# The Gross Profitability Premium: An Empirical Examination in Pakistan Stock Exchange (PSX)

Rita Tharwani[1], Imran Umer Chhapra[2], Sobia Shakeel[3],Salman Sarwat[4]

**Abstract:**

Profitability, which is estimated by the company's gross profits to assets i.e. Revenue (R) less cost of good-sold (COGS) has approximately the same power as a book to market (B/M) in forecasting the stock's average return in 'cross-section'. Profitable companies engender significantly greater average returns as compared to unprofitable companies, even with the greater valuation ratios of the company. Thus, this study endeavors to explore either the gross profitability anomaly exists in the 'Pakistan Stock Exchange (PSX)' and examined through famous asset pricing models i.e. CAPM, FF (three-factor & five-factor) model in the (PSX). Data set of listed-delisted companies are gathered from the period (2000-2018) through "Thomson Reuters Data Stream" and (PSX). Decile portfolios of the companies are constructed for analysis of time-series techniques. Equally (EW) and value-weighted (VW) gross profitability based portfolios are developed to examine the robustness of the sorted portfolio. Generalized method of moments (GMM) and Wald Test are utilized. The empirical time series analysis depicts the findings with significant evidence that gross profitability anomaly exists and yields higher returns in (PSX). Therefore, it can be concluded from the results that all three asset pricing (CAPM, FF- three & five-factor) models are misspecified models in (PSX) and there are other factors such as gross profitability for the prediction of the stocks.

**Keywords:** Gross profits, CAPM, PSX, Fama French three & five-factor

## 1.Introduction

Asset pricing is the core area of research in the context of financial markets and is important for making investment decisions and forecasting asset prices. Assets are priced to earn the maximum return. Asset prices generally follow the law of demand and supply which means the asset price will increase with a decrease in the supply of an asset or surge in demand of an asset. To determine the asset price, numerous research studies have been carried out to examine the financial models. Markowitz (1952) developed a mean-variance model. Various portfolios have been generated in which investors were given the preferences for risk and return. The theory was initiated with the idea of a one-time model, in which the portfolio was formed at

[1]Rita Tharwani, Shaheed Zulfiqar Ali Bhutto Institute of Science and Technology (SZABIST), Karachi
[2]Imran Umer Chhapra, Shaheed Zulfiqar Ali Bhutto Institute of Science and Technology (SZABIST), Karachi
[3]Sobia Shakeel, Shaheed Zulfiqar Ali Bhutto Institute of Science and Technology (SZABIST), Karachi
[4]Salman Sarwat, Benazir Bhutto Shaheed University Lyari, Karachi

the initial period by an investor. Markowitz's contributions which are based on the risk acceptability and the need to make an optimal return with the reduced risk leads to Modern Portfolio Theory (MPT). The MPT was centered on two main ideas. Each investor aims to optimize return for any type of risk and others that the risk can be lessened by portfolio diversification.

The financial economist Sharpe (1964) and Lintner (1965), introduced a famous financial model called the asset pricing model (CAPM). CAPM elucidates the association among the systematic risk and asset's return. This model focuses on individual investments encompass two kinds of risk. Systematic risk is the market risk that can't be mitigated through diversifying the stocks in a different portfolio. Unsystematic (diversifiable) risk can be reduced by diversifying the stocks in different portfolios. Individual stocks are to be rewarded for non- diversifiable risk; the greater the market risk greater will be asset's expected return which generally the investor assumes (Lau & Quay, 1974).

The asset pricing model (CAPM) is the rational and basic concept of finance. However, consequent studies recommend that the cross-sectional changes in the average returns are estimated not only by systematic risk as suggested by the asset pricing (CAPM) model but also by the company's market capitalization, past returns, and (B/M) ratio (Basu, 1977). Ball (1978) claims that market ratios pick up deviation in the expected return as price changes to expected returns. The company's size, market, and (B/M) pull out the information about asset prices which are related to risk and expected return (Fama & French, 1992). Though, both of them identify the linear relationship among the market valuation ratios and the expected return. A question arises, whether beta exhibiting in a risk-based model has been used to single stock can elucidate the size, book to market, value, and impact of momentum on projected return, all of these are considered to be financial market anomalies (Avramov, 2006). Kuhn (1970) marked the term anomaly and suggested that documentation of such anomalies often signals a transitional phase which leads towards an innovative paradigm. These anomalies are either 'cross-sectional' or 'time-series' which are not projected by any paradigm or theory. Market anomaly is termed to as any variations or unexpected occurrence in the pattern of stock's performance from its expected prices which deviate from the currently accepted theories as assumed and determined by the Efficient Market Hypothesis (Frankfurter & Elton, 2001).

There are three basic types of anomalies i.e. fundamental, seasonal, or calendar and technical. Fundamental anomalies are identified using financial analysis of the companies. Calendar anomalies are associated with a specific period i.e. variations in the securities from day to day, month effect, year to year, etc. In technical anomalies, future stock's prices are predicted based on previous prices and related information. Later on, there were many empirical conflicts were observed in the (CAPM) model. The failure of the model and its incomplete description of stock's asset prices lead Fama to develop a model with three factors. They identified the

projected returns of cross-sectional related mainly to the equity features that can be captured by market, value, and size (except momentum). Fama & French (2015) recognized that two vital factors i.e. profitability and investment are to be added in the model with three variables.

