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A comparative study of Fama and French Three and Five Factor Models in Commercial Bank at PSX as an Emerging Capital Market

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Abstract:

This study investigates FF3F Model (Fama and French, 1992, 1993) and FF5F (Fama and French, 2015) both in public and private sectors commercial banks. The study uses daily stock prices data for the period from January 2011a to 2020 retrieved from Websites of Pakistan Stock Exchange (PSX) and SCStrade.com, accounting data, from PSX and bank companies' websites and risk-free rate, from SBP website. Following Fama and French (2015, 2017) methodology, time series GRS (Gibbson, Ross, and Shanken) regression was applied. This test was applied in two steps; firstly, OLS was run and the then Wald test was applied to test intercept terms whether they are jointly zero. The study finds that in commercial banks at PSX, both Fama and French model are rejected in PSX. When compared which model is better than other, the result was interminable. Shareholder, investors and stakeholders desiring to invest funds in commercial banks must carry out thorough analysis in order to understand the explanation and forecasting earnings in commercial banks listed at PSX.

Keywords- Commercial Bank, PSX, Emerging Capital market

Introduction:

The robust and efficient banking system is necessary for an economy for generating investment and economic growth in a country. In Pakistan, the financial sector is an integration, diversified and a well-developed consisting of Banks, Development Finance Institutions, Microfinance Banks, Investment Banks, Leasing Companies, Modaraba Companies, Housing Finance, Mutual Funds, Insurance Companies, Exchange Companies and Venture Capital. Commercial banks are domestic banks consisting of both public and private sectors banks. Commercial banks run their businesses both on conventional and Islamic banking systems having diverse objectives, operational processes, products and also have different regulatory systems. The State Bank of Pakistan, Financial Statement Analysis, various issues.

The reliable and audited information of commercial banks is therefore of very important to shareholders, investors and other stakeholders to make informed pricing and investment decisions. They are mainly concerned with financial indicators reflecting performance of banks and about their future perspective. The 'asset pricing' is based on risk and return and based on fundamental of information of a bank. The intrinsic value thus obtained is used in undertaking investment activities. It is to point out that it is highly controversial topic in finance. The insight of quantification of risk was credited to Markowitz who extended his Modern Portfolio Theory in 1952 and expanded the same in1959 (Markowitz, 1952, 1959). This theory measures portfolio return by applying weights and mean; risk by applying weights and variance (standard deviation) of return, and the interactive risk between financial assets by applying correlation coefficient using weights, and covariances.(Fabozzi, Gupta and Markowitz, 2002; Reilly and Brown, 2012). That is why this theory is called mean-variance theory. Before this was theory was introduced, the decisions of investment were made on the basis of maximization of return. This theory also leads to the concept of diversification. It means that if assets with negative correlation coefficients are added, risk declines on the returns it intends to earn.

The Capital Asset Pricing Model (henceforth, the CAPM) was an extension of the mean-variance theory by Sharpe (1964), Lintner (1965) and Mossin (1966) and was a milestone of creation of asset pricing models. This model emerged as general equilibrium models in the literature of finance (Acaravci and Karaomer, 2018). Thus, the original CAPM is founded on static risk-return methodology of and assuming market is in equilibrium. (Steinbach, 2001). In contrast to mean-variance theory, being a normative theory, the CAPM is a positive theory which assumed behavior of investors. This model also decomposes the risk as: (i) systematic risk which is market risk, and (ii) unsystematic risk, independent of the market forces, can be rduced and eliminated with addition of more securities considering of correlation coefficient among securities. (Reilly and Brown, 2012). As the CAPM is an equilibrium pricing model, the market prices reflect asset's true economic value. Although the CAPM is based on unrealistic assumptions, yet such simplification is sometimes necessary to develop useful models. (Mullins, 1982, Haugen, 1997). The weaknesses of the CAPM, paved the way for the Fama and French (1992/3) three-factor model improving ability to effectively forecast stock market returns (Fama and French, 2015; Avramov and Chordia, 2006). An investor is based on his investment decision on his exposure to risk and return its investment will generate in future. Risk and return characteristics is applicable both to individual security and portfolio equally. Continued research in CAPM also developed different versions of the CAPM, such as the Inter-temporal CAPM by Merton (1973) and Conditional CAPM (CCAPM) by Breeder (1979) models. Chen (2003) tested CCAMP in Taiwan stock exchange and found that CCAPM was unable to explain the consumption beta than the market beta in Taiwan market (Chen, 2003).

The CAPM dominated the field in finance for 15 years (Haugen, 1997). Stephen Rose (1976) criticized the CAPM as to : (i) its empirical testing, being an untestable theory; (ii) the use of beta as a risk measure; (iii) use of SML for measuring portfolio performance as benchmark. He gave an alternative model called 'arbitrage pricing theory (APT)' in 1976.The APT was also founded on market equilibrium. Further research in the CAPM, the model was questioned on the market anomalies and it came into light that CAPM beta does not explain stock's multi- dimensional

aspect. Basu (1977) exhibited that the low P/E ratio stocks beat high P/E stocks. Banz (1981) found that securities with low-market capitalization beat the large-market capitalization securities. Fama and French (1992) showed that value securities tend to produce more risk-adjusted return than growth securities.

As the APT does not precise the number of risk factors for determination of the return of a security, thus this weakness of the theory paved the way for development of different versions of multifactor models with more risk factors, such as, Fama and French Three Factor Model (FF3F) model, Carhart four Factor Model, and Fama and French Five Factor (FF5F) Model. The researchers are working on developing a model that specifies the factors for explaining the return and forecasting in the APT.

Research Problem:

Empirical research shows that the CAPM is unable to predict the return of an asset correctly and unable to capture multi-dimensional risk. Ross (1976 noticing weaknesses in CAPM introduced Arbitrage Pricing Theory (APT) with Multifactor models as an alternative model. So far there is no consensus on factors which fully explain the return and its forecasting process. Fama and French developed three-factor model (1993) included factors, such as, the size and Book Value/Market Value (BV/MV) which are derived from theory of corporate finance and empirical studies also support their relationship to stock market pricing and in returns predictive process. This FF3Fmodel also specify three factors which explain the return process in stock markets to a reasonable extend but not fully. Maroney & Protopapadakis (2002) tested the FF3F Model on the stock markets of Australia, Canada, Germany, France, Japan, the UK and the US and concluded that the size and Book Value/Market Value (BV/MV) effects are of international in character. It is to point out that the multifactor models are yet to be crystalized for factors to be included which fully explain the return process. This point was agitating in the minds of Fama and French and they developed a five factor model in 2015 (Fama and French 2015) by adding two new factors such as, profitability and investment factors derived from theory of corporate finance to their three-factor model. Though these models are criticized and contained some weaknesses but these models explain the return of assets and portfolio better than the CAPM.

