assets	**0.008**	**121.921**
PAT	0.212	4.712

TATR	**0.017**	**57.862**
NPM	0.453	2.206
Perc_Divested	0.769	1.301
Forex Rupees	**0.017**	**59.503**
Nifty	**0.012**	**81.299**
Nifty. Returns	0.656	1.525
Nifty Returns	0.375	2.67
Number of IPO issued in the last 6 months	0.269	3.716
M1	**0.004**	**257.164**
M2.M1	**0.006**	**162.553**
M3.M2	**0.005**	**200.269**
M4.M3	**0.044**	**22.714**
Neotype	0.112	8.923
Private	0.589	1.698
Book building	0.507	1.973
FV5	0.347	2.885
FV10	0.314	3.186
Core Infrastructure	0.613	1.631
Noncore Infrastructure	0.549	1.82
Sale and Fresh Capital	**0.089**	**11.211**
Only Fresh Capital	0.036	**28.065**

Interpretation

This model has given an adjusted R-Squared of 24.7% which is better than the adjusted R-Squared of the previous model (23%). Even the residual standard error of the model is lesser compared to the previous model, where all the variables were considered, indicating an improvement of the model.

However, as there are only 5 variables impacting underpricing; it is important to observe the multicollinearity between the variables. Variables which have a high VIF are said to have high multicollinearity.

As can be seen in table 5.14 there are variables which have significantly higher VIF than 10. (The value shown in the table). Thus, multicollinearity exists and the same needs to be removed.

Principal Component Analysis

When multicollinearity exists PCA can be used to remove the multicollinearity.

Table 5.15: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.721**
Bartlett's Test of Sphericity	Approx. Chi-Square	**10988.498**
	Do	**231**
	Sig.	**.000**

As the KMO sampling adequacy is greater than 0.6 as shown in table 5.15 the results can be used. As Bartlett's test gives a significance value of .000 it can be assumed that the variance is the same across sample and population.

Rotated Component Matrix

The component matrix helps group variables which behave similarly. In table 5.16 we have grouped the variables using PCA.

Table 5.16: Rotated Component Matrix

	Component									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Age Years	0.021	-0.076	0.03	0.084	0.337	0.01	-0.038	0.298	0.086	0.033
Duration	**-0.586**	-0.099	-0.118	-0.007	0.07	0.181	-0.093	-0.079	-0.178	0.254
Offer Price	0.191	-0.236	0.378	**0.511**	0.046	0.028	-0.008	0.313	-0.153	0.317
Fresh_Capital_Perc	0.029	**0.84**	-0.034	0.083	-0.08	-0.097	0.016	-0.084	0.264	0.13
Issue_Amt	0.133	-0.191	**0.791**	0.261	0.136	0.05	0.018	0.126	-0.215	0.133

Time_Gap	-**0.579**	0.025	-0.137	-0.187	0.084	-0.011	0.086	0.13	0.298	0.235
Sales	0.066	-0.251	0.261	0.246	**0.623**	-0.017	0.234	0.296	-0.205	-0.084
Total_Assets	0.12	-0.179	**0.803**	0.18	0.369	0.041	0.071	0.19	-0.084	-0.111
PAT	0.116	-0.147	0.404	0.085	0.368	0.047	0.115	**0.68**	-0.175	-0.098
TATR	-0.087	-0.061	-**0.816**	0.055	0.245	-0.08	0.175	0.067	-0.163	0.074
NPM	0.014	0.022	0.006	-0.011	-0.018	0.065	-0.031	**0.884**	-0.05	-0.016
Perc_Divested	-0.151	0.082	-0.007	-0.132	0.233	-0.046	-0.069	-0.262	**0.598**	-0.038
Forex Rupees	**0.951**	-0.019	0.036	0.014	0.059	-0.015	-0.161	0.072	0.019	0.005
Nifty	**0.926**	0.045	0.072	0.009	0.081	-0.012	0.088	0.019	-0.004	0.297
Nifty. Returns	-0.063	-0.05	-0.041	0.052	-0.04	0.076	**0.797**	-0.051	-0.002	-0.091

Nifty Returns	-0.128	0.069	-0.053	-0.014	0.064	-0.042	**0.845**	0.067	-0.027	0.078
IPO	-0.069	0.259	-0.021	0.003	0.127	-0.019	0	-0.052	0.136	**0.838**
M1	**0.977**	-0.029	0.034	0.013	0.014	-0.012	-0.086	0.027	-0.053	-0.094
M2.M1	**0.969**	-0.035	0.041	0.014	0.018	-0.027	-0.056	0.022	-0.056	-0.113
M3.M2	**0.976**	-0.017	0.038	0.02	0.023	-0.002	-0.094	0.042	-0.038	-0.09
M4.M3	**0.844**	0.01	0.075	0.03	0.088	-0.124	-0.079	0.06	0.088	0.324
Neotype	**0.596**	0.081	0.093	0.017	0.082	0.132	0.396	-0.072	-0.141	0.322
Private	0.155	0.032	-0.063	0.238	-0.219	0.028	-0.046	0.091	**0.708**	0.242
Book building	0.265	-0.117	0.395	0.323	-0.08	-0.003	-0.18	0.042	-0.425	0.247
FV5	-0.04	-0.101	0.022	0.052	-0.007	**0.929**	0.028	0.008	-0.031	0.024

FV10	0.115	0.106	-0.102	-0.069	0.02	**-0.91**	-0.028	-0.095	-0.017	0.032
Core Infrastructure	0.014	0.008	-0.128	**-0.898**	0.242	-0.085	-0.049	-0.028	-0.021	0.087
Economic	0.048	0.044	0.097	**0.808**	0.435	0.059	0.026	-0.007	0.057	0.038
Noncore Infrastructure	-0.079	-0.066	0.041	0.133	**-0.864**	0.034	0.03	0.046	-0.045	-0.161
SaleAndFreshCapital	-0.004	**-0.901**	0.089	0.126	-0.032	0.091	-0.008	-0.003	0.176	-0.022
OnlyFreshCapital	0.023	**0.964**	-0.114	0.003	-0.053	-0.057	0.008	-0.031	0.077	0.093
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.										

The first 9 components can explain more than 75% of the total variance as can be seen in table 5.17.

