DISSECTING THE ASSET GROWTH ANOMALY: A CASE OF PAKISTAN STOCK EXCHANGE (PSX)

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Abstract

The aim of this study is to explore the existence of the asset growth anomaly effect in the Pakistan stock exchange (PSX). The data of all Pakistani listed firms and delisted firms from 2000 to 2017 is collected from Thomson Reuters DataStream and State Bank of Pakistan (SBP) database. Technically, data is organized in decile portfolios (P1 to P10) which is going from the lowest to highest asset growth ratio. Remarkably, the estimation of portfolio returns is performed on monthly basis i.e. post ranking returns. Likewise, equal and value weighted portfolios returns are estimated by adding risk-free rate. After that, the profitability for the asset growth is calculated both portfolios i.e. value and equally weighted portfolios and then it is tested by the Capital Asset Pricing Model (CAPM), Fama three-factor and Fama five-factor models by employing Generalized Methods of Moments (GMM) and Wald Test. Clearly, the discoveries advise that anomaly of asset growth does exist in PSX market and firms with lower assets growth are performing better. Nevertheless, firms that have higher assets growth indicate that asset pricing models are mis specified in PSX. The results will help investors in better understanding the stock returns of Pakistani firms and recommend the investors to build portfolios with lower assets growth rate stock to generate abnormal stock returns from PSX.

Keywords: Asset Growth, CAPM, Decile Portfolios, Fama Three-Factor Model, Fama Five-Factor Model, Pakistan Stock Market, GMM.

1. INTRODUCTION

Modern theory of portfolio that is settled by Harry Markowitz (1952) states that investors always prefer to construct their investment portfolio in such a way that it delivers high return and minimizes the risk. Moreover, this theory provides mean variance analysis

framework. Basically, this framework is a diagnostic tool which helps financial management to estimate the underlying risk for those assets in which business have a plan to invest. Technically, this framework is considered to be innovative and offers a way of entrance to various pricing models for assets. However, among others, the most widely used model is the Capital Asset Pricing Model (CAPM). Notably, CAPM model explains that two various types of risks are associated with investments. One is a market risk which cannot be eliminated but the other risk which is named as specific risk can easily be handled by diversification. Comparatively, investors focus more on market risk for their investments. Principally, it is hard to ignore and overlook market risk even when it is well diversified because this risk is attached with each and every invested stocks of the firm (Black, Jensen and Scholes, 1972). Notably, CAPM handles the issue of this model in the real financial market. This model is based on two assumptions; first, markets are efficient and price of the stock is a true depiction of all the relevant information. Second, investors are usually risk-averse and they require a premium for additional risk-taking (Mullins, 1982). Alike these assumptions, there is another theory that is named as the Efficient Market Hypothesis (EMH). This EMH theory states that capital markets are fully efficient and stock price incorporates all relevant news (Fama, 1969). These assumptions might sound logical but they are impracticable.

Evidently, all financial markets are not efficient and do not observe all relevant information of the stock price (Mullins, 1982). Besides, Fama (1969) postulates that stock prices depict unsystematic movement because of ample amount of information available in the market. However, with the advancement in the field of asset pricing models, stock prices have become predictable to a certain pattern. Technically, these patterns are commonly known as time-series and cross-section series and these series are stated as financial market anomalies (Fama and French, 2008). The existence of these financial market anomalies interrupt with many financial models and theories may result in greater return on investments (Latif et al., 2014).

Asset growth anomaly was first identified by Banz (1981) who discloses that smaller organizations give higher return than bigger organizations. This anomaly states that organizations which are greater in size of its asset deliver low returns on stock (Gray, 2014). Whereas in an efficient market, organizations which are large in size of their assets will give a greater return than those organizations which have lower asset size. Conflicting to this, there are numerous research studies which prove that asset growth anomaly is more like asset growth effect (Cooper, Gulen and Schill, 2009). Furthermore, it is debatable that a financial market which consists of an anomaly can be categorized as an inefficient market. Importantly, Fama and French conclude that to enhance overall efficiency of market, the existence of financial anomalies is required. Moreover, they indicate that CAPM fails at theory and practicality as it does not completely clarify the

relation of risk and return. Also, CAPM does not incorporate any financial anomaly in it, therefore, financial anomalies can be studied by using the model of Fama & French.