The problem is that shareholders, investors and other stakeholders wish to make better investment decisions in the market. The Investment decisions are made on return and risk. These models explain return and risk of an asset adequately which is very useful for the users of these models in investment decision making. Applicability and efficacy of Fama and French models have not yet been evaluated in Pakistani market widely. Thus, this study evaluates these model in commercial banks on which not much work has not been done in PSX. Thus, this study evaluates Fama and French three and five factors models in PSX commercial banks. The results of this study will assist shareholders, investors and other stakeholders whether these models are suitable or not in explaining the return of an asset in PSX and particularly in banks. Furthermore, the results of the study will contribute as valuable input to the body of knowledge of the multiple factor models.

Research Objective:

This study should provide answers to the following questions:

1. Can FF3F asset pricing model with market premium, size, and book-to-market ratio risk factors explain average returns in commercial banks listed at PSX?
2. Can FF5F asset pricing model using market premium, size, book-to-market ratio, profitability and investment risk factors explain average returns in commercial banks listed at PSX?
3. Which model, FF3F model or FF5F asset pricing model, explain average returns in commercial banks sector listed at PSX?

Scope of Research:

The study is based on the statistical data of commercial banks, both operating on conventional and Islamic systems, listed on PSX from January 2011 to December 2020. The findings of the study are relevant to commercial banks listed on PSX only. The findings, if applied elsewhere, must be considered with special care keeping limitations in view.

Significance of the study

Contribution to Theory

This study evaluates FF3F and FF5F factors models, derived from theory of corporate finance. The empirical studies demonstrate relationship of these factors to stock market pricing and returns predictive process. The results of Fama and French model in PSX, being an emerging market, may be useful for investing decision in commercial banks and return explanation and restore confidence of the shareholders, investors and stakeholders in investment activities.

Contribution to Practice

1. The investors, both Institutional, such as, mutual funds, pension funds (both public and private), provident funds, and Units funds, insurance companies, modarabas, brokerage houses etc. will be facilitated, in putting in their hard earned money in the assets traded on Pakistan stock Exchange and will enhance their confidence and decision making process in commercial banks.
2. The management will use the finding of study on these models as an alternative in determining the cost of equity to be applied in capital budgeting process.
3. The CAPM, by providing return, will assists in asset valuation models in determining the intrinsic value of the security (ies) particularly in commercial banks.
4. The banks, in extending financing to public utilities, can set an authorized rate of return in determining their long-term capital requirements and in financing investment in physical plant and assets (asset base) and replacement and expansion of their facilities to fulfill their public utility service obligation.

Limitation of research

This study focuses on evaluation of FF3F and FF5F factors models on commercial banks and will enhance understanding on factors which contribute to predictive power of multifactor

model in expected return of the financial assets and portfolios created with commercial bank and also by others using financial assets of banks.

The findings are based on the following:

1. The factors included in above models effectively measure the return in the PSX or not; in this way the findings of this study will set the direction of the research for future.
2. (ii) The linearity assumption of the multiple regression that the connection between the assets return and the related explanatory variables used in the study and assumptions of the normality of distribution of return, multicolinearity between explanatory variables and heteroscedasticity of constancy of variance of error term.
3. This study has been conducted in commercial banks listed at Pakistan Stock Exchange which is relatively a small and risky emerging market. The findings may be compared with other studies keeping this point in view.
4. The findings of the study should therefore be generalized or compared keeping above mentioned limitations in view.

Gaps to be bridged:

The study of literature brings points out the following gap, these are applicable generally and equally applicable to commercial bank:

1. The identification of exact number of factors to capture the return of a security. (Ragheb, Sakr, and Gebeily, 2016).
2. To increase meaning, factors are to be identified as locally (within the economy), regionally (within some economic region) or globally (using all world's stocks). (Ragheb, Sakr, and Gebeily, 2016).
3. Consistency of factors and robustness of factors is to be assessed across the time and in each market universally.
4. Further investigation of an alternative investment for inter-temporal hedging is to be found out caring the changes for equity portfolios as inconsistent pricing existed in the ICAPM framework. Such hedging investments are also required to hedge risk in the emerging market risk. (Xiao and Zhao, 2013).

5. Imperfections of CAPM and APT models demands a more advanced equilibrium models of asset valuation is to be developed to eliminate the imperfection of the CAPM and APT models in future. (Leković, and Stanišić, 2018).

6. Active management of funds, using are large factors, produced large price errors due to stochastic discount factor (SDF) for arbitrage over derivative-like payoffs. This situation deviates the APT principle as if market has no arbitrage opportunities. A further research is needed on this aspect. (Huberman and Wang, 2005).

7. The APT assumes a linear relationship amongst factors. If factors have non-linear pricing relationships amongst them factors, how accurate predictions of return is to be made. This aspect an important direction in future research. (Cagnetti, nd, Malhottra, 2010).

Literature Review:

Fama and French models were extensively be tested on samples of US and European non-financial firms over several time periods. Fidanza and Morresi (2015). The review of literature also highlights that work on these models is not extensively conducted by other regions. Empirical studies conducted on financial and banking sector related to risk exposure, impact of liberalization and deregulation, intermediation process, diversification of revenue, etc., which are not the topics of this study. The literature on the topic of the CAPM and APT models is relatively poor on commercial banks and particularly on five factor model in Pakistani Markets. This requires more work is to done in this area.

The practitioners still prefer to use the CAPM in asset returns explanation and return prediction and asset selections for investment. (Leković, and Stanišić, 2018) with other methods. FF3F and and FF5F asset pricing models are evolved from CAPM. The study covers literature both on CAPM and FF3F and FF5F asset pricing models which mainly conducted in commercial banks, banking and financial sectors are presented here:

Capital Asset Pricing Model (CAPM):

Zeng, Yong, Treepongkaruna, and Faff (2014) conducted study in US publicly listed banks as to the banking risk premium explains the returns pursuing the CAPM and the FF3F model. They used bank size in constructing portfolio that is long (short) big (small) banks. They found a positive premium for banks and their analysis supports a risk-based interpretation, since the premium is priced. They show a slight preference of CAPM by banks over the Fama-French model with banks Kayani, Hussain, Nawaz (2020) studied CAPM on Pakistani 20 banks for the period of 2006-2017 on which 'pooled based yearly time series was applied and found that CAPM reflects the returns more precisely.