Table 5.17: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**7.24**	**23.3**	**23.36**	**7.2**	**23.36**	**23.36**	**6.61**	**21**	**21.33**
2	**4.44**	**14.3**	**37.7**	**4.4**	**14.34**	**37.7**	**2.81**	**9**	**30.4**
3	**2.5**	**8.08**	**45.78**	**2.5**	**8.08**	**45.78**	**2.59**	**8**	**38.77**
4	**2.09**	**6.74**	**52.52**	**2**	**6.74**	**52.52**	**2.16**	**6.9**	**45.75**
5	**1.77**	**5.72**	**58.24**	**1.7**	**5.72**	**58.24**	**2.02**	**6.5**	**52.29**
6	**1.55**	**5.01**	**63.26**	**1.5**	**5.01**	**63.26**	**1.82**	**5.8**	**58.16**
7	**1.45**	**4.67**	**67.93**	**1.4**	**4.676**	**67.93**	**1.73**	**5.5**	**63.75**
8	**1.23**	**3.97**	**71.91**	**1.2**	**3.976**	**71.91**	**1.72**	**5.5**	**69.31**
9	**1.12**	**3.63**	**75.54**	**1.1**	**3.634**	**75.54**	**1.51**	**4.8**	**74.2**
10	1.08	3.49	79.04	**1**	**3.494**	**79.04**	**1.5**	**4.841**	**79.04**
11	0.95	3.06	82.1						
12	0.91	2.95	85.05						
13	0.73	2.35	87.41						
14	0.68	2.19	89.61						
15	0.58	1.87	91.49						
16	0.51	1.6	93.13						
17	0.43	1.41	94.56						
18	0.38	1.22	95.78						
19	0.34	1.11	96.89						
20	0.26	0.84	97.74						
21	0.22	0.73	98.47						
22	0.16	0.53	99						
23	0.13	0.42	99.42						
24	0.09	0.30	99.73						
25	0.03	0.12	99.86						
26	0.02	0.07	99.93						
27	0.00	0.03	99.96						
28	0.00	0.01	99.98						
29	0.00	0.01	99.99						
30	0.00	0.00	100						

Table 5.18: Naming the Principal Component Drivers

Name of the group	**Factor 1**
Macro-Economic	The duration between the opening and closing of the issue, (negative weight)
	M1, (positive weight)
	Change in M1, M2, M3 & M4 (positive weight)
	Time_Gap between opening and closing (negative weight
	Nifty Value (positive weight)
	Factor 3
Size Related Drivers	Issue Amount
	Total Asset (negative Weight)
	Asset Turnover (negative weight)
Sector-specific Drivers	**Factor 4**
	Offer Price (Positive weight)
	Core Infrastructure versus non-core infrastructure versus Economic Variable (non-core infrastructure negative weight)
	Factor 6
Face Value	Lower value has lower demand.

Above mentioned factors are significant factors since their significance levels are lower than .05.

As there are only 167 data points it is not possible to use ANN. This is because ANN requires sufficient data to divide the data into training data and testing data. Out of the two models used here the second method – Principal Component Analysis followed by stepwise regression is more reliable because the number of drivers identified by the first method is less due to multicollinearity. Hence, the results obtained in this section, through the second method are analyzed in detail in the next section.

CHAPTER 6

FINDINGS, CONCLUSIONS AND SUGGESTIONS

6.1 FINDINGS OF THE STUDY

Identifying the underpricing drivers for infrastructure sector would help remove the anomalies of pricing of stocks and hence reduce wealth erosion for promoters and correct the mispricing syndrome. However, it is difficult to find all variables that would drive underpricing, as underpricing is impacted by several variables.

In the past, various studies used linear regression, with real-time IPO data to analyze the underpricing problem [62]. The major challenge with using linear Regression is that the r-squared for studies where the demand is impacted by human behavior is low. This makes building a predicting model difficult. The same challenge is faced in this study. Hence, attempts have been made to increase the r-square without compromising with the principle of parsimony.

Finally, the researcher has identified significant drivers for all IPO's in general and drivers for IPO's in infrastructure sector specifically using Principal Component Analysis. The p-value of the drivers is low, hence the drivers identified are significant. There is a difference in factors that drive underpricing in all the sectors and in the infrastructure sector.

6.1.1 Findings for Objective 1

Infrastructure sector in India is one of the fastest growing sectors in the country and it requires funding both from the private and public sector. Private sector companies basically look at debt and equity for funding of projects. Off late with

debt becoming difficult to raise, companies should now look at raising funds through equity markets.

6.1.2 Findings for Objective 2

Underpricing is the difference between the issue price and the listing price. Following table captures the level of short-run underpricing existing in various countries as proved through academic research.

Table 6.1: Research on Underpricing

Country	**Source**	**Sample Period**	**Sample Size**	**Average Initial Return**
Australia	Dimovski &Brooks (2008)	1994-2004	834	22.40%
Belgium	Engelen (2003)	1996- 1999	33	14.32%
Brazil	Agarwal, Leal, and Hernandez (1993)	1979-1990	62	78.50%
Canada	Kooli & Suret (2002)	1991-1998	878	20.57%
Chile	Aggarwal et al (1993)	1982-1990	19	16.30%
China	Su & Fleisher (1999)	1987-1995	308	48.69%
Finland	Keloharju (1993)	1984-1992	85	9.60%
Germany	Hunger (2003)	1997-2002	435	42.34%
Hong Kong	McGuinness (1992)	1980-1990	80	17.69%
India	Deb & Marisetty (2010)	2006-2009	163	21.30%
Israel	Hauser, Yaari, Tanchuma and Baker (2006)	1992-1996	94	10.40%
Italy	Cherubinni & Ratti (1992)	1985-1991	75	27.10%
Japan	Kutsuna & Smith (2007)	1995-99	484	31.48%
Korea	Dhan, Kim, and Lin (1993)	1980-90	347	78.10%

Malaysia	Isa (1993)	1980-1991	132	80.30%
New Zeland	Vos & Cheung (1993)	1979-1991	149	28.80%
Spain	Rahneema et al (1992)	1983-1989	71	35%
Sweden	Rydqvist (1993)	1991-1992	213	39%
Switzerland	Kunz & Aggarwal (1994)	1980-1993	42	35.80%
Taiwan	Chen (1992)	1987-1990	168	45%
Thailand	Wethavivom & Koo Smith (1991)	1980 -1996	32	58.10%
United Kingdom	Hill & Wilson (2006)	1991 -1998	502	11.41%
United States	Logharn & Ritter (2004)	1980-1998	5,980	18.90%

Source: Ritchie, M., Dimovski, W., & Deb, S. S. (2013). Underpricing of infrastructure IPOs: evidence from India Journal of Property Research, 30(1), 24-46

The literature review carried out in Chapter 3 indicates that there exists the varied level of underpricing across time and across countries. Researchers have proved that there is a higher level of underpricing in developing countries compared to developed countries. Furthermore, during hot periods the underpricing levels are relatively higher as was seen during the technology bubble of the 2000s in the US market. The level of regulation also plays an important role in identifying underpricing. For example, in the 1990s the level of underpricing in India was relatively higher.

6.1.3 Findings for Objective 3

Based on the empirical research carried in Chapter 5 the researcher has identified 5 variables that impact the underpricing of IPO for all sectors in India. The period for the study as already mentioned is April 2003 to 2015.