This research study focuses on the fundamental type anomaly i.e. “Gross profitability anomaly.” Robert Novy-Marx identified an innovative estimation that is continuing to be maintained by researchers, academics and scholars is the gross profitability premium. The gross profitability produces value such as average excess stock returns and has approximately the same power as (B/M) forecasting the stock’s average return in the ‘cross-section’. Gross profitability provides robust results in the prediction of stock’s return i.e. it includes many anomalies associated with earnings as well as unrelated anomalies like free cash flow-book equity and earning to book- equity. However, a growing literature supports that anomalies associated with profitability have significant power in predicting the cross-section of stock’s return and it could be among the topmost options for the fund manager and investors to earn profit maximization from the market anomalies. Gross profitability anomaly is the ratio of revenue (R) less cost of goods sold (COGS) to its overall assets (Marx, 2010).

This study endeavors to explore either the gross profitability anomaly exists in the ‘Pakistan Stock Exchange (PSX)’. Following the studies of Novy-Marx (2013) & Kenchington et al; (2019), this study focuses on gross profitability anomaly which is not yet examined in the developing economies like Pakistan. Using famous asset pricing models i.e. CAPM, FF (three-factor & five-factor) model, gross profitability anomaly is checked and examined whether gross profitability anomaly is captured by these models in the (PSX).

## 2.Literature Review

The asset pricing models have been discussed that are related to the current research study. These models include the Markowitz mean-variance model, CAPM, FF (three & five-factor) model.

### 2.1:Mean-Variance Model (Markowitz)

Markowitz (1952) proposed a model called mean-variance. The model is a framework for analyzing the association between ‘risk and return’. Portfolios were measured based on only average returns previously. Investors believed that portfolio investment is based on the larger average returns without considering any risk correlated with that portfolio. Markowitz challenged this thought by adding a mean-variance trade-off in examining the selection of the portfolio. His contributions which are based on the risk acceptability and the need to make an optimal return with less risk leads to Modern Portfolio Theory (MPT). Later, the “efficient frontier line” was familiarized by Markowitz which is groundbreaking in various ways. The line is formed when additional stocks in the portfolio are further enhanced in which investors can move and take

decisions along with the frontier line contingent on the risk the individual wants to tolerate. This theory is groundwork by Markowitz which leads to the development of CAPM.

**2.2:Capital Asset Pricing Model and Deviation**

Based on the Modern Portfolio theory, the CAPM model was introduced by Sharpe and Lintner in 1964 and 1965. CAPM elucidates linear association among the systematic (non-diversifiable risk) and return. The model is used generally by the stockholders in which they predict the related risk associated with the investment and the expected return of the securities (Jagannathan & Wang, 1993). This model is based on some strong assumptions: 1. Investors are logical and avoid risk, 2. An individual has the same viewpoint (homogenous expectations), 3. The limitless amount at a risk-free rate can give and take 4. Single investment, 5. Securities divisibility, 6. In a perfect market no transaction cost and taxes (Bhatti & Hanif, 2010).

Any variations or unexpected occurrence in the normal pattern of stock's performance from its expected prices which deviate from the currently accepted theories as CAPM and rules of the Efficient Market Hypothesis (EMH) is referred to as anomaly. Fama (1970) delineated one of the imperative paradigm "efficient market hypothesis" of traditional models. The efficient market asserts the market in which various rational investors are competing for profit maximization. All the information about stocks is easily accessible to the stockholders which makes it difficult to earn a higher return than the expected market return. As soon as new information reaches the market, the stocks are repriced immediately and hence unable to earn a higher profit than other buyers.

Kendall (1953) argued that stock prices are random and change due to unpredictable events. Later, Ross (1976) & Roll (1977) elaborated not only the present theory based on the CAPM model but also instigated an innovative theory called arbitrage pricing (APT) theory. APT is based on the groundbreaking idea that inefficient business market opportunities about arbitrage do not exist. The key concept behind this APT is that numerous X factors are associated with the systematic risk and not only one factor as elucidated by the CAPM model. This theory only focuses on systematic deviation and does not consider the firm's specific risk and returns. These firm's specific variations are not correlated with each other as they can be evaded by diversifying the portfolio. This indicates that market places are not usually efficient all the time that exhibit accessible information to the stockholders and also there may be an occurrence of other arbitrage opportunities.

However, following empirical studies by Basu (1977), Ball (1978), Jagadeesh (1990), Banz (1981), and Fama & French (1992) advocates that the cross-sectional changes in the average returns are estimated not only by systematic risk as suggested by the asset pricing (CAPM) model but also by company's market capitalization, past returns, and (B/M) ratio. Consequently, any deviation, irregularity, or abnormality in the stock's normal pattern signpost the

presence of an anomaly. Kampman (2011) mentioned in his study that any behavior about the stock returns which is left inexplicable by the CAPM asset pricing model is referred to as an anomaly. Fama and French (FF,1992) excavated the breakthrough and found evidence that only a single beta was not virtuous and adequate to describe the variances and cross-sectional of the stock returns. This motivates FF92 to propound three-factor besides size and value in the CAPM model.

**2.3:Fama & French Asset Pricing Models**

Cross-section regressions methods of Fama and MacBeth in 1973 were followed by Fama & French (1992). However, both identified two anomalies i.e. size of the company and book to market which CAPM fails to elucidate the above anomalies. They observed that the size of the company and average returns have a negative correlation and securities holding greater B/M leads towards greater average profits. This two-factor size and value were included in the three-factor model which is an improved version of CAPM. SMB is the small market cap firm minus big market cap firms. SMB estimates the past excess stock's return of the small-cap firms over the large-cap firms. The third factor is value i.e. HML. HML is high (book-to-market B/M) firms minus low (book-to-market B/M) firm's ratio.

