Test of Capital Asset Pricing Model: Nepalese Evidence

A Thesis

By

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RECOMMENDATION

This is to certify that the thesis

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Test of Capital Asset Pricing Model: Nepalese Evidence

has been prepared as approved by this department in the prescribed format of faculty of management. We recommend the thesis for final approval and acceptance and forwarded for examination.

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and found the thesis to be the original work of the student written according to the prescribed format. We recommend the thesis to be accepted as partial fulfillment of the requirement for the degree of "Master of Business Studies (MBS)".

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DECLARATION

I hereby declare that the work reported in this thesis entitled "**Test of Capital Asset Pricing Model: Nepalese Evidence**" submitted to the Office of the Dean, Faculty of Management, Tribhuvan University is my original work. It is done in the form of partial fulfillment of the requirement for the Degree of Master of Business Studies (MBS) under the supervision and guidance of **Prof. Dr. Yuga Raj Bhattarai**, Patan Multiple Campus.

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Abbreviations

BSE	Bombay Stock Exchange
CAPM	Capital Assets Pricing Model
e.g	For Example
i.e	That is
KSE	Karachi Stock Exchange
M/B	Market/Book
MCAPM	Modified Capital Asset Pricing Model
NEPSE	Nepal Stock Exchange
NRB	Nepal Rastra Bank
NYSE	New York Stock Exchange
P/E	Price/Earning
R^2	R-squared
SD	Standard Deviation
SE	Standard Error
UK	United Kingdom
US	United State

CHAPTER I
INTRODUCTION

1.1 Background of the Study

Capital market plays a primary role in the development of the economy by bridging the gap between the firms and investors and creating a fruitful environment for the investment to flow consistently. The securities which are traded in the capital market are preserved by their individual characteristics and future potentiality, hence determining the price of financial security hasn't been an easy task. Thus leading many works of academic pursuit and research which ultimately produced different pricing models. Some of the popular models include Capital Asset Pricing Model, Arbitrage Pricing Theory, Dividend Discount model and many others. Among them the Capital Asset Pricing Model mostly regarded as CAPM almost simultaneously developed by Treynor, J. L. (1962), Sharpe, W. F. (1964), Lintner, J. (1965) and Mossin, J. (1966) is one of the most widely used models in pricing capital assets. The origin of CAMP model was the underlying idea of Markowitz diversification. This study tests the validity of Capital Asset Pricing Model on Nepal Stock Exchange.

In the capital market, the manner in which securities are priced is a core issue and it has attracted the attention of researchers for long. The risk-return relationship performs a central role in pricing of securities and consequently helps in making the right investment decisions (Choudhary, 2010). Since risk and return is a central importance, it is thus crucial for investors to know the risk return relationship in order to minimize the risk and maximize the return (Levy H. et al (2005). Various theories have been developed about this central relation between risk and return and as mentioned above, there are many theories which can be found in application. Markowitz developed the Modern Portfolio Theory for assembling a portfolio of assets such that the expected return is maximized for a given level of risk (Markowitz, 1952).

Tobin (1958) and Markowitz (1959) developed the one period mean-variance model. This was an expansion of Markowitz's (1952) portfolio theory. They introduced the concept of risk-free asset and found that the efficient set of combinations of risk-return is a line, thus simplifying the process of portfolio selection and demonstrating that the same portfolio of risky assets suit all investors.

According to Markowitz (1959), portfolio theory assumes that investors have a single holding period. An investor who purchases a risk free asset at the beginning of a holding period knows exactly what the value of the asset will be at the end of the holding period. There is no uncertainty about the terminal value of the risk free asset. The standard deviation of the risk free asset is therefore zero. The return from the risk free asset is risk free rate of return (Were, 2012).

The origin of Capital Assets Pricing Model (CAPM) is the underlying idea of Markowitz diversification and became a foundation of asset pricing in finance theory and practice. CAPM extended from Markowitz's Modern portfolio theory of 1952 and Tobin's mean-variance model of 1958 to introduce the notion of two types of risks namely systematic and unsystematic risk. CAPM gives the required rate of return of risky assets that are available on the financial market. In an efficient market (here efficient market denotes to the capital market where all investors get market information perfectly thus helping them to make a rational choice among the asset.). The CAPM suggests the concept of market equilibrium to determine the market price and appropriate measure of risk for a single asset. It shows the equilibrium rates of return on all risky assets are a function of their covariance with the market portfolio (Thapa, 2017). It uses beta, the risk free rate, and the market return to estimate the expected return. The theoretical explanation of the CAPM is based upon some assumptions, which have been listed below:

- Investors evaluate portfolios by looking at their expected returns and standard deviation over a single period horizon.
- Investors are risk averse. So they choose the portfolio with higher expected return and lower standard deviation.
- Capital markets are efficient so that all investors get market information perfectly
- Individual securities can be divided infinitely and bought in fraction as well.
- No transaction cost occurs in the capital market.
- The investors can lend and borrow at risk free rate. It is the same for all the investors.
- No investor is able to affect the market price of securities.

CAPM starts with the idea that individual investments contain two types of risks, systematic and unsystematic risks. First, systematic risk is the risk of holding a market portfolio. These are market risks that cannot be diversified away. As the market moves, each individual asset is more or less affected. Interest rates, recessions and wars are examples of systematic risks. Second, unsystematic risk (specific risk) is the risk which is unique to an individual's asset. This risk can be diversified away as the investor increases the number of uncorrelated stocks in his or her portfolio. In more technical terms, it represents the component of an asset's return, which is uncorrelated with general market moves. (Sharpe W. et al 2001, Bhalla V.K. 2008, Levy H. et al 2005). CAPM postulates that only a component of total risk, which is related to the market is relevant for pricing the capital assets. It also establishes the relationship between market risk and return for the capital assets. In CAPM model the assets are assessed based on their market related risk with the market risk of well diversified portfolio. And that equilibrium rate of return for individual assets is given by the model. In other words, CAPM gives the required rate of return on risky assets based on their systematic risks in the market, here systematic risk refers to the risk that is related to the well diversified market portfolio which can't be diversified further.

Since the unsystematic risk can be diversified away through the diversification of portfolio (Markowitz, 1959), there is no purpose for the capital markets to reward investors for bearing this kind of risk. But the second kind of risk, systematic risk is something that can't be diversified away or eliminated no matter what kind portfolio diversification we choose, therefore systematic risk is what the investors should be concerned of while calculating the expected return. Hence CAPM measures this systematic risk using Beta.

1.1.1 Nepal Stock Exchange

The history of securities market began with the floatation of shares by Biratnagar Jute Mills Ltd. and Nepal Bank Ltd. in 1937. Introduction of the company Act in 1951, the first issue of Government Bond in 1964 and the establishment of Securities Exchange centre Ltd in 1978 were other significant developments resulting in capital markets. Securities Exchange was established with an objective of facilitating and promoting the growth of capital market institutions undertaking the job of brokering, underwriting, managing public issue, market making for government bonds and other financial services. His Majesty's Government, under the program initiated to reform the capital market, converted the Securities Exchange Centre into Nepal Stock Exchange in 1993.

Nepal Stock Exchange, in short NEPSE, is a non-profit making organization, operating under Companies Act 2006 and Securities Act, 2007. The basic objectives of NEPSE is to impart free marketability and liquidity to the government and corporate securities by facilitating transactions in its trading floor through market intermediaries such as broker, market makers etc. NEPSE opened its trading floor on 13th January 1994 through licensed members. The Government of Nepal Rastra Bank, Nepal Industrial Development Corporation and licensed Members are the shareholders of NEPSE (Nepal Stock Exchange Ltd., 2008). On October 31, 2019 the equity market capitalization of the companies listed on NEPSE was approximately US$12.779 billion (Wikipedia, 2020).

Trading on equities takes place on all days of week (except Saturdays and holidays declared by exchange in advance). On Friday only odd lot trading is done. The market timings of the equities are:

Market Open: 11:00 AM Market Close: 15:00 PM

Odd Lot Trading is done on Fridays. For Odd Lot Trading Market Timings are: Market Open: 11:00 AM

Market Close: - 15:00 PM

Note: The exchange may however close the market on days other than scheduled holidays or may open the market on days originally declared as holidays. The exchange may also extend, advance or reduce trading hours when it deems fit necessary (Wikipedia, 2020).

NEPSE has adopted an “online system” since August 2007 for the trading purpose (IMS Investment Management Services Pvt. Ltd., 2016). It means transactions of securities are conducted using the internet. The market makers quote their bid and offer price on their own website. Once the bid and offer price matches, contracts between the buying and selling brokers or between the brokers and market makers are concluded.

NEPSE index is the head of Nepal Stock Exchange's index family. The history of NEPSE index goes back to the establishment of NEPSE itself i.e. on February 12th, 1994. The NEPSE index is the composite value of all securities listed in Nepal Stock Exchange (NEPSE) and it takes the market price of all the listed shares and the changes in their prices is reflected in the index. There are other indexes other than NEPSE itself namely Sensitive index, Float index, Float sensitive index and sub-indices to facilitate the investors with the valuable information (IMS Investment Management Services Pvt. Ltd., 2016).

1.2 Statement of the Problem

CAPM has given much importance to the systematic risk which is non diversifiable and thus postulates that investors expect more return on the asset which has higher systematic risk. According to CAPM the expected return on an asset above the risk-free rate is linearly related to the systematic risk which is measured by the asset’s beta. Even though numbers of studies have been taking place in different markets and market conditions, the validity of CAPM model has been always questioned in spite of its widespread usages among the investment decision makers. Some empirical studies conducted have appeared to be in harmony with the principles of CAPM while others contradict this model (Sauer and Murphy, 1992). Most researchers believe that the original CAPM is not applicable in real life because of its unrealistic assumptions. Many empirical tests carried out by researchers show that the models are difficult to apply in real life Blume, M. E. and Friend, I. (1973) ; Jensen, M. C. (1972) and Roll, R. (1977). However, almost five decades after its advent, the CAPM is still widely used by practitioners. Moreover, most of the modern asset pricing methods either evolved from the CAPM (usually by modifying some of its unrealistic assumptions and proposing more real-life assumptions) or bear close resemblance to it. In a survey carried out by Harris (2008), it was discovered that eighty percent of the firms and financial advisers contacted in the survey use CAPM in assessing capital assets, even though with variations in the way they apply the model.

It must be acknowledged that the CAPM gives a good insight into understanding modern investment management, as most modern techniques of investment management get their origin from the model (Abdulkarim, 2012).

A study conducted by Koirala (2015) revealed the superiority of MCAPM over CAPM even though conventional CAPM too had significant explanations of variables for few industry portfolio including the financial sectors. However a similar study done by Karki (2018) showed the superiority of the Fama French three factor model over CAPM. Choudhary (2010) tested CAPM on Indian Equity Market. The findings of this study were not substantiating the theory's basic result that higher risk (beta) is associated with higher levels of return. Wakyiku (2010) tested CAPM on the Ugandan Stock Exchange. The study concluded that there wasn't sufficient evidence for the Black, Jensen, and Scholes (1972) CAPM version, since the zero-beta rate was not statistically different from zero at the 10% level. The most important work of Fama and French (1992, 1993 and 1995) declined the fact that 'Beta' is the only factor which can explain the return generating process of risky assets.

The empirical tests conducted by Friend and Blume (1970), Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) show support to CAPM and concluded that return of risky assets are a linear function of the beta factor Bajpai et.al (2015). The two studies conducted on Nepali stock market using the theories that were extended from CAPM Koirala (2015) and Karki (2018) haven't completely disagreed with the explanatory power of CAPM.

Since investment is a trade-off between risk and return, investors choose a portfolio with lower risk for the same amount of expected return. Hence investors do seek extra return for bearing the extra risk. Since unsystematic risk can be diversified away by constructing efficient portfolios (Markowitz, 1952), the systematic risk is what is left to be taken care of and investors expect to be compensated for this type of risk. And Beta is the measure of this risk, if asset's return fluctuates more often than market returns, then the asset is considered to be volatile hence higher risk and higher beta. Fama and French (1992) however made a shocking confession that almost crippled beta as a measure of risk. The observed that beta is nearly worthless as an explanation of a stock's relative performance over time. They suggested that strategies based on investing in stocks with low price to book ratios and small capitalisation firms produce better long term performance than strategies based on beta. They were supported by Mark Hulbert (1992) who made a formal announcement that "beta was dead" (Were 2012).

Thus, the differences in these previously conducted studies serve as a motivation for conducting this study on the Nepal Stock Exchange. Despite the doubts that have been casted upon the validity of CAPM, it is still widely used by the practitioners (Harris, 2008) and most of the modern asset pricing methods seem to have evolved from CAPM, hence it can't be completely disregard the fact that CAPM still gives good insight of modern investment. Thus, problem statements of this study are:

1. Is there any relationship between risk (beta) and stock return linear?
2. Is CAPM applicable in Nepalese perspective?

1.3 Objectives of the Study

The major objective of this study is to test the validity of Capital Asset Pricing Model (CAPM) on banking sectors in Nepal. The specific objectives of the study are as follows:

1. To examine the relationship between risk (beta) and stock return linear?
2. To evaluate the applicability of CAPM in Nepalese perspective?

1.4 Significance of the Study

This study should be valuable to the investment decision makers, financial analyst, security analyst, stock brokers, individual investors and other stakeholders whose knowledge of the validity of CAPM is an important input for the investment portfolio construction. By using this study investors should be able to decide whether to use CAPM in the present market context and work on their strategies to harvest maximum return.

Especially in the context of Nepal stock exchange, this study can help market regulators and other stakeholders to have a better understanding of the risk-return relation in the capital market and will also help capital market regulators to determine the offer prices of new securities.

Last but not least, this study can be the benchmark for further studies for both security analysts and capital market researchers in Nepal. Since we can hardly find any studies conducted on the conventional CAPM in the present context of Nepalese stock market, this research may attract further studies in the field.

1.5 Limitation of the Study

Since this study has followed a simple methodology to establish the CAPM's validity, there are some limitations of this study. As far as the study is based on historical data, it is always going to be

difficult to make a conclusion from the findings which are usable in the future. The number of commercial banks studied in this research is odd which makes the last two portfolios share one common company. This study only included the commercial banks which may not be the proper representative of overall NEPSE. The methodology followed in this research is coarse and straightforward however there are other sophisticated methods for testing CAPM have been developed such as first pass/second pass regressions. Time series analysis of the stock return could have been done, but considering the scope of this research, they were left. Similarly NEPSE index has been used as a market proxy, and it can't be easily established that NEPSE exactly represented the market return for the commercial banks. Also the number of observations taken for each bank were different, which may not be the limitation but symmetric observation may have been better.

1.6 Organization of the Study

This thesis will be divided into five chapters. The first chapter consists the introduction and brief background of the research problem, the objectives and expectation of the study, the statement of problems and the limitation of the study. Similarly the second chapter incorporates the required theoretical framework to complete this study, which consists the theoretical concepts of CAPM, different methods, its application and limitations. The third chapter "Research Methodology" will deal with the research methodologies that will be used in this study, the research design, data sources, pre-processing and analysis. The fourth chapter showcase the final result of the study by using the empirical methodologies followed by this study. The fifth chapter will showcase the conclusion of the study, the applicability of linear CAPM in Nepal Stock Exchange, any recommendation of the study and suggestion of extension.

CHAPTER II
LITERATURE REVIEW

2.1 Overview of CAPM

The Capital Asset Pricing Model (CAPM) assesses the returns of the capital assets in regards with their systematic or undiversifiable risk. To compute the value of capital assets one needs to look at the inherent risks in such assets and the anticipated or expected return the assets will generate over a specified period of time. The general assumption of most pricing models is that risk and expected return are positively correlated – that is the higher the risk inherent in an asset, the higher the expected return from such assets (Abdulkarim 2012, p. 5). CAPM builds on the model of portfolio choice developed by Harry Markowitz (1952). The model assumes that investors are risk averse and when choosing among portfolios, they care about the mean and variance of their one-period investment return (Fama E. & French K, 2004).

Harry Markowitz in 1952 developed the portfolio theory. It holds that investors will attempt to maximize portfolio expected return for a given amount of portfolio risk, or, alternatively, minimize risk for a given level of expected return, by carefully choosing them proportions of various assets. It is a mathematical formulation of the concept of diversification in investing, which aims at selecting a collection of investment assets that has collectively lower risk than any individual asset. This is done by considering the coefficient of correlation between various assets. An investor can reduce portfolio risk simply by holding combinations of stocks which are not perfectly positively correlated. Markowitz portfolio theory gave birth to multiple asset pricing models.

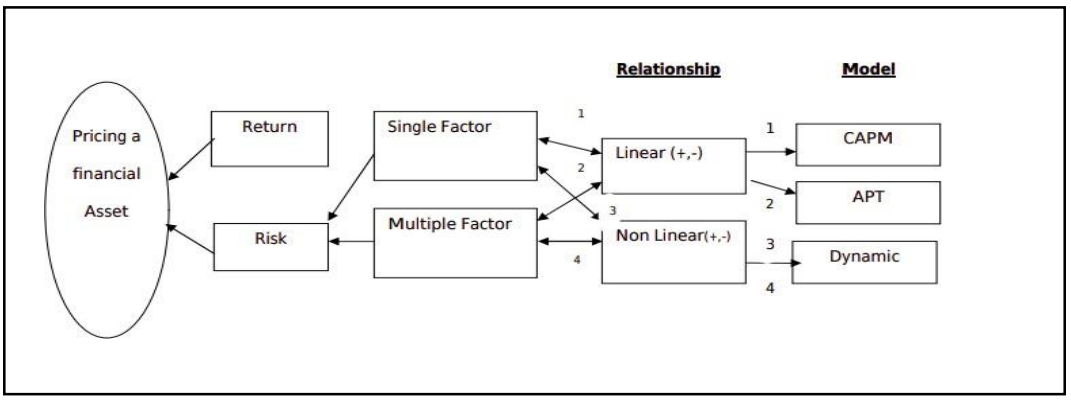
2.1.1 Methods of Pricing Capital Assets

Modeling risk-return has been attempted in the field of finance since the Markowitz Mean- Variance Theorem. The risk return tradeoff models, which are also referred as asset pricing models, since then have travelled a long way to reach the present stage with plethora of sub- areas including prominence in static and dynamic versions (Koirala 2015). The following

figure taken from the work of (Koirala, 2015) shows the theoretical development of the CAPM as well as other asset pricing models.

Figure 2.1

Basic Theoretical development of CAPM



Note. Theoretical development of asset pricing models. Adopted from (Koirala, 2015).

In Figure 2.1, two types of models have been shown depending upon the relationships between the variables, they are linear and non-linear models. A brief description of these pricing theories are discussed below.

CAPM measures the relationship between the systematic risk and the return of the particular asset or of a portfolio. The theoretical assumption of the CAPM model has also been introduced in Chapter 1. CAPM is based on the Markowitz concept of diversifying the risk, hence conceptualizing two types of risk, one is diversifiable risk, which denotes that such risk can be mitigated by creating a portfolio of different security assets which diversify the risk. And another is non-diversifiable risk, which is also known as the systematic risk and such risk can't be diversified, hence the CAPM considers the market risk of the security and derive how likely the return on the security would change, depending upon the market risk. Reilly and brown (2003) observed that the Capital Asset Pricing Model (CAPM) is a model for pricing all risky assets and allows investors to determine the required rate of return for any risky asset. The CAPM provides that in well-functioning capital markets, the risk premium varies in direct proportion to risk. The CAPM provides a measure of risk and a method of estimating the markets risk return line. The market (systematic) risk line is measured in terms of its sensitivity to the market movements. This sensitivity is referred to as the security's beta (ß).

Beta reflects the systematic risk which cannot be reduced. Investors can eliminate their risks if they invest their wealth in well diverse market portfolios. A beta of 1.0 indicates average level of risk while a beta of more than 1.0 means that the security's return fluctuates more than that of the market portfolio. A zero beta means no risk (Were, 2012). Thus the expected return on security is given by the following equation.