Following are the factors which have been identified as drivers for all sectors:

a. **Nifty Price Movement** - indicates percentage change in Nifty from the date of Issue of IPO to the listing date. This driver can be interpreted as an indicator of market sentiments. When the markets are doing well more individuals get interested in the stocks that have just been listed and they did not apply for. It includes both individuals who have not applied for the share and those who have not been allotted stocks due to oversubscription. Thus, it leads to an increase in the level of underpricing.

b. **Macro-Economic Factors** - consists of the following variables that have bundled up together during PCA: Forex rupees, Nifty, M1, M2-M1, M3-M2, and M4-M3. Nifty levels, money supply, Forex and change in Money supply play an important role in determining the level of underpricing. They impact underpricing negatively; a buoyant economy may lead to promoters and underwriters valuing the stocks at a higher level leading to lower underpricing.

c. **Nifty P/E** - is another key driver indicating the underpricing of an IPO. It captures the sentiments of the market. Nifty P/E necessarily captures the price that an investor is ready to pay for the index. A higher Nifty P/E at the date of listing leads to higher level of underpricing.

d. **Core Infrastructure -** A positive coefficient indicates that companies in core infrastructure sector are highly underpriced compared to other infrastructure sectors as well as non-infrastructure sectors. This can be attributed to the factor that most of these companies have higher visibility in their revenue.

e. Issue Size - Indicates the influence of the size of the issue on the underpricing of the IPO. When the issue size is larger, the level of information on the stock is more as there is a larger number of analysts covering the stock. This decreases information asymmetry and thus it leads to a lower level of underpricing.

6.1.4 Findings for Objective 4

Table 6.2 lists the variables which have been identified as drivers of underpricing for the infrastructure sector stocks. These drivers are grouped into 5 factors after the PCA analysis. The table below captures the expected sign and the rationale for the relationship that exists between the factors.

Table 6.2: Factors Impacting Underpricing for the Infrastructure Sector

Factor 1 – Macro Economic Drivers	**Coefficients**	**Signs Expected**	**Reason**
The duration between the opening and closing of the issue, (negative weight)	-.195	Positive (negative sign of coefficient and negative sign of weight implies a positive sign)	More the time gap between issue and listing and duration of issue higher cost of debt which impacts underpricing positively.
M1, (positive weight)		Negative	Higher the money supply more the level of research

			leading to lower under subscription
Change in M1, M2, M3 & M4 (positive weight)		Negative	Higher the money supply more the level of research leading to lower under subscription
Time_Gap between opening and closing (negative weight)		Negative	More the time gap between issue and listing and duration of the issue, higher the cost of debt which impacts underpricing positively.
Nifty Value (positive weight)		Negative	Higher the NIFTY value, better is the economy of the country, hence more information on the stock available leading to a better valuation
Factor 3 – Size Related Drivers			

Issue Amount	-.213	Negative Sign Expected	The higher the issue amount more the coverage of analyst leading to better valuations and lower underpricing
Total Asset (negative Weight)		Positive Sign Expected (negative weight and negative coefficient sign means positive sign)	An important metrics of company performance which leads to latent demand
Asset Turnover (negative weight)		Positive Sign Expected (negative weight and negative coefficient sign means positive sign)	An important metrics of company performance which leads to latent demand
Factor 4 – Sector Specific Market Drivers	-.123		
Offer Price (Positive weight)		Negative sign	The higher the offer price more the coverage of analyst leading to better valuations and lower

			underpricing
Core Infrastructure versus non-core infrastructure versus Economic Variable (non-core infrastructure negative weight)		Depends on the level of underpricing in the subsector	The non-score sector seems to have higher underpricing
Factor 6– Face value	.026		
FV (Rs. 5), FV Rs. 10 (Lower value have negative weight)		A positive sign of higher face value	Higher the face value higher the chances of splitting hence higher the underpricing
Factor 7 – Nifty Returns	.305		
Nifty returns from date of issue to the listing, Nifty returns from the date of opening to closing (+ weights)		Positive signs	A higher level of underpricing in the hot period.

Following are the drivers which have been identified for underpricing in the infrastructure sector:

Factor 1 – Macroeconomic Drivers

The first factor has bundled up macroeconomic drivers. These are drivers that are important for economic growth. As the infrastructure sector depends on economic growth, these variables have played an important role in the underpricing of IPOs.

1. **The Duration of Opening and Closing of Issue and Time Gap between Issue and Listing**

   The duration between the opening and closing of the issue and time gap between issue and listing determines the period for which the money of the investor would be locked with the primary issuer. This implies that the investor would not be getting any return on the investment for the given period. Hence, his opportunity cost would then depend on the prevailing interest rates. Thus, these two drivers are clubbed with macroeconomic drivers. The longer the holding period higher is the interest cost, hence underpricing is higher in the case of the longer holding period

2. **M1 and change in Money Supply**

   Money supply determines liquidity in the market. For a stock market liquidity at the time of issue of stocks is an important driver for determining the level of underpricing. The level of liquidity is different in different markets. They impact underpricing negatively; a buoyant economy may lead to promoters and underwriters valuing the stocks at a higher level leading to lower underpricing.

3. **Nifty Value**

   Nifty 50 refers to the index which captures the movement of stocks listed on National Stock Exchange (NSE), Mumbai. High Nifty 50 indicates hot periods. They impact underpricing negatively. A buoyant economy may

lead to promoters and underwriters valuing the stocks at a higher level due to a higher level of confidence of promoters resulting in lower underpricing.

Factor 3 – Size Related drivers

The factor bundles up drivers that determine the size of the company and the size of the offer. In the case of infrastructural companies, size plays an important role.

4. **Issue Amount**

   It indicates the influence of the size of the issue on the underpricing of the IPO. When the issue size is larger, the level of information on the stock is more as there is a larger number of analysts covering the stock and thus it leads to a lower level of underpricing. The level of information asymmetry decreases which in turn increases efficiency in the pricing process.

5. **Total Asset**

   It refers to the balance sheet size of the company. Furthermore, it indicates how capital intensive the company is. In the case of the infrastructure sector, capital expenditure is high. This is an important parameter to judge the fundamental performance of the company. Hence, the total asset size has emerged as an important driver of underpricing.

6. **Asset Turnover**

   Assets Turnover is arrived at by dividing Sales by Total Assets. It measures the efficiency of managing assets for infrastructure companies. Total Asset Turnover is an important fundamental factor which identifies the efficiency of utilization of assets vis-a-vis the total sales that the

company earns. For a capital, intensive industry such as the infrastructure sector the demand for the stock increases when the company utilizes its assets better. Hence, this factor impacts the infrastructural sector more than other sectors.

Factor 4 – Market-related Sector-specific Drivers

The market-related sector specific variables are responsible for determining the level of underpricing within a given sector. In the case of infrastructure sector – offer price and the sub-sectors to which the stock belongs play an important role in determining the level of underpricing.

7. Offer Price

Offer price refers to the price at which the stocks are offered to the investors who subscribe for the stock. Higher offer price leads to lower level of underpricing. The stocks see higher demand in these cases due to the possibility to split the stocks in the future.