Considering the above discussion it is clear that financial anomalies do exist in the financial markets (Schwert, 2003; Dimson and Marsh, 1999; Levis, 1989). However, in context of Pakistan, the former studies provide contradictory and mix evidences (e.g Rehan et al., 2021; Baloch, 2015; Nisar, 2014). Hence, it is warranted to recheck the existence of these financial anomalies in Pakistan Stock Exchange. Therefore, this research is an attempt to study asset growth anomaly and investigate whether stock portfolios based on asset growth yield abnormal returns in PSX or not. In addition, this research also tests the famous asset pricing models i.e CAPM, three factor model of Fama & French and five factor model of Fama & French to capture asset growth effect in PSX.

The rest of paper is organized as follows: Section 2 discusses the earlier literature, research methodology is described and explained in section 3, while the section 4 i.e. statistical analysis enlightens the empirical findings and discussion about the obtained evidences and in the end section 5 provides conclusions and recommendations for future researchers.

2.   LITERATURE REVIEW

2.1 Asset Growth Anomaly

Technically, financial market anomalies are categorized into three main types. First is fundamental, second is technical and third one is the calendar anomalies. Fundamental anomalies are those which use core financial data of the organizations, technical anomalies are those which use past data of the organization and calendar anomalies use data in a specific pattern in order to make predictions of the stock return. Notably, this investigation works on a specific anomaly which comes under the umbrella of fundamental anomaly that is "Asset growth anomaly".

Asset growth anomaly is introduced by Titman, Wei and Xie (2004). They explain the existence of reverse relationship between firm's capital investment and its returns on stock. They termed it as Asset Growth Effect. Subsequently, Cooper, Gulen, and Schill (2009) explain anomaly for assets growth and indicates that firms with higher asset size give lower stock returns in comparison to firms with lower asset size. Whereas, Layman assumes that organizations which have higher asset size will give higher return than the organizations which have lower asset size. However, in reality, many empirical researches (e.g. Krishnan, 2016; Richardson, Wysocki and Tuna, 2010; Lipson, Mortal and Schill, 2008) have concluded that stocks return of businesses having lower asset size are better than a business having a bigger asset size.

2.2 Factors to Calculate the Asset Growth Effect

Needless to say that different market factors can increase asset size of the organization such as investment effect, external financing effect, and accrual effect. Analytically, Titman, Wei and Xie (2004) are the first researchers who identified the investment effect. Investment effect is defined as an increase or decrease in the organizations return caused by the asset side of the organization. To study the relationship of return of the organization with free cash-flow and low financial opportunities, Titman, Wei and Xie (2004) used CAPEX. Similarly, Loughran and Ritter (1995) are considered as the first researchers who identified external financing effects on organizations. They defined external financing effect on organizations and provide conclusion for those organizations which issued both i.e. debt and equity. Thought behind this external financing effect is Q investment theory. This theory states the anticipated return on stock of the organization would decrease as issuer will keep increasing its capital (Kaldor, 1966). Moreover, Sloan (1996) is the first researcher who identified accruals effect and defined it as an increase or decrease in the organizations' return caused by both sides of the balance sheet of the organization. Basically, Solan (1996) calculated accounting income of the organization by means of operating cash-flow along with non-cash items of the organization and found that whenever accruals of the organization increase, its return starts decreasing in the subsequent years. Empirically, relationship of above three anomalies have been found in numerous investigations, such as Dechow, Richardson and Solan (2008) explain that accrual anomalies in the organization produce external financing anomaly and this has been proven in their research findings that these anomalies lead to future irregular return. Similarly, Lyandres, Sun and Zhang (2007) also describe that investment anomaly is connected with external financing anomaly.

2.3 Developments in Asset Growth Anomaly

Fama & French (2008) investigate dissecting anomalies. They use effects of size, momentum, value, net stock issues, and accruals to study asset growth anomaly and explain that asset growth anomaly occurs in small stock firms with small cap size. Whereas, asset growth anomaly does not arise in large stock firms having large cap size. After that, Lipson, Mortal and Schill (2011) conduct a research and conclude that Fama & French (2008) are unable to find any asset growth anomaly in large stock firms because they study this anomaly with different effects. They, further describe that if they had used total asset growth and external financing factor, then they would have found asset growth anomaly in large stock firms as well. Likewise, Xing (2007) conducts research and indicates asset growth anomaly's existence in both small share price firm and large share price firm. However, to test the existence of this anomaly in both types of firms, it is crucial to use total asset growth.