Wijaya and Ferrari (2020) applied CAPM to segregate the efficient and inefficient banks out of 40 banks isted at the Indonesia Stock Exchange (IDX) for the period of August 2016 - July 2018, using purposive sampling method. The study found that, on the basis CAPM, the 31 banks securities were grouped as efficient and 9, as inefficient bank securities out of 40 securities selected from banking sector. The 31efficient banks securities were, being above zero average rate of returns and the 9 inefficient bank securities werebeing with below zero average rate of returns.

Huy etal.(2021) studied beta of CAPM for evaluating market risk of seven big banks of Vietnam for which they used pre-low and post-low inflation data during the period 2011-2010 and found that post low inflation period weighted CAPM beta higher than 1, suggested that banks needed to be prepared to manage risk better (and bring it to 1).

Fama and French Three factor (FF3F) model:

Rehman and Baten (2006) examined FF3F model of CAPM in Bangladesh market applying beta, book/m value and size (market capitalization and sales) and found that the empirical investigation strongly support the three-factor model. While assessing time impact, they found that the stock return varies with time and have significant time impact and the year impact significant in Bangladesh market. The variables have significant relationship with stock return and active. round.

Rahman (2010) also studied FF3F CAPM in commercial banks (both for the Islamic bank and conventional banks) taking five risk exposures, such as, market, interest rates, exchange rates, total and unsystematic risk exposures. Researcher found: firstly, different determinants for different types of risk exposures; secondly, the Islamic bank have lower market risk exposure than for conventional banks; thirdly, the bank merger showed reduction in the interest rate risk, total risk, and unsystematic risk exposures.Hamid, Hanif, Saif- ul- Malook and Wasimullah (2012) investigated the efficacy of FF3F model in 20 banks listed at PSX (previously Karachi Stock Exchange) using monthly data of 20 banks from January 2006 to December 2010 and found that the FF3F model explained the variations in returns.

Fidanza and Morresi (2015) tested the FF3F model (Fama and French, 1993) in financial industry of European banks over sample of several time periods using size and book-to-market ratio, being the sources of un-diversifiable risks, as risk premiums for the expected returns estimation. They found that (i) S/H -B/M banks were to be riskier; smaller banks are not systemically important; High-B/M banks being unprofitable and without growth opportunities, are close to financial distress. The size premium, value premium and market risk premium help explain time-series changes in stock returns. *The results of some studies* conducted on financial industry were mixed as to the size and the book-to-market ratio in explaining stock returns.

Chandra, Teddy. (2015) conducted the study on FF3F and CAPM in 29 banks listed at Indonesian in their role in predicting the stock return and found that CAPM is acceptable but the FF3F Model cannot fully be used in Indonesian market. It was noted that stock returns are influenced by excess market return and firm size. not3ed while book to market equity does not show any significant influence.

Dash (2019) examined theFF3F model in nine large-cap bank stocks listed at the National Stock Exchange of for the period was from April 1, 2008 to march 31, 2016 and noted significant adverse impact of the Book-to-Market(B/M) ratio on stock mean returns, and impact of beta and size was insignificant. These results are quite puzzling with the previous studies as asserting that stocks with high B/M ratio tend to have higher returns than stocks with low B/M ratio; however, the finding do conform partially to the literature of the three-factor model.

Fama and French Five factor(FF5F) model:

This section discusses studies carried out in FF5F factor model other bank related factors and models. Schuermann and Stiroh (2006) compared one-factor model to a nine-factor model

including the FF5F factors model with factors particularly relevant to banks such as interest and credit variables of U.S. banks from 1997 to 2005 and found that the market factor explained the bank returns, followed by the Fama-French factors and the broadest model contains important hidden factors. The banks' returns are relatively well predicted with standard risk factors as compared to large firms in other sectors. Though both the residual correlation and degree of factor loading agreement was not particularly higher The outcome guide the public policymakers seeking to quantify those shared bank exposures that create systemic risk and to portfolio managers seeking to devise optimal diversification strategies.

Adrian, Friedman, and Muir (2015) proposed a five-factor model adding ROE factor) and the spread between the financial sector and the market return in FF3F model for doubtful financial sector. They found that the total expected return to financial sector equities was below zero with total financial sector ROE, which is doubtful, as ROE is commonly used as a measure of the cost of capital in the financial sector.

Gharaibeh and Al-Qudah (2020) studied FF5F model on stocks of 2 Islamic and 13 commercial banks listed at the Amman Stock Exchange (ASE) from 2006 to 2018 and they found that value and profitability factors were relevant in predicting he expected return in Jordanian banks stocks these two factors provide the highest cumulative returns amongst five factors; on the other hand, the investment CMA and size SMB factors contribute still around zero cumulative returns. The market factor contributes the least negative cumulative returns. Value and investment factors are highly correlated which means that banks with a high book to market value become banks with a conservative investment strategy. Thus, FF5F model is the can be selected as constructing an investment portfolio, especially between the factors of value and profitability.

Methodology:

Two methodologies are used to analyze the Asset pricing models, that is: (i) time-series regression, and/or (ii) cross-sectional regression. (Lozano, 2009). Fama and French (2015, 2017) adopted time series regression methodology. Thus, this study uses time series regression approach. Time-series regression is focused on: (i) the intercept, and (ii) the betas of the risk factors. The excess returns of the test portfolios are regressed on the risk factors to estimate these parameters using the following expression:

$$R_{it} - R_{ft} = \alpha i + \sum_{k=1}^{k} \beta ik \; 'f_{kt} + \varepsilon_{it}, \quad t=1, 2\ldots T, \; i=1, 2\ldots N \qquad (3.1)$$

Where αi is the intercepts, β_{ik} , is the factor slopes, and fkt is the risk factors of FF3F and FF5F. The expression 3.1 is run for each asset i over the time period t, to get estimates of the intercepts and the slope factor . However, to get estimates of each risk factor, Cochrane (2001) advocated using the sample mean of each risk factor. Specifically, the estimate of the market factor is taken as the average return of the market portfolio in excess of the risk-free rate over the sample period as follows:

$$E(\lambda_M) = R_M - R_f \quad (3.2)$$

The GRS Regression:

The GRS test, developed by Gibbson, Ross and Shanken (1989), measures the mean-variance efficiency between a left-hand-side and right-hand-side portfolio. The GRS test is:

$$= \frac{T}{N} \text{ x } \frac{T-N-L}{T-l-1} \text{ x } \frac{\hat{\alpha}\, x\, \Sigma'^{-1}\, x\, \hat{\alpha}}{1+\mu' x\, \Omega'\hat{}-1 x \mu'} \sim F_{N,\ T\text{-}N\text{-}L} \quad (3.3)$$

Where T represents the number of observation, N, is the number of portfolios, L is the number of factors, and Ω is the variance-covariance matrix of the factors. The GRS test rejects the asset pricing model if the statistic is greater than the critical value.

