AN EMPIRICAL INVESTIGATION OF THE IPO UNDERPRICING PHENOMENA IN INDIA

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DECLARATION

I, Mr. Kedar Mukund Phadke, hereby declare that the present thesis titled **"An Empirical Investigation of the IPO Underpricing Phenomena in India"** is the outcome of my own research work which has been carried out by me under the guidance of Prof. Manoj S. Kamat, Principal D.P.M.'s Shree Mallikarjun College of Arts and Commerce, Canacona, Goa. All the sources used in this work have been duly acknowledged in the thesis. This work has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar titles of this or any other University.

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I hereby certify that the thesis titled **"An Empirical Investigation of the IPO Underpricing Phenomena in India"** submitted by Mr. Kedar Mukund Phadke for the award of Doctor of Philosophy in Commerce at Goa University has been completed under my guidance. This thesis is a record of the research work conducted by the candidate during the period of his study and has not previously formed the basis for the award of any degree, diploma, a scholarship or fellowship or other similar titles of this or any other University.

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ABSTRACT

An IPO (Initial Public Offering) is the first sale of shares or stocks by a private limited company to the general public. Underwriters, investment banks, and the issuing companies all try to price the IPOs most accurately; however, more often than not, the price of IPOs is way off the market reception and readiness. Underpricing occurs when IPOs are listed below their market value, which leads to, in some cases, substantial first-day gains for some investors. Underpricing of IPOs remains to be an area of widespread concern to investors as well as issuing firms. Not only do underpriced IPOs generate capital lower than the company's potential, but they also reduce the equity value for the founders and private investors.

Underpriced IPOs create a massive demand in the market, especially from many small investors, resulting in a fragmented allocation of minuscule shareholding by many investors. Some IPOs witness large share trading in a matter of weeks from the time of listing, spelling significant gains for some lucky investors, but at the same time, creating a broad base of new investors with inflated expectations from the stocks that they bought at an elevated price.

Uncertain demand creates complexity in the pricing of goods and services. Time pressures compel the supplier to underprice the goods or services to sell. The existence of information asymmetry between informed and uninformed buyers makes pricing more complex. This particular scenario is authentic in the case of a firm's new equity offering. The security pricing should be attractive to all investors despite the information asymmetry and any other market constraints. Such practice reduces the chances of an unsuccessful offer that results in high costs to the firm and an adverse spillover effect for future issues. Besides the firm's capital requirement, correct pricing ensures that the offering is sold in a given time frame. Due to the above bias, individual investors may feel that, despite the issuing firm's best efforts and underwriters to provide adequate information, insufficient information has been provided. The riskiness in pricing IPOs is further accentuated by factors such as limited time to complete the transaction, inability to change offer prices, and the offered issue size relative to the investor's perceived wealth.

External and internal factors significantly influence IPO underpricing. Issue-specific factors that dramatically affect the degree of underpricing include the issue's size, the issue mechanism, and the underwriter's role. The book-building mechanism gives underwriters discretionary powers in the IPO process. Internal firm factors affect the level of information asymmetry resulting in the IPO price to be influenced by factors such as debt rating, a firm's affiliation with a group, to name a few. There are market-specific factors, including hot and cold market periods, bull and non-bull/neutral markets, the listing firm's industry cycle, market liquidity, sectoral affiliation, etc., that affect an IPO's price discovery process.

The primary objective of this research is to perform an empirical study of IPO underpricing in India. Following are the four objectives in this study:

1. To examine the trends of IPOs listed in India between FY 1999-2013.
2. To study the listing day performance of underpriced IPOs across various cross-sections and to derive a relationship between macroeconomic factors and underpricing of IPOs.
3. To study the long-run performance of underpriced IPOs across various cross-sections.
4. To determine the influence of underwriters on underpricing and find firm-specific factors that influence underwriters' choice.

A universe of IPOs of firms listed from fiscal year (FY) 1999 until 2013 on the 'National Stock Exchange (NSE)' is under study. The study excludes all 'Small and Medium Enterprise (SME)' IPOs, as well as any 'Follow-On Public Offerings (FPOs)', also referred to as 'Secondary Equity Offerings (SEO)'. Access to listing information is retrieved from the Prime Database, and the historical price data for each issue is retrieved from the Prowess database. The sample period provides data for 445 IPOs issued, out of which 297 IPO issues are underpriced. Out of the 297 underpriced IPO issues, 13 IPOs are excluded for the long-run performance test due to insufficient trading history or breaks in the trading. The historical NIFTY index was retrieved from the Prowess database, while Dividend yields were obtained from the NSE portal. Macroeconomic data was obtained from the 'tradingeconomics.com' portal that included data points such as the INR exchange rate, Bond Yields, GDP growth rate (Quarterly), RBI Interest rate changes, Interbank lending rates as well as the money supply (M1, M2, M3). Inflation values were retrieved from 'inflation.eu' while Dividend Yield values were obtained from the NSE Portal. For the robustness of the test, the study uses two measures of short and long-run performance. The short-run performance is measured using normalised 'Marginally-adjusted returns on opening (MAARO)' and log normal returns. The long-run performance is measured using 'Buy-Hold Abnormal Returns (BHAR)' and Wealth Relatives(WR).

Findings from the IPO trend analysis

The trendline of the returns from overpriced IPOs indicates that overpricing IPOs is prevalent in the Indian stock markets since there is no tendency of the trendline to revert towards zero. In the case of overpriced IPOs, the investors do not experience any short-run gains. The decreasing trend in the returns of underpriced IPOs shows that investment banks/syndicates are making an effort to correctly price the IPOs.

Findings from the listing-day performance study

The study finds a statistically significant difference in underpricing between fixed-price and bookbuilt issues and concludes that the 'Market feedback' hypothesis is applicable to this study period. The 'market timing' theory does not apply to our study on comparing the extent of

underpricing of IPOs listed in cold and hot markets and between bull and non-bull markets. The certification results are apparent when this study compares the degree of underpricing between graded and ungraded IPOs. The impacts of certification are visible since lower-grade IPOs are underpriced the most while higher-grade IPOs are underpriced the least. Concerning sectoral affiliation of IPOs, the study finds that high innovation companies are more subject to non-fundamental factors and signaling effects than more seasoned companies with a long history. Small-size IPO issues are severely underpriced when compared to underpricing versus mid or large-size IPOs. The underpricing level is statistically significant between small-size IPOs with mid-cap and large-size IPOs, indicating that the 'signaling' hypothesis is relevant in our research study. A regression analysis shows that dividend yields have a positive effect on the underpricing of IPOs. In contrast, the exchange rate and inflation have a negative impact on the underpricing of IPOs.

Findings from the long-run performance study

IPOs underperform the markets in the long-run, and our sample never delivers a positive return during the study period. Pricing mechanisms do not matter in the long-run performance, with IPOs of both mechanisms returning losses by the end of the study. IPOs listed in cold markets perform substantially better with a positive long-term return than those listed in hot markets, confirming that IPOs in hot markets are subject to the 'fads' hypothesis. The long-run performance of an IPO, whether graded or ungraded, does not matter in the long run since they both end with negative returns. The presence of higher or lower grades does not guarantee positive long-run performance. 'Certification' effects are irrelevant in the long-run in the case of graded IPOs. Since IPOs issued in bull markets incur lower losses than those given in non-bull markets over the long-run, our study suggests that the 'Window of Opportunity Hypothesis' applies in the Indian context. Issuing firms with a considerable history and strong fundamentals perform well in the long-run. This is evident from the sectoral long-run performance study where public sector banks are the only sector that returns a favourable long-term return. All other chosen sectors deliver negative returns by the end of the study. Our study validates that the issuance of large-size IPOs is subject to the overreaction hypothesis.

Findings from the influence of underwriter prestige on underpricing

This study suggests that the 'certification' effects of premier underwriters are not observed concerning underpricing. A regression analysis study finds that listing firms retain reputed banks' services when the issue size is large and when the firms are relatively young. Using a 'back-propagation artificial neural network (BP-ANN)' on our sample, the study discovers that the likelihood of listing firms collaborating with prestigious investment banks is much higher when the issue size is significant.

Contents

List of Figures

List of Tables

Acronyms

ABHAR Average Buy-and-Hold Abnormal Returns.

ADR American Depository Receipts.

ANN Artificial Neural Network.

ANOVA Analysis of Variance.

APT Arbitrage Pricing Theory.

BHAR Buy-and-Hold Abnormal Returns.

BP-ANN Back-Propagation Artificial Neural Network.

BSE Bombay Stock Exchange.

CAAR Cumulative Average Abnormal Returns.

CAPM Capital Asset Pricing Model.

CAR Cumulative Abnormal Returns.

CARE Credit Analysis & Research Ltd.

CCI Controller of Capital Issues.

CI Confidence Interval.

CRISIL Credit Rating Information Services of India Limited.

DEMAT Dematerialised Account.

DSE Dhaka Stock Exchange.

DY Dividend Yield.

ER Exchange Rate.

FPO Follow-On Public Offering.

FY Fiscal Year.

GLM Generalised Linear Model.

GR Growth Rate.

IBP Investment Banker Prestige.

ICRA Information and Credit Rating Agency.

IEPF Investor Education and Protection Fund.

INFL Inflation Rate.

IPO Initial Public Offering.

JSE Johannesburg Stock Exchange.

KSE Karachi Stock Exchange.

M1/M2/M3 Measures of Money Supply.

MAARO Marginally Adjusted Abnormal Returns on Opening.

MLR Multiple Linear Regression.

NASDAQ National Association of Securities Dealers Automated Quotations.

NSCL National Securities Clearing Corporation Limited.

NSE National Stock Exchange.

NYSE New York Stock Exchange.

PIPH Post-Issue Promoter Holding.

RR Repo Rate.

SD Standard Deviation.

SEBI Securities & Exchange Board of India.

SEC Securitues & Exchange Commission.

SEM Standard Error of Mean.

SEO Secondary Equity Offering.

SME Small & Medium Enterprise.

SPP Syndicate Prestige Points.

SS Syndicate Size.

UK United Kingdom.

US United States of America.

WR Wealth Relatives.

Chapter 1

Introduction

1.1 Background of the study

An IPO (Initial Public Offering) is the first sale of shares or stocks by a private limited company to the general public. A private limited company leverages the IPO mechanism to raise capital from the public for the first time. The critical difference between a private and a public company is that the ownership of the former rests in a few hands while the public partially owns the latter. The shares of a public company can be bought or sold on a stock exchange; however, in the case of a private company, it is the discretion of the owners to sell stakes in the company.

It is a general perception that a private company is a small or mid-sized business with small operations and a limited presence. However, the truth is that some of the biggest brands, with global operations, are private companies, for instance, Deloitte, Pricewaterhouse Coopers, and Fidelity Investments. Disclosure of information for a privately-held firm is minimal, whereas a public company must publish its important performance and financial reports in the public domain. A private company decides to go public mainly to raise capital. There are other factors too for going public, such as (1) *The maximisation of shareholder value*: The ultimate goal of a company is to maximise the shareholder's value. The management of a well-performing private company with robust profits and serving a large market might find it more lucrative to go public, in anticipation of enhancing the stock prices, thus increasing the value for shareholders, than to sell the business to another company at a marginally higher valuation than the current value of the business, (2) *Fundraising at more appealing rates*: Investors are attracted to stocks that are freely traded in the markets since they have greater liquidity. This is why public financing permits raising of substantial sums of money at an enhanced valuation than compared to private

fundraising from a handful of investors, (3) *Ease of company valuation*: It is common for larger companies to attain growth through acquisition of smaller companies in similar/aligned businesses. Most acquisitions are made through a simple purchase of majority stock holding in the acquired company. In some cases, an acquisition deal is paid through a combination of cash, stocks, and liquid securities. The noteworthy thing is that the valuation of a company is based on its stock price. Private companies are at a loss of ascertaining a transparent valuation of their operations and lose on profitable opportunities, and (4) *Widespread branding opportunity*: An IPO is a big event for investors, as well as the general public. Upcoming IPOs receive significant coverage with major financial dailies and news channels, giving much free press to the company while analysing its operations and the projected performance of the IPO. Such a branding opportunity is unparalleled to any marketing campaign of scale.

Economic (n.d.) states, *"Initial public offering is the process by which a private company can go public by sale of its stocks to general public. It could be a new, young company or an old company which decides to be listed on an exchange and hence goes public."*

According to Amadeo (2018), *"An IPO is short for an initial public offering. It is when a company initially offers shares of stocks to the public. It's also called "going public." An IPO is the first time the owners of the company give up part of their ownership to stockholders. Before that, the company is privately-owned."*

EduPristine (2018) states, *"An IPO (initial public offering) is referred to a flotation, which an issuer or a company proposes to the public in the form of ordinary stock or shares. It is defined as the first sale of stock by a private company to the public. They are generally offered by new and medium-sized firms that are looking for funds to grow and expand their business."*

From an investor's point of view, the process of launching IPOs requires to be more transparent, especially in the areas of pricing, fee disclosures, and allocation parameters. The principal issue is the pricing of IPOs. Underwriters, investment banks, and the issuing companies all try to price the IPOs most accurately; however, more often than not, the price of IPOs is way off the market reception and readiness. Moreover, while the banks and underwriters mint money through hefty fees, irrespective of the fate of the IPO, some entities suffer real losses.

Underpricing occurs when IPOs are listed below their market value, which leads to, in some cases, substantial first-day gains for some investors. Over time, demand for the issue drives the price to its intrinsic value. The effects of underpricing have been observed globally. Barry and Jennings (1993) were the first to look at underpricing and significant impacts it has

on primary and secondary returns. Agathee, Sannassee, and Brooks (2012), in a study on the Mauritius Stock Exchange, find that issues appreciate by the amount that they were underpriced on the secondary market. Chua (2014) concludes that top-tier underwriters are concerned with the reputation of the listing firm and that the first-day returns are positively correlated with the firm valuation. Kirkulak and Davis (2005), in their study, state that underwriters play a significant role in underpricing issues. However, Su and Bangassa (2011), in their study, find that underwriters do not influence first-day returns. Loughran and McDonald (2013), in their study, find that underpricing stems from a high level of uncertainty, which results in first-day returns.

Underpricing of IPOs remains to be an area of widespread concern to investors as well as issuing firms. Not only underpriced IPOs generate capital lower than the company's potential, but they also reduce the equity value for the founders and private investors. On the other hand, underpriced IPOs create a massive demand in the market, especially from a large number of small investors, which results in a fragmented allocation of minuscule shareholding by a large number of people, triggering rapid investor turnover. Some IPOs witness large share trading in a matter of weeks from the time of listing, spelling significant gains for some lucky investors, but at the same time, creating a broad base of new investors with inflated expectations from the stocks that they bought at an elevated price. These new investors are not privy to pre-IPO company information. The study by Loughran and Ritter (2002) proposed a theory of underpricing called 'Prospect Theory Analysis' which is based on bargaining. The study finds that when the overall outlook of the markets is dim, the issuers are more dominant with regards to increasing the offer price. On the other hand, when the market outlook is good, the underwriters are more dominant with setting the offer price. This difference in control causes higher underpricing when the demand for an IPO is strong.

If one considers the investment bank point of view, they find it difficult to set the initial price of a stock in the absence of any former trading reference. Generally, investment banks set a price, which is 10% - 15% lower than the value of the business to set the price of the IPO on an upward trajectory in the secondary market. However, irrespective of the outcome of the pricing of an IPO, investment banks and initial investors bag their rewards and bear no brunt from an unfavourable market response. However, conflicts of interest are a more potent, though unseen, danger than pricing itself. Investment banks are privy to essential workings and pitfalls of a company. It is conceivable for investment banks to put client interest at the backseat and allocate promising stocks to favoured investors. By doing so, they are benefiting, maybe at a later stage, from the relationship. The current market scenario with the unique position

of investment banks in the process of IPO price-fixing needs more transparency and calls for stringent regulations concerning stock allocation.

Timing is yet another issue as many investors feel that the IPO process is designed in a way that forces them to make hasty purchase decisions. The problem of timing is also related to lopsided information available to the investors. Since leading investment banks and financial agencies handle most IPOs, it is assumed that there is no necessity for independent research. Hence, investors are not only required to make a buying decision during a float; there are chances that the information handed to them is also inadequate and asymmetrical. Such a limitation prevents the banks from being rewarded by vendors for their lending relationship or past unpaid advice. Even this step cannot guarantee proper research on the part of independent brokers who may have insufficient incentive as they are not involved in the deal. A much more plausible solution could be prior engagement with potential investors. Early release of the information would boost not only independent research but also enable potential investors to ask relevant questions, which is essential for making informed decisions. Of course, the IPO price would still not be known, but there could be greater transparency on fees that would allow investors to understand the incentives available for investment banks easily.

In 2003, the 'United States Securities and Exchange Commission (US SEC)' had established an agreement to ensure IPO underwriting did not compromise independent research. The purpose of the research is to show conflicts, but often independent research is overshadowed by market commentary, which is something the US SEC agreement aimed to stop. Unfortunately, the practice continues in the United Kingdom, and the use of social media further amplifies the audience of this lightly regulated commentary.

Presently, book-building happens to be the dominating IPO mechanism even though auctions continue to exist in the United States and India after falling into disuse in the 1980s in most other markets. However, even in India, auctions happen to be just an aberration of the fixed-price public offer. However, what is the reason that equity investors do not prefer auctions? In most cases, investors find the auction process complicated as it involves much calculation around what others are going to pay. On the other hand, investors trust an underwriter, thanks to the convenience and long-term relationship in many cases, almost blindly. However, despite the relationship between an investment bank and its core pool of investors - investors cannot dispense of independent research as underwriters have substantial discretion over allocation and pricing during book-building which must be scrutinised. Higher standards by the regulatory bodies and greater transparency in the IPO sector are required so that mistakes similar to that of

the dot-com IPO boom are not repeated.

Uncertain demand creates complexity in the pricing of goods and services. There are differences in the perceived values of goods and services between the supplier and the customer. Time pressures compel the supplier to underprice the goods or services in order to sell. The existence of information asymmetry between informed and uninformed buyers makes pricing more complex. This particular scenario is especially real in the case of a firm's new equity offering. The pricing of the security should be attractive to all investors despite the information asymmetry and any other market constraints. Such practice reduces the chances of an unsuccessful offer that results in high costs to the firm and an adverse spillover effect for future issues. Besides, the capital requirement by the firm, correct pricing ensures that the offering is sold in a given time frame.

Due to the above bias, individual investors may feel that, despite the best efforts of the issuing firm and its underwriters to provide adequate information, insufficient information has been provided. The riskiness in pricing IPOs is further accentuated by factors such as limited time to complete the transaction, inability to change offer prices, and the offer size relative to the investor's perceived wealth.

Reilly and Hatfield (1969) provided several reasons for seeing superior returns and concluded that new equity issues are underpriced. The author's reasons are centred upon the collaborative nature of pricing between the issuer and underwriters. Possible reasons for observed underpricing include:

1. The inability of the underwriters to judge the investor's perceived value of the new equity issues, mainly due to the listing firm's operations that deal with new technology or product offerings.
2. Underwriters underprice issues to guarantee over-subscription, which leads to sizeable returns on listing.
3. A quick sale minimises the underwriter's exposure to risk as they usually have much smaller capital bases as compared to the amount of underwriting they accept.
4. The underwriter can take stabilising action under the supervision of a regulatory body if they experience high volatility that can affect their capital and resources. However, underpricing ensures a successful issue that requires zero-intervention.
5. Underwriters benefit from a successful issue since they receive a part of their fees in stock offerings or have the option to buy the stock cheaper than the issue price.

1.2 Motivation of the study

Based on the various underpricing theories/hypothesis for listing day as well as long-run performance, this study replicates many of the results purely from an Indian context. The motivation to undertake this study is as follows:

1. This study allows us to verify many of results documented in prior literature and examine their empirical validity over longer time periods.
2. The study covers IPOs listed over a period of 15 years (1999-2013) which is significant given that market conditions do change over such a large duration of time. This allows us to compare underpricing from various angles such as market sentiments, overoptimism, sectoral, etc.
3. Consistent use of measures such as MAARO & long normal returns for listing day performance and BHAR & wealth relatives for the long-run performance study will allow us to compare our results with those found in the review of literature.
4. This study plans to an employ artificial neural network to examine differences in results between a regression and neural network model. The presence of large data sets needs to employ newer techniques to examine noisy data which cannot be otherwise investigated or interpreted using traditional data analysis measures.

1.3 Initial Public Offerings: A Conceptual Framework

An IPO is meant to change the ownership of a company that is privately held into a publicly held company. An IPO infuses capital into the firm, which is a significant step in the growth of a firm. Underwriters assist the firm in choosing the security type to the issues, the issue size, the offer price, and a vital aspect as to the timing of the IPO, keeping in mind the economic indicators and legal aspects.

1.3.1 Pricing Mechanisms

The common pricing mechanisms of IPOs are ‘fixed price’ and ‘book building’. For an IPO issue, the issuing firm can use either of these mechanisms or a combination. Investors resorted to manipulations under the fixed-price mechanism to increase the odds of share allocation. Due to such incidences, the markets have increasingly moved away from the fixed-price to book building mechanism.

Fixed Price: Under this mechanism, the issuing firm establishes the price at which investors

will be offered the shared. In this approach the market demand for the issue is known only when the issue is closed.

Book Building: This mechanism is a price-discovery tool for the proposed listing of shares to determine the final share price based on the bids from the investors. Investors bid on the number of shares and the price at which they would like to buy the shares. This price bid by the potential investors is restricted to a price band. The lowest share price is called the floor price, while the highest share price is called the cap price.

1.3.2 Hot and Cold Markets

A hot or cold market is determined by the number of IPOs listed in that corresponding quarter. We identify a market to be hot if there are more than five IPOs listed in a quarter. Based on a review of extant literature, hot markets are periods which deliver high average initial returns while cold markets deliver lower initial returns.

1.3.3 Grading of IPOs

The IPO is assigned a grade on a five-point scale from 1 to 5; 1 being the lowest and 5 being the highest grade. Grades are assigned based on the fundamental characteristics of the issuing firm relative to the listed firms in India as well as that of the IPO. Fundamentals would include things such as the industry prospects, the firm's financial position, quality of its management and governance, the risks and prospects of its new projects, and the firm's regulatory compliance. One thing to note is that the issue price of the IPO is not taken into account when the rating agencies issue a grade.

Some of the prominent credit rating agencies in India are the CRISIL, CARE, and ICRA. The documents used by these rating agencies are those provided by the listing firm as well as from other sources. It is possible that the issuer may not like the grade assigned by the rating agency. In that case, the issuer can approach another credit rating agency. An issuer has to provide all grades received by credit rating agencies in the red herring prospectus (described later in sub-section 1.3.5).

1.3.4 Bull and Non-Bull Markets

The financial markets are greatly influenced by consumer confidence which are high during sustained periods of growth and low levels of unemployment. Such conditions give

rise to higher investor confidence leading to periods where investors invest in new or hold on to their securities. These are known as bull markets otherwise commonly referred to as a 'buyers' market.

Adverse economic conditions due to lowered productivity and increasing unemployment cause a dent to the consumer confidence. This leads to investors divesting their investments causing markets to fall over a period. These are know as bear markets otherwise commonly referred to as a 'sellers' market.

1.3.5 The IPO Process

An important decision for firm management is to decide unanimously for the need to go public. Once that agreement is reached, although not mandatory, the next big decision is to decide on bankers/underwriters on behalf of the firm. Underwriters also act as market makers to the issue for a specific period once the issue is listed. Additionally, a legal counsel needs to be appointed to negotiate the legalities involved with the listing process. The Securities and Exchange Board of India (SEBI) scrutinises all the firm related documents related to its financial health.

High-level steps involved in listing an IPO in India are as follows:

Step 1: Registration - The firm going public needs to submit a registration statement to the SEBI that includes details such as historical financial information related to performance as well as any business plans. SEBI uses these documents to initiate background checks as well as to ensure that all legal formalities in the registration process are complete.

Step 2: Prospectus - The listing firm, in collaboration with the underwriters, create a preliminary offer document called the 'Red Herring' prospectus. This document, although pending legal approval of listing from SEBI, lists out past financials, future projects that the firm wishes to execute as well as the pricing mechanism used, and the expected price per share. Such information revealed in the prospectus is in the interest of prospective investors.

Step 3: Roadshows/Marketing - Roadshows are essential marketing events for upcoming issues. These events are meant to generate interest in the investors regarding the IPO by visiting important cities and meetings with high network individuals as well as corporates. These roadshows are also an excellent medium to gauge investor interest in the upcoming IPO.

Step 4: SEBI Approval- SEBI provides the listing date only after it approves the registration statement. There could be a scenario where some amendments are mandated to the listing firm's registration statement before SEBI provides an approval. Once all the amendments are made, the firm decides on the exchange(s) where the issue will be listed.

Step 5: Price Band and Issue Size - The underwriter(s), along with the listing firm, decides on the price band of the shares and the issue size of the IPO. In a fixed-price mechanism, the firm decides the issue price and the number of shares that will be sold. A bookbuilt issue is a significant price discovery mechanism for the listing firm. The investors bid for the share price within the price band. The capital raised on listing depends upon the high bid by most investors.
Step 6: Available to Public for Purchase - The shares are made available to investors based on the listing date in the prospectus. Investors specify the price at which they wish to make the purchase.
Step 7: Issue price and allotment - At the end of the subscription period, the investment bankers, listing firm officials, legal counsel, and other teams vital to the listing effort meet to decide the final price at which the shares will be issued. This purely depends on the anticipated demand as also the bids by the investors. In situations where there is an over-subscription, only partial shares are issued to the applicants.
Step 8: Listing and trading in secondary markets - Investors who get allocated shares get credited to their DEMAT accounts, while investors that do not get any shares allocated are refunded their application amounts. On listing, the shares of this public entity are now available for trading in the secondary markets.

1.4 The Research Problem

The literature review confirms that a large number of internal and external factors and their interactions affect IPO's price discovery process leading to underpricing in many markets. Two theories explain the degree of underpricing - information asymmetry and signalling. Given the academic construct of these two theories, IPO literature includes numerous studies that modelled the level of underpricing by using proxies to support these theories. External and internal factors significantly influence IPO underpricing. Issue-specific factors that dramatically affect the degree of underpricing include the size of the issue, the issue mechanism, and the role of the underwriter. The book-building mechanism gives underwriters discretionary powers in the IPO process. Internal firm factors affect the level of information asymmetry resulting in the IPO price to be influenced by factors such as debt rating, firms affiliation with a group, to name a few. There are market-specific factors, including hot and cold market periods, bull and non-bull/neutral markets, the listing firms industry cycle, market liquidity, sectoral affiliation, etc., that affect an IPO's price discovery process.

The research problems in this study can be described under six sub-headings.
(i) What are the impacts on IPO pricing using the fixed-price or the bookbuilt mechanism?

Does IPO performance in the long-run have any bearing on the pricing mechanism used during issuance?

Most research studies point to positive first-day returns on listing. The first-day gains have been attributed to the existence of information asymmetry. Information asymmetry exists between the issuing firm with the underwriter and investors, both informed as well as uninformed. The pricing mechanism used has an influence on the information asymmetry. In the case of the fixed-price mechanism, the underwriter's access to superior information influences the offer price, as well as share distribution. In the bookbuilt mechanism, the price range is responsible for accommodating information asymmetry to an extent since investors submit their bids within a given price range. The extent of undervaluation of an issue depends on the difficulty faced by the issuer to gauge the informational disparity between informed and uninformed investors. As opposed to having a failed issue, the issuer is forced to underprice to generate interest in potential investors.

In fixed-price offers, the issuer's ability to correctly price the issue is based on determining the extent of non-uniform information between various investor classes. To increase the probability of an issue, a risk-averse issuer would reduce the price and encourage higher subscriptions. This method is more suited to small size issues since the costs involved in a bookbuilt issue are high. Also, a fixed-price mechanism is suited to less developed markets where investors are not capable of accessing critical market information. Underpricing of fixed-price issues to reduce the risk of a failed subscription leads to positive returns beyond the first trading day.

The book-building method allows investors to bid within the offer range, which helps in reducing information asymmetry between investor classes. This price discovery process helps the issuing firm to obtain a price as perceived by the investors based on their assessment of the market information. Biais and Faugeron-Crouzet (2002) prepared a model that proved that the book-building process is a robust mechanism that helps reduce underpricing. One reason is that Pre-IPO marketing activities that are a part of the book-building process gives the issuer an idea of investors interest and helps anticipate the demand for an issue which is used for setting the issue price. Marketing costs and underwriter fees are involved in the book-building process. Therefore, the issuer must cogitate cost-benefit analysis with regard to the cost of the issue and the reduction in the degree of underpricing while opting for the book-building method. Ljungqvist, Jenkinson, and Wilhelm Jr (2003) reported that the expense of marketing costs and underwriter fees are outweighed by the positive effect of a lower degree of underpricing.

Based on the literature reviewed, we infer that the pricing mechanism influences the extent of underpricing. Although the degree of information asymmetry cannot be completely eliminated, book-building helps reduce the extent of underpricing since the offer price can be adjusted based on feedback and the level of interest of potential investors.

(ii) What are the pricing impacts on IPOs issued in hot markets or bull periods? Does IPO performance in the long-run have any bearing on the market conditions (hot and cold markets, bull and non-bull markets) during issuance? Do macroeconomic factors play a role in the pricing of IPOs?

"When to issue initial equity offering?" is a critical decision for the issuer. Issuers consider market volatility, IPOs being issued by peer firms, and IPO volume before deciding the timing of the listing. A large number of IPOs get listed in periods with high IPO activity, also referred to as "hot" periods. Past studies such as Ritter (1984) on market timing point to larger underpricing in "hot" periods as opposed to other periods.

Based on the literature reviewed, we infer that market timing is crucial to listing firms since it has a significant influence on the valuation of IPOs and, ultimately, to the success of the issue. Also, many studies point out that the valuation of a firm is affected adversely due to adverse macroeconomic or industry-related issues reducing the probability of a successful issue.

(iii) What is the impact on IPO pricing due to the presence of grading? Are ungraded IPOs underpriced more than graded IPOs? Does the presence of different grades have any impact on IPO pricing? Does a graded IPO perform better in the long-run as opposed to ungraded IPOs? Do higher graded IPOs perform better than the lower graded IPOs in the long run?

Regulators adopt various procedures to minimise information asymmetry. Grading of IPOs was adopted by SEBI in India to make it easier for investors in their decision-making process. Studies such as Deb and Marisetty (2010) and others point to the effective use of grading to reduce underpricing.

The degree of information asymmetry is different between emerging as opposed to developed markets. From the literature reviewed, we infer that the issuing firms signal the quality of the issue by utilising the IPO grading mechanism towards reducing the degree of underpricing.

(iv) What is the impact on pricing due to an IPOs association with the underlying sector? Are IPOs associated with specific sectors priced better than others? Does the sector association of IPOs have any bearing on their long-run performance?

Allen and Faulhaber (1989) proposed a model on similar assumptions as Ritter (1984) that sector/industry-specific underpricing is observed at a particular time. The model breaks up firms into good and bad firms. Good firms have superior information about future cash flows and dividend yields and signal better quality by underpricing. Good quality firms can adopt this strategy since underpricing causes a loss in capital raised in the issue.

We infer that issues of firms belonging to highly regulated sectors such as financial services experience lower underpricing since information asymmetry is lower due to additional regulatory disclosures. On similar lines, unseasoned firms should experience a higher degree of underpricing since the degree of information asymmetry is higher for such firms.

(v) Does a small, medium, or large issue size influence the pricing of an IPO? Also, do smaller issue size IPOs perform better or worse than large issue size IPOs in the long-run?

A large pool of investors leads to a positive subscription of an issue. However, larger the pool, more the information asymmetry which can be addressed by an issuing firm by underpricing the issue. Larger issues are underpriced more to increase the probability of a successful issue (Michaely & Shaw, 1994). We infer that IPOs with a small issue size should be underpriced the least since it takes a smaller pool of investors to subscribe the issue fully.

(vi) Do underwriter ratings influence the pricing of IPOs? How do listing firm-specific factors such as issue size, age, and post-issue promoter holdings (PIPH) influence the choice of an investment bank(s) to collaborate with the listing firm? Can a neural network approach help better determine the firm-specific factors that influence the choice of investment banks?

The pricing of an IPO is impacted significantly by the involvement of an underwriter in the process. Underwriters play a crucial role in correctly pricing issues and reduce underpricing in order to attract long term investors. Issues offered by well-reputed underwriters are considered less risky and result in a lower degree of underpricing (Carter & Manaster, 1990). Reputed underwriters use their clientele to ensure the success of an issue (Carter & Dark, 1993; Beatty & Welch, 1996; Carter, Dark, & Singh, 1998; Dunbar, 2000). The market share of an underwriter is influenced by the fair pricing of IPO (Dunbar, 2000). A study by Beatty and Welch (1996) support the certification hypothesis concerning underwriter reputation. Highly reputed underwriters can estimate the firm value more accurately. Therefore, the reputation of an underwriter and the degree of underpricing are correlated. Short term investors who sell their shares to obtain quick gains increase the volatility of aftermarket returns. Highly reputed underwriters are associated with long term investors, improving long-term performance (Carter et al., 1998). In addition to the underwriter reputation, the price of IPO is influenced by the syndicate size with larger syndicates able to produce information that influences price revision of an IPO. While a study by Corwin and Schultz (2005) does not see the importance of syndicate

structure in defining the degree of underpricing, the authors do agree that a larger syndicate structure helps in producing information and support aftermarket activities.

We infer that while the quality of independent research on upcoming IPO issues helps reduce the degree of information asymmetry, the underwriters to the issue play a significant role in the correct pricing of the issues. The reputation of underwriters helps repose faith in the investors since well-reputed investors expect the issues to be fairly priced. Similarly, underwriters should find it easier to price issues for firms with a long history of operations and profitability.

1.4.1 Research Questions

Over time, the Indian capital markets have evolved with pricing mechanisms moving away from the traditional methods of using fixed-price to a book-building mechanism. The fixed-price mechanism was used until 1999. Under the fixed-price mechanism, investors resorted to manipulations to increase the probability of allocation. SEBI introduced the book-building mechanism in 1999 so that issuing firms could opt for either of the pricing mechanisms. This provides us an opportunity to examine the underpricing of IPOs issued using both mechanisms in the Indian IPO markets. Also, the period between 1992 and 1998 witnessed various controversies and scams in the Indian stock markets. A bulk of these controversies were related to the IPO markets in both the primary and the secondary markets. The year 1998 brought with it the need to strengthen regulations to bring a sense of respect to the Indian security markets. Based on the research problems highlighted in the section above, this study addresses the following research questions about the underpricing of IPOs in India.

What are the listing day return trends for over and under-priced IPOs in India? We perform a cross-sectional trend analysis of marginal returns for all IPOs to examine trends in over and underpricing across various cross-sections for IPOs listed on the 'National Stock Exchange (NSE)' between the fiscal year 1999 until 2013; a period of 15 years.

SEBI introduced the book-building mechanism of IPOs to reduce the extent of underpricing otherwise observed in firms issuing IPOs using the fixed-price mechanism. Book-building, is a much more systematic process of gauging investor demand for shares during an IPO issuance process. Book-building inherently supports efficient price discovery. If that is correct, the extent of underpricing amongst IPOs issued using the book-built mechanism should be less as compared to those IPOs issued using the fixed-price mechanism. This objective seeks to find if this is correct in the Indian context. Also, do pricing mechanisms have any impact on

the long-run performance of the underlying IPOs?

Would the presence of a cold market deter investors from investing in IPOs? Does the presence of a cold market reduce the extent of underpricing, or is the extent of underpricing the same irrespective of a hot or cold market? This study seeks to answer such questions by comparing the extent of underpricing in IPOs during hot and cold markets. Do such market timed IPOs perform positively over the long-run, or are there no impacts of timing when a firm goes public with its IPO issue?

Has grading of IPOs empowered the retail investor, and did investors view IPO grading as a sound barometer regarding the issuing firm's quality? If so, the extent of underpricing should be much lower in graded as opposed to graded IPOs. Also, does a higher grade that signal better firm quality result in lower underpricing as opposed to IPOs with lower grades? Does the presence or absence of an IPO grade have any bearing on its long-run performance? Also, do higher graded IPOs before better than lower graded IPOs in the long-run?

A bull market signals positive investor sentiment and a period when stocks increase in value. Do investors benefit by investing in IPOs issued in bull periods as opposed to non-bull/neutral periods? How do these IPOs issued in bull and non-bull markets perform in the long-run?

Is there any impact of the listing firm's sector affiliation on the underpricing of IPOs. Does it matter if a firm is a technology firm versus a bank? Investors view that technology and consumer services industries carry a risk that is independent of the macro environment. This perception amongst investors would lead to such firms underpricing their IPO issues to encourage investor participation. Do specific sector affiliated IPOs outperform IPOs belonging to other sectors in the long-run?

Does the issue size have any influence on IPO underpricing? Studies on the South African, as well as the US stock markets, have concluded that the issue size of a firm has a bearing on underpricing. In our study of underpriced IPOs, a classification by issue size of all underpriced IPOs would help us to conclude that the extent of underpricing does indeed depend on the issue size. If so, this would then validate similar results found internationally. Does IPO classification by issue size have any impact on the long-run performance?

Can we derive a relationship between the marginally adjusted returns and some independent macroeconomic factors?

Does a higher underwriter/syndicate rating result in a lower underpricing of IPOs? Can we derive a relationship between listing firm-specific factors such as issue size, age, and post-issue promoter holdings on their choice of an investment bank(s) to collaborate with the listing firm? Would moving away from a regression model to a neural network model help better determine the firm-specific factors that influence the selection of investment banks?
This thesis seeks to answer the above questions in Chapter 4 until Chapter 7.

1.5 Significance of the study

Since 1991, the Indian capital markets have evolved and transformed themselves by ushering in significant changes such as de-materialisation of shares (DEMAT), screen-based trading, establishment of SEBI and NSE, setting up of the Investor Education and Protection Fund (IEPF) and National Securities Clearing Corporation Limited (NSCL), providing the ability to trade in central government securities, setting up of mutual funds, access to global market and derivatives trading. Organisations use IPOs as one of the favoured mechanisms to raise capital in order to leverage growth. For the period between FY 1999-2013, a total of 445 IPOs (excluding issues by small and medium enterprises and follow-on public offerings) were listed on this National Stock Exchange (NSE). Out of these, Rs.49,352.80 crore capital was raised from 148 overpriced issues, while Rs.1,20,737.83 crore capital was raised from 297 underpriced issues.

We perform a trend analysis of marginal returns for all IPOs issued in India between FY 1999-2013. This analysis is important since it explores descriptive analysis for the entire sample and then further, by splitting up the sample data by pricing mechanisms, issues in hot/cold periods, between graded/ungraded IPOs, between IPOs of different grades, issues in bull and non-bull markets and finally by issue size. The descriptive analysis also helps analyse trends in marginal returns across fiscal years.

Prior research on the short and long-run performance of IPOs utilises different samples, study horizons, and methods to test abnormal behaviour of IPOs. This study is significant to the academic and professional communities because we look at the performance of IPOs from various facets. This study tests performance of underpriced IPOs for IPOs listed in a 15-year time frame to (a) test the market feedback hypothesis by examining the extent of underpricing where IPOs are issued using the fixed-price or bookbuilt mechanism (b) test the market timing theory to include ”hot” and ”cold” periods as well as market sentiments which would indicate bull and non-bull/neutral markets (c) test for the certification effect while examining the effect

of IPO grades on short-run underpricing and study the extent of underpricing between graded and un-graded IPOs as well as amongst graded IPOs (d) test the signalling hypothesis by studying the extent of underpricing by issue size (e) test if there is any influence of an IPO firms association with specific sectors on the extent of underpricing amongst sectors. Finally, in the short-run study, we also derive a relationship between marginally adjusted returns and certain macroeconomic factors.

As such, there is an absence of a convincing theory to explain the observed long-run underperformance of IPO stocks. However, this study also examines the long-run performance of underpriced IPOs for a 3-year time frame to (a) examine the window of opportunity hypothesis by examining the long-run performance of IPOs issued in bull and non-bull markets and (b) test the fads hypothesis by examining the long-run performance of IPOs issued in hot and cold periods, and (c) test the overreaction hypothesis by examining the long-run performance based on the issue size classification. We also study the long-run performance to examine performance across pricing mechanisms, between graded and ungraded IPOs as well as amongst graded IPOs and finally, the performance of IPOs in specific sectors.

Finally, a significant aspect is examining the influence that underwriters and listing firms have on each other. We try to examine if a listing firms association with top underwriters/syndicates helps reduce underpricing. We also look at deriving a relationship between firm factors that are important for underwriters or syndicates to be interested in associating with listing firms. We extend this model by using artificial neural networks to determine the firm factors that would be important for underwriters or syndicates to be interested in associating with listing firms.

1.6 Objectives of the study

The primary objective of this research is to perform an empirical study of IPO underpricing in India. Following are the four objectives in this study

1. To perform a trend analysis of returns for all IPOs listed in India between FY 1999-2013.
2. To study the listing day performance of underpriced IPOs across various cross-sections as well as to derive a relationship between macroeconomic factors and underpricing of IPOs.
3. To study the long-run performance of underpriced IPOs across various cross-sections.
4. To determine the influence of underwriters on underpricing and to find firm-specific

factors that influence the choice of underwriters.

We perform a analysis of trends of IPO in India for all IPOs listed in India between FY 1999-2013. This objective examines a trend analysis across various cross-sections by splitting up the data by pricing mechanisms, issues in hot and cold markets, between graded/ungraded IPOs, between IPOs of different grades, issues in bull and non-bull markets and finally by issue size. We also examine the trend in marginal returns across fiscal years.

The second objective is devoted to studying the listing day performance of underpriced IPOs and is composed of two sub-objectives. The first sub-objectives includes determining the extent of underpricing when (a) IPOs are listing using either pricing mechanism, IPOs are listed in hot and cold market conditions, IPO are graded and ungraded, IPOs are graded, IPOs are listed in bull and non-bull markets, IPOs are affiliated with select sectors, IPOs are compared across issue size categories (small, mid and large). The second sub-objective derives a relationship between MAARO and certain macroeconomic factors.

The third objective studies the long-run performance of underpriced IPOs and is composed of eight sub-objectives. These sub-objectives focus on the differences in long-run returns by (a) examining the long-run performance of the entire sample, and examine differences when (b) IPOs are listing using different pricing mechanisms, (c) IPOs are listed in hot and cold market conditions, (d) IPOs listed are graded and ungraded, (e) amongst graded IPOs, (f) IPOs are listed in bull and non-bull markets, (g) IPOs are affiliated with select sectors, and (h) IPOs are compared across issue size categories (small, mid and large-size).

The fourth objective determines the influence that underwriters and listing firms have on each other. Specifically, we look at (a) whether the association with top-ranking underwriters reduces underpricing (b) what firm factors would be important for underwriters or syndicates to be interested in associating with listing firms. This is determined using linear regression. Finally (c), we look at determining a model using artificial neural networks to determine the firm factors that would be important for underwriters or syndicates to be interested in associating with listing firms.

1.7 Proposed contributions of the study

Following are the proposed contributions of the study.

1. This study examines the performance of IPOs listed over a substantial period of 15 years.

It is important to understand the trends of IPOs in India concerning underpricing and well as overpricing. The trend and descriptive statistics should help this study make some preliminary observations when data is examined across cross-sections such as by pricing mechanism, IPOs listed in hot and cold markets, etc.

2. Various underpricing theories/hypothesis have been proposed by eminent researchers. This study proposes to find out if some of these theories and hypothesis such as market feedback, signalling hypothesis, etc., are applicable in the Indian IPO scenario. Grading of IPOs is a very unique concept to the Indian markets. This study proposes to find out of there are any certification effects that causes graded IPOs to experience underpriced underpricing.
3. There is certainly a cost associated with raising capital through the IPO process. Information asymmetry is the oft cited reason for undepricing of IPOs. This study proposes to find if external factors such as the dividend yield, repo-rate and inflation play any role in the underpricing of IPOs.
4. The long-run under performance of IPOs is a puzzle. Many theories/hypothesis such as fads hypothesis and window of opportunity have tried to explain long-run performance of IPOs. This study proposes to examine the long-run performance of IPOs across cross-sections such as by sector affiliation, among graded IPOs, etc.
5. Underwriters play a vital role in the regulatory compliance and marketing efforts by way of analyst coverage. This study proposes to find out if there really is any evidence of reduced underpricing by all-star underwriters versus mediocre underwriters.

1.8 Data and Research Methodology

A universe of IPOs of firms listed from fiscal year (FY) 1999 until 2013 on the National Stock Exchange (NSE) is under study. Starting our research study at fiscal year 1999 provides us a breakpoint with the introduction of the book-building mechanism. This allows the study to examine the performance of underpriced IPOs under both pricing mechanisms. We exclude all 'Small and Medium Enterprise (SME)' IPOs (Dhamija & Arora, 2017; Kalra & Kansara, 2017; Bhattacharya, 2017), as well as any 'Follow-On Public Offerings (FPOs)', also referred to as 'Secondary Equity Offerings (SEO)' (Cai, Ramchand, & Warga, 2004; Kim & Park, 2005). Access to listing information is retrieved from the Prime Database, and the historical price data for each issue is retrieved from the Prowess database. As shown in Table 3.1, from this sample period of 445 IPOs issued, 297 IPO issues are underpriced. Out of the 297 underpriced IPO issues, 13 IPOs are excluded from the long-run performance study due to insufficient trading

history or breaks in the trading.

Over time, the Indian capital markets have evolved with pricing mechanisms moving away from the traditional methods of using the fixed-price to a book-building mechanism. Under the fixed-price mechanism, investors resorted to manipulations to increase the probability of allocation. SEBI introduced the book-building mechanism in 1999 so that issuing firms could opt for either of the pricing mechanisms. This provides us an opportunity to examine the underpricing of IPOs issued using both mechanisms in the Indian IPO markets. Based on the research problems highlighted in the section above, this study addresses the following research questions about the underpricing of IPOs in India.

The historical NIFTY index was retrieved from the Prowess database, while Dividend yields were obtained from the NSE portal. Historical listing information obtained from the Prime database provides data points such as issue type, open and close dates, the number of times the issue was subscribed, offer price, listing closing price (unadjusted), issue size, post-issue promoter holdings, the grade assigned by rating agencies, etc.

Macroeconomic data was obtained from the 'tradingeconomics.com' portal that included data points such as the INR exchange rate, Bond Yields, GDP growth rate (Quarterly), RBI Interest rate changes, Interbank lending rates as well as the money supply (M1, M2, M3). Data from 'tradingeconomics.com' has been cited by quite a few scholarly research articles and conference proceedings; for instance, Narasimham and Libison (2010); Bakhtyar, Zaharim, Asim, Sopian, and Lim (2012); Kumar (2013). Daily inflation values were retrieved from 'inflation.eu' while Dividend Yield values were obtained from the NSE Portal.

For the robustness of the test, we use two measures of short and long-run performance. The short-run performance is measured using normalised "Marginally-adjusted returns on opening (MAARO)" and log normal returns. The long-run performance is measured using "Buy-Hold Abnormal Returns (BHAR)" and "Wealth Relatives (WR)".

An independent samples t-test is performed on underpriced IPOs to determine the extent of underpricing between IPOs using the fixed-price and bookbuilt mechanisms, IPOs issued in hot and cold markets, between graded and ungraded IPOs and finally between IPOs issued in bull and non-bull markets. A one-way ANOVA test is performed on underpriced IPOs to determine the extent of underpricing between graded IPOs, between specific sectors and finally between issue size categorised as small, mid, and large-size.

A Mann-Whitney U-test is performed on BHAR to examine the difference in the long-

run performance of underpriced IPOs between fixed-price and bookbuilt IPOs, between IPOs listed in hot and cold markets, between graded and ungraded IPOs and IPOs issued during bull and non-bull periods. A Kruskal-Wallis H-test is performed on BHAR to examine the difference between more than two groups between IPOs assigned different grades, between specific sectors and finally between issue size categorised as small, mid, and large-size.

Chapter 3, entitled "Research Methodology", explains in detail the related theoretical frameworks, secondary data sources used, hypotheses used, statistical and econometric tools used, and the measures of performance used for the short and long-run study.

1.9 Chapter Scheme

The entire research study is organised into eight chapters, bibliography, and appendices. A brief outline of the chapter scheme of the study is presented as under:

Chapter 1, entitled "Introduction", highlights the background and motivation of the study, provides a conceptual framework, states the research problem, significance of the study, research objectives, proposed contributions, data sources and the methodology, the chapter scheme and scope and limitations of the study.

Chapter 2, entitled "Literature Review and Theoretical Framework", describes the theoretical framework adopted in the study. It also presents a review of the literature on the IPO underpricing phenomena experienced globally. It examines the research done on IPO underpricing, including special cases such as the presence of pricing mechanisms, sectoral impacts, market conditions, grading, etc. Finally, this chapter presents the research gap of the study.

Chapter 3, entitled "Research Methodology", describes the secondary data sources, hypotheses, statistical and econometric tools utilised, and the measures of performance used for the short and long-run study.

Chapter 4, entitled "Trends of IPO in India (FY 1999-2013)", undertakes a descriptive analysis of IPOs covering both overpriced and underpriced IPOs across various cross-sections such as by issue type, hot/cold market conditions, graded/ungraded IPOs, amongst graded IPOs, sectoral, and finally by issue size. This chapter also examines the trend in marginal returns across fiscal years.

Chapter 5, entitled "Listing Day Performance of Underpriced IPOs", examines the listing day performance of underpriced IPOs by examining the extent of underpricing across various cross-sections such as by issue type, hot/cold market conditions, graded/ungraded IPOs, amongst graded IPOs, sectoral and finally by issue size. We also derive a relationship between the

marginally adjusted returns and some independent firm related IPO variables as well as a few macroeconomic factors.

Chapter 6, entitled "Long-Run Performance of Underpriced IPOs", examines the long-run performance of underpriced IPOs across various cross-sections such as by examining the extent of underpricing by issue type, hot/cold market conditions, graded/ungraded IPOs, amongst graded IPOs, sectoral and finally by issue size.

Chapter 7, entitled "Effects of Underwriter Prestige, Investment Banks and Firm Factors", examines the presence of any relationship between underwriter/syndicate rating and underpricing of IPOs. We also derive a relationship between listing firm-specific factors such as issue size, age, and post-issue promoter holdings to determine the kind of investment bank/syndicate to collaborate with the listing firm. We modify the previous model, which involves a regression model to a neural network model to help better determine the firm-specific factors that may influence collaborations with investment banks or syndicates.

Chapter 8 is the concluding chapter entitled "Summary and Conclusions". This chapter provides a summary by presenting the significant findings, recommendations, conclusions, contributions of the study, and scope for future research.

1.10 Scope and limitations of the study

A universe of IPOs of firms listed from FY 1999-13 on the National Stock Exchange (NSE) is under study. Prior studies on the underpricing of IPOs in the Indian context have been conducted for medium to smaller durations. This study focuses on IPO underpricing for a much more significant period of 15 years. This study excludes IPOs issued by Small/Medium Enterprises (SME) as well as any follow-on public offering, also referred to as Secondary Equity Offerings (SEO). By excluding SME IPOs, this study ensures that there is no effect of issue size on underpricing. Also, excluding SEOs helps correctly determine the extent of underpricing since SEOs tend to reduce the average level of underpricing. The period of study ends in the fiscal year 2013, which allows IPOs issued until 2013 to be used for the long-run performance study of three years. Also, the period between 1992 and 1998 witnessed various controversies and scams in the Indian stock markets. This is another reason to start the research period in the fiscal year 1999. The scope of this study is divided into four main objectives

1. Examine the trends of IPOs in India and perform a descriptive analysis of IPOs for the entire sample by splitting up the data by pricing mechanisms, IPOs issued in hot/cold markets, between graded/ungraded IPOs, between IPOs of different grades, issues in bull and non-bull markets and finally by issue size.

2. Perform a listing day performance study on underpriced IPOs and determine the extent of underpricing when (a) IPOs are listing using either pricing mechanism, (b) IPOs are listed in hot and cold market conditions, (c) graded and ungraded IPOs, (d) IPOs are graded, (e) IPOs listed in bull and non-bull markets, (f) IPOs are affiliated with select sectors, (g) across issue size categories (small, mid and large-size). Finally, derive a relationship between MAARO and certain macroeconomic factors.
3. Perform a long-run performance study on underpriced IPOs to examine differences in returns by (a) examining the long-run performance of the entire sample (b) examine differences when IPOs are listing using either pricing mechanism, (b) IPOs are listed in hot and cold market conditions, (c) graded and ungraded IPOs, (d) IPOs are graded, (e) IPOs are listed in bull and non-bull markets, (f) IPOs are affiliated with select sectors, (g) across issue size categories (small, mid and large-size).
4. Determine the influence that underwriters and listing firms have on each other. Examine (a) whether the association with top-ranking underwriters reduces underpricing (b) what firm factors would be important for underwriters or syndicates to be interested in associating with listing firms and (c) Derive a model using artificial neural networks to determine the firm factors that would be important for underwriters or syndicates to be interested in associating with listing firms.

Choice of the Prime database was primarily due to the availability of data in regards to banker ratings for the year, availability of post-issue promoter holdings, the breakup of the issue by instruments (debt/equity/convertible) and finally where an IPO issue was partly bookbuilt while the rest used a fixed-price mechanism. Other data sources such as Capitaline and Prowess were also considered but were not used due to inconsistencies in data as well as the inability to distinguish between IPO/FPO as well as SME IPOs. No primary data was collected for this study since this is an empirical study and relies soley on secondary data.

This chapter provided the background of the study, states the research problem, significance of the study, research objectives, data sources and methodology, and the scope and limitations of the study. In the next chapter entitled “Literature Review and Theoretical Framework”, we describe the theoretical framework and present a review of the literature on the IPO underpricing phenomena experienced globally. We examine the research done on IPO underpricing, including special cases such as the presence of pricing mechanisms, sectoral impacts, market conditions, grading, etc., and present the research gap of the study.

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Chapter 2

Literature Review and Theoretical Framework

2.1 Introduction

A private company raises capital from the equity markets through an Initial Public Offering (IPO) for various reasons such as acquisition for inorganic growth, expansion of markets, and investment in capital projects. The purpose of this chapter is to review underlying theories on which the research objectives and questions have been framed. This chapter also reviews the extant literature on past studies undertaken in India and abroad on short and long-run underpricing as well as on the influence of underwriters on underpricing.

Section 2.2 reviews underlying theories on which the research objectives and questions have been framed in the context of India and specifically for IPOs listed between the fiscal year 1999 until 2013. Section 2.3 reviews past literature on the short-run performance of IPOs. Section 2.4 reviews past literature on the long-run performance of IPOs. Finally, Section 2.5 reviews past literature on the influence of underwriters on underpricing of IPOs, firm factors that may influence underwriters, and literature related to using back-propagation artificial neural networks.

2.2 Theoretical Framework

Researchers have proposed various theories explaining the phenomenon of underpricing of IPOs. Some of these theories have found support from stock market data, while others have

not been supported by analysis of available data. We present the different theories/hypothesis concerning the underpricing of IPOs. Ibbotson and Ritter (1995) discuss at length the relationship of theories/hypothesis in relation to short-run and long-run performance of IPOs. A book by Ritter (2003) also delves into the reasons for IPO undepricing and also mentions effects related to secondary equity offerings.

2.2.1 Theories of Initial Underpricing

The winners curse hypothesis: Rock (1986) tries to explain underpricing of IPO's by providing a "winners curse" hypothesis by splitting investors into two groups; the informed that have good knowledge of the markets and uninformed. As such, informed investors due their study have an idea of which upcoming IPO issues will be underpriced. The uninformed investor has no idea and hence will get only a fraction of the shares allotted to them. If the uninformed investors are allotted the number of shares requested, they face loses since informed investors do not want allocation of IPO shares. In order to compensate for the loss of uninformed investors, the shares are underpriced.

The market feedback hypothesis: Benveniste and Spindt (1989) argue that investment bankers induce regular investors to truthfully reveal their valuations of an issue. Investment bankers sometimes use the book-building process to induce regular investors to disclose information during the pre-selling period, which is then used in pricing the issue. To induce regular investors to reveal their valuations truthfully, the investment banker compensates investors through underpricing. This suggests that favourable information provided by the investors would hint the underwriters partially revise the offering price upwards.

Our study tests the market feedback hypothesis by examining the extent of underpricing for IPOs that are issued using the fixed-price or bookbuilt mechanism. Given the statistically significant difference in underpricing between fixed price and bookbuilt issues, our analysis suggests that the market feedback hypothesis is applicable in the context of our study.

The bandwagon hypothesis: Welch (1992) posits that the IPO market may be subject to bandwagon or herd mentality. There is a tendency among investors to go with the crowd. If an investor sees that no one else wants to buy, he or she may decide not to buy even when there is favourable information. To prevent this, the issuer underprices an issue to induce the few knowledgeable investors to subscribe to an issue and thus induce a bandwagon, or cascade, in which all subsequent investors wants to buy into the issue.

The investment banker's monopsony power hypothesis: This hypothesis suggests that investment bankers take advantage of their superior knowledge of market conditions to

underprice offerings, which in turn permits them to expend less marketing effort and ingratiate themselves with buy-side clients. While there is undoubtedly some truth to this, especially with less sophisticated issuers, when investment-banking firms go public, they seem to underprice themselves by as much as other IPOs of similar size. This hypothesis gains importance only in situations where the underwriters have firm commitment offerings where they bear significant costs in situations where they overprice offerings.

The lawsuit avoidance hypothesis: In case investors sustain substantial losses in an IPO, they are very likely to blame the investment banker for their losses and may file lawsuits against investment bankers to recover their losses. This is a likely scenario in economies where the investors are "lawsuit happy". Alexander (1993) suggested that one way of reducing the frequency and severity of future lawsuits is to underprice an IPO issue. However, other countries in which securities class action lawsuits are unknown such as Finland have just as much underpricing as the US. Thus, one has to question the validity of this hypothesis.

Market timing theory: While firm-specific factors such as pricing mechanisms, ownership structure, etc., are essential determinants in pricing an IPO, there are external factors such as macroeconomic condition, the performance of security markets, etc., which are of relevance to the underwriters and issuing firms. The decision of when to issue the IPO is critical to the success of the offering, and hence the timing of the IPO is one of the critical factors. Many extant works of literature point to the existence of "hot" or "cold" markets. Lucas and McDonald (1990) find that adverse macroeconomic or industry conditions lead to an undervaluation of the firms. In such situations, the issuer will not go public because doing so would not help the issue fetch appropriate prices resulting in the failure of the IPO issue.

Our study tests the market timing theory to include "hot" and "cold" periods as well as market sentiments, which would indicate bull and non-bull/neutral markets. We test this theory by examining the extent of the underpricing of IPOs during hot and cold markets as well during bull and non-bull markets. Our analysis suggests that the market timing theory is not applicable for IPOs listed in hot and cold as well as bull and non-bull markets in the context of our study.

The ownership dispersion hypothesis: While the underpricing of issues generates excess demand, it also results in a large number of shareholders. The dispersed ownership leads to increased liquidity and simultaneously results in the absence of any major shareholders which could challenge the management.

The certification effect: This effect is a firm-specific factor applicable to situations when a venture-capital-backed firm decides to go public. Literature attests to lower underpricing of IPOs of firms which had support from venture-backed firms of good reputation. The underwriter's reputation can also provide a certification effect. Our study uses this act of

certification to include the grading of IPOs by rating agencies. A higher grade assigned by rating-firms indicates strong fundamentals of the issuing firm and vice-versa. We test for the certification effect while examining the effect of IPO grades on listing day underpricing as well as study the extent of underpricing between graded and un-graded IPOs. In addition, we also study if the certification effects last over the long-run with respect to graded/ungraded IPOs as well as amongst graded IPOs. We also examine if the presence of reputed lead managers reduces the extent of underpricing to test this effect.

Our analysis suggests that the certification effect is applicable when the extent of underpricing is compared between graded and ungraded IPOs as well as amongst graded IPOs. Analysis of long-run returns suggests that certification effects prove to be inconsequential over the long run. Finally, our analysis of the influence of underwriters suggests that the certification effects of top-rated underwriters are not observed with respect to underpricing.

The signalling hypothesis: Garfinkel (1993) proposed that when new issues provide investors with large initial returns, it creates a pleasurable experience for the investors. This allows the firms and insiders to sell future offerings at a higher price than would otherwise be the case. This reputation argument is the essence of the signalling hypothesis of underpricing IPOs. However, various empirical studies have failed to provide any evidence to support this hypothesis. However, Michaely and Shaw (1994) find that larger issues are underpriced more by firms in order to attract more investors. We test this hypothesis by determining the extent of underpricing by issue size. Our results indicate that the signalling hypothesis is applicable in our study with small issue size IPOs underpriced the most, and large issue size IPOs underpriced the least.

The market incompleteness hypothesis: Many young firms list public offerings in the absence of past revenues or profitable history. This is true in the case of firms operating in the technology sector, where investors are unable to determine the true value of an offering. This creates informational asymmetry, which forces the underwriter and the issuing firm to underprice the offering. Good quality firms probably underprice to bring it more publicity on opening. This is more true of firms in the technology sector, as identified by Karlis (2000). This study determines if that is true when we test the extent of underpricing amongst sectors.

Analyst Lust Hypothesis: Loughran and Ritter (2004) proposed this hypothesis which states the importance of listing firms to be associated with high ranked lead underwriters. Coverage of an upcoming issue by leading analysts is an important aspect for listing firms even if it comes at the cost of underpricing the issue.

2.2.2 Modern Theories of Long-run IPO Performance

As mentioned above, researchers have proposed various theories explaining the phenomena of the underpricing of IPOs. There is abundant extant literature on theories as well as empirical evidence that support theories on short-run underpricing and performance. On the other hand, evidence of theories supporting long-run performance is conflicting. As such, there is an absence of a convincing theory to explain the observed long-run underperformance of IPO stocks. Ibbotson (1975) calls this underperformance a 'mystery', and Loughran and Ritter (1995) call it a 'puzzle'. The following theories are often mentioned in the literature related to IPO underperformance over the long-run. These are

Window of Opportunity Hypothesis: This hypothesis signals a relationship between the timing of issue and underperformance. Ritter (1991) and Loughran and Ritter (1995) reason that firms that plan to time their issues during high valuation periods provide lower returns in the long-run. Firms succeed in overpricing their issues during high IPO activity periods. Some companies with no solid growth prospects have been able to raise capital from the market at unreasonable prices during such periods. Over time, such issues lose value since the markets quickly adjust the issue price to the correct valuation based on the performance of the firm. Many literature document the presence of this hypothesis, such as Jain and Kini (1994); Loughran, Ritter, and Rydqvist (1994); Helwege and Liang (2004). We study if this hypothesis can explain the long-run performance of IPOs issued in bull and non-bull markets. Since IPOs issued in bull markets incur lower losses than those issued in non-bull markets over the long-run, our analysis suggests that the 'Window of Opportunity Hypothesis' is applicable in the Indian context.

Impresario Hypothesis or Fads Hypothesis: This theory introduced by Shiller and McCulloch (1990) states that higher underpricing on listing should exhibit low returns over the long run. Such underpricing of issues guarantees a return for the investors on listing day. As per Ritter (1998), IPOs are subject to fads and are underpriced by investment banks to create an impression of excess demand. Similar findings by Álvarez and González (2005) indicate that firms go public during 'fad' or 'hot' periods. This study will test the long-run performance of IPOs issued in hot/cold markets against the fads hypothesis. Our analysis finds that IPOs issued in cold markets outperform IPOs issued in hot markets, and we conclude that the issuance of IPOs in hot periods are subject to the fads hypothesis in the Indian context.