Furthermore, the use of overall growth of assets for testing anomaly of assets growth is suggested by Cooper, Gulen and Schill (2009). They state that the total asset growth of the company would apprehend the investment and financing activities by comparing various factors like, size, accruals, book value to market value and other similar factors. Besides, Wen (2013) also explain that asset growth anomaly exists in the aggregate stock market and the results explain that asset growth and future irregular returns have negative relation and in the short run the aggregate asset growth can predict future stock returns. Likewise, another research that is performed by Li and Sullivan (2014) indicate that asset growth anomaly exists globally and the existence of this anomaly is the result of mispricing in the stock market.

2.4 Asset Pricing Models for Asset Growth Anomaly

Academically, numerous studies investigate asset growth anomaly to build a rationale for the reverse connection between return of stock and asset growth. However, these former investigations mostly consider and focus on two important factors. The first factor is a risk as it is attached with investments made by the company (Lyandres, Sun and Zhange, 2007). Subsequently, the second factor is investor's behavior, their irrational behavior and response to public information regarding future investments of the company that leads to asset growth anomaly. Moreover, these studies indicate that mispricing is created due to irrational behavior of the investor. Technically, stock returns get lower for a certain period of time to correct stock mispricing and then connect back the stock price with actual return of the investment activities of the company (Lakonsihok, Shleifer and Vishny, 1994). However, Fama & French (1993) indicate that linear relation of risk and return cannot be assessed with the irrational asset pricing model. Similarly, irrational asset pricing model fails to answer the value, size and momentum anomalies. After that, Lyandres, Sun and Zhange (2007) specify that investors demand a higher return for taking additional risk on those companies which have smaller asset growth rate and risky expansion plans. Hence, asset growth anomaly exists because of the risk factor involved in these companies. Apart from the risk factor, financial anomalies can be caused by the behavior of investor with respect to other factors. Notably, Management's Empire Building theory that is developed by Jensen (1986) states that in order to build empire and keeping agency cost of investments in mind, management of the companies takes unnecessary decisions for investments. This leads to building up a huge asset base company. Clearly, companies do not provide a higher return to their investors because of unsuitable allocation of their assets. This leads to a correction in the stock price of the company. Therefore, the classical asset pricing model is introduced by John (1996).

The rational asset pricing model which is considered as investment-based asset pricing model states that investment's NPV relies on the discount rate of the company and companies which offer low return are the ones that make a great investment (Cocharne,

1996). Another rational asset pricing model is a real option model. This model states that companies are considered riskier which have more options pertaining to the growth of the company. Big companies have lesser options for asset growth, therefore, they are less risky companies. Hence, less return for the investors. Whereas smaller companies have more options for asset growth which are riskier and deliver a higher return for investors (Lyandres, Sun and Zhang, 2007).

Above discussed literature indicate that asset growth anomaly is present in stock markets around the world and there are various ways to calculate it. However, in context of Pakistan the earlier studies provide conflicting results (e.g Rehan et al., 2021; Baloch, 2015; Nisar, 2014). Therefore, it is required to reinvestigate the presence of these asset growth anomalies in Pakistan Stock Exchange.

3.   DATA & METHODOLOGY

To perform analysis, the stocks data of all non-financial firms have been collected for the period of 2000 to 2017 from PSX and Thomson Reuters Data Stream. Technically, the reason for the inclusion of all listed firms (listed firms and de-listed firms) in investigation is to evade the bias issue of survivorship (Nagel, 2001). Notably, this is in line with the practices of earlier studies

(e.g Dimson et al., 2003; Soares and Stark, 2009; Shumway, 1997). Notably, this study calculates market value on monthly basis for a time 't-1' and monthly returns for time *'t'*. Likewise, the asset growth ratio is considered in annual frequency at a time *'t-1'*.

Besides, returns on investments are better while constructing a portfolio rather than investments returns of the individual stock. The rationale behind this is that individual stock carries specific risk, which causes hurdles in creating an anticipated pattern of returns (Campbell and MacKinlay, 1997). Such specific risk can simply be minimized by constructing a portfolio and diverse risk (Markowitz, 1952). Due to diversification in the portfolio, their beta is comparatively small as related to the stock of an individual company (Black, Jensen and Scholes, 1972). This research study has constructed portfolios of different companies listed on Pakistan Stock Exchange on monthly approach to calculate asset growth ratio, discrete return, and market value.