$E(R_i) = R_f + \beta_i \times [R_m - R_f]$ Where,

$E(R_i)$: - the required rate of return on asset i.

R_f :- the risk free rate of return of a risk-free asset.

R_m : - the rate of return on the market portfolio.

β_i : - the systematic risk for the asset i.

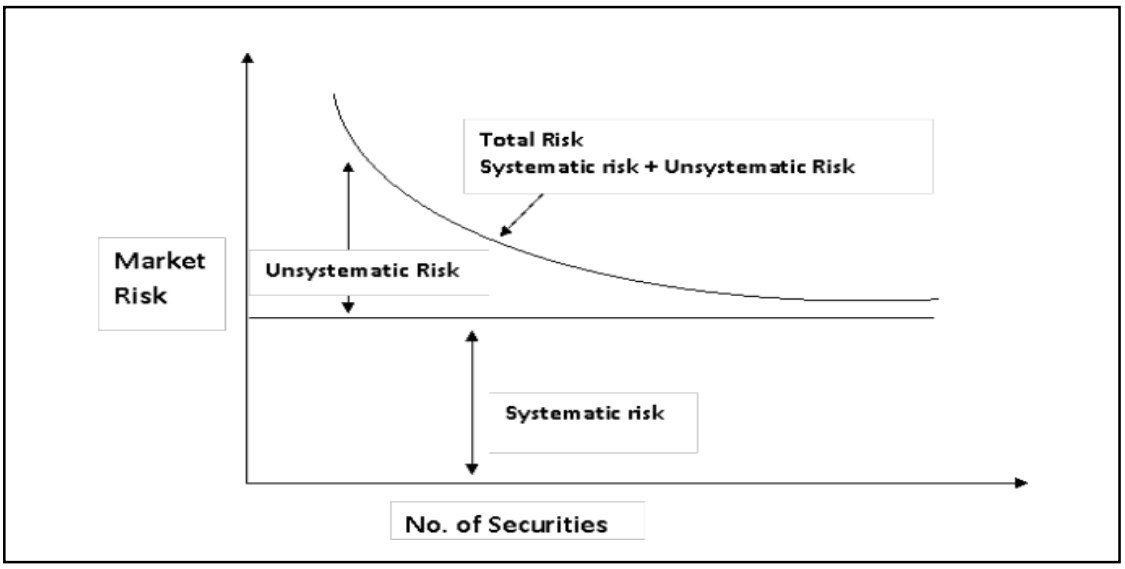
Sometimes the above equation are written in a slightly different form like this: $E(R_i) - R_f = \beta_i \times [R_m - R_f]$

Which denotes that the stock return premium should be equal to the market premium multiplied by a factor Beta of the asset if the CAPM would hold true.

The conceptual model of different types of risks is as illustrated below:

Figure 2.2

Consideration of systematic and unsystematic risk in CAPM.



Note. *Adopted from* Reilly and Brown, (2003)

It can be seen from the figure that as the number of securities are increased in a portfolio the systematic risk remains constant while the unsystematic risk reduces and then becomes stagnant. As a result the total risk also decreases initially and then it reaches a minimum point very close to the systematic risk (Were 2012).

One important point to note here is that investors are not rewarded for assuming unsystematic risk because it can be eliminated through diversification. Thus investors are rewarded for bearing only systematic risk.

2.1.2 Arbitrage Pricing Theory

Arbitrage pricing theory is a multi-factor asset pricing model which too falls in the category of the linear model. The arbitrage theory of capital asset pricing was developed by Stephen Ross as an alternative to the mean-variance capital asset pricing model (CAPM), whose main conclusion is that the market portfolio is mean variance efficient (Huberman, 1980). Arbitrage is the process of earning riskless profits by taking advantage of different pricing for the same physical asset or security. It entails the sale of a security at a relatively high price and the simultaneous purchase of the same security at a relatively low price. APT was developed to counter the assumption of CAPM that each investor is assumed to choose his or her optimal portfolio using indifference curves based on portfolio expected returns and standard deviations. APT however makes the assumption that each investor, when given the opportunity to increase the expected return of his or her portfolio without increasing the risk will do so. The mechanism of doing so involves the use of arbitrage portfolios (Sharpe, Alexander and Bailey, 2001). The following equation describes the APT model:

$$r_i = a_i + b_i F1 + b_i F2 + e_i$$

where, r_i = rate of return on security i,

a_i = the zero factor,

b_i = the sensitivity of security i to the factor,

$F1$ = the value of factor 1,

$F2$ = the value of factor 2,

e_i = random error term

APT starts with the assumption that security returns are related to an unknown number of unknown factors. Unlike CAPM, arbitrage pricing theory entails that the expected rate of return of a capital is the linear function of various risk factors that affects the asset price. While CAPM only considered the market risk as the undiversifiable risk, APT considers that there are many factors which cannot be diversified through the portfolio. Such factors (also having linear relationship with returns) relate to the economy as a whole (example GDP, inflation, interest rates, etc.) and their effects can also be estimated – that is stock's sensitivity to changes in such factors should also be considered, as against its sensitivity to the market beta alone (Abdulkarim, 2012)

2.1.3 Non-Linear Models

The further development in the model led it to consider the non-linearities associated with various variables that can be used in the model. The linear CAPM model assumes both positive and negative relation with market return depending on the nature of the asset. Non-linear models incorporate influence of higher order moments in addition to mean and variance of market return. Non-linear models can be both: time-varying and time stationary and single as well as multiple factors (Koirala 2015, p. 4).

CAPM was developed in a relatively restricted theoretical environment. However, it has provided strong empirical implications that systematic risk and return are linearly related in the capital market. In the last two decades the field of asset pricing, in both the theoretical and empirical domains, has advanced significantly (Celik, 2012) that the more risk factors are being considered and the nonlinearity associated with those factors. Example of such models include Fama, E. and French, K. (1992) three-factor model, Carhart, M. M. (1997) suggested a 4-factor model, adding a fourth factor to the Fama, E. and French, K. (1992) three-factor model.

Asset pricing models also differ in the statistical/econometrics methods they use in their assessments, which is also supposedly determined by the underlying assumptions of the model. From econometric point of view, two methodologies used by models in pricing assets are the Stochastic Discount Factor (SDF) method (where the price of a security is obtained by

'discounting' its future payoff by a valid SDF so that the expected present value of the payoff is equal to the current price) and the beta method which predicts expected returns of assets to be linear in beta (Gospodinov N. and Robotti C. (2012) as cited in Abdulkarim, 2012).

2.1.4 Capital Asset Pricing Model Anomalies

In their seminal study Fama and French (1992) found that beta does not seem to help explain the cross-section of average stock returns, i.e. the relation between beta and average return is flat, and that the combination of size and book-to-market equity seems to absorb the roles of leverage and earnings to price ratio in average stock returns. This was observed at least during the 1963-1990 sample period.

Fama and French (1993) proposed a multi-factor model, which included factors related to the firm's size and firm's book value. This model performed better than the classical CAPM and they argued that stock risks are multidimensional and therefore the addition of other factors improve the CAPM power to explain the average stock returns. On this basis, the following have been documented as anomalies of beta:

2.1.4.1 The Size Effect

Banz (1981) found out that firms with a low market capitalization seemed to earn positive abnormal average returns, while large capitalization firms earned negative abnormal returns. On the contrary, Post and Levy (2005) held that size effect generally is not very strong if only portfolios on size are sorted. They attributed this to the fact that size and beta are correlated very strongly.

2.1.4.2 Value Effect

Basu (1977) also noted that firms with low market value relative to firm fundamentals (low P/E and high M/B) earned abnormal high average returns. Firms with high market value relative to firm fundamentals (high P/E and low M/B) earned negative abnormal returns. This observation was consistent with the findings of Jaffe et al (1989), Rosenberg et al (1985) and Fama and French (1992).

2.1.4.3 The Momentum Effect

This is the tendency for rising asset prices to rise further, and falling prices to keep falling. For instance, it was shown that stocks with strong past performance continue to outperform stocks with poor past performance in the next period with an average excess return of about 1% per month (Jegadeesh and Titman 1993). Momentum effects were also observed by Fama and French (1996).

2.1.5 Limitations of the CAPM

The CAPM, in its original form has many limitations, the basic ones being that it has unrealistic assumptions and it is based on constant betas (and as such is difficult to apply in real-life). It also identifies market risk as the only risk affecting average returns of well- diversified portfolios. As a result of these and other limitations of the model, many researchers have challenged it and hence extensions of the model were developed relaxing different assumptions of the original model (Abdulkarim, 2012).

2.2 Review of Related Studies

In this section we will review the early empirical studies, recent empirical studies and studies conducted in the Nepal Stock Exchange market.

2.2.1 Review of Major Studies Before 2000

The empirical tests conducted by Friend and Blume (1970), Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) show support to CAPM and concluded that return of risky assets are a linear function of the beta factor Bajpai et.al (2015). Bhandari (1988) described that debt-equity ratio plays an important role in explaining rate of return. The most important work of Fama and French (1992, 1993 and 1995) declined the fact that 'Beta' is the only factor which can explain the return generating process of risky assets. An empirical test of CAPM model done in the Hungarian capital market by Andor et.al (1999) however shows rather a moderate explanatory power of CAPM in the Hungarian capital market reality. Tinic and West (1984) who used the same New York Stock Exchange (NYSE) data during 1935-1968 as of Fama and MacBeth (1973) found contrary evidence. Sauer and Murphy (1992) confirmed that CAPM was the best model for describing the German Stock Market data. Guy et al (1977) also

supported the validity of CAPM on the German Stock Exchange. On the contrary, Green (1990) investigated the CAPM on UK private 15 sector data and showed that CAPM did not hold. In a more detailed study Hawawini (1993) could not confirm the validity of CAPM in equity markets in Belgium, Canada, France, Japan, Spain, UK and US.

2.2.2 Review of Related Studies After 2000

Maru and Royama (1974, cited Loukeris N. (2008) also find from their test of the CAPM on stocks from Tokyo Stock Exchange, that a strong linear and positive relationship exists between average returns and beta. Most of the early empirical tests carried out on the CAPM (usually called the Mean-Variance model) assumed market risk premium and betas on assets to be constant over time (Hence the name Unconditional or Static CAPM). A similar study conducted by Habib Abdulkarim on Empirical test of CAPM model using the data from New York Stock Exchange also shows the linear relationship between the risk beta and the expected return on the equally weighted portfolios. In his study he also tested the model with the time varying beta. Similar empirical test conducted by Bajpai et.al (2015) in the Indian equity market concluded that using the intercept term in the second stage of CAPM leads to a total failure of the model in the context of the Indian equity market, while removing the intercept term gives a new model which explains the risk return relationship in the Indian equity market for more than 62% times. Javid (2009) cited by Were (2012) tested the mean-variance capital asset pricing model (CAPM) on individual stocks traded at Karachi Stock Exchange (KSE), the main equity market in Pakistan. The study covered the period 1993-2004 using daily and monthly data. The empirical findings did not support standard CAPM as a model to explain assets pricing in Pakistani equity market. Trifan (2009) sought to find if the relationship between expected return and risk is linear, if beta is a complete measure of the risk and if a higher risk is compensated by a higher expected return. He used a sample of daily data for 24 companies listed on Bucharest Stock Exchange, from 2003 to 2009. The results confirmed that the intercept was statistically insignificant for both individual assets and portfolios. The tests did not provide any evidence against CAPM. Choudhary and Choudhary (2010) examined the Capital Asset Pricing Model (CAPM) for the Indian stock market using monthly stock returns from 278 companies of BSE 500 Index listed on the Bombay stock exchange for the period of January 1996 to December 2009. The findings of this study were not substantiating the theory's basic result that higher risk (beta) is associated with higher levels of return. The model does

explain, however, excess returns and thus lend support to the linear structure of the CAPM equation.

2.2.3 Review of Nepalese Studies

The study conducted by Koirala (2015) in analyzing the relationship between portfolio return and market return under the new specification of the model MCAPM revealed that even the conventional CAPM model had significant explanation of variables for few industry portfolios including the financial sectors, eg: banks, hotels and hydropowers. However with the in-cooperation of co-movement variables, the explanatory power of each of the dependent variables has improved significantly, implying that the MCAM is superior to the conventional CAPM. Similar study done by Karki (2018) on Fundamental analysis of Nepal stock exchange returns using the Fama French three factor model shows the superiority of the three factor model over the conventional CAPM in explaining the variation in the return of the portfolios. In all the five portfolios studied in the study, the three factor model had better explanatory power.

2.3 Concluding Remarks

This chapter reviewed the literature concerning portfolio theory, various pricing models and the studies that were conducted to evaluate the validity of CAPM in different markets and different market conditions. Some of these findings provide evidence in support of the CAPM while others present evidence raising questions about the validity of the model. Hence it is clear that more studies need to be conducted to evaluate the validity of CAPM. Also the debates on the studies are likely to give further development on the CAPM.

In the review of the literature the researcher concludes that not much attempt has been made to examine the validity of CAPM on the stocks listed in the Nepal Stock Exchange. In addition most of the studies that have been carried out have not taken into consideration the Capital Asset Pricing Model anomalies. These deficiencies provided the primary impetus for this current study.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Design

This study has adopted descriptive and casual comparative research design. It is a study which investigates the relationship between beta and the return on a stock and corresponding portfolio. In other words, the validity of CAPM on the Nepal Stock Exchange. Since all the data required are historical and are in numeric form, a quantitative approach was used. The stock exchange data on stock prices and NEPSE index was collected and analyzed. Similarly the data from NRB were collected and used for the analysis. Later those raw data were pre- processed for the various purposes of the analysis which ultimately helped to respond to the proposed research question. The dependent variable for this study was the excess stock return whereas the independent variable was the average risk premium.

3.2 Sources of Data

This study relies on the secondary data source for both stock prices, NEPSE index and risk free rates. The major sources of data are NEPSE website for daily stock price, NRB bulletin publications for risk free rate and NEPSE indices. Those data were later processed to make it suitable for the analysis, e.g. computing the average monthly stock price, monthly indices etc.

3.3 Population and Sample

The study population consisted of all the nineteen (19) commercial banks quoted at the Nepal Stock Exchange as at June 2010. The selection of the Nepal Stock Exchange was because it's the only security exchange currently operating in Nepal.

The study covered a period of one hundred eight (108) months, from June 2010 to July 2019. This period was selected as it captured the most recent changes in Nepalese economy. The selected sample consisted of all 19 stocks that were available in June 2010. This sample size was arrived at after considering the number of available commercial banks at the starting of

the study period in an assumption that the number of observations for all the stocks remains the same.

3.4 Data Collection Procedures

The daily average stock price data as well as number of transactions, for the period of one hundred and eight (108) months, from June 2010 to July 2019, was obtained from the Nepal Stock Exchange daily price lists which are maintained by the Nepal Stock Exchange. The Nepal Stock Exchange daily price lists are historical in nature and were used as a secondary data source for this study. In the studies conducted by Black et al (1972) and Otieno (2011), average monthly data are used and this study too follows the same approach. This is because using high frequency data such as daily observations can result in unwanted anomaly and noises in data and thus may give incorrect results. On the other hand, returns calculated using a longer time period such as yearly observations might result in changes of beta over the examined period introducing biases in beta estimates. All the stocks' returns used for the purpose of this study were not adjusted for dividends. However, the results were not greatly affected by such adjustments since earlier researchers; including Black et al (1972) applied similar measures. Nepal Rastra Bank (NRB)'s bulletin publication was used to collect the 91-days risk-free rate and the monthly NEPSE index.

3.5 Data Analysis Tools

3.5.1 Descriptive Statistics

This research used the average monthly stock prices. The raw data consisted of the daily stock price for 108 months for all the companies listed on NEPSE. From the raw data, the data of interest (19) commercial banks data was pulled out. The data was further pre-processed using Python, Pandas and Jupyter Notebook. The NEPSE index was used as a proxy for the market return and Nepal Rastra Bank's 91-days Treasury bill rate was used as a proxy for the risk free rate.

The individual stock return and the market return was calculated first in accordance with the following formula provided by Brealey et al (2005) as used in (Were, 2012) however with a modification that led to the normalization of the returns.

$$R_t = \frac{P_t - P_{(t-1)}}{P_{(t-1)}}$$

Where, R_t is the monthly stock return, P_t and is the average price of share in the current month (Ending Price) and $P_{(t-1)}$ is the average price of share in the previous month (Beginning Price).

Similarly, the market return was calculated as below:

$$R_m = \frac{Pm - P_{(m-1)}}{P_{(m-1)}}$$

Where, R_m, is the monthly market return, P_m is the market return in the current month (Ending Market Return) and $P_{(m-1)}$ is the market return in the previous month (Beginning Market Return).

3.5.2 The Model

The next step was to estimate a beta coefficient for each stock using the monthly returns during the period of study. The beta was estimated by regressing excess stock returns (stock returns less risk free rate) against excess market returns (market returns less risk free rate) for all the companies under the study according to the following equation:

$$R_{it} - R_{ft} = a_i + \beta_i (R_m - R_f) + e_{it}$$ Where,

R_{it} – individual stock return, R_{ft} – risk free rate of return

β_i – estimate of beta for each stock, R_m – Return on the market

e_i – Disturbance term of the equation

The intercept a_i is supposed to be the difference between estimated return produced by time series and the expected return predicted by CAPM. The intercept a_i of a stock is equivalent to zero if CAPM's description of expected return is accurate.

The intercept a_i is supposed to be the difference between estimated return produced by time series and the expected return predicted by CAPM. The intercept a_i of a stock is equivalent to zero if CAPM's description of expected return is accurate.

Upon the computation of beta, the stocks were grouped into four portfolios each composed of five companies. The first portfolio was composed of the stocks with the highest betas as the portfolios were constructed with the stock sorted using descending order of the beta. Classification of individual stocks into portfolios according to Choudhary (2010) diversifies away most of the firm-specific part of returns thereby enhancing the precision of the estimates of beta and the expected rate of return on the portfolios.

The portfolio stock betas were calculated by simply averaging out the betas of the stock that were included in the corresponding portfolios. This was done instead of regression because the number of observations for the regression of each portfolio is very low that it yielded inefficient results. Hence we followed Were (2012) approach of averaging the stock's beta in a single portfolio.
The average excess portfolio return was calculated as the total excess return of the portfolio divided by the number of securities in the corresponding portfolio in our case which is five. When the regression result was obtained, the data was used to investigate if high beta yields high returns and vice versa.

To evaluate the data and regression result, I conducted a statistical test referred to as significance testing to find out if the independent variable has any effect upon the dependent variable. The t-tests was used and in defining the data significant to conclude with 95% confidence, I selected a 5% level of significance. T Statistic was considered significant if the p-value is less than 0.05.

3.6 Study Variables & Definition

A study variable (also called a research variable) is an informal term that means any variable used in study that has some kind of cause and effect relationship. In this study we have two different regression analysis, for each of them different study variables have been used. For the first regression analysis which estimated the beta, the excess stock returns (stock returns less risk free rate) was used as a dependent variable and excess market returns (market returns less risk free rate) was used as an independent variable for all the companies under the study.
Similarly for the risk and return relationship, a second regression analysis was done and in which the mean return was used as dependent variable and the risk (standard deviation of return) was used as an independent variable to establish the relationship between risk and return.

CHAPTER IV
DATA PRESENTATION AND ANALYSIS

4.1 Descriptive Statistics of Stock Return

The main objective of the study was to establish the validity of Capital Asset Pricing Model using monthly stock returns of companies listed at the Nepal Stock Exchange. This section represents how the stock return was analyzed with respect to its disparity. The monthly stock returns of sampled companies are given in Appendix II. 19 companies have been sampled from the listed companies and all the samples have been taken from the banking sector. Out of the 19 banks that were selected for the study, only 8 banks have traded consistently throughout the period under study, rest of the companies have different numbers of observations.