Fama and French (2015) recognized that two vital factors i.e. profitability and investment are to be added in the (three-factor) model. FF (1993) three-factor asset pricing model has been used extensively in the business industry as well as by academia. However, present evidence advocates the FF (1993) three-factor is an inadequate and incomplete model as the model fails to explain the profitability and investment-related strategies of the stock's return. Initially, Novy-Marx in 2013 provides evidence that profitability monitoring upgrades the value investment strategy performance. Later, Aharoni et al. (2013) recognize the association between investment and equity stock's return. Moreover, stock's mean returns about investment and profitability are not captured by Fama and French (FF93). The findings identified by Novy and Aharoni enthused the foundation of Fama and French (FF, 2015). FF15 tested these two factors i.e. profitability and investment in the US market and noticed that the five-factor (FF15) model provides a better elucidation of average returns as compare to the three-factor model of FF93. Investment is referred to as CMA i.e. Return on the firm's conservative investment minus the firm's aggressive investment. Profitability is referred to as RMW i.e. return of the robust profitable firms minus weak profitable firms.

***2.4:Gross Profitability Premium***

Novy-Marx (2013) advocated that profitability, which is estimated by the company's gross profits to assets i.e. revenue (R) less cost of good-sold (COGS) has almost a similar power as a book to market (B/M) in forecasting the mean returns of the cross-section. Profitable companies

engender significantly greater average returns as compare to unprofitable companies, even with the greater valuation ratios of the company. Profitability monitoring intensely enhances the performance of the companies related to value investment strategy, particularly between the greatest liquid company's stocks. However, the consequences are arduous to resolve with popular elucidations of the value-based premium, as companies with the profitability are not as much concern, have elongated periods of cash flow and the operating leverage of the company is smaller.

Novy-Marx (2010) suggested that gross profits to assets provide significant information efficiently and above than that involved in valuations. It is also complementary to the factor book-to-market (B/M). FF (2006) remarked that earnings have much descriptive and explanatory power in cross-section regression carried out by Fama and MacBeth in 1973. Profitability sorts generate the weakest returns of the hedge portfolio and fail to provide any basis for decisions. However, returns and profitability are positively correlated as market cap and book to market (B/M) is controlled (Fama & French, 2008). Novy-Marx conclusions are different than those of previous studies of FF (1993, 2006), in which the study revealed that there is less contribution of profitability in the forecasting of average returns given by size and book to market (B/M). The modification in the Novy-Marx study is that profitability is computed by utilizing gross profits to assets, not by earnings. Gross profitability denotes the 'other-side' of value. He pointed out that gross profitability generates abundant power than earnings in analyzing the returns of the cross-section.

**2.5:Gross Profitability & Related Studies**

Value strategies surpass the overall market. Value investing is an investment strategy in which stocks are priced lower comparative to earnings and are traded lower than their book value. Comparatively to growth stocks, value stocks outperform in the market apparently, due to the real growth price or trading of growth investing stocks are much lesser as compare to value stocks (Graham and Dodd, 1934). However, the market overvalues the future growth of investing in growth stocks. Investors overvalue due to two reasons. The first reason behind the idea is that they make misjudgments; another reason is that they mainly concentrate on previous performance despite the fact; the growth rate is unexpected to remain constant in the future. Moreover, financial investors favor growth stocks above value stocks, because of the timeline, instead of waiting for months they tend to produce abnormal average returns within a shorter period (Lakonishok, 2002).

Many previous studies claim that the profitability of the value investment strategies firm is mechanical. Usually, companies in which investors expect a higher rate of return with the higher risk are valued lower, and therefore have a greater book to market (B/M) than companies for which individual prefers lower average returns. Since valuation- ratios support in to recognize the

deviations in estimated returns, with greater book to market (B/M) signifying greater required returns. Value strategy companies engender greater average returns as compared to growth companies (Ball, 1978). This claim is consistent with the pricing of the risk-based assets; it works if the deviation in expected returns is determined by the investor's behavioral forces.

Another contention by Lakonishok; Shleifer, & Vishny (1994) that small book to market (B/M) stocks are usually overvalued and also purchasing value investment and sales growth investment stocks signifies a crude but produces mispricing in cross-section of stock's return. Strategies centered on gross profitability produce value like average surplus returns, although these strategies are growth strategies that give an outstanding hedge to value. These two strategies contribute to many common qualities, despite being not similar in both covariance and features. Whereas traditional value investment strategies invest in low-cost assets by dealing in expensive products, whereas, profitability strategies follow a different set of value by acquiring the productive asset in exchange of unproductive assets. Since these two effects are affiliated it is capable to analyze the profitability concerning value. Related arguments indicate that companies having productive assets generate greater mean returns than those companies having unproductive assets. In this tactic, deviation in productivity assists in identifying the deviations in investors' expected return rates.

Profitability is another feature of value. Profitable companies are particularly disparate from the value companies. Profitable companies produce greater returns than least profitable companies even though having greater market capitalization. However, dealing with the gross profitability manipulates the value-philosophy, as a consequence, the strategy formed is a growth strategy assessed by valuation ratios. As the strategies, which are developed on value and profitability, average returns are associated negatively and both strategies work together. Moreover, a valued individual can capture the whole profitability premium exclusive of any extra risk. Putting, a strategy of profitability on the top of a current value strategy decreases the overall volatility of the portfolio, even though doubling the individual's exposure to risky securities. As a consequence, value investor gives whole attention towards gross profitability in portfolio selection, since control of profitability intensely upsurges the value-based strategies performance.