Overreaction Hypothesis: De Bondt and Thaler (1985) introduced a hypothesis called over-optimism or overreaction hypothesis since investors become very optimistic during fad or hot periods. Larger offer size indicates the presence of a more stable, less risky firm, as suggested by Carter, Dark, and Singh (1998). Chan, Wang, and Wei (2004) find evidence of

a negative relationship between initial returns and offer size but no evidence of this in the long-run. Cai, Liu, and Mase (2008) find that over-optimism and the offered size of the offer are strong explanatory factors for poor long-run performance. This study examines the overreaction hypothesis when examining the long-run performance of IPOs based on small/mid/large issue sizes. Our analysis finds that large-size IPOs perform poorly when compared with small and mid-size IPOs. We conclude that the issuance of large-size IPOs is subject to the overreaction hypothesis.

Divergence of Opinion Hypothesis: Miller (1977) posits that a difference in opinion amongst pessimistic and optimistic investors results in overpricing on listing day. This difference can be attributed to the quality and pricing of issues. Over time, as the information flows to the secondary market, the divergence of expectation gets narrowed down, and large-scale corrections in the prices take place resulting in long-run underperformance. Literature supporting this divergence of opinion hypothesis include Houge, Loughran, Suchanek, and Yan (2001); Diether, Malloy, and Scherbina (2002); Gao, Mao, and Zhong (2006).

Entrenchment Theory: This theory signals a relationship between issues that are very tightly controlled by family leading to management entrenchment and long-run performance. There is an adverse effect of entrenchment that is reflected more while valuing such securities. Mostly, issues that are exposed to entrenchment issues perform worse over the long-run. Mazzola and Marchisio (2002) find that family business IPOs, where entrenchment effect is likely to be more, significantly underperform in the long-run.

2.3 Studies on Short-Run Performance

Many studies have been conducted by researchers in capital markets to test the validity of the market feedback hypothesis. For instance, Benveniste and Spindt (1989) found that underpricing is a cost that the issuing firm/underwriter takes to get investors to share information about the perceived value of the stock. Additionally, the theory presented in this study helps to explain the marketing of the types of securities, such as high-yield bonds, for which informational frictions may be important. Further, the model also finds that underwriters can reduce underpricing and make the capital acquisition process much more efficient. Benveniste and Wilhelm (1990) studied the effect that uniform-price restrictions and restrictions on the allocation of oversubscribed issues had on IPO proceeds. The authors found that a uniform-price increased the cost of obtaining information from regular investors and, when combined with even-handed distribution restrictions, make information gathering impossible, which makes it necessary to underprice issues. A posted-price mechanism leads to an allocation of the security

that maximises the seller's expected revenue, given the informational constraints imposed by the potential buyers (Spatt & Srivastava, 1991). Benveniste and Spindt (1989); Benveniste and Wilhelm (1990); Spatt and Srivastava (1991) argue that listing firms maximise revenues with the help of underwriters that reduce underpricing by utilising book-building to obtain information from informed investors. Hanley (1993) first documented that the most commonly discussed factor behind book building theories is the effect of revisions in the offer price during the filing period. The above study found that the final offer price of an issue that exceeds the limits of the offer range has greater underpricing than all other IPOs. This concludes that when demand is strong, underwriters do not fully adjust their pricing upward to keep underpricing. These results are consistent with those of Benveniste and Spindt (1989), who found that shares in an offering are limited, and prices only partially adjust to new information.

Significant contributions have been made by Prof Jay Ritter to the extant literature on IPO underpricing and their long-run performance. Ritter (1984) investigated the presence of hot and cold markets and their impact on IPO underpricing. They concluded that the extent of underpricing is dependent on the number of IPOs in a year. Hot markets exhibited periods where the extent of underpricing was much greater than the average as compared to other periods. Beatty and Ritter (1986) show theoretically that listing firms associated with the technology industry and especially with unseasoned industry are more subject to information asymmetry. This asymmetry results in higher underpricing resulting in higher initial returns. Regarding issue offer size, Ibbotson, Sindelar, and Ritter (1994) find that underpricing is considerably larger on smaller offerings. Ritter and Welch (2002) posit that many firms decision on going public depends on the prevailing market conditions and growth stage of the issuing firm. Loughran and Ritter (2004) propose that issuing firms retain the best intellectual capital in the form of investment bankers that have the capacity to provide high quality analyst coverage even though it is at the cost of higher underpricing (see analyst lust hypothesis). A study by Liu and Ritter (2011) argue on the basis of empirical analysis that VC-backed firms experience reduced underpricing since they value analyst coverage which helps listing firms raise the offer price. The study further finds that firms retain the services of high-ranked underwriters that are specialised in a particular industry. This specialisation of underwriters creates certain oligopolies amongst underwriting firms. The evidence on the long-run performance of IPOs is mixed and continues to be a puzzle. Studies by Ritter (1991); Loughran and Ritter (1995) find that IPOs underperform the markets anywhere from 3 to 5 years post-listing. Given this, the authors suggest that investing in IPOs for the long haul is a bad proposition. Hot markets are also periods where the investors are overly optimistic which is a behavioural bias amongst investors. The paper also finds that IPOs listed in hot markets significantly underperform the markets over

the long-run when compared to the performance of IPOs listed during cold markets. However, a study by Ritter (2011) finds that there is scant evidence of IPOs underperforming in the long run when compared to other peer companies of similar characteristics except for a group of small companies.

Lee, Taylor, and Walter (1999) examined the information revelation theory of book-building. They found that a large number of better-informed investors (Institutional Investors) in the case of IPO issues in Singapore tended to request participation in IPOs with higher initial returns preferentially. Cornelli and Goldreich (2003) examined institutional bids submitted under the book-building procedure for a sample of international equity issues. They concluded that information in bids that included a limit price, especially those of large and frequent bidders, affected the price. A study by Giudici and Paleari (1999) finds no difference in underpricing between fixed-price and book-built offers. Ljungqvist, Jenkinson, and Wilhelm Jr (2003) find that book-built issues do not necessarily lower underpricing in all countries. However, underpricing is lower for book-built IPOs when issuers use U.S. lead managers and when the issues are marketed in the United States. However, as the authors note in their study, the sample excludes data from some sizeable domestic IPO markets, including India. Derrien and Womack (2003), in their study on French IPOs, found both, book-built and fixed-price approaches to be inefficient. Hawaldar, Naveen Kumar, and Mallikarjunappa (2018) examined the short and long-run performance of 464 (365 book-built IPOs and 99 fixed-price IPOs) IPOs issued in India between 2001 and 2011. Using abnormal returns adjusted for market returns, the authors find that bookbuilt IPOs are underpriced lesser than fixed-price IPOs.

Ibbotson and Jaffe (1975); Ritter (1984) investigated the presence of hot and cold markets and their impact on IPO underpricing. They concluded that the extent of underpricing is dependent on the number of IPOs in a year. Hot markets exhibited periods where the extent of underpricing was much greater than the average as compared to other periods. Wang (1999) developed a theoretical model that described the mechanism and causation of hot and cold markets and their relationship to IPO underpricing. The study also concluded that underpricing is higher in the hot market than in the cold market. Garg, Arora, and Singla (2008) studied 126 underpriced IPOs listed on the NSE issued in India between 2000-2006. The sample had 28 and 98 IPOs in the cold and hot market, respectively. The authors conclude that the level of underpricing does not differ much in the hot and cold IPO markets. Neneh and Smit (2013) undertook a study on the Johannesburg Stock Exchange (JSE) to examine IPO performance on a sample of 360 listed companies for the period of 1996-2011. They concluded that the level of underpricing in hot market periods was substantially higher than in the cold market periods.

Similarly, Alim, Ramakrishnan, and Khan (2016) examined the existence of hot and cold issue market phenomena of IPOs issued on the Karachi Stock Exchange (KSE) using IPOs listed from 2000-2015. Their results indicate that issues in a hot market are more underpriced than in cold markets. Jain and Kanjilal (2017) developed a Markov regime-switching vector autoregressive model to study the non-uniform dynamics of hot and cold cycles in Indian IPO markets. The authors utilised a sample of 557 IPOs listed on the Bombay Stock Exchange between 2004-2014. The holding period return was calculated for the 7-day and 30-day intervals. The authors provide evidence of a bi-directional causal relationship between future initial returns and past IPO volume in hot market conditions. In cold markets, this relationship between IPO volume and initial returns is weak. The authors confirm that hot periods are associated with high initial returns and heavy volume, while cold periods are associated with low initial returns and light volume.

Deb and Marisetty (2010) studied a sample of ungraded and graded IPOs during the period 2006-2008 concluded that grading reduces IPO underpricing and also influences retail investor demand. Khurshed, Paleari, Pande, and Vismara (2008) studied 251 IPOs that included graded and ungraded IPOs listed on exchanges in India from 1999-2008. They concluded that grading does not affect underpricing. Poudyal (2008) studied the effectiveness of IPO grading using a sample of 63 IPOs listed in India between 2005-2008 finds an inverse relationship between grading and level of underpricing, i.e., higher grades experience lower underpricing. Jacob and Agarwalla (2015), in their study of 182 IPOs issued between 2005 and 2011, indicate that grading has only a limited bearing on the IPO demand of retail and institutional investors. The lower grade issues appear to have weaker demand from investors relative to the un-graded IPOs. However, there is no evidence to support IPO pricing improvement due to the introduction of IPO grading. Sahoo and Kaur (2017) studied the relevance of IPO grading on the underpricing using 83 graded IPOs listed on the NSE after May-2007. Their results indicate that IPO grading was not relevant in explaining the listing day returns. A study by Tripathi and Pandey (2018) used data of IPOs listed on the NSE between 2011-2015. Using OLS regression, the authors find that a higher grade does not equate with a higher subscription by retail investors. Also, the authors conclude that underpricing is not significantly different between graded and ungraded IPOs and that there is lesser underpricing with IPOs having Grade 4/5. Dhamija and Arora (2017a) studied the underpricing of IPOs on a sample of 399 IPOs listed on the Indian stock markets between 2005-2015. The authors find that ungraded IPOs delivered an excess market-adjusted return of 29.4% as against 14.5% per cent for graded IPOs. The authors find that lower grade 1/2 IPOs generated the highest initial excess returns, followed by grade 3 IPOs. However, Grade 5 IPOs deliver an excess return much higher than Grade 3 IPOs but lower than Grade 1 IPOs.

The author's reason that IPOs with grade 5 generate investor interest and positive sentiments resulting in higher initial excess returns. Kashiramka, Thomas, Yadav, and Rao (2018) studied the short-run performance of graded IPOs listed in India between 2007-2013 using a sample of 270 IPOs out of which 191 & 79 IPOs were graded and ungraded respectively and find that higher graded IPOs have a negative relationship with the extent of underpricing. Chhabra, Kiran, and Sah (2017) utilised a sample of 300 IPOs that were priced using the book built mechanism and were listed on National Stock Exchange (NSE) during 2005-2012. The study focused on examining the influence of the presence or absence of an IPO grade, issue size, and underwriters' reputation on the extent of underpricing. The authors used market-adjusted excess return to measure the return on the IPOs. Using structured equation modelling, the authors conclude that the extent of underpricing (1) increases with higher grades, (2) increases with larger issue sizes, and (3) is not affected by the reputation of the underwriter.

Jog and Riding (1987) examined the degree of underpricing of IPOs of Canadian common stock listed on the Canadian stock exchange between 1971 and 1983 and found that Canadian IPOs were underpriced with the level of underpricing varying significantly among firms. Related to underpricing, they concluded that the degree of underpricing was more significant when the trading volume was low, and that underpricing was greater in the industrial sector than in other sectors. Ritter and Welch (2002) posit that while many firms would want to go public, the question arises as to the timing. The study states that the decision by many firms to go public depends largely on the prevailing market conditions and also the growth stage of the listing firm in its life cycle. Loughran and Ritter (2004), on a study in the US markets, find much higher underpricing during the bubble periods when markets are bullish with the first day returns doubling for IPOs listed in the 1980s when compared with IPOs listed during the late 1990s. The authors also argue that during bull periods, there is less focus on maximising IPO proceeds. Garg et al. (2008) studied underpriced IPOs listed on the NSE issued in India between 2000 and 2006 on a sample of 126 IPOs. The sample had 10 and 116 IPOs in the bear and bull market, respectively. The authors concluded that the abnormal returns from the IPO underpricing differ significantly in the bearish and the bullish phases, where bull phases experienced higher mean underpricing.

Henrick (2012) examined the significance of a firm's industry affiliation on the underpricing of its Initial Public Offering (IPO). IPOs listed in the U.S. between 2001-2011 were subjected to a probit method to determine the probability of an IPO being underpriced across various industries. The author finds that the underpricing of an IPO is closely related to the sectoral affiliation of the firm. Technology and consumer services IPOs have a higher probability

of being underpriced. Both technology and consumer services firms have a characteristic risk which is not related to the macroeconomic environment and requires their IPOs to be underpriced to induce investor participation. Similarly, Karlis (2000) studied IPO underpricing, focusing on the high technology sector. Newer firms without significant past trading histories make their IPOs difficult for investors to judge. Many firms do not have a history of past revenue, while some are not even earning profits before the stock is traded on exchanges. Investors have a difficult time determining the quality and real value of the firm. This is especially true in fast-developing sectors such as the Internet and Technology sectors. Weiss (1988), in his study, mentions that IPO markets contain considerable informational asymmetries and that applying several economic theories does not offer the correct information regarding the value of a firm. Singh and Kumar (2012) proposed a model to explain underpricing using the over-subscription rate, age of the firm, and issue size as independent variables. The authors conducted a sector-wise analysis of short and long-run performance. The short-run performance was measured using log normal returns. 116 IPOs listed in India between January 2006 and October 2007 were considered for analysis. The authors find that the short-run returns of IPOs were positive during this period delivering 18% returns. The study finds that total oversubscription (institutional & retail investors) to be the main determinant of underpricing. The IT sector gave higher initial returns in the short-run.

Yong (2011) in a study revealed that the average initial return of IPOs listed on the ACE Market of Bursa Malaysia is significantly higher than the average of those IPOs listed on the Main Market, an indication that size effect plays a vital role in explaining the underpricing phenomenon in Malaysian IPOs. Similarly, Islam, Ali, and Ahmad (2010) analysed the levels of underpricing in initial public offerings (IPOs) and its determinants on the Dhaka Stock Exchange (DSE). Regression Analysis showed that offer size and size of the company are positively related to the degree of underpricing. However, the age of the firm and offer timing were shown to have no significant impact on the degree of underpricing of IPO in the Dhaka Stock Exchange. Ibbotson et al. (1994) conducted their study on 2439 IPOs during the period 1975–1984. They found the average initial return on IPOs with an offering price of $3.00 or more to be 8.6%, and the average initial return on IPOs with an offering price of less than $3.00 to be 42.8%. This illustrates that underpricing is considerably larger on smaller offerings. Khurshed et al. (2008) in their study used a sample set of 251 firms listed between 1999 to August 2008, which had used the book building mechanism to determine the certification role of the investment bank(s)/syndicates on underpricing. Using regression tests, the authors find that IPOs with issues of larger size are underpriced lesser. Dhamija and Arora (2017a) studied the underpricing of IPOs on a sample of 399 IPOs listed on the Indian stock markets between 2005-2015. Using

multivariate regression analysis, the authors find a negative relation between issue size and extent of underpricing.

The effect of macroeconomic factors on stock market returns has been documented in many studies. Ross (1976) modelled a theory called the Arbitrage Pricing Theory (APT). APT emphasizes that factor variables do hinder stock returns, but the variables were not identified. APT states that stock performance is not perfect due to the presence of factors that influence stock returns to be different from their expected values. To understand the reasons for this deviation from expected values, APT assumes that macroeconomic variables exist that influence returns on assets leading to the volatility of stock returns. Diversification of portfolios does not help minimise volatility since macroeconomic factors cannot be controlled by listing firms as well as by investors. A study on the South African stock markets by Chinzara (2010) finds that macroeconomic factors such as the exchange rate volatility, short-term interest rate volatility, and financial crises have a very negative impact on stock returns. The authors find that variability in gold prices, oil prices, and the inflation rate have a smaller effect on stock returns. Changes to inflation and real output have weak predictive power on stock market volatility and return (Schwert, 1989). Ross, Westerfield, and Jordan (2008) documented that post the Bretton Woods agreement (post-1970s), fluctuations in the U.S. dollar - British pound sterling exchange rates led to uncertainties. This led to market volatilities and means that exchange rate fluctuations influence financial and economic activities. Olweny and Omondi (2011) find that foreign exchange rate volatility significantly affects stock return volatility on the Nairobi Stock Exchange.

Hsing (2011) observed a positive correlation between foreign exchange rates and stock returns. Benita and Lauterbach (2007) observed that there is an economic cost due to volatility in exchange rates, which affect price stability, firm profitability, and economic stability. Foreign exchange rate volatility impacts the economy as well as IPO stock returns. Foreign exchange rates and macroeconomic factors are important factors when deciding on fiscal and monetary policies. The attractiveness of investment opportunities depends on the prevailing interest rates which determine interest payments on assets. Many researchers have studied the influence of interest rates. For instance, Ngugi and Kabubo (1998) stated that growth and development could be faster when interest rates are low enough to assist with the mobilisation of financial resources and utilization of the same. Chen, Roll, and Ross (1986) stated that interest rate promotes economic growth and development, which implies that it has a positive impact on IPO stock returns. Chen, Kim, and Kim (2005) find that there are no substantial effects observed on the Taiwan Hotel stock returns as a result of changes in interest rates. Chiang and Kee (2009)

observed that rising interest rates affected the Singapore Hotel stock market negatively. Walsh (2010) observed that while manipulation of short-term interest rates is useful for implementing monetary policy, aggregate spending decisions are decided if there is an impact of real long-term rates of interest. Short-term interest rate variations influence general investment and spending, given an effect on long-term rates of interest (Shiller & McCulloch, 1990; Campbell & Shiller, 1991). Volatility in interest rates influences investors. Interest rates also affect inflation, and high levels of inflation reduce the purchasing power of investors. Many studies on the influence of inflation rates and stock market returns have been conducted. A Nigerian study by Yaya and Shittu (2010) concludes that past inflation rates and their volatility have substantial effects on stock markets and can be used to predict stock market volatility. Harvey and Huang (1991) witness that the volatility of stock market returns is affected by country-specific monetary policies due to changes in the macroeconomic scenario, which could lead to volatile foreign exchange markets.

This study excludes all 'Small & Medium Enterprise (SME)' IPOs from the study sample. The literature reviewed next in regards to SME IPOs suggests that SME IPOs (1) tend to have lower subscription rates which affect the market liquidity, (2) with lower allocation to market makers results in more underpricing, and (3) market timed IPOs tend to have higher initial underpricing. These are the shortcomings with including SME IPOs in this study and hence are excluded from the sample in this study.

Dhamija and Arora (2017b) examined the initial and after-market performance of 100 SME IPOs listed on the Bombay Stock Market (BSE) and the National Stock Market (NSE) listed between February 2012 and March 2015. The research study employs market-adjusted returns and finds evidence of the underpricing of IPOs by SMEs and that the level of underpricing is discovered to be less than that of IPOs listed on the main board stock market in India. However, the authors also note that SME IPOs have a meager subscription rate, which affects liquidity. Kalra and Kansara (2017) examined SME's in India to determine the effects of IPO variables such as issue size, issue price, under-pricing/overpricing, percentage net, etc., on short and long-term returns. The authors conclude that none of the variables contributed significantly and could not explain returns because of lesser liquidity of SME IPOs in the stock markets. Bhattacharya (2017) examined SME IPOs listed on the BSE between March 2012 and August 2015. The study sample included 106 SME IPOs and was used to study the influence of the issue size, proportion of allocation to market makers, and the influence of market timing, among other variables on underpricing. Firstly, the authors find a negative relationship between the extent of underpricing and the size of the IPO allocation to the market maker. Secondly, the authors find that market

timed SME IPOs tend to have higher initial underpricing.

This study excludes all 'Follow-On Public Offerings (FPO)' or 'Secondary Equity Offerings (SEO)' from the study sample. The literature reviewed next in regards to FPO/SEOs suggests that firms raise the offer prices and reduce underpricing. This study excludes all SEOs so as not to influence the average level of underpricing.

Cai, Ramchand, and Warga (2004) evaluate the signalling hypothesis to establish if secondary equity offerings (SEO) experience lower underpricing compared to other equity IPOs. Their study sample consisted of 91 equity IPOs that have previous public debt outstanding at the time of the equity IPO, which are then compared against a sample of all other IPOs. The study sample had 91 equity IPOs, which had a prior public debt outstanding at the time of the equity IPO. The authors discover that the mean first-day returns (underpricing) of the equity offerings with a prior debt issue is lesser when compared to all the other equity IPOs. Kim and Park (2005) test the issuer's greed hypothesis to determine if firms make opportunistic accounting decisions to increase the prices on secondary offerings at inflated prices. The sample includes 1,040 IPOs of common U.S. stocks issued between 1989 and 2000. Using regression analysis, the authors conclude that SEO firms employ aggressive earnings decisions to increase the offer prices and reducing the degree of underpricing.

2.4 Studies on Long-Run Performance

This section reviews literature related to the long-run performance of IPOs from various facets that touch upon long-run performance by considering issues due to capitalisation, sector affiliation, grade, and market timing. Most of the research on the performance of underpriced IPOs point to negative returns when examined over the long run.

Ibbotson (1975) computed excess returns one stock per month for the period 1960-69. He concluded that there are no departures from market efficiency in the after-market. He, however, did find evidence that these stocks exhibited positive performance in the first year, followed by a negative performance for the next three years, which then returned positive performance in the fifth year.

Ritter (1991) examined the performance of 1,526 IPOs on the NASDAQ Stock Exchange. These included all IPOs that went public between 1975 and 1984. The three-year performance for these IPOs was measured using holding period returns, and the finding from the study was that the average holding period return after three years was 34.47%. In comparison, a control

sample of 1,526 stocks matched by sector and market capitalisation generated an average total return of 61.86% over the same three-year holding period. The above study concluded that IPO's underperformed in the long-run and that the underperformance was concentrated among relatively young growth companies. A later study by Ritter (2011) finds that there is scant evidence of IPOs underperforming in the long run when compared to other peer companies of similar characteristics except for a group of small companies.

A study by Kooli and Suret (2004) on a sample of 445 IPO's unseasoned (new) issues for the period from 1991 to 1998 concluded that Canadian IPO's underperform significantly compared to a sample of seasoned firms with the same market capitalisation. Using the buy-and-hold return measurement for the long-run performance, the authors find that investors who buy the issue in the secondary markets and retain their shares will make a loss of 24.66% at the end of five years.

A study by Purnanandam and Swaminathan (2004) shows that IPOs are overvalued at the offer price, increases afterward and revert to fair value in the long-run, and found that underpriced IPOs can be overvalued. Pandya (2016) studied 183 IPOs listed on the Bombay Stock Exchange (BSE) during the period 2004-2013. The index selected for the analysis was the BSE SENSEX. Capital Asset Pricing Model (CAPM) was applied here to find out whether IPOs have generated an abnormal return or not in short to long-term. The results of the research conclude that IPOs underperformed during the immediate period, which eventually turned negative from medium to longer-term time framework.

Dutta and Swain (2012) studied the post-listing behaviour on a sample of 199 underpriced IPOs listed on the Indian Stock Market through equal distance periods of 1-day, 1-week, 1-month, first quarter, and the 1st-year. Also, the above study tried to find the presence of any correlation between the issue price and periodic return. The study concluded that statistically, there is no relation between the issue price and the returns for any of the periods under study.

Das, Saha, and Kundu (2016) conducted a 5-year long-run performance study on select Indian IPOs listed over the period 1999–2007. For robustness of results, variations of cumulative average abnormal return (CAR), BHAR as well as wealth-relatives (WR) were used to determine performance using monthly returns. The authors find that BHAR is significantly right-skewed and much more pronounced than that of CAR. The authors find that although both measures find positive long-run average abnormal returns, the time frames going from a negative to a positive return or vice-versa are different when results are examined using CAR and BHAR.

A study by Hawaldar et al. (2018) examined the long-run performance of 464 (365 book-built IPOs and 99 fixed-price IPOs) IPOs issued in India between 2001 and 2011. The authors use cumulative average abnormal returns (CAARs) to measure long-run performance and find that book-built IPOs deliver a negative performance up to five years and beyond post-listing while fixed-price IPOs provide positive abnormal performance after 18 months post listing.

Sahoo and Rajib (2010) studied the after-market pricing performance on listing day as well as in the long-run (36 months from listing) on 92 IPOs, which went public on the National Stock Exchange (NSE) in India during the period April 2002- March 2006. The authors find that the average underpricing of Indian IPOs to be 46.55% on listing day. The method for determining the performance of the IPOs was by using "Buy and Hold Abnormal Returns (BHAR)" and "Wealth Relatives (WR)". Both WR and BHAR were evaluated with reference to the IPO issue price and the listing day closing price. The above study documents that the IPO subscribers on listing day had positive returns for IPOs, replaced by persistent underperformance up to 12 months of trading, followed by a positive market-adjusted return. Besides underperformance, they also attempted to determine the predictive relationship between the IPO firm characteristics at the time of issue and long-run underperformance. Hot IPO markets were established on the basis of more than 5 IPOs being issued in a quarter since these would be deemed high activity quarters. Using the OLS regression model, the study concludes by saying that variables such as the offer size, underprice, leverage, ex-ante uncertainty, and presence of hot/cold markets significantly explain the underperformance in the long run. The study finds that variables such as post-issue promoter group holding, the rate of subscription, the age of IPO firm, and offer price-to-book value ratio are statistically insignificant in explaining long-run underperformance.

The study on IPO underpricing by Poudyal (2008) on a sample of 63 graded IPOs issued between 2005 and 2008 reveals that securities with higher IPO grades tend to exhibit underpricing to a lesser extent. They also find that, with higher IPO grades, the subscription rate of the IPOs improves across all classes of investors, including retail investors. The authors also find a weak statistical relationship between the issue grade and long-run performance. Dhamija and Arora (2014) studied the long-term performance of 31 IPOs made by Indian companies during the period May 2007 to January 2010, which have been graded by credit-rating agencies. Their findings imply that the long-run performance of IPOs does not bear any relationship with the grade awarded. Their results show that there is a substantial variation in the long-run performance of IPOs across different grades. IPOs graded lower have performed better than those graded higher. Issues graded lower, if priced reasonably, may provide a higher return to the investor as compared to a high-grade IPO with aggressive pricing. Similar results were also

arrived at in a study conducted by Ramesh and Dhume (2015), which consisted of 150 companies issued on the NSE between 2007-2011 for the short and long-run analysis and 91 companies which had been graded by credit rating agencies. The authors find that better grades do not guarantee long-run returns for IPOs. Kashiramka et al. (2018) studied the long-run performance of graded IPOs listed in India between 2007-2013 using a sample of 270 IPOs, out of which 191 & 79 IPOs were graded and ungraded respectively. Using regression analysis, the authors find that higher graded IPOs do not ensure better returns in the long run.

Sentiments play a considerable role in the short and long-term performance of IPOs. Sentiment or over-optimism drive the price above fundamentals. When prices revert to fundamentals in the long-run, returns are more detrimental to issues that came to a market during periods when sentiment was high. Loughran and Ritter (1995) argue that low long-run returns may be explained by two factors: (i) IPOs come to the market near market peaks; and (ii) IPO firms have a high market to book ratios, which are associated with lower returns. To maximise proceeds from the issue, firm managers and investment bankers will bring IPOs to market when sentiment is high, and when feedback risk is small. Schaub (2011) conducted a study on the New York Stock Exchange (NYSE) to understand the long-term performance of UK American Depository Receipts (ADR) during bull and bear markets. The total sample included 34 UK firms listing ADRs on the NYSE between January 1990 and December 2002. The sample comprised of 27 Secondary equity offerings (SEOs) and 7 IPOs. The above study to capture market-timing effects concluded that the UK ADR trading through the bull market underperformed by nearly 13%, while those listed and trading through the bear market barely outperformed the S&P 500 (by 2.6%).

A study by Kooli and Suret (2004) on a sample 445 IPO's unseasoned (new) issues for the period from 1991 to 1998 using the buy-and-hold returns measurement for long-run performance also find that long-run performance of IPO's varies widely in different industries. A study by Ritter (1991) would also imply that investors are irrationally over-optimistic about the future potential of specific industries. Singh and Kumar (2012) proposed a model to explain underpricing using the over-subscription rate, age of the firm, and issue size as independent variables. The authors conducted a sector-wise analysis of long-run performance. The long-run performance was measured using cumulative abnormal returns. 116 IPOs listed in India between January 2006 and October 2007 were considered for analysis. The authors find that long-run returns of IPOs were positive during this period delivering long-run returns of 11.5%. The authors find that issues with higher institutional demand lend to higher long-term returns. During the sectoral study, the authors find that while the IT sector gave higher initial returns in the short-

run, the returns were negative in the long run. Sharma, Mittal, and Gupta (2013) studied the performance of 319 IPOs issued on the NSE across various sectors, over different time frames (1999 till 2011), to identify the performing sectors and the effect of the non-performing IPOs. Their results indicate that public sector stocks outperform all other sector stocks during short as well as long-term period. Manufacturing sector stocks appear to be least performing stocks during short as well as long-term duration. The only sector that performed well over the long-term was related to the IT industry that delivered the highest appreciation in short as well as over the long-term. The other sector that produced significant short-term returns were the financial sector stocks. The performance of financial sector stocks, however, descends to their lowest during the long-term period. The above study also investigates the performance of sectors over the long-run.

Stoll and Curley (1970) examined 205 small offers to study their performance in the short and long-run. They found that "in the short run, the stocks in the sample showed remarkable price appreciation... In the long-run, investors in small firms did not fare so well". Moreover, De Bondt and Thaler (1985) have also presented evidence that, at least for small-capitalisation stocks, there is a negative relationship between the short and long-run abnormal returns on individual securities when studies for a year or more, which they interpret as evidence of market overreaction.

2.5 Studies on Underwriter prestige and firm factors

We begin this section by reviewing literature that documents the importance of having high-quality underwriters collaborate with listing firms in the interest of reducing underpricing.

Logue (1973) studied 250 IPOs during the period 1965-69 and found that investment bank prestige is an essential factor in understanding underpricing. The association of listing firms with high prestige banks signalled low risk and high quality to potential investors. Beatty and Ritter (1986) propose that underpricing is greater when investors find it difficult to ascertain the value of an IPO issue. This should affect unseasoned new firms which deal with new technology. Keeping the offer price very high and then revising it lower to allay investor fears about the uncertainty is one way for the listing firms to avoid leaving too much money on the table. Underwriters play a very important role in ensuring correct pricing of the IPO issue since the underwriters reputation is at stake. The preceding study finds that underwriters which do not maintain the underpricing equilibrium, i.e., incorrectly pricing lose reputation with respect to clients and also market share in future periods. We can hypothesise from this study

that IPOs managed by higher-rated underwriters should be underpriced lower than lower-rated underwriters. Balvers, McDonald, and Miller (1988) revealed that to reduce undervaluation, investment bankers or underwriters favour working with reputable auditors. Tinic (1988); Slovin, Sushka, and Hudson (1990) claim that investor risk in IPOs significantly reduces due to the presence of high-quality underwriters. Carter and Manaster (1990), in their study, point to the association of low risk, high-quality firms with quality underwriters while low-quality firms are associated with high-risk issues. The authors also identify that getting hold of the endorsement of a prestigious investment bank can be critical to the success of an IPO. Puri (1999), via a model, explains that it becomes imperative for investment banks to hold a high standard and guard their reputation by applying stringent quality norms in their dealings. Mudrik and Imam (2002) stated that companies would prefer hiring a reputable underwriter to reduce the undervaluation of shares. However, a study by Liu and Ritter (2011) finds that IPOs of listing firms which can afford to retain underwriters with a very focused industry expertise and having superior quality analysts tend to be more underpriced. Li, McInish, and Wongchoti (2005) have documented the evidence of information asymmetry between IPO issuers and outside investors. That is the main reason why underwriters and auditors are crucial. Such an asymmetry could provoke IPO issuers to manipulate their earnings before going public and thereby, increasing the proceeds from the offering. Firms recognise the importance of presenting strong earnings in the prospectus, hence window-dressing might seldom be required. Underwriters and auditors have to perform their parts in composing an IPO prospectus that incorporates a report of its present and future operations and audited financial statements.

Prior studies establish the importance of having high-quality underwriters work with the listing firm since the high reputation of underwriters can act to signal a low-risk high-quality investment. We now focus on reviewing literature that discusses the impacts of underwriter prestige on underpricing. With the exception of the study by Khurshed et al. (2008), other research by McDonald and Fisher (1972); Neuberger and La Chapelle (1983); Kim, Krinsky, and Lee (1995); Elsbach and Kramer (1996); Logue, Rogalski, Seward, and Foster-Johnson (2002) find that underpricing is higher in the case of sub-standard underwriters and that better reputation of underwriters reduces underpricing.

McDonald and Fisher (1972), in their study, documented that initial returns were statistically different for various investment banks and that underpricing is higher in the case of sub-standard underwriters. Neuberger and Hammond (1974), in their study using a large sample of 816 IPOs, document that underpricing varies across different categories of investment banks. Neuberger and La Chapelle (1983) used a sample of 118 IPOs issued in the US markets

between 1975 and 1980. The authors find that underwriters with lower prestige underprice IPOs higher than reputable investment banks. A study by Kim et al. (1995) also finds the support for a significant negative relationship between the underwriter reputation and the level of underpricing. The authors state that reputable and organised underwriters can organise and provide a better service to listing firms professionally, which in turn strengthens the image of the firm in the eyes of investors. Elsbach and Kramer (1996) cite that usually, a firm's reputation influences stakeholders' economic choices and contributes to differences in organisational performance, which creates a competitive advantage. Institutions consider it a prestige to be involved in an IPO because its performance will alter the perception of prospective investors. Dhamija and Arora (2017a) studied the underpricing of IPOs on a sample of 399 IPOs listed on the Indian stock markets between 2005-2015. The authors quote a lack of evidence to suggest that certification by the auditor with higher prestige results in lower underpricing. Sundarasen, Khan, and Rajangam (2018) examined relationship between the underwriters' reputation and initial returns of IPOs using a sample of 227 IPO firms listed in Bursa Malaysia between 2005 and 2012. The authors find a negative relationship between prestigious underwriters and IPO initial returns indicating that the reputable underwriters decrease the level of IPO underpricing.

Newer firms with an insufficient performance track record go public with the approval of a leading investment bank, which underwrites the firm's security offerings and a leading auditor to examine the financial statements. Investors consider the evaluation of listing firms by investment banks to determine the quality of the IPO. Logue et al. (2002) examined 1,475 IPOs listed in the US markets between January 1988 through December 1995. The authors document that reputed underwriter firms are more likely to revise the price upwards and help in reducing underpricing. Khurshed et al. (2008), in their study in India, used a sample set of 251 firms listed between 1999 to August 2008 that had used the bookbuilt mechanism to determine the certification role of the investment bank(s)/syndicates on underpricing. Using regression tests, the authors find that investment banks with a high reputation do not determine the extent of underpricing of IPOs.

One of the sub-objectives is related to finding an association using linear regression between the syndicate (measured in terms of prestige points) with listing firm factor variables such as the firm's age, PIPH, and issue size.

Megginson and Weiss (1991) studied the certification hypothesis by comparing venture capital-backed IPOs with a control sample of non-venture capital IPOs by matching the IPOs by industry and offering size. The authors find that VC backed IPOs provide lower initial returns

indicating lower underpricing. One finding from the above study is also related to how the firm's age impacts underpricing with older firms being underpriced lower due to lower information asymmetry. Ljungqvist and Wilhelm (2003) studied IPO pricing by examining IPOs listed during the dot-com bubble in 1999-2000 and three years preceding it. The authors find the highest first-day returns due to internet stocks in the dot-com phase. The authors find that underpricing is inversely related to the issuing firm's age, which means that syndicates need to extract more information during the book-building phase from potential investors to make changes in the offer price.

Brennan and Franks (1997) study a sample of 69 IPOs in the UK and find that underpricing leads to over-subscription, ensuring that large holdings of outside investors will be smaller the greater is the degree of underpricing. Post-Issue promoter holdings, coupled with underpricing dilute majority holding in the investors but also signal the growth prospects of the firm. Contrasting signals are provided in a study by Hill (2006) in a study conducted on 502 IPO issues on the London stock exchange during the period Jan'91 until Dec'98. The author also finds that block holdings play a significant role in IPO underpricing. Bae and Levy (1990), in their study, found that the offering size is positively correlated with the number of managing underwriters. Mok and Hui (1998), in their study of Chinese Class-A shares, find that smaller IPO is riskier and underpriced than one with large issue size. Sinha and Madhusoodanan (2004) also find that smaller issues are subject to severe underpricing.

One of the sub-objectives relates to finding an association using artificial neural networks between the syndicate (measured in terms of prestige points) with listing firm factor variables such as the firm's age, PIPH, and issue size. The literature review that precedes applies to this study as well since the choice of variables is the same. We now continue discussing literature related to the usage of artificial neural networks to solve issues related to financial markets.

Jain and Nag (1995) in their study, attempt to price IPOs using a data-driven, neural network approach. IPO pricing is akin to pricing a new product since pricing a unique product is faced with issues such as no information on market demand and competitive response. Incorrect pricing could result in either under or overpricing. The authors construct a neural network model to price IPOs using a large sample of 552 new issues issued between 1980-1990. The inputs to the network include primary economic variables that potentially influence IPO stock prices. The network was trained with eleven input variables consisting of a broad list of financial indicators usually used by investors in valuing assets of firms going public. The authors conclude that network models outperform investment bankers in pricing IPOs.

Robertson, Golden, Runger, and Wasil (1998), in their study, construct models that predict the first-day return of an initial public offering using a data set that consists of the first-day returns for 1075 firms that went public between 1989-1994. Sixteen predictor variables were used for this analysis, further segmenting the data into technology and non-technology offerings. Three types of models for each segment were used, consisting of a regression model and two neural network models. The authors conclude that for both technology and non-technology segments, neural network models were better than linear regression models at predicting the first-day return of an initial public offering. Zhang, Cao, and Schniederjans (2004), in their study, focus on comparing various multivariate models, to study if neural network models, including important accounting variables, can help to determine future earnings forecasts than models that assume a linear combination of these same variables. The study uses a sample of 283 firms spanning 41 industries. The authors conclude that a neural network approach using important accounting variables results in forecasts much more accurately than linear ARIMA forecasting models. Nur Ozkan-Gunay and Ozkan (2007) examine the usage of artificial neural networks to discover predictive knowledge structures in financial data to help explain prior bank failures in the Turkish banking sector (emerging financial markets). The authors find that neural networks could distinguish patterns or tendencies in financial data using which a majority of bank failures could be predicted much before using a neural network classification approach. The author's further state that neural networks could be an alternative method to predict and prevent future systemic banking crises in order to minimise the cost to the economy. Anyaeche and Ighravwe (2013) study an alternative approach to multiple-linear regression (MLR). As a predictive model for establishing interrelationship among productivity, price recovery, and profitability, the authors use a back-propagation artificial neural network. The authors observe that artificial neural networks outperform multiple linear regression models. Enyindah (2016), in their study, develop a neural network application to predict interest rate on loan investment in a Nigerian bank using the back propagation neural network. The study concludes that artificial neural networks could efficiently determine interest rates with a minimum amount of error (measured as a mean square error). The literature review so far points to the effective use of the back-propagation artificial neural network (BP-ANN) that this study also utilises.

2.6 Research Gap

1. Many research articles discuss the short-run performance of IPOs using MAARO or log normal returns. Most studies have been successful in applying theories such as market timing, information asymmetry to explain the short-run performance of IPOs. However,

no such theory has been successful in explaining the long-run performance of IPOs. Many questions arise regarding the disparity in findings across the world regarding long-run performance. Possible reasons for this disparity point to the period of study and the methodology used to compute long-run returns. Some studies use CAR, while some use BHAR. Very few studies rely on multiple measures of performance. In this study, we utilize two measures each to examine list day and long-run performance.

2. There is a limitation of sample size on a majority of the studies undertaken in India and globally. This study undertakes a short and long-run performance study over a substantial period of 15 fiscal years from 1999-2013. Many studies do not exclude SME or follow-on-offerings, which certainly influence both short and long-run performance findings. This study avoids issues arising out of a smaller issue size (SME IPOs) or the effects of lower underpricing (FPOs).
3. IPO performance differs widely based on the issue mechanism, market conditions, etc. This study is comprehensive in addressing the need to dissect the larger sample and study an IPOs short and long-run performance by issue types, market conditions (hot and cold), graded and ungraded IPOs, amongst grades, investor sentiment (bull and non-bull), sector and issue size.
4. Artificial neural networks (ANN) are gaining importance in research. In this study, we explore the possibilities of using ANN to determine a listing firm's factors that influence underwriters/syndicates to associate with listing firms. We do this by examining the differences in results between a conventional multiple regression model and an ANN model.

This chapter described the theoretical framework adopted in the study. We also presented a review of the literature on the IPO underpricing phenomena experienced globally and examined the research done on IPO underpricing, including special cases such as the presence of pricing mechanisms, sectoral impacts, market conditions, grading etc. and presented the research gap of the study. The next chapter entitled "Research Methodology" describes the secondary data sources, hypotheses of the study, statistical and econometric tools utilised, and the measures of performance used for the short and long-run study.

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Chapter 3

Research Methodology

3.1 Introduction

In this chapter, we focus upon elements of the research methodology that: (a) describe the data source(s) used and justification for specific exclusions, (b) state the hypotheses which will be tested in the study, (c) discuss the statistical and econometric tools used and (d) describe in detail the calculations used to measure the short and long-run performance.

3.2 Data Sources

A sample of IPOs listed on the National Stock Exchange (NSE) between the fiscal year 1999 and 2013 is under study. SEBI introduced the book building mechanism in 1999 so that issuing firms could opt for either of the pricing mechanisms. This provides us an opportunity to examine the underpricing of IPOs issued using both mechanisms. The study period ends in the fiscal year 2013, so as (1) to provide us 15 fiscal years for analysis, and (2) we use the same sample used for the short-run study for a three-year long-run performance study. All 'Small and Medium Enterprise (SME)' IPOs, as well as any 'Follow-On Public Offerings (FPOs)', also referred to as Secondary Equity Offerings (SEO). SME IPOs are excluded from this study. The exclusion of SMEs helps the study to not affect the results due to smaller issue size as well as investors' perception regarding SME IPOs. Also, excluding FPOs helps correctly determine the extent of underpricing since SEOs tend to reduce the average level of underpricing. Access to listing information is retrieved from the Prime Database, and the historical price data for each issue is retrieved from the Prowess database. As shown in Table 3.1, from this sample period of 445 IPOs issued, 297 IPO issues are underpriced. Out of the 297 underpriced IPO issues, 13 IPOs

Table 3.1: *Sample Selection*

Total number of IPOs offered during the period	445
Exclusion number of IPOs overpriced	148
Remaining	297
Exclusion number of IPOs incomplete history	13
Remaining total number of IPOs eligible for study	284
Percentage of eligible IPOs in the sample	63.82%
Underpriced IPOs Sectoral Breakup	
Auto - Cars & Jeeps	1
Breweries & Distilleries	1
Cables - Power & Others	1
Ceramics & Granite	1
Consumer Goods - Electronic	1
Dyes & Pigments	1
Electric Equipment	1
Fertilisers	1
Finance - Leasing & Hire Purchase	1
Food Processing	1
Hospitals & Medical Services	1
Leather Products	1
Machine Tools	1
Paper	1
Pesticides & Agro Chemicals	1
Printing & Stationery	1
Refineries	1
Steel - Tubes & Pipes	1
Telecommunications - Equipment	1
Trading	1
Auto Ancillaries	2
Cement - Major	2
Edible Oils & Solvent Extraction	2
Engineering	2
Metals - Non Ferrous	2
Shipping	2
Sugar	2
Textiles - Manmade	2
Transport & Logistics	2
Banks - Private Sector	3
Castings & Forgings	3
Chemicals	3
Computers - Hardware	3
Diamond Cutting & Jewellery & Precious Metals	3
Engineering - Heavy	3
Finance - Term Lending Institutions	3
Personal Care	3
Plastics	3
Steel - Medium & Small	3
Textiles - Spinning - Cotton Blended	3
Hotels	4
Mining & Minerals	4
Oil Drilling And Exploration	4
Retail	4
Computers - Software - Training	5
Finance - Investments	5
Telecommunications - Service	5
Textiles - General	5
Textiles - Readymade Apparels	5
Packaging	6
Power - Transmission & Equipment	6
Steel - Sponge Iron	6
Finance - General	8
Infrastructure - General	8
Power - Generation & Distribution	8
Banks - Public Sector	10
Construction & Contracting - Real Estate	11
Pharmaceuticals	14
Construction & Contracting - Civil	15
Computers - Software	16
Miscellaneous	16
Computers - Software Medium & Small	20
Media & Entertainment	28
Total	284

Source: Prime Database

are excluded due to insufficient trading history or breaks in the trading.

The historical NIFTY index was retrieved from Prowess, while Dividend yields were obtained from the NSE portal. Historical listing information obtained from the Prime database provides data points such as issue type, open and close dates, the number of times the issue was subscribed, offer price, listing closing price (unadjusted), issue size, post-issue promoter holdings, the grade assigned by rating agencies etc.

Macroeconomic data was obtained from the 'tradingeconomics.com' portal that included

data points such as the INR exchange rate, Bond Yields, GDP growth rate (Quarterly), RBI Interest rate changes, Interbank lending rates as well as the money supply (M1, M2, M3). Data from 'tradingeconomics.com' has been cited by quite a few scholarly research articles and conference proceedings; for instance, Narasimham and Libison (2010); Bakhtyar, Zaharim, Asim, Sopian, and Lim (2012); Kumar (2013). Daily inflation values were retrieved from 'inflation.eu'.

3.3 Hypothesis of the Study

For the short-run study on the extent of underpricing, the null hypothesis are as follows:

- H_1: The extent of underpricing does not differ significantly for IPOs issued using either book-built or fixed mechanisms
- H_2: The extent of IPO underpricing does not differ significantly for IPOs issued using during hot and cold markets
- H_3: The extent of IPO underpricing does not differ significantly between graded and ungraded IPO issues
- H_4: The extent of IPO underpricing remains the same irrespective of the IPO grade assigned by the rating agencies
- H_5: The extent of IPO underpricing does not differ significantly for IPOs issued using during bull and non-bull/neutral markets
- H_6: The extent of underpricing differs significantly across sectors and is the highest for the high technology sector
- H_7: The extent of IPO underpricing differs significantly for the small-size IPOs when compared to mid or large-size IPOs

For the long-run study on the distribution of long-run returns, the null hypothesis is tested at specific intervals during the study period and are as follows:

- H_8: The distribution of BHAR is the same across both issue mechanisms
- H_9: The distribution of BHAR is same across cold and hot markets
- H_{10}: The distribution of BHAR is same across graded and ungraded IPOs
- H_{11}: The distribution of BHAR is the same across grade combinations
- H_{12}: The distribution of BHAR is the same across bull and non-bull/neutral markets
- H_{13}: The distribution of BHAR is same across sectors
- H_{14}: The distribution of BHAR is same across issue size categories

For the study on the effects of an investment bank/syndicate prestige on underpricing, the null hypothesis is stated as follows:

- H_{15}: The extent of IPO underpricing does not differ significantly for IPOs associated with either the Minor, Major or Elite syndicate groups

3.4 Statistical & Econometric Tools

3.4.1 Parametric Tests

The short-run study on underpricing includes a sample of 291 IPOs. The short-run study uses normalised 'Marginally Adjusted Abnormal Returns on Opening (MAARO)' and log normal returns as measures of performance (described later in section 3.5.1). For the short-run study on the extent of underpricing, this study employs two separate tests, which are the independent samples t-test and one-way ANOVA test.

The independent-samples t-test is used to determine if a difference exists between the means of two independent groups on a continuous dependent variable. This study uses the independent samples t-test for identifying any statistical difference in the extent of underpricing related to (1) usage of different pricing mechanisms (Section 5.4.1) (2) IPO issue market conditions identified as hot or cold (Section 5.4.2) (3) IPOs being graded or ungraded (Section 5.4.3) and (4) nature of the markets identified as bull or non-bull/neutral (Section 5.4.5).

The following studies use the independent samples t-test

- Extent of Underpricing between Fixed-price and Bookbuilt IPOs
- Extent of Underpricing between IPOs in Hot and Cold Markets
- Extent of Underpricing between Graded and Ungraded IPOs
- Extent of Underpricing between IPOs in Bull and Non-Bull Markets

For the studies mentioned above, we are examining the differences across the two groups. Since the independent samples t-test studies the difference between two groups, the null and alternative hypothesis for the short-run studies mentioned are H_0: the population means of the two groups are equal (i.e., $\mu_1 = \mu_2$), and the alternative hypothesis is H_A: the population means of the two groups are not equal (i.e., $\mu_1 \neq \mu_2$). An independent-samples t-test will calculate a significance level (p-value), which is the probability of our sample group means being at least as different as we found in our study, given that the null hypothesis is indeed true. If the

probability is sufficiently small (usually p $<$ .05), we can conclude that it is unlikely that the two group means are equal in the population so that we can accept the alternative hypothesis and reject the null hypothesis. Alternatively, we will reject the alternative hypothesis and fail to reject the null hypothesis if the probability is larger (usually p $>$ .05). The hypothesis tests refer to the population means.

The one-way analysis of variance (ANOVA) test is used if there are two or more independent groups. ANOVA is used to determine whether there are any statistically significant differences between the means of two or more independent groups. This study uses ANOVA for identifying any statistical difference in the extent of underpricing related to (1) IPOs with different grades (Section 5.4.4) (2) IPOs that are grouped by sectors (Section 5.4.6) and (3) IPOs classified by issue size (Section 5.4.7).

The following short-run studies use the one-way ANOVA test

- Extent of Underpricing between Graded IPOs
- Impacts of Sector on Extent of Underpricing
- Impacts of Issue Size on Extent of Underpricing

Since we have more than two groups for the tests mentioned above, we run the one-way ANOVA test on the normalised MAARO and log normal returns. The one-way ANOVA test tries to determine whether the group means are different in the population. To achieve this, we assume the null hypothesis, which states that there are, in fact, no differences in population means between the groups. This is described more formally as follows: H_0: all group population means are equal (i.e., $\mu_1 = \mu_2 = ...\mu_k$), and the alternative hypothesis is H_A: at least one group population mean is different. The one-way ANOVA calculates an F ratio based on the variability between groups versus the variability within groups. The probability (p-value) of finding an F ratio as large as the one calculated by the one-way ANOVA is used to either reject or not reject the null hypothesis. If this probability value is less than.05 (i.e., p $<$ .05), there is a less than 5 in 100 (5%) chance of the F ratio being as large as calculated, given that the null hypothesis is true. This is interpreted as there being "real" differences between group mean in the population. When this occurs, the result is called statistically significant.

3.4.2 Nonparametric Tests

The long-run study on the performance of underpriced IPOs consists of a sample of 284 IPOs. For the long-run study on the performance of IPOs, this study employs two separate tests

that are executed against the buy-hold abnormal returns (BHAR) data. These are the Mann-Whitney U test and the Kruskal-Wallis H test. The long-run performance study uses 'Buy-Hold Abnormal Returns (BHAR)' and wealth relatives as measures of performance (described later in 3.5.2).

The Mann-Whitney U test is a rank-based nonparametric test that can be used to determine if there are differences between two groups on a continuous or ordinal dependent variable. This study uses the Mann-Whitney test to examine statistical differences in the distribution of BHAR related to (1) usage of different pricing mechanisms (Section 6.4.2) (2) IPO issue market conditions identified as hot or cold (Section 6.4.3) (3) IPOs being graded or ungraded (Section 6.4.4) and (4) nature of the markets identified as a bull or non-bull/neutral (Section 6.4.6).

The following studies use Mann-Whitney U-test.

- Long-Run Performance of Underpriced IPOs based on Issue Type (Fixed price and Book-built method)
- Long-Run Performance of the Underpriced IPOs during Hot and Cold Markets
- Long-Run Performance of Underpriced IPOs (Graded and Un-Graded IPOs)
- Long-Run Performance of the Underpriced IPOs issued during Bull and Non-Bull periods

For the studies mentioned above, we are examining the differences across the two groups. The Mann-Whitney U test (also called the Wilcoxon-Mann-Whitney test) is a rank-based nonparametric test that is used to determine if there are differences between two groups on a continuous or ordinal dependent variable. Since we are not normalising any on the long-run returns, this test is appropriate since Mann-Whitney U test is often presented as the nonparametric alternative to the independent-samples t-test. The null hypothesis is H_0: the distribution of BHAR across the two groups equal, and the alternate hypothesis is H_A: the distribution of BHAR across the two groups are not equal.

The Kruskal-Wallis H test is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. This study uses the Kruskal-Wallis test to examine statistical differences in the distribution of BHAR related to (1) IPOs with different grades (Section 6.4.5) (2) IPOs that are grouped by sectors (Section 6.4.7) and (3) IPOs classified by issue size (Section 6.4.8).

The following studies use Kruskal-Wallis H-test.

- Long-Run Performance of Underpriced IPOs across Grades
- Long-Run Performance of Underpriced IPOs across Sectors
- Long-Run Performance of Underpriced IPOs based on Issue Size

For the studies mentioned above, we are examining the differences across more than two groups. The Kruskal-Wallis H test is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. The Kruskal-Wallis H test is generally considered the nonparametric alternative to the one-way ANOVA. The null hypothesis is H_0: the distribution of BHAR for the groups are equal, and the alternate hypothesis is H_A: the distribution of BHAR for the groups are not equal.

3.5 Measures of Performance

3.5.1 Listing day performance

For each IPO, two measures of underpricing were calculated. First, the raw underpricing, defined as the difference in percentage between the closing price of the IPO after the first day of listing and the offer price; and second, the adjusted underpricing, defined as the difference between the 'simple' underpricing above and the market index return measured between the offer date of the IPO and the first trading date. In this analysis, the market index is historical NIFTY. The formula for calculating 'Marginally Adjusted Return on Opening (MAARO)' is calculated in three steps. In step 1, the raw returns, which are the percentage difference between the offer price and listing price, are calculated. In step 2, the percentage difference in the NIFTY index is calculated. In step 3, we calculate the difference between the returns obtained in step 1 and step 2. This is done in order to adjust the raw returns for any volatility in the markets between the offer date and the listing date.

Stock Returns (S_R) is calculated as

$$S_{\mathrm{R}} = \left[\frac{P - O}{O}\right] \times 100 \qquad \ldots(3.1)$$

Where S_R = Stock Raw Return

P = Closing price of the stock on the day of listing (day 1)

O = Offer Price

and Market Return (M_R) are captured by

$$M_{\mathrm{R}} = \left[\frac{I_{\mathrm{L}} - I_{\mathrm{O}}}{I_{\mathrm{O}}}\right] \times 100 \qquad \ldots(3.2)$$

Where M_R = Market Return

I_L = Closing Index on day 1 of listing

I_O = Closing Index on the day of the offer

Finally, MAARO (Market Adjusted Return on Opening) is calculated as follows

$$MAARO = \left[\left(\frac{1 + S_{\mathrm{R}}}{1 + M_{\mathrm{R}}}\right) - 1\right] \times 100 \qquad \ldots(3.3)$$

For the robustness of tests, we also calculate log normal returns as another measure of underpricing. This is calculated using the stock returns adjusted for the corresponding market movement by subtracting log market return from the log returns on the listing.

$$\textit{Log Normal Market Return} = \ln\left(\frac{P}{O}\right) - \ln\left(\frac{I_{\mathrm{L}}}{I_{\mathrm{O}}}\right) \qquad \ldots(3.4)$$

3.5.2 Long-run performance

Long-run performance studies are used to examine the price behaviour of equity for periods of one to five years following significant corporate events such as IPOs. This study measures long-run abnormal performance as measured by the Buy and Hold Abnormal Return (BHAR), and subsequently, the Average BHAR (ABHAR). Research papers such as Fama (1998) and Lyon, Barber, and Tsai (1999) prefer the BHAR methodology and is often the most cited method for studies of long-run performance. Barber and Lyon (1997) cite that the appropriate measure of long-run performance is BHAR rather than the long-run cumulative abnormal return (CAR). This position has been taken since BHAR provides a measure of long-run investor experience, whereas CAR measure averages periodic performance and is a biased estimator of the BHAR. One of the issues inherent with BHAR is the skewness bias and the use of standard statistical tests (predominantly t-statistics). Skewness is a result of the long-run holding-period return of individual security that is highly skewed. Barber and Lyon (1997) demonstrate in simulations that the BHAR's positive skewness causes the null hypothesis to be rejected too often when it is true. To overcome this issue, we use skewness-adjusted t-statistics as introduced by Hall (1992).

We measure 'Average Buy and Hold Abnormal Returns' (ABHAR) to evaluate long-term

performance for 36 months from the listing date. For our study, each month consists of 21 consecutive trading days. In addition, we also measure 'Wealth Relative' (WR) to compare how the IPOs performed relative to the market. While ABHAR is calculated with reference to the list price, WR is calculated with reference to the offer price.

Wealth Relatives (WR): Wealth relative is a measure used to evaluate the performance of IPOs at a point in time. Levis (1993) studied the long-run performance of 712 IPOs issued in the UK for the period 1980-88 by calculating the wealth relatives (WR), which he defined as:

$$WR_{it} = \frac{1 + \frac{1}{N}\sum_{i=1}^{N} R_{it}}{1 + \frac{1}{N}\sum_{i=1}^{N} R_{mt}} \quad \ldots(3.5)$$

where R_{it} is the return of the individual IPO stocks *i* on day *t* from the offer day; R_{mt} is the market index return for NSE NIFTY for the corresponding period. We calculate the wealth relatives for all periods from the offer price. The total size of IPOs in the portfolio for discussion is represented by *N*. The methodology for the computation of WR is consistent with Ritter (1991). A Wealth Relative of more than one indicates better performance of IPOs over the market index, while a value of less than one indicates an underperformance of IPOs.

Buy and Hold Abnormal Returns (BHAR): BHAR assumes that an amount of money is passively invested on the first day and held for a specified period (excluding the first day). This return is then corrected using returns on the NIFTY market index to get a market-adjusted BHAR. Market-adjusted BHAR has been computed with reference to list price. Market-adjusted BHAR is computed as:

$$BHAR_{iT} = \prod_{t=1}^{T}(1 + R_{it}) - \prod_{t=1}^{T}(1 + R_{mt}) \quad \ldots(3.6)$$

The **Average BHAR (ABHAR)** for the entire sample is also calculated to find out the overall performance of the portfolio of IPOs for a specific period for the sample of size N. This is computed as:

$$ABHAR = \frac{1}{N}\sum_{i=1}^{N} BHAR_{iT} \quad \ldots(3.7)$$

A positive ABHAR for a specific period is interpreted as better performance for the IPOs compared to the benchmark return for the same period.

A standard *t-test* is prone to cross-sectional correlation and volatility changes. An additional issue occurs when calculating t-statistics for skewed distributions. The skewness

adjusted *t-test*, introduced by Hall (1992), corrects the cross-sectional *t-test* for skewed abnormal return distributions. We implement this test, which is applicable for average abnormal returns, cumulative average abnormal return, and average buy-and-hold abnormal returns. The cross-sectional standard deviation (unbiased by sample size) is calculated as

$$S^2_{ABHAR} = \frac{1}{N-1} \sum_{i=1}^{N} (BHAR_i - ABHAR)^2 \quad \ldots(3.8)$$

The skewness estimation γ (unbiased by sample size) is calculated as

$$\gamma = \frac{N}{(N-2)(N-1)} \sum_{i=1}^{N} (BHARi - ABHAR)^3 S^{-3}_{ABHAR} \quad \ldots(3.9)$$

Further, let *S* be defined as

$$S = \frac{ABHAR}{S_{BHAR}} \quad \ldots(3.10)$$

Skewness adjusted test statistics for ABHAR is calculated as

$$t_{skew} = \sqrt{N} \left(S + \frac{1}{3}\gamma S^2 + \frac{1}{27}\gamma^2 S^3 + \frac{1}{6N}\gamma\right) \quad \ldots(3.11)$$

This calculated value of t_{skew} is asymptotically standard normal distributed.

This chapter described the secondary data sources, hypotheses, statistical and econometric tools utilised and the measures of performance used for the short and long-run study. The next chapter entitled "Trends of IPO in India (FY 1999-2013)" examines a cross-sectional trend analysis of IPO returns by pricing mechanisms, issues in hot and cold markets, between graded and ungraded IPOs, between IPOs of different grades, issues in bull and non-bull markets and finally by issue size. The descriptive analysis also examines the trend in marginal returns across fiscal years.

3.6 References

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Chapter 4

Trends of IPO in India (FY 1999-2013)

4.1 Introduction

The first objective of this study is to examine trends of IPO in India for all IPOs (excluding SEO and FPOs) listed on the 'National Stock Exchange (NSE)' between the fiscal year 1999 and 2013.

Table 4.1: *Count of Over and Underpriced IPOs listed on the NSE (FY 1999-2013)*

Fiscal Year	IPOs		
	Overpriced	Underpriced	Total
1999-2000	3	14	17
2000-2001	12	19	31
2001-2002	5	1	6
2002-2003	2	5	7
2003-2004	0	11	11
2004-2005	4	19	23
2005-2006	12	49	61
2006-2007	34	41	75
2007-2008	17	57	74
2008-2009	7	11	18
2009-2010	15	18	33
2010-2011	18	33	51
2011-2012	13	13	26
2012-2013	5	5	10
2013-2014	1	1	2
	148	297	445

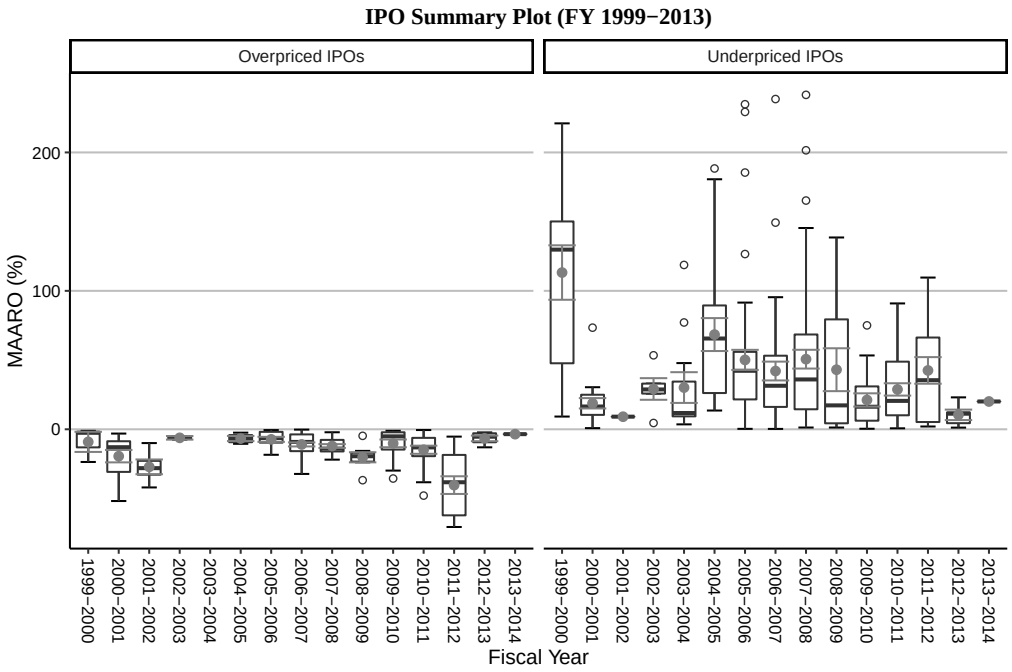
Source: Prime Database and Computed from Equation 3.3

The number of over and underpriced IPOs listed on the NSE between FY 1999-2013 is shown in Table 4.1. This study first examines the summary statistics of the entire sample followed with a cross-sectional study by pricing mechanisms, IPOs listed in hot and cold markets, graded and ungraded IPOs, amongst graded IPOs, IPOs listed in bull and non-bull markets, and finally, based on issue size categories (small, medium and large-size). The study

also examines the trends in underpricing and overpricing for the study period using the entire sample and then by cross-sections of the data. We use MAARO as a measure of short-term performance to determine whether an IPO issue on listing is underpriced or overpriced. A positive or negative return on listing determines if an IPO is underpriced or overpriced. MAARO is calculated using Equation 3.3 (p.66).