From Nepal Stock Exchange daily price list, the daily closing stock price data for the period of our study from June 2010 to July 2019 was obtained, which comprises one hundred and eight (108) months. This price list was used to calculate the monthly stock return. Similarly the daily Nepal Stock Exchange Index (NEPSE) was collected from Nepal Rastra Bank (NRB) economic bulletin publication and was used to calculate the market return. The 91-days treasury bill rate provided by NRB has been used as a risk free rate.

The mean and the standard deviation were also calculated as shown in Table 1 below. Returns on the security and market were measured on a monthly basis. The security return was calculated as described in Chapter III. After calculating the monthly stock return, the stocks were ranked in terms of their means and standard deviation. The table is sorted using the Mean rank which is the mean of stock return that was analyzed to see the relation between the stock return and the risk associated with them. The stock has been sorted in descending order in terms of their mean rank.

Table 4. 1

Descriptive Statistics of Stock Return

Company	No. of Observations	Mean	Std	MeanRank	StdRank
Lumbini Bank Limited	61	0.012	0.133	1	2
Prabhu Bank Limited	78	0.010	0.125	2	3
NMB Bank Limited	95	0.008	0.101	3	13
Siddhartha Bank Limited	103	0.007	0.142	4	1
Global IME Bank Limited	96	0.006	0.100	5	16
Nepal Bangladesh Bank Limited	105	0.006	0.115	6	5
Sunrise Bank Limited	108	0.005	0.113	7	7
Sanima Bank Limited	89	0.005	0.123	8	4
NIC Asia Bank Ltd.	96	0.002	0.107	9	8
Prime Commercial Bank Ltd.	108	0.002	0.100	10	14
Nepal Investment Bank Limited	108	0.001	0.095	11	18
Himalayan Bank Limited	108	0.001	0.103	12	10
Nepal SBI Bank Limited	108	0.001	0.103	13	9
Kumari Bank Limited	101	-0.001	0.113	14	6
Laxmi Bank Limited	107	-0.002	0.099	15	17
Everest Bank Limited	108	-0.002	0.103	16	12
Nabil Bank Limited	108	-0.005	0.092	17	19
Bank of Kathmandu Ltd.	90	-0.008	0.100	18	15
Standard Chartered Bank Limited	108	-0.008	0.103	19	11

Table 4.1, shows the stock returns statistics including the Mean , Standard deviation and rank the stock depending on their mean and standard deviation implying the stock's return and risk

respectively. Below we discuss the brief details of every bank of the study:

Lumbini Bank Limited which has the lowest number of observations has the higher average return as shown in the table. Total 61 observations or 61 months of stock data has been used which amounts to the highest mean being 0.012 and one of the highest risk 0.133 as being the standard deviation rank 2nd out of 19. This shows that Lumbini Bank's higher return is associated with the higher risk.

Prabhu Bank limited traded total of 78 months during the period of our study which has the second highest return, 0.010, also its risk is one of the highest ranking 3rd out of 19. The standard deviation of stock return of Prabhu Bank Limited is 0.125. This also shows that Prabhu Bank Limited's higher return is associated with higher risk associated with it.

NMB Bank Limited traded a total of 95 months during the period of our study and has the third highest return 0.008 and it's risk ranks 13th out of 19, which says that NMB Bank's return is not clearly related with its higher risk as for the above two banks Lumbini Bank Limited and Prabhu Bank Limited.

Siddartha Bank Limited traded 103 months during the period of our study and has the fourth highest return 0.007 and it has the highest standard deviation rank of all the 19 companies which amounts to 0.142. This shows that Siddharth Bank Limited's higher return is associated with higher risk.

Global IME Bank Limited traded 96 months during the period of our study and ranks 5th in terms of return and ranks 16th in terms of standard deviation, which shows that its return isn't clearly associated with the risk.

Nepal Bangladesh Bank Limited traded 105 months during the period of our study has the 6th highest return and ranks 5th in terms of standard deviation amounting return which is equal to Global IME Bank Limited 0.006. However Nepal Bangladesh Bank Limited has higher standard deviation compared with the Global IME Bank Limited even though their returns are the same. There could be other determinants of this outcome.

Sunrise Bank Limited traded all 108 months which is the total number of months of the period of our study and ranks 7th in terms of return and 7th in terms of standard deviation of the return. This shows that Sunrise Bank Limited's return is clearly associated with its corresponding risk.

Sanima Bank Limited traded 89 months during the period of our study and has the 8th highest return and 4th highest risk. This shows that Sanima Bank Limited's return is somehow related with the risk associated.

NIC Bank Limited traded 96 months during the period of our study and has the return of 0.002 ranking as 9th highest return and it's standard deviation ranks 8th amounting to 0.107.

Prime Commercial Bank Ltd. traded all 108 months throughout and has the 10th highest return amounting to 0.002 which is equal to the return of NIC Bank Limited, however their standard deviation ranks are different. Prime Commercial Bank Ltd. shows a lower amount of risk for the same amount of return as of NIC Bank Limited.

Nepal Investment Bank Limited traded all 108 months during the period of our study and has the mean return of 0.001 ranking as 11th highest return, but it's risk ranks the 18th, which shows that even for the higher amount of return, the risk associated with Nepal Investment Bank is lower.

Himalayan Bank Limited traded all 108 months throughout the period of our study and ranks 12th highest return for the similar risk ranking of 10th. Himalayan Bank Limited's return amounts to 0.001 and it's risk 0.103.

Nepal SBI Bank also traded all 108 months throughout the period of our study and has the mean return of 0.001 same as of the Himalayan Bank Limited ranking and its standard deviation is also 0.103 same as of the Himalayan Bank Limited. Their risk looks propertonate with their returns.

Kumari Bank Limited traded a total of 101 months out of 108 months and has a negative return of -0.001 and has a positive standard deviation of 0.113, the rank of its return is 14 and rank of standard deviation is 6th. This shows that Kumari Bank Limited has a lower return for higher amount of risk.

Laxmi Bank Limited traded a total 107 during the period of our study and has the negative return of -0.002 and the positive standard deviation of 0.099. Its return ranks 15th and standard deviation ranks 17th. The risk and return of Laxmi Bank Limited seems in sync.

Everest Bank Limited traded all 108 months throughout the period of our study and has the negative return of -0.002 which is equal to the Laxmi Bank's return, however its standard deviation ranks 12th which is higher than that of Laxmi Bank Limited.

Nabil Bank Limited traded all 108 months throughout the period of study. Nabil Bank Limited has one of the lowest return -0.005 and also the lowest risk ranking 19th. Its risks amounts to 0.092

Bank of Kathmandu Ltd. traded a total of 90 months during the period of study and has the negative return of -0.008 which ranks 18th and its standard deviation is 0.100 which ranks 15th.
Standard Chartered Bank Limited traded all 108 months during the period of our study and has the lowest return which is equal to the return of Bank of Kathmandu Ltd. Its standard deviation ranks 11th.

From Table 1, it can be seen that not all companies which have got higher risks (in this case higher standard deviation) also have higher returns. However, as can be seen from the ranking, most of the company's higher return are associated with the higher risk. For an example we can take the first two companies Lumbini Bank Ltd. and Prabhu Bank Limited which both have the higher return associated with the higher return, we can say similar in case of Siddarth Bank Limited, Nepal Bangladesh Bank Limited, Sunrise Bank Limited, Sanima Bank Limited and NIC Asia Bank Ltd. Their risk and return are quite in sync. However NMB Bank Limited risk and risk relation shows a other way around and similar results can be inferred for Global IME Bank Limited and Nepal Investment Bank Limited. This result was analyzed further by looking at the significant levels which will be shown below in the analysis of risk and return.

4.2 Results of Regression Analysis

Whenever the term investment occurs, both risk and returns come hand in hand, basically it's the process of bearing some risk in an expectation of some returns. Hence our study is to find out if higher risks are associated with higher returns and vice-versa, the regression analysis between the market return and individual stock's return was done. The regression method has been described in Chapter III. The risk (beta) here is the independent variable and the return is our dependent variable. This regression analysis generated the betas, the constant (alpha), the t-values and p-values as shown in Table 4.2. We use T-test to verify the relationship between the dependent variable and independent variable. Furthermore, we also take into account the R-squared value and see how two variables are correlated. Lastly we sort the stocks in terms of their Beta values in descending order. The result of regression analysis is shown below:

Table 4.2:
Regression Results

Company	Alpha	Beta	T-value	P-value	Significance	R-Squared	No. of Observation	BetaRank
Siddhartha Bank Limited	-0.001	1.500	18.413	0.000	Significant	77.22%	103	1
Sunrise Bank Limited	-0.002	1.399	15.564	0.000	Significant	69.76%	108	2
Lumbini Bank Limited	-0.003	1.393	17.721	0.000	Significant	84.41%	61	3
Nepal SBI Bank Limited	-0.007	1.273	15.589	0.000	Significant	69.83%	108	4
Sanima Bank Limited	-0.010	1.255	11.341	0.000	Significant	59.93%	89	5
Standard Chartered Bank Limited	-0.017	1.252	14.188	0.000	Significant	65.72%	108	6
Prime Commercial Bank Ltd.	-0.007	1.248	14.611	0.000	Significant	67.03%	108	7
NMB Bank Limited	-0.002	1.215	14.348	0.000	Significant	69.11%	95	8
Himalayan Bank Limited	-0.008	1.206	13.345	0.000	Significant	62.91%	108	9
Everest Bank Limited	-0.011	1.202	13.543	0.000	Significant	63.60%	108	10
Nepal Bangladesh Bank Limited	-0.004	1.198	10.111	0.000	Significant	50.06%	105	11
NIC Asia Bank Ltd.	-0.011	1.054	13.022	0.000	Significant	64.58%	96	12
Nabil Bank Limited	-0.016	1.030	11.546	0.000	Significant	55.94%	108	13
Nepal Investment Bank Limited	-0.010	1.025	10.808	0.000	Significant	52.66%	108	14
Global IME Bank Limited	-0.008	0.949	10.886	0.000	Significant	56.03%	96	15
Prabhu Bank Limited	-0.008	0.903	8.760	0.000	Significant	50.57%	78	16
Laxmi Bank Limited	-0.014	0.902	7.909	0.000	Significant	37.56%	107	17
Kumari Bank Limited	-0.017	0.706	5.977	0.000	Significant	26.72%	101	18
Bank of Kathmandu Ltd.	-0.028	0.528	5.148	0.000	Significant	23.35%	90	19

Table 4.2 shows the Alpha term, Beta value, T-test, R-squared and significance testing of the regressions that was performed for each company. The brief description of each regression has been presented below:

Siddartha Bank Limited has the highest Beta amounting to 1.5 and also the highest T-value and R-squared. It's R-squared is 77.22% which shows that independent variable highly influences the independent variable. From Table 4.1, Siddartha Bank Limited has one of the highest return and highest standard deviation. This shows that Siddhartha Bank Limited's return is associated with its Beta.

Sunrise Bank Limited has the Alpha term of -0.002, and its Beta is second highest amounting to 1.399 and R-squared is 69.76% which shows that Beta and return are highly associated.

Lumbini Bank Limited has the highest R-squared value 84.41%, and its Beta is the 3rd highest out of 19 companies. Its T-value amounts to 17.721 which is even greater than that of Sunrise Bank Limited.

Nepal SBI Bank Limited has the 4th highest Beta which amounts to 1.393 and R-squared of 69.83%.

Sanima Bank Limited has the Alpha term of -0.010 and 5th highest Beta 1.255, its R-squared is 59.93%. Total 88 observations were used to derive the regression equation of Sanima Bank Limited.

Standard Chartered Bank Limited has the 6th highest Beta of 1.252 and R-squared 65.72% which is higher than that of Sanima Bank Limited. In Table 4.1, it was analyzed that Standard Chartered Bank had the lowest return for the higher amount of risk associated with it.

Prime Commercial Bank Ltd. has the 7th highest Beta of 1.248 and its R-squared is 67.03%, its T-value is 14.611.

NMB Bank Limited has the 8th highest Beta of 1.215 and its R-squared is 69.11% which shows that the variables were highly correlated. It is one of the banks having the highest return from table 4.1.

Himalayan Bank Limited has the 9th highest Beta of 1.206 and its R-squared is 62.91%. Himalayan Bank had consistently traded throughout the period of study, hence total of 107 observations was used for deriving the regression equation.

Everest Bank Limited has 10th highest Beta amounting to 1.202 and its T-value is 13.543, its R-squared value is 63.60% which shows that the variables of the regressions were highly correlated for this bank.

Nepal Bangladesh Bank Limited has the 11th highest Beta of 1.198 and its R-squared is 50.06% even though it's lower than the other counterparts, it shows that the variables are highly correlated.

NIC Asia Bank Ltd. has the 12th highest Beta which is 1.054 and its T-value is 13.022 which is higher than that of Nepal Bangladesh Bank and its R-squared is 64.58% showing that the variables are highly correlated.

Nabil Bank Limited has the 13th highest Beta of 1.030 and the R-squared of 55.94%. It has traded throughout the period of the study and total 107 observations were used to derive the regression equation for Nabil Bank Limited.

Nepal Investment Bank Limited has the 14th highest Beta of 1.025, its T-value is 10.886 and the R-squared 52.66% tells us that the variable for this bank is highly correlated.
Global IME Bank has the 15th highest Beta even though in Table 4.1, it was one of the banks having the highest returns. Its R-squared value is 56.03% which tells us that the variables are correlated.
Prabhu Bank Limited has the 16th highest Beta of 0.903 and its R-squared value is 50.57%, even though, from table 4.1 it is one of the highest yielding banks, its Beta value is lower compared to the other banks.
Laxmi Bank Limited has the 17th highest Beta of 0.902 and its R-squared value is one of the lowest 37.56%. Compared to the other counterparts, this is the lower R-squared value. But the P-value is still significant.
Kumari Bank Limited has the second lowest Beta amounting to 0.706 and its R-squared too is lower 26.72% but this is still greater than 25% and shows that variables are correlated. Its T-value is 5.977 and the P-value is significant.
Bank of Kathmandu has the lowest Beta of 0.528 and its R-squared is below 25% amounting to 23.35%. Total 90 observations were used for deriving the regression equation. However it's P-value is still significant.

From Table 4.2, the data for all companies were considered to be statistically significant due to the fact that p-values were less than 0.05 as well as t-values also being greater than 2. The R-squared which is the percentage of variance explained is also 25% and above for all the companies except for Bank of Kathmandu Ltd. having 23.35%. All the beta coefficients were found to be statistically significant since they had a value that was different from zero and therefore they have information content. It can be also concluded that the rank of standard deviation in table 4.1 is somehow in sync with the Beta rank for the majority of the companies under study.

Furthermore the regression analysis between Risk (Beta) and stock return was done.
If y represents the dependent variable and x the independent variable, this relationship is described as the regression of y on x. In our case, we supposed that y is our Mean Return, and x is the risk meaning standard deviation. From the derived regression result, we learnt that the relationship between risk and return of the twenty sampled banks is linear with the $R^2 = 40.1\%$ and p-value being 0.004 which is less than 0.05.

4.3 Portfolio Formation of Selected Banks

After the computation of beta, the stocks were grouped into four portfolios each composed of five companies. The first portfolio was composed of the stocks with the highest betas and the lowest betas for the last portfolio as shown Table 3 below. However the Global IME Bank Limited was repeated in both Portfolio 3rd and Portfolio 4th to fix the odd number of sample stocks. It has been made sure that the stocks are in order with respect to their Beta's rank. This was done in order to diversify away most of the firm-specific part of returns thereby enhancing the precision of the estimates of beta and the expected rate of return on the portfolios. The portfolios of stocks are shown in the Table 4.3 below:

Table 4.3

Stock Portfolios of Selected Banks

Company	Beta	Return
1st Portfolio		
Siddhartha Bank Limited	1.5	0.007
Sunrise Bank Limited	1.399	0.005
Lumbini Bank Limited	1.393	0.012
Nepal SBI Bank Limited	1.273	0.001
Sanima Bank Limited	1.255	0.005
PORTFOLIO 1 BETA/ RETURN	**1.364**	**0.006**
2nd Portfolio		
Standard Chartered Bank Limited	1.252	-0.008
Prime Commercial Bank Ltd.	1.248	0.002
NMB Bank Limited	1.215	0.008
Himalayan Bank Limited	1.206	0.001
Everest Bank Limited	1.202	-0.002
PORTFOLIO 2 BETA /RETURN	**1.2246**	**0.0002**
3rd Portfolio		
Nepal Bangladesh Bank Limited	1.198	0.006
NIC Asia Bank Ltd.	1.054	0.002
Nabil Bank Limited	1.03	-0.005
Nepal Investment Bank Limited	1.025	0.001
Global IME Bank Limited	0.949	0.006
PORTFOLIO 3 BETA / RETURN	**1.0512**	**0.002**
4th Portfolio		
Global IME Bank Limited	0.949	0.006
Prabhu Bank Limited	0.903	0.01
Laxmi Bank Limited	0.902	-0.02
Kumari Bank Limited	0.706	-0.001
Bank of Kathmandu Ltd.	0.528	-0.008
PORTFOLIO 4 BETA / RETURN	**0.75975**	**-0.00475**

In Table 4.3, the portfolio 1 consists of the 5 banks which have the highest Beta, their beta and return has been presented in the table. This portfolio consists of Siddhartha Bank Limited, Sunrise Bank Limited, Lumbini Bank Limited, Nepal SBI Bank Limited and Sanima Bank

Limited. Their Beta and return have been averaged out as the result of Portfolio 1 beta and return which are 1.364 and 0.006 simultaneously which are higher than all the other protfolios. Portfolio 2 consists of 5 banks which have the second highest Beta, those 5 banks are Standard Chartered Bank Limited, Prime Commercial Bank Ltd., NMB Bank Limited, Himalayan Bank Limited and Everest Bank Limited. Their average Beta is 1.2246 and return is 0.0002 which is lower than that of Portfolio 3.

Portfolio 3 consists of 5 banks having the 3rd highest Beta, those banks are Nepal Bangladesh Bank, NIC Asia Bank Ltd., Nabil Bank Limited, Nepal Investment Bank Limited and Global IME Bank Limited. Their average Beta is 1.0512 and average return is 0.002, even though the average Beta of Portfolio 3 is lower than that of Portfolio 2, its return is higher than that of Portfolio 2 which contradicts that fact that portfolio having the higher Beta should have the higher return.

Portfolio 4 consists of 5 banks having the lowest Beta, those banks are Global IME Bank Limited, Prabhu Bank Limited, Laxmi Bank Limited, Kumari Bank Limited and Bank of Kathmandu Ltd. Global IME Bank Limited has been repeated in this portfolio as well to compensate the odd number remaining banks. The average Beta of this portfolio is 0.75975 and the average return is -0.00475 both of which are lowest of all.

The results as presented in Table 4.3 show that portfolio one has got higher beta and higher returns whereas portfolio four has the lowest beta and lowest return. However there is a mixed result in portfolio second and portfolio 3rd. Even though portfolio second has a higher beta (1.2246) than portfolio third (1.0512), the portfolio third has higher return as can be seen in the table. The contribution factor for this is because two banks Nepal Bangladesh Bank Limited and Global IME Bank Limited have higher returns even though their betas are relatively less than the others.

4.4 Major Findings

The major findings of the study are as follows:

1. The descriptive analysis of stock return shows that not all companies which have higher standard deviation of return also have higher mean return. Only one bank was found to have a clear relation of higher risk and higher return.
2. The regression results indicate the significant testing (T-Test) was implemented to

determine the significance of independent variables on dependent variable at 5% level of significance. The independent variable Beta was found to be significant among all the companies under study. The R-squared which is the percentage of variance explained were also, above than 25% except for one bank. Moreover, the intercept term alpha was found to be close to zero for all the companies under study.

