CHAPTER-3
RESEARCH OBJECTIVES AND METHODOLOGY

This chapter outlines the study's research objectives, hypotheses and the methodology used for analysing the impact of risk factor disclosure on IPO performance. The market performance of an IPO may be measured both in the short and long run. It is considered that the influence of disclosure of risk factors in prospectus remains only in the short term, whereas secondary market dynamics affect market performance in the long run. Hence in the present study, the impact of risk factors disclosed in prospectus is examined in short run only. The first section shows the research objectives and explains the data sources, sample size, sample unit, time period and variable used in the study. The second section covers the hypotheses developed for analysing the data and objective. The third section of this chapter discusses the technique used to measure IPO performance as well as the regression model used to analyse the impact of risk factor disclosure. The statistical tests applied for the constructed multiple regression models are presented in the last section.

3.1 INTRODUCTION

As and when IPOs are launched and even before they are launched in the market, investors start estimating the prices based on their assessment taking into consideration the firm's ex ante risk characteristics. Risk-averse investors are likely to avoid buying riskier securities, and it is reasonable to expect that demand for riskier IPOs will be lower than demand for low-risk IPOs. Hence, because of the fixed supply of IPOs, the price of riskier IPOs will be determined lower in the market than the market prices of their less-risky counterparts. Because there are a limited number of IPO shares available in the market, bull market investors choose to participate in riskier IPOs, but they will not bid the same price as for the less risky IPOs. As a result, market forces determine lower prices for riskier IPOs. Therefore, it can be presumed as Klein's hypothesis (1996) that IPO prices are a decreasing function of firms' ex ante risk factors and it could be condescend that investors expect a higher degree of under-pricing for riskier IPOs in the short-run (Klein, 1996). However, the relationship between the ex-ante risk factors and IPO pricing is assumed to weaken in the long run as investors can obtain more information about the firm from the market in the long-run. But the relationship is expected to follow the general risk-return

hypothesis, which leads to a positive association between risk and expected returns. Companies should report risk-related information to prospective investors if they wish to execute an IPO. Such information is generally set forth in the prospectus. The prospectus is the most important source of basic information to investors. The risk factors disclosed in the prospectus have a significant effect on the perception of investors, which affects their expectation of return.

3.2. RESEARCH ISSUES

The study is primarily designed to examine the impact of risk factor disclosure in the prospectus on IPO performance. The performance of initial public offerings (IPOs) is measured in the short run. It also intends to investigate the influence of disclosure on sector-specific performance. In order to achieve these, the following research questions are empirically examined and analysed:

1. Whether the IPO prospectus contains sufficient information about risk factors unique to the firm, issue, and market.

2. What pattern of risk disclosure is adopted by the Indian firms in their prospectus?

3. Do risk factor disclosures have a significant impact on IPO performance?

4. Can risk factors further be sub-categorized?

5. Do different risk categories have the same impact on IPO performance?

3.3 RESEARCH OBJECTIVES

A prospectus is a bundle of comprehensive information about the firm that is often regarded as one of the primary sources of pre-IPO information (Falconieri & Tastan, 2018). This study aims to investigate the impact of the risk factors disclosed in the prospectus on the IPO performance. The following sub objectives have been defined to help accomplish the main objective of the research study:

1. To classify various risk factors exhibited by Indian companies in their IPO prospectus into risk categories.
2. To analyse the impact of risk categories on IPO performance.
3. To determine the impact of risk categories on IPO performance across various sectors.

4. To recommend key risk factors which has an impact on IPO performance

3.4 THE HYPOTHESES

Firms that reveal more information in the pre-market are more likely to have lower under-pricing (Schrand & Verrecchia, 2005). Theoretical models such as the "ex-ante uncertainty model" (Beatty & Ritter, 1986) record conditions under which ex-ante uncertainty and IPO under-pricing are inversely related, and another model, the "Signaling Hypothesis" (Allen & Faulhaber, 1989), suggests that risk disclosures have the potential to influence investors' risk perceptions. (Karvet & Muslu, 2013) also emphasised that risk disclosures can unveil unknown risk factors and contingencies that influence investors' risk perceptions. Initial public offerings with more informative risk factor disclosures had less ex-ante uncertainty, thus allowing investors to better predict the secondary market valuation distribution, which ultimately led to lower IPO under-pricing (Ding, 2016). Bhabra & Pettway (2003), Arnold et al. (2010), Ding (2016), and Wasiuzzaman et al. (2018) investigated the utility of information disclosure in IPO prospectuses. The Risk Factor Section of the IPO prospectus of any firm makes potential investors aware of significant risks which should be considered while investing in the IPO. Hence, it is logical to assume that the risk disclosure in the IPO prospectus is associated with the IPO performance.