4.2 IPO Trends. Entire Sample

The most substantial variability of MAARO during the fiscal year (FY) 1999-2000 can be observed in Figure 4.1. More considerable variability of MAARO can be observed in the underpriced as opposed to overpriced IPOs. Outliers are far more in the case of underpriced than overpriced IPOs.



Source: Computed from Equation 3.3
Figure 4.1: *Summary Plot (Entire Sample).*

The distribution of MAARO for underpriced IPOs is right-skewed for most years. On the other hand, overpriced IPOs exhibit a left-skewed distribution of MAARO for most years of the study. For Overpriced IPOs, the most frequently observed category of FY was 2006-2007 (n = 34, 22.97%). For underpriced IPOs, the most frequently observed category of FY was 2007-2008 (n = 57, 19.19%). Frequencies and percentages for over and underpriced IPOs are presented in appendix Tables B.1 and B.2.

The summary statistics for the entire sample are presented in Table 4.2. The average issue size for the entire sample is 382.23 Cr. (SD = 1172.65, SE_M = 55.59, Min = 2.50, Max =

15199.44, Skewness = 7.84, Kurtosis = 76.76). The average MAARO is 27.01% (SD = 60.10, SE_M = 2.85, Min = -70.59, Max = 678.30, Skewness = 4.17, Kurtosis = 33.41). When the skewness is greater than 2 in absolute value, the variable is considered to be asymmetrical about its mean. When the kurtosis is greater than or equal to 3, then the variable's distribution is markedly different than a normal distribution in its tendency to produce outliers.

Table 4.2: *Summary Statistics of IPOs - Full Sample*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)	382.23	1172.65	445	55.59	2.50	15199.44	7.84	76.76
MAARO (%)	27.01	60.10	445	2.85	-70.59	678.31	4.17	33.41

Source: Author Computed.

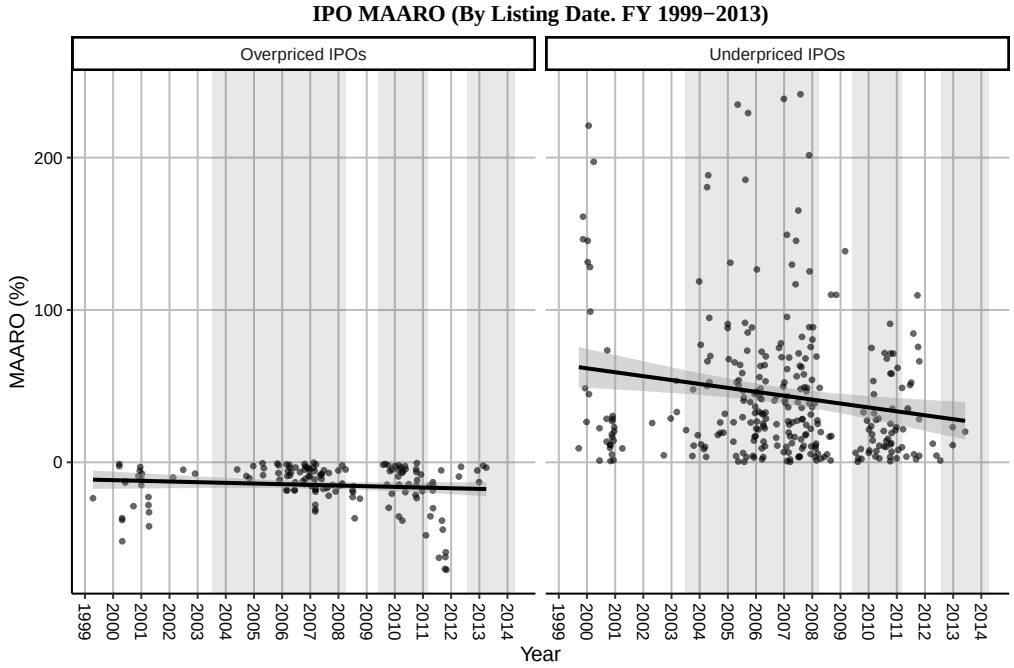
We now look at the summary statistics by splitting the sample into over and underpriced IPOs as presented in Table 4.3. The entire sample contains 148 overpriced and 297 underpriced IPOs respectively. The average issue size of overpriced IPOs is 333.46 Cr. (SD = 823.93, SE_M = 67.73, Min = 4.57, Max = 6038.55).The average issue size of underpriced IPOs is 406.52 Cr. (SD = 1312.92, SE_M = 76.18, Min = 2.50, Max = 15199.44). The average MAARO of overpriced IPOs is -15.01% (SD = 14.40, SE_M = 1.18, Min = -70.59, Max = -0.24). The average MAARO for underpriced IPOs is 47.95% (SD = 63.18, SE_M = 3.67, Min = 0.27, Max = 678.30). Frequencies and percentages for overpriced and underpriced IPOs are presented in appendix Tables B.1 and B.2.

Table 4.3: *Summary Statistics of IPOs - Full Sample (Over and Underpriced)*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Overpriced IPOs	333.46	823.93	148	67.73	4.57	6038.55	5.24	29.91
Underpriced IPOs	406.52	1312.92	297	76.18	2.50	15199.44	7.71	70.21
MAARO (%)								
Overpriced IPOs	-15.01	14.40	148	1.18	-70.59	-0.24	-1.79	3.38
Underpriced IPOs	47.95	63.18	297	3.67	0.27	678.31	4.57	34.82

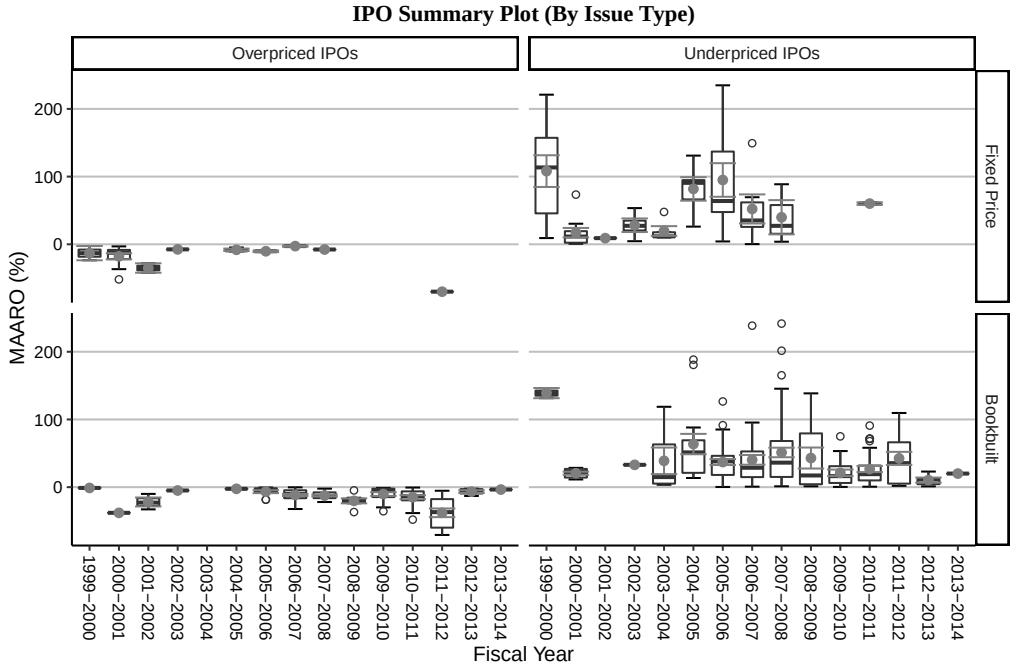
Source: Summarised from appendix Tables B.1 and B.2.

MAARO trend for all over and underpriced IPOs can be observed from Figure 4.2. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14. A majority of IPOs are listed during these bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time. This could be a result of firms pricing their IPOs correctly or could be a result of a majority of IPOs which were graded post-2007. This correction of MAARO, however, is not observed for overpriced IPOs since the trend line appears to be flat or moving away from zero. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.



Source: Computed from Equation 3.3
Figure 4.2: *Scatter Plot IPO Maaro (Entire Sample).*

4.3 IPO Trends (By Issue Type)



Source: Computed from Equation 3.3
Figure 4.3: *Summary Plot IPOs (By Issue Type).*

There are a few periods where no IPOs were issued using either pricing mechanism, which can be observed from Figure 4.3. There are fewer overpriced IPOs when they are split up by the pricing mechanism used. In comparison, there are more underpriced IPOs for both the pricing mechanisms. The variability in MAARO is much more significant for the underpriced fixed price than underpriced bookbuilt IPOs. Also, there are more outliers observed in underpriced bookbuilt than underpriced fixed price IPOs. For either pricing mechanism, the distribution of

MAARO is right-skewed for underpriced IPOs while that of overpriced IPOs is almost normal or slightly left-skewed. For Fixed price issues, the most frequently observed category of FY was 2000-2001 (n = 11, 44%). For bookbuilt issues, the most frequently observed category of FY was 2006-2007 (n = 32, 26.02%).

The summary statistics for the entire sample by issue type are presented in Table 4.4. The average issue size for fixed price IPOs is 47.68 Cr. (SD = 63.39, SE_M = 6.88, Min = 2.50, Max = 385, Skewness = 3.18, Kurtosis = 11.32). The average issue size for bookbuilt IPOs is 461.22 Cr. (SD = 1291.12, SE_M = 68.05, Min = 22.52, Max = 15199.44, Skewness = 7.09, Kurtosis = 62.40). The average MAARO for fixed price IPOs is 51.12% (SD = 102.19, SE_M = 11.08, Min = -69.97, Max = 678.30, Skewness = 3.35, Kurtosis = 15.74). The average MAARO for bookbuilt IPOs is 21.31% (SD = 43.05, SE_M = 2.27, Min = -70.59, Max = 241.60, Skewness = 1.75, Kurtosis = 5.05).

Table 4.4: *Summary Statistics of all IPOs, by Issue Type*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Fixed Priced	47.68	63.39	85	6.88	2.50	385.00	3.18	11.32
Bookbuilt	461.22	1291.12	360	68.05	22.52	15199.44	7.09	62.40
MAARO (%)								
Fixed Priced	51.12	102.19	85	11.08	-69.97	678.31	3.35	15.74
Bookbuilt	21.31	43.05	360	2.27	-70.59	241.60	1.75	5.05

Source: Author Computed.

The summary statistics for overpriced IPOs by issue type are presented in Table 4.5. The entire sample contains 148 overpriced IPOs consisting of 25 fixed price and 123 bookbuilt IPOs respectively. Overpriced fixed price issues have an average issue size of 44.38 Cr. (SD = 31.84, SE_M = 6.37, Min = 4.57, Max = 111.20). Overpriced bookbuilt issues have an average issue size of 392.22 Cr. (SD = 892.84, SE_M = 80.50, Min = 23.50, Max = 6038.55). The average MAARO of overpriced fixed price issues is -17.06% (SD = 17.12, SE_M = 3.42, Min = -69.97, Max = -1.71). The average MAARO of overpriced bookbuilt issues is -14.60% (SD = 13.82, SE_M = 1.25, Min = -70.59, Max = -0.24). Frequencies and percentages for overpriced IPOs split by issue type are presented in appendix Tables B.3 and B.4.

Table 4.5: *Summary Statistics of overpriced IPOs, by Issue Type*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Fixed Priced	44.38	31.84	25	6.37	4.57	111.20	0.85	-0.38
Bookbuilt	392.22	892.84	123	80.50	23.50	6038.55	4.77	24.51
MAARO (%)								
Fixed Priced	-17.06	17.12	25	3.42	-69.97	-1.71	-1.66	2.11
Bookbuilt	-14.60	13.82	123	1.25	-70.59	-0.24	-1.78	3.57

Source: Summarised from appendix Tables B.3 and B.4.

The summary statistics for underpriced IPOs by issue type are presented in Table 4.6. The entire sample contains 297 underpriced IPOs consisting of 60 fixed price and 237 bookbuilt IPOs

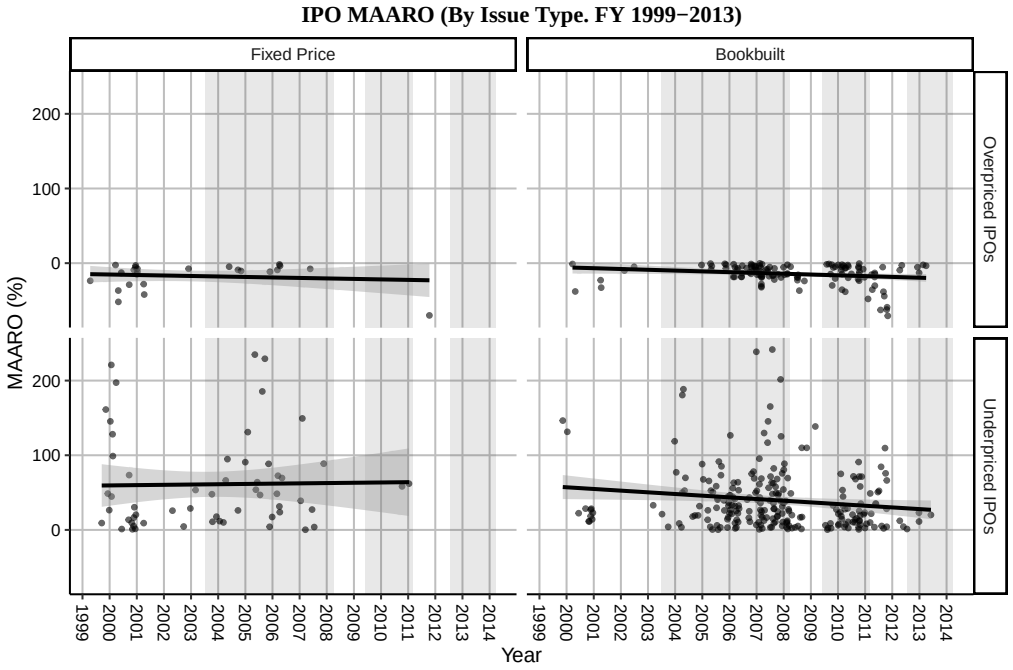
respectively. For underpriced fixed priced issues, the most frequently observed category of FY was 1999-2000 (n = 12, 20%). For underpriced bookbuilt issues, the most frequently observed category of FY was 2007-2008 (n = 53, 22.36%). The average issue size for underpriced fixed price issues is 49.05 Cr. (SD = 72.81, SE_M = 9.40, Min = 2.50, Max = 385.00). The average issue size for underpriced bookbuilt issues is 497.03 Cr. (SD = 1456.00, SE_M = 94.58, Min = 22.52, Max = 15199.44). The average MAARO for underpriced fixed price issues is 79.53% (SD = 109.35, SE_M = 14.12, Min = 0.27, Max = 678.30). The average MAARO for underpriced bookbuilt issues is 39.95% (SD = 41.22, SE_M = 2.68, Min = 0.31, Max = 241.60). Frequencies and percentages for underpriced IPOs split by issue type are presented in appendix Tables B.5 and B.6.

Table 4.6: *Summary Statistics of underpriced IPOs, by Issue Type*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Fixed Priced	49.05	72.81	60	9.40	2.50	385.00	2.92	8.51
Bookbuilt	497.03	1456.00	237	94.58	22.52	15199.44	6.91	56.02
MAARO (%)								
Fixed Priced	79.53	109.35	60	14.12	0.27	678.31	3.22	13.57
Bookbuilt	39.95	41.22	237	2.68	0.31	241.60	2.12	5.73

Source: Summarised from appendix Tables B.5 and B.6.

MAARO trend for all over and underpriced IPOs by issue type can be observed from Figure 4.4. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14.

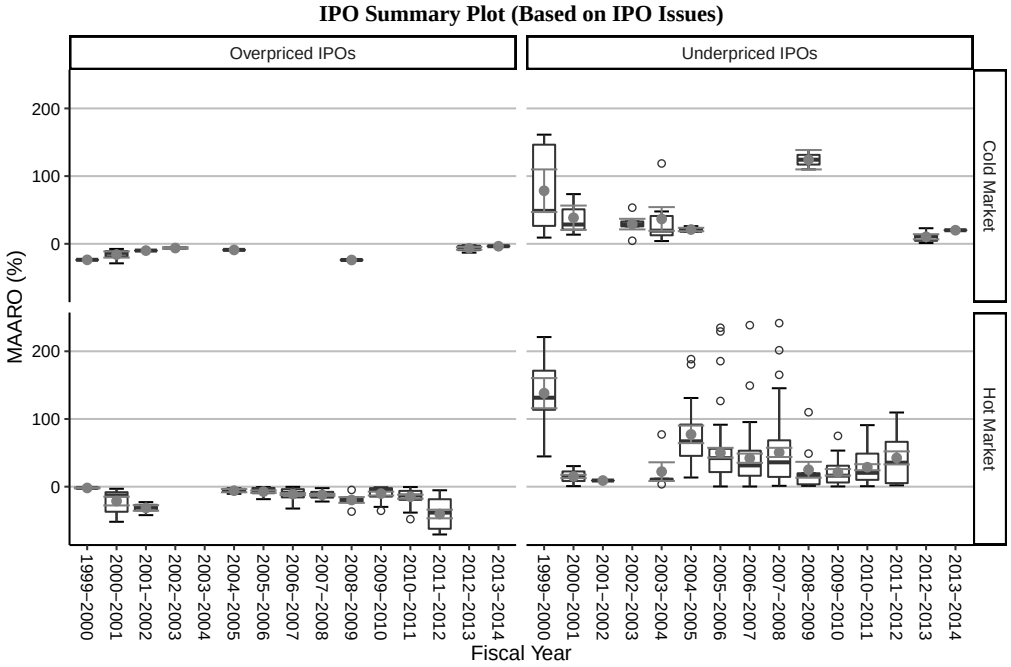


Source: Computed from Equation 3.3
Figure 4.4: *Scatter Plot IPO Maaro (By Issue Type).*

There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time in the case of bookbuilt IPOs but not with fixed price

IPOs. This could be a result of underwriters adjusting the IPO offer pricing based on market feedback using the bookbuilt pricing mechanism. This correction of MAARO, however, is not observed for overpriced IPOs using either pricing mechanism since the trend line appears to be flat or moving away from zero. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.

4.4 IPO Trends (Hot and Cold Markets)



Source: Computed from Equation 3.3
Figure 4.5: *Summary Plot IPOs (Based on IPO Issues).*

We identify a market to be hot if there are five or more IPOs released in a quarter. The underpriced hot market IPOs exhibit quite a few outliers in comparison with cold market IPOs, as shown in Figure 4.5. The variability of MAARO for overpriced IPOs is much smaller in comparison with underpriced IPOs. The range for underpriced cold market IPOs during FY 1999-2000 is the largest when compared with other periods. Distribution of MAARO shows us that overpriced IPOs exhibit a left-skew, while underpriced IPOs exhibit a right-skew. For overpriced cold market IPOs, the most frequently observed category of FY was 2012-2013 (n = 5, 31.25%). For Overpriced hot market IPOs, the most frequently observed category of FY was 2006-2007 (n = 34, 25.76%).

The summary statistics for the entire sample split by IPOs listed in hot and cold markets are shown in Table 4.7. During cold markets, the average issue size is 380.21 Cr. (SD = 989.62, SE_M = 145.91, Min = 10, Max = 5420.49, Skewness = 4.22, Kurtosis = 17.20). During hot

markets, the average issue size is 382.46 Cr. (SD = 1193.03, SE_M = 59.73, Min = 2.50, Max = 15199.44, Skewness = 8.04, Kurtosis = 79.01). During cold markets, the average MAARO is 23.46% (SD = 45.03, SE_M = 6.64, Min = -28.82, Max = 161.24, Skewness = 1.69, Kurtosis = 2.21). During hot markets, the average MAARO is 27.42% (SD = 61.63, SE_M = 3.09, Min = -70.59, Max = 678.30, Skewness = 4.23, Kurtosis = 33.48).

Table 4.7: *Summary Statistics of IPOs - Hot and Cold Markets*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Cold Market	380.21	989.62	46	145.91	10.00	5420.49	4.22	17.20
Hot Market	382.46	1193.03	399	59.73	2.50	15199.44	8.04	79.01
MAARO (%)								
Cold Market	23.46	45.03	46	6.64	-28.82	161.24	1.69	2.21
Hot Market	27.42	61.63	399	3.09	-70.59	678.31	4.23	33.48

Source: Author Computed.

The summary statistics for overpriced IPOs split by hot and cold markets is shown in Table 4.8. The entire sample contains 148 overpriced IPOs consisting of 16 cold market and 132 hot market IPOs, respectively. The average issue size for overpriced cold market issues is 412.69 Cr. (SD = 1021.04, SE_M = 255.26, Min = 23.93, Max = 4172.76). The average issue size for overpriced hot market issues is 323.86 Cr. (SD = 800.96, SE_M = 69.71, Min = 4.57, Max = 6038.55). The average MAARO for overpriced cold market issues is -11.14% (SD = 8.01, SE_M = 2.00, Min = -28.82, Max = -2.28). The average MAARO for overpriced hot market issues is -15.48% (SD = 14.94, SE_M = 1.30, Min = -70.59, Max = -0.24). Frequencies and percentages for overpriced IPOs split by IPOs listed in hot and cold markets are presented in appendix Tables B.7 and B.8.

Table 4.8: *Summary Statistics of Overpriced IPOs - Hot and Cold Markets*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Cold Market	412.69	1021.04	16	255.26	23.93	4172.76	3.42	10.09
Hot Market	323.86	800.96	132	69.71	4.57	6038.55	5.59	34.6
MAARO (%)								
Cold Market	-11.14	8.01	16	2.00	-28.82	-2.28	-0.98	-0.14
Hot Market	-15.48	14.94	132	1.30	-70.59	-0.24	-1.72	2.93

Source: Summarised from appendix Tables B.7 and B.8.

The summary statistics for underpriced IPOs split by hot and cold markets are shown in Table 4.9. The entire sample contains 297 underpriced IPOs consisting of 30 cold market and 267 hot market IPOs, respectively. For underpriced cold market IPOs, the most frequently observed category of FY was 2003-2004 (n = 6, 20%). For Overpriced hot market IPOs, the most frequently observed category of FY was 2007-2008 (n = 57, 21.35%). The average issue size for underpriced cold market issues is 362.88 Cr. (SD = 989.72, SE_M = 180.70, Min = 10.00, Max = 5420.49). The average issue size for underpriced hot market issues is 411.43 Cr. (SD = 1345.78, SE_M = 82.36, Min = 2.50, Max = 15199.44). The average MAARO for underpriced

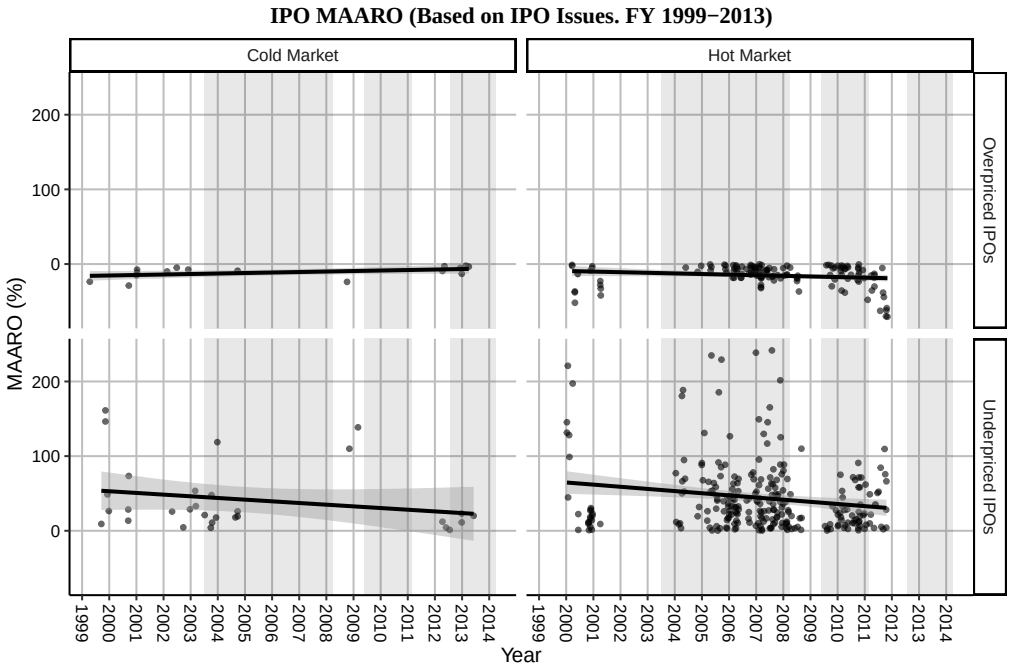
cold market issues is 41.92% (SD = 45.82, SE_M = 8.37, Min = 1.20, Max = 161.24). The average MAARO for underpriced hot market issues is 48.62% (SD = 64.87, SE_M = 3.97, Min = 0.27, Max = 678.30). Frequencies and percentages for underpriced IPOs split by IPOs listed hot and cold markets are presented in appendix Tables B.9 and B.10.

Table 4.9: *Summary Statistics of Underpriced IPOs - Hot and Cold Markets*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Cold Market	362.88	989.72	30	180.70	10.00	5420.49	4.67	21.34
Hot Market	411.43	1345.78	267	82.36	2.50	15199.44	7.77	69.99
MAARO (%)								
Cold Market	41.92	45.82	30	8.37	1.20	161.24	1.49	0.89
Hot Market	48.62	64.87	267	3.97	0.27	678.31	4.62	34.60

Source: Summarised from appendix Tables B.9 and B.10.

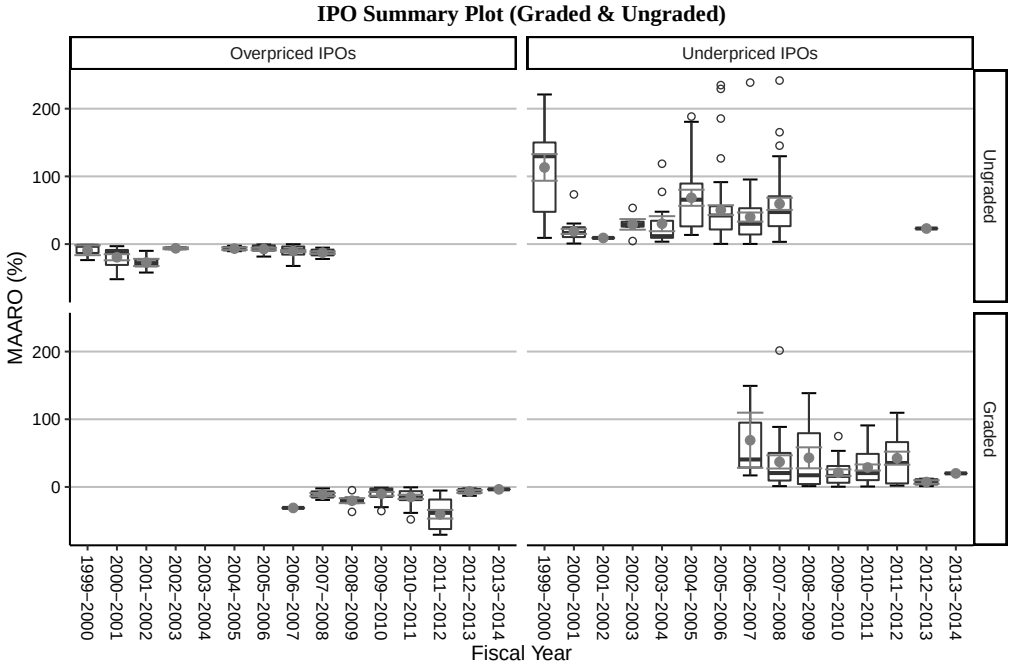
MAARO trends for all over and underpriced IPOs of IPOs listed in hot and cold markets are shown in Figure 4.6. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14. There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time in the case of IPOs issued in hot and cold market conditions. This correction of MAARO, however, is not observed for overpriced IPOs issued in hot markets since the trend line appears to be flat or moving away from zero. However, overpriced IPOs issued in cold markets do show correction with MAARO tending to revert to zero. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.



Source: Computed from Equation 3.3

Figure 4.6: *Scatter Plot IPO Maaro (Based on IPO Issues).*

4.5 IPO Trends (Graded and Ungraded)



Source: Computed from Equation 3.3
Figure 4.7: *Summary Plot IPOs (Graded and Ungraded).*

Ungraded underpriced IPOs exhibit quite a few outliers in comparison with underpriced graded IPOs, as shown in Figure 4.7. The variability of MAARO for overpriced IPOs is much smaller in comparison with underpriced IPOs. The range for underpriced ungraded IPOs during FY 1999-2000 is the largest when compared with other periods. Distribution of MAARO shows us that overpriced IPOs exhibit a left-skew, while underpriced IPOs exhibit a right-skew. For Overpriced ungraded IPOs, the most frequently observed category of FY was 2006-2007 (n = 33, 40.74%). For Overpriced graded IPOs, the most frequently observed category of FY was 2010-2011 (n = 18, 26.87%).

Summary statistics for the entire sample split by graded and ungraded IPOs is shown in Table 4.10. Ungraded IPOs had an average issue size of 293.17 Cr. (SD = 866.43, SE_M = 52.44, Min = 2.50, Max = 9187.50, Skewness = 6.75, Kurtosis = 53.66). Graded IPOs had an average issue size of 523.58 Cr. (SD = 1530.88, SE_M = 116.73, Min = 15.41, Max = 15199.44, Skewness = 7.03, Kurtosis = 57.07). Ungraded IPOs had an average MAARO of 35.98% (SD = 68.72, SE_M = 4.16, Min = -51.84, Max = 678.30, Skewness = 4.14, Kurtosis = 29.19). Graded IPOs had an average MAARO of 12.77% (SD = 39.17, SE_M = 2.99, Min = -70.59, Max = 201.55, Skewness = 1.35, Kurtosis = 3.67)

Table 4.10: *Summary Statistics - Graded and Ungraded IPOs*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Ungraded	293.17	866.43	273	52.44	2.50	9187.50	6.75	53.66
Graded	523.58	1530.88	172	116.73	15.41	15199.44	7.03	57.07
MAARO (%)								
Ungraded	35.98	68.72	273	4.16	-51.84	678.31	4.14	29.19
Graded	12.77	39.17	172	2.99	-70.59	201.55	1.35	3.67

Source: Author Computed.

The summary statistics for overpriced IPOs split by graded and ungraded IPOs is shown in Table 4.11. The entire sample contains 148 overpriced IPOs consisting of 81 ungraded and 67 graded IPOs respectively. Overpriced ungraded IPOs have an average issue size of 221.15 Cr. (SD = 660.18, SE_M = 73.35, Min = 4.57, Max = 5788.79). Overpriced graded IPOs have an average issue size of 469.24 Cr. (SD = 974.43, SE_M = 119.05, Min = 23.93, Max = 6038.55). The average MAARO of overpriced ungraded IPOs is -12.24% (SD = 10.38, SE_M = 1.15, Min = -51.84, Max = -0.24). The average MAARO of overpriced graded IPOs is -18.37% (SD = 17.62, SE_M = 2.15, Min = -70.59, Max = -0.55). Frequencies and percentages for overpriced IPOs split by graded and ungraded IPOs are presented in appendix Tables B.11 and B.12.

Table 4.11: *Summary Statistics of Overpriced IPOs - Graded and Ungraded*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Ungraded	221.15	660.18	81	73.35	4.57	5788.80	7.6	61.10
Graded	469.24	974.43	67	119.05	23.93	6038.55	3.98	17.30
MAARO (%)								
Ungraded	-12.24	10.38	81	1.15	-51.84	-0.24	-1.48	2.30
Graded	-18.37	17.62	67	2.15	-70.59	-0.55	-1.44	1.46

Source: Summarised from appendix Tables B.11 and B.12.

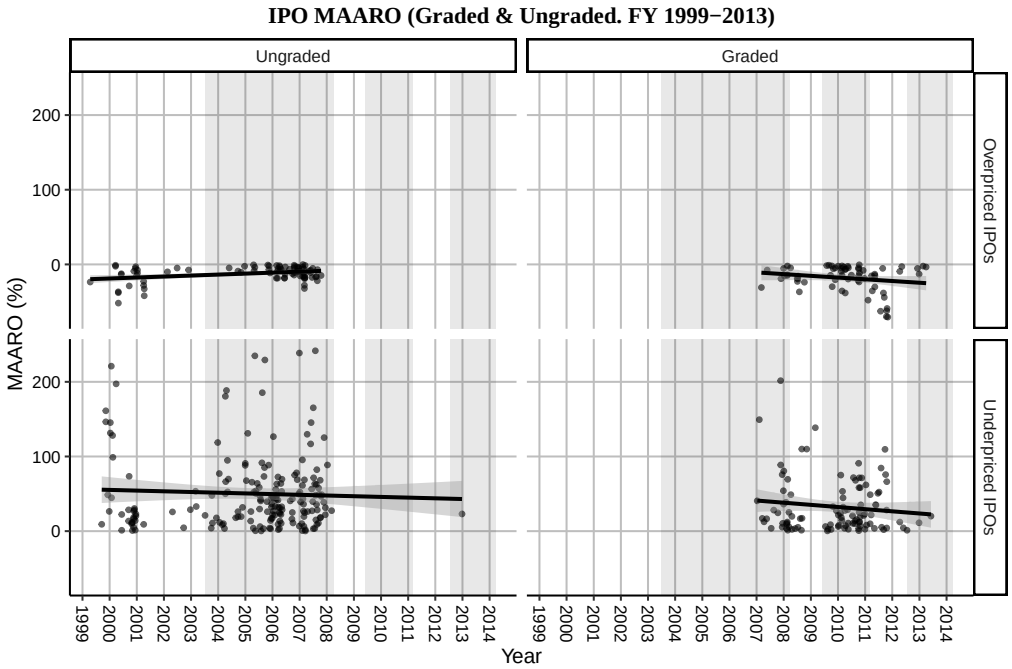
The summary statistics for underpriced IPOs split by graded and ungraded IPOs is shown in Table 4.12. The entire sample contains 297 underpriced IPOs consisting of 192 ungraded and 105 graded IPOs respectively. For underpriced ungraded IPOs, the most frequently observed category of FY was 2005-2006 (n = 49, 25.52%). For underpriced graded IPOs, the most frequently observed category of FY was 2010-2011 (n = 33, 31.43%). The average issue size for underpriced ungraded IPOs is 323.55 Cr. (SD = 939.89, SE_M = 67.83, Min = 2.50, Max = 9187.50). The average issue size for underpriced graded IPOs is 558.26 Cr. (SD = 1802.14, SE_M = 175.87, Min = 15.40, Max = 15199.44). The average MAARO of underpriced ungraded IPOs is 56.31% (SD = 72.65, SE_M = 5.24, Min = 0.27, Max = 678.30). The average MAARO of underpriced graded IPOs is 32.64% (SD = 36.09, SE_M = 3.52, Min = 0.37, Max = 201.55). Frequencies and percentages for underpriced IPOs split by graded and ungraded IPOs are presented in appendix Tables B.13 and B.14.

Table 4.12: *Summary Statistics of Underpriced IPOs - Graded and Ungraded*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Ungraded	323.55	939.89	192	67.83	2.50	9187.50	6.39	48.37
Graded	558.26	1802.14	105	175.87	15.41	15199.44	6.66	47.06
MAARO (%)								
Ungraded	56.31	72.65	192	5.24	0.27	678.31	4.27	28.36
Graded	32.64	36.09	105	3.52	0.37	201.55	1.92	4.52

Source: Summarised from appendix Tables B.13 and B.14.

MAARO trends for all over and underpriced IPOs for graded and ungraded IPOs are shown in Figure 4.8. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14.

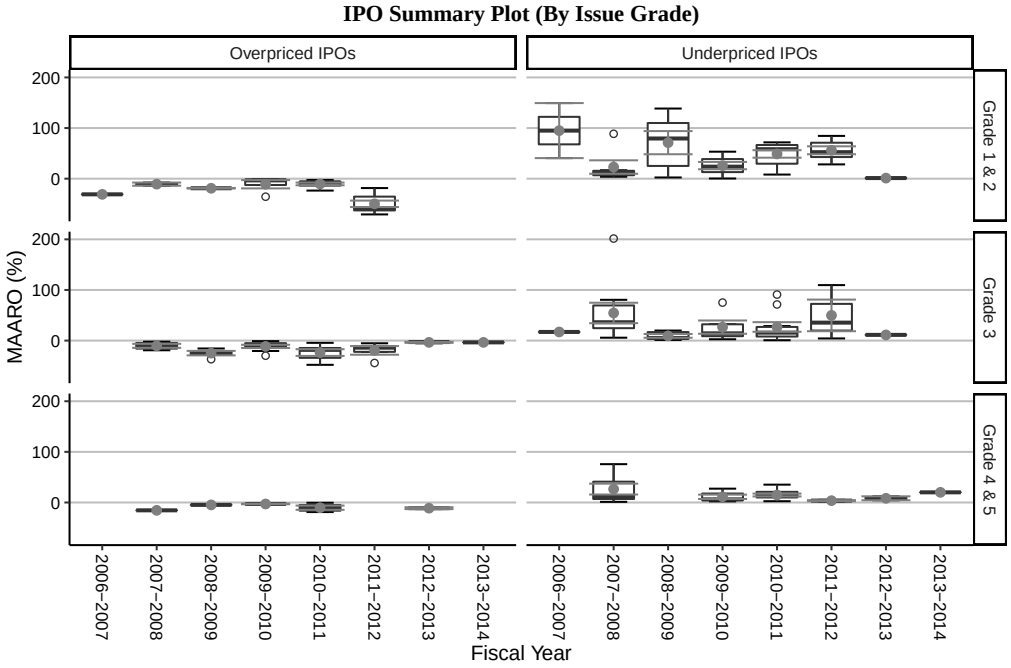


Source: Computed from Equation 3.3

Figure 4.8: *Scatter Plot IPO Maaro (Graded and Ungraded).*

There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time in the case of graded IPOs but not in the case of ungraded IPOs. This correction where MAARO is reverting to zero is not observed for overpriced graded IPOs but is visible in the case of overpriced ungraded IPOs. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.

4.6 IPO Trends (Graded)



Source: Computed from Equation 3.3
Figure 4.9: *Summary Plot IPOs (Graded).*

Underpriced grade 3 IPOs exhibit quite a few outliers in comparison with other graded IPOs, as shown in Figure 4.9. The variability of MAARO for overpriced IPOs is much smaller in comparison with underpriced IPOs. The variability and range of MAARO for underpriced IPOs are the greatest for grade 1 & 2 IPOs. Distribution of MAARO shows us that overpriced IPOs exhibit a left-skew, while underpriced IPOs exhibit a right-skew. For overpriced grade 1 & 2 IPOs, the most frequently observed category of FY was 2011-2012 (n = 9, 34.62%). For overpriced grade 3 IPOs, the most frequently observed category of FY was 2009-2010 (n = 9, 29.03%). For overpriced grade 4 & 5 IPOs, the most frequently observed category of FY was 2010-2011 (n = 4, 40%).

Summary statistics for the entire sample by IPO grade are shown in Table 4.13. The average issue size of grade 1 & 2 IPOs is 100.57 Cr. (SD = 185.55, SE_M = 23.01, Min = 15.40, Max = 1500, Skewness = 6.81, Kurtosis = 48.47). The average issue size of grade 3 IPOs is 434.11 Cr. (SD = 888.56, SE_M = 110.21, Min = 23.93, Max = 6038.55, Skewness = 4.54, Kurtosis = 23.69). The average issue size of grade 4 & 5 IPOs is 1316.72 Cr. (SD = 2747.27, SE_M = 423.91, Min = 75, Max = 15199.44, Skewness = 4.00, Kurtosis = 15.98). The average MAARO of grade 1 & 2 IPOs is 17.75% (SD = 48.07, SE_M = 5.96, Min = -70.59, Max = 149.32, Skewness = 0.49, Kurtosis = 0.11). The average MAARO of grade 3 IPOs is 9.84% (SD = 39.31, SE_M = 4.88, Min = -47.91, Max = 201.55, Skewness = 2.28, Kurtosis = 7.68). The average MAARO of grade 4 & 5 IPOs is 9.60% (SD = 17.82, SE_M = 2.75, Min = -18.91, Max

= 75.71, Skewness = 1.45, Kurtosis = 3.43).

Table 4.13: *Summary Statistics - Graded IPOs*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Grade 1 & 2	100.57	185.55	65	23.02	15.41	1500.00	6.81	48.47
Grade 3	434.11	888.56	65	110.21	23.93	6038.55	4.54	23.69
Grade 4 & 5	1316.72	2747.27	42	423.91	75.00	15199.44	4.00	15.98
MAARO (%)								
Grade 1 & 2	17.75	48.07	65	5.96	-70.59	149.32	0.49	0.11
Grade 3	9.85	39.31	65	4.88	-47.91	201.55	2.28	7.68
Grade 4 & 5	9.60	17.82	42	2.75	-18.91	75.71	1.45	3.43

Source: Author Computed.

Summary statistics for overpriced graded IPOs are shown in Table 4.14. The entire sample contains 67 Overpriced IPOs consisting of 26 grade 1 & 2 , 31 grade 3 and 10 grade 4 & 5 IPOs respectively. Overpriced grade 1 & 2 IPOs have an average issue size of 141.34 Cr. (SD = 286.86, SE_M = 56.26, Min = 29.60, Max = 1500.00). Overpriced Grade 3 IPOs have an average issue size of 572.77 Cr. (SD = 1127.21, SE_M = 202.45, Min = 23.93, Max = 6038.55). Overpriced grade 4 & 5 IPOs have an average issue size of 1000.88 Cr. (SD = 1355.59, SE_M = 428.67, Min = 75.00, Max = 4172.76). The average MAARO for overpriced grade 1 & 2 IPOs is -25.55% (SD = 22.48, SE_M = 4.41, Min = -70.59, Max = -1.60). The average MAARO for overpriced grade 3 IPOs is -15.39% (SD = 12.87, SE_M = 2.31, Min = -47.91, Max = -1.09). The average MAARO for overpriced grade 4 & 5 IPOs is -8.95% (SD = 6.40, SE_M = 2.02, Min = -18.91, Max = -0.55). Frequencies and percentages for overpriced graded IPOs are presented in appendix Tables B.15, B.16 and B.17.

Table 4.14: *Summary Statistics of Overpriced IPOs - Graded*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Grade 1 & 2	141.34	286.86	26	56.26	29.60	1500.00	4.34	17.97
Grade 3	572.77	1127.21	31	202.45	23.93	6038.55	3.98	16.27
Grade 4 & 5	1000.88	1355.59	10	428.67	75.00	4172.76	1.60	1.09
MAARO (%)								
Grade 1 & 2	-25.55	22.48	26	4.41	-70.59	-1.60	-0.84	-0.58
Grade 3	-15.39	12.87	31	2.31	-47.91	-1.09	-1.02	0.25
Grade 4 & 5	-8.95	6.40	10	2.02	-18.91	-0.55	-0.20	-1.40

Source: Summarised from appendix Tables B.15, B.16, and B.17.

Summary statistics for underpriced graded IPOs are shown in Table 4.15.The entire sample contains 105 underpriced IPOs consisting of 39 grade 1 & 2 , 34 grade 3 and 32 grade 4 & 5 IPOs respectively. For underpriced Grade 1 & 2 IPOs, the most frequently observed category of FY was 2010-2011 (n = 10, 25.64%). For underpriced Grade 3 IPOs, the most frequently observed category of FY was 2010-2011 (n = 10, 29.41%). For underpriced Grade 4 & 5 IPOs, the most frequently observed category of FY was 2010-2011 (n = 13, 40.63%). Underpriced grade 1 & 2 IPOs have an average issue size of 73.39 Cr. (SD = 44.18, SE_M = 7.07, Min = 15.40, Max = 190.45). Underpriced grade 3 IPOs have an average issue size of 307.69 Cr. (SD = 584.46,

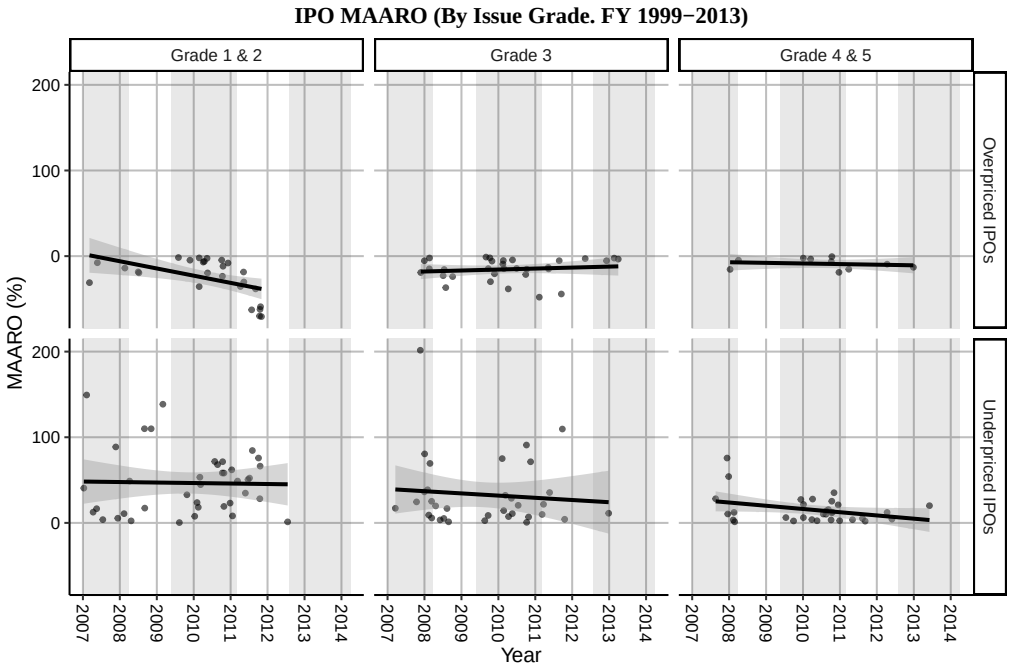
SE_M = 100.23, Min = 36.90, Max = 3016.52). Underpriced grade 4 & 5 IPOs have an average issue size of 1415.42 Cr. (SD = 3066.99, SE_M = 542.17, Min = 99.00, Max = 15199.44). The average MAARO for underpriced grade 1 & 2 IPOs is 46.62% (SD = 37.70, SE_M = 6.04, Min = 0.37, Max = 149.32). The average MAARO for underpriced grade 3 IPOs is 32.85% (SD = 41.26, SE_M = 7.08, Min = 0.69, Max = 201.55). The average MAARO for underpriced grade 4 & 5 IPOs is 15.40% (SD = 16.20, SE_M = 2.86, Min = 1.27, Max = 75.71). Frequencies and percentages for underpriced graded IPOs are presented in appendix Tables B.18, B.19 and B.20.

Table 4.15: *Summary Statistics of Underpriced IPOs - Graded*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Grade 1 & 2	73.39	44.18	39	7.07	15.41	190.45	1.11	0.71
Grade 3	307.69	584.46	34	100.23	36.90	3016.52	3.50	12.44
Grade 4 & 5	1415.42	3066.99	32	542.17	99.00	15199.44	3.70	12.76
MAARO (%)								
Grade 1 & 2	46.62	37.70	39	6.04	0.37	149.32	0.90	0.37
Grade 3	32.85	41.26	34	7.08	0.69	201.55	2.38	6.44
Grade 4 & 5	15.40	16.20	32	2.86	1.27	75.71	2.08	4.74

Source: Summarised from appendix Tables B.18, B.19, and B.20.

MAARO trends for all over and underpriced graded IPOs are shown in Figure 4.10. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14.

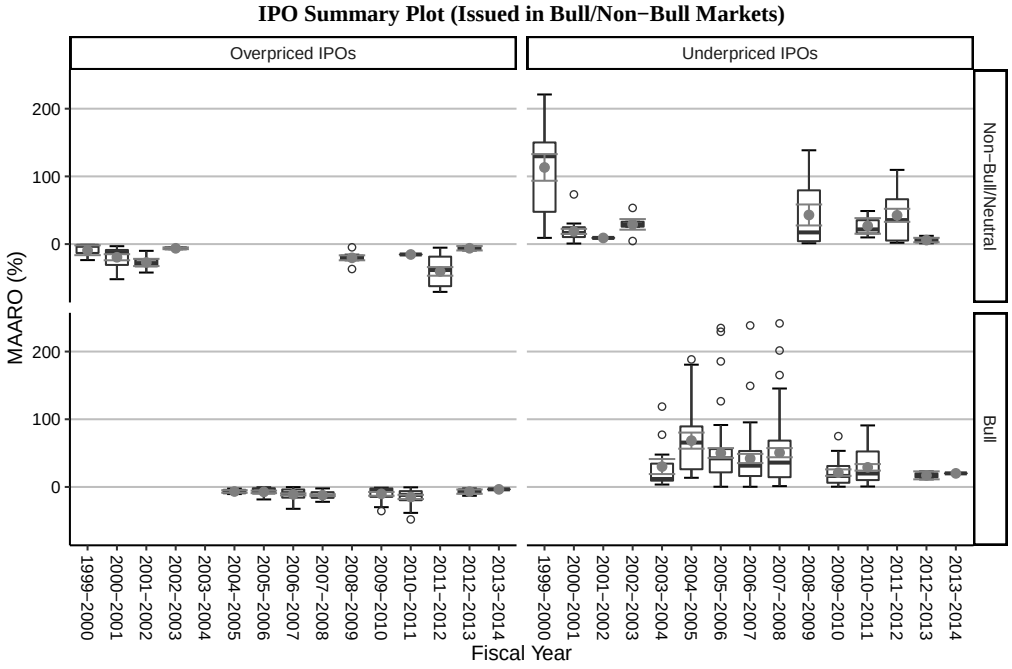


Source: Computed from Equation 3.3

Figure 4.10: *Scatter Plot IPO Maaro (Graded. FY 1999-2013).*

There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time in the case of Grade 3 and Grade 4 & 5 IPOs but not in the case of Grade 1 & 2 IPOs. In the case of overpriced IPOs, MAARO has been reverting to zero over time in the case of Grade 3 IPOs only but not with Grade 1 & 2 and Grade 4 & 5 IPOs.

4.7 IPO Trends (Bull and Non-Bull Markets)



Source: Computed from Equation 3.3
Figure 4.11: *Summary Plot - IPOs listed in bull and non-bull markets.*

Bull period underpriced IPOs exhibit quite a few outliers in comparison with non-bull period IPOs, as shown in Figure 4.11. The variability of MAARO for overpriced IPOs is much smaller in comparison with underpriced IPOs. The range for underpriced non-bull IPOs during FY 1999-2000 is the largest when compared with other periods. Distribution of MAARO shows us that overpriced IPOs exhibit a left-skew, while underpriced IPOs exhibit a right-skew. For overpriced non-bull market issues, the most frequently observed category of FY was 2011-2012 (n = 13, 28.89%). For overpriced bull market issues, the most frequently observed category of FY was 2006-2007 (n = 34, 33.01%).

Summary statistics for the entire sample split by IPOs listed in bull and non-bull markets are shown in Table 4.16. Non-bull period IPOs have an average issue size of 130.40 Cr. (SD = 206.11, SE_M = 19.30, Min = 2.50, Max = 1245.00, Skewness = 3.21, Kurtosis = 10.75). Bull period IPOs have an average issue size of 468.96 Cr. (SD = 1343.93, SE_M = 73.87, Min = 7.50, Max = 15199.44, Skewness = 6.82, Kurtosis = 57.46). The average MAARO during non-bull periods is 25.61% (SD = 87.24, SE_M = 8.17, Min = -70.59, Max = 678.31, Skewness = 4.39, Kurtosis = 27.31). The average MAARO during bull periods is 27.49% (SD = 47.46, SE_M = 2.61, Min = -47.91, Max = 264.06, Skewness = 2.16, Kurtosis = 6.24).

Table 4.16: *Summary Statistics - IPOs listed in Bull and Non-Bull periods*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Non-Bull Market	130.40	206.11	114	19.30	2.50	1245.00	3.21	10.75
Bull Market	468.96	1343.93	331	73.87	7.50	15199.44	6.82	57.46
MAARO (%)								
Non-Bull Market	25.61	87.24	114	8.17	-70.59	678.31	4.39	27.31
Bull Market	27.49	47.46	331	2.61	-47.91	264.06	2.16	6.24

Source: Author Computed.

Summary statistics for overpriced IPOs listed in bull and non-bull markets are shown in Table 4.17. The entire sample contains 148 overpriced IPOs consisting of 45 non-bull and 103 bull market IPOs, respectively. The average issue size for overpriced non-bull market issues is 142.38 Cr. (SD = 199.65, SE_M = 29.76, Min = 4.57, Max = 834.02). The average issue size for overpriced bull market issues is 416.95 Cr. (SD = 968.51, SE_M = 95.43, Min = 20.00, Max = 6038.55). The average MAARO for overpriced non-bull market issues is -24.49% (SD = 19.28, SE_M = 2.87, Min = -70.59, Max = -1.14). The average MAARO for overpriced bull market issues is -10.87% (SD = 9.03, SE_M = 0.89, Min = -47.91, Max = -0.24). Frequencies and percentages for overpriced IPOs listed in bull and non-bull markets are presented in appendix Tables B.21 and B.22.

Table 4.17: *Summary Statistics of Overpriced IPOs listed in bull and non-bull markets*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Non-Bull Market	142.38	199.65	45	29.76	4.57	834.02	2.56	5.80
Bull Market	416.95	968.51	103	95.43	20.00	6038.55	4.4	20.35
MAARO (%)								
Non-Bull Market	-24.49	19.28	45	2.87	-70.59	-1.14	-0.91	-0.10
Bull Market	-10.87	9.03	103	0.89	-47.91	-0.24	-1.42	2.50

Source: Summarised from appendix Tables B.21 and B.22.

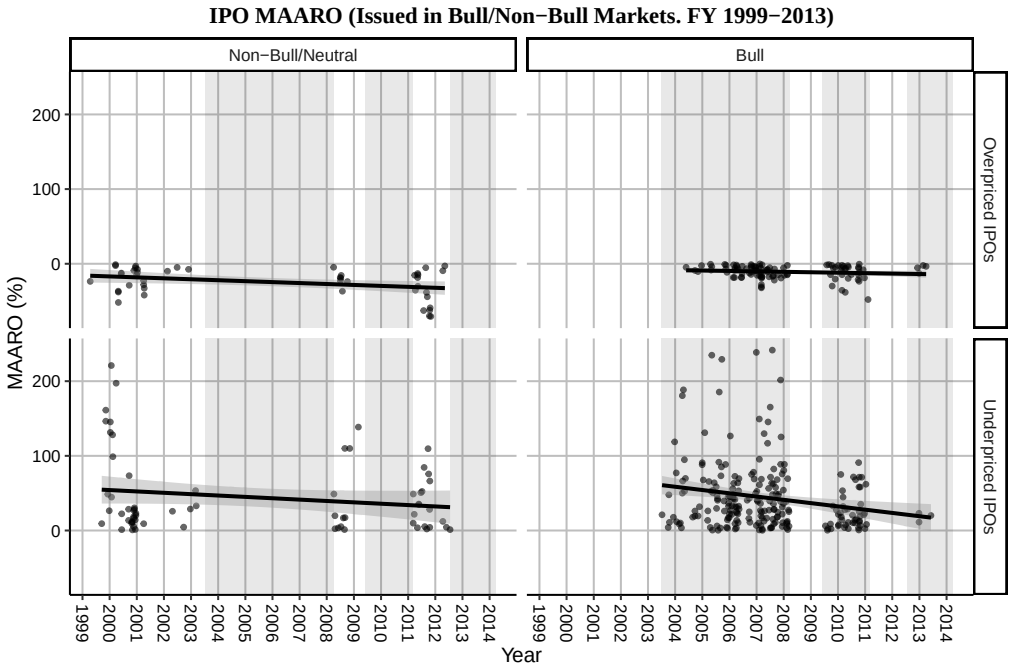
Summary statistics for underpriced IPOs listed in bull and non-bull markets are shown in Table 4.18. The entire sample contains 297 underpriced IPOs consisting of 69 non-bull and 228 bull market IPOs respectively. For underpriced non-bull market issues, the most frequently observed category of FY was 2000-2001 (n = 19, 27.54%). For underpriced bull market issues, the most frequently observed category of FY was 2007-2008 (n = 57, 25%). The average issue size for underpriced non-bull market issues is 122.58 Cr. (SD = 211.29, SE_M = 25.44, Min = 2.50, Max = 1245.00). The average issue size for underpriced bull market issues is 492.46 Cr. (SD = 1484.05, SE_M = 98.28, Min = 7.50, Max = 15199.44). The average MAARO for underpriced non-bull market issues is 58.29% (SD = 98.30, SE_M = 11.83, Min = 0.83, Max = 678.30). The average MAARO for underpriced bull market issues is 44.82% (SD = 47.62, SE_M = 3.15, Min = 0.27, Max = 264.06). Frequencies and percentages for underpriced IPOs listed in bull and non-bull markets are presented in appendix Tables B.23 and B.24.

Table 4.18: *Summary Statistics of Underpriced IPOs listed in bull and non-bull markets*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Non-Bull Market	122.58	211.29	69	25.44	2.50	1245.00	3.59	13.49
Bull Market	492.46	1484.05	228	98.28	7.50	15199.44	6.79	53.94
MAARO (%)								
Non-Bull Market	58.29	98.30	69	11.83	0.83	678.31	4.21	22.01
Bull Market	44.82	47.62	228	3.15	0.27	264.06	2.25	5.89

Source: Summarised from appendix Tables B.23 and B.24.

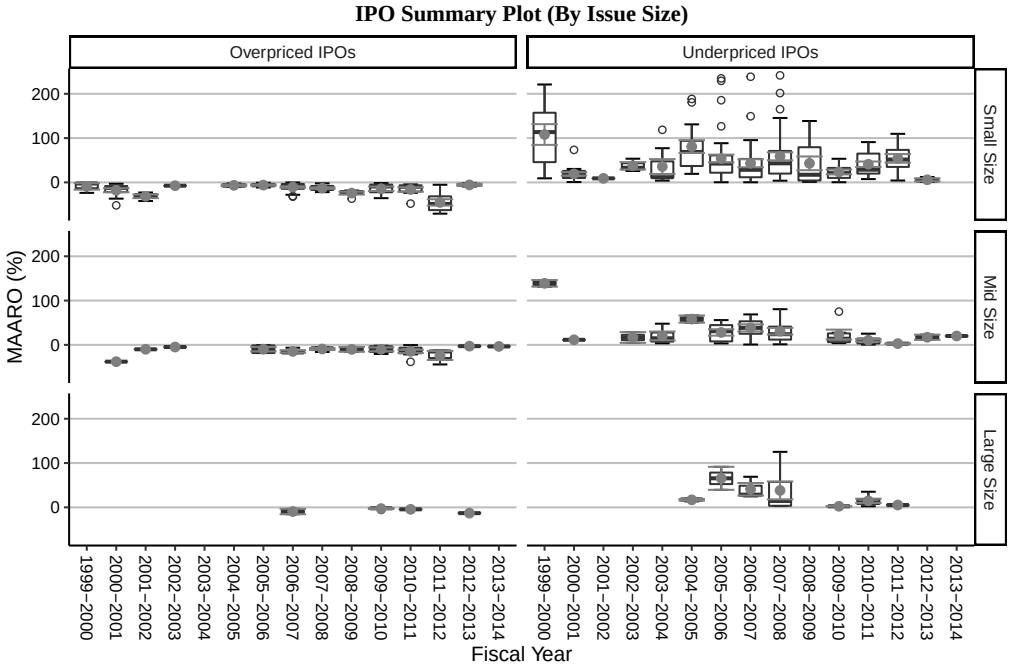
MAARO trends for all over and underpriced IPOs listed in bull and non-bull markets are shown in Figure 4.12. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14. There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs, MAARO has been decreasing over time in the case of IPOs issued in non-bull and bull markets, although the correction in the case of bull markets is higher than non-bull markets. This correction of MAARO, however, is not observed for overpriced IPOs issued in non-bull or bull markets since the trend line appears to be flat or moving away from zero. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.



Source: Computed from Equation 3.3

Figure 4.12: *Scatter Plot IPO Maaro (Based on Market Condition).*

4.8 IPO Trends (By Issue Size)



Source: Computed from Equation 3.3
Figure 4.13: *Summary Plot IPOs (By Issue Size).*

Underpriced small-size IPOs exhibit quite a few outliers in comparison with underpriced mid or large-size IPOs, as illustrated in Figure 4.13. The variability of MAARO for overpriced IPOs is much smaller in comparison with underpriced IPOs. The variability for small-size IPOs is also the most when compared across over or underpriced IPOs. The range for underpriced small-size IPOs during FY 1999-2000 is the largest when compared with other periods. Distribution of MAARO shows us that overpriced IPOs exhibit a left-skew, while underpriced IPOs exhibit a right-skew. For small-size IPOs, the most frequently observed category of FY was 2006-2007 (n = 28, 26.67%). For mid-size IPOs, the most frequently observed category of FY was 2010-2011 (n = 9, 25.71%). For large-size IPOs, the most frequently observed category of FY was 2009-2010 (n = 4, 50%).

Summary statistics for the entire sample split by issue size categories (small, medium and large-size) are shown in Table 4.19. Small-size IPOs havean average issue size of 74.47 Cr. (SD = 46.80, SE_M = 2.61, Min = 2.50, Max = 198, Skewness = 0.65, Kurtosis = -0.41). Mid-size IPOs have an average issue size of 465.63 Cr. (SD = 222.43, SE_M = 23.07, Min = 200, Max = 997.1, Skewness = 0.76, Kurtosis = -0.54). Large-size IPOs have an average issue size of 3318.78 Cr. (SD = 3198.54, SE_M = 574.48, Min = 1028.61, Max = 15199.44, Skewness = 2.20, Kurtosis = 4.77). Small-sizePOs have an average MAARO of 31.74% (SD = 67.37, SE_M = 3.76, Min = -70.59, Max = 678.30, Skewness = 3.89, Kurtosis = 27.81). Mid-size IPOs have an average MAARO of 13.38% (SD = 32.18, SE_M = 3.34, Min = -44.20, Max = 146.4 Skewness =

1.51, Kurtosis = 3.52). Large-size IPOs have an average MAARO of 18.85% (SD = 31.39, SE_M = 5.64, Min = -15.48, Max = 125.30, Skewness = 1.85, Kurtosis = 3.15).

Table 4.19: *Summary Statistics - By Issue Size*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Small Size	74.47	46.80	321	2.61	2.50	198.00	0.65	-0.41
Mid Size	465.63	222.44	93	23.07	200.00	997.19	0.76	-0.54
Large Size	3318.78	3198.54	31	574.48	1028.61	15199.44	2.20	4.77
MAARO (%)								
Small Size	31.75	67.37	321	3.76	-70.59	678.31	3.89	27.81
Mid Size	13.38	32.18	93	3.34	-44.20	146.43	1.51	3.52
Large Size	18.85	31.39	31	5.64	-15.48	125.31	1.85	3.15

Source: Author Computed.