3. Furthermore, the regression analysis between the risk & return was done to determine the R-squared which was found to be 40.1%, depicting the relation to be some-what linear.
4. From the portfolio analysis, it was found out that the portfolio 1st which has the highest Beta also has the higher return and the portfolio 4th which has the lowest beta also has the lowest return. However the result was somewhat different between the portfolio 2nd and 3rd, and the contributing factor for this could be the higher return of two banks (Nepal Bangladesh Bank & Global IME Bank Limited) even though their Beta were relatively less than the others.
5. From the overall analysis, it can be concluded that higher risk is associated with higher returns and that Capital Asset Pricing Model is valid in the Nepal Stock Exchange for the period under study at 5% level of significance.

The findings of this study compare with earlier empirical studies conducted by Andor et. Al (1999) on Hungarian captial market, Abdul (2012) on NYSE, Guy et. Al (1977) on German stock exchange, Maru and Royma (1974) on Tokyo Stock Exchange whose result were in favor of CAPM validity. The finding of this study is also in sync with Koirala (2015) & Karki (2018) on Nepalese capital market that CAPM does have significant explanatory power.

CHAPTER V
SUMMARY, CONCLUSION AND RECOMMENDATIONS

1.1 Summary

The objective of the study was to test the validity of the Capital Asset Pricing Model using monthly stock returns of the commercial banks listed at the Nepal Stock Exchange from June 2010 to July 2019. To achieve the objective of the study, the betas were first estimated using the regression and their significance testing was done. The sample size of 19 commercial banks were taken for this study. From the result of the study it can be concluded that risk and return tradeoff is key in making one's investment decision since high risk is compensated by high returns.

In order to diversify away most of the firm specific part of the returns, thereby enhancing the precision of the beta estimates, the securities were combined into four portfolios each comprising five companies. The portfolio beta and return were calculated by getting the total beta and total return and dividing by the number of companies in each portfolio. The result showed that the portfolio which had higher beta also had higher returns and the portfolio which had the lowest beta had also the lowest return. The finding of this study is therefore in harmony with the CAPM principles.

1.2 Conclusion

From this study, it can be concluded that CAPM is valid for the Nepal Stock Exchange for the period under study. Since our study period also consists of the most recent observations, it can be inferred that CAPM is most likely to be valid for the current market situation as well. The result of this study is in harmony with CAPM principle and it can be concluded that CAPM's higher risk, higher return principle is valid for Nepal Stock Exchange for the period of June 2010 to July 2019. It can be also concluded that the risk and return relationship is also linear.

1.3 Recommendations

Since this study showed that CAPM is applicable in the NEPSE capital market, this same fact can be considered by the investors while making the investment decision. Based upon the finding of this study, investors can look upon the beta to analyze the volatility of the stock return since beta can be a good measure for determining the investment portfolio.

As discussed in the problem statement, there aren't many studies that are conducted on CAPM especially in regards to Nepalese capital market. It is very important that the validity of models such as CAPM be tested frequently. Those researches will not only reveal the applicability of the CAPM in Nepalese capital market but also can become a pavement to the new research that are mixed in variables and can model the complexities of Nepalese capital market. Although extensive research has been done in the area of CAPM, further research which takes into consideration the anomalies of CAPM need to be explored. This will reveal more information as regards the subject.

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Appendix I: Nepal Stock Exchange- Sampled Securities

1. **Lumbini Bank Limited**

   Lumbini Bank Limited was established in 1998. It had NPR 2 billion worth of authorized capital, NPR 2 billion paid of capital and NPR 2 billion issued capital. Lumbini Bank however merged with Bank of Kathamandu Ltd. in 2016.

2. **Prabhu Bank Limited**

   Prabhu Bank has gone through the various phases of its growth trajectory over a short period of its existence. Growth of Prabhu Bank was phenomenal, especially after merger of Grand Bank Nepal Limited, Kist Bank Ltd, Prabhu Bikash Bank Ltd, Gaurishankar Development Bank Ltd and Zenith Finance Ltd in, 2016, attaining the status of "A" class financial institution licensed and regulated by the central bank of Nepal, Nepal Rastra Bank. The Bank has completed years of journey since the inception and has accommodated seven different financial institutions in its making. The bank has a network of 208 Branches, 46 Ext. Counters and 155 ATMs across the country, making it premier private bank in terms of geographical reach and clientele segments with customer base of above 1,400,000.

3. **NMB Bank Limited**

   Established in 1996, NMB Bank Limited licensed as "A" class financial institution by Nepal Rastra Bank in May 2008 has been operating in the Nepalese Financial market for over twenty years and is one of the leading commercial banks in the banking industry.The Bank has a Joint Venture Agreement with Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden (FMO), wherein FMO holds 14.18% of the Bank's shares and is the largest shareholder of the Bank. The bank has total of 164 branches throughout the country.

4. **Siddhartha Bank Limited**

Siddhartha Bank Limited (SBL), established in 2002 and promoted by prominent personalities of Nepal, today stands as one of the consistently growing banks in Nepal. While the promoters come from a wide range of sectors, they possess immense business acumen and share their valuable experiences towards the betterment of the Bank. Within a short span of time, Siddhartha Bank has been able come up with a wide range of products and services that best suits its clientele. Siddhartha Bank has been posting growth in its portfolio size and profitability consistently since the beginning of its operations. It has 180 branches throughout the country.

5. **Global IME Bank Limited**

Global IME Bank Ltd. (GIBL) emerged after successful merger of Global Bank Ltd (an "A" class commercial bank), IME Financial Institution (a "C" class finance company) and Lord Buddha Finance Ltd. (a "C" class finance company) in year 2012. Two more "B" class development banks (Social Development Bank and Gulmi Bikas Bank) merged with Global IME Bank Ltd in year 2013. Later, in the year 2014, Global IME Bank made another merger with Commerz and Trust Bank Nepal Ltd. (an "A" class commercial bank). During 2015-16, Global IME Bank Limited acquired Pacific Development Bank Limited (a "B" Class Development Bank) and Reliable Development Bank Limited (a "B" Class Development Bank). During 2019-20, Global IME Bank Limited acquired Hathway Finance Limited (a "C" class finance company) and merged with Janata Bank Nepal Limited (an "A" class commercial bank). Global Bank Limited (GBL) was established in 2007 as an 'A' class commercial bank in Nepal which provided entire commercial banking services. The bank was established with the largest capital base at the time with paid up capital of NPR 1.0 billion. The paid up capital of the bank has since been increased to NPR 18.97 billion. The bank's shares are publicly traded as an 'A' category company in the Nepal Stock Exchange. It has 56 branches across the country.

6. **Nepal Bangladesh Bank Limited**

Nepal Bangladesh Bank Ltd. is a leading ‘A’ class commercial bank licensed by Nepal Rastra Bank. Nepal Bangladesh Bank was registered with Office of Company Registrar (50-050/051, Dated January 14, 1994) as a public company limited by shares. Nepal Bangladesh Bank started its banking operation from 6th June, 1994. Nepal Bangladesh Bank was established as a joint venture bank with IFIC Bank Ltd., Bangladesh. Shares of the bank are listed in Nepal Stock Exchange Ltd. since 1995. It has 73 branches running throughout the country.

7. **Sunrise Bank Limited**

   Sunrise Bank Limited is a commercial bank in Nepal. The bank is an ‘A’ class commercial bank licensed by Nepal Rastra Bank and has branches all across the nation with its head office in Kathmandu which provides entire commercial banking services. The bank's shares are publicly traded as an 'A' category company in the Nepal Stock Exchange. The bank currently has 106 branches, 29 branchless banking units, 4 extension counters and 121 ATM terminals.

8. **Sanima Bank Limited**

   Sanima Bank Limited, promoted by prominent and dynamic Non-Resident Nepalese (NRNs) Businessmen, commenced its operation in 2004 as a National Level Development Bank. Since February 2012, Sanima has been functioning as an "A" Class Commercial Bank with its registered office at 'Alakapuri', Naxal, Kathmandu. Sanima Bank offers a wide range of banking products and financial services to corporate and retail customers through 79 full-fledged branches and 2 extension counters from all 7 provinces.

9. **NIC Asia Bank Ltd.**

   NIC ASIA Bank has its antecedents in NIC Bank which was established on 21st July 1998. The Bank was rechristened as NIC ASIA Bank after the merger of NIC Bank with Bank of Asia Nepal on 30th June 2013. This was a historic merger in the annals of the Nepalese financial landscape as the first of its kind merger between two successful commercial banks in the country. Today, NIC ASIA has established itself as one of the most successful

commercial banks in Nepal. The Bank has 319 branches, 108 extension counters, 61 branchless banking and 461 ATMs across Nepal with a network covering all major financial centers of the country.

10. Prime Commercial Bank Ltd.

Prime Commercial Bank Ltd. was incorporated in September 2007 as the 21st commercial bank in Nepal. It is a Category 'A' Financial Institution registered under the "Banks and Financial Institutions Act" of Nepal. It has been established by prominent business personnel and professionals from diversified areas with a prime objective of providing 'Banking Services to Everyone' in the country where still large number of population are deprived of Banking Services. It has 198 branches running across the country.

11. Nepal Investment Bank Limited

Nepal Investment Bank Ltd. (NIBL), previously Nepal Indosuez Bank Ltd., was established in 1986 as a joint venture between Nepalese and French partners. The French partner (holding 50% of the capital of NIBL) was Credit Agricole Indosuez, a subsidiary of one of the largest banking group in the world. Later, in 2002 a group of Nepalese companies comprising of bankers, professionals, industrialists and businessmen acquired the 50% shareholding of Credit Agricole Indosuez in Nepal Indosuez Bank Ltd., and accordingly the name of the Bank also changed to Nepal Investment Bank Ltd. It has 82 branches and 16 extension counters.

12. Himalayan Bank Limited

Himalayan Bank was established in 1993 in joint venture with Habib Bank Limited of Pakistan. Despite the tough competition in the Nepalese Banking sector, Himalayan Bank has been able to maintain a lead in the primary banking activities- Loans and Deposits. It has 44 branches operating across the country.

13. Nepal SBI Bank Limited

Nepal SBI Bank Limited a subsidiary of State Bank of India (SBI) was established in July 1993 and has emerged as one of the leading banks of Nepal, with 994 skilled and dedicated Nepalese employees working in a total of 116 outlets that include 88 full-fledged branches, 19 extension counters, 7 Province offices, 1 Intouch Outlet and Corporate Office.

14. Kumari Bank Limited

Kumari Bank Limited, came into existence as the fifteenth commercial bank of Nepal by starting its banking operations from Chaitra 21, 2057 B.S (April 03, 2001) with an objective of providing competitive and modern banking services in the Nepalese financial market. The Bank has paid up capital of NPR 9.55 billion of which 51% is contributed from promoters and remaining from public. Kumari Bank Limited has been providing wide-range of modern banking services through 153 points of representation located in various urban, semi urban part and rural parts of the country, with 96 outside valley branches, 30 inside valley branches, 6 extension counters and 21 Branchless Banking Units.

15. Laxmi Bank Limited

Laxmi Bank Ltd. was incorporated in April 2002 as the 16th commercial bank in Nepal. In 2004 Laxmi Bank merged with HISEF Finance Limited, a first generation financial company which was the first merger in Nepali corporate history. Further, the bank acquired Professional Diyalo Bikas Bank in January 2017, a class “B” development bank. The Bank closed the previous financial year 2018/19 with a balance sheet size of NPR 102 billion that includes deposits and risk assets of NPR 86.87 billion and NPR 78.46 billion respectively. All key financial indicators of the Bank are well within prudential and regulatory norms. It has 121 branches across the country.

16. Everest Bank Limited

Everest Bank Limited is the Commercial Bank of Nepal. Which is joint venture of Punjab National Bank, India. Punjab National Bank holds 20% equity shares of Bank. This is first Nepalese Bank which have Representative Office in India. It has 57 branches operating across the country.

17. Nabil Bank Limited

Nabil Bank Limited is the nation's first private sector bank, commencing its business since July 1984. Nabil was incorporated with the objective of extending international standard modern banking services to various sectors of the society. Pursuing its objective, Nabil provides a full range of commercial banking services through its 93 points of representation. In addition to this, Nabil has presence through over 1500 Nabil Remit agents throughout the nation.

18. Bank of Kathmandu Ltd.

Bank of Kathmandu Limited has become a notable name in the Nepalese banking scenario today with a high ranking performance. It was awarded the coveted title of 'Bank of The Year' in 2010 and strive to become the best bank in Nepal. It has 86 branches operating throughout the country.

19. Standard Chartered Bank Limited

Standard Chartered Bank Nepal Limited has been in operation in Nepal since 1987 when it was initially registered as a joint-venture operation. Today, the Bank is an integral part of Standard Chartered Group having an ownership of 70.21% in the company with 29.79% shares owned by the Nepalese public. The Bank enjoys the status of the only international bank currently operating in Nepal. It has 15 branches in operation.

Appendix II: Tables

Table 4.4
Panel A: Market Return, Risk-Free Rate & Market Premium (During July 2010 to Oct 2014)

S. No	Year-Month	Risk-Free Rate	NEPSE Index	Market Return	Market Premium
1	2010-07	0.081	465.099	-0.019	-0.1000
2	2010-08	0.038	447.591	-0.038	-0.0757
3	2010-09	0.038	408.715	-0.087	-0.1246
4	2010-10	0.056	417.432	0.021	-0.0350
5	2010-11	0.077	421.727	0.010	-0.0670
6	2010-11	0.077	421.727	0.032	-0.0455
7	2010-12	0.068	400.154	-0.051	-0.1194
8	2011-01	0.082	402.746	0.006	-0.0756
9	2011-02	0.078	404.170	0.004	-0.0743
10	2011-02	0.078	404.170	-0.032	-0.1096
11	2011-03	0.081	378.924	-0.062	-0.1434
12	2011-04	0.091	362.019	-0.045	-0.1352
13	2011-05	0.090	343.181	-0.052	-0.1420
14	2011-06	0.083	323.081	-0.059	-0.1420
15	2011-07	0.085	357.383	0.106	0.0210
16	2011-08	0.040	350.304	-0.020	-0.0596
17	2011-09	0.023	328.164	-0.063	-0.0860
18	2011-10	0.018	330.240	0.006	-0.0119
19	2011-11	0.010	330.012	-0.001	-0.0104
20	2011-12	0.008	316.604	-0.041	-0.0486
21	2012-01	0.007	319.739	0.010	0.0029
22	2012-02	0.006	313.277	-0.020	-0.0263

23	2012-02	0.006	313.277	-0.339	-0.3451
24	2012-03	0.010	308.153	-0.016	-0.0261
25	2012-04	0.011	342.829	0.113	0.1016
26	2012-05	0.008	401.502	0.171	0.1628
27	2012-06	0.013	369.395	-0.080	-0.0934
28	2012-07	0.012	389.510	0.054	0.0430
29	2012-08	0.002	400.515	0.028	0.0265
30	2012-09	0.002	414.694	0.035	0.0339
31	2012-09	0.002	414.694	0.324	0.3222
32	2012-10	0.003	428.542	0.033	0.0303
33	2012-11	0.006	481.975	0.125	0.1187
34	2012-12	0.007	506.631	0.051	0.0438
35	2013-01	0.015	522.818	0.032	0.0168
36	2013-02	0.019	531.959	0.017	-0.0018
37	2013-03	0.040	532.164	0.000	-0.0398
38	2013-04	0.035	513.709	-0.035	-0.0696
39	2013-05	0.045	493.937	-0.038	-0.0831
40	2013-06	0.027	494.531	0.001	-0.0255
41	2013-07	0.012	516.944	0.045	0.0334
42	2013-07	0.012	516.944	0.399	0.3875
43	2013-08	0.003	543.537	0.051	0.0489
44	2013-08	0.003	543.537	0.100	0.0979
45	2013-09	0.001	546.737	0.006	0.0045
46	2013-10	0.001	567.699	0.038	0.0376
47	2013-11	0.000	615.685	0.085	0.0842
48	2013-12	0.001	735.755	0.195	0.1942
49	2013-12	0.001	735.755	0.383	0.3818

50	2014-01	0.005	778.667	0.058	0.0536
51	2014-02	0.002	802.533	0.031	0.0284
52	2014-03	0.001	786.324	-0.020	-0.0210
53	2014-04	0.001	810.549	0.031	0.0302
54	2014-04	0.001	810.549	0.316	0.3159
55	2014-05	0.000	852.991	0.052	0.0520
56	2014-06	0.001	910.640	0.068	0.0663
57	2014-07	0.000	1035.625	0.137	0.1370
58	2014-07	0.000	1035.625	0.408	0.4074
59	2014-08	0.000	1003.641	-0.031	-0.0309
60	2014-09	0.001	912.079	-0.091	-0.0919
61	2014-10	0.009	924.188	0.013	0.0040
	Mean	**0.025**	**526.120**	**0.039**	**0.0136**
	Std	**0.031**	**206.815**	**0.124**	**0.137**
	Variance	**0.001**	**42772.6**	**0.015**	**0.019**

Panel B: Market Return, Risk-Free Rate & Market Premium (During Nov 2014 to July 2019)

S. No	Year-Month	Risk-Free Rate	NEPSE Index	Market Return	Market Premium
1	2014-11	0.005	878.876	-0.049	-0.0542
2	2014-12	0.001	879.881	0.001	-0.0002
3	2015-01	0.002	946.179	0.075	0.0737
4	2015-01	0.002	946.179	0.167	0.1657
5	2015-02	0.007	982.191	0.038	0.0307
6	2015-03	0.012	965.793	-0.017	-0.0283
7	2015-04	0.007	942.939	-0.024	-0.0306
8	2015-05	0.006	867.008	-0.081	-0.0864

9	2015-05	0.006	867.008	-0.048	-0.0538
10	2015-06	0.004	931.152	0.074	0.0703
11	2015-07	0.002	973.032	0.045	0.0433
12	2015-08	0.010	1118.416	0.149	0.1399
13	2015-09	0.022	1178.954	0.054	0.0319
14	2015-10	0.011	1136.911	-0.036	-0.0467
15	2015-11	0.003	1079.555	-0.050	-0.0533
16	2015-11	0.003	1079.555	0.184	0.1807
17	2015-12	0.005	1116.767	0.034	0.0297
18	2016-01	0.007	1192.243	0.068	0.0608
19	2016-02	0.004	1266.552	0.062	0.0588
20	2016-03	0.005	1332.911	0.052	0.0471
21	2016-04	0.011	1415.063	0.062	0.0506
22	2016-05	0.013	1496.056	0.057	0.0438
23	2016-06	0.001	1614.575	0.079	0.0780
24	2016-07	0.001	1771.791	0.097	0.0969
25	2016-07	0.001	1771.791	0.486	0.4856
26	2016-08	0.004	1752.817	-0.011	-0.0151
27	2016-09	0.021	1793.234	0.023	0.0026
28	2016-09	0.021	1793.234	0.504	0.4836
29	2016-09	0.021	1793.234	0.606	0.5852
30	2016-10	0.021	1783.787	-0.005	-0.0265
31	2016-10	0.021	1783.787	0.513	0.4918
32	2016-11	0.030	1636.794	-0.082	-0.1124
33	2016-12	0.023	1506.968	-0.079	-0.1027
34	2017-01	0.017	1443.338	-0.191	-0.2083
35	2017-01	0.017	1443.338	-0.042	-0.0596