8. Core Infrastructure Versus Non-core Infrastructure versus Economic drivers

The level of underpricing in the sub-segments of infrastructure sectors is gauged by using dummy variables and it can be concluded that non-core infrastructure has a lower level of underpricing than the other two sub-segments.

Factor 6 - Face Value

It has an impact on the underpricing of the infrastructural sector. Lower the face value, lesser are the chances of splitting in the future. This impacts the demand for the infrastructural sector stock.

9. FV Rs. 5, FV Rs. 10

Face value is the nominal value of shares. The lower the face value, lesser is the chance of splitting the shares in the future. Hence, it is observed that shares with lower face value have a lower level of underpricing due to lower possibility of splitting the shares in the future.

Factor 7– Nifty Returns

10. Nifty Returns from Date of Issue Listing; Nifty Returns from the Date of Opening to Closing

It indicates whether the stock markets are enjoying a hot period or cold period. If the stock markets are enjoying a hot period, the markets would see higher underpricing. On the other hand, if the markets are going through a cold period, it would see a lower level of underpricing.

6.1.5 Findings for Objective 5

Suggestions for Reducing Underpricing

The findings for objectives 3 and 4 pave way for helping reduce underpricing. To reduce underpricing, it is important to categorize the drivers based on their ability to impact underpricing. Following are ways by which each group of drivers can help reduce underpricing.

Market-Related Factors

Market-Related Factors indicate the hot and cold periods. Hence, the level of Nifty, offer price and size of the issue relative to the size of other stocks would determine the level of underpricing.

A promoter can ensure higher levels of pricing for his stocks at the time of issue if he can time the market well. The stocks can be priced higher when the economy is buoyant and there is an expectation that the economy will continue to grow from here.

Fundamental Factors

It has been observed that larger balance sheet size and higher efficiency of utilization of assets leads to an increase in demand for shares. Thus, the performance of the company in terms of asset utilization is an important driver of underpricing. However, the profitability of the company does not play a role in reducing underpricing. Hence, stocks which are performing well may be priced higher, leaving lesser room for underpricing.

Macro-Economic Factors

Macro-Economic factors such as money supply are important drivers for the infrastructure sector demand. Hence, it has been observed, that underpricing may be reduced by timing the market to leverage on higher macroeconomic growth and a brighter outlook.

6.2 LIMITATIONS OF THE STUDY

The research was conducted based on data for 12 years [April 2003 to 2015]. The total number of IPOs in this period was limited to 404 out of which 179 stocks were infrastructure sector stocks. Hence, it is not possible to accommodate all the variables in the research. The number of factors impacting the study is huge as it is impacted by behavioral factors such as disposition effect. The behavioral factors are unpredictable. This leads to a low r square as is common in social science and related studies where the dependent variable is impacted by factors such as human nature, predicting which with precision is not possible. Thus,

developing a predicting model is not possible. However, as p-value is low for the variables identified, it is possible to identify drivers of each of the sub-sector of IPO infrastructure.

6.3 FUTURE SCOPE OF THE STUDY

Scholars in future may carry out a detailed study of the factors identified in this research and can make use of other analytical tools which can give the exact probability of the contribution of each factor in determining the causes of underpricing.

Scholars can also go forward and do a detailed analysis of various other variables available in the literature. Further by conducting more extensive primary literature survey scholars can add more variables which might have been missed out in this study.

Further study also needs to be conducted to determine drivers of underpricing for core, non-core and economic sector underpricing. A robust model to predict underpricing infrastructure in India needs to be created.

Impact of variables on underpricing in all core, non-core and economic sector may be studied. Other variables such as the impact of the land bank, number of litigations, and order book position can be studied.

6.4 CONCLUDING REMARK

It should be noted that fundamental factors relating to the market and the economy play an important role in determining the level of underpricing for IPOs. Hence, to reduce the level of mispricing and mis-valuation, economic development has a larger role to play.

Similarly, wealth maximization for promoters and private equity players can be attained with an increase in the rate of economic development. In the case of infrastructure stocks, asset utilization also plays an important role.

The researcher believes that if the promoter and the private equity players take into consideration the IPO drivers while fixing the price, the underpricing would reduce, and the stock price would move towards the intrinsic value thus reducing the anomaly in pricing. This would move the stock price towards the one price that has been conceived by the proponents of traditional corporate finance as the true price.

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APPENDIX

A1 - Cost Overruns in Rs. Billion for Infrastructure Sector

Sector / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Power						
a) Number of projects	40	50	53	44	63	64
b) Original estimate	1055.6	1377.6	1356.5	1244.9	1649.4	1716.2
c) Now anticipated	1102.2	1522.6	1504.9	1421.7	1932.6	2088.3
d) Cost overrun	46.31	145	148	176.81	283.23	372.08
Railways						
a) Number of projects	31	34	41	37	35	31
b) Original estimate	225.32	236.71	279.24	285.89	290.92	367.14
c) Now anticipated	437.74	560.68	735.37	730.22	862.53	904.32
d) Cost overrun	212.42	324	456	444.32	571.6	537.18
Surface transport						
a) Number of projects	109	93	95	23	104	128
b) Original estimate	390.92	402.72	549.5	88.43	770.42	884.02
c) Now anticipated	404.9	431.72	581.95	110.95	789.83	908.42
d) Cost overrun	13.99	29	32.5	22.53	19.41	24.4
Telecommunication						
a) Number of projects	35	9	5	4	2	2
b) Original estimate	166.28	38.56	29.35	20.18	7.21	154.45
c) Now anticipated	171.39	40.35	27.61	18.43	7.21	153.45

Sector / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
d) Cost overrun	5.11	2	-1.74	-1.75	0	-1
Others						
a) Number of projects	4	2	1	1	17	18
b) Original estimate	157.28	69.38	63.95	24.94	826.62	648.08
c) Now anticipated	318.72	127.96	116.09	24.94	826.62	721.18
d) Cost overrun	161.44	58.58	52.14	0	0	73.1
Total						
Number of projects	271	264	285	209	328	343
Original estimate	2990.02	4259.98	4750.42	4378.08	5752.27	5288.2
Now anticipated	3618.29	5004.67	5698.43	5387.49	6992.34	6447.03
Cost overrun	628.27	745.58	948.9	1009.4	1240.0	1158.8

Source: RBI, September 6, 2016

A2- Trend in External Borrowings

- The following table gives the External Commercial Borrowings sector-wise in $million for core and economic infrastructure.