The GRS test, if a model fully explains the sample return variation, determines that the alpha values from individual model regressions are jointly non-significant. The main numerator is '$\boldsymbol{\alpha' x\ \Sigma'^{-1} x\ \alpha'}$', which is the difference between the 'max square Sharpe ratio' one can construct with the combination of the left-hand-side (LHS) and right-hand-side (RHS) returns, and the max one can construct with only RHS factor returns (Fama-French, 2016). Thus, as intercepts from individual regressions approach zero, the GRS statistic will also approach zero. A model with a higher number of explanatory variables will produce a more efficient optimal RHS portfolio, which leads to a larger denominator in the GRS equation. The larger denominator acts as leverage for the numerator, and thus produce higher alpha values compared to a model with less RHS factors. For this reason, the GRS results are interpreted with caution and considering average absolute alpha values for model comparison purposes.

Data Analysis and Results:

Asset pricing models measures the returns considering the risk associate with it. Equity prices are used to determine the return on the basis of continuously compounding basis. Stock market price of an asset is based on overall performance of a bank and it decomposes the risk into systematic and unsystematic or banking company specific risk. The information is useful both for shareholders and investor in deciding or choosing an asset for investment. Equity prices are forward-looking and supports investment activity. This study covers twenty commercial banks listed on Pakistan Stock Exchange (PSX).

Research Questions

This study should provide answers to the following questions:

1. Can FF3F asset pricing model using market premium, size, and book-to-market ratio risk factors explain average returns in commercial banks listed at PSX?
2. Can FF5F asset pricing model using market premium, size, book-to-market ratio, profitability and investment risk factors explain average returns in commercial banks listed at PSX?
3. Which model, FF3F model or FF5F asset pricing model, explain average returns in commercial banks sector listed at PSX?
4. .2 Hypotheses and testing Methods

5. This paper assesses the performance of FF3F and FF5F models on sample data taken from Pakistan Stock Exchange (PSX). If a model completely explains expected returns, the intercept (alpha) terms should not be significantly different from zero.
    i. Hypotheses
6. The first hypothesis is:
    a. H0: The regression intercepts (alphas) obtained regarding FF3F model are jointly not significantly different from zero in commercial banks listed at PSX.
    b. H1: The regression intercepts (alphas) obtained regarding FF3F model are significantly different from zero in commercial banks listed at PSX.
7. The second hypothesis is:
    a. H0: The regression intercepts (alphas) obtained regarding FF5F are jointly not significantly different from zero in commercial banks listed at PSX.
    b. H1: The regression intercepts (alphas) obtained regarding FF5F are jointly not significantly different from zero in commercial banks listed at PSX.
8. The third hypothesis is:
    a. H0: FF3F model explain the return in commercial banks listed at PSX than FF5F.
    b. H1: FF3F model does not explain the return in commercial banks listed at PSX than FF5F.

Testing methods:

To test whether Fama-French models valid for commercial banks and provides a complete explanation of return patterns, GRS regression test is conducted which tests whether the intercept (alpha) values obtained from regression are jointly not different from zero.
The researcher applied the Eviwes 7 to deal with the FF models. To run the GRS test, the researcher applied two-step procedure in Eviwes 7, as under:

1. A set of equation system is to be developed and then the Ordinary Least Square regression was run.
2. Intercepts (alphas) obtained for OLS are to be tested jointly as zero, using Wald test which produces Chi square statistic which is compared with the tabulated Chi square value at 95 % confidence level. In this case, null hypothesis is intercepts (alphas) are equal to zero; the alternate hypothesis is intercepts (alphas) are not equal to zero. If null hypothesis is rejected, it means that model is not explain the return process in commercial banks listed at PSX.

4.3 Sampling and Data Collection Method

This study employs the daily pricing data of commercial banks both public and private sector listed on PSX excluding foreign banks; year-end figures have been taken. Banks follow calendar year, that is, January to December. The sample consists of 20 commercial banks listed on Pakistan Stock Exchange (PSX) (see Appendix 1) for the period January 2011 to December 2020. Daily pricing data is retrieved from the *website of PSX and also CSCTrade.com;* for book equity, profitability and assets from audit accounts available at PSX data portal and also retrieved from respective banks' websites and State Bank of Pakistan's publication also entitled as 'Financial Statement Analysis of financial Sector' for various periods.

4.4 Data preparation and Construction of Fama-French Factors:

4.4.1 Returns Calculations:

(i) The daily closing prices of bank stocks are converted into continuous compounding return using the following equation of stocks:

$$Rit = LN\ (Pt/Pt\text{-}1) \qquad (4.1)$$

Where

R_{it} daily return

P_t at daily / week-end market closing.

P_{t-1} daily/ week-end market closing

LN represents natural log to obtain continuous compounding of return.

(ii) Similarly, the daily closing index points of the KSE-100 Index are converted into continuous compounding return using the following equation of stocks:

$$Rmt = LN\ (I_t/I_{t-1}) \qquad (4.2)$$

4.4.2Variables explained

The table 1 gives description of variables and how they are to be estimated as contained in this paper.

Table 4.1; Variables explained

Variables	Explanation
Size	Market equity is determined by multiplying number of outstanding shares by year-end closing price of the respective banks.
Book Equity (BE)	Book value of the equity (excluding revaluation reserves) as contained in year-end audited accounts the respective banks.
Book-to-Market ratio	Book value (excluding revaluation reserves) is divided by market value as determined at year-end.
Profit before tax	Year-end 'profit before tax' as contained in year-end audited accounts the respective banks.
Profitability ratio	'Profit before tax' for the year is divided by year-end Book value of the equity (excluding revaluation reserves).
Total Assets	Total assets as contained in year-end audited accounts the respective banks.
Investment	The growth in total assets, It will be calculated year –end assets (t) minus previous year's assets (t-1) and divided by previous year's assets (t-1).