Summary statistics for overpriced IPOs split by issue size categories are shown in Table 4.20. The entire sample contains 148 overpriced IPOs consisting of 105 small-size and 35 mid-size and 8 large-size IPOs respectively. The average issue size for overpriced small-size issues is 76.71 Cr. (SD = 43.83, SE_M = 4.28, Min = 4.57, Max = 192.00). The average issue size for overpriced mid-size issues is 457.58 Cr. (SD = 233.29, SE_M = 39.43, Min = 200.00, Max = 900.00). The average issue size for overpriced large-size issues is 3160.40 Cr. (SD = 1940.11, SE_M = 685.93, Min = 1067.34, Max = 6038.55). The average MAARO for overpriced small-size issues is -16.32% (SD = 15.65, SE_M = 1.53, Min = -70.59, Max = -0.24). The average MAARO for overpriced mid-size issues is -13.16% (SD = 10.65, SE_M = 1.80, Min = -44.20, Max = -0.55). The average MAARO for overpriced large-size issues is -5.97% (SD = 5.36, SE_M = 1.90, Min = -15.48, Max = -1.09). Frequencies and percentages for overpriced IPOs split by issue size categories are presented in appendix Tables B.25, B.26 and B.27.

Table 4.20: *Summary Statistics of Overpriced IPOs - By Issue Size*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Small Size	76.71	43.83	105	4.28	4.57	192.00	0.58	-0.40
Mid Size	457.58	233.29	35	39.43	200.00	900.00	0.63	-1.10
Large Size	3160.40	1940.11	8	685.93	1067.34	6038.55	0.54	-1.29
MAARO (%)								
Small Size	-16.32	15.65	105	1.53	-70.59	-0.24	-1.68	2.60
Mid Size	-13.16	10.65	35	1.80	-44.20	-0.55	-1.21	1.38
Large Size	-5.97	5.36	8	1.90	-15.48	-1.09	-0.96	-0.69

Source: Summarised from appendix Tables B.25, B.26, and B.27.

Summary statistics for underpriced IPOs split by issue size categories are shown in Table 4.21. The entire sample contains 297 underpriced IPOs consisting of 216 small-size and 58 mid-size and 23 large-size IPOs, respectively. For underpriced small-size issues, the most frequently observed categories of FY were 2005-2006 and 2007-2008, each with an observed frequency of 39 (18.06%). For underpriced mid-size issues, the most frequently observed category of FY was 2007-2008 (n = 12, 20.69%). For underpriced large-size issues, the most frequently observed categories of FY were 2007-2008 and 2010-2011, each with an observed frequency

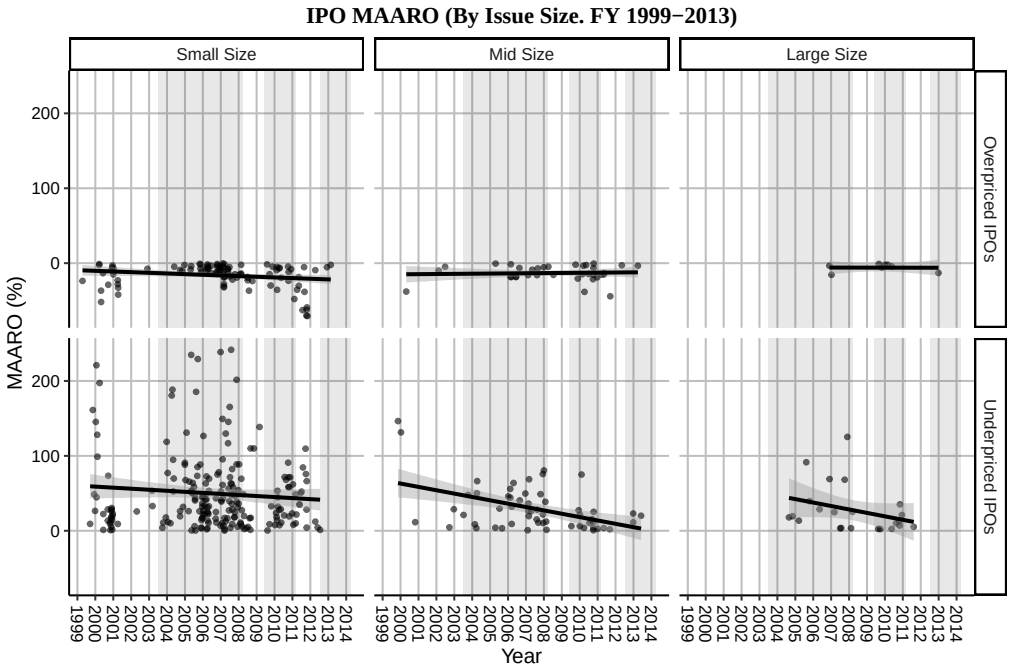
of 6 (26.09%). The average issue size for underpriced small-size issues is 73.38 Cr. (SD = 48.24, SE_M = 3.28, Min = 2.50, Max = 198.00). The average issue size for underpriced mid-size issues is 470.50 Cr. (SD = 217.56, SE_M = 28.57, Min = 200.02, Max = 997.19). The average issue size for underpriced large-size issues is 3373.87 Cr. (SD = 3569.45, SE_M = 744.28, Min = 1028.61, Max = 15199.44). The average MAARO for underpriced small-size issues is 55.11% (SD = 70.42, SE_M = 4.79, Min = 0.27, Max = 678.30). The average MAARO for underpriced mid-size issues is 29.39% (SD = 30.17, SE_M = 3.96, Min = 0.69, Max = 146.43). The average MAARO for underpriced large-size issues is 27.48% (SD = 32.13, SE_M = 6.70, Min = 2.25, Max = 125.30). Frequencies and percentages for underpriced IPOs split by issue size categories are presented in appendix Tables B.28, B.29 and B.30.

Table 4.21: *Summary Statistics of Underpriced IPOs - By Issue Size*

Variable	Mean	Std. Dev.	n	SE_M	Min	Max	Skewness	Kurtosis
Issue Size (Cr.)								
Small Size	73.38	48.24	216	3.28	2.50	198.00	0.69	-0.42
Mid Size	470.50	217.56	58	28.57	200.02	997.19	0.87	-0.13
Large Size	3373.87	3569.45	23	744.28	1028.61	15199.44	2.11	3.74
MAARO (%)								
Small Size	55.11	70.42	216	4.79	0.27	678.31	4.25	28.93
Mid Size	29.39	30.17	58	3.96	0.69	146.43	1.86	4.04
Large Size	27.48	32.13	23	6.70	2.25	125.31	1.71	2.21

Source: Summarised from appendix Tables B.28, B.29, and B.30.

MAARO trends for all over and underpriced IPOs categorised by issue size is shown in Figure 4.14. The shaded columns represent bull periods encountered between FY 1999-00 and 2013-14.



Source: Computed from Equation 3.3

Figure 4.14: *Scatter Plot IPO Maaro (By Issue Size).*

There are a majority of IPOs listed during bull periods. In the case of underpriced IPOs,

MAARO has been decreasing over time in the case of small, mid, and large-size IPOs with the largest decreases observed for mid and large-size IPOs. This correction of MAARO, however, is not observed for overpriced IPOs for any of the issue sizes. From the trend line, it can be observed that the standard error increases during non-bull periods when a few IPOs are issued in comparison to the standard error during bull periods.

4.9 Summary and Conclusions

The first study presents a descriptive analysis of all IPOs (excluding SME IPOs and FPOs) listed on the NSE in India between the fiscal year 1999 and 2013. Out of the 445 IPOs issued in this period, over and underpriced IPOs were 33.26% and 66.75%, respectively. Underpriced IPOs are twice as that of overpriced IPOs. A majority of these IPOs are listed during the three bull periods encountered in the period of study. The MAARO trendline for overpriced IPOs indicates that the overpricing of IPOs continues to be prevalent in the Indian stock markets since there is no tendency of the trendline to revert towards zero. An important point here is that in the case of overpriced IPOs, the investors do not experience any short-run gains while the listing firms raise more capital when IPOs are overpriced. The decreasing trend in MAARO in the case of underpriced IPOs indicates that investment banks/syndicates are making an effort to price the IPOs correctly. This could also be a result of graded IPOs, which was made mandatory by SEBI in 2007.

Usage of the bookbuilt mechanism allows for revision to the offer price based on market feedback. From the MAARO trendline for underpriced IPOs, we see that there is an absence of any tendency to reduce overpricing using either pricing mechanism. In the case of overpriced IPOs, 16.89% and 83.10% IPOs were issued using the fixed-price and bookbuilt mechanism, respectively. The mean MAARO in the case of overpriced IPOs -17.06% and -14.60% for IPOs issued using the fixed-price and bookbuilt mechanism, respectively.

A declining trend of MAARO is observed in the case of underpriced bookbuilt issues. A declining trend in MAARO is not observed for underpriced fixed-price IPOs. In the case of underpriced IPOs, 20.20% and 79.80% IPOs were issued using the fixed-price and bookbuilt mechanism, respectively. The mean MAARO in the case of underpriced IPOs 79.53% and 39.95% for IPOs issued using the fixed-price and bookbuilt mechanism, respectively.

MAARO exhibits a declining trend for underpriced IPOs issued in hot and cold market conditions as well as for overpriced IPOs in cold markets but not so in hot markets. In the case

of overpriced IPOs, only 16 IPOs were listed in cold conditions, while 132 IPOs were listed in hot conditions. Underwriters are more likely to overprice IPOs in hot market conditions than in cold markets. The mean MAARO in the case of overpriced IPOs during hot markets is -15.48%, while that in cold markets is -11.14%. Underwriters are also more likely to underprice IPOs in hot market conditions than in cold markets. The mean MAARO in the case of underpriced IPOs during hot markets is 48.62%, while that in cold markets is 41.92%.

MAARO exhibits a decreasing trend for overpriced ungraded IPOs but not so for overpriced graded IPOs. The mean MAARO for overpriced graded IPOs is -18.37%, while that of ungraded IPOs is -12.24%. This indicates that underwriters extract a premium from investors for graded IPOs.

MAARO exhibits a decreasing trend for underpriced graded as well as ungraded IPOs. The mean MAARO for underpriced graded IPOs is 32.64%, while that of ungraded IPOs is 56.31%. Underwriters underprice ungraded IPOs much more than graded IPOs to compensate investors for the risk that they take by investing in ungraded IPOs.

MAARO trend is trending to zero over time in the case of overpriced Grade 3 IPOs only but not with that of Grade 1/2 and Grade 4/5 IPOs. Overpriced graded IPOs are composed of 38.80% Grade 1/2 IPOs, with the rest 61.20% IPOs composed of Grade 3/4/5. The mean MAARO of overpriced IPOs is -25.55%, -15.30%, and -8.95% for Grade 1/2, 3, and 4/5, respectively. This results in rapid price correction on listing day with the Grade 1/2 IPOs affected the most while 4/5 IPOs affected the least.

MAARO has been decreasing over time in the case of underpriced Grade 3 and Grade 4/5 IPOs but not in the case of Grade 1/2 IPOs. Underpriced graded IPOs are composed of 37.14% Grade 1/2 IPOs, with the rest 68.20% IPOs composed of Grade 3/4/5. The mean MAARO of underpriced IPOs is 46.62%, 32.85%, and 15.40% for Grade 1/2, 3, and 4/5, respectively. It is evident from the mean MAARO for underpriced graded IPOs that underwriters underprice lower graded IPOs much more than higher-graded IPOs to compensate investors for the risk that they take by investing in lower graded IPOs.

MAARO trendline does not show any tendency to correct overpricing for overpriced IPOs in bull and non-bull markets. Out of the 148 overpriced IPOs, 30.41% and 69.59% IPOs were issued in non-bull and bull markets, respectively. The mean MAARO for overpriced IPOs was -24.49% and -10.87% for non-bull and bull market IPOs, respectively. The presence of very few IPO offerings in non-bull markets leads underwriters to overprice non-bull IPOs higher than

during bull periods. However, this results in a faster negative correction of IPO prices issued in non-bull periods when investor sentiments are low as opposed to bull periods when investor sentiments are high.

MAARO trendline shows a tendency to correct underpricing for underpriced IPOs in bull and non-bull markets. Out of the 297 underpriced IPOs, 23.23% and 76.77% IPOs were issued in non-bull and bull markets, respectively. The mean MAARO for underpriced IPOs was 58.29% and 44.82%, respectively, for non-bull and bull market IPOs. In non-bull markets, the absence of positive market sentiments leads underwriters to underprice IPO issues higher as opposed to bull markets when investor sentiments are very high.

Correction of MAARO is not observed from the trendline of overpriced IPOs for any of the issue size classifications. Out of the 148 overpriced IPOs, 70.95%, 23.65%, and 5.40% IPOs were issued and classified as small, mid, and large-size IPOs, respectively. The mean MAARO for overpriced IPOs was -16.32%, -13.16%, and -5.97% for small, mid, and large-size IPOs, respectively. Small-size IPOs are overpriced the most with large-size IPOs overpriced the least.

MAARO exhibits a decreasing trend in the case of small, mid, and large-size IPOs with the most significant decreases observed for mid and large-size IPOs. Out of the 297 underpriced IPOs, 72.72%, 19.53%, and 7.75% IPOs were issued and classified as small, mid, and large-size IPOs, respectively. The mean MAARO for underpriced IPOs was 55.11%, 29.39%, and 27.48% respectively for small, mid, and large-size IPOs. Small-size IPOs are underpriced the most with large-size IPOs underpriced the least.

This chapter examined the trends of all IPO listed in India between fiscal year 1999 and 2013 by performing a trend analysis across cross-sections such as by pricing mechanisms, issues listed in hot/cold markets, between graded/ungraded IPOs, between IPOs of different grades, issues listed in bull/non-bull markets and finally based on issue size categories. This chapter also examined the trend in marginal returns across fiscal years. The next chapter entitled “Listing Day Performance of Underpriced IPOs” studies the short-run performance of underpriced IPOs and examines the extent of underpricing across various cross-sections such as (a) IPOs listed using either pricing mechanism, (b) IPOs listed in hot/cold market conditions, (c) IPOs are either graded/ungraded, (d) IPOs are graded, (e) IPOs are listed in bull/non-bull markets, (f) IPOs are affiliated with select sectors, (g) IPOs are compared across issue size categories (small, mid and large). The next chapter also derives a relationship between MAARO and certain macroeconomic factors.

Chapter 5

Listing Day Performance of Underpriced IPOs

5.1 Introduction

This chapter seeks to study the listing day performance of underpriced IPO's listed on the 'National Stock Exchange (NSE)' in India between fiscal periods 1999 and 2013. Listing day performance is the difference in the percentage return between the closing price of the IPO after the first day of listing and the offer price adjusted for the market performance during the same period. IPOs are underpriced when MAARO is positive, i.e., when investors realize a gain on listing. Two measures of listing day performance, which are 'Marginally Adjusted Abnormal Return On Opening (MAARO)' and log normal returns, are used in this study. We use two measures of performance to examine results separately and confirm the robustness of results. MAARO is calculated using Equation 3.3 (p.66), while log normal returns are calculated using Equation 3.4 (p.66).

It is of interest to find out if there is a reduced level of underpricing exhibited when IPOs are issued using the book-building mechanism. If so, this would support the market feedback hypothesis. From time to time, capital market exchanges in the world experience surges in IPO issuance. We term these as hot as opposed to cold markets. It is of interest to examine the extent of underpricing amongst IPOs issued in hot and cold markets. Grading of IPOs was made mandatory by Securities and Exchange Board of India (SEBI) in May-2007 (IPO grading was made optional for the issuer from February 04, 2014) to make additional information about unlisted companies or those without any track record of their performance available to

the investors, helping them assess the issue before investing. An IPO grade is assigned by a SEBI-certified rating agency on a 5-point scale with a higher score indicating better quality of the issuing firm. It is of interest to find the impact on the extent of underpricing between graded and ungraded IPOs or even amongst graded IPOs. Similar to hot and cold markets, stock exchanges go through bullish and non-bullish/neutral phases. Would the extent of IPO underpricing for IPOs listed during bull and non-bull periods be different? Additionally, we would like to determine if underpricing is dependent on a firms association with any specific sectors or the issue size of the IPO. Finally, we would like to come up with a regression model to determine if any macroeconomic factors play a statistically significant role in determining the listing day returns.

Towards measuring listing day performance of underpriced IPOs, this chapter contains two sub-objectives. The first sub-objective is to determine the extent of underpricing between book-built and fixed-price IPOs; IPOs issued in hot and cold markets; graded and ungraded IPOs; amongst graded IPOs; IPOs issued in bull and non-bull periods; IPOs belonging to specific sectors; across various issue size classifications. The second sub-objective in this chapter is to determine the impacts of selected macroeconomic factors on underpricing.

5.2 Literature Review

Issuing equity through IPOs involves a large amount of publicity and marketing. Investment bankers (underwriters) in the case of bookbuilt issues undertake roadshows/marketing campaigns to gather information from regular investor's opinions before pricing the issue. This information gathered during the pre-IPO phase works as a price discovery mechanism. Based on the feedback received from large investors, underwriters may decide to underprice IPOs to entice regular investors. There is a risk that investors take in subscribing to such issues. Underwriters compensate that risk by underwriting the issues. The offer price is adjusted upwards or downwards in the final prospectus based on the market feedback. Initial gains would be lower for IPOs where the offer price has been adjusted upwards as opposed to an offer price that is revised downwards.

Many studies have been carried out by researchers in capital markets to test the validity of the market feedback hypothesis. Benveniste and Spindt (1989); Benveniste and Wilhelm (1990); Spatt and Srivastava (1991) argue that listing firms maximise revenues with the help of underwriters that reduce underpricing by utilising book-building to obtain information from informed investors. The most commonly discussed factor behind book building theories is the

effect of revisions in the offer price during the filing period and that Underwriters do not fully adjust their pricing upward to keep underpricing (Hanley, 1993). Lee, Taylor, and Walter (1999) find that a large number of better-informed investors (Institutional Investors) tended to request participation in IPOs with higher initial returns preferentially. Cornelli and Goldreich (2003) conclude in their study that information in bids that included a limit price, especially those of large and frequent bidders, affected the price. However, Giudici and Paleari (1999) find no difference in underpricing between fixed-price and book-built offers. Further, Ljungqvist, Jenkinson, and Wilhelm Jr (2003) also find that book-built issues do not necessarily lower underpricing in all countries. Derrien and Womack (2003), in their study on French IPOs, found book-built and fixed-price approaches to be inefficient. Hawaldar, Naveen Kumar, and Mallikarjunappa (2018), in their study of IPOs issued in India between 2001-2011, find that bookbuilt IPOs are underpriced lesser than fixed-price IPOs.

Ibbotson and Jaffe (1975); Ritter (1984) conclude that the extent of underpricing is dependent on the number of IPOs in a year. Hot markets exhibited periods where the extent of underpricing was much greater than the average as compared to other periods. Wang (1999) concluded that underpricing is higher in the hot market than in the cold market. A study in India by Garg, Arora, and Singla (2008) concluded that the level of underpricing is not much different amongst IPOs issued in hot and cold IPO markets. Neneh and Smit (2013) find that the level of underpricing in hot market periods was substantially higher than in the cold market periods. Similarly, results by Alim, Ramakrishnan, and Khan (2016) indicate that issues in a hot market are more underpriced than in cold markets. Jain and Kanjilal (2017) provide evidence of a bi-directional causal relationship between future initial returns and past IPO volume in hot market conditions. In cold markets, this relationship between IPO volume and initial returns is weak. The authors confirm that hot periods are associated with high initial returns and heavy volume, while cold periods are associated with low initial returns and light volume.

Deb and Marisetty (2010) studied a sample of ungraded and graded IPOs and concluded that grading reduces IPO underpricing and also influences retail investor demand. However, a study by Khurshed, Paleari, Pande, and Vismara (2008) concluded that grading does not affect underpricing. Poudyal (2008) finds an inverse relationship between grading and level of underpricing. Jacob and Agarwalla (2015), in their study, found no evidence to support IPO pricing improvement due to the introduction of IPO grading. However, a study by Sahoo and Kaur (2017) find that IPO grading was not relevant in explaining the listing day returns. Tripathi and Pandey (2018) find that a higher grade does not equate with higher subscriptions by retail investors. The authors also conclude that underpricing is not significantly different between

graded and ungraded IPOs and that there is lesser underpricing with IPOs having Grade 4/5. Dhamija and Arora (2017) find that ungraded IPOs delivered higher excess market-adjusted returns than graded IPOs. The authors also find that excess returns decrease as the grade increases except for Grade 5 IPOs, which could be because of investor sentiments resulting in a higher excess return. The study by Kashiramka, Thomas, Yadav, and Rao (2018) concludes that higher graded IPOs have a negative relationship with the extent of underpricing. The study by Chhabra, Kiran, and Sah (2017) concludes that the extent of underpricing increases with higher grades.

Jog and Riding (1987), in their study, concluded that the degree of underpricing is higher when the trading volume was low, and that underpricing was greater in the industrial sector than in other sectors. A study by Loughran and Ritter (2004) find a much higher underpricing during bullish periods and that during bull periods, there is less focus on maximizing IPO proceeds. Garg et al. (2008) studied underpriced IPOs listed on the NSE issued in India and concluded that the abnormal returns from the IPO underpricing differ significantly in the bearish and the bullish phases which had higher mean underpricing.

Henrick (2012) examined the significance of a firm's industry affiliation on the underpricing of its Initial Public Offering (IPO) and find that the effect of a firm's industry affiliation is a key influence on the underpricing of its IPO. Investors consider both the technology and consumer sectors as carrying an inherent risk, which results in a price reduction in order for the investors to participate in the offering. Similarly, Karlis (2000) finds that in rapidly emerging sectors such as the Internet and Technology sectors, IPOs are underpriced since investors do not even have the luxury of looking to the past performance of the industry or finding information about the quality and real value of the firm. The existence of substantial informational asymmetries in the IPO markets makes obtaining correct information regarding the value of a firm extremely difficult (Weiss, 1988). Karlis (2000) hypothesised and confirmed that IPO pricing in newer industries such as Internet companies was underpriced much more than other sectors. Singh and Kumar (2012) proposed a model to explain underpricing using oversubscription rates, age of the firm, and issue size as independent variables. The authors conducted a sector-wise analysis of short-run performance using 116 IPOs listed in India between January 2006 and October 2007. The authors find that the short-run returns of IPOs were positive during this period delivering 18% returns with IT sector IPOS delivering higher initial returns in the short-run.

Past studies by Ibbotson, Sindelar, and Ritter (1994); M'kombe and Ward (2002); Islam,

Ali, and Ahmad (2010); Yong (2011); Dhamija and Arora (2017) find that issue size has an impact on the extent of underpricing. Yong (2011), in a study, revealed that the size effect plays a vital role in explaining the underpricing phenomenon in Malaysian IPOs. Similarly, Islam et al. (2010) analyzed the levels of underpricing in IPOs and find that the offer size and size of the company are positively related to the degree of underpricing. Ibbotson et al. (1994), in their study, find that underpricing is considerably larger on smaller offerings. M'kombe and Ward (2002) find that low priced shares are viewed as high risk, so one would expect high returns to be associated with them to compensate for the risk. Khurshed et al. (2008), in their study, found that IPOs with issues of larger size are underpriced lesser. The study by Dhamija and Arora (2017) find a negative relation between issue size and extent of underpricing increases with larger issue sizes.

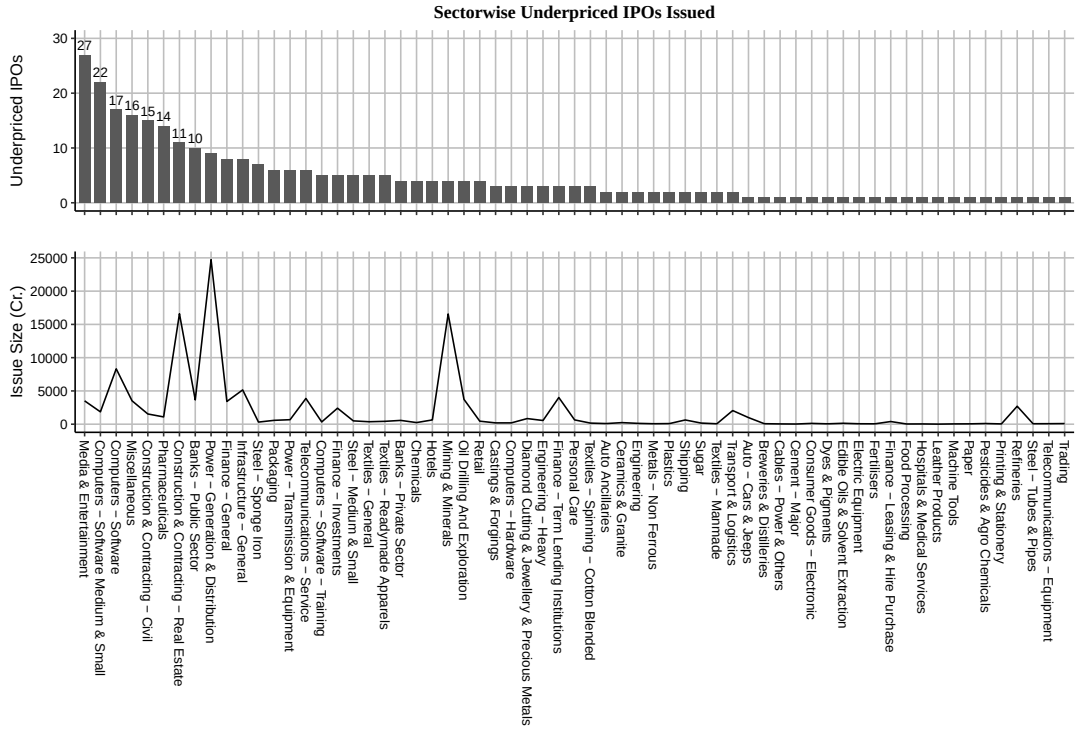
A model by Ross (1976) called the Arbitrage Pricing Theory (APT) presumes that some macroeconomic variables exist that impact returns on assets, which causes volatility. Past studies by Harvey and Huang (1991); Benita and Lauterbach (2007); Chinzara (2010); Ross, Westerfield, and Jordan (2008); Olweny and Omondi (2011) point to exchange rate as one of the important reasons that influence market volatility and stock performance. The interest rate has been another macroeconomic factor that influences stock performance Shiller and McCulloch (1990); Campbell and Shiller (1991); Ngugi and Kabubo (1998); Chen, Kim, and Kim (2005); Walsh (2010); Chinzara (2010). Yaya and Shittu (2010) discover on a Nigerian research study, that previous inflation rates have considerable impacts on conditional stock exchange volatility. Modifications in inflation rates, as determined by changes in these rates, likewise have a higher effect in predicting the stock returns volatility. The studies by Schwert (1989); Chinzara (2010) find that inflation has little predictive power in predicting market volatility.

5.3 Data and Techniques

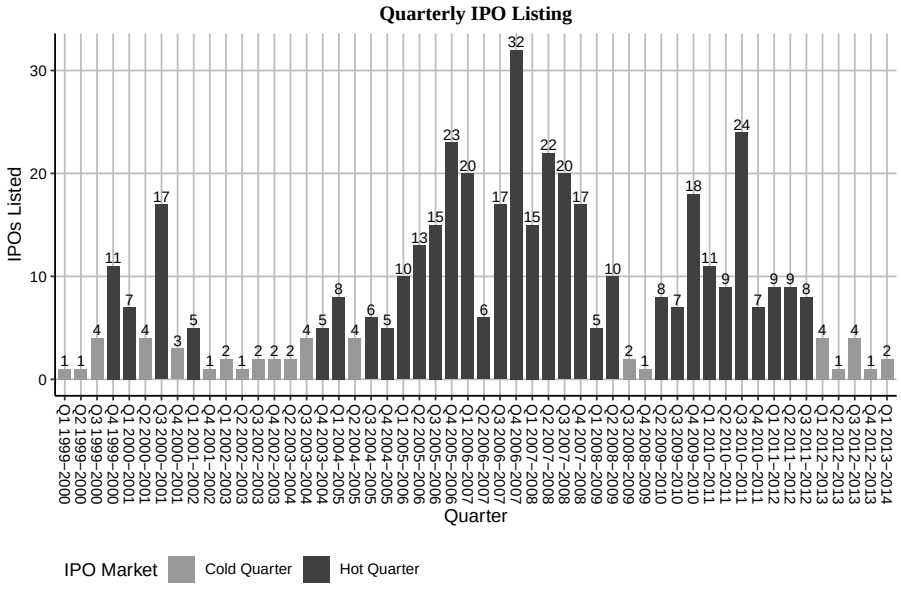
The source of secondary data used for the study has been described in section 3.2 (p.59). This section discusses additional details such as choice of sectors for the sectoral study, identification of bull markets as well as that of hot markets. The study uses MAARO and log normal returns as measures of listing day performance. MAARO is calculated using Equation 3.3 (p.66), while log normal returns are calculated using Equation 3.4 (p.66). We now continue with the data selection and categorisation techniques used for the remaining objectives.

A study on the extent of underpricing by sector is conducted for underpriced IPOs. The count of IPOs issued and their issue size is as shown in Figure 5.1. In the selected sample, 8 out

of 63 sectors had ten or more IPOs issued and were selected for listing day sectoral performance. The average issue size across all the sectors was 1,911.86 Cr, while the average issue size across the selected eight sectors was 5,009.58 Cr. The sectors selected for listing day sectoral performance are Banks-Public Sector, Computers (Software), Computers (Software Medium & Small), Construction & Contracting (Civil), Construction & Contracting (Real Estate), Media & Entertainment, Miscellaneous Issues, and Pharmaceuticals.



Source: Prime Database and Computed from Equation 3.3
Figure 5.1: *Counts and Issue Sizes of Underpriced IPOs - Sectorwise (FY 1999-2013)*

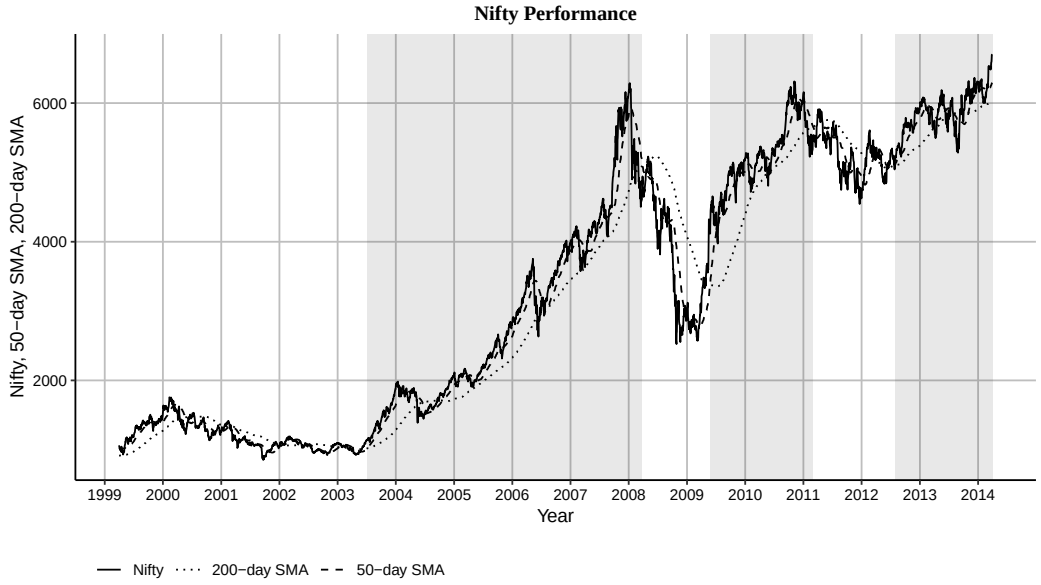


Source: Prime Database
Figure 5.2: *Hot and Cold IPO markets - Quarterly (FY 1999-2013).*

The number of IPOs listed by quarter on the NSE is illustrated in Figure 5.2. We make

a determination of a cold and hot IPO market based on the number of IPOs listed in that corresponding quarter. We identify a market to be hot if there are five or more IPOs released in a quarter. Ritter (1991); Helwege and Liang (2004); Sahoo and Rajib (2010) have used a similar method. Our study period provides us 32 out of 52 quarters where five or more IPOs were listed. Our sample provides for 30 and 261 IPOs issued during cold and hot markets, respectively.

For a comparison on the extent of underpricing by grade, we compare the listing day performance of IPOs based on the grade classification issued by various rating agencies. In the selected sample, we have 104 graded and 187 ungraded IPOs, respectively. We also conduct a comparison of the listing day performance across grade categories. For our study, graded IPOs are combined to yield us 38, 34, and 32 IPOs in grades 1 & 2, 3 and 4 & 5, respectively.



Source: NSE

Figure 5.3: *NIFTY Performance. Identification of bull and non-bull markets (FY 1999-2013).*

Market index NIFTY performance between the fiscal year 1999 until 2013 is illustrated in Figure 5.3. A significant upward momentum and bull markets are observed during the period 7th July 2003 until 27th March 2008, 26th May 2009 until 3rd March 2011 and 27th July 2012 until the end of the period of study. These bull periods (depicted as shaded areas) were identified using a cross-over method of the 50-day SMA and 200-day SMA. From the 291 IPOs in the selected sample, there are 224 IPOs that were issued during bull periods, while 67 IPOs were issued during non-bull/neutral markets.

To determine if the issue size had any influence on underpricing, we classify IPOs as small, medium, and large-size based on their issue size. IPOs with an issue size of fewer than 200 Crores are categorised as Small-size, greater than or equal to 200 Crores, but less than 1000 Crores are categorised as Mid-size and issue size greater than or equal to 1000 Crores are

categorised as Large-size. This classification yields us 210, 58, and 23 IPOs in Small, Mid, and Large-size, respectively.

Many vital results in statistical analysis follow from the assumption that the population being sampled or investigated is normally distributed with a common variance and additive error structure. Towards achieving results on non-normalised data, MAARO and log normal returns will be transformed using the Johnson transformation as per Johnson (1949).

5.4 Results and Discussions

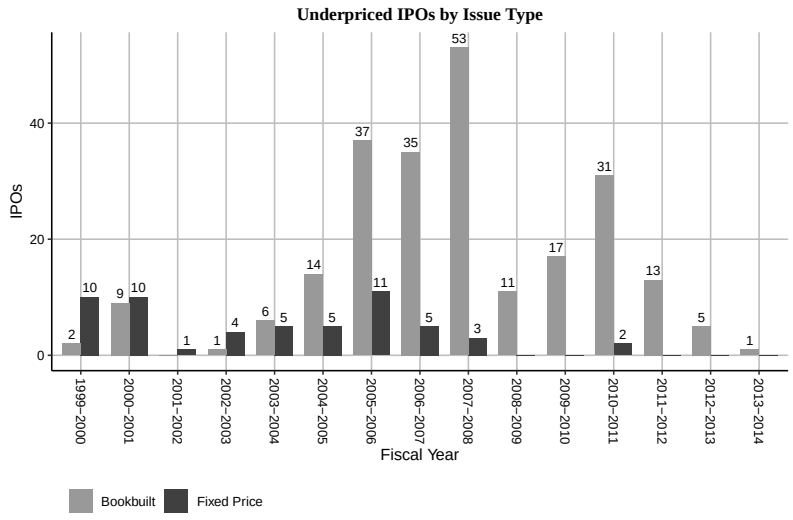
MAARO, as well as log normal returns, were transformed using Johnson (1949) transformations by utilising the 'Minitab Statistical Software'. All results on normalised data are back-transformed for clarity. The equation used for normalising MAARO is

$$2.07995 + 0.847812 * \text{Ln}\left[(\text{X} + 2.16595)/(384.536 - \text{X})\right] \quad \ldots(5.1)$$

, and the equation used for normalising log normal returns is

$$1.34952 + 0.872502 * \text{Ln}\left[(\text{X} + 0.0236064)/(1.53542 - \text{X})\right] \quad \ldots(5.2)$$

5.4.1 Extent of Underpricing between Fixed-price and Bookbuilt IPOs



Source: IPOs identified using Equation 3.3 (p.66)
Figure 5.4: *Underpriced IPOs by Issue Type (FY 1999-2013).*

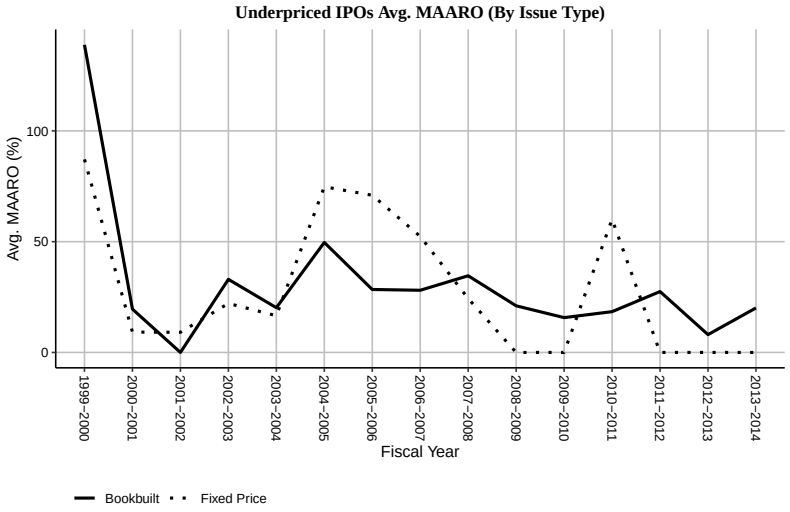
The number of underpriced IPOs listed by fiscal year and split by pricing mechanism used during the study period is illustrated in Figure 5.4. There is a significant increase in listing firms using the bookbuilt pricing mechanism with the highest number of underpriced bookbuilt IPOs

in our sample listed in the fiscal year 2007-2008. There are no underpriced fixed-price IPOs from the fiscal year 2008-2009 onwards except in the fiscal year 2010-2011.

Table 5.1: *Listing Day Performance of Underpriced Fixed Price & Bookbuilt IPO Issues (FY 1999-2013)*

Fiscal Year	Underpriced IPOs		Average MAARO (%)		Avg. Log Normal Returns	
	Fixed Price	Bookbuilt	Fixed Price	Bookbuilt	Fixed Price	Bookbuilt
1999-2000	10	2	87.14	138.83	0.6295	0.8706
2000-2001	10	9	9.18	19.55	0.0939	0.1785
2001-2002	1	0	9.10		0.0871	
2002-2003	4	1	22.11	32.99	0.1995	0.2852
2003-2004	5	6	16.58	20.21	0.1533	0.1835
2004-2005	5	14	74.76	49.65	0.5584	0.4035
2005-2006	11	37	70.95	28.41	0.5396	0.2498
2006-2007	5	35	52.38	28.06	0.4214	0.2473
2007-2008	3	53	24.34	34.61	0.2713	0.2971
2008-2009	0	11		21.04		0.1907
2009-2010	0	17		15.72		0.1459
2010-2011	2	31	60.10	18.40	0.4706	0.1688
2011-2012	0	13		27.48		0.2423
2012-2013	0	5		8.05		0.0776
2013-2014	0	1		20.08		0.1830
	56	235				

Source: Computed from Equations 3.3 and 3.4



Source: From Table 5.1
Figure 5.5: *Underpriced IPOs Average MAARO by Issue Type (FY 1999-2013).*

Average MAARO and Average Log Normal Return for underpriced IPOs using both the pricing mechanisms for the study period are shown in Table 5.1. A graph depicting the average MAARO from Table 5.1 is illustrated in Figure 5.5. There is a decrease in average MAARO in the case of bookbuilt issues from FY 2004-2005. However, fixed-price issues do not display any decrease in average underpricing.

It is hypothesised that the extent of underpricing does not differ significantly for IPOs issued using either book-built or fixed mechanisms. This would be in line with a study by Mishra (2010), who attempted to provide new evidence on the first-day IPO market performance

using a set of 235 IPOs listed between April 1997 and March 2008 on Indian stock exchanges. The above study finds no evidence that there is a difference in underpricing between fixed-price and bookbuilt offers. In contrast, in a study on the Bombay Stock Exchange, Bansal and Khanna (2012), found a significant difference in the level of magnitude of underpricing in IPOs priced through book-built than those through the fixed-price option. We use a sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14. The sample comprises 235 bookbuilt and 56 fixed-price IPO issues, respectively.

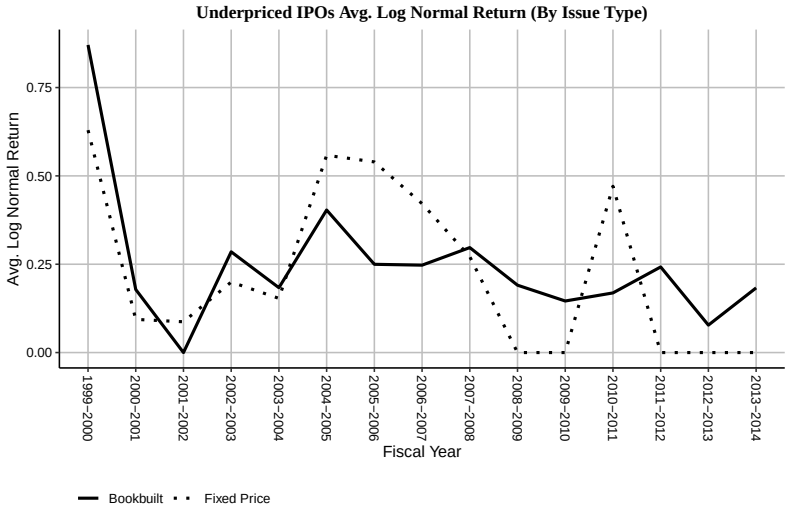
Table 5.2: *Comparison of extent of underpricing, by Issue Type using MAARO*

IPO Pricing Mechanism	Mean	Variance	Std. Deviation	t-test
Fixed-Price	39.22	8813.02	93.88	2.202
Bookbuilt	25.92	5761.07	75.90	

Source: Author Computed

We now discuss the results of the independent samples t-test using MAARO presented in Table 5.2. There were two outliers in the normalised data, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. These outliers were ignored for further analysis. Marginally adjusted average returns for fixed-price, as well as bookbuilt issues, were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean $\pm$ standard deviation unless otherwise stated. There were 233 book-built and 56 fixed-price issues considered. Underpricing was lower in the case of book-built issues (25.92 $\pm$ 75.90) than fixed-price issues (39.22 $\pm$ 93.88). The variance for fixed-price issues (8813.02) was almost 1.5 times than that of book-built issues (5761.07). The assumption of homogeneity of variances on normalised returns was violated, as assessed by Levene's test for equality of variances (p = .025). Underpricing for book-built issues was 13.30% (95% CI, 29.62 to 60.52) lower than underpricing for fixed-price issues. There was a statistically significant difference in mean underpricing between book-built and fixed-price IPO issues, $t(72.882) = 2.202, p = .031$, and therefore, we can reject the null hypothesis.

The results using log normal returns are presented next.



Source: From Table 5.1
Figure 5.6: *Underpriced IPOs Average Log Normal Return by Issue Type (FY 1999-2013).*

A graph depicting average log normal returns from Table 5.1 is illustrated in Figure 5.6.

Table 5.3: *Comparison of extent of underpricing, by Issue Type using Log Normal Returns*

IPO Pricing Mechanism	Mean	Variance	Std. Deviation	t-test
Fixed Price	0.33	0.442	0.66	2.208
Book-built	0.23	0.325	0.57	

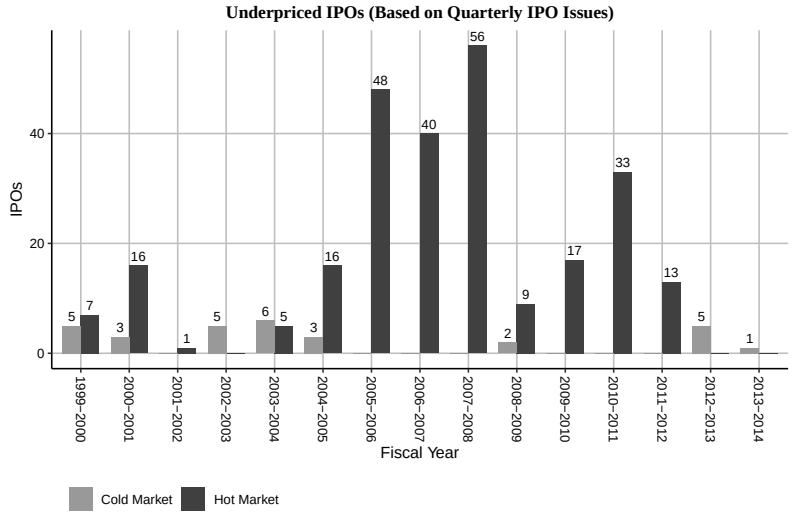
Source: Author Computed

We now discuss the results of the independent samples t-test using log normal returns presented in Table 5.3. There were two outliers in the normalised data, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. These outliers were ignored for further analysis. Log normal returns for fixed-price, as well as book-built issues, were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean $\pm$ standard deviation unless otherwise stated. There were 233 book-built and 56 fixed-price issues considered. Underpricing was lower in the case of book-built issues (0.23 ± 0.57) than fixed-price issues (0.33 ± 0.66). The variance for fixed-price issues (0.442) was almost 1.3 times than that of book-built issues (0.325). The assumption of homogeneity of variances on normalised returns was violated, as assessed by Levene's test for equality of variances (p = .025). Underpricing for book-built issues was 0.10 (95% CI, 0.26 to 0.48) lower than underpricing for fixed-price issues. There was a statistically significant difference in mean underpricing between book-built and fixed-price IPO issues, $t(72.765) = 2.208$, $p = .030$, and therefore, we can reject the null hypothesis.

Empirical findings using both either MAARO or log normal returns suggest that the extent of underpricing in the case of book-built issues is much smaller than fixed-price IPO issues. This can be seen from the mean values for either of the IPO issue types since mean values for book-built issues are smaller than fixed-price issues. This could be the case since the offer price is

adjusted upwards or downwards in the final prospectus based on the market feedback when the book-built pricing mechanism is used. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.2 Extent of Underpricing between IPOs in Hot and Cold Markets



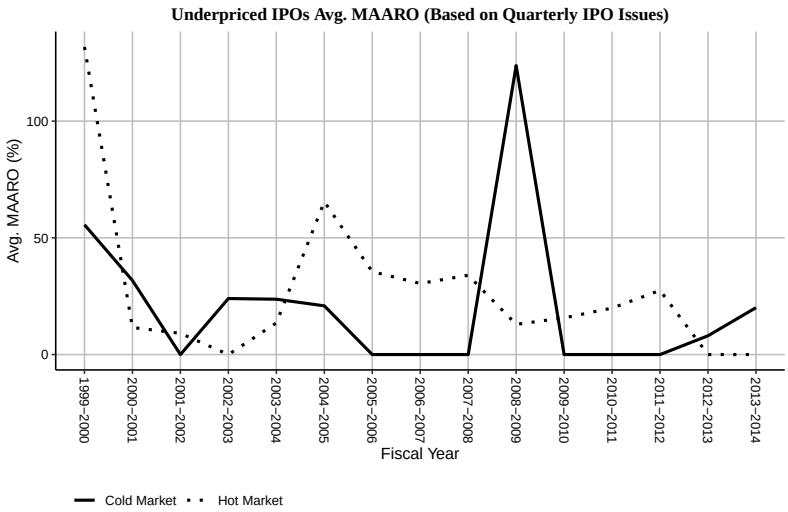
Source: Prime Database and Computed from Equation 3.3
Figure 5.7: *Hot and Cold Markets for Underpriced IPOs (FY 1999-2013).*

The number of underpriced IPOs in hot and cold markets by fiscal year is illustrated in Figure 5.7. We identify a market to be hot if there are five or more IPOs released in a quarter. A majority of underpriced IPOs listed in hot markets between fiscal years 2005 and 2008. Average MAARO and Average Log Normal Return for underpriced IPOs listed in hot and cold markets for the study period are shown in Table 5.4.

Table 5.4: *Listing Day Performance of Underpriced IPOs listed in Cold and Hot Markets (FY 1999-2013)*

Fiscal Year	Underpriced IPOs		Average MAARO (%)		Avg. Log Normal Returns	
	Cold Market	Hot Market	Cold Market	Hot Market	Cold Market	Hot Market
1999-2000	5	7	55.61	131.78	0.4425	0.8436
2000-2001	3	16	31.74	11.59	0.2752	0.1099
2001-2002	0	1		9.10		0.0871
2002-2003	5	0	24.00		0.2149	
2003-2004	6	5	23.71	13.53	0.2124	0.1267
2004-2005	3	16	20.86	65.50	0.1895	0.5044
2005-2006	0	48		35.51		0.3040
2006-2007	0	40		30.45		0.2658
2007-2008	0	56		33.98		0.2924
2008-2009	2	9	123.80	12.94	0.8058	0.1219
2009-2010	0	17		15.72		0.1459
2010-2011	0	33		19.90		0.1813
2011-2012	0	13		27.48		0.2423
2012-2013	5	0	8.05		0.0776	
2013-2014	1	0	20.08		0.1830	
	30	261				

Source: Computed from Equations 3.3 and 3.4



Source: From Table 5.4

Figure 5.8: *Underpriced IPOs Average MAARO in Hot and Cold Markets (FY 1999-2013).*

A graph depicting the average MAARO from Table 5.4 is illustrated in Figure 5.8. It is hypothesised that the extent of IPO underpricing does not differ significantly for IPOs issued during hot or cold markets. We use a sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14. The sample comprises of 30 and 261 IPOs issued in cold and hot markets, respectively.

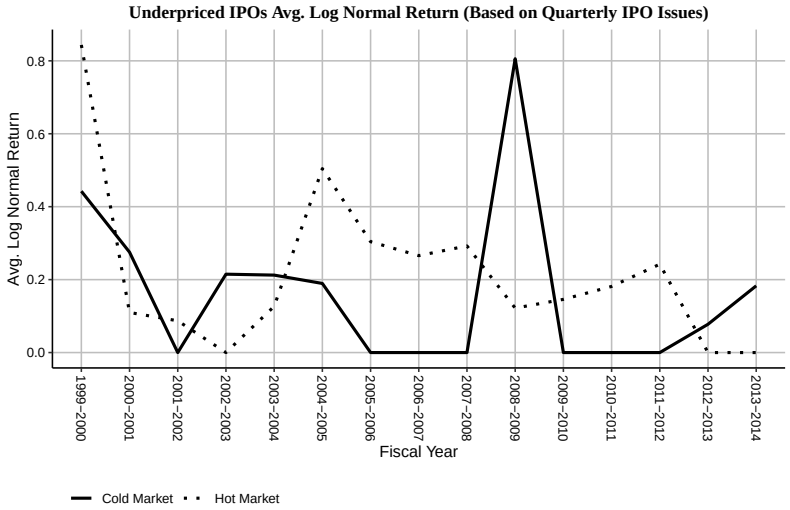
Table 5.5: *Comparison of extent of underpricing during cold and hot markets, using MAARO*

Market	Mean	Variance	Std. Deviation	t-test
Cold	26.98	6261.56	79.13	-0.312
Hot	28.93	6724.00	82.00	

Source: Author Computed

We now discuss the results of the independent samples t-test using MAARO presented in Table 5.5. There were no outliers in the normalised data for hot markets, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. Marginally adjusted average returns for cold market IPO issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Hot market IPOs were normally distributed based on a visual inspection of the Q-Q plot. Data are mean $\pm$ standard deviation unless otherwise stated. There were 261 hot and 30 cold market IPO issues considered. Underpricing was lower in the case of cold market issues (26.98 $\pm$ 79.13) than hot market issues (28.93 $\pm$ 82.00). The variance for cold market issues (6261.56) was slightly less than that of hot market issues (6724.00). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.541). Underpricing for cold market issues was 1.95% (95% CI, 16.75 to 40.79) lower than underpricing for hot market issues. There was no statistically significant difference in mean underpricing between cold and hot market IPO issues, $t(289) = -0.312$, $p = 0.756$, and therefore, we can accept the null hypothesis.

The results using log normal returns are discussed next.



Source: From Table 5.4

Figure 5.9: *Underpriced IPOs Average Log Normal Return in Hot and Cold Markets (FY 1999-2013)*

A graph depicting average log normal returns from Table 5.4 is illustrated in Figure 5.9.

Table 5.6: *Comparison of extent of underpricing during cold and hot markets, using Log Normal Returns*

Market	Mean	Variance	Std. Deviation	t-test
Cold	0.24	0.341	0.58	-0.315
Hot	0.25	0.361	0.60	

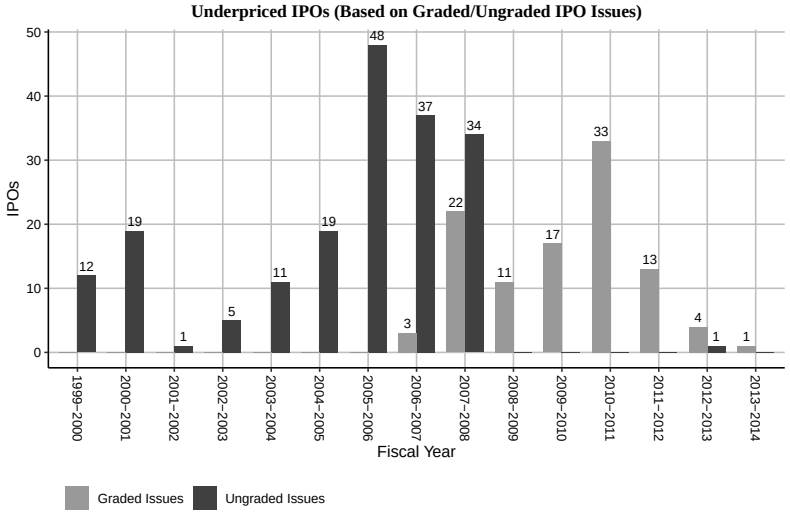
Source: Author Computed

We now discuss the results of the independent samples t-test using log normal returns presented in Table 5.6. There were no outliers in the log normal returns for hot market IPOs, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. Log normal returns for cold market IPO issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Log normal returns for hot market IPOs returns were normally distributed based on a visual inspection of the Q-Q plot. Data are mean $\pm$ standard deviation unless otherwise stated. There were 261 hot and 30 cold market IPO issues considered. Underpricing was lower in the case of cold market issues (0.24 ± 0.58) than hot market issues (0.25 ± 0.60). The variance for cold market issues (0.341) was slightly less than that of hot market issues (0.361). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.538). Underpricing for cold market issues was 0.02 (95% CI, 0.15 to 0.34) lower than underpricing for hot market issues. There was no statistically significant difference in mean underpricing between cold and hot market IPO issues, $t(289) = -0.315$, $p = 0.753$, and therefore, we can accept the null hypothesis.

Empirical findings using both either MAARO or log normal returns suggest that the extent of underpricing of IPOs listed in hot or cold markets is the same. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.3 Extent of Underpricing between Graded and Ungraded IPOs

We undertake this study by comparing the extent of underpricing between graded and ungraded IPOs. The next study that follows compares the extent of underpricing amongst graded IPOs only.



Source: Prime Database and Computed from Equation 3.3
Figure 5.10: *Graded and Ungraded Underpriced IPOs (FY 1999-2013).*

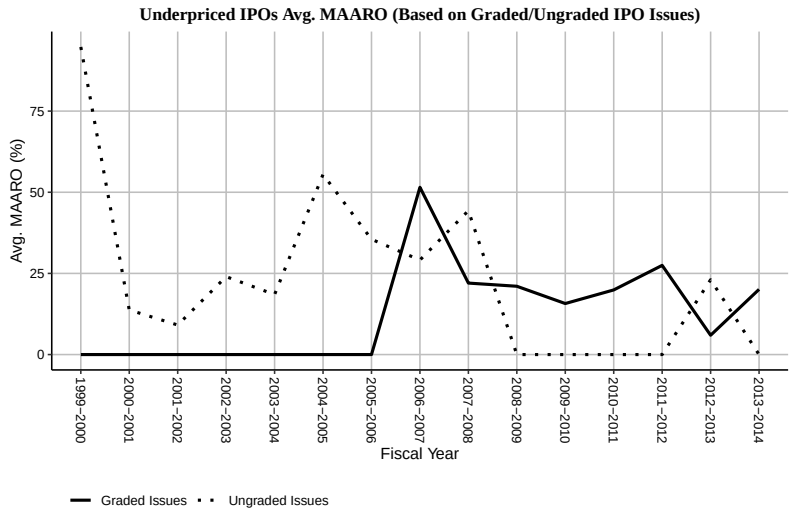
The number of underpriced graded and ungraded IPOs by fiscal year in our sample is illustrated in Figure 5.10. Average MAARO and Average Log Normal Return for underpriced ungraded and graded IPOs for the study period is shown in Table 5.7.

Table 5.7: *Listing Day Performance of Underpriced Ungraded and Graded IPO Issues (FY 1999-2013)*

Fiscal Year	Underpriced IPOs		Average MAARO (%)		Avg. Log Normal Returns	
	Ungraded	Graded	Ungraded	Graded	Ungraded	Graded
1999-2000	12	0	94.76		0.6692	
2000-2001	19	0	13.74		0.1289	
2001-2002	1	0	9.10		0.0871	
2002-2003	5	0	24.00		0.2149	
2003-2004	11	0	18.48		0.1693	
2004-2005	19	0	55.49		0.4417	
2005-2006	48	0	35.51		0.3040	
2006-2007	37	3	29.12	51.52	0.2555	0.4158
2007-2008	34	22	44.33	22.02	0.3671	0.1988
2008-2009	0	11		21.04		0.1907
2009-2010	0	17		15.72		0.1459
2010-2011	0	33		19.90		0.1813
2011-2012	0	13		27.48		0.2423
2012-2013	1	4	23.04	5.95	0.2074	0.0580
2013-2014	0	1		20.08		0.1830
	187	104				

Source: Computed from Equations 3.3 and 3.4

A graph depicting the average MAARO from Table 5.7 is illustrated in Figure 5.11.



Source: From Table 5.7

Figure 5.11: *Underpriced Graded and Ungraded IPOs Average MAARO (FY 1999-2013).*

It is hypothesised that the extent of IPO underpricing does not differ significantly between graded and ungraded IPO issues. We use a sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14. The sample comprises of 187 ungraded and 104 graded IPO issues, respectively.

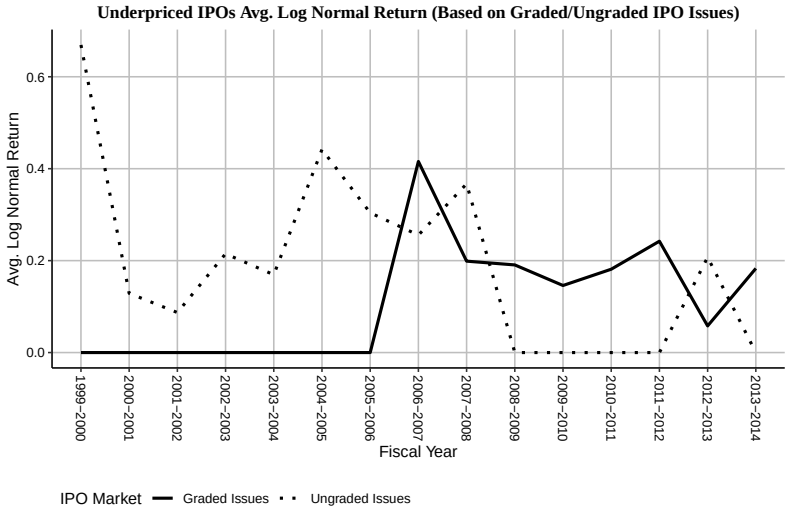
Table 5.8: *Comparison of extent of underpricing between graded and ungraded IPOs, using MAARO*

Market	Mean	Variance	Std. Deviation	t-test
Ungraded	33.59	5838.40	76.41	3.716
Graded	20.28	6252.10	79.07	

Source: Author Computed

We now discuss the results of the independent samples t-test using MAARO presented in Table 5.8. There were four outliers in the normalised data for ungraded IPOs, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. These outliers were ignored for further analysis. Marginally adjusted average returns for ungraded and graded IPO issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean $\pm$ standard deviation unless otherwise stated. There were 183 ungraded and 104 graded IPO issues considered. Underpricing was lower in the case of graded issues (20.28 $\pm$ 79.07) than ungraded issues (33.59 $\pm$ 76.41). The variance for ungraded issues (5838.40) was lower than that of graded issues (6252.10). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.319). Underpricing for graded issues was 13.31% (95% CI, 35.83 to 58.38) lower than ungraded issues. There was a statistically significant difference in mean underpricing between ungraded and graded IPO issues, $t(285) = 3.716$, $p = 0.000$, and therefore, we can reject the null hypothesis.

The results using log normal returns are discussed next.



Source: From Table 5.7

Figure 5.12: *Underpriced Graded and Ungraded IPOs Average Log Normal Return (FY 1999-2013).*

A graph depicting average log normal return from Table 5.7 is illustrated in Figure 5.12.

Table 5.9: *Comparison of extent of underpricing between graded and ungraded IPOs, using Log Normal Returns*

Market	Mean	Variance	Std. Deviation	t-test
Ungraded	0.29	0.317	0.56	3.638
Graded	0.18	0.340	0.58	

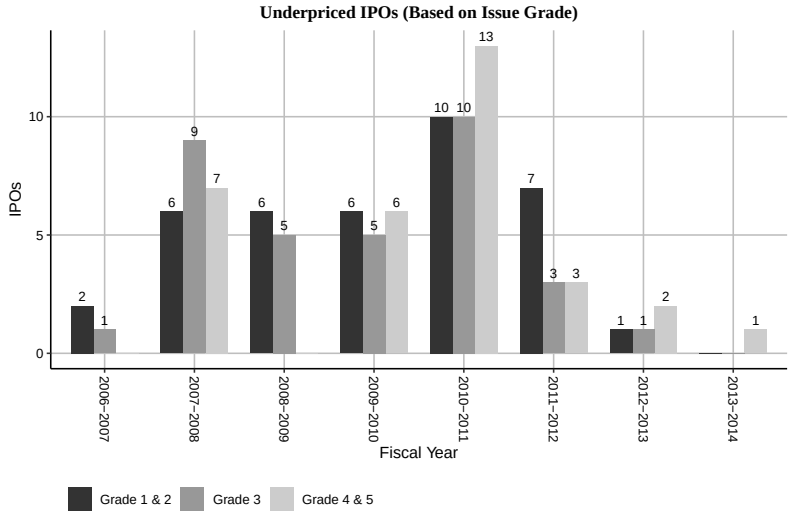
Source: Author Computed

We now discuss the results of the independent samples t-test using log normal returns presented in Table 5.9. There were five outliers in the normalised data for ungraded IPOs, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. These outliers were ignored for further analysis. Log normal returns for ungraded and graded IPO issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean $\pm$ standard deviation unless otherwise stated. There were 182 ungraded and 104 graded IPO issues considered. Underpricing was lower in the case of graded issues (0.18 $\pm$ 0.58) than ungraded issues (0.29 $\pm$ 0.56). The variance for ungraded issues (0.317) was almost similar to that of graded issues (0.340). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.254). Underpricing for graded issues was 0.11 (95% CI, 0.30 to 0.45) lower than ungraded issues. There was a statistically significant difference in mean underpricing between ungraded and graded IPO issues, $t(284) = 3.638$, $p = 0.000$, and therefore, we can reject the null hypothesis.

Empirical findings using both either MAARO or log normal returns suggest that the extent of underpricing of ungraded IPOs is much greater than graded IPOs, and this result is statistically significant. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.4 Extent of Underpricing between & among Graded IPOs

The number of graded IPOs by fiscal year is illustrated in Figure 5.13. Our sample provides for 38, 34, and 32 IPOs of grade 1 & 2, grade 3, and grade 4 & 5 IPOs, respectively.



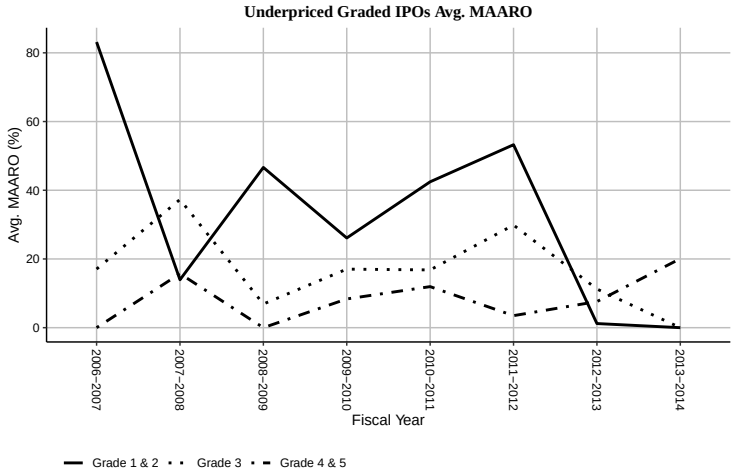
Source: Prime Database and Computed from Equation 3.3
Figure 5.13: *Underpriced Graded IPOs (FY 2006-2013).*

Average MAARO and Average Log Normal Return for underpriced graded IPOs is shown in Table 5.10. A graph depicting the average MAARO from Table 5.10 is illustrated in Figure 5.14.