The trend in External Commercial Borrowings					
$ million	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16 (Till Octobe r 2015)**
Power	6898.97	4231.09	2899.71	2196.48	450
Telecommunication	3877.2	1288.35	262.75	2379.42	2318.06
Oil &Gas	3768.88	8195.04	26309.21	8411.11	4100.23
Ports & Shipping	2089.25	449.38	375.34	79.37	774.17
Financial Institutions	808.27	553.4	1725	147.04	2150
Diversified	791.49	796.91	545.37	509	0
Aviation	738.74	2343.65	1387.05	1227.85	405.31
Renewable	648.85	746.18	361.12	635.12	100.35
Roads and bridges	590.15	210.83	37.5	82.5	0
Total	**20211.8**	**18814.83**	**33903.05**	**15667.89**	**10298.1**

Source: Indian Infrastructure, December 2015

In %	2011-12	2012-13	2013-14	2014-15	2015-16 (Till October 2015)
Power	34%	22%	9%	14%	4%
Telecommunication	19%	7%	1%	15%	23%
Oil &Gas	19%	44%	78%	54%	40%
Ports & Shipping	10%	2%	1%	1%	8%
Financial Institutions	4%	3%	5%	1%	21%
Diversified	4%	4%	2%	3%	0%
Aviation	4%	12%	4%	8%	4%
Renewable	3%	4%	1%	4%	1%
Roads and bridges	3%	1%	0%	1%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Indian Infrastructure, December 2015

A3- IPO Stock Market in India (1989-90 to 2015-16)

Year	No. Of Issues	% of Total Issues in the period	Amount (Rs. Cr.)	% of Amount Raised in the given period
1989-90	186	3.00%	2,522	0.60%
1990-91	140	2.30%	1,450	0.30%
1991-92	195	3.10%	1,400	0.30%
1992-93	526	8.50%	5,651	1.30%
1993-94	764	12.30%	10,821	2.50%
1994-95	1336	21.50%	12,928	2.90%
1995-96	1402	22.60%	8,723	2.00%
1996-97	684	11.00%	4,372	1.00%
1997-98	58	0.90%	1,132	0.30%
1998-99	22	0.40%	504	0.10%
1999-00	56	0.90%	2,975	0.70%
2000-01	110	1.80%	2,380	0.50%
2001-02	6	0.10%	1,082	0.20%
2002-03	6	0.10%	1,039	0.20%
2003-04	28	0.50%	17,807	4.00%

Year	No. Of Issues	% of Total Issues in the period	Amount (Rs. Cr.)	% of Amount Raised in the given period
2004-05	29	0.50%	21,432	4.90%
2005-06	102	1.60%	23,676	5.40%
2006-07	85	1.40%	24,993	5.70%
2007-08	90	1.50%	52,219	11.90%
2008-09	21	0.30%	2,034	0.50%
2009-10	44	0.70%	46,941	10.70%
2010-11	57	0.90%	46,182	10.50%
2011-12	36	0.60%	23,982	5.40%
2012-13	44	0.70%	34,313	7.80%
2013-14	83	1.30%	15,234	3.50%
2014-15	39	0.60%	29,716	6.70%
2015-16	42	0.70%	34,322	7.80%
2016-17	15	0.20%	10,629	2.40%
Total	**6,206**	**100.00%**	**440,459**	**100%**

Source: Prime Database

A4 - Table Showing Discretionary and Non-Discretionary Pricing

Sector / Year	2011	2012	2013	2014	2015	2016
Power						
a) Number of projects	40	50	53	44	63	64
b) Original estimate	1055.6	1377.6	1356.5	1244.9	1649.4	1716.2
c) Now anticipated	1102.2	1522.6	1504.9	1421.72	1932.6	2088.3
d) Cost overrun	46.31	145	148	176.81	283.23	372.08
Railways						
a) Number of projects	31	34	41	37	35	31
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c) Now anticipated	437.74	560.68	735.37	730.22	862.53	904.32
d) Cost overrun	212.42	324	456	444.32	571.6	537.18
Surface transport						
a) Number of projects	109	93	95	23	104	128
b) Original estimate	390.92	402.72	549.5	88.43	770.42	884.02
c) Now anticipated	404.9	431.72	581.95	110.95	789.83	908.42
d) Cost overrun	13.99	29	32.5	22.53	19.41	24.4
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a) Number of projects	35	9	5	4	2	2
b) Original estimate	166.28	38.56	29.35	20.18	7.21	154.45
c) Now anticipated	171.39	40.35	27.61	18.43	7.21	153.45
d) Cost overrun	5.11	2	-1.74	-1.75	0	-1
Others						
a) Number of projects	4	2	1	1	17	18

Sector / Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
b) Original estimate	157.28	69.38	63.95	24.94	826.62	648.08
c) Now anticipated	318.72	127.96	116.09	24.94	826.62	721.18
d) Cost overrun	161.44	58.58	52.14	0	0	73.1
Total						
Number of projects	271	264	285	209	328	343
Original estimate	2990.0	4259.9	4750.4	4378.0	5752.2	5288.2
Now anticipated	3618.2	5004.6	5698.4	5387.4	6992.3	6447.0
Cost overrun	628.27	745.58	948.9	1009.4	1240.0	1158.8

Source: CMIE

A5 – Literature Review Infrastructure Sector

S. No	Paper	Year	Key Takeaway	Relevance to our study
Impact of Infrastructure on Economic Growth				
1	Aschauer, D. A. (1989). "Is public expenditure productive?" Jou rnal of monetary economics, 23(2), 177-200.	1989	It finds significant weight should be attributed to public investment decisions - specifically, additions to the stock of nonmilitary structures such as highways, streets, water systems, and sewers- when assessing the role, the government plays during economic growth and productivity improvement.	Seminal Paper on Infrastructure which acknowledges the importance of public expenditure on development of non- military infrastructure. The research has been conducted in the US.
2	Pereira, A. and Andraz, J. (2005), "Public investment in transportation infrastructures and economic Performance in Portugal", Review of Development Economics, Vol. 9, pp. 177-196.	2005	It uses a VAR approach to investigate the effects of public investment in transportation infrastructures on private investment, employment, and output in Portugal. Estimation results suggest that public investment crowds in private investment and employment and has a strong positive effect on output as one euro in public investment increases output in the long-term by 9.5 euros, which corresponds to a rate of return of 15.9%.	Increase in investment in Logistic infrastructure by the government increases output in Portugal, which is in Europe.
3	Nadiri, M. and	1996	Results reported in this	Highway

	Mamuneas, T. (1996), "Contribution of highway capital to industry and national productivity growth", Report prepared for Apogee Research, Inc., for the Federal Highway Administration Office of Police Development.		study show that for the past forty years, the nation's investment in highways has provided a significant economic return, in large degree by helping reduce costs of industrial production.	investment impacts National Productivity positively.
4	Teklebirhan, A. (2015). Public Infrastructure Investment, Private Investment and Economic Growth in Ethiopia: Co-Integrated VAR Approach (Doctoral dissertation, AAU).	2015	The contribution of physical public infrastructure investment to the real GDP is positive and significant in the long-run while it has a significant negative impact in the short run.	In underdeveloped countries such as Ethiopia, the impact of infrastructural spending by the government on overall development is positive.
5	Canning, D., & Pedroni, P. (1999). Infrastructure and long-run economic growth. Center for Analytical Economics working paper, 99(09).	1999	It investigates the long run consequences of infrastructure provision on per capita income in a A panel of countries over the period 1950-1992. The research finds a great deal of heterogeneity in the results across countries and the sector.	There is the difference in impact on output depending on the country and subsector