Therefore, the following sets of hypotheses are framed which are based on different reviews of literature and the above-mentioned models:

H_{01}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and the IPO Issue Price.

H_{02}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and IPO Listing Day Opening Price.

H_{03}: There is no significant relationship between the extent of risk factors disclosure in different risk categories and IPO Listing Day Closing Price.

H_{04}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and the IPO stock price after one week (PA1W).

H_{05}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and the IPO stock price after two weeks (PA2W).

H_{06}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and the IPO stock price after three weeks (PA3W).

H_{07}: There is no significant relationship between the extent of risk factor disclosure

in different risk categories and the IPO stock price after one month (PA1M).

H_{08}: There is no significant relationship between the extent of risk factor disclosure in different risk categories and IPO stock price after 3 months (PA3M)

H_{09}: The extent of risk factor disclosure in different risk categories has no significant impact on the IPO initial under-pricing in the primary market.

H_{010}: The extent of risk factor disclosure in different risk categories has no significant impact on the IPO listing under-pricing in the secondary market.

H0 (H_{011} to H_{015}): The extent of risk factor disclosure in different risk categories has no significant impact on the level of IPO under-pricing in the post listing secondary market.

(Post listing under-pricing in the secondary market is treated as UP1W, UP2W. UP3W, UP1M and UP3M)

Similar hypotheses are assumed for measuring impact of risk category disclosure on the level of under-pricing across various sectors.

3.5 RESEARCH DESIGN

Research design for a research study can be defined as a detailed outline of the investigation process. Research design is a master plan defined for future guidance during the process of data collection and analysing the collected data. This research study is an experimental research study which includes the collection of secondary data on different variables related to the Indian primary stock market observes the impact caused by the independent variable on the dependent variable. The main purpose of the study is to analyse the impact of risk factor disclosure in prospectuses on the aftermarket performance of IPOs. This research study is qualitative in nature

3.5.1 Sampling Framework

A sampling frame is a procedure that determines the research unit, population, target sample, sampling technique, sample size, and data collecting method etc. The sampling framework for the present study is detailed as following:

   i. **Population:** The population of the present research study includes all economic sectors under which companies have issued IPOs in India.

   ii. **Timeline and sample size:** All the IPOs from each economic sector, listed on the main boards of the NSE and BSE from January 2013 to December 2019 are considered as a sample for the present study. The Companies Act was

restructured in 2013, which laid down stringent disclosure norms. Hence, the time period (2013-2019) after the implementation of the Companies Act 2013 is taken for the present study. Further, all the listed IPOs during the study period are subdivided into 10 sectors using the industry criterion, namely the Finance Sector, Healthcare Sector, Consumer Durable & Non-durable Sector, Consumer Services Sector, Commercial Services Sector, Transportation & Logistics Sector, Software & IT Sector, Construction, Engineering & Infrastructure Sector, Producer Manufacturing Sector, and Miscellaneous Sector. Banking and non-banking financial companies such as housing finance companies, asset management companies, financial services and insurance companies, and so on are included in the Finance Sector. The healthcare sector includes health services and health technology companies such as hospitals, health care facilities, laboratories, and pharmaceuticals and chemicals companies etc.

iii. **Sources of data:** The present research study is purely based on secondary data. The stock trading data of IPO firms is extracted from the official websites of the National Stock Exchange and the Bombay Stock Exchange, while the requisite documents like the Red Herring Prospectus etc., are downloaded from the SEBI website.

iv. **Sample selection:** The present study is undertaken which is based on the sample size of 131 companies. A total of 656 IPOs occurred in India from 2013 to 2019, out of which 139 IPOs were applied on the mainline of stock exchanges. But out of these 139 IPOs, 133 IPOs were listed on the Main Board of the NSE while 6 IPO issues failed. Moreover, 2 IPOs, namely *IRB InvIT Fund IPO* and *IndiGrid InvIT Fund IPO,* were related to Infrastructure Investment Trusts which are registered under the Indian Trusts Act, 1882. Hence, these two IPOs are not included in the final selected sample for the present study. All the IPOs in the sample are issued on the book built pricing method and are listed on the NSE and BSE, except two, namely the Central Depository Services (India) Limited IPO and the BSE Limited IPO, which are listed only on the main board of NSE.