4.4.3 Fama-French Factors:

The factor constructions methods are discussed in view of non-availability of data conversion into factors from PSX or other sites as rhe calculated factors are available in developed economies.

4.4.3.1Commercial bank Market factor (CB-rm-rft):

As contained in Fama-French model, 1993, the market factor is based on the KSE-100 Index, a value-weighted prime index of the PSX is substituted for the market for this study. Risk-free rate is represented by three-month Treasury bill rates. Using these substitutions, proxies, market excess return is the difference between value-weighted return of the KSE-100 Index and three-month Treasury bill rate.

4.4.3.2 The CB-SMB and CB-HML factors

4.4.3.2.1 Commercial Bank Market capitalization

The commercial bank market capitalization is determined by multiplying outstanding shares of each bank in the sample by its year-end share price. Market capitalization is then to be sorted out ascendingly and the median of the market capitalization is pinpointed as breakpoint and the banks, whose market capitalizations are below median, are termed as CB-small stocks(CB-S) and banks whose market capitalization above median are termed as CB-big stocks (CB-B).

4.4.3.2.2 CB-BE/ME Ratio

The CB-BE/ME ratio is calculated dividing the accounting book equity value by the market capitalization at December year-end to make impact of market conditions ineffective on ratio. (Ragab, Abdou and Sakr, 2020).Less than zero BE/ME ratios of Banks are excluded from the analysis. Again, BE/ME ratios are to be sorted out ascendingly; then the median of the BE/ME ratio is calculated. Again the median serves as breakpoint for sorting the banks with low and high ratio. The banks' whose BE/ME ratio are below median are termed as low (L) or growth stock and Banks whose BE/ME ratios are above median are termed as high (H) or banks with value stocks.

4.4.3.2.3 Construction of portfolios

From Size and Value factors, four portfolios, that is, two of size and two of value portfolios are constructed as: CB-SH (small market banks and high value banks); CB-SL (small market banks and low value banks); CB-BH (big market banks and high value banks); CB-BL (big market banks and low value banks). Then the daily mean return for each of these portfolios are calculated.

4.4.3.2.4 Construction of CB-SMB$_{BM}$ and CB-HML factors

4.4.3.2.4.1Construction of CB-SMB$_{BM}$

The SMB_{BM} factor is formed by subtracting the simple average return on two portfolios of banks with small stocks (CB-SH and CB-SL) from simple average return on two portfolios of big stocks (BH and BL), as under:

$$\text{CB-SMB}_{BM} = \frac{CB-SH+CB-SL}{2} - \frac{CB-BH-CB-BL}{2} \qquad \textbf{(4.3)}$$

4.4.3.2.4.2Construction of CB-HML factor

The CB-HML factor is built as the subtracting the simple average return on two portfolios of banks with high value stocks (CB-SH and CB-BH) from simple average return on two portfolios of big stocks (CB-SL and CB-BL), as under:

$$\text{CB-HML} = \frac{CB-SH+CB-BH}{2} - \frac{CB-SL+CB-BL}{2} \qquad \textbf{(4.4)}$$

4.4.3.2.5 Commercial Bank Profitability and Investment factors

These factors are developed as formed the CB-HML factor. However, the next sorting is either done on profitability or investments.

4.4.3.2.5.1 Commercial Bank Profitability ratio

The profit before Tax is divided by the CB-BE. The profitability ratio is sorted and two portfolios are obtained as a result of sorting, such as, the weak portfolios (CB-W) that are consisted of banks whose profitability is below the median and robust portfolios that is above median. With the meeting point of two size portfolios and two profitability ratio portfolios, four portfolios are formulated, such as, CB-SW (small and weak), CB-SR (small and robust),CB-BW(big and weak) ,CB-BR(big and robust). For each of these portfolios, returns are calculated. Hence, two additional factors are obtained, as under:

$$\text{CB-SMB}_{OP} = \frac{CB-SW+CB-SR}{2} - \frac{CB-BW-CB-BR}{2} \quad \textbf{(4.5)}$$

The CB-RMW (robust minus weak) factor is obtained by reducing the simple average returns of the two portfolios of banks with robust profitability (CB-SR and CB-BR) and simple average returns of two portfolios of stocks with weak profitability (CB-SW and CB-BW), as under:

$$\text{CB-RMW} = \frac{CB-SR+CB-BR}{2} - \frac{CB-SW-CB-BW}{2} \quad \textbf{(4.6)}$$

4.4.3.2.5.2 Commercial Bank Investment ratio

The commercial bank investment factor uses investment ratio to develop the investment factor, and represents as percentage change in total assets from December year-end last to current December year-end and divided by last year. Again the banks will be classified into two portfolios; the first one is termed as conservative portfolios which are below the median and the second is termed as aggressive portfolios.

Then the investment portfolios will be connected to size portfolios. When this is done, four portfolios are obtained, such as, CB-SC (small and conservative), CB-SA (small and aggressive), CB_BC (big and conservative), CB-BA (big and aggressive). For each portfolio value-weighted returns are. In this way two more portfolios are obtained, such as CB-SMB_{INV} and CB-CMA (conservative minus aggressive). The CB-SMB_{INV} factor is the change in the simple average returns of the two portfolios of small banks (CB-SC and CB-SA) and the simple average returns of the two portfolios of big banks (CB-BC and CB-BA), as under:

$$\text{CB-SMB}_{INV} = \frac{CB-SC+CB-SAR}{2} - \frac{CB-BC-CB-BA}{2} \quad \textbf{(4.7)}$$

The CB-CMA factor is found as change between the simple average returns of the two portfolios of small banks with conservative growth (CB-SC and CB-BC) and the simple average returns of the two portfolios of aggressive growth banks (SA and BA), as under:

$$\text{CB-CMA} = \frac{CB-SC+CB-BR}{2} - \frac{CB-SA-CB-BA}{2} \quad \textbf{(4.8)}$$

The construction of RMW and CMA leads to development of two more size factors, such as, the SMB_{OP}, the SMB_{INV}. Thus unlike the Fama-French three-factor model, the SMB factor is used in Fama-French five factor model is calculated as the average of $\text{SMB}_{BM,}$ SMB_{OP}, the $\text{SMB}_{INV,as}$ under:

$$\text{CB-SMB} = \frac{\text{CB-SMB(BM)} + \text{CB-SMB(OP)} + \text{CB-SMB(INV)}}{3} \quad \textbf{(4.9)}$$

Descriptive Statistics:

During the period of sample, the country fought; war on terror' and suffered heavily on economic front and experienced political instability. Fama and French factors are: size, value, profitability and investments. Only market factor is giving positive return which is 2.7 basis point; whereas, other factors, such as, cb-smb_{bm} (size), cb-hml (value) , cb-rmw (profitability), cb-cma (investment/growth) factors, are giving negative return of - 2.09, -2.68, -2.58, -4.38, -2.40 basis points respectively. These negative returns of SMB_{BE} favour stocks of cb-big cb-size, cb-hml favours growth stocks, cb-rmw favours weak profit stocks and negative return of cb-cma favours aggressive stock. Skewness measures the asymemetry of the distributions. The cb-smb_{bm}, cb-hml, and cb-smb show a positive skewness means that it has right tail andcb- rm_rft, cb-rmw and cb-cma show a negative skewness being left tailed. The kurtosis measures the peakedness or flatness of the distribution. The returns of all factors are highly leptokurtic. Table 2 gives the detail of descriptive statistics of FF factors?

Table4.2: FF Factors Descriptive Statistics

	CB-RM_RFT	CB-SMB_{BM}	CB-HML	CB-RMW	CB-CMA	CB-SMB
Mean	0.000273	-0.000209	-0.000268	-0.000258	-0.000438	-0.000240
Std. Dev.	0.010425	0.007556	0.005597	0.006651	0.006008	0.007249
Skewness	-0.600784	2.001142	3.739542	-2.705723	-3.318435	2.209381
Kurtosis	7.379094	27.94723	72.01684	42.01585	68.47818	31.71461
Jarque-Bera	2109.278	65301.21	492970.2	158707.6	443070.2	86339.74
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Correlation Matrix:

The table 3 exhibits the correlation matrix for Fama and French factors. The market has negative correlation with size and value factor and positive, correlation with profitability and investments factors. Value factor is adversely related to cb-rm_rtf (market), cb-rmw (Profitability) and cb-cma (Investment/growth) but favourably related to size factor. The cb-rmw (Profitability) factor is negatively related to size and value factors and positively related to investment factor. Highly positively and negatively correlated variables have been highlighted.

Table4.3: The correlation Matrix between Fama and French factors

	CB-RM_RFT	CB-HML	CB-RMW	CB-CMA	CB-SMB

CB-MR_RFT	1.000000	-0.068411	0.011075	0.185590	-0.015249
CB_HML	-0.068411	1.000000	-0.738930	-0.334648	0.752116
CB-RMW	0.011075	-0.738930	1.000000	0.616978	-0.952008
CB-CMA	0.185590	-0.334648	0.616978	1.000000	-0.639802
CB-SMB	-0.015249	0.752116	-0.952008	-0.639802	1.000000

The Fama-French Models testing:

Ordinary Least Square (OLS):

The OLS assumes that all coefficient is unknown and can be obtained from the data. The OLS does not consider correlation between the equations if variables of each equation is determined by OLS. It is understood that correlation in error term is not existed contemporaneously. Seemingly Unrelated Regression (SUR) The SUR works with correlation coefficients, whereas, OLS ignores correlation between error terms of equations in the system. The SUR is applied if error-terms emerge in the same time- frame and correlated and gives efficient parameter estimates. The application of econometrics in finance is in the analysis of financial markets. SUR framework is applied to CAPM. When models are applied to group of related variables and considered several models jointly. This model is extensively used in empirical finance where closely related identical variables (repressors) are modeled overtime. (Brooks, 2008; Greene 2003).

If the like repressors are applied, the covariance matrix of the residuals becomes singular. Hence, the weighting matrix of the SUR estimator cannot be inverted so that a SUR estimation of all equations becomes infeasible. In this situation, a variable or variables are to be dropped or the size of the sample is increased. The Three-factor and five-factor models are well-defined and tested as such change in the model is not possible. So far as to increase the sample size, there are only 20 commercial banks listed at PSX; as such, the size of the sample cannot be increased.

Gujrati (2003, p.489)) stated in a footnote "… the OLS estimation of each equation separately produces identical (and efficient) estimate."
However, as all equations can be estimated by OLS and these estimates coincide with SUR estimates in our current model specification, there is no advantage of using SUR over OLS for estimating these models.

Thus variables are obtained by OLS irrespective of any correlation between the error terms of different equations. The study has applied the Eviwes 7 to deal with the Fama and French models. To run the GRS test, the study applied two-step procedure in Eviwes 7, as under:

1. A set of equations system is to be developed and then the Ordinary Least Square regression to be run.
2. Intercepts (alphas) obtained from OLS are to be tested jointly as zero, using Wald test which produces Chi square statistic. The test statistic will be compared with the tabulated Chi square value at 95 % confidence level. In this case, null hypothesis is that intercepts (alphas) are jointly equal to zero; the alternate hypothesis is that intercepts (alphas) are not

equal to zero. If null hypothesis is rejected, it means that model is not explaining the return in commercial banks listed at PSX.

3.

4.8.1Testing Procedure for FF3F Model:

The following equations of system will be developed and run as OLS:

CB-Sl = C (1) +C (2)* CB-rm_rft+C (3)* CB-smbbm+ C (4) *CB-hml.
CB-Sh=C (5) +C (6)* CB-rm_rft+C (7)*CB- smbbm+ C (8) *CB-hml.
CB-Bl = C (9) +C (10)* CB-rm_rft+C (11)* CB- smbbm+ C (12) *CB-hml.
CB-BH=C (13) +C (14)* CB-rm_rft+C (15)* CB-smbbm+ C (16) *CB-hml.

The intercepts will then be tested applying Wald test, if the alphas are jointly equal to zero. The following equation will be tested by Wald test:

C (1) =C (5) =C (9) =C (13) = 0.