6	Sahoo, P., & Dash, R. K. (2009). Infrastructure development and economic growth in India. Journal of the Asia Pacific economy, 14(4), 351-365.	2009	It investigates the role of infrastructure in economic growth in India for the period 1970–2006 based on the empirical framework developed by D.A. Aschauer. It concludes that there exists a positive relationship between inputs.	In India, too the framework built by Aschauer works.
7	Röller, L. H., & Waverman, L. (2001). Telecommunications infrastructure and economic development: A simultaneous approach. American economic review, 909-923.	2001	The paper proves a causal relationship between telecommunication density and output in the United States.	There exists a relationship between telecommunication sector and output in the US.
8		2004	The volume of infrastructure development has a positive impact on infrastructure in countries across the globe.	There exists a relationship between development and infrastructure.
It can be concluded from academic literature that Infrastructure Growth is important for the overall growth of the economy				
Inequality and Infrastructure Development				
9	López, H. (2003). Macroeconomics and inequality. Washington DC: The World Bank Processed.	2003	The research suggests that improvements in education and infrastructure lead to lower inflation levels which would lead to growth and equality in the US.	Economic Inequality is a function of infrastructural development.

10	Anand, S., & Segal, P. (2008). What do we know about global income inequality? Journal of Economic Literature, 46(1), 57-94.	2012	For any country, it is important to remove inequality to increase the level of satisfaction among residents of the country.	Inequality impacts the development of a country
11	López, H. (2003). Macroeconomics and inequality. Washington DC: The World Bank Processed.	2003	This paper finds that improvements in education and infrastructure and lower inflation levels would lead to both growth and progressive distributional change.	Infrastructure development has a positive impact on reducing inequality.
12	Estache, A. (2004). Emerging infrastructure policy issues in developing countries: a survey of the recent economic literature (Vol. 3442). World Bank Publications.	2004	Rural infrastructure sector plays a key role in decreasing the level of inequality that exists in any country expenditure on infrastructure has a positive impact on infrastructural growth and inequality.	Rural inequality can be removed through infrastructural development
13	Ghosh, B., & De, P. (2005). Investigating the linkage between infrastructure and regional development in India: the era of planning to globalization. Journal of Asian Economics, 15(6), 1023-1050.	2005	The paper aims at finding out the role played by economic and social infrastructure facilities in economic development across Indian states over the last quarter century. It concludes that economic and social infrastructure facilities have been proved to be highly significant factors in determining the inter-	Inequality in India is related to the infrastructural development and infrastructural development is regionally unbalanced leading to different levels of inequality in India.

			state level of development.	
Hence, Academic Literature proves Infrastructure Growth plays a role in reducing inequality				
Financing of infrastructure				
14	Briceno-Garmendia, C., & Estache, A. (2004). Infrastructure services in developing countries: access, quality, costs, and policy reform (Vol. 3468). World Bank Publications.	2004	For the period 2005-2010, the infrastructural need in developing countries is $550 billion - $600 billion	Developing countries need 5% to 7% of their GDP as financing need.
15	Ahluwalia, Montek S. "Financing private infrastructure: lessons from India."	1997	The infrastructure spending by private firms in developing is low compared to developed countries.	The infrastructure spending by private firms is inadequate in the Indian context.
16	Purohit, M. C. (2016). Financing urban infrastructure in India an overview of policy lessons.	2016	The present scenario of financing urban infrastructure indicates that it needs to take care of the existing deficiencies in the system. For example, there is an absence of rigorous project preparation and appraisal process in many MCs. This has led to giving inappropriate incentives	In India, urban financing needs require proper funding strategies.
17	Chong, S., & Poole, E. (2013). Financing Infrastructure: A Spectrum of	2013 `	It is the risk-return profile of an infrastructure project that will determine the extent of private involvement,	Source of financing a project is contingent upon the method of

	Country Approaches. RBA Bulletin, September 65-76.		and government decisions and policy actions have a significant influence on this calculation.	financing used.
18	Engel, E., Fischer, R., & Galetovic, A. (2013). The basic public finance of public-private partnerships. Journal of the European Economic Association, 11(1), 83-111.	2012	The optimal revenue guarantees, revenue sharing agreements, and auction mechanisms are different from those observed in the real world.	Revenue share cap has a binding impact on the PPP contracts.
19	Estache, A. (2004). Emerging infrastructure policy issues in developing countries: a survey of the recent economic literature (Vol. 3442).	2004	The efficient regulatory system may lead to higher risk for the infrastructure company	Private companies may face higher levels of risks in countries where regulatory levels are higher such as India
Academic research proves Equity is important for infrastructure financing				

Source: Researcher

A6 – Literature Review IPO

S. No	Paper	Year	Key Takeaway	Relevance to our study
IPO – Misevaluation leading to underpricing				
1	Loughran, T., & Ritter, J. R. (1995). The new issues puzzle. *The Journal of finance*, *50*(1), 23-51.	1995	If firms in an industry time their offers to take advantage of industry-wide mis-valuations. Controlling for industry effects will reduce the ability to reduce abnormal returns to short-term traders	There exists a Mis-valuation of assets in the short run due to macro factors and it causes a gap between one price (intrinsic value) and actual price.
2	Ritter, J. R., & Welch, I. (2002). A review of IPO activity, pricing, and allocations. *The Journal of Finance*, *57*(4), 1795-1828.	2002	Asset mispricing is not only based on fundamental factors.	There are very many reasons for underpricing and they stem from mis-valuation due to the existence of behavioral and fundamental market factors.
3	Koop, G., & Li, K. (2001). The valuation of IPO and SEO firms. *Journal of Empirical Finance*, *8*(4), 375-401.	2001	Mis-valuation of IPO's exist for both IPO's and FPO's	The existence of mis-valuation leads to underpricing.
4	Kara, A., & Arab, M. B. (2006). IPO's initial returns: Underpricing versus noisy trading. *Finance India*, *20*(1), 145.	2006	Mis-valuation of IPO does exist due to various factors including trading anomalies in India.	Mis-valuation of IPOs occurs in the Indian context.