Table-3.1: IPOs listed on Main-board in India from 2013-2019

Year	No. of IPOs issued	Amount Raised (In Rs Cr)	Issue Succeeded
2013	5	1,283.95	3
2014	7	1,200.94	5
2015	21	13,513.17	21
2016	27	26,500.82	26
2017	38	75,278.57	38
2018	25	31,731.28	24
2019	16	12,687.32	16
Total	139	1,62,196.05	133

(Source: Author's compilation from NSE and BSE website)

3.5.2 Research Methodology

This section explains the methods used in this study to examine the pattern of risk disclosure by Indian enterprises, as well as the approach used to determine mutually exclusive risk categories. It also outlines the process for measuring the impact of specified risk categories on IPO short-term market performance.

3.5.2.1 Risk disclosure measurement methodology

Keeping in view the research objectives, the required information regarding risk factors has been obtained through content analysis of the prospectus of each sample firm. Content analysis is defined in a formal way as "the analysis of the manifest and latent content of a body of communicated material through classification, tabulation, and evaluation of its key symbols and themes in order to ascertain its meaning and probable effect" (Krippendorff, 2004).

Weber (1990) refers to content analysis as "a method of codifying the text of a piece of writing into various groups or categories depending on selected criteria." Content analysis is a subjective technique whose major objective is to evaluate systematically the subject-matter of the risk factor sections and to preliminary identify the different kinds of risk that are described in the prospectus. It can be conducted through character-counts, word-counts, page proportions, and sentence-counts etc., and for drawing valid conclusions, a reliable coding method should be used.

Hanley & Hoberg (2008) used characters and word vectors for content analysis. However, the words of the risk factor section can be counted easily and accurately,

but different risk categories can only be coded with reference to the sentences. Hence, sentences are used for both coding and measurement to conduct complete and reliable content analysis (Milne & Adler, 1999). Sentences are used to code for risk disclosure by Zeghal & Ahmed (1990), Beretta & Bozzolan (2004), Lajili & Zéghal (2009) and Linsley & Shrives (2006). Spindler (2009) has applied word counts, page counts, and heading counts for measuring the degree of information disclosure. Deumes (2008) used an alternative approach to investigate the attributes of risk factors, as well as the reduction of data into composite measures of risk disclosure, by employing principal component analysis by alternating least-squares optimal scaling (PRINCIPALS).Moreover, the issuer should use various plain English principles to make the risk factors easier to read and understand. The Flesch Reading Ease Score (FRES) test is applied to determine the readability index of the risk factor section of each sample prospectus in the present study.

In the present study, the methodology used by Spindler (2009) has been followed and for data reduction and risk factor categorization factor analysis, it is applied. An investment in equity shares involves a high degree of risk. It is clearly mentioned by each company in its Risk Factors Section of the prospectus that before making an investment in the equity shares, the investor should carefully consider all the risks and uncertainties described in it. Furthermore, it is also suggested in the introductory information of the Risk Factors Section that in order to obtain a better understanding of the issuer's business, investors should read the risk factor section in conjunction with the other sections of the RHP entitled Forward-looking Statements, Our Business, Management's Discussion and Analysis (MD&A), and the Financial Statements Section. So, while attempting content analysis of the IPO prospectus, the Risk Factors Section as well as other concerned sections are analysed carefully.