4.8.1.1 Empirical test:

When OLS and Wald test is applied on above equations regarding FF3F model through Eview-7, the following output is obtained as tabulated in Table4.4:

Table 4.4: **OLS Regression Result of FF3F Model**:

Variable	**Description**	Intercept **(alpha)**	Market **(CB-rm_rft)**	Size (CB-**SMBbm)**	Value **(CB-hml)**
CB-SL	**Coefficient**	-0.00004	0.89048	1.3306	-0.5901
	t-Statistics	-0.2757	69.05033	50.972	-16.7122
	Probability	0.7828	0.0000	0.00000	0.00000
	R^2	0.782493			
	Adjusted R^2	0.784029			
CB-SH	**Coefficient**	0.0002	0.8385	1.9997	0.4598
	t-Statistics	1.4718	68.3426	48.3148	13.6671
	Probability	0.1411	0.00000	0.00000	0.00000
	R2	0.8356			
	Adjusted R^2	0.8354			
CB-BL	**Coefficient**	-0.80003	0.83821	0.19996	-0.53976
	t-Statistics	-2.668	68.30665	8.03386	-16.06105
	Probability	0.0076	0.00000	0.00000	0.00000
	R2	0.683984			
	Adjusted R^2	0.683597			
CB-BH	**Coefficient**	-0.000037	0.890378	0.33055	0.409875
	t-Statistics	-0.275651	69.05029	12.06315	11.6055

	Probability	0.7828	0.00000	0.00000	0.00000
	R^2	0.705504			
	Adjusted R 2	0.705144			
`Wald Test Result	**df**	Calculated test Statistic	Tabulated statistic	Result	
Chi Square	**4**	9.436455	0.711(at 95% CL)	Null rejected	

Wald test produced the Chi square statistic at 4 degrees of freedom. The Chi square statistic is 9.436455 at four degrees of freedom as against tabulated statistic as 0.711 at 95 % confidence level. Thus, this test rejects the null hypothesis showing that three factor models is not applicable to commercial banks in PSX. It answers the first question and also evaluates the first hypothesis.

4.8.2 Testing Procedure of the FF5F Model:

The following equations of system will be as ordinary least square regression:

CB-Sl = c (1) +C (2) *CB-rm_rft+ C (3)*CB-smb+ C (4)*CB-hml+ c (5) *CB-rmw+ c (151) *CB-cma
CB-Sh = c (6) +C (7)* CB-rm_rft + C (8)*CB-smb+ C (9)*CB-hml+ c (10) *CB-rmw+ c (152) *CB-cma
CB-Bl = c (11) +C (12)*CB-rm_rft+C (13)*CB-smb+ C (14)*CB-hml+ c (15) *CB-rmw+ c (153) *CB-cma
CB-Bh = c (16) +C (17)*CB-rm_rft +C (18)*CB-smb+ C (19)*CB-hml+ c (20) *CB-rmw+ c (154) *CB-cma
CB-Sw = c (21) +C (22) *CB-rm_rft +C (23)*CB-smb+ C (24)*CB-hml+ c (25) *CB-CB-rmw+ c (155) *cma
CB-Sr = c (26) +C (27) *CB-rm_rft +C (28)*CB-smb+ C (29)*CB-hml+ c (30) *CB-rmw+ c (156) *CB-cma
CB-Bw = c (31) +C (32)*CB- rm_rft +C (33)*CB-smb+ C (34)*CB-hml+ c (35) *CB-CB-rmw+ c (157) *CB-cma
CB-Br = c (36) +C (37)* CB-rm_rft + C (38)*CB-smb+ C (39)*CB-hml+ c (40) *rmw+ c (158) *CB-cma
CB-Sc = c (41) +C (42)*CB-rm_rft +C (43)*CB-smb+ C (44)*CB-hml+ c (45) *rmw+ c (159) *CB-cma
CB-Sa= c (46) +C (47)*CB-rm_rft +C (48)*CB-smb+ C (49)*CB-hml+ c (50) *rmw+ c (160) *CB-cma
CB-Bc = c (51) +C (52)*CB-rm_rft +C (53)*CB-smb+ C (54)*CB-hml+ c (55) *rmw+ c (161) *CB-cma
CB-Ba = c (56) +C (57) *CB-rm_rft+C (58)*CB-smb+ C (59)*CB-hml+ c (60) *rmw+ c (162) *CB-cma

The intercepts will then be tested applying Wald test if the intercepts (alphas) are jointly equal to zero. The following equation will be tested by Wald test:

C(1)=C(6)=C(11)=C(16)=C(21)=C(26)=C(31)=C(36)=C(41)=C(46)=C(51)=C(56)=0

The output of the OLS of FF5F generated by the Eviews-7 is tabulated in Table4.5, as under:

4.8.2.1 Empirical test:

When OLS and Wald test is applied on above equations regarding FF5F model through Eview-7, the following output is obtained as tabulated in Table4.5:

Table 4.5: **OLS Regression Result of FF5F Model**

Variable	Description	Intercept (alpha)	Market (CB-rm_rft)	Size (CB-SMB_{bm})	Value (CB-hml)	Profitability (CB-rmw)	Investment (cma)
CB-SL	**Coefficient**	-0.000189	0.92145	0.982552	0.61285	-0.463105	0.055627
	t-Statistics	-1.29478	65.37033	14.34019	-15.00434	-6.621057	1.675794
	Probability	0.1954	0.0000	0.0000	0.0000	0.0000	0.0000
	R^2	0.758856					
	Adjusted R^2	0.758364					
CB-SH	**Coefficient**	0.000006	0.860185	0.851626	0.367247	-0.55341	0.089984
	t-Statistics	0.47505	67.09617	13.66619	9.885996	-8.699491	2.980573
	Probability	0.9621	0.0000000	0.000000	0.000000	0.0000000	0.0029
	R^2	0.832064					
	Adjusted R^2	0.831722					
CB-BL	**Coefficient**	-0.000549	0.825225	-0.209784	-0.631489	-0.619216	0.143901
	t-Statistics	-4.274221	66.48554	-3.47713	-17.55805	-10.05399	4.92318

	Probability	0.000000	0.000000	0.0005	0.000000	0.000000	0.000000
	R^2	0.697543					
	Adjusted R^2	0.696926					
CB-BH	**Coefficient**	-0.000221	0.886779	-0.832972	0.387742	-0.53444	0.109241
	t-Statistics	-1.60679	66.71444	-1.289218	10.06706	-8.102973	3.489936
	Probability	0.1081	0.000000	0.1973	0.000000	0.000000	0.0005
	R^2	0.707251					
	Adjusted R^2	0.706653					
CB-SW	**Coefficient**	-0.000228	0.816991	0.890412	-0.144307	-0.99969	0.137589
	t-Statistics	-1.798499	66.56059	1,492,393	-4.057354	-16.41369	4.760038
	Probability	0.0721	0.000000	0.000000	0.000000	0.000000	0.000000
	R^2	0.852381					
	Adjusted R^2	0.852079					
CB-SR	**Coefficient**	-0.0000065	0.837717	0.814808	-0.154964	-0.074835	0.11921
	t-Statistics	-0.050005	66.34819	13.27637	-4.23563	-1.194474	4.009321
	Probability	0.9601	0.0000000	0.000000 00	0.000000 00	0.2323	0.0001
	R^2	0.731077					
	Adjusted R^2	0.730528					
CB-BW	**Coefficient**	-0.0000536	-847692	-0.172966	-0.109278	-1.097791	0.114675
	t-Statistics	-4.123636	67.46696	-2.83209	-3.001508	-17.60815	3.875699