Table 5.10: *Listing Day Performance of Underpriced Graded IPO Issues (FY 1999-2013)*

Fiscal Year	Underpriced IPOs			Average MAARO (%)			Avg. Log Normal Returns		
	Grade 1 & 2	Grade 3	Grade 4 & 5	Grade 1 & 2	Grade 3	Grade 4 & 5	Grade 1 & 2	Grade 3	Grade 4 & 5
2006-2007	2	1	0	83.14	17.06		0.6063	0.1575	
2007-2008	6	9	7	13.95	37.31	15.72	0.1304	0.3172	0.1460
2008-2009	6	5	0	46.64	6.89		0.3823	0.0668	
2009-2010	6	5	6	26.11	17.04	8.36	0.2318	0.1572	0.0804
2010-2011	10	10	13	42.46	16.81	11.95	0.3535	0.1553	0.1130
2011-2012	7	3	3	53.25	29.87	3.50	0.4268	0.2607	0.0344
2012-2013	1	1	2	1.20	11.25	7.60	0.0119	0.1066	0.0731
2013-2014	0	0	1			20.08			0.1830
	38	34	32						

Source: Computed from Equations 3.3 and 3.4



Source: From Table 5.10
Figure 5.14: *Underpriced Graded IPOs Average MAARO (FY 1999-2013).*

It is hypothesised that the extent of IPO underpricing remains the same irrespective of the IPO grade assigned by the rating agencies. We use a sub-sample of graded IPOs from a larger sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14.

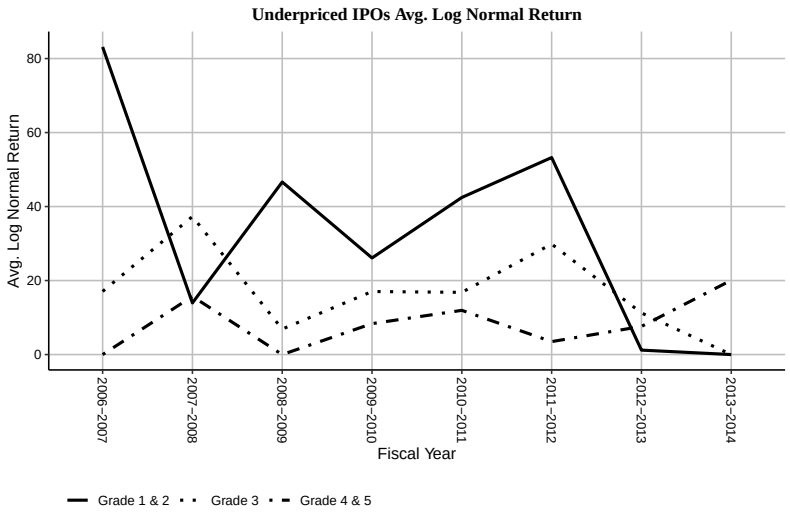
Table 5.11: *Comparison on extent of underpricing amongst graded IPOs, using MAARO*

Grade Category	IPOs	Mean	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
						Lower Bound	Upper Bound
Grade 1 & 2	38	34.44	75.42				
Grade 3	33	17.70	74.61	16.74	0.019	31.10	85.47
Grade 4 & 5	32	10.66	62.70	23.78	0.000	47.63	120.55

Source: Author Computed

We now discuss the results of the one-way ANOVA test using MAARO presented in Table 5.11. A one-way ANOVA was conducted to determine if the normalised marginally adjusted average return was different amongst graded underpriced IPOs. All IPOs were classified into three categories: the first category consisted of all underpriced IPOs issued Grade 1 & 2 (n=38), the second category consisted of all underpriced IPOs issued Grade 3 (n=34) and finally, the third category consisted of all underpriced IPOs issued Grade 4 & 5 (n=32). There was a presence of one outlier for a Grade 3 IPO, which was ignored for further analysis. There was homogeneity of variances, as assessed by Levene's test for equality of variances ($p=0.353$). Data are presented as mean $\pm$ standard deviation. Marginally adjusted returns decreased from IPOs with Grade 1 & 2 (n=38, 34.44 $\pm$ 75.43), to Grade 3 (n=33, 17.70 $\pm$ 74.61), to Grade 4 & 5 (n=32, 10.66 $\pm$ 62.70), in that order. Normalised marginally adjusted average return was statistically different amongst grades, $F(2,100) = 10.954$, $p < .0005$, $\omega^2 = 0.162$.

Tukey-Kramer post hoc analysis (results used if homogeneity of variances assumption is not violated) revealed that marginally adjusted average returns decreased from 34.44 $\pm$ 75.42 for IPOs in Grade 1 & 2 to 17.70 $\pm$ 74.61 for Grade 3 IPOs, a decrease of 16.74% (95% CI, 31.10 to 85.47), which was statistically significant ($p=0.019$). Marginally adjusted average returns decreased from 34.44 $\pm$ 75.42 for IPOs in Grade 1 & 2 to 10.66 $\pm$ 62.70 for Grade 4 & 5 IPOs, a decrease of 23.78% (95% CI, 47.63 to 120.55), which was statistically significant ($p=0.000$). We can thus reject the null hypothesis. There was no statistically significant decrease in the marginally adjusted average returns between Grade 3 and Grade 4 & 5 IPOs ($p=0.164$).
The results using log normal returns are discussed next.



Source: From Table 5.10

Figure 5.15: *Underpriced Graded IPOs Average Log Normal Return (FY 1999-2013).*

A graph depicting the average MAARO from Table 5.10 is illustrated in Figure 5.15.

Table 5.12: *Comparison on extent of underpricing amongst graded IPOs, using Log Normal Returns*

Grade Category	IPOs	Mean	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
						Lower Bound	Upper Bound
Grade 1 & 2	38	0.300	0.56				
Grade 3	33	0.160	0.56	0.140	0.019	0.27	0.62
Grade 4 & 5	32	0.100	0.49	0.200	0.000	0.39	0.79

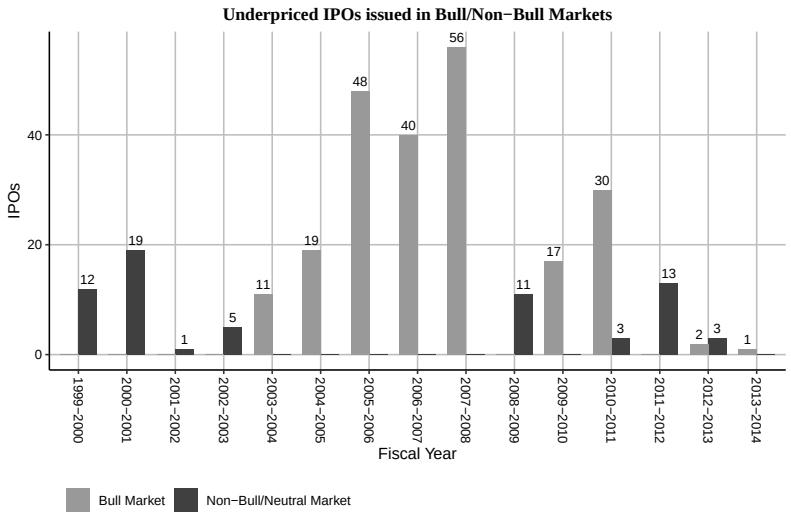
Source: Author Computed

We now discuss the results of the one-way ANOVA test using log normal returns presented in Table 5.12. A one-way ANOVA test was conducted to determine if the normalised log normal return was different amongst graded underpriced IPOs. There was a presence of one outlier for a Grade 3 IPO, which was ignored for further analysis. There was homogeneity of variances, as assessed by Levene's test for equality of variances ($p=0.355$). Data are presented as mean ± standard deviation. Log normal returns decreased from IPOs with Grade 1 & 2 (n=38, 0.30 ± 0.56), to Grade 3 (n=33, 0.16 ± 0.56), to Grade 4 & 5 (n=32, 0.10 ± 0.49), in that order. Normalised log normal return was statistically different between grades, $F(2,100) = 10.961$, $p < .0005$, $\omega^2 = 0.162$.

Tukey-Kramer post hoc analysis (results used if homogeneity of variances assumption is not violated) revealed that log normal returns decreased from 0.30 ± 0.56 for IPOs in Grade 1 & 2 to 0.16 ± 0.56 for Grade 3 IPOs, a decrease of 0.14 (95% CI, 0.27 to 0.62), which was statistically significant ($p=0.019$). Log normal returns decreased from 0.30 ± 0.56 for IPOs in Grade 1 & 2 to 0.10 ± 0.49 for Grade 4 & 5 IPOs, a decrease of 0.20 (95% CI, 0.39 to 0.79), which was statistically significant ($p<0.0005$). There was no statistically significant decrease in the log normal returns between Grade 3 and Grade 4 & 5 IPOs ($p=0.142$). We can thus accept the null hypothesis.

Empirical findings using both either MAARO or log normal returns suggest that the mean underpricing decreases as IPOs receive higher grades. There is a statistically significant difference in the extent of underpricing between Grade 1 & 2 IPOs with Grade 3 IPOs as well as Grade 1 & 2 IPOs with Grade 5 IPOs. However, there is no statistically significant difference between Grade 3 IPOs with Grade 4 & 5. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.5 Extent of Underpricing between IPOs in Bull/Non-Bull Markets



Source: Prime Database, NSE and Computed from Equation 3.3
Figure 5.16: *Underpriced IPOs issued in Bull/Non-Bull Markets (FY 1999-2013).*

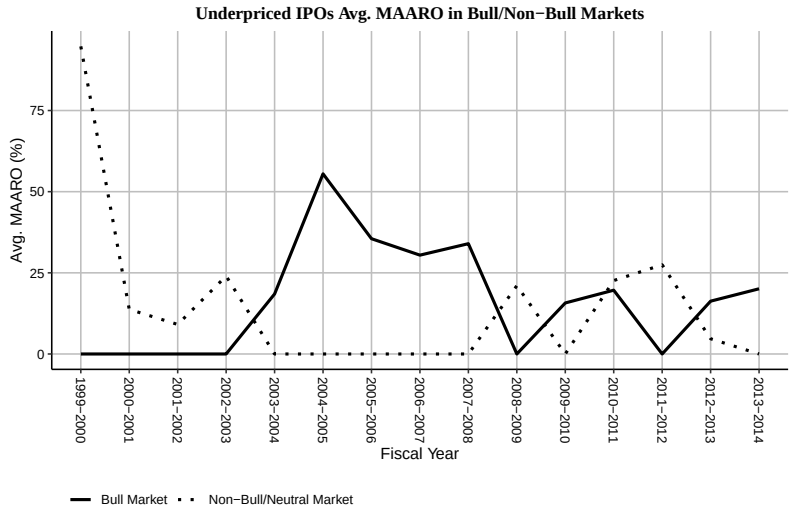
There are three significant bull periods in our study period. The number of underpriced IPOs issued in bull and non-bull markets by fiscal year is illustrated in Figure 5.16. Our sample provides for 67 and 224 underpriced IPOs issued in non-bull and bull markets, respectively.

Average MAARO and Average Log Normal Return for underpriced IPOs issued in bull and non-bull markets for the study period is shown in Table 5.13. A graph depicting the average MAARO from Table 5.13 is illustrated in Figure 5.17.

Table 5.13: *Listing Day Performance of IPOs issued in Non-Bull & Bull Markets (FY 1999-2013)*

Fiscal Year	Underpriced IPOs		Average MAARO (%)		Avg. Log Normal Returns	
	Non-Bull/Neutral	Bull	Non-Bull/Neutral	Bull	Non-Bull/Neutral	Bull
1999-2000	12	0	94.76		0.6692	
2000-2001	19	0	13.74		0.1289	
2001-2002	1	0	9.10		0.0871	
2002-2003	5	0	24.00		0.2149	
2003-2004	0	11		18.48		0.1693
2004-2005	0	19		55.49		0.4417
2005-2006	0	48		35.51		0.3040
2006-2007	0	40		30.45		0.2658
2007-2008	0	56		33.98		0.2924
2008-2009	11	0	21.04		0.1907	
2009-2010	0	17		15.72		0.1459
2010-2011	3	30	22.62	19.65	0.2037	0.1792
2011-2012	13	0	27.48		0.2423	
2012-2013	3	2	4.69	16.27	0.0460	0.1507
2013-2014	0	1		20.08		0.1830
	67	224				

Source: Computed from Equations 3.3 and 3.4



Source: From Table 5.13

Figure 5.17: *Average MAARO in Bull & Non-bull markets for Underpriced IPOs (FY 1999-2013).*

It is hypothesised that the extent of IPO underpricing does not differ significantly for IPOs issued using during a bull or non-bull/neutral markets. We use a sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14. The sample comprises of 67 and 224 IPOs issued in non-bull/neutral and bull markets, respectively.

Table 5.14: *Comparison of extent of underpricing during bull and non-bull markets, using MAARO*

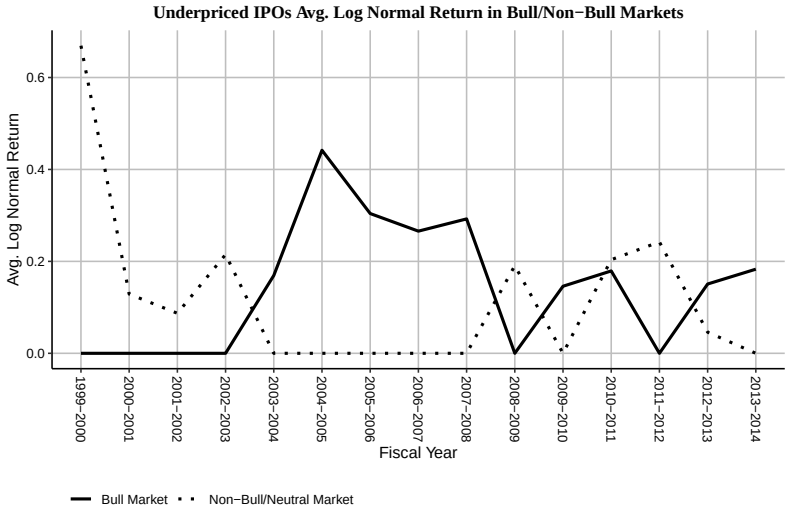
Market	Mean	Variance	Std. Deviation	t-test
Non-Bull	25.29	8498.55	92.19	-1.019
Bull	29.82	6140.93	78.36	

Source: Author Computed

We now discuss the results of the independent samples t-test using MAARO presented in Table 5.14.There were no outliers in the marginally adjusted returns for non-bull and bull market IPOs, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. Marginally adjusted average returns for non-bull and bull market

issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean ± standard deviation unless otherwise stated. There were 67 non-bull and 224 bull market IPO issues considered. Underpricing was lower in the case of non-bull market issues (25.29 ± 92.19) than bull market issues (29.82 ± 78.36). The variance for non-bull issues (8498.55) was almost 38% higher than that of bull issues (6140.93). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.071). Underpricing for non-bull market issues was 4.54% (95% CI, 17.27 to 33.11) lower than bull market issues. There was no statistically significant difference in mean underpricing between non-bull and bull market IPO issues, *t(289) =-1.019, p = 0.309*, and therefore, we can accept the null hypothesis.

The results using log normal returns are discussed next.



Source: From Table 5.13

Figure 5.18: *Underpriced Bull/Non-bull IPOs Average Log Normal Return (FY 1999-2013).*

A graph depicting average log normal return from Table 5.13 is illustrated in Figure 5.17.

Table 5.15: *Comparison of extent of underpricing during bull and non-bull markets, using Log Normal Returns*

Market	Mean	Variance	Std. Deviation	t-test
Non-Bull	0.23	0.429	0.65	-1.018
Bull	0.26	0.337	0.58	

Source: Author Computed

We now discuss the results of the independent samples t-test using log normal returns presented in Table 5.15. There were no outliers in the log normal returns for non-bull and bull market IPOs, as assessed by inspection of a box plot for values greater than 1.5 box-lengths from the edge of the box. Log normal returns for non-bull and bull market issues were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Data are mean ± standard deviation unless otherwise stated. There were 67 non-bull and 224 bull market IPO issues considered. Underpricing was lower in the case of non-bull market issues (0.23 ± 0.65) than bull market

issues (0.26 ± 0.58). The variance for non-bull issues (0.429) was almost 27% higher than that of bull issues (0.337). The assumption of homogeneity of variances on normalised returns was met, as assessed by Levene's test for equality of variances (p = 0.073). Underpricing for non-bull market issues was 0.04 (95% CI, 0.16 to 0.29) lower than bull market issues. There was no statistically significant difference in mean underpricing between non-bull and bull market IPO issues, *t(289) =-1.018, p = 0.310*, and therefore, we can accept the null hypothesis.

Empirical findings using both either MAARO or log normal returns suggest that although the mean underpricing IPOs issued in bull markets is higher than that of IPOs in non-bull markets, there is no statistical difference in the extent of underpricing between IPOs issued in bull and non-bull markets. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.6 Impacts of Sector on Extent of Underpricing

A study on the extent of underpricing by sector is conducted for underpriced IPOs. The count of IPOs issued and their issue size is as shown in Figure 5.1 (p.100). In the selected sample, 8 out of 63 sectors had ten or more IPOs issued and were selected for the listing day sectoral performance. The sectors selected for the listing day sectoral performance are Banks-Public Sector, Computers (Software), Computers (Software Medium & Small), Construction & Contracting (Civil), Construction & Contracting (Real Estate), Media & Entertainment, Miscellaneous Issues, and Pharmaceuticals.

It is hypothesised that the extent of underpricing does differ significantly across sectors and is the highest for the high technology sector. This study is similar to the study conducted by Gregoriou (2005) who found that firms belonging to new and emerging industries exhibit greater initial returns on their IPOs, this analysis finds evidence that supports this: IT sector IPOs are the most severely underpriced. Out of the 291 IPOs in the sample set, 132 underpriced IPOs covering eight sectors were considered for this study. Only sectors that had at least ten underpriced IPOs between FY 1999-00 and FY 2013-14 were selected for this study.

Table 5.16: *Average MAARO of selected sectors*

Sector	IPO's	Mean	Std. Dev.
Banks - Public Sector	10	19.63	65.43
Computers - Software	17	41.16	94.52
Computers - Software (Medium & Small)	22	54.21	80.31
Const. & Contracting - Civil	15	30.63	59.03
Const. & Contracting - Real Estate	11	11.43	72.16
Media & Entertainment	27	23.96	68.00
Miscellaneous	16	45.42	58.22
Pharmaceuticals	14	36.63	92.80
	132		

Source: Computed from Equation 3.3

The average marginally adjusted returns for select sectors are presented in Table 5.16. Our sample is comprised of 132 IPOs across eight sectors. Computers (Software Medium & Small) sector has the highest average marginally adjusted return when compared to other sectors.

Table 5.17: *Comparison of extent of underpricing for select sectors, using MAARO*

Sector	IPO's	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
					Lower Bound	Upper Bound
Computers - Software (Medium & Small)	22	80.31				
Computers - Software	16	84.00	6.2	1.000	8.35	97.27
Miscellaneous	16	58.22	8.8	0.998	12.16	83.41
Const. & Contracting - Civil	12	41.93	12.2	0.964	15.21	81.47
Pharmaceuticals	14	92.80	17.6	0.972	9.69	134.68
Media & Entertainment	27	68.00	30.2	0.121	25.29	132.89
Banks - Public Sector	10	65.43	34.6	0.147	23.17	176.76
Const. & Contracting - Real Estate	11	72.16	42.8	0.013	35.80	229.18
	128					

Source: Author Computed

We now discuss the results of the one-way ANOVA test using MAARO presented in Table 5.17. The one-way ANOVA test was conducted to determine if the MAARO returns were different based on the sector. There was a presence of three outliers for the Const. & Contracting-Civil sector and one outlier for the Computers-Software sector as assessed by the box plot. These outliers were not considered for analysis. The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances ($p=0.039$). A Welch-ANOVA test was run, and the extent of underpricing was statistically significantly different for different sectors, Welch's $F(7, 45.091) = 3.996, p = 0.002$. Games-Howell post hoc analysis (results used if homogeneity of variances assumption is violated) revealed that the mean marginally adjusted average returns were statistically significant ($p < .05$) between sectors such as Computers-Software (Medium & Small) and Const. & Contracting-Real Estate as well as between Const. & Contracting-Real Estate and Const. & Contracting-Civil as well as Miscellaneous sector.

The results using log normal returns are presented next.

Table 5.18: *Average Log Normal Returns of specific selected sectors*

Sector	IPO's	Mean	Std. Dev.
Banks - Public Sector	10	0.18	0.50
Computers - Software	17	0.35	0.67
Computers - Software (Medium & Small)	22	0.43	0.59
Const. & Contracting - Civil	15	0.27	0.46
Const. & Contracting - Real Estate	11	0.11	0.54
Media & Entertainment	27	0.22	0.52
Miscellaneous	16	0.37	0.46
Pharmaceuticals	14	0.31	0.66
	132		

Source: Computed from Equation 3.4

The average log normal returns for the sectors in the sample are shown in Table 5.18. Our sample is comprised of 132 IPOs across eight sectors. Computers (Software Medium & Small) sector has the highest log normal returns when compared with other sectors.

Table 5.19: *Comparison of extent of underpricing for select sectors, using Log Normal Returns*

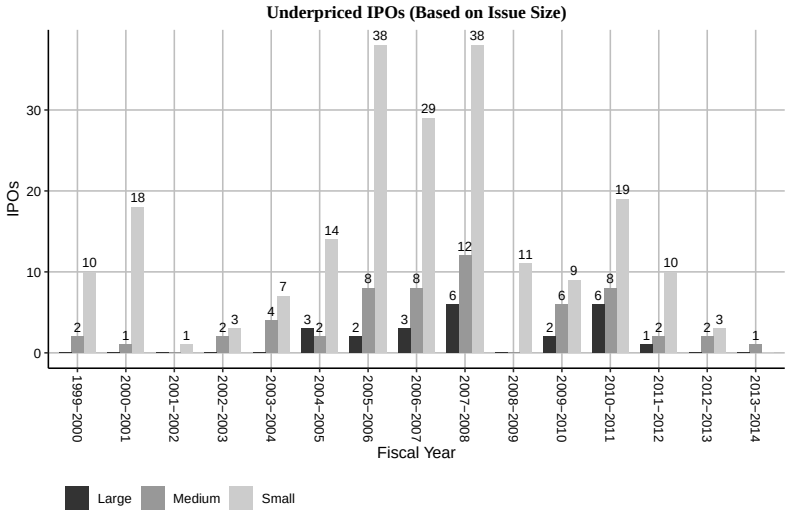
Sector	IPO's	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
					Lower Bound	Upper Bound
Computers - Software (Medium & Small)	22	0.593				
Miscellaneous	16	0.458	0.06	0.998	0.115	0.609
Const. & Contracting - Civil	12	0.350	0.084	0.963	0.141	0.599
Computers - Software	15	0.560	0.086	0.992	0.103	0.717
Pharmaceuticals	14	0.659	0.122	0.972	0.092	0.856
Media & Entertainment	27	0.519	0.219	0.121	0.225	0.849
Banks - Public Sector	10	0.504	0.255	0.147	0.210	1.017
Const. & Contracting - Real Estate	11	0.543	0.326	0.013	0.306	1.182
	127					

Source: Author Computed

We now discuss the results of the one-way ANOVA test using log normal returns presented in Table 5.19. There was a presence of three outliers for the Const. & Contracting-Civil sector and two outliers for the Computers-Software sector as assessed by the box plot. These outliers were not considered for analysis. The assumption of homogeneity of variances was not violated, as assessed by Levene's test for equality of variances ($p=0.066$). Normalised log normal return was statistically different for different sectors, $F(7,119) = 3.829$, $p < .05$. Tukey-Kramer post hoc analysis (results used if homogeneity of variances assumption is not violated) revealed that the mean log normal returns were statistically significant ($p < .05$) between sectors such as Computers-Software (Medium & Small) and Const. & Contracting- Real Estate, Computers-Software and Const. & Contracting-Real Estate as well as Const. & Contracting-Real Estate and Miscellaneous sector.

Empirical findings using both either MAARO or log normal returns suggest that Computers-Software (Medium & Small) sector exhibits the highest level of underpricing, and thus we can accept the null hypothesis. From an investor standpoint, besides Computers-Software (Medium & Small) sector, the other sectors favourable for short-term gains are Computers-Software, Miscellaneous, and Const. & Contracting-Civil. Const. & Contracting-Real Estate sector would deliver the lowest short-term gains. Our results concur using both measures of listing performance, which add to the robustness of the results.

5.4.7 Impacts of Issue Size on Extent of Underpricing



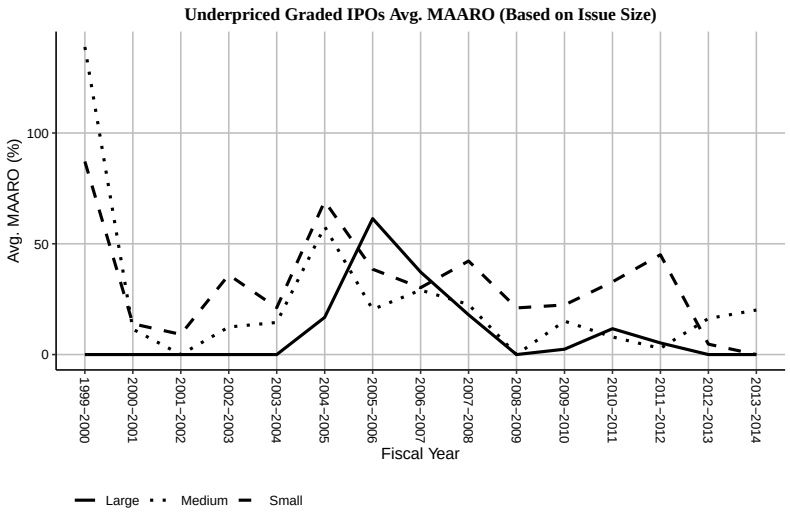
Source: Prime Database and Computed from Equation 3.3
Figure 5.19: *Underpriced IPOs by Issue Size (FY 1999-2013).*

The number of IPOs by fiscal year and classified by issue size in our sample is illustrated in Figure 5.19. We classify IPOs as small, medium, and large-size based on their issue size. IPOs with an issue size of fewer than 200 Cr. are categorised as small-size, greater than or equal to 200 Cr., but less than 1000 Cr. are categorised as mid-size, and issue size greater than or equal to 1000 Cr. are categorised as large-size. This classification yields us 210, 58, and 23 IPOs in small, mid, and large-size, respectively.

Table 5.20: *Listing Day Performance of Underpriced IPOs by Issue Size (FY 1999-2013)*

Fiscal Year	Underpriced IPOs			Average MAARO (%)			Avg. Log Normal Returns		
	Small Size	Mid Size	Large Size	Small Size	Mid Size	Large Size	Small Size	Mid Size	Large Size
1999-2000	10	2	0	87.13	138.84		0.6295	0.8706	
2000-2001	18	1	0	13.88	11.45		0.1301	0.1084	
2001-2002	1	0	0	9.10			0.0871		
2002-2003	3	2	0	35.97	12.42		0.3071	0.1171	
2003-2004	7	4	0	21.16	14.49		0.1915	0.1352	
2004-2005	14	2	3	69.19	57.74	16.80	0.5267	0.4558	0.1553
2005-2006	38	8	2	38.52	20.37	61.36	0.3263	0.1852	0.4784
2006-2007	29	8	3	30.18	29.09	37.24	0.2638	0.2553	0.3163
2007-2008	38	12	6	42.22	22.59	17.94	0.3524	0.2035	0.1647
2008-2009	11	0	0	21.04			0.1907		
2009-2010	9	6	2	22.39	15.09	2.42	0.2018	0.1404	0.0238
2010-2011	19	8	6	32.81	7.95	11.67	0.2833	0.0768	0.1104
2011-2012	10	2	1	45.04	2.79	5.24	0.3714	0.0275	0.0511
2012-2013	3	2	0	4.69	16.27		0.0460	0.1507	
2013-2014	0	1	0		20.08			0.1830	
	210	58	23						

Source: Computed from Equations 3.3 and 3.4



Source: From Table 5.20

Figure 5.20: *Average MAARO by Issue Size for Underpriced IPOs (FY 1999-2013).*

Average MAARO and Average Log Normal Return for small, mid, and large-size classifications for the study period are shown in Table 5.20. A graph depicting the average MAARO from Table 5.20 is illustrated in Figure 5.20.

It is hypothesised that the extent of IPO underpricing differs significantly for the small-size IPOs when compared to mid or large-size IPOs. This is in support of the study conducted by Chalk and Peavy III (1987); Ibbotson et al. (1994) on U.S. data, which in the short-run, reported that underpricing is found to occur more often on smaller offerings than larger offerings, on average.

Table 5.21: *Comparison of extent of underpricing among issue size categories, using MAARO*

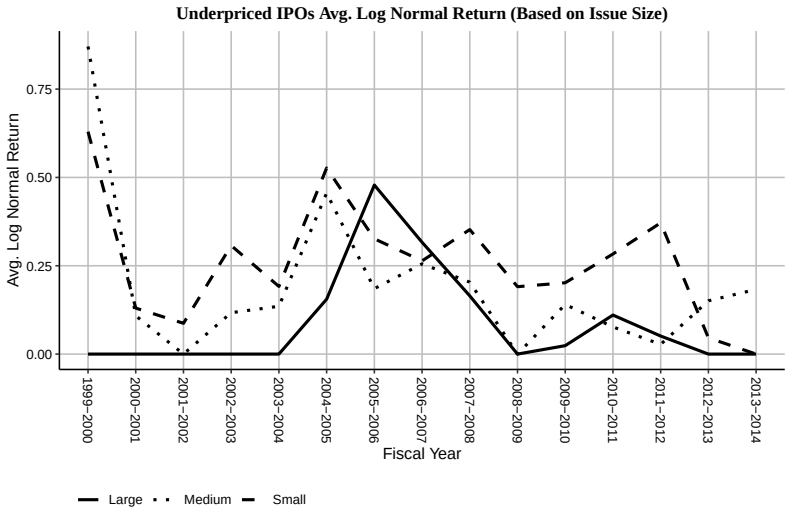
Size Classification	IPOs	Mean	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
						Lower Bound	Upper Bound
Small Size	210	33.96	80.95				
Mid Size	58	18.95	75.38	15.01	0.002	33.98	69.73
Large Size	23	16.45	78.28	17.51	0.013	32.12	90.65

Source: Author Computed

We now discuss the results of the one-way ANOVA test using MAARO presented in Table 5.21. There were no outliers in the sample considered for analysis. The sample comprises of 291 underpriced IPOs, which were further classified into small, mid, and large-size stocks. A one-way ANOVA was conducted to determine if the normalised marginally adjusted average return was different for issue size categories. All IPOs were classified into 3 groups: Small-size (n=210), Mid-size (n=58), and Large-size (n=23). There was homogeneity of variances, as assessed by Levene's test for equality of variances ($p=.937$). Data are presented as mean ± standard deviation. Marginally adjusted returns increased from large-size (n=23, 16.45 ± 78.28), to mid-size (n=58, 18.95 ± 75.38), to small-size (n=210, 33.96 ± 80.95), in that order. Normalised marginally adjusted average return was statistically different for issue size categories, $F(2,288) = 7.696$, $p < .0005$, $\omega^2 = 0.050$.

Tukey-Kramer post hoc analysis (results used if homogeneity of variances assumption is not violated) revealed that marginally adjusted average returns increased from 16.45 ± 78.28 in the large-size group to 33.96 ± 80.95 in the small-size group, an increase of 17.51% (95% CI, 32.12 to 90.65), which was statistically significant (*p=0.013*). Marginally adjusted average returns increased from 18.95 ± 75.38 in the mid-size group to 33.96 ± 80.95 in the small-size group, an increase of 15.01% (95% CI, 33.98 to 69.73), which was statistically significant (*p=.002*). There was no statistically significant increase in the marginally adjusted average returns between large-size and mid-size stocks (*p=0.884*). We can thus, accept the null hypothesis.

The results using log normal returns are discussed next.



Source: From Table 5.20

Figure 5.21: *Average Log Normal Returns by Issue Size for Underpriced IPOs (FY 1999-2013).*

A graph depicting average log normal returns from Table 5.20 is illustrated in Figure 5.21.

Table 5.22: *Comparison of extent of underpricing among issue size categories, using Log Normal Returns*

Size Classification	IPOs	Mean	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
						Lower Bound	Upper Bound
Small Size	210	0.292	0.59				
Mid Size	58	0.173	0.56	0.119	0.002	0.29	0.53
Large Size	23	0.152	0.58	0.140	0.013	0.28	0.65

Source: Author Computed

We now discuss the results of the one-way ANOVA test using log normal returns presented in Table 5.22. There were no outliers in the sample considered for analysis. The sample comprises of 291 underpriced IPOs, which were further classified into small, mid, and large-size stocks. A one-way ANOVA test was conducted to determine if the normalised log normal return was different for issue size categories. All IPOs were classified into 3 groups: Small-size (n=210), Mid-size (n=58), and Large-size (n=23). There was homogeneity of variances, as assessed by Levene's test for equality of variances (*p=.936*). Data are presented as mean ± standard deviation. Log normal returns increased from large-size (n=23, 0.152 ± 0.58), to mid-size (n=58, 0.173 ± 0.56), to small-size (n=210, 0.292 ± 0.59), in that order. Normalised

log normal return was statistically different for different issue size categories, $F(2,288) = 8.706$, $p < .0005$, $\omega^2 = 0.050$.

Tukey-Kramer post hoc analysis (results used if homogeneity of variances assumption is not violated) revealed that log normal returns increased from 0.152 ± 0.58 in the large-size group to 0.292 ± 0.59 in the small-size group, an increase of 0.119 (95% CI, 0.28 to 0.65), which was statistically significant ($p=.013$). Log normal returns increased from 0.173 ± 0.56 in the mid-size group to 0.292 ± 0.59 in the small-size group, an increase of 0.14 (95% CI, 0.29 to 0.53), which was statistically significant ($p=.002$). There was no statistically significant increase in the log normal returns between large-size and mid-size stocks ($p=.884$). We can thus, accept the null hypothesis.

Empirical findings using both either MAARO or log normal returns tell us that the mean underpricing of IPOs reduced as the issue size increased. The difference in the extent of underpricing between small-size IPOs when compared to mid or large-size IPOs is statistically significant.

5.4.8 Role of Macroeconomic Factors on Underpricing

Some macroeconomic variables exert an influence that affects stock returns and increases volatility (Ross, 1976). Macroeconomic factors affect stock market volatility such that exchange rate volatility, short-term interest rate volatility, and financial crises have a very negative impact on stock returns (Chinzara, 2010). Fluctuations in the exchange rates lead to uncertainties and market volatilities (Ross et al., 2008). Hsing (2011) observed that there is a positive relationship between stock returns and the foreign exchange rate. Benita and Lauterbach (2007) observe that exchange rate volatility has real economic costs that affect price stability, firm profitability, and the general economy's stability. Foreign exchange rate volatility impacts IPO stock returns and variability because of its ability to impact the economy. The study by Schwert (1989) finds that movements in inflation and real output have weak predictive power on the volatility of the stock market and return. Interest rates promote economic growth and development, implying that a lower interest rate has a positive impact on IPO stock returns Chen, Roll, and Ross (1986). Short-term interest rate variations influence general investment and spending, given an effect on long-term rates of interest (Shiller & McCulloch, 1990; Campbell & Shiller, 1991). Changes in inflation rates, as measured by changes in these rates, have a greater impact on predicting the stock market volatility (Yaya & Shittu, 2010).

Most of the past research has been conducted to study the effect of macroeconomic

variables on stock prices. We partly use those results to assess the impact on underpricing by way of a regression model. This study considers the following independent variables: dividend yield, growth rate, exchange rate, repo rate, and inflation.

Choice of Variables for Regression Model and Hypothesis

The following explanatory variables were chosen for the regression model to ascertain the major determinants of MAARO.

Dividend Yield (DY): When dividend yields are abnormally high, stocks are cheaper to buy. In that case, the expectation would be for investors to invest in existing stocks as opposed to taking a risk by investing in IPOs. This would suggest a negative relationship between dividend yield and the level of underpricing.

Growth Rate (GR): When the economy is growing, the expectation would be for investors to invest in IPOs. This would suggest a positive relationship between growth rate and MAARO. We expect a positive relationship between the growth rate and the level of underpricing.

Exchange Rate (ER): A higher exchange rate impacts the economy by way of firm stability and profitability, indicating a negative relationship between exchange rate and MAARO. We expect a negative relationship between the exchange rate and the level of underpricing.

Repo Rate (RR): This is the overnight lending rate amongst banks. This variable is chosen as a proxy for short-term interest rates. A higher short-term interest rate should return a higher MAARO. This would be in line with the findings from Chen et al. (1986). However, the study by Choe, Masulis, and Nanda (1993) concludes that while business cycle variables are significant explanatory variables, interest rate variables are generally insignificant. We expect to observe a positive relationship between the overnight lending repo rate and the level of underpricing.

Inflation Rate (INFL): Past studies reveal that inflation rates impact stock market volatility. We expect a negative relationship between the inflation rate and the level of underpricing.

Bond Yield and Interest rates were excluded from these variables since they both exhibited a high level of correlation with other macroeconomic variables.

The regression equation is defined by

$$\widehat{MAARO}(N) = \alpha + \beta_1(DY) + \beta_2(GR) + \beta_3(ER) + \beta_4(RR) + \beta_5(INFL) + \epsilon \quad \ldots(5.3)$$

where:

MAARO (Normalised) = the explained variable;

DY, GR, ER, RR, INFL = the explanatory variables;

β_1 ... β_5 = model parameters; where it is assumed that $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 > 0$, $\beta_5 < 0$;

α = Constant, ϵ = specification error, unknown (the difference between the true and the specified model)

The variables under consideration are the normalised marginally adjusted returns on opening as the dependent variable and the dividend yield, growth rate, exchange rate, repo rate, and the monthly inflation rate as the independent variables. There were 291 cases considered for this multiple regression. There were no outliers identified in the case-wise diagnostics. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.911.

The assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were met. All variables statistically significantly predicted marginally adjusted return on opening, $F(5,285)=5.059$, $p<0.005$, adj. $R^2 = 0.065$. All five independent variables added statistically significantly to the prediction, $p < 0.05$.

Table 5.23: *Regression Analysis Results - Influence of Macroeconomic factors on Underpricing*

Variable	B	SE_B	β
Intercept	2.278	0.989	
DY	0.395	0.183	0.142*
GR	0.091	0.051	0.112
ER	-0.070	0.021	-0.204*
RR	0.031	0.040	0.049
INFL	-0.163	0.077	-0.124*

Note: * $p < 0.05$;
B= unstandardized regression coefficient;
SE_B = Standard error of the coefficient;
β = standardized coefficient
Source: Computed from Equation No. 5.3

Based on the multiple linear regression results, as shown in Table 5.23, it is clear that all the independent variables were regressed against the level of underpricing, i.e., MAARO. Concerning dividend yields, we expect that as dividend yields rise, stocks in the market become cheaper, and investors would rather not invest in IPOs. However, this is not observed in the Indian context for the period FY 1999-00 until FY 2013-14. There is also a significant positive relationship between dividend yield and MAARO at the 5% significance level. We, therefore, reject the null hypothesis. In the case of growth rate, there is a very mild positive relationship between the growth rate and MAARO. Although not statistically significant, we accept the null hypothesis. The exchange rate exhibits a negative relationship with MAARO, which is also significant at the 5% significance level. We accept the null hypothesis. The relationship between repo rate and MAARO, although positive as expected, is not statistically significant. We accept the null hypothesis. Finally, we observe a statistically significant negative relationship between inflation rate and MAARO, and hence we accept the null hypothesis.

5.5 Summary and Conclusions

First, this study tries to confirm if there is a reduced level of underpricing exhibited when IPOs are issued using the book-building mechanism. We study the extent of underpricing between book-built and fixed-price IPOs. Empirical findings suggest that the extent of underpricing in the case of book-built issues is much smaller than fixed-price IPO issues. The book-built mechanism allows for the adjustment of the offer price upwards or downwards in the final prospectus based on the market feedback and hence could be the reason behind lower underpricing. Market feedback hypothesis is applicable in our study, given the statistically significant difference in underpricing between fixed-price and bookbuilt issues. Our results are in line with observations made by Benveniste and Spindt (1989); Benveniste and Wilhelm (1990); Spatt and Srivastava (1991); Hawaldar et al. (2018) but not with findings of Giudici and Paleari (1999); Ljungqvist et al. (2003); Derrien and Womack (2003).

The next aspect of our study is on the extent of underpricing amongst IPOs issued in hot and cold markets. Empirical findings suggest that the mean underpricing in either market is almost the same. Our results concur with the findings of Garg et al. (2008), who also concluded that the level of underpricing does not differ much in the hot and cold IPO markets. The results indicate that the market timing theory does not apply to our study. Our results do not match other studies in the international scenario such as Ibbotson and Jaffe (1975); Ritter (1984); Wang (1999); Neneh and Smit (2013); Alim et al. (2016).

Our next element of the study is related to the extent of underpricing between graded and ungraded IPOs as well as amongst graded IPOs. Our results indicate that IPO grading is relevant in explaining the listing day returns. Empirical findings show us that the ungraded IPO issues exhibit a higher level of underpricing as opposed to graded IPOs. This indicates the effects of certification towards reducing underpricing for graded IPOs. Our conclusions are similar to the findings of Deb and Marisetty (2010); Dhamija and Arora (2017); Tripathi and Pandey (2018) but different from that of Khurshed et al. (2008); Chhabra et al. (2017).

Empirical findings to understand the extent of underpricing based on graded IPOs show us that the IPO issues with Grade 1 & 2 exhibit the highest level of underpricing followed by IPOs with Grade 3 and finally Grade 4 & 5 IPOs that exhibit the lowest level of underpricing. IPOs with a higher grade exhibit fundamental strength of the firm and hence are underpriced the least as opposed to firms with Grade 1 & 2, which indicates a low quality of the issuing firm. Higher grade IPOs also indicate the quality of the IPO in the eyes of the investor and

hence a lower risk investment as opposed to poorly graded IPOs where one would expect high returns to be associated with them to compensate for the risk. This results in the underwriters severely underpricing poor grade IPO issues to generate interest amongst investors. Regarding statistical significance, the extent of underpricing is significant between Grade 1 & 2 with Grade 3 as well as between Grade 1 & 2 with Grade 4 & 5 IPOs. There is no statistically significant difference between IPOs with Grade 3 and Grade 4 & 5. Our results, however, do indicate that underpricing decreases with increasing grades. This indicates the effects of certification towards reducing underpricing amongst graded IPOs. Our results concur with previous other findings in India, such as Poudyal (2008); Tripathi and Pandey (2018); Kashiramka et al. (2018) but not with those of Sahoo and Kaur (2017); Dhamija and Arora (2017); Chhabra et al. (2017).

The next aspect under study focuses on the extent of underpricing of IPOs issued in bull or non-bull/neutral markets. We find that the extent of underpricing in either market is the same. The mean underpricing during non-bull markets is lower as compared to bull markets, but the results are not statistically significant. The results indicate that the market timing theory does not apply to our study. This result is different from past studies by Jog and Riding (1987); Loughran and Ritter (2004); Garg et al. (2008). Jog and Riding (1987) conclude that the degree of underpricing was higher when the trading volume was low. The study by Loughran and Ritter (2004) find a much higher underpricing during bullish periods and that during bull periods, there is less focus on maximising IPO proceeds. The study by Garg et al. (2008) concludes that the abnormal returns from the IPO underpricing differ significantly in the bearish and bullish phases of the market.

The next aspect under study determines the impacts of an IPOs association with any specific sector on the extent of underpricing. Empirical findings show us that the Computers-Software (Medium & Small) sector exhibits the highest level of underpricing, whereas the Const. & Contracting (Real Estate), followed by Banks-Public sectors, exhibits the lowest level of underpricing. A possible reason could be because newer industries, especially ones where high technology is utilised, are more subject to non-fundamental factors and signalling effects than more seasoned industries with a longer, more informative history. Many technology companies that go public have dismal or no earlier revenue records to study. Also, many are yet to be profitable before their stock is trading on the exchanges. As a result, underwriters underprice such issues to generate interest amongst investors. Our outcome is similar to those found in other countries and documented by researchers such as Karlis (2000); Henrick (2012); Singh and Kumar (2012).

Our next aspect studies the impacts of issue size on underpricing. Small-size IPO issues exhibit the highest level of underpricing followed by the mid-size and then by large-size, which exhibits the lowest level of underpricing. Small-size issues with low priced shares are viewed by investors as high risk, so one would expect high returns to be associated with them to compensate for the risk. As a result, underwriters are severely underpricing small-size issues to generate interest amongst investors. Regarding statistical significance, the extent of underpricing is significant between Small-size with Mid-size as well as between Small-size with Large-size IPOs. There is no statistically significant difference between Mid-size and Large-size IPOs. The results indicate that the signalling hypothesis is applicable to our study since small issue size IPOs are underpriced the most, and large issue size IPOs underpriced the least. Our results are comparable to those found in other countries and documented by researchers such as Ibbotson et al. (1994); Khurshed et al. (2008); Islam et al. (2010); Yong (2011); Dhamija and Arora (2017) but is different from the conclusion arrived in a study by Michaely and Shaw (1994); Chhabra et al. (2017).

Finally, we study the impacts of macroeconomic factors on underpricing to determine a regression model that can estimate MAARO. In our results with the regression model to determine MAARO, we find a robust positive relation between Dividend Yield and MAARO. This is an exception since where we expect that as dividend yields rise, stocks in the market become cheaper, and investors would instead not invest in IPOs. This was not observed in our study. There is also a very mild positive relationship observed between the growth rate as well as the repo rate to MAARO. Our study uses the repo rate as a proxy for short-term interest rates, and the conclusions are similar to those made by Shiller and McCulloch (1990); Campbell and Shiller (1991) who observed that variation in the short-term interest rates influence general investment and spending and sways investment by investors. The findings are also similar to that of Chen et al. (1986). However, the study by Choe et al. (1993) concluded that while business cycle variables are significant explanatory variables while interest rate variables are insignificant. We observe a statistically significant negative relationship between the inflation rate and MAARO. The model also indicates a statistically significant negative relationship between the exchange rate and MAARO.

This chapter studied the listing day performance of underpriced IPOs. It examined the extent of underpricing across various cross-sections such as (a) IPOs listed using either pricing mechanism, (b) IPOs listed in hot/cold market conditions, (c) IPOs are either graded/ungraded, (d) IPOs are graded, (e) IPOs are listed in bull/non-bull markets, (f) IPOs are affiliated with select sectors, (g) IPOs are compared across issue size categories (small, mid and large). The

chapter also derived a relationship between MAARO and certain macroeconomic factors. The next chapter, entitled "Long-Run Performance of Underpriced IPOs", studies the long-run performance of underpriced IPOs across cross-sections similar to the listing day performance study.

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Chapter 6

Long-Run Performance of Underpriced IPOs

6.1 Introduction

The Indian economy has undergone several structural as well as policy reforms over the past two decades. Globalisation, liberalisation, and strengthened regulations over a period have contributed to the broadening of the securities market. The most noticeable change was the dismantling of the Controller of Capital Issues (CCI) and the introduction of the Securities and Exchange Board of India (SEBI). The initiative to bring reforms to the markets was taken up by SEBI, the securities market regulating body in India. There was a need to make the Indian stock market amongst the best in the world regarding the safety, transparency, and security of investment. A large number of regulations pertained to Initial Public Offerings (IPOs), which is a mechanism used by firms to help raise capital in the primary market.

Most investors look at capital market investment to generate long-term assets. Given that investment in securities is a long-term investment, any study of IPO performance would not be complete without examining the long-run performance of the shares issued through an IPO. This study evaluates the 3-year long-run performance of underpriced IPOs in the Indian IPO market listed on the National Stock Exchange (NSE).

Numerous studies in the Indian markets such as Aggarwal and Rivoli (1990); Purnanandam and Swaminathan (2004); Sahoo and Rajib (2010); Pandya (2016) have been conducted over various periods to evaluate the long-run performance of IPOs. In the same spirit, this study seeks to assess the long-run performance of the selected sample of underpriced

IPOs issued on the National Stock Exchange (NSE) in India.

IPOs on the Indian stock market can be priced using either the fixed-price or bookbuilt mechanism. Does the use of either pricing mechanism impact long-run performance? This study investigates to understand if there is any impact on the long-run performance of IPOs issued using either pricing mechanisms from our selected sample of underpriced IPOs. Does the market timing of IPOs lead to a positive performance over the long-run? Would IPOs perform differently in the long-run listed during periods of high IPO listing activity? To determine this, we study the long-run performance of the underpriced IPOs during hot and cold markets from our selected sample. Many studies such as Poudyal (2008); Deb and Marisetty (2010); Khurshed, Paleari, Pande, and Vismara (2014); Phadke and Kamat (2016) investigate the impact of IPO grades and their returns on the listing. Studies on the influence of grades on long-run performance have been done by Dhamija and Arora (2014); Ramesh and Dhume (2015). This study compares the performance of underpriced graded and ungraded IPOs over the long-run. This study also compares the performance of IPOs across grades from our selected sample of underpriced IPOs. Markets over the long-run, go through various phases of a bull, bear or flat markets. This study compares the long-run performance of IPOs listed during bull market periods against non-bull/neutral market periods. Kooli and Suret (2004); Sharma, Mittal, and Gupta (2013) studied the performance of IPOs across different industries and the effect of the non-performing IPOs. On similar lines, we also undertake a study of the long-run performance of underpriced IPOs across select sectors. Does the size of the IPO impact long-run performance? Previous studies to understand the impact of issue size on long-run performance have been conducted by Stoll and Curley (1970); De Bondt and Thaler (1985). This paper also undertakes a similar study to understand the impact of capitalisation on the long-run performance of the underpriced IPOs on the Indian stock markets from our selected sample.

The remaining part of this study is divided as follows. This introduction is followed with the review of literature in Section 6.2, data and techniques in Section 6.3, results and discussion in Section 6.4. Finally, the summary and conclusions are covered in Section 6.5.

6.2 Literature Review

The phenomena of poor returns on IPOs has been examined across the world by many researchers such as Ibbotson (1975); Ritter (1991); Kooli and Suret (2004); Purnanandam and Swaminathan (2004); Sahoo and Rajib (2010); Dutta and Swain (2012).

The study by Ibbotson (1975) finds that there are no departures from market efficiency in the after-market; however, stock returns are positive initially before becoming negative but start delivering a positive return over the long term. Ritter (1991) finds that IPO's underperformed in the long-run and that the underperformance was concentrated among relatively young growth companies. The study by Kooli and Suret (2004) in Canada find that Canadian IPO's underperform significantly compared to a sample of seasoned firms with the same market capitalisation. Purnanandam and Swaminathan (2004) find that IPOs are overvalued at the offer price, increases afterwards and revert to fair value in the long-run, and found that underpriced IPOs can be overvalued. Pandya (2016) find that IPOs underperformed during the immediate period, which eventually turned negative from medium to longer-term time framework. Sahoo and Rajib (2010) find that the IPO subscribers on listing day had positive returns for IPOs, replaced by persistent underperformance up to 12 months of trading followed by a positive market-adjusted return. The authors also find that variables such as the offer size, underprice, leverage, ex-ante uncertainty, and IPO activity period (i.e., Hot/Cold markets) significantly explain the underperformance in the long run. However, variables such as post-issue promoter group holding, the rate of subscription, the age of IPO firm, and offer price-to-book value ratio were statistically insignificant in explaining long-run underperformance. Dutta and Swain (2012) find no reason to believe that underpriced IPOs perform better over the long run. Das, Saha, and Kundu (2016) conducted a 5-year long-run performance study on select Indian IPOs listed over the period 1999–2007 using various measures of long-run performance and find that the methodology used provides mixed results. The authors find that although both measures find positive long-run average abnormal returns, the time frames going from a negative to a positive return or vice-versa are different when results are examined using CAR and BHAR.

A study by Hawaldar, Naveen Kumar, and Mallikarjunappa (2018) examined the long-run performance of 464 (365 bookbuilt IPOs and 99 fixed-price IPOs) IPOs issued in India between 2001 and 2011. The authors find that bookbuilt IPOs deliver a negative performance up to five years and beyond post-listing while fixed-price IPOs provide positive abnormal performance after 18 months post listing.

Sahoo and Rajib (2010) studied the after-market pricing performance on listing day as well as in the long-run. They concluded that variables such as the offer size, underprice, leverage, ex-ante uncertainty, and presence of hot/cold markets significantly explain the underperformance in the long run.

The study on IPO underpricing by Poudyal (2008) find a weak statistical relationship

between the issue grade and long-run performance. Findings by Dhamija and Arora (2014) imply that the long-run performance of IPOs does not bear any relationship with the grade awarded. The study by Ramesh and Dhume (2015) finds that better grades do not guarantee long-run returns for IPOs. A study by Kashiramka, Thomas, Yadav, and Rao (2018) states that higher graded IPOs do not ensure better returns in the long run.

Sentiment or over-optimism drive the price above fundamentals. When prices revert to fundamentals in the long-run, returns are more detrimental to issues that came to a market during periods when sentiment was high. Firm managers and investment bankers will bring IPOs to market when sentiment is high; markets are at the peak, and when feedback risk is small towards maximising proceeds (Loughran & Ritter, 1995). The study by Schaub (2011) finds that IPOs issued in bull markets underperform while those issued in bear markets outperform the market index.

The study by Ritter (1991) implies that investors are irrationally over-optimistic about the future potential of specific industries. A study by Kooli and Suret (2004) find that the long-run performance of IPO's varies widely in different industries. Sharma et al. (2013) studied the performance of IPOs in various sectors and find that public sector stocks outperform all other sector stocks during short as well as long-term period. Over the long-term, the only sector that performed well was the IT industry. Singh and Kumar (2012) proposed a model to explain underpricing using the over-subscription rate, age of the firm, and issue size as independent variables. The authors conducted a 250-day long-run sector-wise analysis of performance. The authors find that issues with higher institutional demand lend to higher long-term returns. During the sectoral study, the authors find that while the IT sector gave higher initial returns in the short-run, the returns were negative in the long run. The education sector provided the highest long-run returns in their study.

IPO issues with small capitalisation do not perform well over the long run (Stoll & Curley, 1970; De Bondt & Thaler, 1985). Stoll and Curley (1970), in their study using small offers, find that stocks show appreciation in the short-run but perform poorly in the long-run. De Bondt and Thaler (1985), in their study, present evidence for small-capitalisation stocks and their negative relationship between the short and long-run abnormal returns, which they interpret as evidence of market overreaction.

6.3 Data and Techniques

The source of secondary data used for the study has been described in section 3.2. As shown in Table 3.1 (p. 60), there are 284 IPOs that are considered for long-run performance analysis over 36 periods (each period is 21 consecutive trading days). The selected sample represents 63.82% of the IPO activity from FY 1999-2013. Trading history for each of the 284 underpriced IPOs was analysed from the date of listing for 36 periods to evaluate their long-run price performance.

This study utilises Wealth Relative (WR) and Average Buy-And-Hold Abnormal Return (ABHAR) as the two measures of long-run performance as defined in Eq. 3.5 and 3.7. We compare the long-run performance of underpriced IPOs using the fixed-price and bookbuilt mechanism to evaluate the long-run performance of IPOs issued using either pricing mechanisms. Our sample includes 230 bookbuilt and 54 fixed-price issues. We determine the presence of a cold or hot IPO market based on the number of IPOs listed in that corresponding quarter. We identify a market to be hot if there are five or more IPOs released in a quarter. There are 32 out of 52 quarters where five or more IPOs were listed, as shown in Figure 5.2 (p. 100). Our sample provides for 28 and 256 underpriced IPOs listed during cold and hot markets, respectively. For a comparison of performance by grade, we compare the long-run performance of underpriced IPOs based on the grade classification issued by various rating agencies. Our sample consists of 100 graded and 184 ungraded IPOs, respectively. We also conduct a comparison of long-run performance across grade categories. Our sample provides us 35 IPOs in grades 1 and 2, 33 IPOs in grade 3, and 32 IPOs in grades 4 and 5. From Figure 5.3 (p. 101), we observe a significant upward momentum and bull markets during periods 7th July 2003 until 27th March 2008, 26th May 2009 until 3rd March 2011 and 27th July 2012 until the end of the period of study. These bull periods were identified using a cross-over method of the 50-day SMA and 200-day SMA. From the 284 IPOs in the selected sample, there are 219 IPOs that were issued during bull periods while 65 IPOs were issued during non-bull/neutral markets. This study seeks to find out if, over the long-run, underpriced IPOs issued during a bull market performed better as compared to IPOs issued during non-bull/neutral markets. A study of long-run performance by sector is conducted for underpriced IPOs. The count of IPOs issued and their issue size is as shown in Fig.5.1 (p. 100). In the selected sample, eight out of 63 sectors had ten or more underpriced IPOs that are selected for long-run sectoral performance. To test the influence of issue size on the long-run performance of IPOs, we categorise IPOs as small, medium, and large-size based on their issue size. IPOs with an issue size of fewer than 200 Crores are categorised as “Small Size”, an issue size greater than or equal to 200 Crores, but

less than 1000 Crores are categorised as "Mid Size", and an issue size greater than or equal to 1000 Crores are categorised as "Large Size". Our sample includes 203, 58, and 23 underpriced IPOs categorised as small, mid and large-size, respectively. This study seeks to find the long-run performance of IPOs based on these issue size categories.

6.4 Results and Discussions

6.4.1 Long-Run Performance of Underpriced IPOs (Entire Sample)

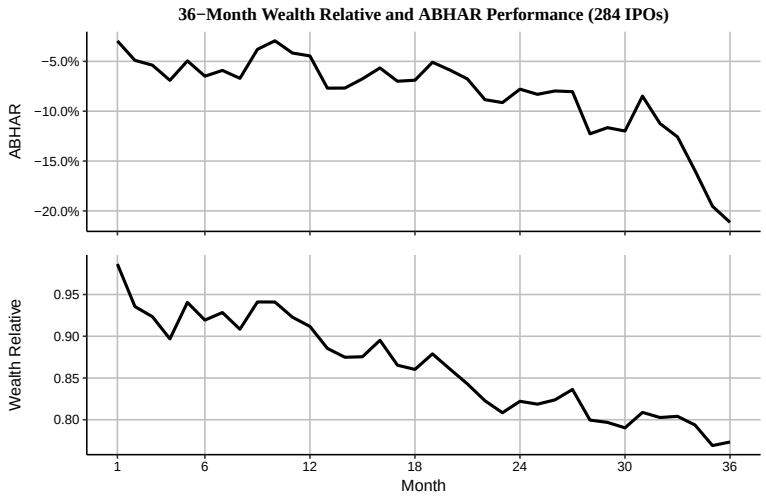
For the long-run performance of the entire sample of 284 underpriced IPOs, we hypothesise that over the long-run, there are no abnormal returns observed.

Table 6.1: *36-month long-run performance of Underpriced IPOs*
Entire Sample (284 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-2.96%	-1.8013	*	0.986		19	-5.09%	-0.6063		0.879
2	-4.90%	-1.9074	*	0.936		20	-5.87%	-0.7188		0.861
3	-5.38%	-1.6412		0.923		21	-6.77%	-0.8398		0.843
4	-6.90%	-1.6915	*	0.897		22	-8.84%	-1.0895		0.823
5	-4.95%	-1.2597		0.940		23	-9.14%	-0.9565		0.808
6	-6.49%	-1.6718	*	0.919		24	-7.79%	-0.6880		0.822
7	-5.91%	-1.5249		0.928		25	-8.31%	-0.7199		0.819
8	-6.70%	-1.5675		0.908		26	-7.97%	-0.5969		0.824
9	-3.80%	-0.7408		0.941		27	-8.04%	-0.5031		0.836
10	-2.93%	-0.4705		0.941		28	-12.27%	-1.0852		0.800
11	-4.17%	-0.6855		0.923		29	-11.65%	-1.0484		0.797
12	-4.45%	-0.7167		0.912		30	-11.99%	-1.0258		0.790
13	-7.69%	-1.3625		0.885		31	-8.49%	-0.5606		0.809
14	-7.68%	-1.3214		0.875		32	-11.23%	-0.8098		0.803
15	-6.75%	-1.1277		0.875		33	-12.58%	-0.8411		0.804
16	-5.66%	-0.9043		0.895		34	-15.96%	-1.0579		0.794
17	-6.99%	-1.0827		0.865		35	-19.53%	-1.2790		0.769
18	-6.89%	-0.9505		0.860		36	-21.15%	-1.1978		0.773

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5

As seen in Table 6.1, there are no positive abnormal returns during the period of study. Long-term abnormal returns get worse after the 31st month. Abnormal returns are -8.49% in the 31st month and end with -21.15% in the 36th month. Wealth relatives value of less than one also denotes that the IPOs are doing much worse as compared to the market index. Figure 6.1 depicts the long-run performance of the entire sample of 284 underpriced IPOs over 36 months.

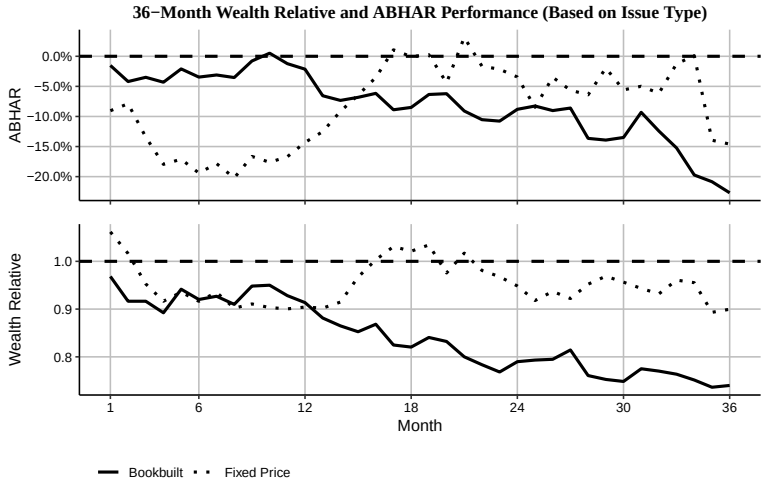


Source: From Table 6.1
Figure 6.1: *Long-run performance of underpriced IPOs.*

6.4.2 Long-Run Performance of Underpriced IPOs based on Issue Type (Fixed-Price and Bookbuilt method)

The long-run performance of underpriced IPOs listed using either the fixed-price or bookbuilt mechanism is examined using a sample of 230 bookbuilt and 54 fixed-price issues. For the long-run performance test of ABHAR across issue types, we hypothesise that the distribution of BHAR is the same across both issue mechanisms at specific intervals during the study period.

Appendix Tables A.1 and A.2 contain the t_{skew} and wealth relatives for each month of the IPOs based on issue type, which is illustrated in Figure 6.2. Bookbuilt IPO issues do not exhibit any statistically abnormal returns for the entire period of study. Fixed-price issues exhibit statistically abnormal returns in 9 out of the 36 months, with two months being statistically abnormal at 99%.