Fama & French (2006) examine the expected association among profitability and stock's expected returns and identified their regression of cross-sectional which indicates that earnings are associated with the prediction of the average returns. However, their portfolio analysis recommends that profitability has slight or nothing in the stock's return prediction specified by size and B/M. Additionally, used a simple proxy of current earnings for the measurement of the future profitability, Novy Marx (2013) documents; though gross profitability is a superior and better proxy. Earnings signify a company's real economic profitability and off the income-statement denote the company's real economic profitability decreased by investments which are considered expenses like research and development, expansion of the human capital, or advertisement.

These expenses directly decrease earnings without any increment in book equity, however, they are related to greater economic profits and hence greater dividends in the future.

However, Gross-profits are the unpolluted accounting measure in which real economic profits can be evaluated. If one moves, farther down the gross profit in the income statement, the more unclean measures of the profitability. Likewise, if the company expensed on research and development to upsurge its production or make investments in the company's capital to further maintain competitive gain. As a consequence, these actions decrease current earnings. Furthermore, capital expenses that directly upsurge the scale of the company's operations further decrease its free cash flows compared to its competition. These facts indicate that creating the empirical proxy for the company's productivity utilizing gross profits is scaled by a measure of a book based despite market-based. Novy-Marx (2013) utilized book assets to measure gross profitability instead of book equity. As gross profits denote as an asset-based scale of earnings. Thus, gross profit will not decrease by interest payments and therefore, liberated of leverage.

Novy-Marx (2013) documents the result of value-weighted returns constructed based on gross profitability (single sorting), utilizing the New York Stock Exchange (NYSX) data from July (1963) to December 2010. The findings from the time-series regression by using the asset pricing model i.e. Fama & French (three-factor) model depicts the highly significant correlation among gross profits to its assets and book to market (B/M) ratio by using Spearman-rank-correlation. Profitable firms yield greater average returns as compare to unprofitable firms with significant t-statistic value. Hence, gross profitability is a strong predictor of forthcoming growth.

Lettau & Wachter (2007) reported contradictory findings and observed obstacles from the statement that profitable companies produce greater returns in comparison to the least profitable companies. The model observed that short period assets are riskier over long period assets. Companies based on value strategy have shorter periods and as a result, generate greater average returns as compare to long-period growth companies. Moreover, gross profitability is correlated to long-period growth in earnings, dividends, profits & free cash flow. As a result, profitable companies have an elongated duration in comparison to unprofitable companies. Therefore, the model forecast that profitable companies should under-perform less in comparison to unprofitable companies.

In comparison with other anomalies, gross- profitability anomaly might be the topmost selections for the portfolio managers who expect to deal with and earns revenue through market anomalies (Stambaugh et al, 2012; Novy-Marx, 2013 & Edelen et al, 2016). Kenchington et al; (2019) conducted a study in the U.S market to assess if portfolio managers employ the gross profitability based anomaly. The gross-profitability investing measure (GPIM) was constructed utilizing mutual fund data. The study found that funds contained in the highest GPIM (quintile) are significantly performed well than those contained in the lowest (quintile) and yield greater monthly return through (three-factor) model and Carhart (four-factor) model. The study reports a positive

association among GPIM and the future performance of the funds. Ball et al. (2015) report that operating profitability has the same power in predicting the stock's return to gross profitability. To check if the findings are robust as compare to other profitability measures, two stock level measures i.e. GPIM and OPIM of trend were formed. GPIM and OPIM depict the positive association with the fund performance by using the Carhart four-factor (alpha) model.

Foye (2018) extends prior research studies by analyzing the alternative profitability measures. Fama and French (2015) cite the study as the motivation, conducted by Novy-Marx (2013) for involving a profitability factor in their model. The primary analysis depicts that the re-specified, Fama, and French (five-factor) model utilizing gross profit instead of operating profit reveals better elucidation of UK market equity. The findings depict that FF (five-factor) model utilizing gross profitability factor showed the greater r-square when portfolios sorted on size. The study constructed the portfolios based on profitability utilizing the operating profit (OP), net income (NI), gross profitability (GP) factor, and free cash flow (FCF). Moreover, the profitability measure (OP) utilized by FF (2015) has significantly less t-value as compare to gross profitability.

## 3.Research Methodology

The research methodology explains the data collection, measurement of determinants, asset pricing models, statistical techniques in which gross profitability premium is tested using asset pricing models i.e. CAPM, FF (three-factor & five-factor) model, and portfolio construction.