Discrete return can be defined as the value of individual stock weighted to its proportion of investment in the portfolio (Campbell and MacKinlay, 1997). Thus, in this study, we have used discrete return of 655 non-financial companies listed in PSX. Discrete return can be expressed in equation form in which portfolio return *'p'* at a specific time *'t'* is being calculated, as below:

$$R_{pt} = \sum W_{ip}.R_i, \qquad Where\ i = 1,2,3,4, ...N$$

Data for market value along with the mnemonic code (WC02999) of market value is collected from Thomson Reuters DataStream. Asset growth ratio is calculated using data from the PSX data portal. Cooper, Gulen and Schill (2009) defined asset growth ratio as a variation in the total assets of the organization per annum in terms of percentage. They defined asset growth anomaly as the organizations having a smaller asset base give better stock returns than organizations with a bigger asset base. The formula to calculate the asset rate given by them is as below:

$$\text{Asset Growth Rate} t = \frac{TotalAssets_t - TotalAssets_{t-1}}{TotalAssets_{t-1}}$$

Where, asset growth rate mentions change for total assets at explained time period *'t'* that is divided by overall total assets at specific time *'t – 1'*. Besides, the calculation for assets growth from assets or other resources is obtained from equation explained as:

Total Asset Growth = Cash Growth + Non-Cash (Current Assets Growth) + Long Term Assets Growth + Other Asset Growth

Furthermore, asset growth by equities or from other financing sources is calculated as:

Total Asset Growth = Operating Liabilities Growth + Retained Earnings Growth + Debt Financing Growth + Equity Financing

Subsequently, having found the asset growth rate, portfolios' ranking is done on the basis of their asset growth rates. Notably, those firms which have missing values are excluded from the constructed data set.

Sorting Criteria & Portfolio Construction

Notably, this study uses single sorting method to construct portfolio and perform analysis. In this method nominated stocks are separated as per their ratio of asset growth (sorting criteria) in that month into decile portfolios. For analysis purpose, data is organized in ten different portfolios (P1 to P10) which is moving from the lowermost ratio of asset growth toward higher ratio of asset growth. Additionally, P1 (portfolio number 1) which consists of stocks that have lowest growth of asset ratio figures, while P10 (portfolio number 10) is with stocks which have higher asset growth figures. Furthermore, in this method, portfolios returns are assessed on monthly basis which is also known as post-ranking returns. After that, both portfolios i.e. equal-weighted and value-weighted portfolios that contain returns which is risk-free (T-bills of las 6 months) are estimated. Later, the profitability of the asset growth portfolios calculated by value

weighted and equally weighted and tested by three dissimilar models i.e. FAMA three-factor model, FAMA five-factor model and CAPM.

4.   STATISTICAL ANALYSIS

Descriptive Statistics

For this research study, the data has been extracted from the data portal of PSX, SBP, and Thomson Reuters Datastream. Month wise data of 17 years was extracted from January 2000 to December 2017. The data was used to create decile portfolios. Decile portfolios are those which have 10 portfolios in it. For identification purposes, the decile portfolio one is named as P1, second as P2, third abbreviates with P3, fourth mentions with P4 then P5 and it continues until the last one which is named as P10. Technically, the decile portfolios constructed in this research are in ascending order of asset growth in the companies which means that P1 consists of companies that have lowest asset growth, P2 consists of companies that have greater asset growth as companies in P1 and likewise for all other portfolios. Whereas, P10 consists of companies that have the highest asset growth. Moreover, portfolios' returns are calculated by two methods i.e. value and equally weighted methods. Similarly, returns are extracted on monthly values for all 18 years. These monthly returns of one year are averaged to get annualized returns of the year for the entire study period. Analytically, the results of the risk-adjusted performance of VW and EW portfolio are tested on three different time series models that are CAPM, model of Fama-French three factor and model of Fama-French five factor.