Source: From Appendix Tables A.1 and A.2
Figure 6.2: *Long-Run performance of underpriced IPOs by Issue Type (Fixed-Price and Bookbuilt).*

We observe from Figure 6.2 that IPOs issued using a fixed-price mechanism provided

positive abnormal returns for very brief periods in the 17th month (1.07%), 19th month (0.26%), and the 34th month (0.10%). Bookbuilt IPO issues fail to provide positive abnormal returns for the entire period of study. In terms of losses, by the 36th month, bookbuilt IPOs returned -22.68% while fixed-price IPOs returned -14.59%. The reversal of fortunes when examining long-run performance is interesting since, on listing day, bookbuilt issues exhibit the least level of underpricing when compared to fixed-price issues.

Table 6.2: *Comparison of long-run performance, by Issue Type*

Month	Median (%)		Mann-Whitney U	Z	Asymp. Sig. (2-tailed)	Decision
	Fixed-Price	Bookbuilt				
1	-10.91	-2.64	7,708.00	2.7580	0.006	Reject
6	-28.10	-14.63	7,324.50	2.0520	0.040	Reject
12	-34.63	-24.62	6,935.50	1.3360	0.182	Retain
18	-40.27	-30.27	6,368.50	0.2920	0.770	Retain
24	-45.32	-35.94	6,322.50	0.2070	0.836	Retain
30	-49.66	-44.35	6,224.50	0.0270	0.979	Retain
36	-58.05	-54.43	6,331.50	0.2240	0.883	Retain

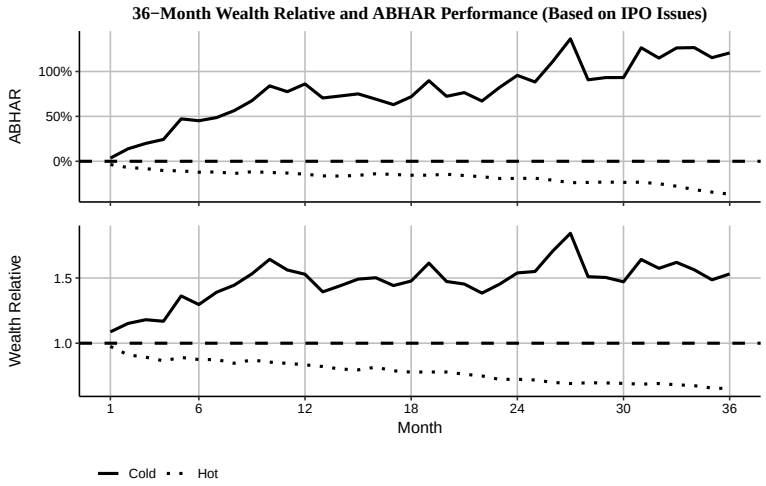
Source: Author Computed

Results of the Mann-Whitney U test to determine if the distribution of BHAR between IPOs issued using either bookbuilt or fixed-price mechanisms was the same are shown in Table 6.2. Distributions of BHAR between either pricing mechanisms were not similar, as assessed by visual inspection. For the months examined, BHAR was statistically significantly different between IPOs issued using fixed-price and bookbuilt pricing mechanisms in the 1st and 6thmonth. We reject the null hypothesis for these months. For the 1st month, BHAR was statistically higher for bookbuilt issues (mean rank = 149.01) than fixed-price issues (mean rank = 114.06), *U = 7708.00, z = 2.7580, p = .006*. For the 6th month, BHAR was statistically higher for bookbuilt issues (mean rank = 147.35) than fixed-price issues (mean rank = 121.86), *U = 7324.50, z = 2.0520, p = .040*.

6.4.3 Long-Run Performance of the Underpriced IPOs (Listed in Cold and Hot Markets

A hot or cold market is determined based on the number of IPOs listed in that corresponding quarter. We define a market to be hot if there are five or more IPOs released in a quarter. This method is similar to the one used by Ritter (1991); Helwege and Liang (2004); Sahoo and Rajib (2010). As shown in Figure 5.2 (p. 100), there are 32 out of 52 quarters where five or more IPOs were listed. Our sample provides for 28 and 256 IPOs issued during cold and hot markets, respectively. For the long-run performance test on a comparison of ABHAR between cold and hot markets, we hypothesise that the distribution of BHAR is the same across cold and hot markets at specific intervals during the study period.

Appendix Tables A.3 and A.4 contain the t_{skew} and wealth relatives for each month of the appropriate cold and hot periods, as shown in Figure 6.3. Cold markets exhibit statistically significant positive abnormal returns in 33 out of 36 months, with 12 months being statistically significant at 99%. In contrast, hot markets exhibit statistically negative abnormal returns in 35 out of the 36 months, with 14 months being statistically significant at 99%.



Source: From Appendix Tables A.3 and A.4

Figure 6.3: *Long-Run Performance of Underpriced IPOs listed in Cold and Hot markets.*

IPOs issued in cold markets have far outperformed IPOs issued in hot markets, as illustrated in Figure 6.3. Over the long-run, cold market IPO issues return 120.65% while hot market IPO issues return -36.65% at the end of the study period.

Table 6.3: *Comparison of long-run performance of IPOs issued in cold and hot markets*

Month	Median (%)		Mann-Whitney U	Z	Asymp. Sig. (2-tailed)	Decision
	Cold	Hot				
1	0.55	-4.86	2,897.00	-1.665	0.096	Retain
6	2.62	-17.79	2,276.00	-0.176	0.002	Reject
12	11.60	-27.87	2,233.00	-3.274	0.001	Reject
18	-13.69	-34.92	2,435.00	-2.785	0.005	Reject
24	-18.99	-39.84	2,649.00	-2.266	0.023	Reject
30	-11.45	-45.50	2,847.00	-1.786	0.074	Retain
36	-48.29	-57.29	3,278.00	-0.742	0.458	Retain

Source: Author Computed

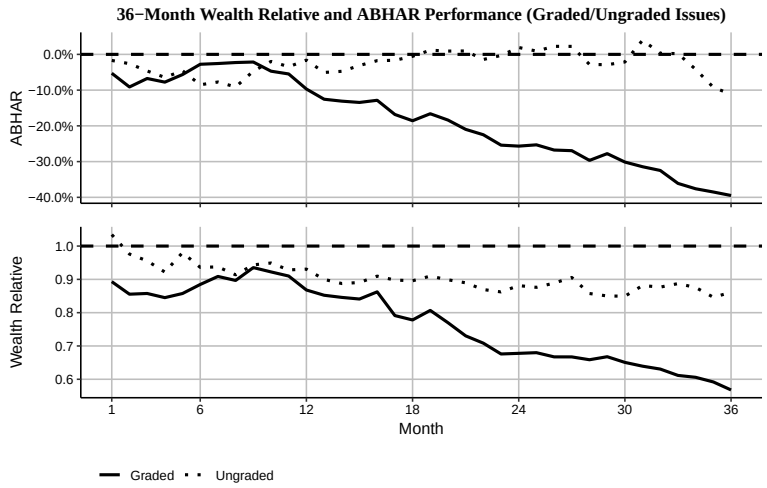
Results of the Mann-Whitney U test to determine differences in BHAR between cold and hot markets are shown in Table 6.3. The BHAR of cold and hot markets was not similar, as assessed by visual inspection. For the months examined, the distribution of BHAR was statistically significantly different between cold and hot markets in the 6th, 12th, 18th, and 24th month. For the 6th month, BHAR was statistically significantly higher in cold markets (mean rank = 189.21) than in hot markets (mean rank = 137.39), *U = 2276.00, z = -0.176, p = .002*. For the 12th month, BHAR was statistically significantly higher in cold markets (mean rank = 190.75) than in hot markets (mean rank = 137.22), *U = 2233.00, z = -3.274, p = .001*. For the 18th month, BHAR was statistically significantly higher in cold markets (mean rank = 183.54)

than in hot markets (mean rank = 138.01), *U = 2435.00, z = -2.785, p = .005*. For the 24th month, BHAR was statistically significantly higher in cold markets (mean rank = 175.89) than in hot markets (mean rank = 138.85), *U = 2649.00, z = -2.266, p = .023*.

6.4.4 Long-Run Performance of Underpriced IPOs (Ungraded and Graded IPOs)

For the long-run performance test on a comparison of ABHAR between graded and ungraded IPOs, we hypothesise that the distribution of BHAR is the same across graded and ungraded IPOs at specific intervals during the study period.

Appendix Tables A.5 and A.6 contain the t_{skew} and wealth relatives for each month of the IPOs based on graded/ungraded IPOs, as shown in Figure 6.4. Graded IPOs exhibit statistically abnormal returns for 24 out of the 36 months, with nine months being statistically abnormal at 99%. In contrast, ungraded IPOs exhibit statistically abnormal returns only once in the 6th month.



From Appendix Tables A.5 and A.6
Figure 6.4: *Long-run performance of ungraded and graded IPOs.*

The long-run performance of graded IPOs and ungraded IPOs is illustrated in Figure 6.4. Graded IPOs are performing worse than ungraded IPO after the 10th month. While there are short periods when the ungraded IPOs deliver positive average buy-and-hold abnormal returns, graded IPOs never provide positive abnormal returns during the entire period of study. Investors fare worse regarding investment returns over a longer time horizon when investing in graded IPOs as opposed to ungraded IPOs. Over the long-run, ungraded IPOs return -11.18% while graded IPOs return -39.49%.

Table 6.4: *Comparison of long-run performance between graded and ungraded IPOs*

Month	Median (%)		Mann-Whitney U	Z	Asymp. Sig. (2-tailed)	Decision
	Ungraded	Graded				
1	-4.35	-2.51	9,065.00	-.2040	0.838	Retain
6	-17.59	-13.48	9,676.00	.7200	0.471	Retain
12	-27.87	-24.63	9,599.00	.6040	0.546	Retain
18	-34.42	-29.27	9,173.00	-.0410	0.967	Retain
24	-37.07	-35.23	8,973.50	-.3430	0.732	Retain
30	-45.51	-44.35	9,221.00	.0320	0.975	Retain
36	-58.05	-52.92	9,366.00	.2510	0.802	Retain

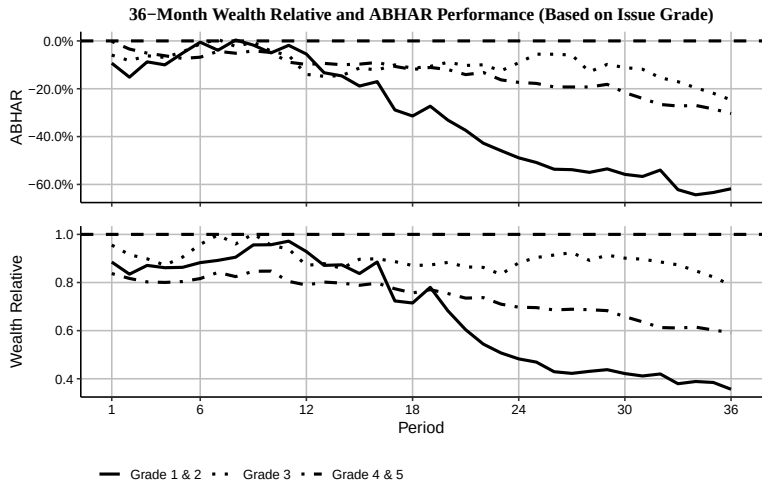
Source: Computed

Results of the Mann-Whitney U test to determine if there were differences in BHAR between graded and ungraded IPOs are shown in Table 6.4. Distributions of BHAR between graded and ungraded IPOs were not similar, as assessed by visual inspection. For the months examined, BHAR was not statistically significantly different between graded and ungraded IPOs.

6.4.5 Long-Run Performance of Underpriced IPOs across Grades

For the long-run performance test on a comparison of ABHAR across grades, we hypothesise that the distribution of BHAR is the same across grade combinations at specific intervals during the study period. For this test, IPOs from grades 1 & 2, as well as from grades 4 & 5 were combined separately. These combinations yield us 35 IPOs having grades 1 & 2, 33 IPOs having grade 3, and 32 IPOs having grades 4 & 5.

Appendix Tables A.7, A.8 and A.9 contain the t_{skew} and wealth relatives for each month of the appropriate IPOs, grouped as Grades 1 and 2, Grade 3 & Grades 4 and 5. Figure 6.5 shows the long-run performance between groups of graded IPOs. None of the graded IPOs provided positive abnormal returns for any of the months during the long-run performance study of 36 months. Grade 1 & 2 IPOs provide statistically abnormal negative returns in 17 out of the 36 months, with five months being statistically significant at 99%. Grade 3 IPOs exhibit only one occurrence of statistically significant abnormal return at 90% in the 13th month. Grade 4 & 5 IPOs provide statistically significant abnormal returns in 21 out of the 36 months, with 13 months being statistically significant at 99%.



Source: From Appendix Tables A.7, A.8 and A.9
Figure 6.5: *Long-Run Performance of underpriced Graded IPOs.*

The results of the BHAR comparison between grade combinations are shown in Table 6.5.

Table 6.5: *Comparison of long-run performance among graded IPOs*

Month	Asymp. Sig. (2-tailed)	Chi-Sq.	Decision	Grade Median (%)		
				1 & 2	3	4 & 5
1	0.243	2.831	Retain	-11.73%	-9.61%	0.32%
6	0.502	1.380	Retain	-29.28%	-13.28%	-11.38%
12	2.895	0.235	Retain	-34.41%	-26.20%	-15.15%
18	0.005	10.577	Reject	-56.94%	-34.19%	-17.42%
24	0.000	15.930	Reject	-73.87%	-27.26%	-20.94%
30	0.001	13.886	Reject	-87.12%	-44.18%	-27.19%
36	0.002	12.235	Reject	-97.23%	-64.08%	-39.41%
			IPOs	35	33	32

N = 100, df = 2, Significance level test = 0.05

Source: Author Computed

Table 6.6 lists the results of the grade pairwise comparison.

Table 6.6: *Pairwise comparison of graded IPOs*

Month	Pair		Adj. Sig.
	Grade	Grade	
18	1 & 2	4 & 5	0.003
24	1 & 2	3	0.018
24	1 & 2	4 & 5	0.000
30	1 & 2	3	0.045
30	1 & 2	4 & 5	0.001
36	1 & 2	4 & 5	0.002

Source: Author Computed

A Kruskal-Wallis test was conducted at the 95% significance level to determine if the distribution of BHAR was the same across the combination of grades for specific months. Results indicate that the months where we can reject the null hypothesis are the 18th, 24th, 30th, and the 36th month. Subsequently, pairwise comparisons were performed using the Dunn (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < .017$ significance level. As seen in Table 6.6, we find statistically

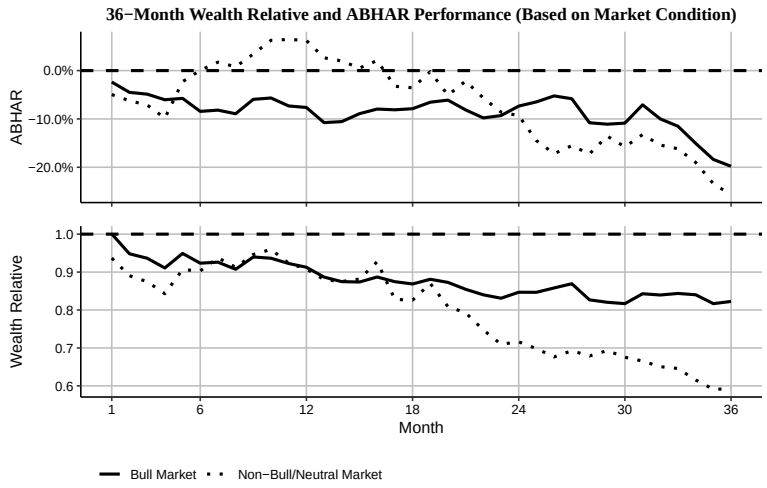
significant pairwise comparisons for 18th, 24th, 30th and the 36th month. A combination of IPOs having Grade 1 and 2 provide an abnormal return of -61.82% in the 36th month. Similarly, IPOs with Grade 3 provides an abnormal return of -24.65%, while a combination of IPOs having Grade 4 and 5 provide an abnormal return of -30.37%; both in the 36th month.

6.4.6 Long-Run Performance of the Underpriced IPOs (Listed in Non-Bull and Bull periods

For the long-run performance test on a comparison of ABHAR between bull and non-bull markets, we hypothesise that the distribution of BHAR is the same across both markets at specific intervals during the study period. From Figure 5.3, we observe a significant upward momentum and bull markets during periods 7th July 2003 until 27th March 2008, 26th May 2009 until 3rd March 2011 and 27th July 2012 until the end of the period of study. These bull periods were identified using a cross-over method of the 50-day SMA and 200-day SMA. From the 284 IPOs in the selected sample, there are 219 IPOs that were issued during bull periods while 65 IPOs were issued during non-bull/neutral markets. This study seeks to find out if, over the long-run, IPOs issued during a bull market performed better as compared to IPOs issued during non-bull/neutral markets.

Tables A.10 and A.11 contain the t_{skew} and wealth relatives for each month of the IPOs grouped by market periods. Non-bull/neutral markets do not exhibit any occurrence of statistically significant abnormal returns. Bull markets exhibit statistically abnormal returns in 5 out of the 36 months. In contrast, non-bull market IPOs do not exhibit statistically abnormal returns for the entire period of study.

We observe from Figure 6.6 that irrespective of optimism in the markets, none of the IPOs issued in bull markets were able to provide positive abnormal returns over the long-run. IPOs issued in non-bull/neutral markets deliver positive abnormal returns from the 6th month until the 16th month.



Source: From Appendix Tables A.10 and A.11
Figure 6.6: *Long-Run Performance of underpriced IPOs listed during Non-Bull and Bull periods.*

There are no periods of positive abnormal returns for IPOs issued in bull markets. Towards the end of the study, IPOs issued in bull markets end up with lower losses of -19.79% as compared to non-bull/neutral market IPOs with losses of -25.70%.

Table 6.7: *Comparison of long-run performance of IPOs issued in bull and non-bull markets*

Month	Median (%)		Mann-Whitney U	Z	Asymp. Sig. (2-tailed)	Decision
	Non-Bull	Bull				
1	-4.09	-4.52	7,083.00	-.0590	0.953	Retain
6	-15.18	-16.29	7,174.00	.0970	0.923	Retain
12	-23.68	-26.20	7,107.00	-.0180	0.986	Retain
18	-38.61	-29.03	7,503.00	.6630	0.507	Retain
24	-54.64	-35.38	8,012.00	1.5380	0.124	Retain
30	-52.98	-40.12	7,766.00	1.1150	0.265	Retain
36	-63.72	-53.32	8,264.00	1.9720	0.049	Reject

Source: Author Computed

Results of the Mann-Whitney U test to determine if there were differences in BHAR between IPOs issued during bull and non-bull periods are shown in Table 6.7. Distributions of BHAR between bull and non-bull IPOs were not similar, as assessed by visual inspection. For the months examined, BHAR was not statistically significantly different between IPOs issued during bull and non-bull periods except for the 36th month.

6.4.7 Long-Run Performance of Underpriced IPOs across Sectors

The study on the long-run performance of sectors looks at eight sectors within the selected sample of 284 IPOs that have ten or more underpriced IPOs. The selected sectors are Banks - Public Sector, Computers (Software), Computers (Software Medium & Small), Construction & Contracting (Civil), Construction & Contracting (Real Estate), Media & Entertainment, Miscellaneous issues, and Pharmaceuticals. For the long-run performance test on a comparison of ABHAR across sectors, we hypothesise that the distribution of BHAR is the same across

sectors at specific intervals during the study period.

Appendix Tables A.12 till A.19 contain the t_{skew} and wealth relatives for each month of the relevant sector, as shown in Figure 6.7b. All sectors except Miscellaneous and Pharmaceutical exhibit statistically significant abnormal returns during the long-run study. Banks-Public sector issues exhibit positive abnormal returns at 95% significance from the 14th till the 36th month. Computers (Software) sector issues exhibit positive abnormal returns at 99% significance from the 14th till the 36th month. Except for the Banks-Public sector, all other sectors return negative returns towards the end of the period of study.

Table 6.8: *Sectoral Performance - For Sectors having 10 or more IPOs*

Sector	IPOs	BHAR (%)			
		Mean	Median	Minimum	Maximum
Banks - Public Sector	10	80.00	5.95	-115.13	791.48
Computers - Software	16	-32.30	-35.51	-160.37	-32.30
Computers - Software Medium & Small	20	-34.50	-50.14	-199.26	553.24
Construction & Contracting - Civil	15	-24.50	-27.55	-154.43	130.07
Construction & Contracting - Real Estate	11	-17.96	-21.62	-104.56	265.01
Media & Entertainment	28	-22.46	-32.76	-246.57	358.99
Miscellaneous	16	-5.44	-13.68	-147.10	383.03
Pharmaceuticals	14	-12.72	-42.32	-228.66	749.49

Source: Author Computed
Mean, Median, Minimum and Maximum BHAR obtained for periods 1,6,12,18,24,30 & 36.

Seven out of the eight sectors had negative median returns, as shown in Table 6.8. The most reduced median performance is observed from the Computers (Software - Medium & Small) sector IPOs at -50.14%. The best performance was from the Banks - Public sector IPOs with a positive median return of 5.95%. Performance of the sectors towards the end of the study period is shown in Table 6.9. While the Banks - Public sector outshines with a positive abnormal return of 174.79% in the 36th month, Computers - Software, Computers - Software (Medium & Small) and Civil construction & contracting sectors return abnormal returns of -56.88%, -50.19% & -58.32% respectively in the 36th month.

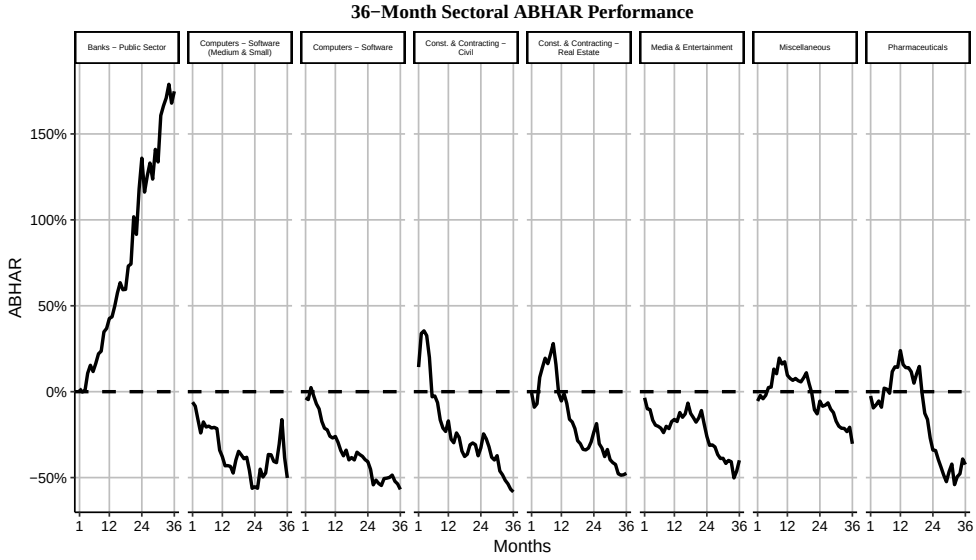
Table 6.9: *Long-Run Sectoral Performance by the 36th month*

Long-Run Sector Performance (Sorted by Performance)

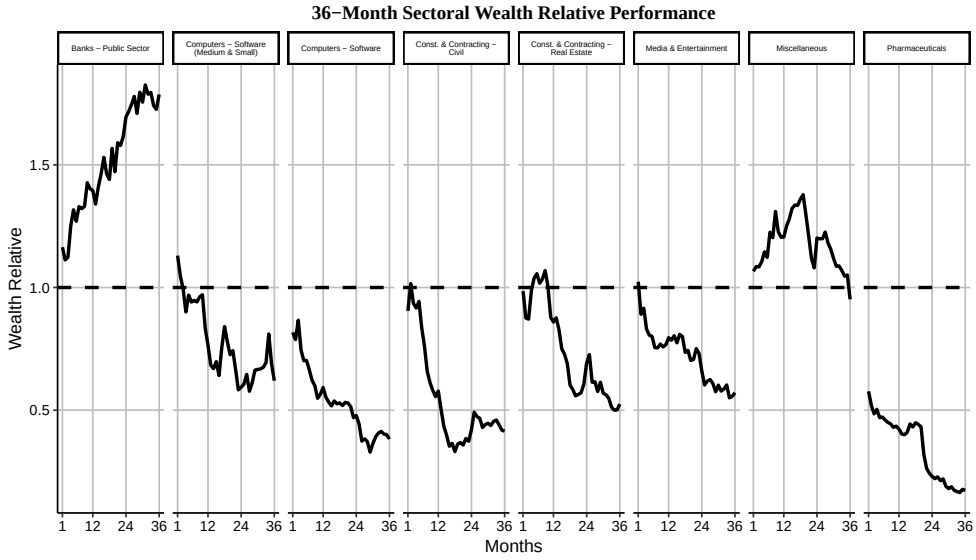
Sector	IPOs	36th Month Performance (%)
Banks - Public	10	174.79
Miscellaneous	16	-30.32
Media & Entertainment	28	-39.92
Pharmaceuticals	14	-42.40
Construction & Contracting (Real Estate)	11	-47.46
Computers (Software Medium & Small)	20	-50.19
Computers (Software)	16	-56.88
Construction & Contracting (Civil)	15	-58.32

Source: From Appendix Tables A.12 till A.19.

It can be observed from Figure 6.7a that, of the eight sectors examined, only Banks - Public sector IPOs exhibit a positive long-run performance during the entire period of study.



(a) *Long-run performance of underpriced IPOs by Sector*



(b) *Long-run performance. Sectoral Wealth Relative*
Source: From Appendix Tables A.12 till A.19

Figure 6.7: *Sectoral Long-run performance using ABHAR and wealth relatives.*

The results of the BHAR sectoral comparison are shown in Table 6.10. The results of the sectoral pairwise comparisons are shown in Table 6.11. This Kruskal-Wallis test was conducted at the 95% significance level to determine if there were any months where the distribution of BHAR was the same across the eight sectors. The test reveals that we can reject the null hypothesis for the 12^{th}, 18^{th}, and 24^{th} month. Subsequently, pairwise comparisons were performed using the Dunn (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < .0017$ significance level. As seen in Table 6.11, we could find statistically significant pairwise comparisons only for the 12^{th} and the 18^{th} month between Computers - Medium & Small and Banks - Public sector only.

Table 6.10: *Comparison of sectoral long-run performance*

				Median (%)							
Month	**Asymp. Sig. (2-tailed)**	**Chi-Sq.**	**Decision**	**Banks - Public Sector**	**Computers - Software**	**Computers - Software Medium & Small**	**Const. & Contracting - Civil**	**Const. & Contracting - Real Estate**	**Media & Entertainment**	**Misc.**	**Pharmaceuticals**
1	0.246	9.093	Retain	-1.80	-0.89	-12.29	10.32	-4.08	-7.08	-2.97	-5.11
6	0.103	11.941	Retain	6.98	-23.96	-33.21	-4.70	-14.66	-18.18	9.19	-27.34
12	0.029	15.593	Reject	-1.79	-25.44	-57.03	-24.29	-16.30	-34.95	7.37	-40.56
18	0.015	17.341	Reject	22.25	-34.92	-54.76	-47.49	-31.92	-36.45	-16.18	-55.70
24	0.044	14.403	Reject	1.23	-37.14	-55.98	-58.82	-35.67	-51.13	-23.63	-80.95
30	0.124	11.343	Retain	41.19	-45.08	-59.90	-45.02	-37.40	-49.65	-40.04	-91.88
36	0.199	9.816	Retain	44.77	-56.73	-69.43	-65.87	-54.51	-62.07	-43.53	-82.50
			IPOs	10	16	20	15	11	28	16	14

N = 130, df = 7, Significance level test = 0.05

Source: Author Computed

Table 6.11: *Pairwise comparison among sectors*

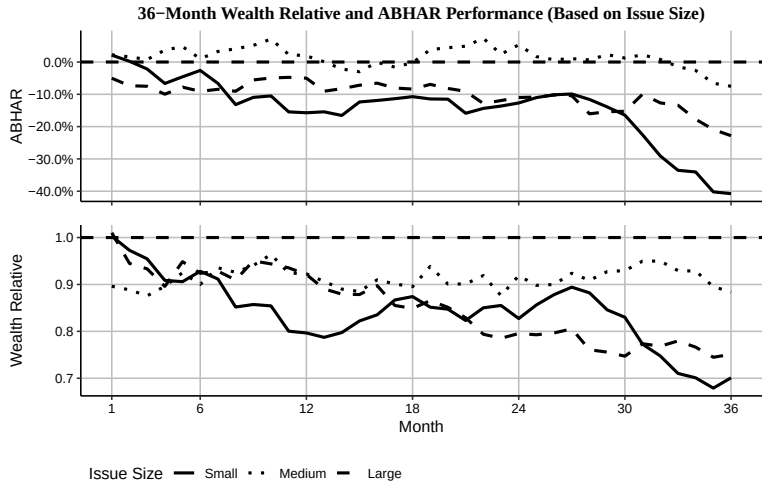
	Pair		
Month	**Sector 1**	**Sector 2**	**Adj. Sig.**
12	Computers - Software Medium & Small	Banks - Public Sector	0.047
18	Computers - Software Medium & Small	Banks - Public Sector	0.020

Source: Author Computed

6.4.8 Long-Run Performance of Underpriced IPOs based on Issue Size

To test the influence of the IPO issue size on long-run performance, we classify IPOs as small, medium, and large size based on their issue size. IPOs with an issue size of fewer than 200 Crores are categorised as "Small Cap", greater than or equal to 200 Crores, but less than 1000 Crores are categorised as "Mid Cap" and issue size greater than or equal to 1000 Crores are categorised as "Large Cap". Our sample includes 203, 58, and 23 IPOs categorised as small, mid, and large size, respectively. For the long-run performance test on a comparison of ABHAR between the categories of the issue size, we hypothesise that the distribution of BHAR is the same across issue size categories at specific intervals during the study period.

Appendix Tables A.20, A.21 and A.22 contain the t_{skew} and wealth relatives for each month of the IPOs grouped by issue size. Small-Size IPOs exhibit statistically abnormal returns in 5 out of the 36 months, while large size IPOs exhibit statistically abnormal returns in 8 out of the 31 months with two months statistically significant at 99%. Mid-Size IPOs do not exhibit statistically abnormal returns in any of the months.



Source: From Appendix Tables A.20, A.21 and A.22
Figure 6.8: *Long-run performance of underpriced IPOs by issue size categories.*

From Figure 6.8, we observe that irrespective of classification based on issue size, none of the IPOs were able to provide positive abnormal returns towards the end of the study. The long-run abnormal returns at the end of the period of study were -22.82% for small-size issues, -7.51% for mid-size issues and the worst-performing were large-size issues that returned -40.76%. Although none of the issue size classifications provides positive returns, the mid-size IPOs perform the best concerning minimising the losses.

Table 6.12 lists the results of the BHAR comparison between issue size categories. A Kruskal-Wallis test was conducted at the 95% significance level to determine if the distribution

of BHAR was the same across the classifications of the issue size. Results indicate that the null hypothesis can be rejected for all the months in this study. Subsequently, pairwise comparisons were performed using the Dunn (1964) procedure. A Bonferroni correction for multiple comparisons was made with statistical significance accepted at the $p < .017$ significance level.

Table 6.12: *Comparison of long-run performance among issue size categories*

Month	Asymp. Sig. (2-tailed)	Chi-Sq.	Decision	Median (%)		
				Small-size	Mid-size	Large-size
1	0.007	9.984	Reject	-7.62%	0.04%	-0.79%
6	0.011	8.945	Reject	-19.25%	-12.11%	-7.14%
12	0.026	7.331	Reject	-31.52%	-13.41%	-15.22%
18	0.001	13.809	Reject	-40.54%	-20.29%	-14.94%
24	0.000	19.802	Reject	-49.21%	-19.56%	-21.86%
30	0.000	15.434	Reject	-57.37%	-32.51%	-16.10%
36	0.002	12.647	Reject	-67.41%	-37.68%	-40.77%
			IPOs	203	58	23

N = 284, df = 2, Significance level test = 0.05

Source: Author Computed

As seen in Table 6.13, we find statistically significant pairwise comparisons for all months under study between Small to Mid-size. There was one occurrence of a significant pairwise comparison between Small to Large-size in the 24th month.

Table 6.13: *Pairwise comparison among issue size categories*

Month	Pair		Adj. Sig.
	Size	Size	
1	Small	Mid	0.019
6	Small	Mid	0.033
12	Small	Mid	0.027
18	Small	Mid	0.003
24	Small	Mid	0.000
24	Small	Large	0.044
30	Small	Mid	0.001
36	Small	Mid	0.002

Source: Author Computed

6.5 Summary and Conclusions

Numerous studies to evaluate the long-run performance of IPOs in the Indian markets have been conducted, such as Aggarwal and Rivoli (1990); Purnanandam and Swaminathan (2004); Sahoo and Rajib (2010); Pandya (2016). We commence this aspect of the study of long-run performance of IPOs by examining the selected sample of underpriced IPOs. We find that the IPOs always underperform the markets. The sample fails to provide a positive BHAR during the entire period of study. Similarly, WR never crosses 1 to indicate better performance than the markets. By the 36th period of the study, the selected sample returns -21.15%. Similar results were arrived by Ritter (1991); Kooli and Suret (2004); Pandya (2016). However, our results differ from those reached by Sahoo and Rajib (2010) where they observed that their sample of

IPOs experienced a positive market-adjusted return after 12 months or that by Das et al. (2016) who find that IPOs in the long-run over-perform the markets up to 24 months from listing but underperform after that.

In the Indian context for the period of study (FY 1999-2000 until FY 2013-14), the market feedback hypothesis is applicable since the extent of underpricing with bookbuilt issues is far less than that of IPOs issued using the fixed-price mechanism. However, when it comes to the long-run performance of IPOs issued using either mechanism, bookbuilt IPOs fared much worse (-22.68%) when compared with fixed-price IPOs (-14.59%) towards the end of the study period. Bookbuilt IPOs exhibit no statistically significant abnormal returns while fixed-price IPO issues do for a few months during this study. Our result from a long-run performance standpoint is indifferent in regards to the pricing mechanism used with either returning losses. Our findings are similar to that of Hawaldar et al. (2018) regarding the long-run performance of bookbuilt issues but not in regards to fixed-price issues. The difference in our findings with that of Hawaldar et al. (2018) could be because of a difference in methodology utilised (BHAR v/s Cumulative Average Abnormal Returns) to measure long-run performance and also the period of the study.

Our next aspect of the study is to determine if the presence of a hot or cold market during IPO listing has any impact on the long-run performance. Cold market IPO returns were 120.65% towards the end of the study period, while those of IPOs listed in hot markets were -36.65%. This goes against the grain of thought, where one would expect to see IPOs listed in hot markets to outperform those listed in cold markets. One can conclude from this finding that investors value the quality of the IPO and that firms listing in cold markets must have strong fundamentals and growth prospects. During hot markets, investors may shun low quality IPO issues dragging the performance of other IPOs. These findings are similar to those found by Loughran and Ritter (1995); Schaub (2011). Our study validates that the issuance of IPOs in hot periods are subject to the fads hypothesis.

The next aspect of the study looks at examining the long-run performance of graded and ungraded IPOs. Our sample consists of 100 graded, and 184 ungraded IPOs, respectively. It is interesting that, even though both graded and ungraded IPOs end up with negative returns, there are a few pockets of time where ungraded IPOs deliver positive abnormal performance. In contrast, graded IPOs fail to deliver positive abnormal returns during the entire period of study. Towards the end of the period of study, ungraded IPOs provide an abnormal return of -11.18%, while in comparison, graded IPOs provide an abnormal return of -39.49%. Statistically,

for the months examined, BHAR was not significantly different between graded and ungraded IPOs. While it is not possible to pinpoint the exact reason why ungraded IPOs perform better than graded IPOs, it is of importance to note that from the sample of 100 graded IPOs, 7 IPOs were listed in a cold market and 93 were listed in a hot market. Our prior study on long-run performance finds that IPOs listed in cold markets perform better. Another important fact from our sample of graded IPOs is that there are 3 IPOs listed using the fixed-price mechanism, while 97 were listed using the bookbuilt mechanism. Our study results find a poor performance of IPOs listed using the bookbuilt mechanism as opposed to the fixed-price mechanism. It is also important to note the possible presence of IPOs with inferior grades that may drag down the overall performance of graded IPOs. Analysis of long-run returns between graded and ungraded IPOs suggests that certification effects prove to be inconsequential over the long run. The next study tries to determine if IPOs with specific grades outperform IPOs with other grades.

Our next aspect of the study deals with examining the performance of IPOs that are graded. For a comparison of performance by grade, we compare the long-run performance of IPOs based on the grade classification issued by various rating agencies. For our study, graded IPOs are combined to yield us 35 IPOs in Grade 1 & 2, 33 IPOs in Grade 3, and 32 IPOs in Grade 4 & 5. Despite negative returns across all categories of grades, the best investments in terms of minimising losses turn out to be Grade 3 IPOs. Towards the end of this long-run performance study, a combination of Grade 1 & 2 IPOs return -61.82%, Grade 3 IPOs return -24.65%, and finally, a combination of Grade 4 & 5 IPOs return -30.37%. Our aspect of study on listing day performance finds that IPOs with Grade 5 had the lowest extent of underpricing. However, there is a reversal in fortunes with IPOs in Grades 4 & 5 performed the second-worst with IPOs in Grades 1 & 2 being the worst performers in the long run. A few reasons for graded IPOs performing the way they did can be gleaned from the underlying data. Of the 35 IPOs having Grades 1 & 2, 32 were issued in hot while three were issued in cold markets. From a prior study, we have seen that IPOs perform much better when issued in cold markets, which could be because of the quality of the IPO itself or due to investors' appetite for IPO issues. Out of the 35 IPOs in Grades 1 & 2, 32 IPOs were issued using the bookbuilt mechanism, while 3 IPOs used the fixed-price mechanism. A prior study discusses the better performance of IPOs using the fixed-price mechanism as opposed to the bookbuilt mechanism. On similar lines, for the Grade 3 IPOs, 32 IPOs were issued in hot markets while 1 IPO was issued in cold markets. All the 33 grade 3 IPOs were issued using the bookbuilt mechanism. The third reason could be that all the IPOs issued in Grades 1 & 2 were small-size IPOs. A later study finds that small-size issues (issue size $<$ 200 Cr.) were the second-worst performers with large-size issues (issue size $>=$ 1000 Cr.) being the worst. Out of the 33 IPOs for Grade 3, 25 were small-size, five were

mid-size, while 3 were large-size issues. As for IPOs in Grade 4 & 5, 29 IPOs were issued in a hot market while 3 IPOs were issued in cold markets. All the 32 IPOs were issued using the bookbuilt mechanism. Out of the 32 IPOs in Grade 4 & 5, four were small-size, 20 were mid-size, while 8 IPOs were large-size issues. Our results point that Grade 3 and Grade 4/5 IPOs outperform IPOs with Grade 1/2. Our results are similar to that by Kashiramka et al. (2018) but differ from those of Poudyal (2008); Dhamija and Arora (2014); Ramesh and Dhume (2015). Our analysis of long-run returns amongst graded IPOs suggests that the effects of certification are inconsequential over the long run.

Markets over the long-run, go through various phases of a bull, bear or neutral markets. Our next aspect of the study compares the long-run performance of IPOs during bull market periods against that of other periods. Investing in IPOs listed during either market conditions do not yield positive long-term gains. Bull market IPOs end the long-run study with a return of -19.79% as opposed to -25.70% during non-bull/neutral periods. On closer comparison of IPOs issued in bull and non-bull markets, a couple of differences stand out that potentially point to the weaker performance of IPOs in a non-bull market. Bull market IPOs had a higher percentage of ungraded IPOs (67.10%) as opposed to non-bull markets (56.52%). Also, of the IPOs in the bull market, 68% were of Grades 3/4/5 while the same for non-bull markets was only 50%. These reasons potentially account for the reason why bull market IPOs end the study period with lower losses when compared with non-bull market IPOs. Issuing IPOs in bull markets is a sign that firms and underwriters use bull phases as a market timing opportunity (Loughran & Ritter, 1995). Our results differ from those stated by Schaub (2011), where IPOs issued in bull markets underperformed while those issued in bear markets overperformed the market indices. Our study validates that the issuance of IPOs in bull periods are subject to the window of opportunity hypothesis.

Our next aspect of the study focuses on the long-run performance of underpriced IPOs across selected sectors. Kooli and Suret (2004); Singh and Kumar (2012); Sharma et al. (2013) similarly studied the performance of IPOs across different industries and the effect of non-performing IPOs. For this study, we only consider sectors that listed ten or more IPOs, and accordingly, we identify eight sectors within the selected sample of 284 IPOs. The eight sectors in this study are Banks - Public Sector, Computers (Software), Computers (Software Medium & Small), Construction & Contracting (Civil), Construction & Contracting (Real Estate), Media & Entertainment, Miscellaneous Issues, and Pharmaceuticals. Out of these sectors, the Banks - Public sector IPOs perform well, delivering a return of 174.79% towards the end of the study. None of the other sectors could deliver positive abnormal returns towards the end of the study

period. The primary reasons for Banks - Public sector IPOs doing exceptionally well are because of the gradual partial privatisation of these banks, a well-developed capital market as well as investor faith in the Indian financial banking system (Sathye, 2005). Our results find that long-run returns vary across industries, which were similar to the findings stated by Kooli and Suret (2004). The worst performing sector is the Construction & Contracting - Civil sector returning -58.32% over the long run. Seven out of the eight sectors had a negative median return with the worst performance from Computers (Software - Medium & Small) sector IPOs at -50.14%. The best performance was from the Banks - Public sector IPOs with a positive median return of 5.95%. All sectors except Miscellaneous and Pharmaceutical exhibit statistically significant abnormal returns during the long-run study. Banks-Public sector issues exhibit positive abnormal returns at 95% significance from the 14th till the 36th month. Computers (Software) sector issues exhibit positive abnormal returns at 99% significance from the 14th till the 36th month. Except for Banks-Public sector, all other sectors return negative returns towards the end of the period of study.

Our last aspect of the study on long-run performance focuses on the influence of IPO issue size on the long-run performance of an IPO. Towards the end of the long-run study, small-size IPOs return -22.82%, mid-size IPOs return -7.51%, while large-size IPOs return -40.76%. Small-size IPOs exhibit statistically abnormal returns in 5 out of the 36 months while large-size IPOs exhibit statistically abnormal returns in 8 out of the 31 months with two months statistically significant at 99%. Mid-size IPOs do not exhibit statistically abnormal returns in any of the months. Our findings concerning large-size IPOs performing the worst are different from research results undertaken by Stoll and Curley (1970); De Bondt and Thaler (1985). Our study validates that the issuance of large-sized IPOs is subject to the overreaction hypothesis.

This chapter studied the long-run performance of underpriced IPOs across various cross-sections such as (a) IPOs listed using either pricing mechanism, (b) IPOs listed in hot/cold market conditions, (c) IPOs are either graded/ungraded, (d) IPOs are graded, (e) IPOs are listed in bull/non-bull markets, (f) IPOs are affiliated with select sectors, (g) IPOs are compared across issue size categories (small, mid and large). The next chapter entitled “Effects of Underwriter Prestige, Investment Banks and Firm Factors” looks explicitly at (a) whether the association with top-ranking underwriters reduces underpricing, (b) what firm factors are essential for underwriters or syndicates to be interested in associating with listing firms, and finally in (c) we look to arrive at a model using artificial neural networks to determine firm factors that are important for underwriters or syndicates to be interested in associating with listing firms.

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Chapter 7

Effects of Underwriter Prestige, Investment Banks and Firm Factors

7.1 Introduction

A private company raises capital from the equity markets through an Initial Public Offering (IPO) for various reasons such as acquisition for inorganic growth, expansion of markets, and investment in capital projects. There are three essential role players in the listing process. They are the issuer themselves, the investment bank(s) required for underwriting, marketing and monitoring all legal activities, and finally, the investors. Towards raising the maximum capital, firms must obtain the maximum share price on listing of the IPO. Expectations of the investors are opposite to that of the firms as they expect to pay the least. This conflict of expectations is where the investment bank(s) play a significant role in assisting the listing firm to adjust the offer price. In the case of IPOs listed through the bookbuilt mechanism, this is done relatively quickly since the pricing system becomes a price discovery mechanism. An investment bank could be working alone with a listing firm, or there could be a consortium of banks, also called as a syndicate. The investment bank acts as a conduit between the listing firm and regulatory bodies such as SEBI. Given this, it becomes vital for a listing firm to choose the right investment banks so that the issue price reflects the fundamental qualities of the firm.

Similarly, prestigious investment banks' may want to be associated with firms having strong fundamentals and excellent growth prospects. A consideration for banks would be factors such as the IPO issue size, the age of the firm, and Post-Issue Promoter Holding (PIPH). Fundamentally strong listing firms use PIPH to retain ownership concentration, which lends

a strong signal to potential investors about the firm's growth prospects. In-spite of firms having collaborated with an investment bank or a syndicate, underpricing of IPOs does happen to result in first-day gains on listing in secondary markets.

After the initial studies on the extent of underpricing on listing day and the long-run performance of IPOs, this study looks at whether the prestige of an IPO associated with an investment bank or a syndicate has any influence on the market-adjusted abnormal return. It is also of interest to identify if the age of the listing firm, PIPH, and issue size are determinants for a particular category of an investment bank(s) to be interested in associating themselves with the listing firm. Finally, this study revisits the problem of the likelihood of an investment bank(s) category associating with a listing firm based on listing firm variables by adopting a neural network approach.

Towards meeting these objectives, this chapter is divided into three sub-objectives. Firstly, we determine if the classification of bank syndicates based on their annual rankings at the time of listing has any effect on market-adjusted abnormal return. Secondly, to develop a regression model that helps predict the influence of issue-specific variables such as firm age, PIPH and issue size on investment banks, and, thirdly, to develop a neural network model to predict the influence of issue-specific variables such as firm age, PIPH, and issue size on investment banks.

The remaining part of this study is divided as follows. This introduction is supported by a review of the literature related to investment bank prestige and IPO underpricing in Section 7.2, data and techniques in Section 7.3, results, and discussion in Section 7.4. Finally, the summary and conclusions are covered in Section 7.5.

7.2 Literature Review

The appearance of a prestigious underwriter and auditor may assist as a useful means to reduce the risk of future cash flows of the newly-traded firm and, consequently, underpricing. Hence the type and amount of experience possessed by the underwriter and auditor leading a firm through its IPO process can provide a potent symbol of legitimacy to critical third parties, such as the investment community. The presence of prestigious underwriters and auditors play a very symbolic role that supports the signalling theory.

In regards to the importance of hiring good underwriters, prior studies undertaken by Logue (1973); Balvers, McDonald, and Miller (1988); Tinic (1988); Slovin, Sushka, and Hudson (1990); Carter and Manaster (1990); Puri (1999); Mudrik and Imam (2002); Li,

McInish, and Wongchoti (2005) agree that companies hire reputable underwriters to avoid undervaluation of their shares and also as an endorsement by underwriting firms to signal firm quality. Endorsement by reputed underwriters becomes a more critical issue for newer firms.

McDonald and Fisher (1972); Neuberger and La Chapelle (1983); Kim, Krinsky, and Lee (1995); Elsbach and Kramer (1996); Logue, Rogalski, Seward, and Foster-Johnson (2002) find that underpricing is higher in the case of sub-standard underwriters and that better reputation of underwriters reduces underpricing. These findings are in contrast to those by Khurshed, Paleari, Pande, and Vismara (2008), who find that investment banks with a high/low reputation do not influence underpricing. Similar results were observed on the Indian stock markets by Dhamija and Arora (2017), who cite a lack of evidence to suggest that certification by the auditor with higher prestige results in lower underpricing. Similarly, the study by Chhabra, Kiran, and Sah (2017) finds that the extent of underpricing is not affected by the reputation of the underwriter. However, the study by Sundarasen, Khan, and Rajangam (2018) finds a negative relationship between prestigious underwriters and IPO initial returns indicating that reputable underwriters decrease the level of IPO underpricing.

The literature documented so far are in support of the impacts of a syndicate's prestige on underpricing. We now focus on research in favour of the variables that we will use to determine the association of a syndicate category (measured using prestige points) with a listing firm based on firm variables such as the firm's age, PIPH, and issue size.

The listing firm's age signals strong leadership and the ability to change itself over time as a company matures. Many studies such as Megginson and Weiss (1991); Ljungqvist and Wilhelm (2003) refer to age as one of the variables that are considered by investment banks when they decide to work with listing firms. Post-issue promoter holdings (PIPH) signals ownership concentration to potential investors. It also indicates the future growth potential of the company. PIPH and its impacts on underpricing have been considered in many studies, such as Brennan and Franks (1997); Hill (2006). We have already seen that lower issue size IPOs are subject to the most severe underpricing. The offer size is in relation to the capital that will be invested by the listing firm in ongoing or future projects. Investment banks are attracted to listing firms that have a significant issue size. Offer size is a signalling variable to investment banks and has been documented in studies (Bae & Levy, 1990; Mok & Hui, 1998; Sinha & Madhusoodanan, 2004).

The literature review that follows relates to finding an association using artificial neural networks between the syndicate (measured in terms of prestige points) with listing firm factor variables such as the firm's age, PIPH, and issue size. The literature review that precedes is

common to this study as well since the choice of variables is the same. We now look at literature related to the usage of artificial neural networks to solve issues related to financial markets.

Jain and Nag (1995), in their study, construct a neural network model to price IPOs and conclude that network models outperform the investment bankers in pricing IPOs. Robertson, Golden, Runger, and Wasil (1998), in their study, construct models that predict the first-day return of an initial public offering and conclude that for both technology and non-technology segments, neural network models were better than linear regression models at predicting the first-day return of an initial public offering. Zhang, Cao, and Schniederjans (2004), in their study, concluded that the application of the neural network approach incorporating fundamental accounting variables results in forecasts that are more accurate than linear ARIMA forecasting models. Nur Ozkan-Gunay and Ozkan (2007), in their study, found that neural networks could differentiate patterns or trends in financial data in predicting bank failures with the utilisation of a neural network classification approach. Anyaeche and Ighravwe (2013) study an alternative approach to multiple-linear regression (MLR) and use a back-propagation artificial neural network to find that artificial neural networks outperform multiple linear regression. Enyindah (2016), in their study, developed a neural network application to predict interest rates and conclude that artificial neural networks could efficiently determine interest rates with a minimum amount of error (measured as a mean square error).

7.3 Data and Techniques

The source of secondary data used for the study has been described in section 3.2. We now continue with the data selection and categorisation techniques used for the objectives in this chapter. Table 7.1 shows the number of investment bankers involved in an IPO from FY 1999-00 until 2013-14. The importance that listing firms lay on retaining multiple investment banks can be observed from the fact that there are 106 (out of 291) IPOs that used only one investment bank while the rest used two or more investment banks to form a syndicate.

Table 7.1: *Count of bankers retained for Underpriced IPO Issues (FY 1999-2013)*

Bankers Involved	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
One	1	8		1	3	3	21	15	22	2	6	13	8	3	
Two	7	5		1	2	9	16	14	19	7	4	10	2		1
Three	1	4			3	4	6	5	8	1	3	5	2	1	
Four	1	2	1	1	1		4	5	2	1	2	4			
Five				1	2	2	1		2		1				
More than 5	2			1		1		1	3		1	1	1	1	
Total IPOs (291)	12	19	1	5	11	19	48	40	56	11	17	33	13	5	1

Source: Prime Database

Table 7.2 provides the descriptive statistics for the sample of 297 underpriced IPOs for this study.

Table 7.2: *Descriptive statistics for the selected sample of underpriced IPOs (FY 1999-2013)*

Variables	Mean	Median	Minimum	Maximum	Std. Deviation
PIPH (%)	59.86	60.36	25.35	90.00	15.60
Subscription Rate	24.57	13.14	0.11	175.88	29.23
Firm Age	15.32	12.35	0.47	102.47	13.33
MAARO	44.49	28.40	0.52	241.60	46.86
No. of Issue Managers	2.25	2.00	1.00	10.00	1.47
Prestige Points	8.66	5.00	0.13	49.00	10.46
Offer Size (Cr.)	413.91	93.28	2.50	15199.44	1325.40

PIPH: Post-Issue Promoter Holding, MAARO: Marginally Adjusted Average Return on Opening.
Source: Prime Database and Author Computed.

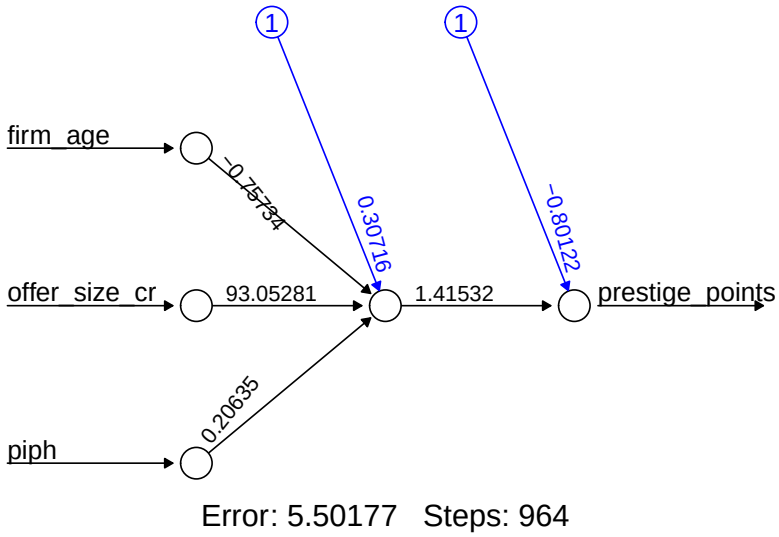
One of the measures this study requires to meet its objectives is called "Investment Banker Prestige (IBP)". There are various methodologies to calculate this measure and have been mentioned in studies by Hayes (1971); Johnson and Miller (1988); Carter and Manaster (1990). Carter and Manaster (1990) use a 10-point scale to assign values to investment banks with 0 points provided to non-prestigious banks and 9 to the most prestigious banks. Hayes (1971) uses a 3-point scale for ranking of investment banks with top-rated banks provided a value of 3, and low rated banks provided a value of 1. Another variation includes providing binary values; 0 for non-prestigious and 1 for prestigious banks. This study adopts a methodology by Megginson and Weiss (1991) that apply a ranking based on the market share approach of the investment bank in that year. This approach works well since underwriters/investment banks that have more market share get higher prestige points. A similar approach has also been used in a study by Sahoo and Rajib (2009).

We calculate investment bank prestige in three steps. In the first step, ranking from the Prime Database of investment bankers for the study period are collected. For each investment bank, Prime Database provides rankings every year based on the annual issue size managed by the bank. In the second step, total rank value points using the rank from the previous step are calculated for each IPO based on the manager(s) to the issue. Rank value points correspond to the ranking from Prime Database for a bank. For example, if an investment bank is ranked the highest in terms of the total IPO issue size managed in a financial year, the investment bank is assigned ten rank value points while a ranking of 2 gets assigned nine rank value points, and so on. A bank having an annual ranking between 11 and 15 is given 0.50 rank value points. A bank having an annual rank value between 16 and 20 is given 0.25 rank value points. Finally, a bank having a ranking of greater than 20 is given a rank value of 0.125. The last step involves adding up all the rank value points for all banks involved in the underwriting for each IPO to arrive at the score for the syndicate of banks that have managed the IPO issue. For example, a syndicate of three banks for an IPO issue having a Prime Database ranking of 2, 4, and 5 will have a total rank value point of 22 (9+7+6).

By the total rank value points, we bucket each IPO into one of the three prestige point categories. Placing each IPO into a prestige point category will help the study with a statistical comparison concerning underpricing across the categories. These are (1) The Elite group which consists of all IPOs that have total rank value points greater than or equal to 15; (2) The Major group in which all IPOs have total rank value points between 6.5 but less than 15 and finally (3) The Minor group in which we include IPOs that have total rank value points less than 6.5.

Back-propagation artificial neural networks (BP-ANN) are computing constructs that are programmed to match the knowledge similar to humans in the biological nervous system. ANN structures are most useful in solving nonlinear and poorly defined problems. The business community has adopted the utilisation of BP-ANN and has been the subject of much research in their scientific application. Neural networks have also been effectively used in the fields of business and finance. BP-ANN constructs have proved to be very popular due to their efficiency and robustness, making them very valuable for analysis. Parametric models are another alternative but are based on strong assumptions making them very sensitive to specification errors. BP-ANN based methods, unlike parametric models, do not need to specify the functional relationship between the dependent variable and the independent variables. There is no need to assume log-normality making them robust to specification errors. BP-ANN determines the internal relationships of the variables after scanning the data, making them very adaptive constructs. ANN can handle large amounts of noisy data, which may include correlated variables, which are mostly the situation in the case of financial applications.

One of the sub-objectives of this study is to study the likelihood of an investment bank(s) associating with a listing firm given variables such as firm age, issue size, and post-issue promoter holding (PIPH) by adopting a simple multiple regression and a neural network approach. Under the neural network approach, this study uses the generalised linear model (GLM) since it allows data to be non-normally distributed. Since we use a regression approach, this study uses the mean squared error (MSE), which allows us to measure how much our predictions deviate from the real data. When using neural networks, this study normalises the data by using the min-max method and scales the data in the interval [0,1]. BP-ANN relies on hidden layers containing neurons. Usually, one hidden layer is enough for a vast number of applications. After trying different combinations to determine a model that produces the least sum squared errors, this study uses only one layer. There was no significant improvement in performance with two or more hidden layers; hence this study relies on only one layer. These findings are consistent with those of Dutta and Shekhar (1988); Salchenberger, Cinar, and Lash (1992).



Source: Author Computed

Figure 7.1: *Neural Network for predicting prestige points with one hidden layer*

Referring to Figure 7.1, the black lines show the connections between layers for firm age, offer size, PIPH, and the weights on each connection. The black lines (with circled numbers) show the bias term added in each step. The bias can be thought of as the intercept of a linear model. The net is a black box, so not much can be said about the fitting, the weights, and the model.

Train and test sets are created from the data in a ratio of 75:25. This study compares the MSE's of the GLM model as well as the BP-ANN model. An important measure of robustness to determine the fit of predictive models using BP-ANN is to run cross-validation tests. The data is then split using a random split of the data (90:10) to form train-test splits and to run the process K-times to determine the average MSE of the cross-validation test.

In artificial neural networks, the presence of hidden layers makes it difficult to evaluate the importance of independent variables on the output variable. The methodology proposed by Yoon, Swales Jr, and Margavio (1993) overcomes this limitation and helps calculate the impact of each input variable. The impact of each input variable measured as relative strength, assuming one hidden layer is calculated as follows.

$$RS_{ji} = \sum (W_{ki} * U_{jk}) / (\sum ABS\{(W_{ki} * U_{jk})\}) \quad \ldots(7.1)$$

where RS_{ji} is the relative strength between the i^{th} input and the j^{th} output variables, W, is the weight between the k^{th} hidden unit and the i^{th} input unit and U_{jk} is the weight between the j^{th} output unit and the k^{th} hidden unit.

7.4 Results and Discussions

MAARO was transformed using Johnson (1949) transformations by utilising the 'Minitab Statistical Software'. All results on normalised data are back-transformed for clarity. The equation used for normalising MAARO is

$$2.07995 + 0.847812 * \text{Ln}\left[(\text{X} + 2.16595)/(384.536 - \text{X})\right] \quad \ldots(7.2)$$

7.4.1 Impacts of Prestige Points on Extent of Underpricing

We refer to Investment Banker Prestige as Syndicate Prestige Points (SPP). Prior studies such as McDonald and Fisher (1972); Logue (1973); Block and Stanley (1980); Neuberger and La Chapelle (1983); Puri (1999) document the influence of investment banks or syndicates on reducing the extent of underpricing. A study by Sahoo and Rajib (2010) has documented a strong inverse relationship between SPP and level of underpricing. Section 7.3 details the calculation of SPP.

The underpricing trend by the prestige point category is shown in Table 7.3. A majority of the IPOs are listed during the first bull-period of our study, i.e., between 7th July 2003 until 27th March 2008, and also that most of the IPOs during these periods are not relying on high-quality underwriters since a significant number of the IPOs belong to minor prestige points category.

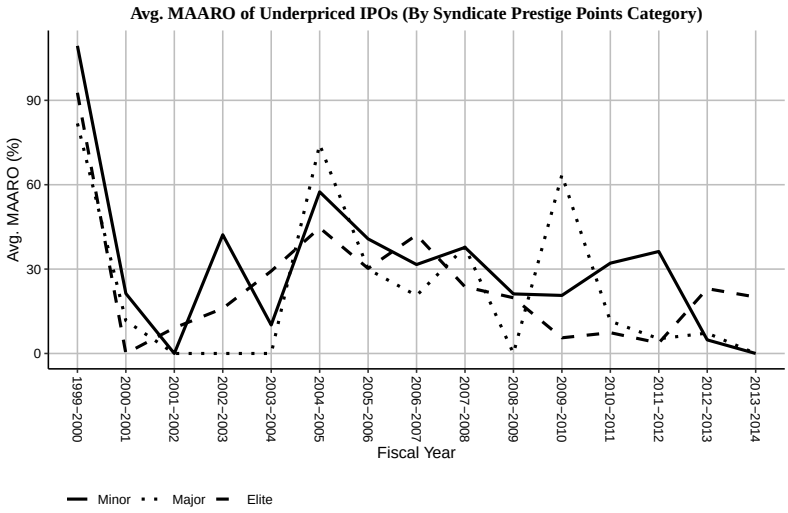
Table 7.3: *MAARO of Underpriced IPOs by syndicate prestige category*

Fiscal Year	Underpriced IPOs			Average MAARO (%)		
	Minor	Major	Elite	Minor	Major	Elite
1999-2000	3	2	7	109.37	81.79	92.69
2000-2001	5	14		21.32	11.65	
2001-2002			1			9.10
2002-2003	2		3	42.21		16.00
2003-2004	5		6	10.13		29.29
2004-2005	8	4	7	57.46	74.32	44.67
2005-2006	26	11	11	40.73	29.93	30.23
2006-2007	21	10	9	31.62	20.59	42.13
2007-2008	33	10	13	37.72	37.82	23.70
2008-2009	10		1	21.17		19.80
2009-2010	9	2	6	20.64	63.49	5.57
2010-2011	20	5	8	32.11	11.48	7.39
2011-2012	11	1	1	36.26	5.24	3.73
2012-2013	2	2	1	4.83	7.24	23.04
2013-2014			1			20.08
IPOs	155	61	75			

Source: MAARO Computed from Equation 3.3. See Section 7.3 (p.164) for SPP calculation method.

While the average MAARO for the minor category IPOs is more or less stable, substantial

variability is observed for the IPOs which fall under the major or elite categories. The trend in the average MAARO by syndicate category is depicted in Figure 7.2.



Source: From Table 7.3
Figure 7.2: *Average MAARO by SPP Categories for Underpriced IPOs (FY 1999-2013)*

It is hypothesised that the extent of IPO underpricing does not differ significantly for IPOs associated with either the Minor, Major, or Elite syndicate groups. We use a sample of 291 underpriced IPOs that went public during the period FY 1999-00 until FY 2013-14.

Table 7.4: *Comparison of extent of underpricing , by syndicate prestige category*

Syndicate Category	IPOs	Mean	Std. Dev.	Mean Difference	Sig.	Confidence Interval	
						Lower Bound	Upper Bound
Elite	75	25.24	84.04				
Major	61	23.58	87.54	1.66	0.934	19.23	46.67
Minor	150	30.12	70.88	-4.88	0.497	16.15	34.36

Source: Author Computed

The results of the one-way ANOVA test to determine any statistically significant difference in the mean underpricing for IPOs between the Minor, Major, or Elite groups are shown in Table 7.4. The sample comprises of 75, 61, and 155 IPOs, which are categorised by their syndicate prestige points as Elite, Major, and Minor groups, respectively. A one-way ANOVA was conducted to determine if the normalised MAARO was statistically different among syndicate categories. There was a presence of 5 outliers in the Minor category as assessed by the box plot and were excluded from the analysis. Data were normally distributed for each group, as assessed by the Shapiro-Wilk test ($p > .05$), but there was heterogeneity of variances, as assessed by Levene's test of homogeneity of variances ($p = .033$). Data are presented as mean $\pm$ standard deviation. Mean adjusted returns for Elite (n=75, 25.24 $\pm$ 84.04) and Major categories (n=61, 23.58 $\pm$ 87.54) was almost the same but increased for Minor category (n=150, 30.12 $\pm$ 70.88) in that order. Normalised MAARO was not statistically different amongst syndicate categories, $F(2,283) = 1.306, p > .05$. We can thus, accept the null hypothesis.