### 3.1:Data and variables

To empirically examine the gross profitability premium in Pakistan stock exchange, a dataset of all registered and non-registered companies is gathered from the period (2000-2018) through the "Thomson Reuters Data Stream" and Pakistan Stock Exchange (PSX). Both dead and alive, listed-delisted companies are to be taken to keep away from the survivorship bias (Kostakis et al., 2012). The gross profitability ratios are taken on the monthly frequency considering the selection criterion (t-1). Excess return is estimated on the current period at a time (t) and the market value (MV) is estimated taking the last period lag on a monthly basis at a time (t-1). Risk-free rate (6-months T-bills) are to be taken monthly at a time't'. Survivorship bias can be a very serious concern in predicting the stock returns as portfolios are developed with innate ex-post selection biases based on the accounting data which do not signify dealing strategies that are considered replicable ex-ante (Nagel, 2001). The empirical studies conducted by Banz & Breen (1986) and Davis (1996) exhibit that the results can be sensitive as it only includes firms that earn higher stock returns and disparate share of non-surviving companies are excluded from the data which may misinform the stock returns. The dependent variables in this study are an excess rate of return and explanatory variables in asset pricing models which involves CAPM, FF (three-factor & five-factor) models contains a market, size, value, profitability, and investment.

### 3.2:Variables Estimation

Portfolios returns are preferred over individual stocks returns because stocks in which investment is made individually contain unsystematic risk or company's specific risk for which there are challenges in determining the expected returns. Traditional acumen holds this sort of portfolio a well-diversified portfolio that can mitigate the idiosyncratic risk through diversification. However, this risk can be managed by building portfolios that are stable for a while (Campbell et al., 2001). The study utilized the portfolio approach in which discrete returns, gross profitability ratios, and market value are estimated every month. Data of all individual stocks registered and non-registered; listed and delisted (non-financial companies) in (PSX) are gathered for the estimation of discrete and market returns. Monthly returns are measured using a discrete returns approach. Discrete returns are defined as the value-weighted aggregate sum of individual asset returns in a portfolio in which weights are assigned on all assets which exhibit the contribution of a portfolio from total investment in a particular asset. Additionally, discrete returns are a more appropriate approach to examining cross-sectional asset returns (Campbell et al., 1997). The data for the estimation of market value (MV) and gross profitability is collected from "Thomsen Reuters Data Stream."

### *3.3:Gross Profitability Measure*

Following the empirical studies documented by Novy-Marx (2013) & Kenchington et al; (2019), gross profitability is calculated as revenue (R) less the cost of good-sold (COGS) ascended by assets.

$$\frac{Gross\ Profits}{Assets} = \frac{Revenue\ (R) - Cost\ of\ Good\ Sold\ (COGS)}{Total\ Assets}$$

Decile portfolios are constructed at the end of every year i.e. June (t) by utilizing (PSX) as sorting criteria based on gross profitability at (t-1). Then value-weighted (VW) average returns decile portfolios are computed from year July (t) to June (t+1). Each portfolio is rebalanced at year June (t+1). Data of total revenue with mnemonic codes (WC01001), mnemonic code (WC01051)-cost of goods sold (COGS), and mnemonic code-(WC02999) are gathered from "Thomson Reuters Data Stream" and utilized for gross profitability.

### *3.4:Construction of Portfolio & Sorting Criteria*

Following the study of Novy-Marx (2013), stock returns are sorted monthly at the time (t) into deciles based on the stock's gross profitability ratio at a time (t-1) monthly. Market value (mv) on a monthly basis at a time (t-1) is sorted to calculate the portfolio returns at the period (t). Portfolio returns are measured monthly in which single sorting technique or post ranking stock returns are adopted. Decile portfolios are constructed as they contribute greater division of sorting

criteria in comparison with percentile portfolios (Fama, & French, 1993). Decile portfolios assist in constructing the more effective and diversified portfolios. Stocks are ranked in ten decile portfolios i.e. from P1 to P10. Portfolio (P1-P10) represents the stocks with a low value of gross profitability to the highest values. Then the two sorts of portfolios i.e. equally (EW) and value-weighted (VW) gross profitability based portfolios are developed to examine the robustness of the sorted portfolio (Kostakis et al., 2012). Value weighted returns are computed to find all stock's weights in a portfolio. The gross profitability based portfolio is assessed and tested using asset pricing models.

### *3.5:Estimation Techniques*

In this study, the first decile portfolios of the companies are constructed for analysis of time- series. To analyze the gross profitability anomaly through asset pricing models, generalized method of moments (GMM) and Wald Test are utilized. The Time-series technique is applied that is centered on regressing the additional return portfolio on a single or multifactor explanatory variable over a period (Black et al., 1972). This regression method reflects only a single factor over a different period. In the time series technique, the test needs factors which are also returned. FF (1993) applied the time series technique to assess the stock's returns performance. Hence, verified that intercept in the time series can be utilized by asset pricing models for estimating stock's return performance. Slopes utilized in the time series regression are the risk factors that can capture the stock's return performance. To estimate methods, Generalized Methods of Moments (GMM) are utilized grounded on the method of Newey and West (1987). GMM is employed to estimate the 'W' termed as weighting matrix estimator which can tackle the statistical problems like autocorrelation and heteroskedasticity in the asset returns which are non-normally distributed (Cochrane, 2005). GMM is a framework in which parameters are estimated as a sample mean that includes the model misspecification in the distribution theory and then evaluates the model by observing at the errors of pricing. The alphas of the expected stock returns are measured using GMM. Walt test is applied, to examine the joint significance of intercepts (alpha) or pricing error and also to test that all intercepts that are jointly significance equivalent to zero under the null hypothesis (Cochrane, 2005).