36	2017-02	0.026	1331.707	-0.077	-0.1037
37	2017-03	0.007	1422.113	0.068	0.0605
38	2017-04	0.009	1667.954	0.173	0.1636
39	2017-05	0.008	1636.889	-0.019	-0.0264
40	2017-06	0.010	1584.195	-0.032	-0.0425
41	2017-07	0.007	1605.604	0.014	0.0064
42	2017-08	0.006	1632.145	0.017	0.0110
43	2017-09	0.005	1527.368	-0.064	-0.0690
44	2017-10	0.012	1538.737	0.007	-0.0041
45	2017-11	0.026	1497.513	-0.027	-0.0523
46	2017-12	0.055	1489.488	-0.005	-0.0605
47	2018-01	0.058	1418.075	-0.048	-0.1061
48	2018-02	0.039	1388.734	-0.021	-0.0600
49	2018-03	0.047	1259.938	-0.093	-0.1397
50	2018-04	0.050	1307.890	0.038	-0.0117
51	2018-05	0.052	1337.591	0.023	-0.0288
52	2018-06	0.044	1233.557	-0.078	-0.1216
53	2018-07	0.037	1197.493	-0.029	-0.0666
54	2018-08	0.033	1185.532	-0.010	-0.0434
55	2018-09	0.027	1239.995	0.046	0.0185
56	2018-10	0.018	1231.783	-0.007	-0.0243
57	2018-11	0.022	1190.387	-0.034	-0.0556
58	2018-12	0.010	1165.173	-0.021	-0.0312
59	2019-01	0.009	1175.091	0.009	-0.0001
60	2019-02	0.034	1122.362	-0.045	-0.0793
61	2019-03	0.036	1138.487	0.014	-0.0211
62	2019-04	0.044	1223.587	0.075	0.0303

63	2019-05	0.043	1306.149	0.067	0.0246
	Mean	**0.018**	**1325.991**	**0.042**	**0.0244**
	Std	**0.016**	**279.346**	**0.145**	**0.148**
	Variance	**0.00**	**78033.965**	**0.021**	**0.022**

Table 4.5
Stock Premium (Panel A 1st)

S. NO	Year-Month	Bank of Kathmandu Ltd.	Everest Bank Limited	Global IME Bank Limited	Himalayan Bank Limited	Kumari Bank Limited	Laxmi Bank Limited	Lumbini Bank Limited	NIC Asia Bank Ltd.	NMB Bank Limited
1	2010-07	-0.104	-0.084	-0.133	-0.149	-0.087	0.060	-0.097	-0.113	-0.079
2	2010-08	-0.119	-0.057	-0.100	-0.079	-0.094	0.084	-0.065	-0.086	-0.053
3	2010-09	-0.262	-0.288	-0.124	-0.164	-0.141	-0.023	-0.142	-0.183	-0.070
4	2010-10	-0.059	-0.087	-0.005	-0.043	-0.090		-0.046	-0.021	-0.147
5	2010-11	-0.060	-0.054	-0.039	0.026	-0.143	-0.180	-0.093	-0.044	0.000
6	2010-12	-0.139	-0.134	-0.143	-0.136	-0.188	-0.319	-0.192	-0.160	-0.121
7	2011-01	-0.065	-0.066	-0.058	-0.238	-0.068	0.059	-0.050	-0.049	-0.037
8	2011-02	-0.050	-0.070	-0.087	-0.010	-0.095	-0.128	-0.058	-0.059	-0.031
9	2011-03	-0.148	-0.134	-0.170	-0.190	-0.199	-0.015	-0.141	-0.142	-0.184
10	2011-04	-0.165	-0.084	-0.193	-0.182	-0.059	-0.093	-0.144	-0.158	-0.221
11	2011-05	-0.144	-0.129	-0.124	-0.099	-0.187	-0.303	-0.173	-0.123	-0.204
12	2011-06	-0.164	-0.088	-0.159	-0.224	-0.177	-0.188	-0.118	-0.110	-0.192
13	2011-07	0.169	-0.025	0.139	0.213	0.100	-0.109	0.118	0.096	0.047
14	2011-08	-0.023	-0.088	-0.073	0.007	-0.094	-0.118	-0.049	-0.018	-0.073
15	2011-09	-0.176	-0.091	-0.120	-0.097	-0.115	-0.091	-0.093	-0.106	-0.081
16	2011-10	-0.111	-0.076	-0.119	0.005	-0.037	-0.034	-0.027	-0.075	-0.064
17	2011-11	-0.002	-0.064	0.045	0.042	0.009	-0.003	-0.131	-0.059	0.002
18	2011-12	-0.070	-0.120	-0.032	-0.154	-0.063	-0.069	-0.135	-0.094	-0.073
19	2012-01	0.014	-0.054	0.022	-0.107	-0.021	-0.067	0.004	0.018	0.003
20	2012-02	-0.035	-0.021	-0.036	-0.022	-0.106	-0.019	-0.039	-0.065	-0.060
21	2012-03	-0.017	-0.008		-0.011	-0.080	-0.003	-0.045	-0.021	-0.003
22	2012-04	0.245	0.199		0.146	0.212	0.205	0.314	0.224	0.196
23	2012-05	0.263	0.219		0.312	0.214	0.279	0.339	0.222	0.253

24	2012-06	-0.118	-0.085		-0.169	-0.148	-0.146	-0.212	-0.193	-0.180
25	2012-07	0.073	0.061		0.089	0.009	0.054	0.049		-0.069
26	2012-08	-0.036	0.057		0.037	0.020	-0.004	-0.011		-0.105
27	2012-09	-0.062	0.038	0.490	0.030	0.011	-0.007	0.050		-0.006
28	2012-10	-0.059	-0.001	0.051	0.008	-0.010	-0.052	0.002		0.051
29	2012-11	0.160	0.035	0.279	0.174	0.131	0.080	0.103		0.323
30	2012-12	0.033	0.083	0.243	-0.016	-0.025	0.049	0.000		0.099
31	2013-01	0.030	0.068	-0.024	-0.065	-0.013	-0.037	-0.018		0.025
32	2013-02	-0.002	0.065	0.088	-0.003	0.023	-0.011	-0.021		0.042
33	2013-03	-0.038	0.037	0.083	-0.038	-0.016	-0.085	-0.075		-0.036
34	2013-04	-0.096	-0.057	-0.045	-0.099	-0.082	-0.076	-0.101		-0.088
35	2013-05	-0.125	-0.064	-0.144	-0.095	-0.086	-0.105	-0.131		-0.102
36	2013-06	-0.078	-0.027		-0.033	-0.065	-0.039	-0.111		-0.044
37	2013-07	-0.041	0.058		-0.016	0.064	0.036	0.020	0.433	0.037
38	2013-08	0.053	0.098	-0.001	0.048	0.151	0.080	0.048	-0.031	-0.017
39	2013-09	-0.059	-0.097	-0.084	-0.086	-0.040	0.013	-0.069	-0.073	-0.042
40	2013-10	-0.033	-0.042	0.046	0.076	-0.003	-0.022	0.046	0.019	0.030
41	2013-11	0.003	0.087	0.009	0.051	0.062	0.025	0.045	0.049	0.103
42	2013-12	0.146	0.207		0.089	0.458	0.360	0.210	0.157	0.361
43	2014-01	0.015	0.064		0.052	0.184	0.072		0.047	0.064
44	2014-02	-0.069	-0.032		0.016	-0.018	-0.027		-0.014	0.000
45	2014-03	-0.051	-0.028		-0.059	-0.080	-0.009		-0.067	-0.048
46	2014-04	-0.018	0.054	0.077	-0.039	-0.133	-0.064		-0.015	0.003
47	2014-05	0.008	0.030	0.266	0.028	-0.035	-0.005		0.029	0.081
48	2014-06	0.007	0.042	-0.061	0.018	0.068	0.035		0.074	0.072
49	2014-07		0.159	0.195	0.125	0.255	0.248	0.682	0.183	0.160
50	2014-08		-0.049	0.012	-0.014	0.030	0.001	0.025	-0.092	-0.039
51	2014-09		-0.276	-0.055	-0.082	-0.016	-0.080	-0.197	-0.110	-0.049
52	2014-10		0.008	-0.175	-0.002	-0.076	0.069	-0.071	0.008	
53	2014-11		-0.086	-0.071	-0.043	-0.280	-0.206	-0.077	-0.049	
54	2014-12		0.042	-0.015	-0.147	-0.028	-0.024	0.042	-0.055	
55	2015-01		0.097	0.012	0.195	0.033	0.072	0.060	-0.048	
56	2015-02		0.052	-0.050	0.063	0.033	0.050	0.039	-0.003	
57	2015-03		-0.024	-0.047	-0.059	-0.051	0.011	-0.028	-0.037	

58	2015-04		-0.006	-0.027	-0.052	-0.021	-0.039	-0.034	-0.022	
59	2015-05	-0.182	-0.153	-0.112	-0.133	-0.138	-0.108	-0.131	-0.144	
60	2015-06	0.214	0.133	0.121	0.086	0.127	-0.097	0.113	0.105	
61	2015-07	0.039	0.090	0.001	0.079	0.035	-0.042	0.034	0.028	
62	2015-08	0.025	0.325	0.145	0.390	0.045	0.082	0.077	0.300	
63	2015-09	-0.041	0.051	-0.013	0.080	0.098	0.069	0.058	0.087	
64	2015-10	0.009	-0.059	-0.048	-0.063	-0.048	0.058	-0.057	-0.019	
65	2015-11	-0.043	-0.132	-0.237	-0.001	-0.100	-0.088	-0.053	-0.078	-0.066
66	2015-12	0.008	-0.231	0.005	-0.208	-0.015	0.071	0.028	0.095	-0.074
67	2016-01		0.082	0.085	-0.057	-0.018	0.118		-0.173	0.082
68	2016-02		0.069	0.077	0.105		0.052		-0.070	0.137
69	2016-03		0.059	0.007	0.072		0.026		0.024	0.088
70	2016-04		0.106	0.028	0.156		0.033		0.082	0.094
71	2016-05		0.012	0.010	0.076		0.070		-0.010	0.071
72	2016-06		0.061	0.003	0.024		0.102		-0.084	0.068
73	2016-07		0.101	0.077	0.065		0.107		0.114	0.138
74	2016-08		-0.054	-0.021	-0.022		-0.001		-0.003	0.011
75	2016-09	-0.107	0.058	-0.035	0.024	-0.040	-0.004		-0.072	0.017
76	2016-10	0.342	0.016	-0.063	-0.044	0.502	-0.030		-0.217	-0.110
77	2016-11	-0.112	-0.067	-0.109	-0.229	-0.023	-0.139		-0.156	-0.173
78	2016-12	-0.074	-0.233	-0.088	-0.153	-0.095	-0.106		-0.093	-0.117
79	2017-01	-0.070	-0.349	-0.063	-0.227	-0.028	-0.008		-0.079	-0.207
80	2017-02	-0.153	-0.100	-0.089	-0.068	-0.074	-0.072		-0.137	-0.092
81	2017-03	-0.185	0.037	0.018	0.060	-0.308	0.060		-0.005	0.046
82	2017-04	0.183	0.090	0.033	0.110	0.025	-0.355		0.109	0.268
83	2017-05	-0.053	-0.114	-0.042	-0.053	-0.097	-0.015		-0.063	-0.055
84	2017-06	-0.069	-0.090	-0.056	-0.064	-0.036	-0.084		-0.056	-0.072
85	2017-07	-0.006	-0.163	0.013	-0.015	-0.014	-0.155		0.013	-0.027
86	2017-08	0.006	-0.009	-0.007	0.001	-0.037	-0.080		0.016	-0.032
87	2017-09	-0.089	-0.099	-0.043	-0.045	-0.075	-0.057		-0.250	-0.105
88	2017-10	0.004	-0.022	-0.022	-0.008	0.024	-0.035		0.024	-0.008
89	2017-11	-0.083	-0.075	-0.160	-0.045	-0.049	-0.097		-0.042	-0.038
90	2017-12	-0.057	-0.090	-0.044	-0.121	-0.052	-0.159		-0.058	-0.056
91	2018-01	-0.075	-0.273	-0.088	-0.240	-0.110	-0.090		-0.084	-0.097

92	2018-02	-0.102	-0.082	-0.017	-0.037	-0.078	-0.024		-0.030	-0.018
93	2018-03	-0.131	-0.175	-0.092	-0.143	-0.107	-0.139		-0.124	-0.128
94	2018-04	-0.081	0.037	-0.030	-0.011	-0.056	-0.024		-0.027	0.003
95	2018-05	-0.069	-0.107	-0.060	-0.067	-0.099	0.037		-0.022	-0.046
96	2018-06	-0.141	-0.137	-0.100	-0.119	-0.159	-0.079		-0.095	-0.242
97	2018-07	-0.168	-0.062	-0.061	-0.057	-0.109	-0.054		-0.058	-0.068
98	2018-08	0.008	-0.041	-0.009	-0.032	-0.020	-0.104		-0.025	-0.127
99	2018-09	0.145	-0.032	0.041	-0.017	0.149	0.055		0.254	0.064
100	2018-10	-0.001	-0.056	-0.014	-0.045	0.041	-0.059		0.051	0.000
101	2018-11	-0.052	-0.121	-0.030	-0.054	-0.025	-0.082		-0.064	-0.033
102	2018-12	0.012	-0.070	-0.008	-0.053	-0.020	-0.055		-0.087	0.022
103	2019-01	-0.110	-0.017	-0.157	-0.097	-0.005	-0.034		0.005	-0.120
104	2019-02	-0.192	-0.070	-0.055	-0.090	-0.088	-0.152		-0.044	-0.074
105	2019-03	-0.022	0.020	-0.028	0.012	-0.031	-0.023		-0.007	0.002
106	2019-04	0.057	0.121	0.050	0.107	-0.006	0.085		0.154	0.103
107	2019-05	-0.016	0.018	0.032	0.094	-0.138	-0.009		-0.015	-0.001
	Mean	**-0.034**	**-0.025**	**-0.018**	**-0.021**	**-0.025**	**-0.024**	**-0.012**	**-0.021**	**-0.016**
	Std	**0.105**	**0.108**	**0.107**	**0.109**	**0.120**	**0.106**	**0.141**	**0.110**	**0.110**
	Variance	**0.011**	**0.012**	**0.011**	**0.012**	**0.014**	**0.011**	**0.020**	**0.012**	**0.012**

Stock Premium (Panel A 2nd)

S. No	Year-Month	Nabil Bank Limited	Nepal Bangladesh Bank Limited	Nepal Investment Bank Limited	Nepal SBI Bank Limited	Prabhu Bank Limited	Prime Commercial Bank Ltd.	Sanima Bank Limited	Siddhartha Bank Limited	Standard Chartered Bank Limited	Sunrise Bank Limited
1	2010-07	-0.114	-0.108	-0.133	-0.103	-0.161	-0.083		-0.064	-0.128	-0.208
2	2010-08	-0.101	-0.128	-0.047	-0.071	-0.101	-0.053		-0.164	-0.101	-0.092
3	2010-09	-0.134	-0.113	-0.110	-0.126	-0.094	-0.084		-0.219	-0.246	-0.123
4	2010-10	-0.266	-0.053	-0.105	0.016	0.101	0.057		0.000	-0.057	0.003
5	2010-11	-0.106		-0.054	-0.094	-0.163	-0.435		-0.072	-0.126	-0.060
6	2010-12	-0.180		-0.122	-0.088	-0.131	-0.222		-0.135	-0.150	-0.159
7	2011-01	-0.036		-0.062	-0.193	-0.088	-0.099		-0.086	-0.049	-0.075
8	2011-02	-0.075	0.009	-0.070	-0.026	-0.111	-0.073		-0.105	-0.098	-0.087
9	2011-03	-0.182	-0.365	-0.131	-0.198	-0.152	-0.191		-0.190	-0.187	-0.213

10	2011-04	-0.166	-0.096	-0.192	-0.157	-0.272	-0.253		-0.116	-0.169	-0.358
11	2011-05	-0.080	-0.142	-0.127	-0.142	-0.111	-0.132		-0.184	-0.088	-0.125
12	2011-06	-0.137	-0.229	-0.194	-0.154	-0.184	-0.124		-0.174	-0.153	-0.110
13	2011-07	0.088	-0.020	0.041	0.135	0.228	0.088		0.166	0.079	0.104
14	2011-08	-0.077	-0.079	-0.017	-0.060	0.012	-0.043		-0.063	-0.063	-0.101
15	2011-09	-0.234	-0.118	-0.057	-0.159	-0.223	-0.107		-0.118	-0.171	-0.065
16	2011-10	-0.016	0.064	0.091	0.036	0.149	-0.021		0.000	-0.032	-0.008
17	2011-11	-0.063	0.095	-0.239	-0.077	-0.093	-0.001		0.012	-0.041	-0.026
18	2011-12	-0.077	-0.093	-0.095	-0.102	-0.070	-0.081		-0.101	-0.065	-0.068
19	2012-01	0.034	-0.032	-0.001	0.014	-0.014	-0.002		-0.029	0.023	-0.016
20	2012-02	-0.021	-0.101	-0.055	-0.030	-0.130	-0.056	-0.489	-0.044	-0.021	-0.045
21	2012-03	0.023	-0.052	-0.026	0.010	-0.031	-0.041	-0.387	-0.019	0.017	-0.030
22	2012-04	0.242	0.123	0.197	0.226	0.172	0.221	0.201	0.211	0.184	0.209
23	2012-05	0.250	0.191	0.202	0.210	0.089	0.255	0.361	0.449	0.171	0.131
24	2012-06	-0.120	-0.174	-0.136	-0.131	-0.151	-0.156	-0.141	-0.190	-0.120	-0.178
25	2012-07	0.100	0.057	0.089	0.097	-0.032	0.030	0.006	0.057	0.027	0.046
26	2012-08	0.064	0.033	0.022	-0.050	-0.027	-0.045	-0.125	-0.049	-0.001	-0.017
27	2012-09	-0.003	0.082	0.008	-0.037	0.000	-0.013	-0.023	0.008	-0.019	-0.011
28	2012-10	-0.183	0.104	-0.013	-0.108	0.004	-0.007	-0.028	-0.038	-0.016	-0.011
29	2012-11	0.200	0.394	0.301	0.253	0.186	0.177	0.176	0.097	0.128	0.191
30	2012-12	0.055	0.105	0.207	0.138	0.037	0.106	0.154	-0.017	0.004	0.071
31	2013-01	0.048	-0.024	-0.082	0.101	-0.027	0.022	-0.001	-0.039	-0.009	-0.015
32	2013-02	0.066	0.176	-0.010	0.001	-0.064	0.023	0.025	-0.015	-0.048	0.143
33	2013-03	0.027	0.076	-0.052	-0.033	0.039	-0.012	-0.033	-0.069	-0.072	0.026
34	2013-04	-0.078	-0.109	-0.084	-0.056		-0.060	-0.069	-0.073	-0.073	-0.068
35	2013-05	-0.086	-0.117	-0.104	-0.068		-0.026	-0.114	-0.080	-0.069	-0.075
36	2013-06	-0.022	-0.002	-0.008	-0.027		-0.039	-0.043	-0.022	-0.011	-0.027
37	2013-07	0.041	0.007	0.072	0.030		-0.017	0.018	0.081	0.022	0.032
38	2013-08	0.016	0.046	0.044	-0.003		-0.029	-0.013	0.158	-0.003	0.025
39	2013-09	0.040	0.179	0.013	-0.040		-0.061	0.011	0.041	-0.039	-0.014
40	2013-10	0.080	0.045	0.031	-0.075		0.085	-0.001	0.014	-0.029	0.004
41	2013-11	0.099	0.074	0.014	0.073		0.097	0.185	0.100	0.002	0.160
42	2013-12	0.038	0.340	0.101	0.200	0.497	0.356	0.456	0.400	0.117	0.432
43	2014-01	-0.111	0.130	0.027	0.105	0.083	0.022	0.157	-0.020	0.003	0.126