	Probability	0.0000000	0.0000000	0.46	0.0027	0.000000	0.0001
	R^2	0.736382					
	Adjusted R^2	0.735844					
CB-BR	**Coefficient**	-0.000235	0.827251	-0.101801	-0.099293	-0.028175	0.132751
	t-Statistics	-1.870547	68.16416	-1.725688	-2.823533	-0.467864	4.645004
	Probability	0.0614	0.0000000	0.0844	0.0048	0.6399	0.0000000
	R^2	0.690053					
	Adjusted R^2	0.68942					
CB-SC	**Coefficient**	-0.000106	0.930885	0.622966	-0.105126	-842021	0.642383
	t-Statistics	-0.742333	67.14342	9.244438	-2.616914	-12.24018	19.67641
	Probability	0.4579	0.000000	0.000000	0.0089	0.000000	0.000000
	R^2	0.778129					
	Adjusted R^2	0.777676					
CB-SA	**Coefficient**	-0.000291	0.830497	0.79189	-0.109318	-0.636223	-0.358669
	t-Statistics	-2.271823	67.17332	13.17699	-3.051447	-10.37073	-12.31916
	Probability	0.0231	0.000000	0.000000	0.0023	0.000000	0.000000
	R^2	0.832135					
	Adjusted R^2	0.831792					
CB-BC	**Coefficient**	-0.000252	0.854913	-0.150049	-0.154924	-0.536403	0.592554

	t-Statistics	-1.895885	66.54863	-2.402935	-4.16189	-8.414916	19.58725
	Probability	0.0580	0.000000	0.0163	0.000000	0.0000000	0.0000000
	R^2	0.712105					
	Adjusted R^2	0.711517					
CB-BA	**Coefficient**	-0.000591	954981	-0.314535	-0.150059	-0.736673	-0.406091
	t-Statistics	-3.987453	66.67309	-4.517693	-3.61555	-10.36506	-12.03946
	Probability	0.0001	0.00000	0.00000	0.0003	0.00000	0.00000
	R^2	0.683434					
	Adjusted R^2	0.682788					

The equations system was run OLS and then, Wald test was applied. Wald test produced Chi square statistic as 71.47627 with 12 degrees as against tabulated statistic of 0.711 at 95 % confidence level. It shows that the null hypothesis is rejected, reflecting that five factor model is not applicable to banking sector in PSX. It answers the second question and evaluates the second hypothesis.

4.8.3 Comparison of FF3F and FF5F models:

To compare the FF3F and FF5F models, the following test equations will be developed and run as OLS:

CB-rmw = C (1) +C (2)*CB-rm_rft+ C (3)* CB-smbbm +C (4)*CB-hml

CB-cma = C (5) +C (6)*CB-rm_rft+ C (7)* CB-smbbm +C (8)*CB-hml

The intercepts will be tested applying Wald test as zero from the following equation:

C (1) = (5) =0

4.8.3.1 Testing of FF3F and FF5F models

When OLS and Wald test is applied on above equations through Eview-7, the following output is obtained as tabulated in Table4.7:

Table 4.6: OLS of comparison of FF3F and FF5F

Variable	Description	Intercept (alpha)	Market (CB-rm_rft)	Size (CB-SMBbm)	Value (CB-hml)
CB-rmw	Coefficient	-0.000455	0.016013	-0.754226	-0.129418

	t-Statistics	-9.881182	3.601096	-83.78537	-10.62798
	Probability	0.0000000	0.0003	0.0000000	0.0000000
	R^2	0.882919			
	Adjusted R^2	0.882776			
CB-cma	Coefficient	-0.000525	0.133875	-0.724306	0.374786
	t-Statistics	-6.220572	16.4172	-43.87635	0.022331
	Probability	0.0000000	0.0000000	0.0000000	0.0000000
	R^2	0.517535			
	Adjusted R^2	0.516945			

Wald Test Result	df	Calculated test Statistic	Tabulated statistic	Result
Chi Square	2	NA	NA	Indeterminable

Wald test produced Chi square statistic as nil with 2 degrees of freedom. As against nit test statistic, the tabulated critical value is 0.103 at 95 % confidence level. It shows that comparison between two models, FF3F and FF5F models, is indeterminable in respect of commercial banks in PSX. It answers the third question and evaluates the third hypothesis.

Conclusion:

This study investigates the performance of FF3F and FF5F models on a sample of 20 commercial bank using daily stock prices from January 2011 to December 2020 in Pakistan Stock Exchange (PSX). Pakistan is an emerging market. The stock market was opened for the foreigners in 1994. The Pakistan is pursuing the policy of liberalization, deregulation and privatization since 1980s. The stock market was revamped with technical and financial assistance of the Asian Bank in 90s to enhance confidence in both domestic and the foreigners in the markets. Thus, this study assesses the performance of FF3F and FF5F models to understand the explanation of earning by these models of Fama and French in the market.

The analysis of the study leads the following results:
(i) Both FF3F and FF5F models are not workable in commercial banks listed at PSX in explaining returns.
(ii) When compared the performance of both FF3F and FF5F, the result shows that these models are indeterminable in commercial banks listed at PSX.

Recommendation:

1. Any one desiring to invest funds in commercial banks must carry out thorough analysis in order to understand the explanation and forecasting earnings in commercial banks listed at PSX.
2. Analytical procedure and process used in these models is more tilted to non-financial sector and seems to not suitable for commercial banks. Dermine (2009) suggested to use MBV ratio rather than Book-to-Market ratio. Banks in emerging or new markets, such as, Brazil and Russia, show MBV of above 3, an indicator of large expected growth in the futures (that is, in Size).
3. Large volume of literature discusses the valuation of non-financial companies, very little has been written on bank valuation Koller et al., (2005) who stated that 'valuing banks is conceptually difficult' as quoted by Dermine (2009).
1. 4. Being a large and different types of risk profiles of bank, its return pattern is also difficult to understand and methods developed on non-financial companies cannot be applicable to commercial banks, as variables used these models are not 'fit-for-all' cases.

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