## 4.Data Analysis & Findings

### *4.1:Descriptive Statistics*

In this section, first descriptive statistics of two sorts of portfolios i.e. equally (EW) and value-weighted (VW) gross profitability-based portfolios are developed to examine the robustness of the sorted portfolio. Equally Weighted & Value Weighted excess returns are considered as the annualized average returns (monthly) of the EW & VW portfolio. Portfolio (P1-P10) represents the

stocks with a low value of gross profitability to the highest values. The t-statistic is utilized to the differences among the largest decile portfolio (P10) and the smallest decile portfolio to assess if the extreme portfolios perform differently or not. The difference (P10-P1) represents the spread level among the largest gross profitability portfolio P10 and the smallest gross profitability portfolio P1. In the last column, t-values of hedge portfolios are represented. The findings of equally weighted (EW) and value-weighted (VW) excess returns depicts monotonically growing return trends and significant deviation among decile portfolios denoting the importance of gross profitability as a sorting criterion.

The descriptive statistics of equally (EW) and value-weighted (EW) decile portfolios are formed based on gross profitability are reported in table 1. The table-1 represents descriptive statistics of all gross profitability portfolios from the period of January 2000- December 2018. The results report that EW and VW excess returns of the decile portfolios which are sorted based on gross profitability exhibit a monotonic increasing trend of returns and observe a substantial variation among all portfolios presenting the importance of gross profitability as a sorting criterion. However, there is no specific size pattern among gross profitability portfolios. The results depict that P1 (low value of gross profitability) involves shares with relatively lowest market value and exhibit significantly higher value i.e. (1.25) of CAPM beta (highly risky) as compare to portfolios P10 (higher value of gross profitability) have a lower beta value of (0.75) indicating less risky. The results of EW & VW excess returns depicts that portfolio (P10) yields higher average returns 0.40% p.a. and 0.25% p.a. than the portfolio (P1) yields lower returns of 0.27% p.a. and 0.15% p.a. respectively. However, the CAPM model implies that P1 would expect to earn higher returns as compared to the P10 portfolio. Thus, the result shows portfolio (P10) yield greater returns than the portfolio (P1). Also, the spread level (P10-P1) of EW and VW excess returns among the largest and smallest gross profitability portfolio are statistically significant with the returns of 0.13% (1.80) and 0.10% (2.21) respectively. Therefore, contradictory to the CAPM implication, it can be determined that gross profitability is a significant consideration in the portfolio analysis for the investors in their decision making.

**Table 1 Performance and features of decile portfolios based on Gross Profitability**

| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P10-P1 | t-test |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EW Excess Returns (% p.a.)** | 0.27 | 0.28 | 0.29 | 0.28 | 0.25 | 0.28 | 0.31 | 0.31 | 0.35 | 0.40 | 0.13 | 1.80* |
| **VW Excess Returns (% p.a.)** | 0.15 | 0.15 | 0.17 | 0.29 | 0.18 | 0.20 | 0.17 | 0.22 | 0.19 | 0.25 | 0.10 | 2.21** |
| **MV (Rs. mn)** | 0.062 | 0.093 | 0.130 | 0.118 | 0.156 | 0.147 | 0.150 | 0.313 | 0.370 | 0.873 | 0.812 | 16.76 |
| **CAPM β** | 1.25 | 1.08 | 1.06 | 1.11 | 0.87 | 1.08 | 0.77 | 1.00 | 0.90 | 0.75 | -0.49 | -20.58 |

*Table 1 presents the characteristics of gross profitability in the decile portfolio from January 2000 – December 2018. All stocks which are listed on the (PSX) are sorted monthly at a time (t) based on gross profitability values in ascending order. Gross profitability values are measured by utilizing the rolling window of 60 observations (monthly) and are allocated in ten decile portfolios i.e. from P1 to P10. Portfolio (P1-P10) represents the stocks with the lowest gross profitability values to the highest gross profitability values. Portfolios' excess returns are measured at month (t+1) in which single sorting technique or post ranking stock returns is presented and each portfolio is rebalanced (monthly basis). P10-P1 denotes the spread level. EW and VW (excess returns) denote annualized average returns (monthly) of both portfolios i.e. equally weighted and value-weighted. MV (Rs. mn) presents the stock's average market value contained in all portfolios. CAPM beta shows volatility measures against market risk and is an estimate of (VW) portfolio's returns. The t-statistics (last column) reports the Wald test results denoting the null hypothesis of no mean difference among the portfolio's (P1 & P10) characteristics. single (*) indicates t-values significance at 10% and (**) indicates 5% and (***) at 1% significance level respectively.*

### *4.2:Risk-adjusted performance (Asset Pricing Models)*

The descriptive statistics in the above table exhibit that risk premium is correlated with portfolios that are constructed based on gross profitability. Risk-adjusted abnormal performances of the EW and VW portfolios are estimated by utilizing three known asset pricing models. CAPM (Jensen's alpha), Fama & French's (three-factor alpha, and five-factor alpha) are considered. To analyze the Risk-adjusted abnormal performance through asset pricing models, generalized method of moments (GMM) and Wald Test are utilized grounded on the method of Newey and West (1987).