44	2014-02	-0.024	-0.017	-0.049	-0.051	-0.038	0.011	-0.027	-0.011	-0.019	0.037
45	2014-03	-0.076	-0.066	-0.069	-0.061	-0.066	-0.061	-0.069	-0.068	-0.073	-0.024
46	2014-04	0.004	0.027	-0.040	0.012	-0.040	0.004	-0.009	0.007	-0.011	-0.053
47	2014-05	0.010	0.066	0.004	0.043		0.023	0.038	0.124	0.008	-0.050
48	2014-06	0.063	0.042	0.004	0.103		0.027	0.068	0.125	0.170	0.012
49	2014-07	0.206	0.055	0.184	0.130		0.198	0.202	0.173	0.314	0.219
50	2014-08	-0.031	-0.052	-0.053	-0.082		-0.034	-0.044	0.048	-0.063	-0.096
51	2014-09	-0.056	-0.119	-0.074	-0.126		-0.107	-0.074	-0.155	-0.139	-0.146
52	2014-10	0.002	-0.027	-0.127	-0.030		-0.020	-0.111	-0.102	-0.066	0.008
53	2014-11	-0.172	-0.127	-0.091	-0.055		-0.051	0.002	-0.110	-0.158	-0.058
54	2014-12	-0.075	-0.133	-0.037	0.037		0.037	0.036	0.038	0.044	0.043
55	2015-01	0.061	0.113	0.072	-0.035	0.352	-0.085	0.074	0.108	0.061	0.080
56	2015-02	0.032	0.064	0.006	0.007	0.136	0.020	0.010	0.025	0.044	0.003
57	2015-03	-0.050	-0.036	-0.049	-0.064	0.036	-0.069	-0.027	-0.047	-0.061	-0.050
58	2015-04	-0.012	-0.037	-0.019	-0.029	0.014	-0.013	-0.006	-0.002	-0.017	-0.016
59	2015-05	-0.134	-0.167	-0.121	-0.132	-0.153	-0.090	-0.116	-0.115	-0.121	-0.150
60	2015-06	0.142	0.194	0.119	0.122	0.111	0.106	0.127	0.090	0.098	0.196
61	2015-07	0.053	0.064	0.032	0.071	0.059	0.026	0.037	0.058	0.065	0.058
62	2015-08	0.244	0.150	0.330	0.420	0.187	0.220	0.261	0.148	0.328	0.122
63	2015-09	-0.009	0.057	0.034	0.093	-0.003	0.066	0.078	-0.020	0.008	0.049
64	2015-10	-0.074	-0.081	-0.022	-0.082		-0.046	-0.191	-0.101	-0.048	-0.039
65	2015-11	-0.068	-0.213	-0.326	-0.077		-0.054	-0.049	-0.102	-0.080	-0.272
66	2015-12	-0.148	-0.107	-0.021	0.078		0.024	0.039	-0.045	-0.009	0.050
67	2016-01	-0.031	0.051	0.113	-0.001		-0.149	0.038	-0.067	0.054	0.046
68	2016-02	0.023	0.107	0.215	-0.017		0.042	0.063		0.038	0.088
69	2016-03	0.019	0.062	0.032	0.028		0.048	0.056		0.051	0.049
70	2016-04	0.093	0.045	0.139	0.128		0.075	0.066		0.131	0.167
71	2016-05	0.034	0.170	-0.039	0.052		0.079	0.053		-0.114	0.062
72	2016-06	0.016	0.187	-0.042	0.013		0.084	-0.178		0.111	0.094
73	2016-07	0.043	0.118	0.049	0.106		0.136	0.050	0.849	0.097	0.203
74	2016-08	-0.035	0.128	-0.054	-0.048		-0.160	-0.015	0.157	-0.040	0.026
75	2016-09	-0.084	0.112	-0.182	-0.002		-0.022	-0.024	0.026	0.049	0.117
76	2016-10	-0.209	-0.224	-0.108	-0.040	-0.033	-0.064	-0.183	-0.213	-0.050	-0.327
77	2016-11	-0.086	-0.193	-0.081	-0.181		-0.151	-0.118	-0.093	-0.185	-0.217

78	2016-12	-0.079	-0.075	-0.054	-0.092		-0.122	-0.088	-0.043	-0.310	-0.072
79	2017-01	-0.068	-0.053	-0.063	-0.056	-0.225	-0.154	-0.065	-0.042	-0.086	-0.056
80	2017-02	-0.074	-0.144	-0.060	-0.274	-0.104	-0.187	-0.125	-0.405	-0.059	-0.146
81	2017-03	0.021	0.054	0.046	0.070	0.080	0.045	0.065	-0.014	0.029	0.020
82	2017-04	0.062	-0.299	0.116	0.222	0.264	0.167	-0.049	0.216	0.109	0.279
83	2017-05	-0.026	-0.111	-0.054	-0.211	-0.019	-0.058	-0.056	-0.108	-0.019	-0.183
84	2017-06	-0.054	-0.043	-0.034	-0.167	-0.042	-0.071	-0.050	-0.253	-0.008	-0.174
85	2017-07	0.050	-0.028	0.026	-0.040	-0.015	0.023	-0.036	-0.058	0.015	0.004
86	2017-08	0.099	-0.096	-0.006	-0.023	-0.031	0.049	-0.035	-0.064	-0.017	-0.056
87	2017-09	-0.201	-0.118	-0.023	-0.099	-0.070	-0.050	-0.083	-0.068	-0.063	-0.108
88	2017-10	-0.119	-0.017	-0.159	-0.026	0.009	0.026	-0.111	-0.032	-0.019	-0.025
89	2017-11	-0.077	-0.148	-0.021	-0.104	-0.088	-0.038	-0.011	-0.082	-0.068	-0.182
90	2017-12	-0.080	-0.061	-0.033	-0.168	-0.069	-0.167	-0.057	-0.080	-0.058	-0.070
91	2018-01	-0.136	-0.102	-0.064	-0.161	-0.311	-0.271	-0.083	-0.087	-0.556	-0.091
92	2018-02	-0.019	-0.113	-0.016	-0.057	-0.147	-0.037	0.012	-0.077	-0.082	-0.055
93	2018-03	-0.111	-0.124	-0.076	-0.112	-0.119	-0.097	-0.069	-0.209	-0.151	-0.119
94	2018-04	-0.057	-0.014	-0.031	-0.029	-0.016	0.000	-0.021	0.037	-0.077	-0.068
95	2018-05	-0.053	-0.086	-0.068	-0.076	-0.080	-0.008	-0.070	-0.016	-0.095	-0.015
96	2018-06	-0.093	-0.116	-0.087	-0.120	-0.133	-0.123	-0.106	-0.120	-0.110	-0.125
97	2018-07	-0.078	-0.060	-0.047	-0.047	-0.096	-0.066	-0.068	-0.072	-0.060	-0.052
98	2018-08	-0.017	-0.069	-0.024	-0.034	-0.034	-0.020	-0.056	-0.003	-0.058	-0.049
99	2018-09	0.012	0.023	0.009	-0.021	0.114	0.098	0.049	0.044	-0.050	0.081
100	2018-10	-0.039	-0.020	-0.032	-0.046	0.125	-0.003	-0.027	-0.006	-0.040	-0.011
101	2018-11	-0.055	-0.062	-0.037	-0.094	0.017	-0.031	-0.055	-0.053	-0.133	-0.075
102	2018-12	-0.070	-0.040	-0.005	-0.115	-0.018	-0.012	-0.066	-0.060	-0.039	-0.047
103	2019-01	-0.030	-0.056	-0.152	-0.046	-0.025	-0.001	-0.012	-0.063	-0.034	-0.042
104	2019-02	-0.081	-0.064	-0.088	-0.069	-0.109	-0.084	-0.068	-0.075	-0.111	-0.065
105	2019-03	-0.153	0.016	-0.010	-0.009	-0.014	-0.023	-0.018	-0.005	-0.005	0.005
106	2019-04	0.078	0.094	0.011	0.115	0.109	0.031	0.068	0.101	0.096	0.092
107	2019-05	0.020	-0.004	-0.059	0.036	0.016	-0.016	0.032	-0.008	0.043	0.004
	Mean	**-0.027**	**-0.015**	**-0.021**	**-0.021**	**-0.017**	**-0.020**	**-0.010**	**-0.016**	**-0.031**	**-0.017**
	Std	**0.099**	**0.122**	**0.102**	**0.110**	**0.134**	**0.110**	**0.126**	**0.148**	**0.111**	**0.120**
	Variance	**0.010**	**0.015**	**0.010**	**0.012**	**0.018**	**0.012**	**0.016**	**0.022**	**0.012**	**0.015**

APPENDIX III: GRAPHS

Figure 1

Histogram of number of observations taken

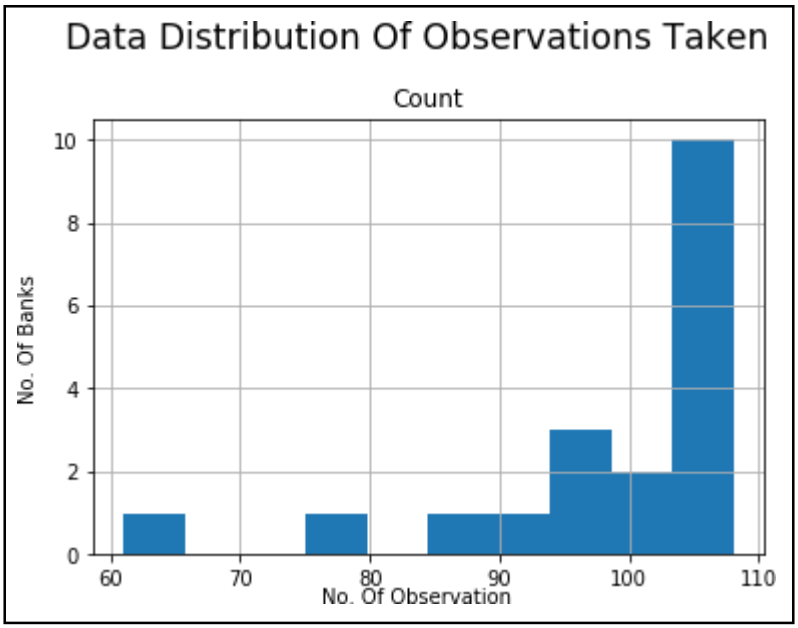


Figure 2

Regression plot of overall risk (std) vs. return.

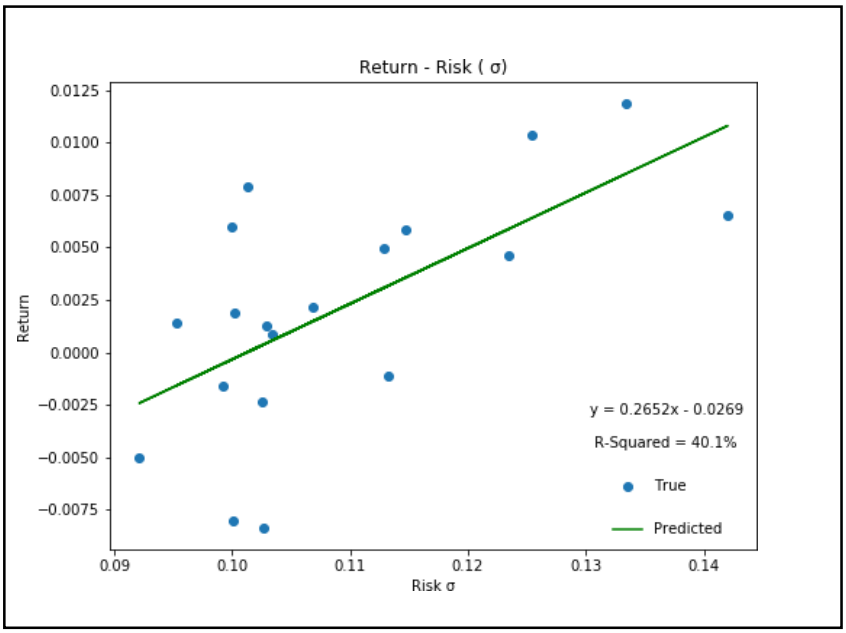


Figure 3

Regression plot of Lumbini Bank Limited.

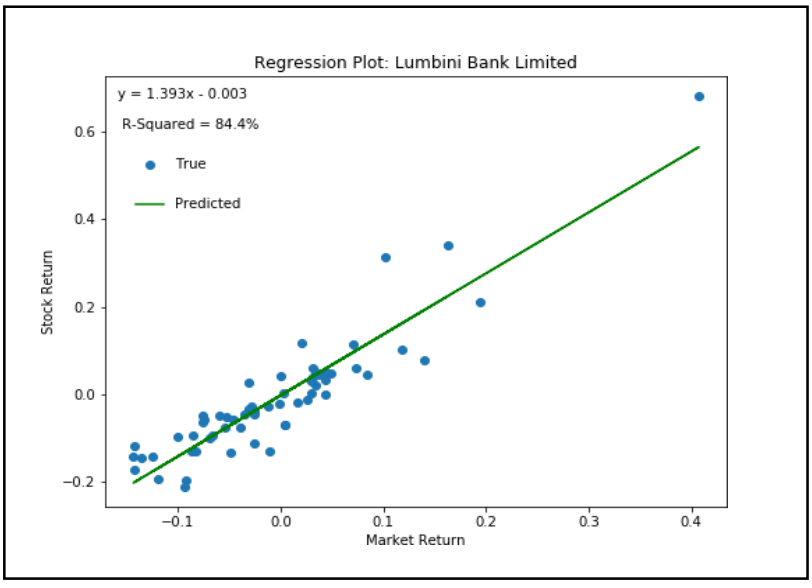


Figure 4

Regression plot of Prabhu Bank Limited.

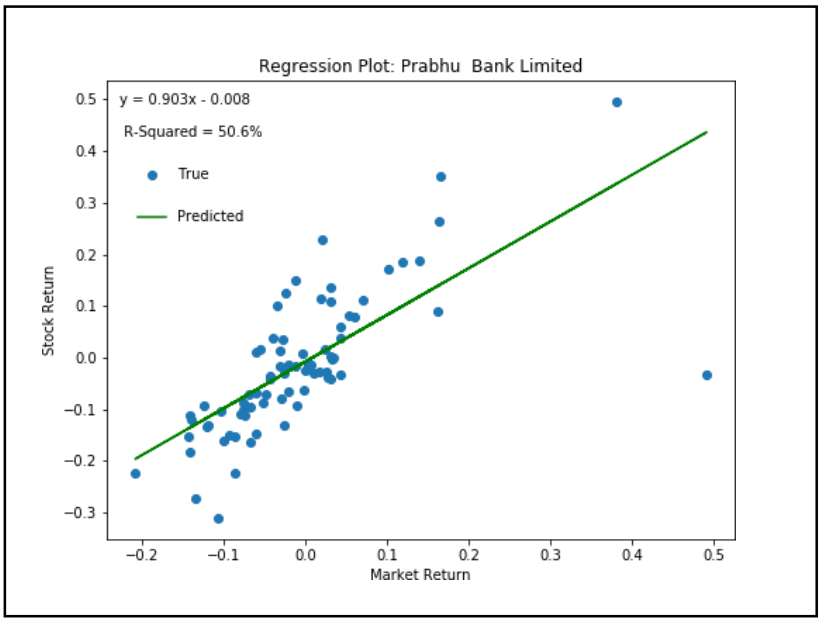


Figure 5

Regression plot of NMB Bank Limited.

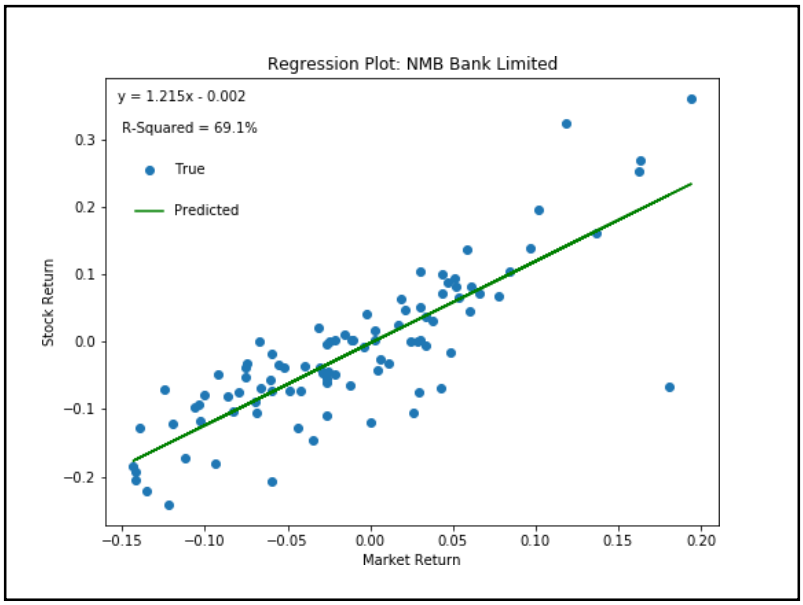


Figure 6

Regression plot of Siddhartha Bank Limited.

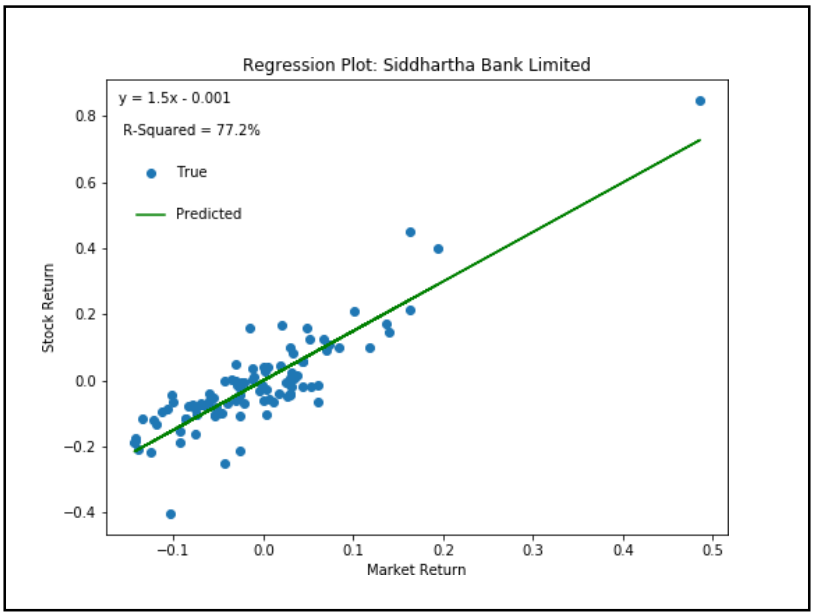


Figure 7

Regression plot of Global IME Bank Limited.

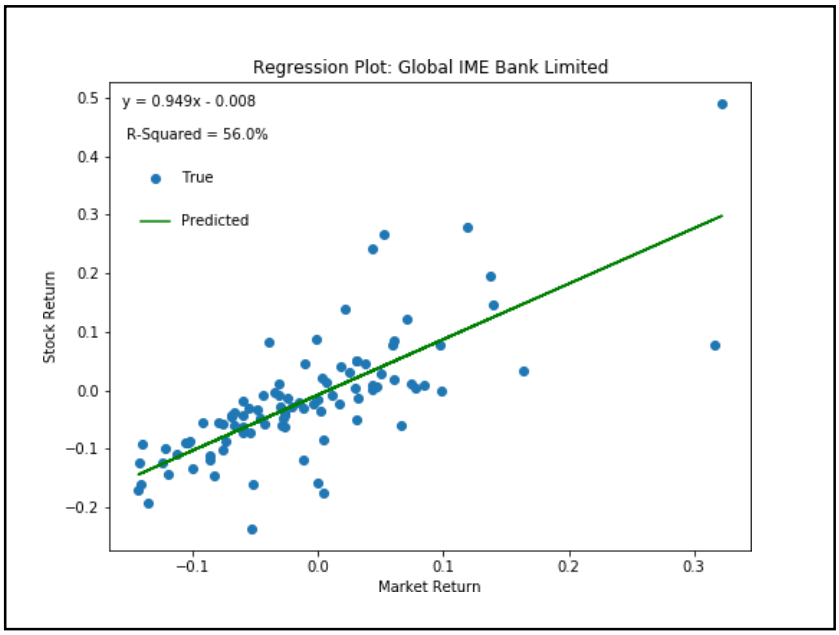


Figure 8

Regression plot of Nepal Bangladesh Bank Limited.