To analyse and measure the degree of information disclosure in IPO prospectuses, the following information was collected under the content analysis:

i.   Page counts for the prospectuses' Risk Factors, Forward-looking Statements, Our Business, MD & A, and Financial Statements sections. Page counts refer to the number of pages covering the Risk Factors Section and other conjecture sections. The more the pages are utilised, the more the disclosure will be. Its percentage of the total page count of the whole prospectus is also considered.

ii.   The total number of words in the Risk Factors Section, as well as the number of words in internal, external, and issue-related risk factors. Word counts are the number of words in the whole risk factors section as well as per category.

iii.   Total Risk Factor Character Counts Section and category-wise character count of risk factors

iv.   The total number of sentences in the Risk Factors Section, as well as the number of sentences in the internal, external, and issue-related risk factors. Sentence counts are the number of sentences in the whole risk factors section as well as category-wise.

v.   Risk factor headings/statement counts-Risk factor headings are the number of subject headings in the risk factor section.

vi.   Risk factor disclosure is considered "negative" disclosure, whereas everything else is "positive" disclosure. Under-pricing is a positive function of negative disclosures (Spindler, 2009). Due to differences in firms' structure and operations across diversified industries, the risk factors mentioned in the prospectuses differ from firm to firm. Therefore, "risk factor statements" are considered as a unit of analysis instead of "words" for evaluating the impact of risk factor disclosure on IPO performance. The number of risk sentences is used as a unit of measurement in a number of studies. Statements indicating the same risk are grouped into one category and factor analysis is applied to identify different risk sub-categories. A total of 15 sub-categories are formed by grouping the homogeneous risk disclosure statements under each category. Risk factor statements disclosed by each issuer are recorded on the five-point Likert Scale. Then the Factor Analysis technique is applied to analyse the 5-Point Likert Scale data. Mean score and Principal Component Analysis as a part of Factor Analysis are used to group similar statements and identify the latent factors. The method of estimation of mutually exclusive risk categories is depicted in Fig. 3.1.
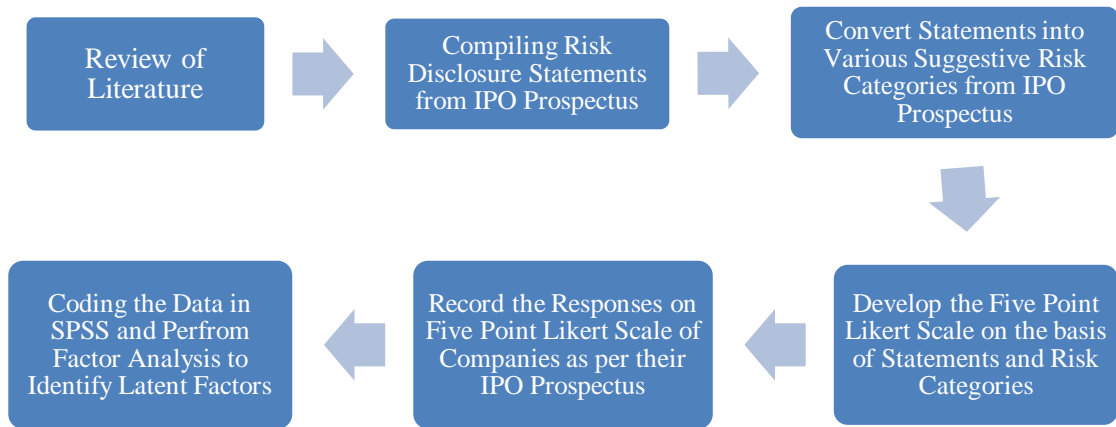
Figure– 3.1: Factor Analysis Research Model

(Source: Author's own compilation)

3.5.2.1.1 Principal Component Analysis

Costello & Osborne (2005); Tabachnick & Fidell (2007) describe the Principal Component Analysis technique as a data reduction technique that is used to reduce a large number of variables into a limited number of mutually exclusive factors. Leech et al. (2013) highlights the employ-ability of factor analysis in summarising the requisite information into a smaller number of factors by grouping highly correlated information into a single factor.