7.4.2 Investment Banks & firm factors - a linear regression approach

This study determines the listing firm-specific factors that may influence an investment bank category to collaborate with the listing firm. Earlier studies have documented the importance of firm age, PIPH, Issue Size, and the Syndicate Size (SS) as influencing factors. Many studies, such as Megginson and Weiss (1991); Elsbach and Kramer (1996); Ljungqvist and Wilhelm (2003) refer to age as one of the variables that are considered by investment banks when they decide to work with listing firms. Post-issue promoter holdings (PIPH) indicates ownership concentration to potential investors. It also signals the future growth potential of the company. PIPH and its impacts on underpricing have been considered in many studies such as Brennan and Franks (1997); Hill (2006). Investment banks are attracted to listing firms that offer a large issue size. Offer size is a signalling variable to investment banks and has been documented in studies such as Bae and Levy (1990); Mok and Hui (1998); Sinha and Madhusoodanan (2004).

Choice of Variables for Regression Model and Hypothesis

The following explanatory variables were chosen to ascertain the major determinants of listing firm factors on investment banks for the regression model.

Firm Age (Age): Older firms signal more operational history and stability. We measure Age as the difference in years between the date of incorporation and the listing date. A log of the firm age (to resolve issues with heteroscedasticity) is used in the regression analysis. We expect that older firms associate with banks/syndicates having higher rankings, i.e., a positive relationship between a firm's age and syndicate prestige.

Issue Size: The issue size indicates the capital that the issuing firm wishes to raise during the IPO. It also indicates the capital that an issuing firm wishes to deploy on upcoming/ongoing projects. A log of the issue size (to resolve issues with heteroscedasticity) is used in the regression analysis. We expect that firms with a significant issue size to be associated with banks/syndicates having higher rankings, i.e., a positive relationship between issue size and syndicate prestige.

Post Issue Promoter Holdings (PIPH): Post-issue promoter holdings (PIPH) signals ownership concentration to potential investors. It also signals the future growth potential of the company. We expect that firms with a large PIPH to be associated with banks/syndicates having higher rankings, i.e., a positive relationship between PIPH and syndicate prestige.

The regression equation is defined by

$$\widehat{SPP} = \alpha + \beta_1(Log\,Age) + \beta_2(Log\,Issue\,Size) + \beta_3(PIPH) + \epsilon \qquad \ldots(7.3)$$

where:

SPP = the explained variable;

Log Age, Log Issue Size, PIPH = the explanatory variables;

β_1 ... β_3 = model parameters; where it is assumed that $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$

α = Constant, ϵ = specification error, unknown (the difference between the true and the specified model)

There were 291 cases considered for this multiple regression. There were two outliers identified in the case-wise diagnostics and two listing firms for which PIPH data was not available. These four records have been ignored from further analysis. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.87.

The assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were met. Firm age (log) and Issue Size (log) were statistically significant in predicting Syndicate Prestige, $F(3,283) = 59.81$, $p<0.005$, $adj.R^2 = 0.382$. All three independent variables added statistically significantly to the prediction, $p < 0.05$.

Table 7.5: *Regression Analysis Results - Determine prestige points from firm listing factors*

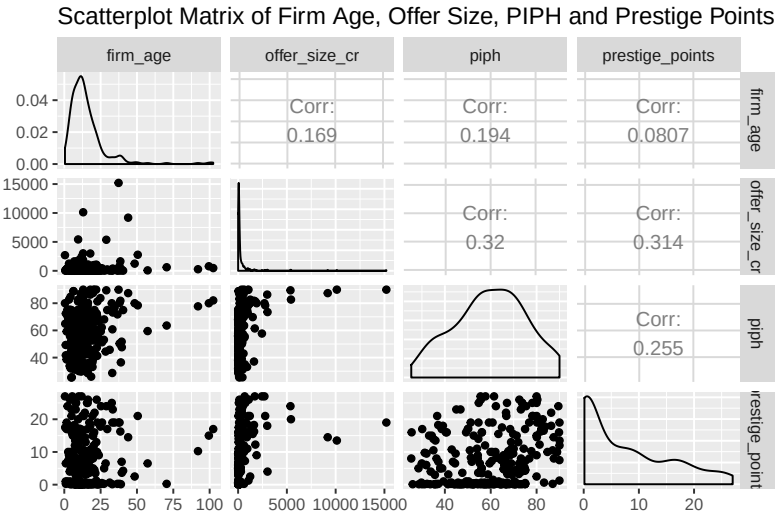
Variable	***B***	***SE_B***	***β***
Intercept	-6.899	1.904	
Firm Age (Log)	-2.977	1.146	-0.122***
Issue Size (Log)	7.931	0.652	0.616***
PIPH	0.017	0.026	0.034

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$;
B= unstandardized regression coefficient;
SE_B = Standard error of the coefficient;
β = standardized coefficient
Source: Computed from Equation 7.3

Based on the multiple linear regression results shown in Table 7.5, firm age and issue size variables were regressed against syndicate prestige. As expected, there is a more significant relationship observed between issue size in relation to the syndicate prestige. Firm age, however, indicates a negative relationship to syndicate prestige. There is a significant positive relationship between issue size and syndicate prestige at the 99% significance level. We accept the null hypothesis for the issue size independent variable. Firm age exhibits a negative relationship to syndicate prestige at the 99% significance level. We fail to accept the null hypothesis for the firm age independent variable.

7.4.3 Investment Banks & firm factors - a neural network approach

The choice of variables for the neural network model is the same as used in Section 7.4.2. For this study, we are not concerned with issues related to multicollinearity since we use generalised linear regression (GLM) followed by testing the neural network against a training and test data set.



Source: Prime Database and Author Computed.
Figure 7.3: *Scatter plot & correlations of variables used in the neural network.*

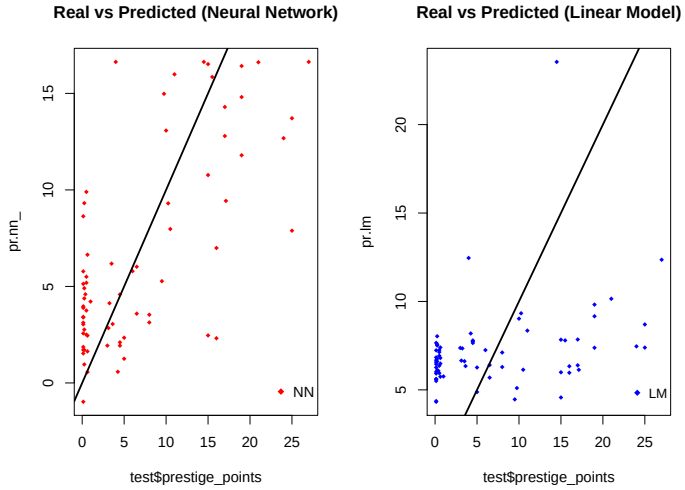
There is no linear relationship between prestige points (dependent variable) and firm age, offer size, and PIPH(independent variables), which can be verified from Figure 7.3. Valid comparison of the efficiency is made after comparing the values for the mean square error (MSE) between the GLM model and the BP-ANN model. For robustness, the study also runs a cross-validation test on the BP-ANN model to review the average MSE. Results from the GLM indicate that MSE is 53.38. After splitting the data into train and test data sets, the model is trained using the train data set. After training the model, the test data is run against the trained BP-ANN model. BP-ANN will output a normalised prediction, so we scale it back in order to make a meaningful comparison. The MSE reported for the BP-ANN model is 30.57, which indicates a superior model fit when compared with GLM.

Table 7.6 shows a comparison between the calculated prestige points for each IPO and the predicted values for prestige points using the BP-ANN model and the GLM model.

Table 7.6: *Syndicate Prestige Points - Actual and Predicted*

Sr. No.	Prestige Points	Predicted Values		Sr. No.	Prestige Points	Predicted Values		Sr. No.	Prestige Points	Predicted Values	
		BP-ANN Model	GLM Model			BP-ANN Model	GLM Model			BP-ANN Model	GLM Model
1	19.000	16.631	12.358	25	11.000	9.431	6.134	49	6.000	2.568	6.575
2	9.000	4.217	5.760	26	20.000	15.852	7.798	50	0.250	3.053	6.346
3	4.000	9.314	8.031	27	0.250	6.642	6.805	51	0.250	4.583	7.730
4	0.125	13.076	9.027	28	15.500	6.991	5.968	52	5.000	1.932	7.652
5	7.000	2.103	7.793	29	0.625	7.973	6.139	53	15.000	5.190	6.365
6	9.500	5.271	4.462	30	0.125	3.422	6.017	54	0.250	16.517	5.994
7	23.000	1.255	6.266	31	10.500	2.500	5.948	55	0.125	4.907	6.607
8	27.000	1.712	7.236	32	0.125	3.534	7.113	56	4.500	3.752	6.927
9	0.500	2.461	4.570	33	5.000	1.529	5.611	57	22.000	6.181	6.620
10	9.500	14.296	6.389	34	0.250	4.379	7.510	58	0.250	2.455	7.398
11	8.000	10.769	7.836	35	0.125	1.712	7.579	59	3.500	14.810	9.163
12	10.000	9.897	7.255	36	0.125	5.780	7.658	60	13.000	3.397	6.268
13	18.250	2.343	4.878	37	0.125	5.131	6.682	61	26.000	1.863	6.839
14	18.000	3.890	6.458	38	0.250	16.631	12.458	62	0.375	0.960	6.761
15	0.250	15.988	8.350	39	11.000	16.614	10.150	63	19.000	12.678	7.459
16	16.000	2.315	6.335	40	0.500	4.131	7.346	64	9.000	5.501	7.137
17	3.000	1.934	7.370	41	7.125	3.119	5.927	65	0.625	3.589	5.693
18	25.000	7.888	7.390	42	4.000	3.134	6.293	66	19.000	0.561	5.746
19	1.500	2.763	6.113	43	13.500	1.635	6.487	67	19.000	-0.975	4.363
20	3.125	4.593	6.083	44	0.375	3.037	5.503	68	16.250	11.794	7.381
21	25.000	6.019	6.402	45	0.250	2.843	6.657	69	7.000	16.419	9.822
22	0.125	8.633	5.607	46	0.250	14.979	5.102	70	4.250	0.577	8.190
23	7.250	5.790	7.250	47	0.250	12.793	7.849	71	6.500	16.631	23.544
24	0.250	3.968	4.328	48	6.500	13.712	8.698	72	15.000	9.304	9.330

Source: Prestige Points - Author Computed
Source: Predicted Prestige Points - BP-ANN and GLM Model



Source: Author Computed

Figure 7.4: *Comparison of real & predicted values using BP-ANN & linear models.*

A visual approach to the performance of the network and the linear model on the test set is plotted in Figure 7.4. A visual inspection of the plot shows us that the predictions made by the neural network are (in general) more concerted around the line (a perfect alignment with the line would indicate an MSE of 0 and thus an ideal perfect prediction) than those made by the linear model.

Table 7.7: *Relative Strength of IPO firm factors using BP-ANN*

Input Variable	Relative Strength
Firm Age	-0.0081
Offer Size (Cr.)	0.9897
PIPH	0.0022

Source: Computed from Equation 7.1

The results of the BP-ANN model in Table 7.7 indicate that firm age is a negative indicator of prestige points while offer size and PIPH are positive indicators. Offer size has the highest

relative strength in this model, indicating that investment banker(s) would be more inclined towards firms with more substantial issue size. The MSE of the cross-validation model is 34.08, which is a considerable improvement over the GLM MSE of 53.38, indicating that the BP-ANN model is a better predictor than the GLM in establishing the relationship between syndicate categories and listing firm variables such as age, issue size, and post-issue promoter holdings.

7.5 Summary and Conclusions

This study is unique since the first aspect focuses on the influence of bank syndicates measured as prestige points on the extent of underpricing in IPOs listed on the NSE for a significant period from FY1999–2013. The second aspect models a multiple regression equation to estimate how listing firms age, issue size, and post-issue promoter holdings variables influence the choice of investment banks/syndicates. Finally, the last aspect revisits the prior problem by attempting to solve it using an artificial neural network.

Regarding the impacts of syndicate prestige points on underpricing, although we find that IPOs associated with the group categorised as Minor category (IPOs having the investment bank prestige points less than 6.5) exhibit the highest level of underpricing, we do not see any statistically significant difference between underpricing in IPOs belonging to the Minor, Major or Elite groups. Our analysis of the influence of underwriters suggests that the certification effects of top-rated underwriters are not observed with respect to underpricing. Our results are similar to those observed by Khurshed et al. (2008); Dhamija and Arora (2017); Chhabra et al. (2017) but different from studies such as McDonald and Fisher (1972); Neuberger and La Chapelle (1983); Kim et al. (1995); Logue et al. (2002); Sundarasen et al. (2018) that point to an inverse relationship between underpricing and syndicate prestige points.

Another aspect of the study is the influence of IPO specific listing factors on syndicate categories and determine a regression model that can estimate syndicate prestige points and, in turn, the syndicate category with which the listing firm will associate. In our results with the regression model, we find a robust positive relationship observed between issue size in relation to the syndicate category, indicating that investment banks prefer listing firms with large issue sizes. Firm age, however, indicates a negative relationship to syndicate category, indicating that younger firms rely on highly rated investment banks to market their issue.

Finally, in the last aspect of the study, an alternative approach to a generalised linear model (GLM) as a predictive model for establishing a relationship between firm age, issue size,

post-issue promoter holding (PIPH), and syndicate prestige points was proposed using back-propagation artificial neural network (BP-ANN). The results of the BP-ANN model indicate that firm age, while negative, and PIPH, while positive, are very weak indicators of the likelihood of association with investment bank(s). Offer size, on the other hand, is a significant positive indicator of an investment banker(s) likelihood of working with a listing firm. A comparison of the MSE values returned with the GLM versus BP-ANN helps us conclude that the BP-ANN model is a better predictor than GLM, and therefore may be applied in establishing the relationship between syndicate category and listing firm age, issue size, and post-issue promoter holdings variables.

In summary, we find that firstly, underwriters classified under different prestige categories do not influence the level of underpricing. Secondly, using a linear regression model, we find that younger firms, as well as firms with a significant issue size, are more likely to associate with higher-ranked investment banks. Thirdly, using an artificial neural network, we conclude that investment banks are interested in associating with large issue size firms. In the case of both, the linear regression, as well as the artificial neural network model, post issue promoter holdings, do not seem to play any significant role in influencing investment banks. The final concluding chapter entitled “Summary and Conclusions” provides a summary by presenting the significant findings, recommendations, conclusions, contributions of the study, and scope for future research.

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Chapter 8

Summary and Conclusions

8.1 Introduction

It is often observed that the issuer accepts lower proceeds from investors so that the future issues are successful. For a firm, this is important because a single equity offer will not satisfy its capital needs. Consequently, the issuer must accept lower proceeds in the initial round to fulfil these investors' future capital requirement. In the light of the reasons mentioned above, it is quite clear that underpricing is often induced when the stakeholders' objectives, that is, the underwriter, the issuer and the investors are not in line. Numerous researchers have explored the difference in the goals of these players which point to the issues with information asymmetry which are existent at two levels being (1) Issuer and Underwriter (Baron, 1982; Muscarella & Vetsuypens, 1989) and (2) Informed investors and Uninformed investors (Rock, 1986).

Past research by Baron (1982); Rock (1986); Welch (1992) have tied information asymmetry as a major determinant of IPO underpricing. The literature recognises that information asymmetry exists between the issuing firm with the underwriter and investors; both informed as well as uninformed. The level of information asymmetry leads to differences in price perceptions making the pricing of IPOs difficult. Studies by Baron and Holmström (1980); Baron (1982) identify information asymmetry among the issuer and the underwriter. The authors theorise that underwriters are more informed about market demand than the issuer. This dynamic relationship between the two parties can be explained by the principal–agent problem wherein underpricing is employed by the underwriter to lessen their distribution efforts. This model supports the progressively divergent objectives of the issuer and underwriter wherein the underwriters meet their objective costing the issuer by way of lower proceeds.

The regulatory environment that governs the process of IPOs also controls the level of information asymmetry. Studies by Neupane and Poshakwale (2012); Khurshed, Paleari, Pande, and Vismara (2014) state that transparent bidding by various institutional investors in the IPO process will help the participation of retail investors since they will base their investment decision by observing the bids of institutional investors. Thus, if the investors' participation process is made transparent, the degree of information asymmetry may reduce the various classes of investors.

This study performs an analysis of trends of IPOs in India, a cross-sectional time-series analysis by examining the listing day and long-run performance of underpriced IPOs, determines the influence of underwriters on underpricing, and finally, identifies firm listing factors that influence underwriters. Our study is unique since we examine the performance of IPOs across various cross-sections using the same dataset. Prior studies on the underpricing of IPOs in the Indian context have been conducted for small to medium durations. This study focuses on IPO underpricing for a much more significant period of 15 years. This study excludes IPOs issued by Small/Medium Enterprises (SME) and any follow-on public offering, also referred to as Secondary Equity/Follow-On Public Offerings (SEO/FPO). By excluding SME IPOs, this study ensures that there is no effect of issue size on underpricing. FPO/SEOs are excluded since they tend to reduce the average level of underpricing.

This research study is aimed at fulfilling the following gaps.

1. Past research studies have been useful in applying theories such as market timing, information asymmetry, to name a few in explaining the short-run performance of IPOs. Some research studies make use of the cumulative returns while some apply the buy-and-hold abnormal returns method. Very few research studies rely on multiple measures of performance for the short and long-run performance study.
2. Many research studies have limited sample sizes on most of the research studies carried out in India and worldwide. Additionally, research studies do not clarify if they leave out medium and small enterprise (SME) or follow-on-offerings (FPO), which undoubtedly influence both short and long-run performance findings.
3. IPO performance varies extensively based on the pricing mechanism, market conditions, etc. This study is extensive in resolving this need to dissect the data. The study undertakes a cross-sectional study of the IPOs long and listing-day performance by issue types, market conditions (cold and hot), graded and ungraded IPOs, amongst grades, investor sentiment (bull and non-bull), sector association and the issue size.

4. Artificial neural networks (ANN) are gaining importance in economic research. In this research study, we explore the possibilities of utilising ANN to identify listing firms factors that influence underwriters' participation using a traditional multiple regression design and an ANN model.

This research study aims to fulfil the research gaps by performing an empirical analysis of IPO underpricing in India, which is split into four parts.

We examine trends of IPOs in India issued in India between FY 1999-2013 to perform a descriptive analysis of over and underpriced IPOs. The cross-sectional trend analysis is done by pricing mechanisms, between IPOs issued in hot and cold markets, between graded and ungraded IPOs, between IPOs of different grades, between IPOs issued in bull and non-bull markets and finally by categories of the issue size. The descriptive analysis also examines the trends in the marginally adjusted abnormal returns across cross-sections during the period of study.

The second objective is devoted to studying the listing day performance of underpriced IPOs and is composed of two sub-objectives. The first sub-objective determines the extent of underpricing between IPOs listed using the fixed-price and book building pricing mechanism; IPOs listed in hot and cold market conditions; graded and ungraded IPOs; between graded IPOs; IPOs listed in bull and non-bull markets; IPOs are affiliated with select sectors; between IPOs across issue size categories (small, mid and large). The second sub-objective derives a relationship between 'Marginally Adjusted Returns on Opening (MAARO)' and certain macroeconomic factors.

The third objective is devoted to a long-run performance study of underpriced IPOs and has eight sub-objectives. These sub-objectives foci on the differences in long-run returns by (a) examining the long-run performance of the entire sample, and discuss differences when (b) IPOs are listing using different pricing mechanisms, (c) IPOs are listed in hot and cold market conditions, (d) IPOs listed are graded, and ungraded, (e) amongst graded IPOs, (f) IPOs are listed in bull, and non-bull markets, (g) IPOs are affiliated with select sectors and (h) IPOs are compared across issue size categories (small, mid and large-size).

The fourth objective looks at the influence that underwriters and listing firms have on each other. Firstly, we look at whether the classification of bank syndicates based on their annual rankings at the time of listing affects market-adjusted abnormal return. Secondly, we develop a regression model that helps predict the influence of issue-specific variables such as firm age, PIPH and issue size on investment banks, and, thirdly, to develop a neural network

model to predict the influence of issue-specific variables such as firm age, PIPH and issue size on investment banks.

We perform a trend analysis of all over and underpriced IPOs issued in India between FY 1999-2013 using descriptive statistics and using box-plots which highlight the outliers across various cross-sections in this analysis. We also examine the trends in marginally adjusted abnormal returns across fiscal years for the period of study.

The study on the extent of underpricing using listing day performance employs two tests executed against normalised marginal abnormal returns. These are the independent samples t-test and one-way ANOVA test. As shown in Table 3.1 (p.60), from this sample period of 445 IPOs issued, 297 IPO issues are underpriced. Out of the 297 underpriced IPO issues, 13 IPOs are excluded from the long-run study due to insufficient trading history or breaks in the trading.

The independent-samples t-test is used to determine if a difference exists between the means of two independent groups on a continuous dependent variable. This study uses the independent samples t-test for identifying any statistical difference in the extent of underpricing related to (1) usage of different pricing mechanisms (Section 5.4.1, p.102) (2) IPO issue market conditions identified as hot and cold (Section 5.4.2, p.106) (3) IPOs being graded and ungraded (Section 5.4.3, p.109) and (4) nature of the markets identified as bull and non-bull/neutral markets (Section 5.4.5, p.115). The one-way analysis of variance (ANOVA) test is used to determine statistically significant differences between the means of two or more independent groups. This study uses ANOVA for identifying any statistical difference in the extent of underpricing related to (1) IPOs with different grades (Section 5.4.4, p.112) (2) IPOs that are grouped by sectors (Section 5.4.6, p.118) and (3) IPOs classified by issue size (Section 5.4.7, p.121).

The long-run performance study of underpriced IPOs employs two non-parametric tests executed against the buy-hold abnormal returns (BHAR) data. These are the Mann-Whitney U test and the Kruskal-Wallis H test. This study uses the Mann-Whitney test to examine statistical differences in the distribution of BHAR related to (1) usage of different pricing mechanisms (Section 6.4.2, p.141) (2) IPO issue market conditions identified as hot and cold (Section 6.4.3, p.142) (3) IPOs being graded and ungraded (Section 6.4.4, p.144) and (4) nature of the markets identified as bull and non-bull/neutral (Section 6.4.6, p.147). This study uses the Kruskal-Wallis test to examine statistical differences in the distribution of BHAR related to (1) IPOs with different grades (Section 6.4.5, p.145) (2) IPOs that are grouped by sectors (Section 6.4.7, p.148) and (3) IPOs classified by issue size (Section 6.4.8, p.152).

For the listing day performance of each IPO, we calculate two measures of underpricing; 'Marginally Adjusted Abnormal Returns on Opening (MAARO)' and Log Normal Returns. In calculating market returns, the historical NIFTY is used as the market index. We calculate MAARO in three steps. In step 1, the raw returns, which are the percentage difference between the offer price and listing price, are calculated. In step 2, the historical NIFTY index's percentage difference is calculated between the offer and listing dates. In step 3, the difference between returns from step 1 and step 2 is calculated to adjust the raw returns (from step 1) for any volatility in the markets between the offer and listing dates. For the robustness of tests, we also calculate log normal returns as another measure of underpricing. This is calculated using the stock returns adjusted for the corresponding market movement by subtracting log market return from the log returns on the listing date.

This study measures long-run performance using the BHAR method. Research papers such as Fama (1998); Lyon, Barber, and Tsai (1999) prefer the BHAR methodology and are often the most cited method for long-run performance studies. To overcome skewness bias with BHAR, we use skewness-adjusted t-statistics as introduced by Hall (1992). For the robustness of tests, we also calculate the wealth relative (WR) to evaluate the performance of IPOs at specific points in time.

The final objective looks at the influence that underwriters and listing firms have on each other. A one-way ANOVA test is employed to test if the classification of bank syndicates based on their syndicate prestige affects underpricing. A multivariate regression model helps predict the influence of issue-specific variables such as firm age, PIPH and issue size on their association with investment banks/syndicates. A back-propagation artificial neural network model is used to help predict the influence of issue-specific variables such as firm age, PIPH and issue size on their association with investment banks/syndicates.

8.2 Summary of Major Findings

The findings of objective one in chapter four entitled "Trends of IPO in India (FY 1999-2013)" is provided in subsection 8.2.1, objective two in chapter five entitled "Listing Day Performance of Underpriced IPOs" in subsection 8.2.2, objective three in chapter six entitled "Long-Run Performance of Underpriced IPOs" in subsection 8.2.3, and finally, objective four in chapter seven entitled "Effects of Underwriter Prestige, Investment Banks and Firm Factors" in subsection 8.2.4.

8.2.1 Findings from trends of IPOs in India

1. We observed considerable variability in listing day market-adjusted returns (hereafter returns) during 1999-2000. More considerable variability of returns is observed in the case of underpriced IPOs. Extreme return values are present for underpriced IPOs. Returns display a reducing pattern in the case of underpriced IPOs. This might be an outcome of firms pricing their IPOs correctly or could be an outcome of a bulk of graded IPOs post-2007 in the sample. The pattern of returns for overpriced IPOs seem flat or moving away from zero. A majority of over and underpriced IPOs are noted during bull periods.
2. In the cross-sectional trend study by issue type, we observe a few periods of times in which no IPOs are issued using either pricing mechanisms. There is significant variability in returns for underpriced fixed price as opposed to underpriced bookbuilt IPOs. Also, there are more extreme return values observed in underpriced bookbuilt than underpriced fixed price IPOs. Returns for underpriced bookbuilt IPOs have been decreasing gradually in but not with underpriced fixed price IPOs. This possibly results from underwriters correcting the IPO offer price based upon market feedback using the bookbuilt pricing mechanism. Correction in the returns pattern is not observed for overpriced IPOs using either pricing mechanisms.
3. In the cross-sectional trend study of IPOs issued in hot and cold market conditions, we notice that the hot market underpriced IPOs show several extreme return values compared to cold market underpriced IPOs. The variability of returns for overpriced IPOs is much smaller compared to underpriced IPOs. Returns reduce at a slower rate when it comes to underpriced hot and cold market IPOs. This correction of returns is not seen for overpriced IPOs issued in cold market IPOs but are observed in overpriced hot market issues.
4. In the cross-sectional trend study of graded and ungraded IPOs, we observe that ungraded underpriced IPOs display numerous extreme return values in contrast to underpriced graded IPOs. The variability of returns for overpriced IPOs is much smaller in contrast with underpriced IPOs. When it comes to underpriced IPOs, returns reduce gradually in graded IPOs but not when it comes to ungraded IPOs. Returns going back to zero is not noticed for overpriced graded IPOs.
5. In the cross-sectional trend study of graded IPOs, we refer to Grade 1 & 2, Grade 3 and Grade 4 & 5 IPOs as lower, average and higher grade IPOs. We observe that average grade IPOs show extreme return values in contrast with other grades. The variability of returns for overpriced IPOs is much smaller in comparison with underpriced IPOs. The variability and range of returns for underpriced IPOs are most significant for lower-grade

IPOs. When it comes to underpriced IPOs, returns reduce gradually in average and higher grade IPOs only. In overpriced IPOs, returns are seen reverting to zero gradually only for average grade IPOs.

6. In the cross-sectional trend study of IPOs listed in bull and non-bull markets, we notice that bull period underpriced IPOs show several extreme return values compared to non-bull period underpriced IPOs. The variability of returns for overpriced IPOs is much smaller in comparison with underpriced IPOs. While returns for underpriced IPOs are gradually decreasing over time, a faster correction is observed in bull market IPOs. This correction of returns is not seen for overpriced IPOs issued in non-bull and bull markets.
7. In the cross-sectional trend study based on the IPO issue size, we notice that small-size underpriced IPOs exhibit many extreme return values compared to mid and large-size underpriced IPOs. The variability of returns for overpriced IPOs is much smaller in comparison with underpriced IPOs. Small-size IPOs show high variability in returns for both, overpriced and underpriced IPOs. In the case of underpriced IPOs, market-adjusted returns have gradually reduced for all issue size categories with the most considerable decrease observed in mid and large-size IPOs. This correction of returns, however, is not observed for overpriced IPOs.

8.2.2 Findings from the listing day performance of underpriced IPOs

We now summarise our findings from the listing day performance of underpriced IPOs.

1. Market feedback hypothesis contributes to lowering the underpricing level for bookbuilt issues. Our results are similar to findings by Benveniste and Spindt (1989); Benveniste and Wilhelm (1990); Spatt and Srivastava (1991); Hawaldar, Naveen Kumar, and Mallikarjunappa (2018) but are different from findings of Giudici and Paleari (1999); Ljungqvist, Jenkinson, and Wilhelm Jr (2003); Derrien and Womack (2003).
2. A comparison of the extent of underpricing amongst IPOs issued in hot and cold markets reveals that the mean underpricing of IPOs issued in either market is almost the same. The results indicate that the market timing theory does not apply to our study. Our results concur with the findings of Garg, Arora, and Singla (2008) but not with other studies such as Ibbotson and Jaffe (1975); Ritter (1984); Wang (1999); Neneh and Smit (2013); Alim, Ramakrishnan, and Khan (2016).
3. A comparison of the extent of underpricing amongst graded and ungraded IPOs reveals that graded IPOs exhibit a lower level of underpricing than ungraded IPOs. This signifies the effects of certification towards reducing underpricing for graded IPOs. Our

conclusions resemble the findings of Deb and Marisetty (2010); Dhamija and Arora (2017); Tripathi and Pandey (2018) but are different from that of Khurshed, Paleari, Pande, and Vismara (2008); Chhabra, Kiran, and Sah (2017).

4. When we examine the extent of underpricing among IPO grades, we refer to Grade 1 & 2, Grade 3 and Grade 4 & 5 IPOs as lower, average and higher grade IPOs. We find that lower grade IPOs exhibit the highest underpricing level, followed by average and higher grade IPOs indicating that underpricing reduces with increasing grades. This signifies the effects of certification among graded IPOs. Our results are similar to other findings in India such as Poudyal (2008); Tripathi and Pandey (2018); Kashiramka, Thomas, Yadav, and Rao (2018) but different from that of Sahoo and Kaur (2017); Dhamija and Arora (2017); Chhabra et al. (2017).
5. A comparison of the extent of underpricing between IPOs issued in bull and non-bull markets suggests that the market timing theory does not apply to our period of study. Although the mean underpricing during non-bull markets is lower than in bull markets, the results are not statistically significant. Our result is different from past findings such as Jog and Riding (1987); Loughran and Ritter (2004); Garg et al. (2008).
6. A comparison of the extent of underpricing among sectors reveals that the Computers - Software (Medium & Small) sector exhibits the highest level of underpricing, whereas the Const. & Contracting (Real Estate) followed by Banks - Public sectors show the lowest level of underpricing. A possible reason could be because newer industries where high technology is utilised are more subject to non-fundamental factors and signalling effects resulting in higher underpricing to generate interest amongst investors. Our finding is similar to those found in other countries such as Karlis (2000); Henrick (2012).
7. An examination of the impacts of issue size on the underpricing reveals that small-size IPO issues exhibit the highest underpricing level, followed by the mid-size and finally large-size issues, in that order. The extent of underpricing is statistically significant between small-size IPOs with mid-size IPOs as well with large-size IPOs. Our results indicate that the signalling hypothesis applies to our study. Our results are similar to those of Ibbotson, Sindelar, and Ritter (1994); M'kombe and Ward (2002); Khurshed et al. (2008); Islam, Ali, and Ahmad (2010); Yong (2011) but are different from that by Michaely and Shaw (1994); Chhabra et al. (2017).
8. Our last study concerning listing day performance analyses the effects of specific macroeconomic factors on underpricing using a multivariate regression model. We discover a robust positive relationship between Dividend Yield and adjusted abnormal returns. This is an exception because we expect that as dividend yields increase, stocks in

the market end up being less expensive, and investors would instead not invest in IPOs. A very mild positive relationship is observed among the growth rate and the repo rate to adjusted abnormal returns. Repo rate is used as a proxy for short-term interest rate, and the conclusions are comparable to those made by Chen, Roll, and Ross (1986); Shiller and McCulloch (1990); Campbell and Shiller (1991) but not with that of Choe, Masulis, and Nanda (1993). We observe a statistically significant negative relationship between the inflation rate and adjusted abnormal returns. The model indicates a statistically significant negative relationship between the currency exchange rate and adjusted abnormal returns.

8.2.3 Findings from the long-run performance of underpriced IPOs

We now summarise our findings from the long-run performance study of underpriced IPOs.

1. Examination of the entire sample reveals that our sample of IPOs always underperformed the markets. The sample never provides a positive return during the entire study period and delivers a return of -21.15% at the end of 3-years. Similar results were arrived by Ritter (1991); Kooli and Suret (2004); Pandya (2016). Our results differ from the findings arrived at by Sahoo and Rajib (2010); Das, Saha, and Kundu (2016).
2. A comparison of the performance of IPOs using either pricing mechanisms reveals that bookbuilt IPOs fared much worse (-22.68%) as opposed to fixed price IPOs (-14.59%) at the end of the 3-years. Bookbuilt IPOs exhibited no statistically significant abnormal returns while fixed price IPO issues did so during a few months. Our sample result is indifferent in regards to the pricing mechanism used with either returning losses. Our findings are similar to that of Hawaldar et al. (2018) regarding the long-run performance of bookbuilt issues but not regarding fixed-price issues.
3. A comparison of the performance of IPOs listed in hot and cold markets reveals that IPOs listed in cold markets (120.65%) performed better than those listed in hot markets (-36.65%) towards the end of 3-years. From this finding, we conclude that the issuance of IPOs in hot periods are subject to the fads hypothesis. Our findings are similar to those found by Loughran and Ritter (1995); Schaub (2011).
4. A comparison of the IPO performance between graded and ungraded IPOs reveals that both graded and un-graded IPOs end up with negative returns of -39.49% and -11.18%, respectively. There are a few periods where ungraded IPOs deliver positive abnormal performance. Statistically, BHAR was not significantly different between graded and ungraded IPOs. Our study finds that the effects of certification are inconsequential over

the long run for graded IPOs.

5. For the study on long-run performance of graded IPOs, we refer to Grade 1 & 2, Grade 3 and Grade 4 & 5 IPOs as lower, average and higher grade IPOs. We find that all graded IPOs provide negative returns at the end of the 3-year study. Lower, average and higher grade IPOs provide a return -61.82%, -24.65% and -30.37% towards the end of 3-years. Our results are similar to that of Kashiramka et al. (2018) but different from those of Poudyal (2008); Dhamija and Arora (2014).
6. The study on the long-run performance of IPOs issued in bull and non-bull/neutral periods reveals that IPOs listed during either market conditions do not yield positive long-term gains. Bull market IPOs end the long-run study with a return of -19.79% as opposed to -25.70% during non-bull/neutral periods. Bull market IPOs end the study period with lower losses than non-bull market IPOs which suggests that firms and underwriters use bull phases as a market timing opportunity (Loughran & Ritter, 1995). Our results differ from those stated by Schaub (2011). Our analysis suggests that the 'Window of Opportunity' hypothesis is applicable in the Indian context.
7. In our study of the long-run sectoral IPO performance, we find that the Banks - Public sector IPOs perform exceptionally well, delivering a return of 174.79% towards the end of the 3-years of study. In contrast, none of the other seven sectors exhibits a positive abnormal return. The primary reasons for Banks - Public sector IPOs doing exceptionally well are because of the gradual partial privatisation of these banks, a well-developed capital market, and investor faith in the Indian financial banking system (Sathye, 2005). Our results find that long-run returns vary across industries similar to the findings stated by Kooli and Suret (2004). The worst performing sector is the Construction & Contracting - Civil sector returning -58.32%. Seven out of the eight sectors had a negative median return with the worst performance from Computers (Software - Medium & Small) sector IPOs at -50.14%. The best performance was from the Banks - Public sector IPOs with a positive median return of 5.95%.
8. Our last study focuses on the influence of issue size on long-run performance. We find that small, mid and large-size IPOs return -22.82%, -7.51% and -40.76% respectively at the end of the 3-year study. Large-size issues perform the worst in this study. Our findings concerning large-size IPOs performing the worst are different from other researchers such as Stoll and Curley (1970); De Bondt and Thaler (1985) where the authors find that IPO issues with small capitalisation do not perform well over the long-run. Our study validates that issuance of large-size IPOs is subject to the overreaction hypothesis.

8.2.4 Findings from the effects of underwriter prestige, investment banks & firm factors

We now summarise our findings regarding the influence that underwriters and listing firms have on each other. Firstly, we examine if a classification of bank syndicates based on their annual rankings at the time of listing affects market-adjusted abnormal return. Secondly, we develop a regression model to predict the influence of firm listing factors such as firm age, PIPH and issue size on association with investment banks. Thirdly, we develop a neural network model to help predict the influence of firm listing factors such as firm age, PIPH and issue size on association with investment banks.

1. We find that IPOs associated with the group categorised as Minor category (IPOs having the investment bank prestige points less than 6.5) exhibit the highest underpricing level. However, we do not see any statistically significant difference between underpricing in IPOs belonging to the Minor, Major or Elite groups, suggesting that top-rated underwriters' certification effects do not affect underpricing. Our results are similar to Khurshed et al. (2008) but different from past findings in studies such as McDonald and Fisher (1972); Neuberger and La Chapelle (1983); Kim, Krinsky, and Lee (1995); Logue, Rogalski, Seward, and Foster-Johnson (2002); Sundarasen, Khan, and Rajangam (2018) which point to the inverse relationship between underpricing and syndicate prestige points.
2. The regression model to estimate the influence of firm listing factors on investment banks finds a robust positive relationship observed between issue size with the syndicate prestige indicating that higher-ranked investment banks associated with listing firms with larger issue sizes. Firm age indicates a negative relationship to syndicate prestige, indicating that younger firms retain more prestigious investment banks to market the issue.
3. An alternative approach to a generalised linear model (GLM) as a predictive model for establishing a relationship between firm age, issue size and post-issue promoter holding (PIPH) is proposed using the back-propagation artificial neural network (BP-ANN). The BP-ANN model results indicate that issue size is the only strong positive indicator of a listing firm associating with prestigious banks. A review of the MSE values returned with the GLM versus BP-ANN helps us conclude that the BP-ANN model is a better predictor than GLM and therefore may be applied in establishing the relationship between syndicate category and listing firm age, issue size and post-issue promoter holding variables.

8.3 Recommendations/Suggestions

1. Our findings conclude that although the mean underpricing of IPOs during non-bull markets is lower than in bull markets, the distinction is not statistically significant. We end up at a comparable conclusion when we examine the level of underpricing for IPOs listed in hot and cold market conditions. While these IPOs deliver high returns on listing day, it is not so in the long-run with IPOs under-performing in the case of IPOs issued in bull, non-bull markets and hot market conditions. To avoid losses, the retail investor should ignore market sentiments and focus solely on IPO firm fundamentals and its prospects.
2. Barring the positive long-run performance of IPOs in cold markets, IPOs coming from the public banking sector and sporadic positive performance of medium-sized IPOs, all other sub-groups underperform the markets; sometimes severely. Long-run performance is extremely tough to gauge considering that market conditions continue to change over different periods. Long-term performance likewise varies depending on the measurement approach adopted and the chosen benchmark. Further, measuring long-run performance ends up being harder given that company events such as bonus issues and splits have a substantial influence on long-run performance. Investors need to retain focus on fundamentals when choosing IPOs as an investment instrument and monitor their portfolios closely.
3. Our findings have essential suggestions for issuers, regulators and investors. There continues to be a significant emphasis laid out by SEBI to increase disclosure and transparency for listing firms. Grading of IPOs was a substantial step in the right direction to empower the retail investor in making the correct decision. Since Feb-2014, IPO grading was made optional by SEBI given that there was no correlation discovered between the issue grade and its subscription or the post-listing performance. Grading of IPOs ensured that listing companies and regulators decrease information asymmetry. Grading of IPOs has helped enhance pricing efficiency, and the regulators must think about presenting measures in place of IPO grading in an easy to comprehend format that highlights the listing firms valuations to assist retail investors.
4. The review of literature has interesting findings with respect to issuing firms retaining reputed underwriters which are specifically focused on a specific industry domain. The presence of an issue underwritten by industry focused underwriters that provide excellent analyst coverage will help investors manage their expectation regarding potential returns. A suggestion that SEBI can undertake is to enforce a regulation to provide details of the book-running lead managers such as the market share of IPOs and their relative rankings

amongst their peers on the red herring prospectus.

5. In the long-run, a higher grade for a listing firm does not provide any advantage for the listing firm. What it does however is that a firm does not end up leaving too much money on the table on listing. We cannot ignore that the extent of underpricing for graded IPOs is much lower than that of ungraded IPOs. Firms should consider voluntary grading of their issues since it reduces the extent of underpricing and helps raise more capital.
6. A reduced trend in underpricing of IPOs is a signal to investors that a large degree underpricing is unsustainable. This has been largely owing to the regulatory changes and disclosure requirements enforced by regulators. While all financial instruments are subject to investment risks, the expectation of high returns on an ongoing basis is not sustainable, which is something that investors should keep in mind. It is in investors' interest to review the offer documents to help arrive at an informed decision.
7. High initial returns followed by dismal performances over the long-run do not augur well for financial markets. For markets to be efficient in the long-run, there should be low gains on listing followed by moderate gains over the short-run followed by long-run gains. What we observe is exactly the opposite of what should happen. SEBI should find a mechanism for inclusion by listing firms in the prospectus for investors to review essential ratios such as the current ratio, debt-equity ratio, and return on net worth. This mechanism should be simple enough for average investors to understand the investment risks involved.
8. For long-term investors, based upon the period we have studied, we recommend financial investments in IPOs with a long history of operational profits and choose to list their IPOs in cold markets and are ungraded.

8.4 Conclusion

Following are the significant conclusions that emerge from this study.

1. The first objective studies and provides a descriptive analysis of all IPOs (leaving out SME IPOs and FPOs) listed on the NSE in India between 1999 and 2013. Out of the 445 IPOs provided in this period, over and underpriced IPOs were 33.26 % and 66.75 % respectively. A bulk of these IPOs are listed during the three bull periods encountered in the duration of the research study. The trendline of the returns from overpriced IPOs indicates that overpricing of IPOs continues to be prevalent in the Indian stock markets since there is no tendency of the trendline to revert towards zero. In the case of overpriced IPOs, the investors do not experience any short-run gains. The decreasing trend in the returns of underpriced IPOs shows that investment banks/syndicates are making an

effort to correctly price the IPOs. This might be a result of graded IPOs which was made necessary by SEBI in 2007. The bookbuilt system results in decreased over and underpricing. Use of the bookbuilt mechanism enables revisions to the offer price based on market feedback. Hot market conditions lead to underwriters over and underpricing IPOs much more than cold market conditions. While underwriters draw out a premium from investors for graded IPOs by overpricing more than ungraded IPOs, underwriters underprice ungraded IPOs much more than graded IPOs to compensate investors for the risk of investing in ungraded IPOs.

Similarly, underwriters underprice lower graded IPOs much more than higher-graded IPOs to compensate investors for investing in lower graded IPOs. The presence of fewer IPO offerings in non-bull markets leads underwriters to overprice non-bull period IPOs higher than during bull periods. However, this results in a faster negative correction of IPO prices issued in non-bull periods when investor sentiments are low as opposed to bull periods when investor sentiments are high. In non-bull markets, the absence of favourable market sentiments leads underwriters to underprice IPO issues higher as opposed to a booming market when investor sentiments are very high. Small-size IPOs are over and underpriced the most while large-size IPOs are over and underpriced the least. This could be since investors view a larger issue size indicative of stable companies with a strong operational history.

2. In the listing day performance study of underpriced IPOs, we test hypotheses such as market feedback, certification, market timing theory, and signalling effects. We conclude that market feedback hypothesis contributes to lowering the underpricing level for bookbuilt issues because there is a statistically significant difference in underpricing between fixed-price and bookbuilt issues. The market timing theory does not apply to our study when comparing the extent of underpricing of IPOs listed in cold and hot markets and likewise between bull and non-bull markets. The results of certification are apparent when we compare the degree of underpricing between graded and ungraded IPOs. Underpricing for graded IPOs is much lower than ungraded IPOs, and the difference is statistically significant. When we compare the extent of underpricing among graded IPOs, we discover that the impact of certification are at play towards decreasing underpricing with lower grade IPOs underpriced the most and higher grade IPOs underpriced the least. Concerning sectoral affiliation of IPOs, we find that high innovation companies are more subject to non-fundamental factors and signalling effects than more seasoned companies with a long history. Small-size IPO issues are severely underpriced when compared to underpricing versus mid or large-size IPOs. The level of underpricing is statistically

significant between small-size IPOs with mid-size and large-sized IPOs, indicating that the signalling hypothesis is relevant in our research study. Utilising regression analysis, we find that dividend yields have a positive effect on the underpricing of IPOs. In contrast, the exchange rate and inflation have a negative impact on the underpricing of IPOs.

3. Internationally, studies on the long-run performance of IPOs have presented conflicting findings. Furthermore, no specific theories of underpricing could be concretely applied to the long-run performance of IPOs. Our study on the 3-year long-run performance of underpriced IPOs makes the following determinations. Our observation of long-run performance shows that IPOs underperform the markets in the long-run, and our sample never delivers a positive return during the period of study. Pricing mechanisms do not matter in the long-run performance with IPOs of both mechanisms returning losses by the end of the study. IPOs listed in cold markets perform substantially better with a positive long-term return than those listed in hot markets, confirming that IPOs in hot markets are subject to the fads hypothesis. The long-run performance of an IPO, whether graded or ungraded, does not matter in the long run since they both end with negative returns. Presence of higher or lower grades does not guarantee positive long-run performance. Our study establishes that underpriced IPOs irrespective of their grades provide a negative return and also that certification effects are irrelevant in the long-run. IPOs issued in bull and non-bull markets also provide negative returns in the long-run although bull market IPO losses are less than non-bull market IPOs. Since IPOs issued in bull markets incur lower losses than those issued in non-bull markets over the long-run, our study suggests that the 'Window of Opportunity Hypothesis' applies in the Indian context. Issuing firms with a considerable history and strong fundamentals perform well in the long-run. This is evident from the sectoral long-run performance study where public sector banks are the only sector that returns a positive long term return with all other chosen sectors delivering negative returns by the end of the study. Regarding the issue size of IPOs, we find that while a larger issue size is viewed positively in the short-run, in the long-run, we find that small-size IPOs perform the worst, followed by large and mid-size IPOs. None of the IPOs based upon issue size classification returns a positive BHAR towards the end of the long-run study. Our study validates that issuance of large-size IPOs is subject to the overreaction hypothesis.
4. A partnership between listing firms and premium underwriters/syndicates does not ensure lower underpricing of IPOs. Our study on the leverage of underwriters on underpricing suggests that premier underwriters' certification effects are not observed. Using regression analysis, we discover that listing firms retain reputed banks' services

when the issue size is large, and when the firms are relatively young. Using back-propagation artificial neural network (BP-ANN) on our sample, we discover that the likelihood of listing firms collaborating with prestigious investment banks is much higher when the issue size is significant. The back-propagation artificial neural network (BP-ANN) is a better model and has a much lower mean square error (MSE) value than the generalised linear model.

8.5 Contributions of the Study

8.5.1 Theoretical Contributions

1. A decreasing trend in abnormal listing returns is observed over the research study period with underpriced bookbuilt IPOs but not with underpriced fixed price IPOs. The market feedback hypothesis plays a role in reducing the extent of underpricing for bookbuilt issues. A statistically significant difference in underpricing is observed between bookbuilt and fixed-price issues.
2. A decreasing trend in abnormal listing returns is observed over the research study period with underpriced IPOs issued in cold and hot market conditions. The market timing theory does not apply in our study since there is no statistically significant difference in underpricing between IPOs issued in hot or cold markets. Our analysis finds that IPOs issued in cold markets outperform IPOs issued in hot markets over the long term. We conclude that the issuance of IPOs in hot periods is subject to the fads hypothesis.
3. A decreasing trend in abnormal listing returns is observed over the research study period with underpriced graded IPOs but not so with ungraded IPOs. Effects of certification are evident since underpricing for graded IPOs is much lower than ungraded IPOs, and the difference is statistically significant. Over the long term, the performance of graded and ungraded IPOs reveals that both graded and ungraded IPOs deliver negative returns. The effects of certification are inconsequential in the case of graded IPOs over the long run.
4. In the case of underpriced graded IPOs, abnormal listing returns have been decreasing over the research study period in the case of average and higher grade IPOs but not so in the case of lower grade IPOs. Lower grade IPOs exhibit the highest level of underpricing, followed by average and higher grade IPOs. The difference in the extent of underpricing is statistically significant between lower grade with average as well as higher grade IPOs. This indicates the effects of certification towards reducing underpricing among graded IPOs. Over the long term, while all IPO grades deliver losses, average grade IPOs

performs the best in minimising losses. Lower grade IPOs deliver the worst long-term return, followed by higher grade IPOs and finally average grade IPOs. None of the graded IPOs provides a positive long-term return. The effects of certification are irrelevant in the case of graded IPOs over the long run.

5. A decreasing trend in abnormal listing returns is observed over the research study period with IPOs issues listed in non-bull and bull markets. The market timing theory does not apply to underpriced IPOs issued in bull and non-bull markets since the difference in the mean underpricing among IPOs listed in bull and non-bull markets is not statistically significant. Over the long-run, underpriced bull market IPO returns losses which are less than non-bull market IPOs. The long term returns are not statistically significantly different between IPOs issued during bull and non-bull periods validating that the issuance of IPOs in bull markets are subject to the window of opportunity hypothesis.
6. A decreasing trend in abnormal listing returns is observed over the research study period in underpriced small, mid and large-size IPOs. Most significant decreases are observed for mid and large-size IPOs. The extent of underpricing is statistically significantly different between small-size IPOs with mid-size IPOs and between small-size IPOs with large-size IPOs indicating the applicability of the signalling hypothesis. Contrary to other studies performed globally, over the long run, we find that large-size IPOs perform the worst, followed by small-size IPOs and finally mid-size IPOs. None of the IPOs based on issue size classification returns a positive long term return towards the end of the long-run study. Our study validates that issuance of large-size IPOs is subject to the overreaction hypothesis.

8.5.2 Managerial Contributions

1. High technology firm IPOs are subject to more underpricing that IPOs from other sectors. High technology firms are more subject to non-fundamental factors and signalling effects than more seasoned industries with a longer, more informative history.
2. Dividend yields in the stock markets have a positive effect on the underpricing of IPOs. On the other hand exchange rate and inflation have a negative effect on the underpricing of IPOs.
3. IPOs underperform the markets in the long run, and our study sample never provides a positive return during the period of study.
4. Public sector banks are the only sector that returns a positive long term return with all other chosen sectors providing negative returns at the end of the study. Public sector

banks outperform other sectors in our study, possibly due to gradual partial privatisation of banks and investor faith in the Indian financial banking system.

5. Based on investment bank prestige points computed for each IPO, we find no statistically significant difference in the underpricing amongst the prestige category groups.
6. Using a regression model and the back-propagation artificial neural network (BP-ANN) to approximate syndicate prestige points, we find a robust positive relationship between issue size and prestigious investment banks. Likewise, in the linear regression model, we discover that firm age has a negative relationship to syndicate prestige, suggesting that younger firms retain the services of the more prominent financial investment banks.

8.6 Scope for Further Research

This study is an empirical study of IPOs issued in India between FY 1999-2013, which focuses on a time-series analysis of IPOs, studies listing day, and long-run performance of underpriced IPOs from various aspects. Lastly, it establishes the significance of underwriter prestige, firm factors and the influence that they have on underpricing. Further research needs to examine more points such as

1. A mix of market theories is at work during the period of study wherein a majority of the IPOs were listed during bull periods. What theories apply to IPOs when market conditions change? Is it market-timing, information cascade or some other theory? This study only concentrates on examining specific theories on underpricing in the Indian context and not on a conceivable interaction of theories.
2. An IPO listed in a non-bull phase could experience various market cycles including cold and hot markets, bull markets etc. Can we quantify the impact of these shifting market conditions on the long-term performance of an IPO? How do IPOs behave internationally over the long-run with altering market conditions? This study does not answer these questions because of an absence in determining a comprehensive, robust methodology to answer the question adequately.
3. A large number of IPOs get listed over a reasonably long bull phase. Would the short-run performance be different if the IPOs were listed in a bull phase at the start, middle or the end of the bull phase? Even though studying a former bull-run is possible, anticipating one and the bull-run duration is hard to forecast. Owing to such practical considerations, such questions are not in the scope of this study.

8.7 References

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Appendix A

Long-run performance (ABHAR & Wealth Relative)

Table A.1: *Month-wise long-run performance of Bookbuilt IPO Issues*

Bookbuilt Issues (230 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-1.53%	-0.8256		0.968		19	-6.35%	-0.6388		0.841
2	-4.20%	-1.4876		0.916		20	-6.22%	-0.6475		0.832
3	-3.49%	-0.9388		0.916		21	-9.09%	-0.9790		0.800
4	-4.31%	-0.9430		0.892		22	-10.53%	-1.1122		0.784
5	-2.10%	-0.4643		0.942		23	-10.77%	-0.9721		0.768
6	-3.46%	-0.7883		0.920		24	-8.81%	-0.6600		0.790
7	-3.11%	-0.7064		0.927		25	-8.27%	-0.5978		0.793
8	-3.53%	-0.7305		0.910		26	-9.02%	-0.5538		0.795
9	-0.78%	-0.1017		0.948		27	-8.60%	-0.4332		0.814
10	0.51%	0.1427		0.950		28	-13.65%	-1.0161		0.761
11	-1.23%	-0.1415		0.928		29	-13.92%	-1.0658		0.753
12	-2.14%	-0.2777		0.914		30	-13.49%	-0.9793		0.749
13	-6.56%	-1.0268		0.881		31	-9.31%	-0.5102		0.775
14	-7.33%	-1.1065		0.865		32	-12.43%	-0.7534		0.770
15	-6.82%	-1.0019		0.853		33	-15.24%	-0.8307		0.764
16	-6.16%	-0.8681		0.868		34	-19.73%	-1.0270		0.752
17	-8.89%	-1.2037		0.825		35	-20.85%	-1.0983		0.736
18	-8.50%	-1.0070		0.820		36	-22.68%	-0.9853		0.740

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.2: *Month-wise long-run performance of Fixed-Price IPO Issues*

Fixed Price Issues (54 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-9.05%	-2.5129	**	1.062		19	0.26%	0.0486		1.034
2	-7.89%	-1.2252		1.016		20	-4.40%	-0.2637		0.976
3	-13.43%	-2.2521	**	0.953		21	3.13%	0.2341		1.017
4	-17.96%	-2.6113	***	0.917		22	-1.65%	-0.0685		0.981
5	-17.10%	-2.0810	**	0.935		23	-2.16%	-0.0461		0.968
6	-19.40%	-2.8405	***	0.916		24	-3.44%	-0.0973		0.948
7	-17.83%	-2.3573	**	0.935		25	-8.47%	-0.4245		0.918
8	-20.21%	-2.4341	**	0.902		26	-3.49%	-0.1362		0.937
9	-16.64%	-2.0380	**	0.911		27	-5.64%	-0.2329		0.922
10	-17.61%	-1.9056	*	0.903		28	-6.40%	-0.2664		0.952
11	-16.69%	-1.5396		0.900		29	-1.96%	-0.0448		0.969
12	-14.31%	-1.2060		0.904		30	-5.58%	-0.2093		0.956
13	-12.52%	-1.0010		0.902		31	-4.99%	-0.1609		0.943
14	-9.15%	-0.7154		0.915		32	-6.14%	-0.1962		0.932
15	-6.46%	-0.4649		0.967		33	-1.25%	0.0049		0.961
16	-3.52%	-0.2269		1.003		34	0.10%	0.0663		0.955
17	1.07%	0.1085		1.031		35	-13.95%	-0.4760		0.893
18	-0.06%	0.0289		1.021		36	-14.59%	-0.5245		0.900

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.3: *Month-wise long-run performance of Cold Market IPO Issues*

Cold Market Issues (28 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	3.52%	0.5320		1.087		19	89.75%	2.4502	**	1.615
2	13.92%	1.5756		1.152		20	72.32%	2.1988	**	1.473
3	19.89%	1.7092	*	1.180		21	76.49%	2.2341	**	1.454
4	24.36%	2.0244	**	1.168		22	67.08%	2.0835	**	1.384
5	47.24%	2.8323	***	1.362		23	82.34%	2.0596	**	1.453
6	45.15%	2.6670	***	1.297		24	95.68%	1.9919	**	1.539
7	48.66%	2.9362	***	1.391		25	88.33%	1.8794	*	1.550
8	56.42%	-3.3873	***	1.445		26	111.10%	1.8924	*	1.706
9	67.47%	-2.6355	***	1.532		27	136.34%	1.9653	**	1.843
10	84.00%	-3.0295	***	1.643		28	90.73%	1.9856	**	1.510
11	77.52%	-3.0953	***	1.561		29	93.24%	1.9849	**	1.504
12	86.13%	-3.3179	***	1.529		30	93.25%	1.9295	*	1.471
13	70.50%	-3.6150	***	1.394		31	126.42%	1.9576	*	1.642
14	72.73%	-3.4276	***	1.441		32	114.95%	1.9105	*	1.574
15	75.07%	2.8344	***	1.492		33	126.21%	1.8663	*	1.620
16	69.20%	2.5783	***	1.502		34	126.58%	1.8071	*	1.563
17	63.08%	2.4101	**	1.442		35	115.38%	1.6689	*	1.486
18	71.88%	2.2988	**	1.477		36	120.65%	1.5752		1.531

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.4: *Month-wise long-run performance of Hot Market IPO Issues*

Hot Market Issues (256 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-3.67%	-2.1313	**	0.975		19	-15.47%	-2.3050	**	0.779
2	-6.96%	-2.4650	**	0.911		20	-14.43%	-1.9284	*	0.779
3	-8.15%	-2.2520	**	0.893		21	-15.87%	-2.1552	**	0.762
4	-10.32%	-2.0642	**	0.865		22	-17.15%	-2.1365	**	0.749
5	-10.66%	-2.9549	***	0.891		23	-19.14%	-2.0326	**	0.722
6	-12.14%	-3.6894	***	0.875		24	-19.11%	-1.7526	*	0.724
7	-11.88%	-3.4958	***	0.874		25	-18.88%	-1.7413	*	0.718
8	-13.61%	-3.3873	***	0.846		26	-20.99%	-2.2232	**	0.699
9	-11.59%	-2.6355	***	0.872		27	-23.83%	-2.1784	**	0.691
10	-12.44%	-3.0295	***	0.855		28	-23.53%	-2.0664	**	0.697
11	-13.10%	-3.0953	***	0.846		29	-23.12%	-2.2770	**	0.695
12	-14.36%	-3.3179	***	0.834		30	-23.50%	-2.0381	**	0.692
13	-16.24%	-3.6150	***	0.821		31	-23.25%	-1.6328		0.686
14	-16.47%	-3.4276	***	0.802		32	-25.03%	-1.9130	**	0.691
15	-15.70%	-3.1379	***	0.796		33	-27.76%	-2.3230	**	0.681
16	-13.85%	-2.4153	**	0.816		34	-31.55%	-2.8946	***	0.674
17	-14.66%	-2.3181	**	0.788		35	-34.29%	-2.9398	***	0.656
18	-15.51%	-2.4652	**	0.778		36	-36.65%	-3.8514	***	0.652

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.5: *Month-wise long-run performance of Graded IPO Issues*

Graded Issues (100 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-5.28%	-1.8218	*	0.893		19	-16.61%	-1.8148	*	0.807
2	-9.12%	-2.6667	***	0.855		20	-18.38%	-1.9000	*	0.770
3	-6.75%	-1.4751		0.858		21	-20.98%	-2.0464	**	0.730
4	-7.77%	-1.4462		0.845		22	-22.49%	-2.2546	**	0.708
5	-5.65%	-0.8318		0.858		23	-25.40%	-2.5191	**	0.676
6	-2.77%	-0.3838		0.885		24	-25.67%	-2.4274	**	0.678
7	-2.56%	-0.3975		0.909		25	-25.31%	-2.3955	**	0.680
8	-2.28%	-0.3026		0.897		26	-25.46%	-2.4426	**	0.667
9	-2.14%	-0.2483		0.935		27	-26.94%	-2.5298	**	0.667
10	-4.70%	-0.7087		0.922		28	-29.67%	-2.6538	***	0.659
11	-5.48%	-0.8033		0.910		29	-27.77%	-2.5576	**	0.668
12	-9.69%	-1.3233		0.868		30	-30.13%	-2.7114	***	0.651
13	-12.55%	-1.6215		0.852		31	-31.44%	-2.8827	***	0.639
14	-13.09%	-1.7083	*	0.846		32	-32.48%	-2.7888	***	0.631
15	-13.45%	-1.7895	*	0.841		33	-36.10%	-2.9095	***	0.612
16	-12.85%	-1.6340		0.863		34	-37.61%	-2.9882	***	0.606
17	-16.82%	-2.0894	**	0.791		35	-38.51%	-3.2225	***	0.592
18	-18.57%	-2.1322	**	0.778		36	-39.49%	-3.1279	***	0.568

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.6: *Month-wise long-run performance of Ungraded IPO Issues*

Ungraded Issues (184 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-1.70%	-0.8575		1.034		19	1.17%	0.1710		0.910
2	-2.61%	-0.7722		0.976		20	0.92%	0.1410		0.899
3	-4.64%	-1.0514		0.956		21	0.95%	0.1374		0.890
4	-6.44%	-1.1447		0.922		22	-1.43%	-0.0960		0.869
5	-4.58%	-0.9179		0.980		23	-0.30%	0.0271		0.862
6	-8.51%	-1.7421	*	0.936		24	1.92%	0.2052		0.881
7	-7.73%	-1.5163		0.937		25	0.93%	0.1313		0.876
8	-9.11%	-1.6347		0.914		26	1.04%	0.1399		0.889
9	-4.70%	-0.6753		0.944		27	2.23%	0.2218		0.906
10	-1.98%	-0.1899		0.949		28	-2.81%	-0.1430		0.858
11	-3.45%	-0.3812		0.928		29	-2.89%	-0.1528		0.850
12	-1.61%	-0.1511		0.931		30	-2.13%	-0.0918		0.849
13	-5.05%	-0.6538		0.900		31	3.98%	0.2891		0.881
14	-4.74%	-0.5895		0.887		32	0.31%	0.0801		0.877
15	-3.11%	-0.3621		0.891		33	0.21%	0.0850		0.887
16	-1.75%	-0.1803		0.910		34	-4.19%	-0.1592		0.876
17	-1.66%	-0.1621		0.898		35	-9.22%	-0.4289		0.846
18	-0.55%	-0.0152		0.896		36	-11.18%	-0.4615		0.861

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5.