There is a mis-valuation at the time of issue of IPO and cause for the same is not known				
IPO Underpricing Impacts Wealth Maximization of Promoters				
5	Loughran, T., & Ritter, J. R. (2002). Why don't issuers get upset about leaving money on the table in IPOs? Review of Financial Studies, 15(2), 413-444.	2002	Money left on the table or the amount of underpricing is defined as the number of shares sold times the difference between the first-day closing market price and the offer price. The average IPO leaves $9.1 million on the table. This number is approximately twice as large as the fees paid to investment bankers and represents a substantial indirect cost to the issuing firm.	Money left on the table impacts wealth maximization of promoters and private equity investors looking for an exit.
6	Carto, S. T., Coven, J. G., Daily, C. M., & Dalton, D. R. (2001). Wealth and the effects of founder management among IPO-stage new ventures. *Strategic Management Journal*, *22*(6-7), 641-658.	2001	Results based on data collected from 368 IPO-stage new ventures suggest that founder management has an impact on IPO underpricing.	Wealth maximization is impacted by the quality of promoters in the management.
IPO Underpricing impacts wealth maximization of promoters adversely and reduces their returns however there is no model to predict underpricing				
7	Boulton, T. J., Smart, S., & Zutter, C. J. (2015).	2015	The paper aims to study the impact of	In India, the underpricing is

	Conservatism and International IPO Underpricing. *Kelley School of Business Research Paper*, (15-46).		country-level accounting conservatism on IPO underpricing. Examining 10,103 IPOs from 36 countries, the study finds that the timely incorporation of news into earnings, both good and bad, is negatively correlated with underpricing.	higher than in developed countries.
8	Aggarwal, R., Leal, R., & Hernandez, L. (1993). The aftermarket performance of initial public offerings in Latin America. Financial Management, 42-53.	1993	The aftermarket performance of initial public offerings (IPOs) in Brazil, Chile, and Mexico is examined. The results show patterns like those of the US and UK markets: positive initial returns, long-run oversubscription during 'hot issues' years, despite different issuing procedures in the three Latin markets. However, the level of underpricing is different.	Oversubscription takes places in hot periods and in a short period the firms are underpriced and overpriced in long terms across countries

9	Christian Hopp, Axel Dreher. Do Differences in Institutional and Legal Environments Explain Cross-Country Variations in IPO Underpricing? Applied Economics, Taylor & Francis (Routledge), 2011, 45 (04), pp.435-454.	2011	They empirically analyze the determinants of Initial Public Offering (IPO) underpricing using panel data for 24 countries over the 1988 to 2005 period. The hypotheses stress the importance of institutional and legal factors in explaining cross-country variations.	They find evidence that underpricing is higher in countries with stronger protection of outside investors.
10	Chowdhry, B., & Sherman, A. (1996). International differences in oversubscription and underpricing of IPOs. Journal of Corporate Finance, 2(4), 359-381.	1996	The method used in the United Kingdom and in most Asian countries may lead to more underpricing and more extreme levels of oversubscription than the method used for firm commitment offerings in the United States.	The difference exists in underpricing levels in different countries which can be attributed to the difference in methods of arriving at the price. In different countries.
11	Banerjee, S., Dai, L., & Shrestha, K. (2011). Cross-country IPOs: What explains differences in underpricing? Journal of Corporate Finance, 17(5), 1289-1305.	2011	They study the impacts of country-level information asymmetry, investors' home-country bias, the effectiveness of contract enforcement mechanisms, and the accessibility of legal recourse on IPO underpricing in 36 countries around the globe. They find evidence consistent with all four of the hypotheses.	Behavioral factors such as information asymmetry and investors home country bias play an important role in the process of the difference in country level biases

12	Kaustia, Markku, and SamuliKnupfer Do Investors Overweight Personal Experience? Evidence from IPO Subscriptions, Journal of Finance, Vol. 63, 2679-2702, 2008.	2008	The paper finds a strong positive link between past IPO returns and future subscriptions at the investor level in Finland.	This paper establishes the relationship between past IPO returns and future subscriptions at the investor level in Finland.
There is a difference in underpricing across countries however how this impacts India is difficult to predict.				
Temporal Studies				
12	Ritter, J. R. (1991). The long-run performance of initial public offerings. *The journal of finance*, *46*(1), 3-27.		There is substantial variation in the underperformance year-to-year and across industries, with companies that went public in high-volume years faring the worst.	The patterns are consistent with an IPO market in which (1) investors are periodically overoptimistic about the earnings potential of young growth companies, and (2) firms take advantage of these "windows of opportunity.
13	Chambers, D., & Dimson, E. (2009). IPO Under-pricing over the very long run. The Journal of Finance, 64(3), 1407-1443.	2009	The study presents new and comprehensive	IPO Under-pricing may differ based on time- horizon.

			evidence covering British IPOs since World War I.	
14	Loughran, T., & Ritter, J. (2004). Why Has IPO Under-pricing Changed Over Time? Financial Management, 5-37.	2009	In the 1980s, the average first-day return on initial public offerings (IPOs) was 7 which doubled to almost 15% during 1990-1998 and reached 65% during the internet bubble years of 1999-2000.	IPO Pricing differs in different periods depending on the objective function of the issuer and availability of information.
The timing of issue impacts underpricing and variables impacting underpricing might change. Hence, it is important to identify factors impacting all the sectors independently with the same data set.				
Long Run Underpricing in India				
15	Singh, B., & Mittal, R. K. (2003). Underpricing of IPOs: Indian Experience. The ICFAI Journal of Applied Finance, 9(2), 29.	2003	In the long run the prices of IPO fall.	In the long run, there is a correction in IPO pricing and the prices move towards their listing price.

17	Beatty, R. P., & Ritter, J. R. (1986). Investment banking, reputation, and the underpricing of initial public offerings. Journal of financial economics, 15(1), 213-232.	2008	This paper develops and tests two propositions. They demonstrate that there is a monotone relation between the (expected) underpricing of an initial public offering and the uncertainty of investors regarding its value. They also argue that the resulting underpricing equilibrium is enforced by investment bankers, who have reputation capital at stake.	In 1986 Beatty and Ritter in this seminal paper proposed a model which aimed at correlating underpricing to the level of ex-ante risk.
Long Run Underpricing behaves differently from short-run underpricing hence there is a need for India specific study.				
Short Run Underpricing in India				
18	Shah, A. (1995). The Indian IPO market: empirical facts. *Social Science*	1995	The primary market in India is unique by world standards in many ways.	The Indian markets are unique and behave differently.

19	Krishnamurti, C., & Kumar, P. (2002). The initial listing performance of Indian IPOs. *Managerial Finance*, *28*(2), 39-51.	2002	Describes the environment for making initial public offerings (IPOs) in India and the process itself and discusses the applicability of various research explanations for underpricing to the Indian Market. Suggests that it will be greater for new firms and issues managed by reputable merchant bankers, and analyses 1992-1994 data on 386 IPOs to assess their performance.	Shows that issues with high risk and/or smaller offer prices are more underpriced and that returns are strongly correlated with subscription levels. Discusses the underlying reasons for this and the implications for public policy.
20	Ray, R. S., & Chattopadhyay, A. K. (2015). The rationality behind Mispricing of IPOs in Indian Primary Market. *Research Bulletin*, *41*(2), 29-40.	2015	In this paper, an attempt has been made to investigate different aspects of the mispricing of IPOs in the Indian primary market during the study period 2000-14.	Prospect Theory impact underpricing in India