3.5.2.1.2 Kaiser-Meyer-Olkin (KMO) & Bartlett's Test of Sphericity

Kaiser (1960) developed the KMO test to investigate the adequacy of samples for performing Principal Component analysis (PCA) on the data. Field (2000) and Leech et.al. (2013) support KMO utility by stating that high values (> 0.5) give an indication of the sample adequacy for devising PCA (Factor analysis) on the given data set. Bartlett (1954) developed Bartlett's Test of Sphericity to examine the strength of the association among the understudy variables. Field (2000) and Pallant (2013) further discussed the application of Bartlett's Test for testing whether the original correlation matrix is an identity matrix. The significant value < 0.05 indicates the existence of multivariate normality and acceptability of data for further analysis.

3.5.2.1.3 Scree Plot

The Scree plot depicts the graphical representation of Eigen value and the number of factors. Cattell (1978) argues that all those factors that lie above the point of inflexion must be retained in factor analysis.

3.5.2.2 **Methodology to measure market performance**

IPO market performance, based on stock returns, can be examined in the short run as well as the long run. In this study, market performance is only measured in the short run. Short-run market performance is evaluated in the present study, considering both the initial day return and the post-day-listing return. The time when a firm has to raise initial equity capital is considered the most crucial time for any firm. The risk factor disclosures made by the firm that wishes to raise equity capital will have direct ramifications for the price that can be attained for that capital. The present study looks at how these risk disclosures in the risk factor section of the prospectus impact the stock's pricing and returns. In line with other researchers (Abdou & Dicle, 2007; Mousa et al., 2014; Wasiuzzaman et al., 2018 and Jain & Vasudeva, 2018), the first listing day return i.e. Under-pricing for each security is measured as the percentage difference between the issue price of the issued stock and the listing day opening price in primary market as well as subsequent closing price on and after the first trading day in the secondary market.

$$UPsec, x = \frac{Pc - Pi}{Pi} \times 100 \dots\dots (3.1)$$

Here Pc= Listing day closing price of x security Pi= Issue /Offer price of x security

While the under-pricing for each security in the primary market is calculated as the percentage difference between the issue price of the issued stock and the opening price of the security on the first trading day.

$$UPPRIp, x = \frac{Po - Pi}{Pi} \times 100 \dots\dots (3.2)$$

Here Po= Listing day opening price of x security, Pi= Issue price of x security

Post-listing day returns are calculated as the percentage difference between the issue price of the issued stock and the subsequent closing price of the security in the secondary market after one week, two weeks, three weeks, one month, and three months.

$$UPst, x = \frac{Pt - Pi}{Pi} \times 100 \dots\dots (3)$$

Here Pt = Subsequent closing price of x security, Pi= issue price of x security

Where t = subsequent closing price of the x security in the secondary market after one week, two weeks, three weeks, one month, and three months of first day listing.

Post-Listing day Under-pricing	• $(P_t - P_i)/P_i * 100$
Secondary market Under-pricing	• $(P_c - P_i)/P_i * 100$
Primary Market Under-pricing	• $(P_0 - P_i)/P_i * 100$

Figure-3.2: Measurement of Under-pricing
(Source: Author's own compilation)

The market performance of Indian IPOs in the short run is evaluated using listing day Primary Market Under-pricing (Excess Return), listing day Secondary Market Under-pricing and post-listing day Under-pricing. This short-run market performance using the first-day primary market can be considered as opening price performance, whereas using first-day total returns in the secondary market is known as closing price performance. So, in the present study, IPO performance is examined in terms of listing day opening price and closing price performance, followed by post-listing-day returns after one week, two weeks, three weeks, one month, and three months for a better understanding and conclusion. The key determinants of under-pricing, i.e. IPO performance, are the listing day closing price and the Issue/Offer price. Hence, the impact of risk factor disclosures on the Issue Price, Listing Day Opening Price, Listing Day Closing Price, and subsequent prices is also investigated along-with measuring its impact on the degree of Under-pricing.

The issue price is the price at which newly issued stock is made available to the public. The final offer price is determined by the company after the book building

process or the fixed price process to the public for subscription to the Initial Public Offering (IPO). According to Santhapparaj & Murugesu (2010), the disclosure of risk in a prospectus will represent the offering price and initial return of IPOs. The risk disclosure may affect the amount of discount to offer price and thus the valuation of IPOs. The natural logarithm of the issue price, listing day opening price, listing day closing price, and their subsequent prices in the short run are calculated so that they can be used as dependent variables in a regression model to examine the impact of risk factors on IPO performance. It is also analysed whether the effect of the risk factors is the same on the stock price on the first day of trading, one week after the offer, two weeks after the offer, three weeks after the offer, after one month and three months after the offer. Further, listing day under-pricing in the primary market as well as in the secondary market for each security in the sample is calculated using Equations (1), (2) and (3) and this data is used in Regression Equations to determine whether the under-pricing/initial returns are statistically significantly influenced by the risk factor disclosure in the IPO prospectus.