Table A.7: *Month-wise long-run performance of IPOs with Grade 1 & 2*

Grade 1 & 2 Issues (35 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-9.31%	-1.3456		0.885		19	-27.29%	-1.3803		0.780
2	-15.15%	-1.8674	*	0.835		20	-33.13%	-1.4772		0.682
3	-8.75%	-0.8054		0.871		21	-37.38%	-1.3236		0.604
4	-10.01%	-0.7742		0.861		22	-42.77%	-1.5498		0.544
5	-5.10%	-0.2792		0.863		23	-45.89%	-1.7086	*	0.507
6	-0.54%	0.0275		0.883		24	-48.89%	-1.7487	*	0.483
7	-3.90%	-0.2518		0.892		25	-50.84%	-2.1608	**	0.469
8	0.12%	0.0630		0.905		26	-53.64%	-2.2704	**	0.429
9	-1.74%	-0.0260		0.956		27	-53.83%	-2.4430	**	0.422
10	-5.00%	-0.2911		0.957		28	-54.95%	-2.2315	**	0.431
11	-1.85%	-0.0761		0.972		29	-53.50%	-2.2345	**	0.438
12	-5.50%	-0.2868		0.929		30	-55.81%	-2.3226	**	0.422
13	-13.31%	-0.7086		0.871		31	-56.68%	-3.0319	***	0.412
14	-14.63%	-0.8196		0.873		32	-54.00%	-2.8857	***	0.420
15	-18.87%	-1.1415		0.837		33	-62.19%	-3.4335	***	0.379
16	-17.02%	-0.9814		0.885		34	-64.34%	-3.8073	***	0.389
17	-28.86%	-2.0276	**	0.723		35	-63.37%	-2.6797	***	0.385
18	-31.40%	-1.9374	*	0.715		36	-61.82%	-1.7060	*	0.356

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.8: *Month-wise long-run performance of IPOs with Grade 3*

Grade 3 Issues (33 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-5.92%	-1.1704		0.956		19	-10.65%	-0.5797		0.873
2	-8.26%	-1.4051		0.916		20	-8.94%	-0.4654		0.884
3	-6.21%	-0.8199		0.898		21	-10.26%	-0.6031		0.865
4	-6.91%	-0.8121		0.872		22	-9.99%	-0.5559		0.863
5	-4.61%	-0.4609		0.906		23	-12.50%	-0.7098		0.833
6	-1.22%	-0.1023		0.959		24	-9.12%	-0.4654		0.882
7	0.61%	0.0801		0.998		25	-5.55%	-0.2398		0.904
8	-2.07%	-0.1887		0.960		26	-5.57%	-0.2384		0.914
9	-0.59%	-0.0203		1.002		27	-5.88%	-0.2537		0.924
10	-4.27%	-0.4108		0.955		28	-12.94%	-0.6022		0.892
11	-6.04%	-0.6059		0.939		29	-9.81%	-0.4507		0.914
12	-13.99%	-1.6137		0.871		30	-11.14%	-0.5113		0.901
13	-14.80%	-1.6540	*	0.879		31	-11.84%	-0.5368		0.897
14	-14.50%	-1.3521		0.859		32	-15.39%	-0.6604		0.886
15	-11.32%	-0.8372		0.897		33	-17.05%	-0.7302		0.873
16	-12.15%	-0.8544		0.899		34	-19.57%	-0.8288		0.849
17	-10.02%	-0.5683		0.887		35	-21.90%	-0.9744		0.823
18	-11.39%	-0.6102		0.871		36	-24.65%	-1.1894		0.789

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.9: *Month-wise long-run performance of IPOs with Grade 4 & 5*

Grade 4 & 5 Issues (32 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-0.21%	-0.1587		0.837		19	-11.08%	-1.5521		0.770
2	-3.41%	-1.4093		0.817		20	-11.97%	-1.7907	*	0.754
3	-5.10%	-1.6857	*	0.803		21	-14.09%	-2.1844	**	0.735
4	-6.20%	-1.7188	*	0.800		22	-13.20%	-2.3839	**	0.737
5	-7.32%	-1.3562		0.804		23	-16.28%	-2.8294	***	0.710
6	-6.81%	-1.4010		0.816		24	-17.34%	-2.8773	***	0.697
7	-4.35%	-0.6224		0.842		25	-17.77%	-3.0750	***	0.696
8	-5.03%	-0.7713		0.825		26	-19.23%	-3.3758	***	0.686
9	-4.18%	-0.5033		0.847		27	-19.26%	-3.3116	***	0.689
10	-4.82%	-0.7449		0.847		28	-19.25%	-3.1796	***	0.687
11	-8.89%	-1.7232	*	0.805		29	-18.15%	-2.4827	**	0.683
12	-9.84%	-1.5673		0.790		30	-21.62%	-2.9418	***	0.658
13	-9.39%	-1.2339		0.802		31	-24.04%	-2.9721	***	0.637
14	-9.95%	-1.0626		0.798		32	-26.57%	-3.2361	***	0.613
15	-9.71%	-1.1597		0.788		33	-27.21%	-3.3077	***	0.611
16	-9.01%	-1.0782		0.797		34	-26.97%	-3.3598	***	0.615
17	-10.65%	-1.4582		0.774		35	-28.45%	-3.4029	***	0.602
18	-11.94%	-1.9380	*	0.757		36	-30.37%	-3.2045	***	0.592

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5.

Table A.10: *Month-wise long-run performance of Bull Market IPO Issues*

Bull Market Issues (219 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-2.36%	-1.3677		1.001		19	-6.54%	-0.6474		0.881
2	-4.50%	-1.5636		0.948		20	-6.11%	-0.6215		0.873
3	-4.87%	-1.2668		0.937		21	-8.14%	-0.8730		0.855
4	-6.03%	-1.2393		0.911		22	-9.79%	-1.0307		0.840
5	-5.74%	-1.3268		0.949		23	-9.30%	-0.8253		0.831
6	-8.44%	-2.1205	**	0.923		24	-7.34%	-0.5291		0.847
7	-8.18%	-1.9443	*	0.926		25	-6.47%	-0.4459		0.847
8	-8.93%	-1.8671	*	0.907		26	-5.24%	-0.2914		0.858
9	-5.94%	-1.0457		0.940		27	-5.82%	-0.2607		0.869
10	-5.67%	-0.7916		0.936		28	-10.79%	-0.7873		0.827
11	-7.32%	-1.0412		0.923		29	-11.09%	-0.8278		0.820
12	-7.63%	-1.1622		0.913		30	-10.87%	-0.7694		0.817
13	-10.76%	-1.9449	*	0.887		31	-7.08%	-0.3633		0.843
14	-10.55%	-1.7572	*	0.875		32	-10.00%	-0.5852		0.840
15	-8.91%	-1.3829		0.874		33	-11.51%	-0.6188		0.844
16	-7.96%	-1.1235		0.887		34	-15.06%	-0.8111		0.840
17	-8.11%	-1.0979		0.875		35	-18.39%	-0.9720		0.817
18	-7.88%	-0.9318		0.869		36	-19.79%	-0.8713		0.823

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.11: *Month-wise long-run performance of Non-Bull/Neutral Market IPO Issues*

Non-Bull/Neutral Market Issues (65 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-4.95%	-1.1530		0.937		19	-0.21%	0.0383		0.870
2	-6.24%	-1.0139		0.890		20	-5.09%	-0.3024		0.809
3	-7.10%	-1.0826		0.875		21	-2.16%	-0.0773		0.793
4	-9.84%	-1.3305		0.843		22	-5.67%	-0.3015		0.747
5	-2.30%	-0.2076		0.906		23	-8.59%	-0.3989		0.710
6	0.06%	0.0587		0.903		24	-9.31%	-0.4134		0.716
7	1.74%	0.2312		0.938		25	-14.49%	-0.7931		0.698
8	0.80%	0.1301		0.913		26	-17.18%	-0.9086		0.676
9	3.43%	0.3898		0.946		27	-15.53%	-0.7955		0.693
10	6.27%	0.6139		0.960		28	-17.24%	-0.8961		0.679
11	6.45%	0.5942		0.923		29	-13.55%	-0.6583		0.693
12	6.24%	0.5198		0.908		30	-15.77%	-0.7500		0.676
13	2.65%	0.2615		0.880		31	-13.24%	-0.5495		0.665
14	1.99%	0.2122		0.875		32	-15.41%	-0.6340		0.651
15	0.53%	0.1006		0.882		33	-16.17%	-0.6486		0.646
16	2.07%	0.2031		0.927		34	-19.00%	-0.6731		0.616
17	-3.24%	-0.1890		0.828		35	-23.40%	-0.8483		0.591
18	-3.56%	-0.1905		0.826		36	-25.70%	-0.9606		0.592

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.12: *Month-wise long-run performance of Banks - Public Sector IPO Issues*
Banks - Public Sector Issues (10 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	1.79%	0.4572		1.164		19	73.11%	2.0175	**	1.567
2	-0.17%	0.0157		1.112		20	74.28%	1.9773	**	1.472
3	0.53%	0.0973		1.124		21	101.79%	2.0948	**	1.590
4	10.73%	1.0653		1.249		22	91.54%	2.1559	**	1.579
5	15.37%	1.1134		1.317		23	118.00%	2.0281	**	1.615
6	11.72%	1.0069		1.270		24	135.90%	2.0441	**	1.696
7	16.50%	1.1319		1.330		25	116.14%	2.0752	**	1.717
8	22.06%	1.2613		1.321		26	125.48%	2.1420	**	1.746
9	23.59%	1.4366		1.331		27	133.07%	2.1017	**	1.779
10	34.81%	1.6337		1.427		28	123.70%	2.0165	**	1.709
11	36.82%	1.6223		1.403		29	141.02%	2.0997	**	1.796
12	42.60%	1.6665	*	1.395		30	133.68%	2.0940	**	1.756
13	43.56%	1.5326		1.340		31	160.73%	2.1459	**	1.826
14	49.83%	2.0058	**	1.410		32	166.32%	2.1590	**	1.788
15	57.54%	1.9996	**	1.463		33	170.89%	2.1133	**	1.795
16	63.43%	2.0030	**	1.531		34	178.89%	2.0417	**	1.742
17	59.34%	2.0349	**	1.464		35	167.91%	2.0762	**	1.726
18	59.54%	1.9848	**	1.440		36	174.79%	2.1392	**	1.787

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5.

Table A.13: *Month-wise long-run performance of Computers (Software) IPO Issues*
Computers (Software) Issues (16 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-3.57%	-0.5081		0.817		19	-39.73%	-4.7564	***	0.519
2	-4.59%	-0.5046		0.788		20	-35.22%	-3.1400	***	0.532
3	2.39%	0.2469		0.867		21	-36.57%	-3.9367	***	0.529
4	-2.44%	-0.0700		0.745		22	-37.60%	-4.1342	***	0.514
5	-7.09%	-0.3186		0.702		23	-39.58%	-4.8305	***	0.469
6	-10.01%	-0.5723		0.703		24	-40.72%	-4.9758	***	0.478
7	-17.27%	-1.0223		0.664		25	-45.19%	-6.4773	***	0.444
8	-21.29%	-0.9580		0.621		26	-54.21%	-8.0952	***	0.374
9	-22.19%	-1.1118		0.600		27	-51.47%	-7.8760	***	0.383
10	-25.94%	-1.4062		0.548		28	-53.41%	-8.1675	***	0.372
11	-26.94%	-1.6770	*	0.565		29	-54.59%	-7.7899	***	0.329
12	-26.04%	-1.5847		0.593		30	-50.55%	-6.7954	***	0.364
13	-29.53%	-1.9097	*	0.553		31	-50.32%	-5.9511	***	0.391
14	-34.23%	-2.9187	***	0.533		32	-49.89%	-6.3912	***	0.407
15	-37.32%	-3.6866	***	0.517		33	-48.54%	-5.2059	***	0.414
16	-34.02%	-3.6726	***	0.538		34	-52.13%	-5.5634	***	0.402
17	-39.69%	-5.8664	***	0.526		35	-53.67%	-4.4493	***	0.400
18	-38.33%	-5.4683	***	0.529		36	-56.88%	-4.5600	***	0.382

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.14: *Month-wise long-run performance of Computers (Software - Medium & Small) IPO Issues*
Computers (Software Medium & Small) Issues (20 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-6.10%	-0.8542		1.130		19	-36.77%	-1.7566	*	0.780
2	-8.43%	-0.5873		1.047		20	-39.03%	-1.9374	*	0.726
3	-16.35%	-1.0893		0.994		21	-38.17%	-1.7224	*	0.743
4	-24.02%	-1.9082	*	0.900		22	-45.85%	-1.9204	*	0.665
5	-17.59%	-1.0714		0.969		23	-56.23%	-3.1454	***	0.583
6	-20.54%	-1.3113		0.941		24	-55.35%	-3.2000	***	0.593
7	-20.05%	-1.1210		0.947		25	-56.22%	-3.2139	***	0.606
8	-21.12%	-1.2398		0.941		26	-45.07%	-1.1978		0.646
9	-20.76%	-1.0425		0.962		27	-49.65%	-1.2404		0.577
10	-21.50%	-1.1999		0.970		28	-47.33%	-1.0938		0.612
11	-34.02%	-2.2125	**	0.834		29	-36.54%	-0.7375		0.663
12	-37.85%	-2.7088	***	0.765		30	-36.73%	-0.7196		0.666
13	-43.11%	-3.5019	***	0.683		31	-40.57%	-0.8685		0.668
14	-43.03%	-3.4823	***	0.669		32	-41.30%	-1.0031		0.675
15	-43.47%	-2.6088	***	0.698		33	-30.52%	-0.5312		0.693
16	-47.36%	-3.2941	***	0.641		34	-16.25%	-0.2118		0.810
17	-39.83%	-1.6188		0.756		35	-38.39%	-1.0900		0.690
18	-34.71%	-1.1911		0.841		36	-50.19%	-2.0269	**	0.620

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5.

Table A.15: *Month-wise long-run performance of Construction & Contracting (Civil) IPO Issues*
Construction & Contracting (Civil) Issues (15 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	14.32%	2.1116	**	0.905		19	-36.37%	-2.1788	**	0.362
2	33.88%	2.0378	**	1.016		20	-30.90%	-1.3593		0.368
3	35.41%	1.6695	*	0.935		21	-29.85%	-1.2069		0.358
4	32.64%	1.1388		0.916		22	-30.88%	-1.2574		0.385
5	19.95%	1.0547		0.943		23	-37.31%	-1.6086		0.373
6	-2.96%	-0.2787		0.836		24	-32.63%	-1.4893		0.421
7	-2.52%	-0.1963		0.760		25	-24.54%	-1.1993		0.492
8	-6.36%	-0.6479		0.658		26	-27.47%	-1.3768		0.474
9	-16.44%	-2.0012	**	0.612		27	-32.02%	-1.8674	*	0.467
10	-21.20%	-3.6478	***	0.580		28	-38.15%	-2.1797	**	0.429
11	-23.15%	-3.1755	***	0.555		29	-39.75%	-2.4171	**	0.442
12	-17.01%	-1.7899	*	0.578		30	-37.22%	-1.9380	*	0.447
13	-27.66%	-2.8806	***	0.503		31	-46.11%	-2.0549	**	0.437
14	-29.71%	-3.8331	***	0.435		32	-48.39%	-1.9790	**	0.454
15	-24.00%	-2.3248	**	0.398		33	-51.57%	-2.5526	**	0.460
16	-26.65%	-2.9622	***	0.353		34	-53.63%	-2.7011	***	0.440
17	-34.52%	-2.7883	***	0.365		35	-56.77%	-3.4006	***	0.418
18	-37.72%	-2.7694	***	0.331		36	-58.32%	-3.2730	***	0.415

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.16: *Month-wise long-run performance of Construction & Contracting (Real Estate) IPO Issues*
Construction & Contracting (Real Estate) Issues (11 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-0.73%	-0.0750		0.985		19	-30.28%	-2.1504	**	0.584
2	-9.03%	-1.1415		0.875		20	-33.56%	-2.3507	**	0.558
3	-7.03%	-0.4621		0.871		21	-33.90%	-2.1330	**	0.564
4	8.34%	0.5094		0.987		22	-32.80%	-2.1462	**	0.571
5	14.09%	0.8555		1.038		23	-29.24%	-1.6647	*	0.606
6	19.48%	0.9239		1.056		24	-23.49%	-1.0927		0.692
7	16.31%	0.8050		1.017		25	-18.57%	-0.9850		0.726
8	21.91%	0.7965		1.034		26	-30.37%	-3.1145	***	0.614
9	28.00%	0.8682		1.069		27	-32.88%	-3.2543	***	0.616
10	15.74%	0.6426		1.005		28	-37.78%	-3.3241	***	0.576
11	-1.06%	0.0375		0.878		29	-33.64%	-2.3405	**	0.614
12	-5.40%	-0.1837		0.859		30	-39.57%	-2.9593	***	0.569
13	-1.21%	0.0257		0.876		31	-41.29%	-2.2784	**	0.563
14	-6.89%	-0.2250		0.828		32	-42.37%	-2.1068	**	0.549
15	-16.07%	-1.0184		0.750		33	-47.75%	-2.7745	***	0.512
16	-17.62%	-1.0726		0.728		34	-48.61%	-2.7190	***	0.500
17	-21.47%	-1.5782		0.690		35	-48.37%	-2.5609	**	0.501
18	-28.51%	-2.1821	**	0.602		36	-47.46%	-2.3368	**	0.525

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.17: *Month-wise long-run performance of Media & Entertainment IPO Issues*
Media & Entertainment Issues (28 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-3.56%	-0.3934		1.024		19	-15.06%	-0.8544		0.744
2	-9.94%	-1.2081		0.891		20	-17.72%	-0.9502		0.703
3	-10.43%	-1.3755		0.915		21	-15.29%	-0.8090		0.707
4	-16.57%	-1.6544	*	0.830		22	-10.97%	-0.5397		0.751
5	-19.48%	-2.0961	**	0.806		23	-18.80%	-1.1339		0.731
6	-20.14%	-2.2495	**	0.801		24	-26.01%	-1.4895		0.660
7	-21.23%	-2.3913	**	0.755		25	-31.23%	-1.7488	*	0.602
8	-23.82%	-2.6594	***	0.754		26	-30.95%	-1.7624	*	0.619
9	-20.14%	-2.6170	***	0.769		27	-32.18%	-1.8303	*	0.625
10	-21.49%	-2.8805	***	0.758		28	-36.57%	-2.5151	**	0.609
11	-17.38%	-1.7355	*	0.767		29	-38.85%	-2.3821	**	0.575
12	-16.14%	-1.4488		0.795		30	-38.80%	-2.3483	**	0.602
13	-17.38%	-1.5587		0.785		31	-41.76%	-2.1374	**	0.578
14	-12.12%	-0.8546		0.803		32	-39.99%	-1.9943	**	0.586
15	-14.89%	-1.1099		0.775		33	-40.77%	-1.7032	*	0.603
16	-12.93%	-0.8785		0.809		34	-50.20%	-2.2976	**	0.550
17	-6.65%	-0.3164		0.800		35	-46.27%	-1.7819	*	0.556
18	-12.63%	-0.6954		0.735		36	-39.92%	-1.3588		0.571

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.18: *Month-wise long-run performance of Miscellaneous IPO Issues*

Miscellaneous Issues (16 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-5.43%	-1.1130		1.066		19	11.03%	0.6243		1.379
2	-2.21%	-0.3346		1.085		20	4.79%	0.3075		1.297
3	-4.12%	-0.5337		1.084		21	-0.74%	0.0207		1.211
4	-2.12%	-0.2571		1.105		22	-10.54%	-0.4741		1.119
5	2.41%	0.2180		1.145		23	-12.92%	-0.5587		1.080
6	2.63%	0.2277		1.123		24	-5.48%	-0.1436		1.202
7	13.15%	0.9190		1.225		25	-8.48%	-0.2154		1.199
8	10.45%	0.6729		1.203		26	-7.87%	-0.1712		1.199
9	19.53%	1.0863		1.310		27	-6.50%	-0.1197		1.226
10	16.13%	1.0975		1.227		28	-10.18%	-0.2183		1.181
11	17.40%	1.1507		1.205		29	-12.17%	-0.2757		1.156
12	9.59%	0.7184		1.205		30	-17.16%	-0.4209		1.119
13	7.76%	0.5514		1.250		31	-20.07%	-0.4894		1.087
14	6.59%	0.4279		1.280		32	-21.29%	-0.4658		1.088
15	7.70%	0.4585		1.322		33	-21.37%	-0.4731		1.069
16	6.40%	0.3709		1.336		34	-23.24%	-0.5129		1.046
17	5.69%	0.3338		1.334		35	-20.71%	-0.5064		1.051
18	8.06%	0.4684		1.360		36	-30.32%	-0.8034		0.952

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.19: *Month-wise long-run performance of Pharmaceuticals IPO Issues*

Pharmaceuticals Issues (14 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-2.51%	-0.3959		0.577		19	14.69%	0.4048		0.442
2	-9.45%	-0.8778		0.520		20	-0.87%	0.0486		0.432
3	-7.75%	-0.5188		0.485		21	-12.58%	-0.2096		0.319
4	-5.42%	-0.2398		0.503		22	-16.15%	-0.2524		0.263
5	-9.05%	-0.3934		0.469		23	-26.93%	-0.5116		0.243
6	2.04%	0.1888		0.472		24	-33.97%	-0.7352		0.230
7	1.48%	0.1611		0.460		25	-34.25%	-0.7254		0.221
8	-0.91%	0.0780		0.450		26	-39.50%	-0.8736		0.228
9	11.71%	0.4056		0.444		27	-43.94%	-0.8512		0.213
10	14.48%	0.4278		0.430		28	-48.55%	-0.9105		0.220
11	14.19%	0.4216		0.435		29	-52.38%	-0.8724		0.189
12	23.92%	0.5708		0.423		30	-46.51%	-0.6282		0.180
13	15.80%	0.4391		0.403		31	-42.14%	-0.5222		0.188
14	13.97%	0.3929		0.400		32	-54.10%	-0.7937		0.173
15	13.95%	0.3965		0.410		33	-49.48%	-0.6823		0.168
16	11.60%	0.3665		0.444		34	-47.76%	-0.6124		0.164
17	4.96%	0.2102		0.431		35	-39.15%	-0.4550		0.177
18	10.39%	0.3200		0.449		36	-42.40%	-0.5287		0.173

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed using Equations 3.7 and 3.5.

Table A.20: *Month-wise long-run performance of Small-Size IPO Issues*

Small-Size Issues (203 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	-5.02%	-2.2741	**	1.010		19	-6.93%	-0.6055		0.865
2	-7.34%	-2.0934	**	0.945		20	-8.18%	-0.7372		0.851
3	-7.51%	-1.6605	*	0.933		21	-9.07%	-0.8274		0.829
4	-9.96%	-1.7282	*	0.896		22	-12.84%	-1.1532		0.794
5	-7.77%	-1.4685		0.949		23	-11.93%	-0.9069		0.785
6	-9.08%	-1.7177	*	0.924		24	-10.98%	-0.6996		0.795
7	-8.45%	-1.6386		0.928		25	-10.85%	-0.6808		0.793
8	-9.05%	-1.5925		0.910		26	-10.21%	-0.5489		0.797
9	-5.54%	-0.8015		0.950		27	-10.42%	-0.4642		0.805
10	-4.94%	-0.5834		0.944		28	-16.04%	-1.0338		0.761
11	-4.75%	-0.5722		0.935		29	-15.38%	-1.0149		0.756
12	-5.00%	-0.5900		0.921		30	-15.26%	-0.9572		0.747
13	-9.04%	-1.1883		0.891		31	-9.96%	-0.4740		0.774
14	-8.25%	-1.0598		0.879		32	-12.66%	-0.6670		0.768
15	-7.18%	-0.8940		0.879		33	-13.38%	-0.6535		0.780
16	-6.55%	-0.7833		0.897		34	-17.72%	-0.8607		0.766
17	-8.05%	-0.9282		0.855		35	-20.90%	-1.0123		0.745
18	-8.37%	-0.8527		0.849		36	-22.82%	-0.9446		0.751

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.21: *Month-wise long-run performance of Mid-Size IPO Issues*

Mid-Size Issues (58 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	2.23%	1.1255		0.896		19	3.84%	0.4334		0.938
2	1.59%	0.5034		0.888		20	4.44%	0.4951		0.901
3	0.77%	0.2413		0.876		21	4.90%	0.5659		0.901
4	3.70%	0.8504		0.896		22	7.34%	0.8129		0.919
5	4.77%	0.8943		0.925		23	2.42%	0.2920		0.876
6	1.02%	0.2260		0.900		24	5.32%	0.5464		0.919
7	3.27%	0.5500		0.935		25	1.67%	0.1897		0.898
8	4.09%	0.6304		0.926		26	0.71%	0.1116		0.900
9	5.15%	0.7612		0.941		27	1.04%	0.1383		0.924
10	7.10%	0.9841		0.964		28	0.67%	0.1070		0.909
11	2.34%	0.3621		0.925		29	2.28%	0.2255		0.927
12	1.91%	0.2913		0.922		30	1.23%	0.1458		0.929
13	0.07%	0.0373		0.906		31	2.24%	0.2065		0.950
14	-2.15%	-0.2755		0.890		32	0.82%	0.1072		0.950
15	-3.02%	-0.3722		0.885		33	-1.46%	-0.0460		0.929
16	-0.09%	0.0325		0.910		34	-2.61%	-0.1138		0.928
17	-1.58%	-0.1518		0.901		35	-6.57%	-0.3699		0.895
18	-0.21%	0.0197		0.895		36	-7.51%	-0.4293		0.884

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Table A.22: *Month-wise long-run performance of Large-Size IPO Issues*

Large-Size Issues (23 IPOs)

Month	ABHAR	t-skew	Sig.	WR		Month	ABHAR	t-skew	Sig.	WR
1	2.15%	0.862		1.003		19	-11.44%	-1.0904		0.852
2	0.22%	0.0982		0.973		20	-11.50%	-0.9676		0.847
3	-2.16%	-0.5503		0.955		21	-15.87%	-1.6070		0.823
4	-6.65%	-1.6249		0.909		22	-14.36%	-1.3564		0.850
5	-4.58%	-0.7592		0.906		23	-13.63%	-1.2770		0.855
6	-2.61%	-0.4149		0.928		24	-12.68%	-1.1335		0.827
7	-6.61%	-1.3830		0.912		25	-11.01%	-0.9139		0.856
8	-13.19%	-3.5298	***	0.852		26	-10.14%	-0.8016		0.878
9	-10.94%	-2.2509	**	0.857		27	-9.90%	-0.7985		0.894
10	-10.50%	-1.8344	*	0.854		28	-11.59%	-0.8414		0.882
11	-15.44%	-2.6751	***	0.800		29	-13.89%	-0.9691		0.846
12	-15.71%	-2.4481	**	0.797		30	-16.44%	-1.0051		0.830
13	-15.42%	-2.3834	**	0.787		31	-22.54%	-1.4508		0.773
14	-16.55%	-2.5708	**	0.797		32	-29.08%	-2.1026		0.748
15	-12.37%	-1.7131	*	0.822		33	-33.53%	-3.1199		0.710
16	-11.90%	-1.3269		0.835		34	-34.04%	-2.9905		0.701
17	-11.36%	-1.1790		0.867		35	-40.21%	-3.7846		0.679
18	-10.73%	-1.0600		0.874		36	-40.76%	-3.1160		0.701

Sig. column denotes significance at 90% (*), 95% (**) and 99% (***).
Source: Computed from Equations 3.7 and 3.5.

Appendix B

Descriptive Statistics

Table B.1: *Descriptive Statistics of Overpriced IPOs - Full Sample*

Fiscal Year	MAARO (%)(Overpriced IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-2.54	-9.10	-23.62	-1.14	158.68	12.60	3	2.03%	235.77
2000-2001	-12.90	-19.42	-51.84	-3.10	241.15	15.53	12	8.11%	928.19
2001-2002	-28.10	-27.14	-42.01	-9.97	141.91	11.91	5	3.38%	929.73
2002-2003	-6.18	-6.18	-7.47	-4.89	3.33	1.82	2	1.35%	309.97
2003-2004									
2004-2005	-6.86	-6.66	-10.49	-2.45	13.81	3.72	4	2.70%	232.06
2005-2006	-6.36	-7.28	-18.43	-0.59	39.35	6.27	12	8.11%	1841.91
2006-2007	-9.15	-10.95	-32.27	-0.24	71.75	8.47	34	22.97%	10709.85
2007-2008	-13.90	-12.11	-21.94	-2.16	31.81	5.64	17	11.49%	4174.95
2008-2009	-19.50	-20.24	-36.77	-4.73	93.19	9.65	7	4.73%	1461.95
2009-2010	-5.11	-10.18	-35.57	-1.09	117.92	10.86	15	10.14%	14379.61
2010-2011	-13.11	-14.78	-47.91	-0.55	154.97	12.45	18	12.16%	7323.54
2011-2012	-38.30	-40.34	-70.59	-5.31	529.82	23.02	13	8.78%	1783.38
2012-2013	-5.37	-6.59	-13.03	-2.28	20.73	4.55	5	3.38%	4771.65
2013-2014	-3.51	-3.51	-3.51	-3.51			1	0.68%	270.23
							148	100.00%	49352.80

Source: Computed from Equation 3.3.

Table B.2: *Descriptive Statistics of Underpriced IPOs - Full Sample*

Fiscal Year	MAARO (%)(Underpriced IPOs)						IPOs	Obs (%)	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	138.00	170.42	9.19	678.30	29239.02	170.99	14	4.71%	1515.48
2000-2001	16.50	18.78	0.83	73.41	265.35	16.29	19	6.40%	1314.84
2001-2002	9.10	9.10	9.10	9.10			1	0.34%	150.00
2002-2003	28.80	29.11	4.55	53.45	305.42	17.48	5	1.68%	893.20
2003-2004	11.80	30.14	3.55	118.72	1356.07	36.82	11	3.70%	2470.58
2004-2005	65.60	68.42	13.55	188.42	2687.07	51.84	19	6.40%	14182.63
2005-2006	42.30	50.12	0.31	234.82	2584.36	50.84	49	16.50%	8814.34
2006-2007	31.40	42.08	0.27	238.57	1890.50	43.48	41	13.80%	13106.02
2007-2008	36.20	54.40	1.27	264.06	3328.01	57.69	57	19.19%	36319.71
2008-2009	17.30	43.03	1.25	138.55	2639.98	51.38	11	3.70%	834.87
2009-2010	16.30	21.17	0.37	75.07	415.71	20.39	18	6.06%	9596.26
2010-2011	20.50	28.79	0.69	90.91	654.91	25.59	33	11.11%	26063.10
2011-2012	35.40	42.52	2.00	109.59	1200.70	34.65	13	4.38%	3086.30
2012-2013	11.20	10.42	1.20	23.04	71.10	8.43	5	1.68%	1471.38
2013-2014	20.08	20.08	20.08	20.08			1	0.34%	919.14
							297	100.00%	120737.83

Source: Computed from Equation 3.3.

Table B.3: *Descriptive Statistics of Overpriced Fixed Price IPOs*

Fiscal Year	MAARO (%)(Overpriced Fixed Price IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-13.10	-13.08	-23.62	-2.54	222.27	14.91	2	8.00%	116.52
2000-2001	-12.50	-17.74	-51.84	-3.10	227.93	15.10	11	44.00%	593.26
2001-2002	-35.10	-35.05	-42.01	-28.09	96.98	9.85	2	8.00%	9.57
2002-2003	-7.47	-7.47	-7.47	-7.47			1	4.00%	100.00
2004-2005	-8.97	-8.07	-10.49	-4.75	8.85	2.98	3	12.00%	82.78
2005-2006	-10.30	-10.27	-11.47	-9.06	2.92	1.71	2	8.00%	58.33
2006-2007	-2.65	-2.65	-3.59	-1.71	1.78	1.33	2	8.00%	51.02
2007-2008	-7.66	-7.66	-7.66	-7.66			1	4.00%	38.12
2011-2012	-69.97	-69.97	-69.97	-69.97			1	4.00%	60.00
							25	100.00%	1109.60

Source: Computed from Equation 3.3.

Table B.4: *Descriptive Statistics of Overpriced Bookbuilt IPOs*

Fiscal Year	MAARO (%)(Overpriced Bookbuilt IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-1.14	-1.14	-1.14	-1.14			1	0.81%	119.25
2000-2001	-37.92	-37.92	-37.92	-37.92			1	0.81%	334.94
2001-2002	-22.80	-21.86	-32.81	-9.97	130.99	11.45	3	2.44%	920.16
2002-2003	-4.89	-4.89	-4.89	-4.89			1	0.81%	209.97
2004-2005	-2.45	-2.45	-2.45	-2.45			1	0.81%	149.28
2005-2006	-4.78	-6.68	-18.43	-0.59	45.39	6.74	10	8.13%	1783.58
2006-2007	-10.10	-11.47	-32.27	-0.24	71.59	8.46	32	26.02%	10658.83
2007-2008	-14.40	-12.39	-21.94	-2.16	32.53	5.70	16	13.01%	4136.84
2008-2009	-19.50	-20.24	-36.77	-4.73	93.19	9.65	7	5.69%	1461.95
2009-2010	-5.11	-10.18	-35.57	-1.09	117.92	10.86	15	12.20%	14379.61
2010-2011	-13.10	-14.78	-47.91	-0.55	154.97	12.45	18	14.63%	7323.54
2011-2012	-36.90	-37.87	-70.59	-5.31	491.48	22.17	12	9.76%	1723.38
2012-2013	-5.37	-6.59	-13.03	-2.28	20.73	4.55	5	4.07%	4771.65
2013-2014	-3.51	-3.51	-3.51	-3.51			1	0.81%	270.23
							123	100.00%	48243.20

Source: Computed from Equation 3.3.

Table B.5: *Descriptive Statistics of Underpriced Fixed Price IPOs*

Fiscal Year	MAARO (%)(Underpriced Fixed Price IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	114.00	175.67	9.19	678.30	34334.44	185.30	12	20.00%	526.18
2000-2001	11.50	17.21	0.83	73.41	481.95	21.95	10	16.67%	187.53
2001-2002	9.10	9.10	9.10	9.10			1	1.67%	150.00
2002-2003	27.30	28.14	4.55	53.45	400.94	20.02	4	6.67%	848.34
2003-2004	11.80	19.66	10.03	47.81	256.90	16.03	5	8.33%	298.24
2004-2005	90.80	81.80	26.12	131.00	1502.48	38.76	5	8.33%	295.00
2005-2006	63.90	95.01	4.22	234.82	6773.12	82.30	11	18.33%	246.76
2006-2007	35.20	52.22	0.27	149.32	2768.57	52.62	6	10.00%	186.09
2007-2008	27.30	95.96	3.83	264.06	13839.42	117.64	4	6.67%	135.16
2010-2011	60.10	60.12	58.27	61.97	6.85	2.62	2	3.33%	69.50
							60	100.00%	2942.79

Source: Computed from Equation 3.3.

Table B.6: *Descriptive Statistics of Underpriced Bookbuilt IPOs*

Fiscal Year	MAARO (%)(Underpriced Bookbuilt IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	139.00	138.92	131.41	146.43	112.87	10.62	2	0.84%	989.30
2000-2001	22.40	20.52	11.38	28.52	48.37	6.95	9	3.80%	1127.31
2002-2003	33.00	32.99	32.99	32.99			1	0.42%	44.87
2003-2004	14.90	38.88	3.55	118.72	2304.99	48.01	6	2.53%	2172.35
2004-2005	51.30	63.65	13.55	188.42	3164.91	56.26	14	5.91%	13887.63
2005-2006	38.00	37.13	0.31	126.61	749.47	27.38	38	16.03%	8567.57
2006-2007	28.70	40.34	0.74	238.57	1795.71	42.38	35	14.77%	12919.93
2007-2008	36.20	51.26	1.27	241.60	2642.68	51.41	53	22.36%	36184.55
2008-2009	17.30	43.03	1.25	138.55	2639.98	51.38	11	4.64%	834.87
2009-2010	16.30	21.17	0.37	75.07	415.71	20.39	18	7.59%	9596.26
2010-2011	19.20	26.77	0.69	90.91	628.66	25.07	31	13.08%	25993.60
2011-2012	35.40	42.52	2.00	109.59	1200.70	34.65	13	5.49%	3086.30
2012-2013	11.20	10.42	1.20	23.04	71.10	8.43	5	2.11%	1471.38
2013-2014	20.10	20.08	20.08	20.08			1	0.42%	919.14
							237	100.00%	117795.05

Source: Computed from Equation 3.3.

Table B.7: *Descriptive Statistics of Overpriced IPOs in Cold Markets*

Fiscal Year	MAARO (%)(Overpriced Cold Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-23.62	-23.62	-23.62	-23.62			1	6.25%	72.00
2000-2001	-13.40	-15.77	-28.82	-7.54	85.01	9.22	4	25.00%	289.47
2001-2002	-9.97	-9.97	-9.97	-9.97			1	6.25%	834.02
2002-2003	-6.18	-6.18	-7.47	-4.89	3.33	1.82	2	12.50%	309.97
2004-2005	-8.97	-8.97	-8.97	-8.97			1	6.25%	31.78
2008-2009	-23.87	-23.87	-23.87	-23.87			1	6.25%	23.93
2012-2013	-5.37	-6.59	-13.03	-2.28	20.73	4.55	5	31.25%	4771.65
2013-2014	-3.51	-3.51	-3.51	-3.51			1	6.25%	270.23
							16	100.00%	6603.04

Source: Computed from Equation 3.3.

Table B.8: *Descriptive Statistics of Overpriced IPOs in Hot Markets*

Fiscal Year	MAARO (%)(Overpriced Hot Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-1.84	-1.84	-2.54	-1.14	0.98	0.99	2	1.52%	163.77
2000-2001	-12.90	-21.25	-51.84	-3.10	331.06	18.20	8	6.06%	638.72
2001-2002	-30.40	-31.43	-42.01	-22.81	66.46	8.15	4	3.03%	95.71
2004-2005	-4.75	-5.90	-10.49	-2.45	17.16	4.14	3	2.27%	200.28
2005-2006	-6.36	-7.28	-18.43	-0.59	39.35	6.27	12	9.09%	1841.91
2006-2007	-9.15	-10.95	-32.27	-0.24	71.75	8.47	34	25.76%	10709.85
2007-2008	-13.90	-12.11	-21.94	-2.16	31.81	5.64	17	12.88%	4174.95
2008-2009	-18.90	-19.64	-36.77	-4.73	108.75	10.43	6	4.55%	1438.02
2009-2010	-5.11	-10.18	-35.57	-1.09	117.92	10.86	15	11.36%	14379.61
2010-2011	-13.10	-14.78	-47.91	-0.55	154.97	12.45	18	13.64%	7323.54
2011-2012	-38.30	-40.34	-70.59	-5.31	529.82	23.02	13	9.85%	1783.38
							132	100.00%	42749.75

Source: Computed from Equation 3.3.

Table B.9: *Descriptive Statistics of Underpriced IPOs in Cold Markets*

Fiscal Year	MAARO (%)(Underpriced Cold Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	48.70	78.40	9.19	161.24	4965.43	70.47	5	16.67%	469.38
2000-2001	28.50	38.50	13.55	73.41	970.35	31.15	3	10.00%	121.60
2002-2003	28.80	29.11	4.55	53.45	305.42	17.48	5	16.67%	893.20
2003-2004	19.40	36.74	4.12	118.72	1835.54	42.84	6	20.00%	1477.34
2004-2005	19.30	21.11	17.90	26.12	19.32	4.40	3	10.00%	5484.40
2008-2009	124.00	124.22	109.90	138.55	410.34	20.26	2	6.67%	50.11
2012-2013	11.20	10.42	1.20	23.04	71.10	8.43	5	16.67%	1471.38
2013-2014	20.08	20.08	20.08	20.08			1	3.33%	919.14
							30	100.00%	10886.54

Source: Computed from Equation 3.3.

Table B.10: *Descriptive Statistics of Underpriced IPOs in Hot Markets*

Fiscal Year	MAARO (%)(Underpriced Hot Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	131.00	221.55	44.72	678.30	36797.47	191.83	9	3.37%	1046.10
2000-2001	15.30	15.08	0.83	30.38	96.69	9.83	16	5.99%	1193.23
2001-2002	9.10	9.10	9.10	9.10			1	0.37%	150.00
2003-2004	10.00	22.23	3.55	77.15	952.15	30.86	5	1.87%	993.25
2004-2005	67.00	77.30	13.55	188.42	2690.22	51.87	16	5.99%	8698.23
2005-2006	42.30	50.12	0.31	234.82	2584.36	50.84	49	18.35%	8814.34
2006-2007	31.40	42.08	0.27	238.57	1890.50	43.48	41	15.36%	13106.02
2007-2008	36.00	54.40	1.27	264.06	3328.01	57.69	57	21.35%	36319.71
2008-2009	16.80	24.99	1.25	109.96	1234.48	35.14	9	3.37%	784.76
2009-2010	16.30	21.17	0.37	75.07	415.71	20.39	18	6.74%	9596.26
2010-2011	20.50	28.79	0.69	90.91	654.91	25.59	33	12.36%	26063.10
2011-2012	35.40	42.52	2.00	109.59	1200.70	34.65	13	4.87%	3086.30
							267	100.00%	109851.29

Source: Computed from Equation 3.3.

Table B.11: *Descriptive Statistics of Overpriced Ungraded IPOs*

Fiscal Year	MAARO (%)(Overpriced Ungraded IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-2.54	-9.10	-23.62	-1.14	158.68	12.60	3	3.70%	235.77
2000-2001	-12.90	-19.42	-51.84	-3.10	241.15	15.53	12	14.81%	928.19
2001-2002	-28.10	-27.14	-42.01	-9.97	141.91	11.91	5	6.17%	929.73
2002-2003	-6.18	-6.18	-7.47	-4.89	3.33	1.82	2	2.47%	309.97
2004-2005	-6.86	-6.66	-10.49	-2.45	13.81	3.72	4	4.94%	232.06
2005-2006	-6.36	-7.28	-18.43	-0.59	39.35	6.27	12	14.81%	1841.91
2006-2007	-9.07	-10.35	-32.27	-0.24	61.11	7.82	33	40.74%	10667.85
2007-2008	-13.00	-12.73	-21.94	-5.25	30.01	5.48	10	12.35%	2767.90
							81	100.00%	17913.39

Source: Computed from Equation 3.3.

Table B.12: *Descriptive Statistics of Overpriced Graded IPOs*

Fiscal Year	MAARO (%)(Overpriced Graded IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	-30.95	-30.95	-30.95	-30.95			1	1.49%	42.00
2007-2008	-13.90	-11.23	-19.14	-2.16	38.27	6.19	7	10.45%	1407.05
2008-2009	-19.50	-20.24	-36.77	-4.73	93.19	9.65	7	10.45%	1461.95
2009-2010	-5.11	-10.18	-35.57	-1.09	117.92	10.86	15	22.39%	14379.61
2010-2011	-13.10	-14.78	-47.91	-0.55	154.97	12.45	18	26.87%	7323.54
2011-2012	-38.30	-40.34	-70.59	-5.31	529.82	23.02	13	19.40%	1783.38
2012-2013	-5.37	-6.59	-13.03	-2.28	20.73	4.55	5	7.46%	4771.65
2013-2014	-3.51	-3.51	-3.51	-3.51			1	1.49%	270.23
							67	100.00%	31439.41

Source: Computed from Equation 3.3.

Table B.13: *Descriptive Statistics of Underpriced Ungraded IPOs*

Fiscal Year	MAARO (%)(Underpriced Ungraded IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	130.00	170.42	9.19	678.30	29239.02	170.99	14	7.29%	1515.48
2000-2001	16.50	18.78	0.83	73.41	265.35	16.29	19	9.90%	1314.84
2001-2002	9.10	9.10	9.10	9.10			1	0.52%	150.00
2002-2003	28.80	29.11	4.55	53.45	305.42	17.48	5	2.60%	893.20
2003-2004	11.80	30.14	3.55	118.72	1356.07	36.82	11	5.73%	2470.58
2004-2005	65.60	68.42	13.55	188.42	2687.07	51.84	19	9.90%	14182.63
2005-2006	42.30	50.12	0.31	234.82	2584.36	50.84	49	25.52%	8814.34
2006-2007	30.00	39.95	0.27	238.57	1711.36	41.37	38	19.79%	12969.60
2007-2008	47.30	65.32	3.34	264.06	3864.89	62.17	35	18.23%	19270.11
2012-2013	23.04	23.04	23.04	23.04			1	0.52%	539.98
							192	100.00%	62120.75

Source: Computed from Equation 3.3.

Table B.14: *Descriptive Statistics of Underpriced Graded IPOs*

Fiscal Year	MAARO (%)(Underpriced Graded IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	40.60	69.00	17.06	149.32	4977.42	70.55	3	2.86%	136.43
2007-2008	20.60	37.01	1.27	201.55	2101.77	45.85	22	20.95%	17049.60
2008-2009	17.30	43.03	1.25	138.55	2639.98	51.38	11	10.48%	834.87
2009-2010	16.30	21.17	0.37	75.07	415.71	20.39	18	17.14%	9596.26
2010-2011	20.50	28.79	0.69	90.91	654.91	25.59	33	31.43%	26063.10
2011-2012	35.40	42.52	2.00	109.59	1200.70	34.65	13	12.38%	3086.30
2012-2013	7.83	7.27	1.20	12.22	28.44	5.33	4	3.81%	931.40
2013-2014	20.10	20.08	20.08	20.08			1	0.95%	919.14
							105	100.00%	58617.08

Source: Computed from Equation 3.3.

Table B.15: *Descriptive Statistics of Overpriced Grade 1 & 2 IPOs*

Fiscal Year	MAARO (%)(Overpriced Grade 1 & 2 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	-31.00	-30.95	-30.95	-30.95			1	3.85%	42.00
2007-2008	-10.80	-10.80	-13.94	-7.66	19.71	4.44	2	7.69%	110.57
2008-2009	-18.90	-18.93	-19.47	-18.39	0.58	0.76	2	7.69%	174.48
2009-2010	-3.39	-10.99	-35.57	-1.60	270.51	16.45	4	15.38%	1652.75
2010-2011	-7.49	-10.39	-23.50	-2.51	55.59	7.46	8	30.77%	1194.01
2011-2012	-59.00	-49.65	-70.59	-18.53	368.21	19.19	9	34.62%	500.91
							26	100.00%	3674.72

Source: Computed from Equation 3.3.

Table B.16: *Descriptive Statistics of Overpriced Grade 3 IPOs*

Fiscal Year	MAARO (%)(Overpriced Grade 3 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2007-2008	-10.10	-10.39	-19.14	-2.16	62.93	7.93	4	12.90%	1221.49
2008-2009	-23.30	-24.77	-36.77	-15.62	77.45	8.80	4	12.90%	1011.08
2009-2010	-9.32	-11.45	-29.84	-1.09	89.35	9.45	9	29.03%	9701.71
2010-2011	-18.30	-23.62	-47.91	-4.47	266.22	16.32	6	19.35%	3795.01
2011-2012	-14.00	-19.37	-44.20	-5.31	291.23	17.07	4	12.90%	1282.47
2012-2013	-2.89	-3.51	-5.37	-2.28	2.68	1.64	3	9.68%	473.92
2013-2014	-3.51	-3.51	-3.51	-3.51			1	3.23%	270.23
							31	100.00%	17755.90

Source: Computed from Equation 3.3.

Table B.17: *Descriptive Statistics of Overpriced Grade 4 & 5 IPOs*

Fiscal Year	MAARO (%)(Overpriced Grade 4 & 5 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2007-2008	-15.46	-15.46	-15.46	-15.46			1	10.00%	75.00
2008-2009	-4.73	-4.73	-4.73	-4.73			1	10.00%	276.39
2009-2010	-2.87	-2.87	-3.44	-2.31	0.63	0.80	2	20.00%	3025.15
2010-2011	-10.80	-10.29	-18.91	-0.55	70.00	8.37	4	40.00%	2334.52
2012-2013	-11.20	-11.20	-13.03	-9.38	6.66	2.58	2	20.00%	4297.73
							10	100.00%	10008.79

Source: Computed from Equation 3.3.

Table B.18: *Descriptive Statistics of Underpriced Grade 1 & 2 IPOs*

Fiscal Year	MAARO (%)(Underpriced Grade 1 & 2 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	95.00	94.96	40.61	149.32	5908.80	76.87	2	5.13%	68.20
2007-2008	11.70	22.97	3.83	88.68	1057.95	32.53	6	15.38%	394.71
2008-2009	79.40	71.15	2.36	138.55	3136.71	56.01	6	15.38%	400.30
2009-2010	23.70	25.84	0.37	53.32	365.93	19.13	7	17.95%	656.22
2010-2011	58.20	48.89	8.14	71.71	549.54	23.44	10	25.64%	836.85
2011-2012	52.30	56.07	28.21	84.51	428.73	20.71	7	17.95%	450.88
2012-2013	1.20	1.20	1.20	1.20			1	2.56%	55.00
							39	100.00%	2862.16

Source: Computed from Equation 3.3.

Table B.19: *Descriptive Statistics of Underpriced Grade 3 IPOs*

Fiscal Year	MAARO (%)(Underpriced Grade 3 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	17.06	17.06	17.06	17.06			1	2.94%	68.22
2007-2008	36.20	54.56	5.71	201.55	3662.96	60.52	9	26.47%	3154.69
2008-2009	5.18	9.30	1.25	19.80	70.55	8.40	5	14.71%	434.56
2009-2010	14.30	26.58	2.59	75.07	857.14	29.28	5	14.71%	3721.37
2010-2011	15.70	26.89	0.69	90.91	906.81	30.11	10	29.41%	2219.20
2011-2012	35.40	49.76	4.24	109.59	2928.57	54.12	3	8.82%	262.17
2012-2013	11.20	11.25	11.25	11.25			1	2.94%	601.31
							34	100.00%	10461.53

Source: Computed from Equation 3.3.

Table B.20: *Descriptive Statistics of Underpriced Grade 4 & 5 IPOs*

Fiscal Year	MAARO (%)(Underpriced Grade 4 & 5 IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2007-2008	12.20	26.49	1.27	75.71	802.56	28.33	7	21.88%	13500.20
2009-2010	6.20	11.22	2.25	27.33	110.18	10.50	6	18.75%	5218.66
2010-2011	12.50	14.78	2.52	35.23	101.88	10.09	13	40.63%	23007.05
2011-2012	3.73	3.66	2.00	5.24	2.62	1.62	3	9.38%	2373.25
2012-2013	8.31	8.31	4.41	12.22	30.45	5.52	2	6.25%	275.09
2013-2014	20.08	20.08	20.08	20.08			1	3.13%	919.14
							32	100.00%	45293.40

Source: Computed from Equation 3.3.

Table B.21: *Descriptive Statistics of Overpriced IPOs in Non-Bull Markets*

Fiscal Year	MAARO (%)(Overpriced Non-Bull Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-2.54	-9.10	-23.62	-1.14	158.68	12.60	3	6.67%	235.77
2000-2001	-12.90	-19.42	-51.84	-3.10	241.15	15.53	12	26.67%	928.19
2001-2002	-28.10	-27.14	-42.01	-9.97	141.91	11.91	5	11.11%	929.73
2002-2003	-6.18	-6.18	-7.47	-4.89	3.33	1.82	2	4.44%	309.97
2008-2009	-19.50	-20.24	-36.77	-4.73	93.19	9.65	7	15.56%	1461.95
2010-2011	-15.32	-15.32	-15.32	-15.32			1	2.22%	433.28
2011-2012	-38.30	-40.34	-70.59	-5.31	529.82	23.02	13	28.89%	1783.38
2012-2013	-6.13	-6.13	-9.38	-2.89	21.03	4.59	2	4.44%	324.97
							45	100.00%	6407.24

Source: Computed from Equation 3.3.

Table B.22: *Descriptive Statistics of Overpriced IPOs in Bull Markets*

Fiscal Year	MAARO (%)(Overpriced Bull Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2004-2005	-6.86	-6.66	-10.49	-2.45	13.81	3.72	4	3.88%	232.06
2005-2006	-6.36	-7.28	-18.43	-0.59	39.35	6.27	12	11.65%	1841.91
2006-2007	-9.15	-10.95	-32.27	-0.24	71.75	8.47	34	33.01%	10709.85
2007-2008	-13.90	-12.11	-21.94	-2.16	31.81	5.64	17	16.50%	4174.95
2009-2010	-5.11	-10.18	-35.57	-1.09	117.92	10.86	15	14.56%	14379.61
2010-2011	-11.80	-14.75	-47.91	-0.55	164.63	12.83	17	16.50%	6890.27
2012-2013	-5.37	-6.89	-13.03	-2.28	30.61	5.53	3	2.91%	4446.68
2013-2014	-3.51	-3.51	-3.51	-3.51			1	0.97%	270.23
							103	100.00%	42945.56

Source: Computed from Equation 3.3.

Table B.23: *Descriptive Statistics of Underpriced IPOs in Non-Bull Markets*

Fiscal Year	MAARO (%)(Underpriced Non-Bull Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	130.00	170.42	9.19	678.30	29239.02	170.99	14	20.29%	1515.48
2000-2001	16.50	18.78	0.83	73.41	265.35	16.29	19	27.54%	1314.84
2001-2002	9.10	9.10	9.10	9.10			1	1.45%	150.00
2002-2003	28.80	29.11	4.55	53.45	305.42	17.48	5	7.25%	893.20
2008-2009	17.30	43.03	1.25	138.55	2639.98	51.38	11	15.94%	834.87
2010-2011	21.70	26.81	9.87	48.86	399.56	19.99	3	4.35%	333.25
2011-2012	35.40	42.52	2.00	109.59	1200.70	34.65	13	18.84%	3086.30
2012-2013	4.41	5.94	1.20	12.22	32.10	5.67	3	4.35%	330.09
							69	100.00%	8458.02

Source: Computed from Equation 3.3.

Table B.24: *Descriptive Statistics of Underpriced IPOs in Bull Markets*

Fiscal Year	MAARO (%)(Underpriced Bull Market IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2003-2004	11.80	30.14	3.55	118.72	1356.07	36.82	11	4.82%	2470.58
2004-2005	65.60	68.42	13.55	188.42	2687.07	51.84	19	8.33%	14182.63
2005-2006	42.30	50.12	0.31	234.82	2584.36	50.84	49	21.49%	8814.34
2006-2007	31.40	42.08	0.27	238.57	1890.50	43.48	41	17.98%	13106.02
2007-2008	36.00	54.40	1.27	264.06	3328.01	57.69	57	25.00%	36319.71
2009-2010	16.30	21.17	0.37	75.07	415.71	20.39	18	7.89%	9596.26
2010-2011	19.90	28.99	0.69	90.91	694.66	26.36	30	13.16%	25729.85
2012-2013	17.10	17.15	11.25	23.04	69.56	8.34	2	0.88%	1141.29
2013-2014	20.08	20.08	20.08	20.08			1	0.44%	919.14
							228	100.00%	112279.81

Source: Computed from Equation 3.3.

Table B.25: *Descriptive Statistics of Overpriced Small Size IPOs*

Fiscal Year	MAARO (%)(Overpriced Small-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	-2.54	-9.10	-23.62	-1.14	158.68	12.60	3	2.86%	235.77
2000-2001	-12.50	-17.74	-51.84	-3.10	227.93	15.10	11	10.48%	593.26
2001-2002	-30.40	-31.43	-42.01	-22.81	66.46	8.15	4	3.81%	95.71
2002-2003	-7.47	-7.47	-7.47	-7.47			1	0.95%	100.00
2004-2005	-6.86	-6.66	-10.49	-2.45	13.81	3.72	4	3.81%	232.06
2005-2006	-6.36	-6.06	-11.47	-0.84	13.40	3.66	8	7.62%	654.43
2006-2007	-8.84	-10.51	-32.27	-0.24	78.93	8.88	28	26.67%	2106.70
2007-2008	-14.80	-12.97	-21.94	-2.16	33.53	5.79	13	12.38%	1300.66
2008-2009	-22.80	-24.27	-36.77	-18.39	54.02	7.35	5	4.76%	354.90
2009-2010	-9.32	-14.40	-35.57	-1.60	176.04	13.27	7	6.67%	500.71
2010-2011	-9.90	-16.07	-47.91	-4.63	211.00	14.53	8	7.62%	868.39
2011-2012	-48.70	-45.22	-70.59	-5.31	523.93	22.89	10	9.52%	612.97
2012-2013	-5.37	-5.68	-9.38	-2.28	12.66	3.56	3	2.86%	398.89
							105	100.00%	8054.46

Source: Computed from Equation 3.3.

Table B.26: *Descriptive Statistics of Overpriced Mid Size IPOs*

Fiscal Year	MAARO (%)(Overpriced Mid-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2000-2001	-37.92	-37.92	-37.92	-37.92			1	2.86%	334.94
2001-2002	-9.97	-9.97	-9.97	-9.97			1	2.86%	834.02
2002-2003	-4.89	-4.89	-4.89	-4.89			1	2.86%	209.97
2005-2006	-9.92	-9.72	-18.43	-0.59	101.16	10.06	4	11.43%	1187.48
2006-2007	-17.10	-14.76	-18.43	-6.44	32.13	5.67	4	11.43%	1747.02
2007-2008	-7.90	-9.30	-16.00	-5.41	21.82	4.67	4	11.43%	2874.29
2008-2009	-10.20	-10.17	-15.62	-4.73	59.33	7.70	2	5.71%	1107.05
2009-2010	-9.06	-10.16	-20.56	-1.98	80.19	8.96	4	11.43%	1882.21
2010-2011	-15.20	-14.78	-38.28	-0.55	129.74	11.39	9	25.71%	4197.54
2011-2012	-14.90	-24.06	-44.20	-13.07	304.93	17.46	3	8.57%	1170.41
2012-2013	-2.89	-2.89	-2.89	-2.89			1	2.86%	200.00
2013-2014	-3.51	-3.51	-3.51	-3.51			1	2.86%	270.23
							35	100.00%	16015.14

Source: Computed from Equation 3.3.

Table B.27: *Descriptive Statistics of Overpriced Large Size IPOs*

Fiscal Year	MAARO (%)(Overpriced Large-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2006-2007	-9.47	-9.47	-15.48	-3.46	72.26	8.50	2	25.00%	6856.13
2009-2010	-2.18	-2.82	-5.84	-1.09	4.32	2.08	4	50.00%	11996.70
2010-2011	-4.47	-4.47	-4.47	-4.47			1	12.50%	2257.61
2012-2013	-13.03	-13.03	-13.03	-13.03			1	12.50%	4172.76
							8	100.00%	25283.20

Source: Computed from Equation 3.3.

Table B.28: *Descriptive Statistics of Underpriced Small Size IPOs*

Fiscal Year	MAARO (%)(Underpriced Small-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	114.00	175.67	9.19	678.30	34334.44	185.30	12	5.56%	526.18
2000-2001	17.40	19.18	0.83	73.41	277.62	16.66	18	8.33%	640.55
2001-2002	9.10	9.10	9.10	9.10			1	0.46%	150.00
2002-2003	33.00	37.41	25.79	53.45	205.86	14.35	3	1.39%	220.20
2003-2004	11.80	35.78	4.12	118.72	1962.57	44.30	7	3.24%	415.12
2004-2005	68.70	80.91	19.30	188.42	2913.82	53.98	14	6.48%	949.64
2005-2006	42.50	53.86	0.31	234.82	3022.73	54.98	39	18.06%	2818.57
2006-2007	28.50	43.22	0.27	238.57	2436.06	49.36	30	13.89%	2412.94
2007-2008	43.00	64.14	3.83	264.06	4076.35	63.85	39	18.06%	3067.64
2008-2009	17.30	43.03	1.25	138.55	2639.98	51.38	11	5.09%	834.87
2009-2010	21.00	23.61	0.37	53.32	290.25	17.04	10	4.63%	1032.35
2010-2011	28.70	40.95	7.37	90.91	728.26	26.99	19	8.80%	1738.78
2011-2012	51.50	54.18	4.24	109.59	945.92	30.76	10	4.63%	713.05
2012-2013	4.41	5.94	1.20	12.22	32.10	5.67	3	1.39%	330.09
							216	100.00%	15849.97

Source: Computed from Equation 3.3.

Table B.29: *Descriptive Statistics of Underpriced Mid Size IPOs*

Fiscal Year	MAARO (%)(Underpriced Mid-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
1999-2000	139.00	138.92	131.41	146.43	112.87	10.62	2	3.45%	989.30
2000-2001	11.45	11.45	11.45	11.45			1	1.72%	674.29
2002-2003	16.70	16.66	4.55	28.78	293.40	17.13	2	3.45%	673.00
2003-2004	14.90	20.28	3.55	47.81	391.22	19.78	4	6.90%	2055.47
2004-2005	58.20	58.19	50.07	66.30	131.80	11.48	2	3.45%	545.00
2005-2006	30.80	28.04	3.40	55.93	416.15	20.40	8	13.79%	3127.19
2006-2007	38.30	38.27	0.74	68.76	515.97	22.72	8	13.79%	4459.56
2007-2008	24.10	30.84	1.27	80.55	660.26	25.70	12	20.69%	5838.91
2009-2010	13.90	23.36	3.84	75.07	732.67	27.07	6	10.34%	2770.14
2010-2011	11.10	10.46	0.69	25.30	66.66	8.16	8	13.79%	2967.23
2011-2012	2.87	2.87	2.00	3.73	1.49	1.22	2	3.45%	1128.25
2012-2013	17.10	17.15	11.25	23.04	69.56	8.34	2	3.45%	1141.29
2013-2014	20.08	20.08	20.08	20.08			1	1.72%	919.14
							58	100.00%	27288.76

Source: Computed from Equation 3.3.

Table B.30: *Descriptive Statistics of Underpriced Large Size IPOs*

Fiscal Year	MAARO (%)(Underpriced Large-Size IPOs)						IPOs	Obs %	Issue Size (Cr.)
	Median	Mean	Min	Max	Variance	Std. Deviation			
2004-2005	17.90	16.97	13.55	19.45	9.36	3.06	3	13.04%	12687.98
2005-2006	65.50	65.52	39.53	91.51	1351.19	36.76	2	8.70%	2868.58
2006-2007	28.70	40.80	24.73	69.02	601.12	24.52	3	13.04%	6233.52
2007-2008	14.40	38.19	3.34	125.30	2453.57	49.53	6	26.09%	27413.16
2009-2010	2.42	2.42	2.25	2.59	0.06	0.24	2	8.70%	5793.77
2010-2011	11.30	14.73	2.52	35.23	139.38	11.81	6	26.09%	21357.09
2011-2012	5.24	5.24	5.24	5.24			1	4.35%	1245.00
							23	100.00%	77599.10

Source: Computed from Equation 3.3.

Appendix C

Publications

Kedar Phadke, Dr. Manoj Kamat, "Impact of IPO Grading on listing returns at the National Stock Exchange (NSE) in India" *International Journal of Research in Economics and Social Sciences (ISSN 2249-7382)*, vol. 6, no. 5, pp. 359–366, May 2016.

Kedar Phadke, Dr. Manoj Kamat, "Do IPOs in Cold Markets Provide Better Returns?" *International Journal of Financial Management (ISSN 2229-5682)*, vol. 7, no. 2 & 3, pp. 10–19, April & July 2017.

Kedar Phadke, Dr. Manoj Kamat, "Impacts of Macroeconomic and IPO Factors on Underpricing of Initial Public Offerings on the National Stock Exchange (NSE) in India" *International Journal of Management Studies (ISSN 2249-0302)*, vol. V, no. 1(4), pp. 46–52, January 2018.

Kedar Phadke, Dr. Manoj Kamat, "Impact of IPO Pricing Mechanisms on Short and Long-run Returns in India: an empirical study" *International Journal of Management Studies (ISSN 2249-0302)*, vol. VI, no. 2(3), pp. 1–7, April 2019.

Kedar Phadke, Dr. Manoj Kamat, "DOES IPO GRADING IMPACT PRICE EFFICIENCY IN INDIA?" *The Review of Finance and Banking - Bucharest University of Economic Studies (ISSN 2067-2713)*, vol. XI, no. 2, pp. 79–90, December 2019.

Kedar Phadke, Dr. Manoj Kamat, "Sectoral Impact on IPO Underpricing: An Empirical Study of the Indian Markets." *Akshar Wangmay (ISSN 2229-2949)*, vol. IV, pp. 123–125, December 2020.