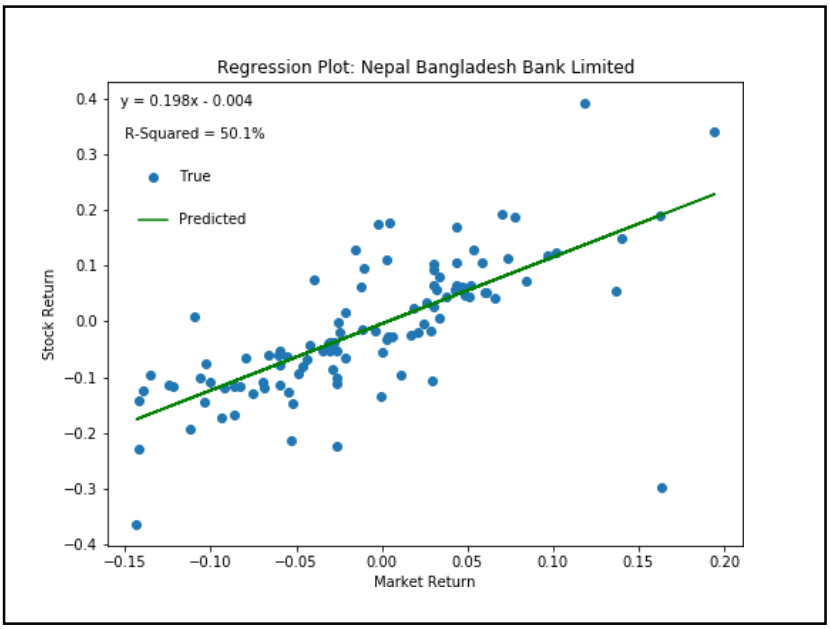


Figure 9

Regression plot of Sunrise Bank Limited.

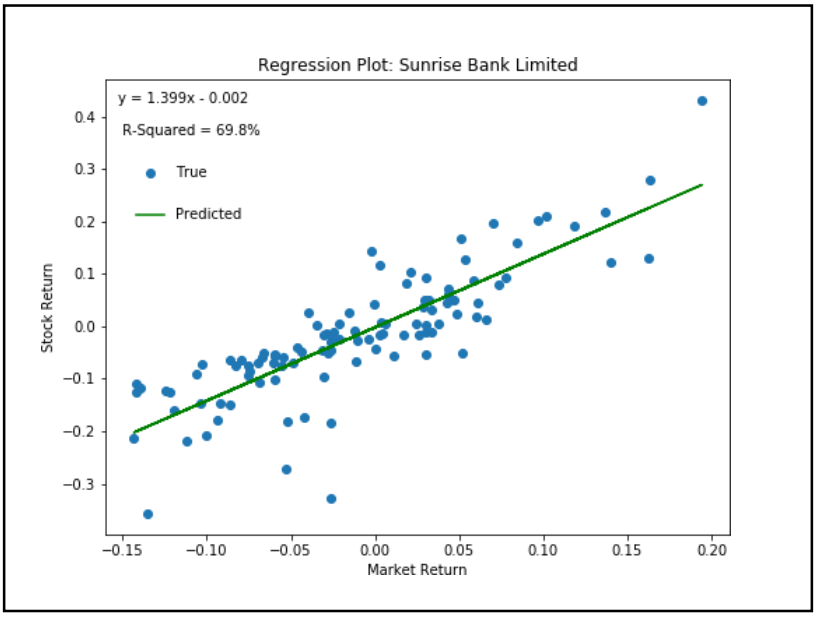


Figure 10

Regression plot of Sanima Bank Limited.

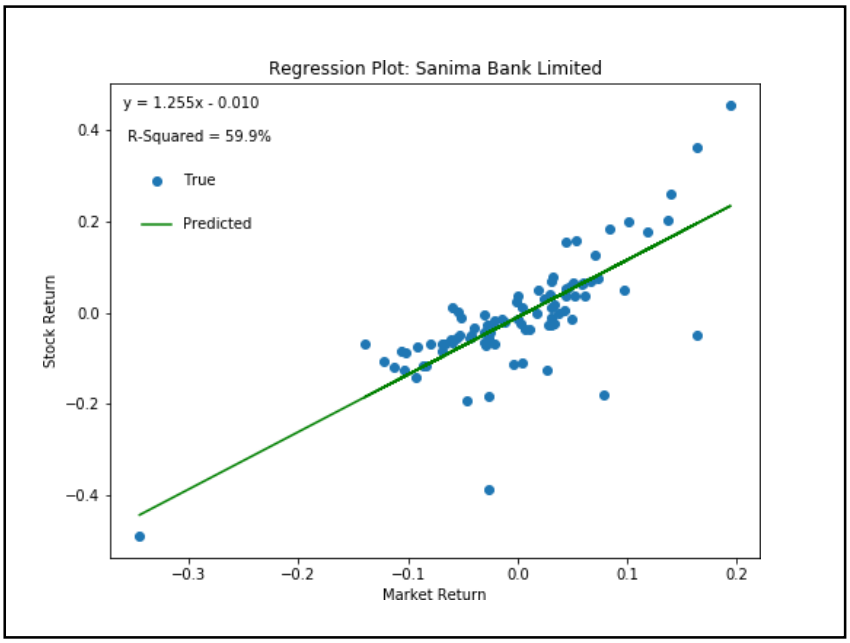


Figure 11

Regression plot of NIC Asia Bank Limited.

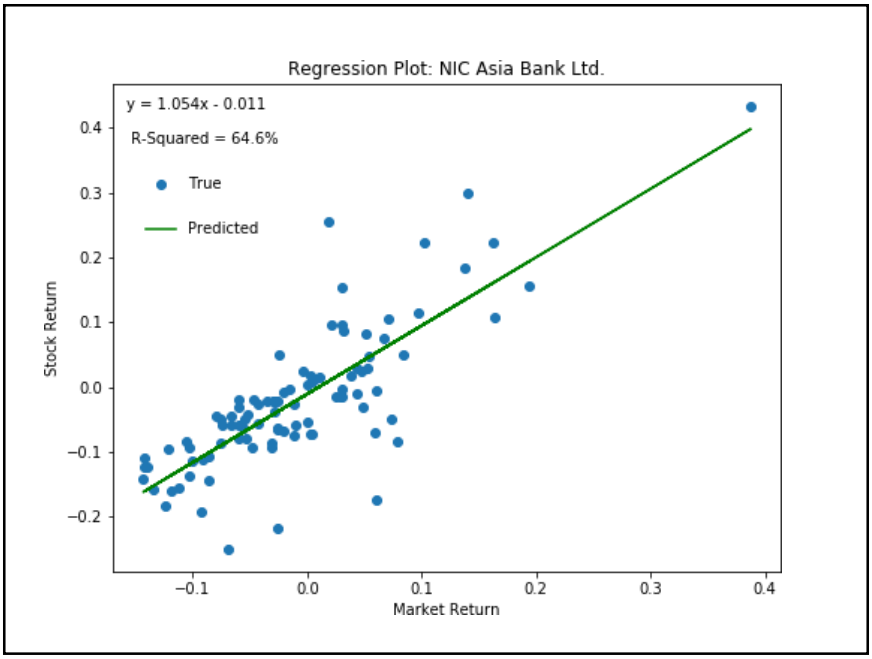


Figure 12

Regression plot of Prime Commercial Bank Limited.

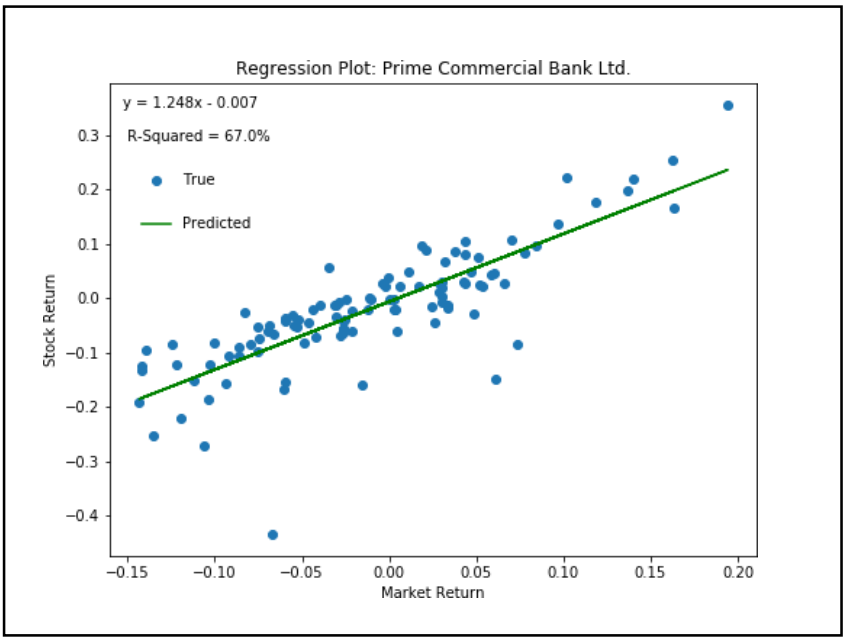


Figure 13

Regression plot of *Nepal Investment Bank Limited.*

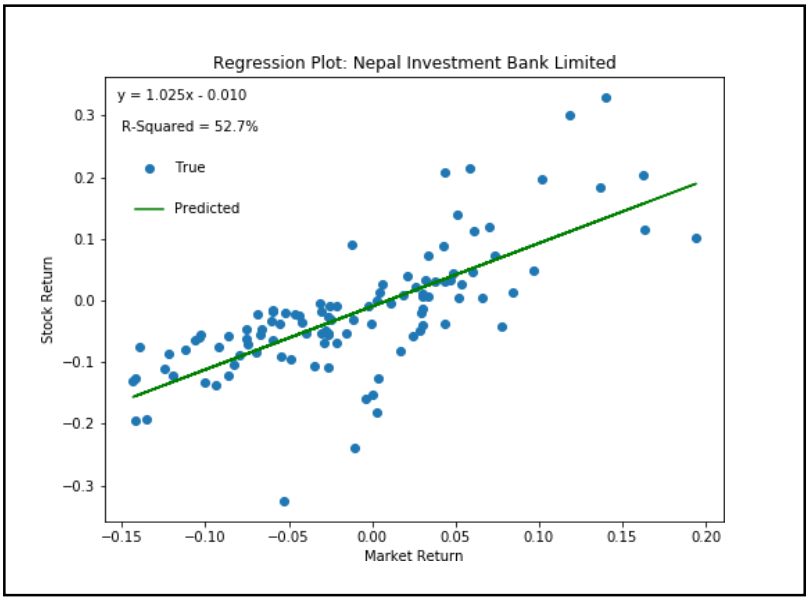


Figure 14

Regression plot of Himalayan Bank Limited.

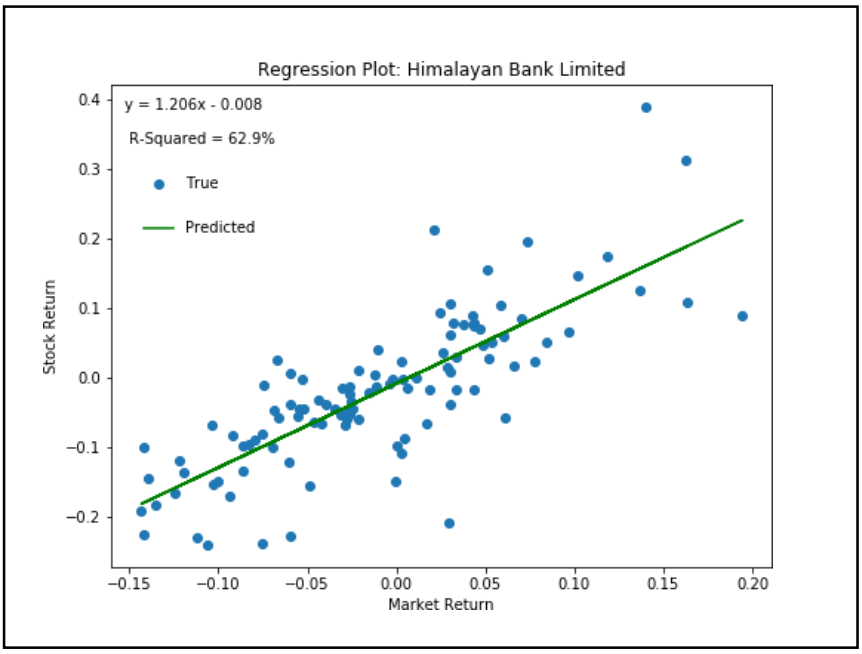


Figure 15

Regression plot of Nepal SBI Bank Limited.

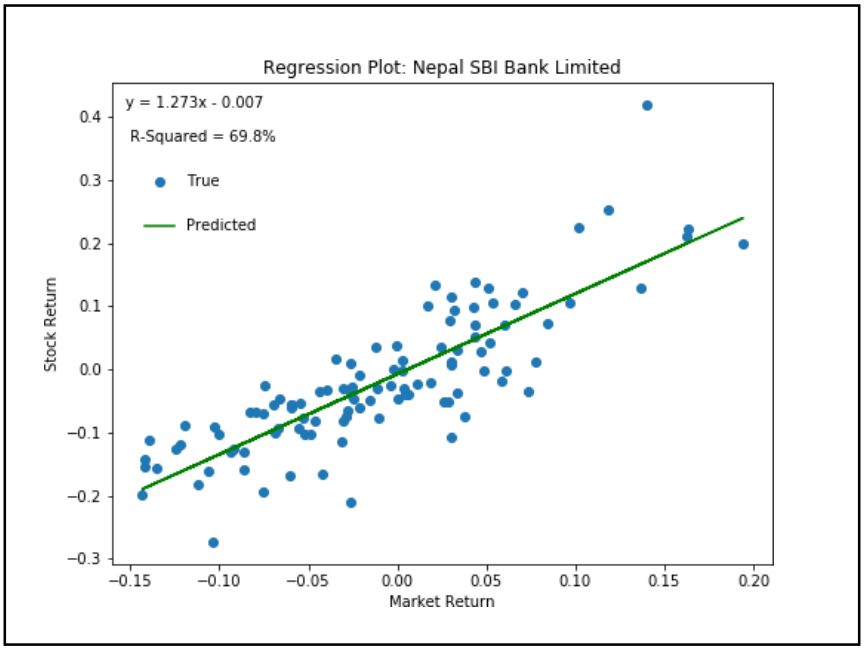


Figure 16

Regression plot of Kumari Bank Limited.

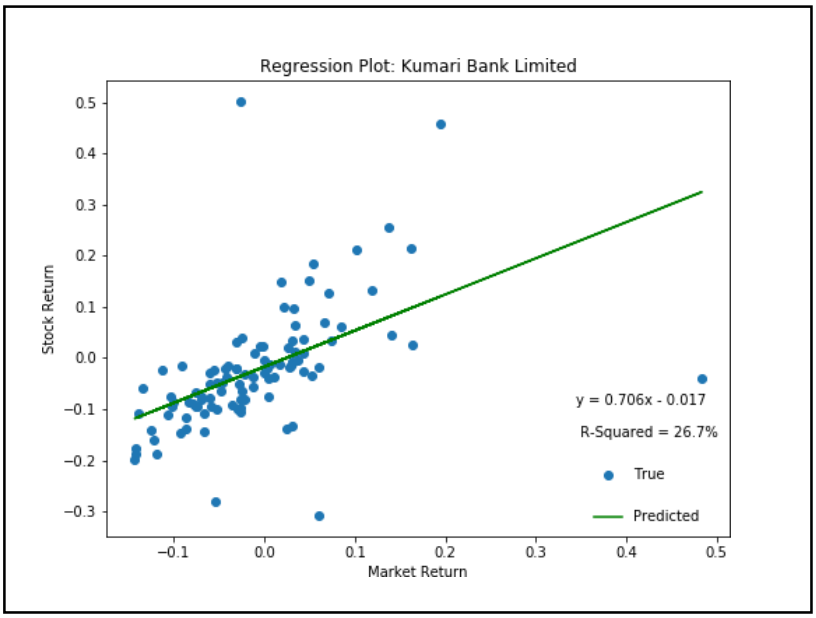


Figure 17

Regression plot of Laxmi Bank Limited.

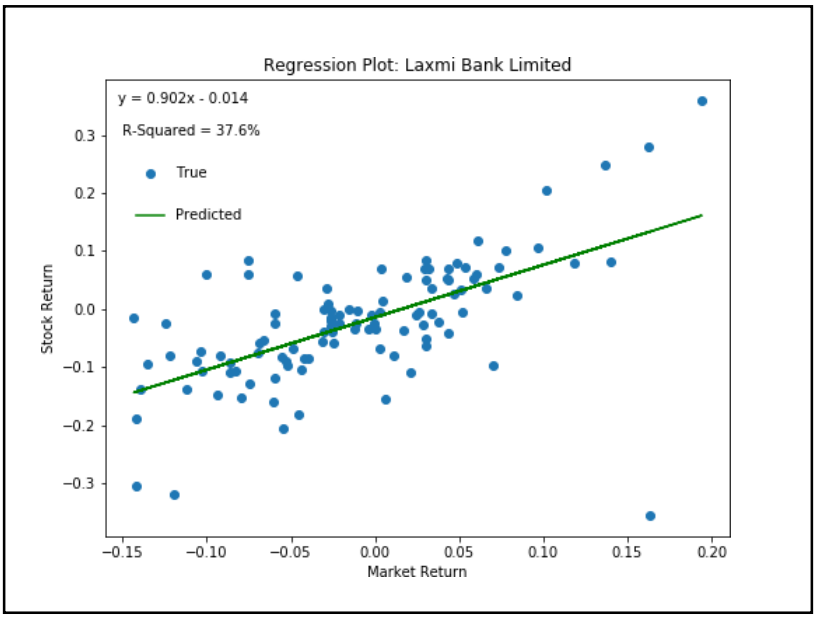


Figure 18

Regression plot of Everest Bank Limited.

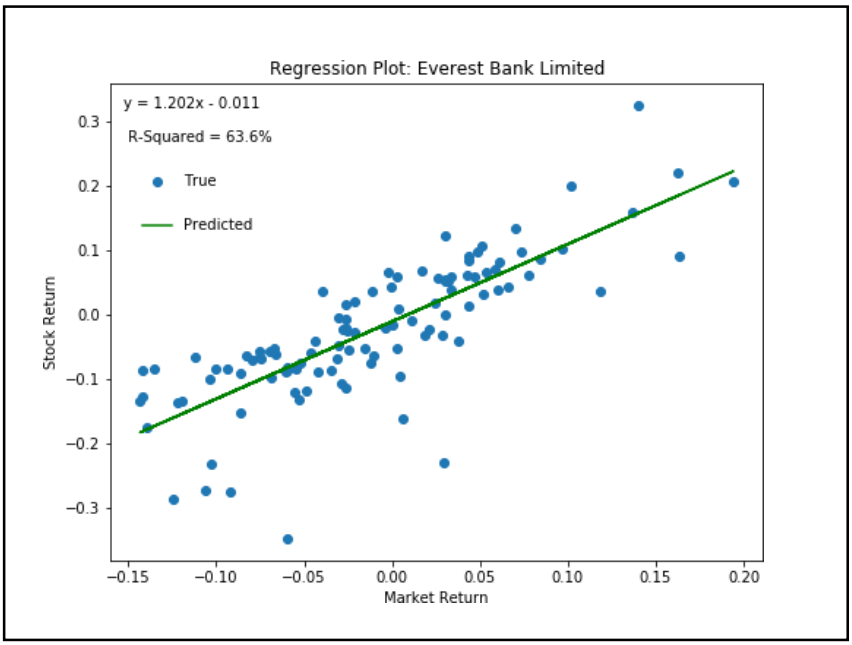


Figure 19

Regression plot of Nabil Bank Limited.