3.5.2.3 Methodology to measure the impact of risk factor disclosure on IPO performance

The Factor Analysis has extracted the latent factors and loaded into six mutually exclusive risk factors (Operating Risk, Compliance Risk, Managerial Risk, Equity Risk, Financial Risk, Technological & Competitive Risk), which provided us more understandable risk categories. The impact of risk factors on IPO performance is measured in two ways: first by analysing their impact on initial and subsequent stock prices, and secondly by analysing their impact on under-pricing. The OLS Regression Model is used to examine the impact of newly identified risk categories on IPO performance. The dependent variables used in the present study are: offer price, listing day opening price, opening day closing price, and subsequent market price, as well as under-pricing in the primary market, under-pricing in the secondary market on listing day, and under-pricing in subsequent time periods, as explained earlier. While the different independent variables used are Operating Risk, Compliance Risk, Managerial Risk, Equity Risk, Financial Risk, Technological and Competitive Risk, along with three control variables, namely Age of the Company, Issue Size of the IPO and Percentage Change in Market Sensex.

3.5.2.4 Dependent Variables

The study uses IPO performance on the first day and subsequent weeks and months as a dependent variable. Taking the logarithm of the variables is a popular approach to manage instances where the dependent variable and the independent variables have a non-linear relationship in regression analysis. It is also a method for transforming highly skewed variables into more normal variables (R. B. Carter et al., 2011). The following dependent variables are used in this study:

1. **Issue Price (ISSP) -** The issue price is the price at which new issued stock is offered to the public. It is calculated as the natural logarithm of the issue price for regression purpose.

2. **Listing Day Opening Price (LDOP)** - It is the price at which a newly issued security is listed at the very beginning of the first day. It is considered as the first-day primary market performance. The natural logarithm of the opening price is calculated to use it in SPSS.

3. **Listing day Closing Price (LDCP) -** It is calculated as the natural logarithm of the price at which a newly issued stock is closed on its first listing day.

4. **Stock Price after One Week (PA1W) -** It is the natural logarithm of the stock price on a stock exchange after one week of its first listing.

5. **Stock Price after Two Weeks (PA2W) -** It is the natural logarithm of the stock price on a stock exchange after two weeks of its first listing.

6. **Stock Price after Three Weeks (PA3W)** - It is the natural logarithm of the stock price on the stock exchange after three weeks of its first listing.

7. **Stock Price after One Month (PA1M) -** It is the natural logarithm of the stock price on the stock exchange after one month of its first listing.

8. **Stock Price after Three Months (PA3M) -** It is the natural logarithm of the stock price on a stock exchange after three months of its first listing.

9. **Under-pricing in Primary Market (UPPRIM) -** The under-pricing for each security in the primary market is calculated as the percentage difference between the issue price of the issued stock and the opening price of the security on the first trading day.

10. **Under-pricing in Secondary Market (UP$_{sec}$)-**The percentage difference between the issue price of the issued stock and the closing price of the security

on the first trading day is used to compute the under-pricing for each share in the secondary market on the listing day.

11. **Under-pricing after One Week (UP1W) -** It is a percent change in the stock price after one week of trading from the stock issue price. It is calculated as:

(Share price one week after the first day's close of trading – Issue price)/Issue price

12. **Under-pricing after Two Weeks (UP2W) -** It is a percent change in the stock price after two weeks of trading from the stock issue price. It is calculated as:

(Share price two weeks after the first day of trading – Issue price)/Issue price

13. **Under-pricing after Three Weeks (UP3W) -** UP3W is a percent change in the stock price after three weeks of trading from the issue price of the IPO. It is calculated as:

(Share price three weeks after first trading day – Issue price)/Issue price

14. **Under-pricing after One Month (UP1M) -** It is a percent change in the stock price after one month of trading from the stock issue price. It is calculated as:

(Share price one month after the first trading day – Issue Price) / Issue Price

15. **Under-pricing after Three Months (UP3M) -** It is a percent change in the stock price after three months of trading from the stock issue price. It is calculated as:

(Share price three months after the first day of trading – Issue price)/Issue price

3.5.2.5 Independent Variables

Firm risks sourced from the IPO prospectus issued by the different firms in the prescribed period are used as independent variables in the present study (Abdou and Dicle, 2007; Mousa et al., 2014 and Wasiuzzaman et al., 2018, Jain and Vasudeva, 2018) The following mutually exclusive risk categories are identified using factor analysis and combined the subgroups of risk factors as per their factor loading in the specific groups. These risk categories are used as independent variables in the regression model.

1. **Operating Risk (OPRRISK) -**It involves Operational Risks, Business Risks, and Risks related to Project Management. It is extracted through applying factor analysis.

2. **Compliance Risk (COMPRISK) –** Compliance risk refers to the possibility that a company is not obeying or adhering to applicable legislation and regulations in the course of its operations. It consists of three risks: IT Policy Risk, Company Policy Risk, and Litigation Risk. Certain business decisions may expose the company to the risk of violating or failing to comply with specific laws.

3. **Managerial Risk (MNGRRISK)-**Third Party Risk, Manpower Risk, and Management Related Risks are all examples of managerial risks

4. **Equity Risk (EQRISK)-** Equity Risk includes (a) economic risks such as exchange rate and interest rate fluctuations, seasonal trends in the economy, downgrading of India's debt rating, changing global economic conditions, inflation and financial instability, etc. (b) equity shareholders' related risks such as non-guaranteed listing of equity shares in a timely manner, volatility in securities markets in this country and other countries, restrictions on exercising pre-emptive rights, restrictions on daily movements in the price of the equity shares, issue of equity shares to our promoters at prices lower than the offer price, capital gain taxes etc.

5. **Financial Risk (FINRISK)-** Financial Risks involve risk issues like restrictive debt covenants, need for additional financing, working capital deficit, deficiency in customer credit evaluation, down business credit rating, negative cash flows, non-recovery of secured loans, reduction in or termination of tax incentives etc. and regulatory policy risks such as stringent regulatory requirements, regulatory uncertainty, non-compliance with observations made by regulatory authorities, and changes in tax laws and accounting standards etc.

6. **Technological and Competitive Risk (TECHCMPRISK)-** (i) Technological Risks include the risk of not coping with new technology, research and development capabilities, product obsolescence, inadvertently infringing on the patents of others, and unsuccessful innovation, etc. (ii) Competition and Industry Risks, such as the inability to effectively compete, a fragmented industry, a lack of prior experience, technological advancements, customer preferences, and the development of new products, etc.

3.5.2.6 Control Variables

Control variables are variables whose hidden effect is kept under control in order to eliminate any potential negative impact on the research objectives due to their presence. Control variables in this study include Firm Age, IPO Issue Size (Mousa et al., 2013, Rasidah et al., 2017, and Wasiuzzaman et al., 2018), and Percentage Change in the Market Sensex (Jain and Vasudeva, 2018).

1. **Age of the IPO Company (FAGE) -**The age is calculated as the natural logarithm of one plus the number of years since the firm was established.
2. **The Issue Size (ISSIZE) -** It is the total amount that the issuing company wishes to raise through an Initial Public Offering (IPO). The total issue size is the total number of shares offered multiplied by the final offer price of the IPO as decided by the underwriters and company.
3. **Percentage change in the Market Sensex ((PRCHGSENSX) -** To give a good representation of the level of under-pricing or overpricing, the initial return on the stock has to be adjusted by the return of the market. Therefore, in this research, the percentage change in the market sensex is used as a control variable. It is calculated as the percentage change in the market index from the day of offer to the opening/closing market index price on the first day of listing. The post-day percentage change in the market index is also calculated as a percent change from the issue day index for the same interval as the dependent variable. The benchmark used for Market Index in the study is S&P CNX NIFTY which is generally known as "NIFTY 50".