21	Malhotra, M., & Nair, M. (2015). Initial Public Offerings' Underpricing: A Study on the Short Run Price Performance of Book-Built IPOs in India.*Paripex-Indian Journal of Research, 4*(2).	2015	Issuing of shares through book building process leads to efficient price discovery. This study attempts to examine how the initial public offerings (IPO) issued through book building fare in short-run. The study examines the first day returns of 288 book-built IPOs in India for a 7-year period (2004-2010). Based on this set of observations this study builds a comprehensive model of the short-term price performance of the new offerings. Results indicate that the IPOs are underpriced in India.	High level of underpricing exists in India
22	Handa, R., & Singh, B. (2015). Women directors and IPO underpricing: evidence from Indian markets. *Gender in Management: An International Journal*, *30*(3), 186-205.	2016	This paper aims to fill the gap of the relatively under-researched impact of women directors on initial public offering (IPO) underpricing in developing countries. Gender diversity is an important emerging	In India, Gender Diversity does not impact IPO pricing

			issue within the corporate governance literature. The paper examines the influence of women directors on the underpricing phenomenon pervasive in the IPO context.	
23	Krishnamurti, C., & Pensiero, D. (2013). Price Band, Offer Price Adjustment, and Initial Listing Returns Evidence from the Indian IPO Market. *Offer Price Adjustment and Initial Listing Returns: Evidence from the Indian IPO Market (November 2013)*.	2013	Extant research on developed markets shows that investor sentiment plays a prominent role in IPO markets. There is sparse work in the context of emerging markets. The offer price band is a crucial component of the book building process and has not been studied in the context of emerging markets.	Factors such as offer price adjustment and price band have an impact on prices.
24	Deb, S. S., & Marisetty, V. B. (2010). The information content of IPO grading. *Journal of Banking & Finance*, *34*(9), 2294-2305.	2012	The paper examines whether grading impacts pricing	Grading reduces IPO underpricing

25	Kumar, S. S. S. (2007). Short and Long-Run Performance of Book built IPOs in India.	2007	The paper aims at studying the impact of issuing shares through book-building.	The companies generate positive returns in the beginning however they start generating negative returns in the long run.
26	Banerjee, S. (2016). Determinants of Under-pricing of Graded IPOs in the Indian Capital Market. *ISSN 2251-239X*, 44.	2016	This research paper reports on the company-specific and market sentiment related	The reputation of the credit factors that influence the underpricing of Graded Initial Public Offerings (IPOs) between the rating agency, the appetite of the retail and institutional investors, Foreign Institutional
27	Clarke, J., Khurshed, A., Pande, A., & Singh, A. K. (2016). Sentiment traders & IPO initial returns: The Indian evidence. *Journal of Corporate Finance*, *37*, 24-37.	2016	Using a sample of 362 Indian the results support sentiment-based models of IPO initial returns.	In India, sentiments impact stock prices. Non-institutional groups determine the price of the stocks.
28	Kaustia, Markku, and SamuliKnupfer Do Investors Overweight Personal Experience? Evidence from IPO Subscriptions, Journal of Finance, Vol. 63, 2679-2702, 2008.	2008	The paper finds a strong positive link between past IPO returns and future subscriptions at the investor level in Finland.	This paper establishes a relationship between past IPO returns and future subscriptions at the investor level.

29	Aggarwal, Reena, Allocation of initial public offerings and flipping activity, Journal of Financial Economics, Vol. 68, 111–135, 2003.	2003	On average, flipping accounts for only 19% of trading volume and 15% of shares offered during the first two days of trading.	Institutions flip shares more than others.
30	Gohil, R., & Vyas, V. (2015). Performance of Private Equity Backed Initial Public Offerings: Empirical Evidence from India. *The Journal of Private Equity*, *18*(4), 56-64.	2015	This article investigates the initial and long-term performance of private equity (PE) backed initial public offerings (IPOs) in India.	PE-backed IPOs perform better in India.
Short run under-pricing in India differs from under-pricing in other countries.				

Source: Researcher

CURRICULUM VITAE

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CAREER OBJECTIVE

Be a part of the education industry, and share knowledge and skills, through research, consulting, and MDP programs.

CAREER HIGHLIGHTS

- Eight years of teaching experience
    - Blind Reviewer at FIIB, Fortune Institute of Business, for Perspectives and Issues
    - Best Academic Associate at ISB, 2012
    - Developing online academic content for IBS, Hyderabad; avagmah.com and conduira.com
    - Writing columns and commentaries in business magazines and research magazines
    - Research Interest – IPO, Valuation of Alternative Assets
    - Consulting - Start-Ups on how to prepare a business plan
    - Executive Training Conducted – Finance for Non-Finance Managers, How to Build a Business Plan
    - Part of Admission Committee - Managed Digital Marketing, Conducted Seminars, Student Counselling, and PIs at VJIM
- Six years of corporate experience
    - Expertise in Fundamental Research and Valuation
    - Experience in Business Research and Consulting

- Experience in Funding and Business Planning

SUMMARY OF WORK EXPERIENCE

TEACHING EXPERIENCE

- Assistant Professor of Investment and Finance at VJIM, Hyderabad
- Subjects Taught – Investment Analysis and Portfolio Management, Business Valuation, Economics, Accounts, Financial Statement Analysis, Derivatives, and Enterprise Risk Management.
- Conducted MDP's at GVK -EMRI and Shiv Shakti Group
- Academic Associate at ISB, Hyderabad – Was awarded the best academic associate at ISB 2012 for engaging tutorials
- Organized business report writing and financial modelling workshops

EQUITY RESEARCH

- Conducting in-depth equity research on various sectors such as steel, infrastructure, and cement
- Analyzing the competitive landscape of sectors researched
- Financial Modelling
- Portfolio Management
- Providing advice to clients on stocks to buy and sell

BUSINESS RESEARCH AND CONSULTING

- Conducting financial analysis for companies across sectors
- The job involved analyzing economy, industry, market, and company by using secondary as well as primary research.
- Identifying and analyzing the industry value chain and key dynamics involved in each segment of the value chain.
- Identifying and analyzing business drivers and inhibitors of the industry and the company.

PUBLICATIONS

- Abhishek Sinha, "Bitcoins a super bubble waiting to burst" - FRMB Journal Issue (FBR), Volume 3 Issue 3 July 2014, ISSN -2319-7145 RNI-DELENG/2012/46552 (Perspectives)
- Abhishek Sinha, “Financial Frauds- Revitalizing the system of checks and balances The Global Analyst", NOVEMBER 2014 - Vol. 3 - No.11 ISSN No. 2320-5628 (9772320 562001)
- Abhishek Sinha, “Small Local Banks- Any Takers?” The Global Analyst October 2014- Vol.2 NOVEMBER 2014 - Vol. 3 - No.11 ISSN No. 2320-5628 (9772320 562001)
- Abhishek Sinha, “Independent Directors - Are they really independent?” Industrial Economist January 2015, Industrial Economist
- Abhishek Sinha, “The gainers and the losers” Industrial Economist, October 2014
- Abhishek Sinha, “A solution to funding social causes” Industrial Economist, December 2014

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- Master’s in Business Administration (MBA)
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  Marketing & Finance
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