**Table 2 Jensen Alphas of Equally-Weighted (EW) Portfolios – Gross Profitability**

| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P10-P1 | Wald-Test |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAPM** | **0.46** | **0.67** | **1.37** | **5.51** | **5.47** | **8.11** | **13.40** | **12.72** | **18.52** | **18.04** | **17.58** | **47.26** |
| **Alpha** | **(0.05)** | **(0.08)** | **(0.21)** | **(0.86)** | **(1.08)** | **(1.72)*** | **(2.56)**** | **(3.07)***** | **(3.34)***** | **(3.90)***** | **(1.77)*** | **[0.00]** |
| **FF3** | **4.03** | **3.42** | **4.14** | **7.83** | **3.82** | **9.16** | **13.89** | **12.71** | **19.05** | **17.82** | **13.78** | **32.33** |
| **Alpha** | **(0.33)** | **(0.35)** | **(0.52)** | **(1.03)** | **(0.60)** | **(1.59)** | **(2.14)**** | **(2.47)**** | **(2.75)***** | **(3.10)***** | **(2.08)**** | **[0.00]** |
| **FF5** | **0.32** | **2.01** | **3.79** | **7.49** | **5.40** | **8.42** | **16.15** | **13.76** | **19.40** | **18.63** | **18.31** | **32.46** |
| **Alpha** | **(0.02)** | **(0.20)** | **(0.45)** | **(0.94)** | **(0.81)** | **(1.38)** | **(2.39)**** | **(2.54)**** | **(2.64)***** | **(3.10)***** | **(1.92)*** | **[0.00]** |

*Table 2 reports the risk-adjusted performance of the equally-weighted gross profitability in the decile portfolio from January 2000 – December 2018. All stocks which are listed on the (PSX) are sorted monthly at a time (t) based on gross profitability values in ascending order. (P1-P10) represents the stocks with the lowest gross profitability values to the highest gross profitability values. Each portfolio is rebalanced (monthly basis). P10-P1 denotes the spread level. CAPM (Jensen's alpha), Fama & French's (three-factor alpha & five-factor alpha) are alpha estimates (annualized). The chi-square t-statistics (last column) reports the Wald test results denoting the null hypothesis of ten portfolios intercepts (alphas) are jointly equivalent to zero under the null hypothesis. P-values are reported in square brackets. The t-statistics are given in parentheses i.e. single (*) indicates t-values significance at 10% and (**) indicates 5% and (***) at 1% significance level respectively.*

**4.3:Equally Weighted (EW) Portfolios**

The alphas estimation and the equally weighted (EW) gross profitability-based decile portfolios are reported here. Table 2 depicts the alphas of equally-weighted portfolios ranges from (P1 to P10) constructed based on gross profitability from January 2000 – December 2018. Portfolio P10, that contains the stocks exhibiting the highest positive gross profitability yields an annualized CAPM (Jensen's alpha) of 18.04% p.a. (t-value= 3.90), FF (three factor-alpha) of 17.82% p.a. (t-value= 3.10), FF (five factor-alpha) of 18.63% p.a. (t-value = 3.10). Whereas portfolio P1 involves the stocks with the necessary features of lowest gross profitability values yields the lowest alpha value of 0.32% under the FF (five-factor) model. The findings reveal that the spread level (P10-P1) is statistically significant for asset pricing models at 10% and 5% significance level and yields an annualized CAPM (Jensen's alpha) of 17.58 % p.a. ( t-value = 1.77), FF (three-factor & five-factor alpha) are 13.78% p.a. (t-value =2.08) and18.31 % p.a.(t-value= 1.92) respectively. The Wald test values reveal that cross-sectional deviations of returns exist among the equally-weighted portfolios (P10-P1) constructed based on gross profitability since the p-values are less than 0.05. Further, table 2 exhibits the significant evidence that gross profitability anomaly exists. The results depict the significant evidence that the gross profitability

premium is priced in the (PSX). The Wald-test results of the estimated intercepts (alphas) are significant as a null hypothesis of ten portfolios intercepts (alphas) jointly equivalent to zero has been rejected. The overall findings of the EW portfolios by using three asset pricing models are found to be statistically significant. Even after analyzing the risk-adjusted factors in (EW) returns, the outcomes documented in descriptive statistics in table 1 remains intact and provides evidence of gross profitability premium in (PSX). Hence, it can be concluded from the results that all three asset pricing (CAPM, FF- three & five-factor) models are inefficient or misspecified models in (PSX) and there are other factors such as gross profitability for the prediction of the stocks. Hence, the finding gives strong evidence of gross profitability within EW returns.

| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P10-P1 | Wald-Test |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAPM Alpha** | **-15.15 (-1.52)** | **-10.94 (-1.81)*** | **-8.76 (-1.67)*** | **1.34 (0.20)** | **-3.32 (-0.66)** | **-5.83 (-1.06)** | **-2.24 (-0.53)** | **-2.34 (-0.61)** | **-2.56 (-0.44)** | **-1.09 (-0.28)** | **14.06 (1.84)*** | **10.89 [0.03]** |
| **FF3 Alpha** | **-13.40 (-1.09)** | **-11.11 (-1.52)** | **-9.41 (-1.42)** | **3.27 (0.39)** | **-4.41 (-0.70)** | **-6.07 (-0.87)** | **0.51 (0.10)** | **0.05 (0.01)** | **-0.78 (-0.11)** | **-1.02 (-0.21)** | **12.38 (2.89)*** ** | **6.97 [0.03]** |
| **FF5 Alpha** | **-16.64 (-1.29)** | **-13.14 (-1.73)*** | **-13.48 (-1.96)** ** | **-0.03 (-0.00)** | **-1.15 (-0.17)** | **-10.51 (-1.51)** | **2.49 (0.45)** | **-1.30 (-0.26)** | **-1.37 (-0.19)** | **1.07 (0.22)** | **17.71 (1.91)*** | **11.15 [0.03]** |