3.5.2.7 Regression Models/Equations used in Analysis

The hypotheses will be tested using multiple regression analysis. This technique investigates the association between a dependent variable and one or more independent variables. The Ordinary Least Square regression model is used in this study to investigate the impact of independent variables such as Operating Risk (OPRRISK), Compliance Risk (COMPRISK), Managerial Risk (MNGRRISK), Equity Risk (EQRISK), Financial Risk (FINRISK), and Technological & Competitive Risk Categories (TECHCMPRISK), Issue Size (ISSIZE), Firm Age (FAGE), and Percentage Change in Market Sensex (PRCHGSENSX) on the dependent variable, namely IPO Performance. The market stock price and degree of under-pricing on

listing day, as well as the stock market price and the amount of under-pricing in future weeks and months are considered the variables of IPO performance. All these variables (dependent and independent variables) have already been discussed in the preceding sections.

The regression model can be expressed as:

$$Y_j = \alpha + \beta_1 X_{1j} + \beta_2 X_{2j} + \ldots\ldots + \beta_p X_{pj} + \text{\euro}_j$$

Here in the above regression equation X's are the independent variables. Y is the dependent variable. The subscript j represents the number of observations. The β's are the regression coefficients. The €j represents the residuals of observation j.

3.5.2.8 Assumptions of Regression Analysis

The underlying assumptions must be met in order to generalise the regression model's results outside of the samples used. Linearity, multi-collinearity, autocorrelation, homoscedasticity, and normal distribution of errors were all tested for the regression data. Linearity refers to the degree to which the dependent variable is linearly associated with one or more predictors, or independent variables. Collinearity shows how closely two or more predictors are correlated with one another. Independent variables should not be too correlated. The residuals are related to autocorrelation, homoscedasticity, and the normal distribution of errors. Autocorrelation measures the degree to which the residual terms for any two observations are independent, or uncorrelated. Homoscedasticity concerns the extent to which the residuals of the dependent and the independent variables have the same variance. One more assumption for applying regression is that the residuals in the model are random and are normally distributed with 0 mean for variables. All assumptions were satisfied in the regression model applied in the present study.

3.5.2.9 Diagnostic Tests for Multiple Regression Models

F-statistics, likelihood of F-statistic, R-squared, and Adjusted R-squared tests were used as diagnostic tests for multiple regression models. These test results are examined further in depth in the study.

i. **F-statistics**

The overall significance of the constructed OLS regression models was tested using F-statistics. If the crucial value of the F-statistics was less than or equal to the F-test statistics, the null hypothesis was rejected. The rejection of the null hypothesis indicates that the estimated relationship is significant. Hence, it demonstrates the validity of the created model.

ii. **Probability of F-statistics**

P-value of the model shows the probability of F-statistics. If the p-value of the F-test statistics was less than or equal at a 5% significance level, the null hypothesis was rejected. This indicates that at least one of the model's explanatory variables influences the IPO performance.

iii. **R-squared and Adjusted R-squared statistics**

The strength of the association between your model and the dependent variable is measured by R-squared value. R^2 measures how well the model explains the observed variance in the dependent variable in comparison to the mean. Falk & Miller, (1992) suggested that R^2 values be equal to or more than 0.10 in order for the variance explained of a certain endogenous concept to be considered satisfactory. Moreover, adjusted R-squared was used to assess the goodness of fit of the developed OLS regression models. This metric assesses how well the created models' regression lines approach the actual data points.

3.5.2.10 Statistical Techniques and Software

The Statistical Package for Social Sciences (SPSS) has been used to devise both Factor Analysis and Multiple Regression Analysis. Descriptive statistics etc. are computed using MS-Excel and SPSS software.

3.6 CONCLUDING REMARKS

The chapter covers the research issues, research objectives, research methodology, implementation design, and the creation of a conceptual framework for identifying mutually exclusive risk factors that influence IPO performance. The research problem was established by a review of the literature. The literature study identifies risk proxies influencing the extent of under-pricing and stock pricing. The technique chosen, the research design, the formulation of hypotheses, and the building of a

conceptual framework are all thoroughly addressed. A snapshot of the Sample, as well as the methodology employed in the study has been provided. The execution part of methodology is covered in the following chapters.