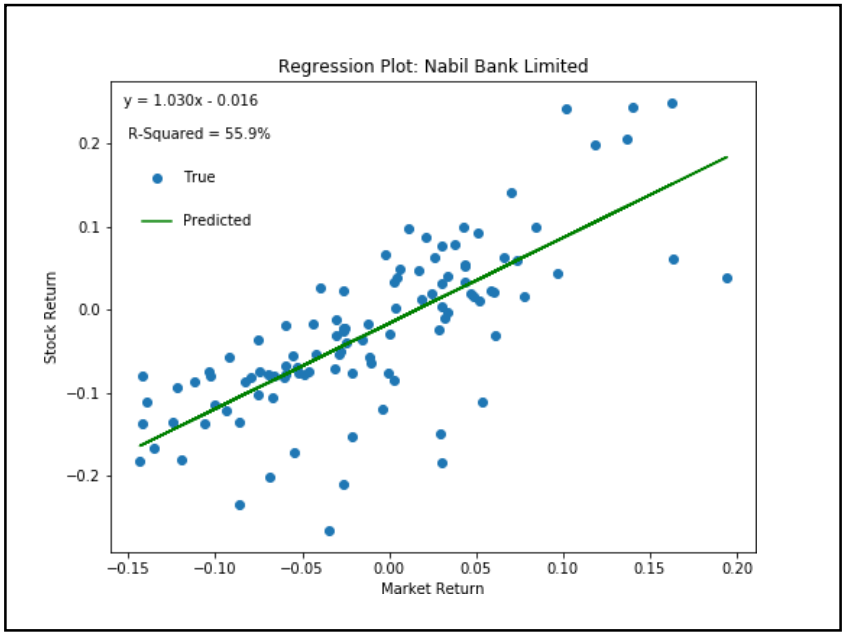


Figure 20

Regression plot of Bank of Kathmandu Limited.

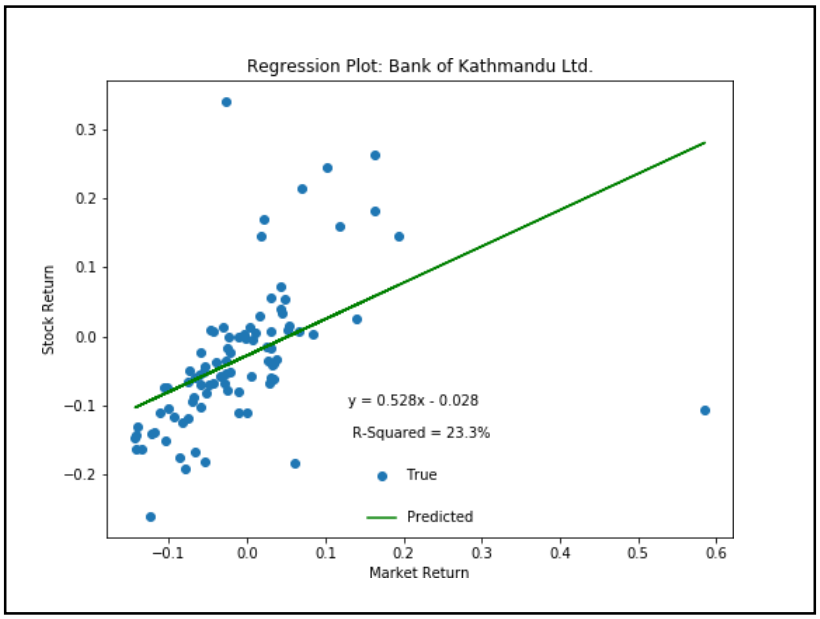
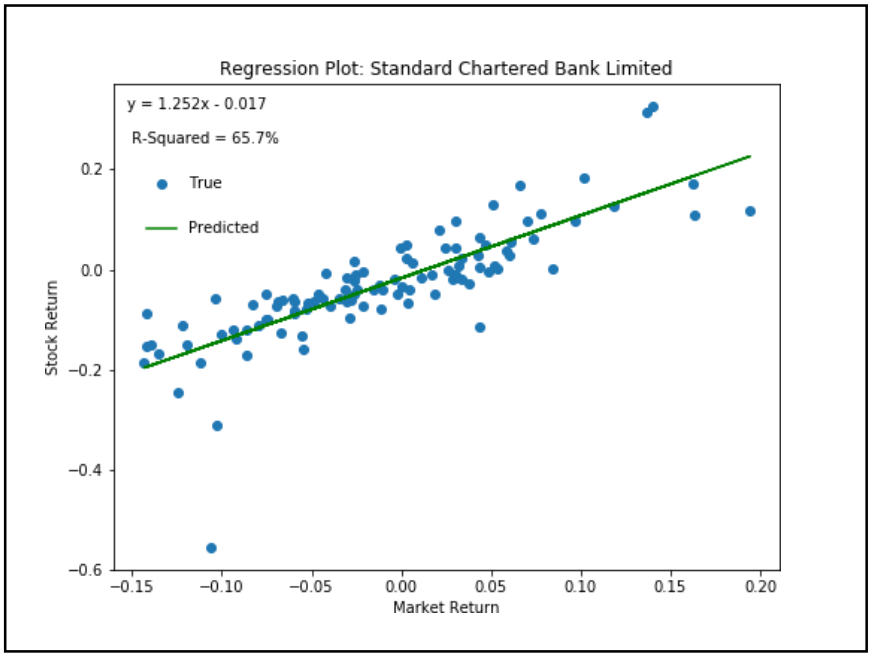


Figure 21

Regression plot of Standard Chartered Bank Limited.



APPENDIX IV: JUPYTER NOTEBOOK & PYTHON

```
#import necessary packages.
import pandas as pd
import os, glob
from datetime import datetime
# Load & Prepare the data.
data_dir = "years/"
all_csvs = os.listdir(data_dir)
df = pd.concat([pd.read_csv(data_dir+f) for f in all_csvs], ignore_index = True)
df[df["Date"]=="2010-06-31"]
```

Calculate Monthly Price and Stuffs:

```
df["year-month"] = df["Date"].apply(lambda row:row[0:7])
d = df.groupby(["year-month", "Traded Companies"])

df['Avg_Price']= df.groupby(["year-month", "Traded Companies"])['Closing Price'].transform('mean')
df['No_of_Transection']= df.groupby(["year-month", "Traded Companies"])['No. Of Transaction'].transform('sum')
final_share_data = df.drop_duplicates(subset=["year-month", "Traded Companies"])
final_share_data = final_share_data[["year-month", "Traded Companies", "Avg_Price", "No_of_Transection"]]
final_share_data["Count"] = final_share_data.groupby(["Traded Companies"])["year-month"].transform("count")
final_share_data.to_csv("clear-share-price.csv")
final_share_data.head(5)
```

No need to run this section, as modified nepse is already there.

```
nepse_data = pd.read_csv("nepse.csv")
```

```
def change_date_format(string_date):
        d = datetime.strptime(string_date, "%m/%d/%Y")
        formatted_date = d.strftime("%Y-%m-%d")
        return formatted_date


nepse_data["date"] = nepse_data["date"].apply(lambda row: change_date_format(row))
nepse_data.to_csv("modified-nepse.csv", index=False)
```

Create Index & Risk-Free Rate

```
# Put The Risk free rate and NEPSE Index on Individual Row: The row should be as such only one data point of a month
# should be there in the final dataframe.
nepse_data = pd.read_csv("modified-nepse.csv")
nepse_data["year-month"] = nepse_data["date"].apply(lambda row:row[0:7])
nepse_data['Avg_Index']= nepse_data.groupby(["year-month"])['value'].transform('mean')
nepse_final_monthly = nepse_data.drop_duplicates(subset=["year-month"])
nepse_final_monthly.drop(["date", "value"], axis=1, inplace=True)
nepse_final_monthly.to_csv("nepse-final-monthly.csv")
```

Merge Share Price, Risk Free Rate and NEPSE Index

```
# Read 91 days Risk Free rates.
risk_free = pd.read_csv("risk-free-modified.csv")
risk_free
merged_left = pd.merge(left=final_share_data,right=risk_free, how='left', left_on='year-month', right_on='year-month')
merged_with_nepse = pd.merge(left=merged_left,right=nepse_final_monthly, how='left', left_on='year-month', right_on='year-month')
merged_with_nepse.to_csv("processed-data.csv", index=False)
```

```
merged_with_nepse.sort_values(['year-month'], inplace = True, ascending=[True])

merged_with_nepse["rate"] = merged_with_nepse["rate"]/100

merged_with_nepse.head(5)
```

Calculate Stock Return & Market Return

```
#(merged_with_nepse.groupby('Traded Companies')['Avg_Price'].apply(pd.Series.pct_change))

merged_with_nepse["stock_return"] = (merged_with_nepse.groupby('Traded Companies')['Avg_Price'].apply(pd.Series.pct_change))

merged_with_nepse["market_return"] = (merged_with_nepse.groupby('Traded Companies')['Avg_Index'].apply(pd.Series.pct_change))

merged_with_nepse["excess_return_Y"] = merged_with_nepse["stock_return"] - merged_with_nepse["rate"]

merged_with_nepse["excess_market_return_X"] = merged_with_nepse["market_return"] - merged_with_nepse["rate"]

merged_with_nepse = merged_with_nepse.dropna(axis=0)

#merged_with_nepse.set_index(keys="year-month", inplace=True)

merged_with_nepse.head(5)
```

Data For 4.1 Panel A (During June 2010 to July 2019)

```
panelA = merged_with_nepse[merged_with_nepse["Traded Companies"].isin(listof_bank)]

panelA.drop_duplicates(subset=["market_return"], inplace=True)

panelA.to_csv("stock_return_PanelA.csv")
```

Data For Stock Return Panel (9x9) Table

```
panelB = merged_with_nepse[merged_with_nepse["Traded Companies"].isin(listof_bank)]

panelB.drop(columns=["No_of_Transection", "Count", "annual", "Avg_Index", "market_return", "excess_market_return_X", "Avg_Price", "rate", "stock_return"], inplace=True)

#panelB.to_csv("panelB_return.csv")
```

```
panelB.head(5)

panel_result = panelB.pivot_table('excess_return_Y', ['year-month'], 'Traded Companies')

panel_result.head(5)

panel_result.to_csv("panelB_return.csv")
```

Going Ahead With Ordinary Least Square

```
import statsmodels.api as sm

def regress(X, Y):

        X = sm.add_constant(X)

        model = sm.OLS(Y, X).fit()

        # removing the constant

        X = X[:,1]

        return model


# alpha, beta = models.params[0], models.params[1]

X = merged_with_nepse[merged_with_nepse["Traded Companies"] =='Standard Chartered Bank Limited']["excess_market_return_X"]

Y = merged_with_nepse[merged_with_nepse["Traded Companies"] =='Standard Chartered Bank Limited']["excess_return_Y"]

model = regress(X.values, Y.values)

print("Alpha: ", model.params[0], "Beta: ", model.params[1])

#print(dir(model), model.pvalues[1], model.tvalues[1], model.rsquared)

model.summary()
```

Visualize The Result

```
import matplotlib.pyplot as plt

plt.figure(figsize=(20, 10))

merged_with_nepse[merged_with_nepse["Traded Companies"] =='Everest Bank Limited']["stock_return"].plot()
```

```
merged_with_nepse[merged_with_nepse["Traded Companies"] =='Everest Bank Limited']["market_return"].plot()

plt.ylabel("Monthly Return Of Everest Vs. Market Return NEPSE")

plt.show()
```

Plot Regression Residual Plot

```
fig, ax = plt.subplots(figsize=(12, 8))

fig = sm.graphics.plot_ccpr(model, "x1", ax=ax)
```

Plot Regression Result For Annex (Individual Stock)

```
prstd, iv_l, iv_u = wls_prediction_std(model)


fig, ax = plt.subplots(figsize=(8,6))

X = X.values

Y = Y.values


#ax.plot(X, Y, 'o', label="Data")

ax.plot(X, Y, 'o', label="True")

ax.plot(X, model.fittedvalues, 'g-', label="Predicted")

#ax.plot(X, iv_u, 'r--')

#ax.plot(X, iv_l, 'r--')

legend = ax.legend(loc="best")

plt.legend(scatterpoints=1, frameon=False, labelspacing=2, title='y = 1.252x - 0.017\n\n R-Squared = 65.7%')


plt.xlabel('Market Return')

plt.ylabel('Stock Return')

plt.title("Regression Plot: Standard Chartered Bank Limited")

plt.savefig("graphs/standard.png")
```

Filter The Companies

```
# Choosing the list of banks for the study.
temp = df[df["Date"]=="2010-06-01"]
temp["Traded Companies"].unique()


listof_bank = ['Nepal SBI Bank Limited','Nabil Bank Limited','Laxmi Bank Limited', 'Siddhartha Bank Limited',
'Himalayan Bank Limited','NMB Bank Limited', 'Prabhu Bank Limited','Global IME Bank Limited',
'Lumbini Bank Limited','Nepal Bangladesh Bank Limited',
'Sunrise Bank Limited', 'Prime Commercial Bank Ltd.',
'Nepal Investment Bank Limited','Bank of Kathmandu Ltd.','Sanima Bank Limited', 'NIC Asia Bank Ltd.',
'Kumari Bank Limited','Everest Bank Limited','Standard Chartered Bank Limited' ]
len(listof_bank)
temp["Traded Companies"].unique()
```

Calculate Beta For Each Selected Stock

```
data = merged_with_nepse[merged_with_nepse["Traded Companies"].isin(listof_bank)]
data.to_csv("dataforsir.csv")
result = []
for i in range(len(listof_bank)):
bank_name = listof_bank[i]
bank_data = merged_with_nepse[merged_with_nepse["Traded Companies"] == bank_name]
X = bank_data["excess_market_return_X"]
Y = bank_data["excess_return_Y"]
model = regress(X.values, Y.values)
#model.pvalues[1], model.tvalues[1]
if model.pvalues[1]>0.05:
significance = "Not Significant"
else:
significance = "Significant"
```

```
result.append({"Traded Companies":bank_name, "Alpha": model.params[0], "Beta":model.params[1],
"T-value": model.tvalues[1], "P-value": model.pvalues[1], "Significance": significance,
"R-Squared":model.rsquared})


data_with_beta = pd.DataFrame(result)
data_with_beta["Beta_Rank"] = data_with_beta["Beta"].rank(ascending=False)
data_with_beta.to_csv("selected_banks_beta.csv")
data_with_beta.round(3)
```

Table 1:- Stock Returns' Mean and Standard Deviation

```
from scipy.stats import trim_mean, kurtosis
return_analysis = pd.DataFrame(columns=["Bank", "Count", "Mean", "Median", "TrMean", "St.Dev",
"SE Mean",
"Rank Mean", "Rank StDev"])
return_analysis = data
return_analysis["Mean"] = return_analysis.groupby(["Traded
Companies"])["stock_return"].transform("mean")
return_analysis["Median"] = return_analysis.groupby(["Traded
Companies"])["stock_return"].transform("median")


trimmed_mean = return_analysis.groupby(["Traded Companies"])["stock_return"].apply(trim_mean,
.1).reset_index(name='TrMean')
return_analysis["Std"] = return_analysis.groupby(["Traded
Companies"])["stock_return"].transform("std")
return_analysis["SE Mean"] = return_analysis.groupby(["Traded
Companies"])["stock_return"].transform("sem")
#return_analysis.groupby(["Traded Companies"])["stock_return"].apply(trim_mean, .1)
merged_with_tr_mean = pd.merge(left=return_analysis,right=trimmed_mean, how='left', left_on='Traded
Companies', right_on='Traded Companies')


merged_with_tr_mean.drop_duplicates(subset=["Traded Companies"], inplace=True)
table = merged_with_tr_mean.drop(["Avg_Price", "No_of_Transection", "rate", "annual", "Avg_Index",
"stock_return", "market_return", "excess_return_Y", "excess_market_return_X" ], axis=1)
```

```
# table.sort_values(by=["Mean"], inplace=True, ascending=False)
# table.reset_index()
table["Mean_Rank"] = table["Mean"].rank(ascending=False)
table["Std_Rank"] = table["Std"].rank()
table.sort_values(by=["Mean_Rank"], inplace=True, ascending=True)
#table.to_csv("returnanalysis.csv", index=False)
table
```

Create A Histogram of Data Distribution

```
# set up figure & axes
fig, axes = plt.subplots(nrows=1, ncols=1, sharex=True, sharey=True)
table.hist(column='Count', ax=axes)
# set title and axis labels
plt.suptitle('Data Distribution Of Observations Taken', x=0.5, y=1.05, ha='center', fontsize='xx-large')
fig.text(0.5, 0.04, 'No. Of Observation', ha='center')
fig.text(0.04, 0.5, 'No. Of Banks', va='center', rotation='vertical')
```

Table 2:- Individual Stock Betas and Other Variables

```
beta_table = pd.merge(left=data_with_beta,right=table, how='left', left_on='Traded Companies',
right_on='Traded Companies')
beta_table.drop(["Median", "SE Mean", "TrMean", "Mean_Rank", "Std_Rank"], axis=1, inplace=True)
beta_table.to_csv("beta_result_table_2.csv")
beta_table
```

Plot Graph Of Overall Regression- Risk(std) Vs. Return

```
beta_table.sort_values(by=["Mean"], axis=0, inplace=True)
X = beta_table["Std"]
Y = beta_table["Mean"]
model = regress(X.values, Y.values)
fig, ax = plt.subplots(figsize=(12, 8))
```

```
fig = sm.graphics.plot_ccpr(model, "x1", ax=ax)
print(model.mse_total)
model.summary()
from statsmodels.sandbox.regression.predstd import wls_prediction_std
from matplotlib.legend import Legend
import numpy as np

prstd, iv_l, iv_u = wls_prediction_std(model)

fig, ax = plt.subplots(figsize=(8,6))
X = beta_table["Std"]
Y = beta_table["Mean"]

#ax.plot(X, Y, 'o', label="Data")
ax.plot(X, Y, 'o', label="True")
ax.plot(X, model.fittedvalues, 'g-', label="Predicted")
#ax.plot(X, iv_u, 'r--')
#ax.plot(X, iv_l, 'r--')
legend = ax.legend(loc="best")
plt.legend(scatterpoints=1, frameon=False, labelspacing=2, title='y = 0.2652x - 0.0269\n\n R-Squared = 40.1%')

plt.xlabel('Risk σ')
plt.ylabel('Return')
plt.title("Return - Risk ( σ)")
plt.savefig("return-risk.png")
```

Plot The Graph (Market Risk- Beta vs Return)

```
beta_table.sort_values(by=["Mean"], axis=0, inplace=True)
X = beta_table["Beta"]
```

```
Y = beta_table["Mean"]
model = regress(X.values, Y.values)
fig, ax = plt.subplots(figsize=(12, 8))
fig = sm.graphics.plot_ccpr(model, "x1", ax=ax)
print(model.mse_total)
model.summary()
from statsmodels.sandbox.regression.predstd import wls_prediction_std
from matplotlib.legend import Legend
import numpy as np

prstd, iv_l, iv_u = wls_prediction_std(model)

fig, ax = plt.subplots(figsize=(8,6))
X = beta_table["Beta"]
Y = beta_table["Mean"]

#ax.plot(X, Y, 'o', label="Data")
ax.plot(X, Y, 'b-', label="True")
ax.plot(X, model.fittedvalues, 'g-', label="Predicted")
#ax.plot(X, iv_u, 'r--')
#ax.plot(X, iv_l, 'r--')
legend = ax.legend(loc="best")
plt.legend(scatterpoints=1, frameon=False, labelspacing=1, title='y = 0.010x - 0.0091\n\n R-Squared = 18.7%')

plt.xlabel('Market Risk β')
plt.ylabel('Return')
plt.title("Return Vs Market Risk (β)")
# plot
```

```
plt.scatter(model.model.exog[:,1], model.resid)
plt.show()
# Create the data of 19 banks.
data = df[df["Traded Companies"].isin(listof_bank)]
data.to_csv("intrested_list.csv")
```