**Table 3 Jensen Alphas of Value-Weighted (VW) Portfolios – Gross Profitability**

*Table 3 reports the risk-adjusted performance of the value-weighted gross profitability in the decile portfolio from January 2000 – December 2018. All stocks which are listed on the (PSX) are sorted monthly at a time (t) based on gross profitability values in ascending order. (P1-P10) represents the stocks with the lowest gross profitability values to the highest gross profitability values. Each portfolio is rebalanced (monthly basis). P10-P1 denotes the spread level. CAPM (Jensen's alpha), Fama & French's (three-factor alpha & five-factor alpha) are alpha estimates (annualized). The chi-square t-statistics (last column) reports the Wald test results denoting the null hypothesis of ten portfolios intercepts (alphas) are jointly equivalent to zero under the null hypothesis. P-values are reported in square brackets. The t-statistics are given in parentheses i.e. single (*) indicates t-values significance at 10% and (**) indicates 5% and (***) at 1% significance level respectively.*

### 4.4:Value-Weighted (VW) Portfolios

The alphas estimation and the value-weighted (VW) gross profitability-based decile portfolios are reported here. Table 3 depicts the alphas of value-weighted portfolios ranges from (P1 to P10) constructed based on gross profitability from January 2000 – December 2018. The findings reveal that the spread level (P10-P1) is statistically significant for asset pricing models at 1% and 10% significance level and yields an annualized CAPM (Jensen's alpha) of 14.06 % p.a. (t-value = 1.84), FF (three-factor & five-factor alpha) are 12.38% p.a. (t-value =2.89) and 17.71 % p.a. (t-value= 1.91) respectively. The Wald test values reveal that cross-sectional deviations of

returns exist among the value-weighted portfolios (P10-P1) constructed based on gross profitability since the p-values are less than 0.05. Table 3 exhibits the significant evidence that gross profitability anomaly exists. The results depict the significant evidence that the gross profitability premium is priced in the (PSX). The Wald-test results of the estimated intercepts (alphas) are significant as a null hypothesis of ten portfolios intercepts (alphas) jointly equivalent to zero has been rejected. The overall findings of the VW portfolios by using three asset pricing models are found to be statistically significant. Even after analyzing the risk-adjusted factors in (VW) returns, the outcomes documented in descriptive statistics in table 1 remains intact and provides evidence of gross profitability premium in (PSX). Therefore, it can be concluded from the results that all three asset pricing (CAPM, FF- three & five-factor) models are inefficient or misspecified models in (PSX) and there are other factors such as gross profitability for the prediction of the stocks. Thus, the overall findings depict that decile based gross profitability anomaly exists and yields higher returns in (PSX).

## 5.Conclusion

To attain the objective of the study and to empirically examine the gross profitability existence and premium in Pakistan Stock Exchange (PSX), we utilize famous asset pricing models i.e. CAPM model, Fama & French (three-factor & five-factor) models.

The descriptive statistics of equally (EW) and value-weighted (EW) decile portfolios reveal the findings that the lowest gross profitability companies involve shares with relatively lowest market value exhibit significantly higher value of CAPM beta (highly risky) as compare to highest profitability companies having a lower beta value indicating less risky. The result of EW & VW excess returns depicts that the highest portfolio yields a high average return than the lower portfolio which yields lower returns. However, the CAPM model implies that P1 would expect to earn higher returns as compared to the P10 portfolio. The results support the critique document by Roll (1977) & Ross (1976) in which both claim that numerous X factors are associated with the systematic risk and not only one factor as elucidated by the CAPM model. Thus, the result shows portfolio (P10) yield greater returns than the portfolio (P1) and supports the evidence that gross profitability exists in (PSX). The results are consistent with the Novy-Marx (2013 in which they claim that profitable firms yield greater average returns as compare to unprofitable firms. Also, the spread level (P10-P1) of EW and VW excess returns among the largest and smallest gross profitability portfolio are statistically significant.

The risk-adjusted performance of the EW and VW portfolios reports that the spread level (P10-P1) is statistically significant under the asset pricing models. The Wald test values reveal that cross-sectional deviations of returns exist among the (EW) and (VW) portfolios (P10-P1) constructed based on gross profitability since the p-values are less than 0.05. The empirical time series analysis depicts the findings with significant evidence that gross profitability anomaly exists

in the (PSX). The Wald-test results of the estimated intercepts (alphas) are significant as a null hypothesis of ten portfolios intercepts (alphas) jointly equivalent to zero has been rejected overwhelmingly and report evidence that gross profitability is priced in the (PSX). The overall findings of the EW and VW portfolios by using three asset pricing models are found to be statistically significant. Hence, it can be concluded from the results that all three asset pricing (CAPM, FF- three & five-factor) models are inefficient or misspecified models in (PSX) as these models are unable to explicate the cross-sectional deviation in returns of the portfolio based on company's gross profitability and there are other factors such as gross profitability for the prediction of the stocks. Thus, the overall findings depict that decile based gross profitability anomaly exists and yields higher returns in (PSX). From the above results, it can be determined that gross profitability is a key factor in (PSX) returns because it captures cross-sectional deviation among the returns of the stock better than the models. Furthermore, the results can benefit investors in determining an applicable risk measure in forming well-diversified portfolios. The future research can be conducted in which decile portfolios are constructed based on different profitability measures utilizing the operating profit (OP), net income (NI), gross profitability (GP) factor, and free cash flow (FCF) by testing the asset pricing models in Pakistan and other developing economies to determine the robustness and predictive power of the stock return.

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