Table 1: Descriptive Statistics of Asset Growth in Decile Portfolios

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	T Values
EW	0.42	0.31	0.29	0.27	0.28	0.17	0.34	0.25	0.19	0.16	0.26	3.35 ***
VW	0.35	0.25	0.23	0.27	0.19	0.16	0.31	0.22	0.10	0.27	0.08	2.32 **
MV Rs. (000)	60.12	145.64	117.86	163.95	225.03	192.75	199.24	121.80	146.27	121.06	-60.94	6.66 ***
CAPM Beta	0.86	0.83	0.92	0.97	0.85	0.90	1.07	0.80	1.03	1.00	-0.14	3.71

Table 1 above shows descriptive statistics of asset growth in decile portfolios for a period of 2000 to 2017. The table shows that there are 10 portfolios arranged in 10

columns and for each portfolio that is equally weighted returns, value weighted returns, market value and CAPM beta is calculated. Last two columns represent the result of P1-P10 and T-values of the EW, VW, MV and beta for 'CAPM'. The data is categorized in 10 portfolios in ascending order, namely P1 to P10. P1 portfolio is a representation of those companies, which have smallest asset growth. Similarly, P2 portfolio is a representation of those companies which have greater asset growth than P1 companies. Lastly, the P10 portfolio is a representation of those companies which have the biggest asset growth in comparison to those companies which are in other portfolios. Evidently, results show that EW return of P1 is 0.42, EW return of P10 is 0.16, and P1-P10 result is negative 0.26. This means that EW return of P1 is greater than EW return of P10. Similarly, VW return of P1 is 0.35, VW return of P10 is 0.27 and P1-P10 result is 0.08. This means that VW return of P1 is greater than VW return of P10. Both EW and VW returns' results indicate that companies with lower asset growth give higher return and companies with higher asset size give lower returns. This illustrates that asset growth anomaly does exist in Pakistan Stock Exchange, as per descriptive statistics of asset growth in decile portfolio.

Risk Adjusted Performance of Stock Returns

This section displays the Jensen's and Fama French's alphas that are estimated and described to calculate the equally and value weighted risk adjustment performance of constructed portfolios (P1 to P10). The below equation is used to calculate Jensen's alpha:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}(R_{m,t} - R_t^f) + \varepsilon_{i,t} \quad (1)$$

Where, $R_{i,t}$ mentions the portfolio 'i' return for a month 't'. Likewise, R_t^f indicates the rate that is risk free in month 't', $(R_{m,t} - R_t^f)$ specifies the excess portfolio return of market for a month 't'. Similarly, to calculate alpha, Fama & French (1993) model of three factor and Fama & French (2015) model of five factor are used respectively:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,\ MKT}(R_{m,t} - R_t^f) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + \varepsilon_{i,t} \quad (2)$$

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}(R_{m,t} - R_t^f) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + \beta_{i,RMW}RMW_t + \beta_{i,CMA}CMA_t + \varepsilon_{i,t}$$
(3)

Where, SMB_t mentions the size risk factor for a month 't', HML_t indicates value risk factor for a month t, RMW_t is the operational income risk free factor for a month 't'. Similarly, 'CMA_t ' is the risk factor for investment for a month 't'. Furthermore, to calculate the combined significance of decile portfolio i.e. alphas, the constructed above systems of equations 2 and 3 are used. Technically, the system of equations are used because it overcomes and controls the measurement problems in variables and then handles the heteroscedasticity and auto correlation issues and corrected the models if alphas are calculated by employing Generalized Methods of Moments (GMM).

Equally Weighted Returns (EW Returns)

Table 2: Equally Weighted (EW) Asset Growth Portfolios' Jensen Alpha

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	WALD-TEST
CAPM Alpha	0.20 (1.92)*	0.11 (2.28)**	0.08 (1.70)*	0.06 (2.18)**	0.09 (-2.39)**	-0.02 (1.90)*	0.07 (1.17)	0.04 (2.42)**	0.01 (1.86)*	-0.09 (3.15)**	0.29 (3.28)**	22.70 (0.01)
FF3 Alpha	0.19 (1.97)**	0.07 (2.26)**	0.06 (1.37)	0.05 (2.52)**	0.07 (-1.04)	-0.02 (1.91)*	0.04 (1.76)*	0.02 (1.87)*	-0.01 (1.93)*	-0.09 (2.45)**	0.28 (2.60)**	10.80 (0.03)
FF5 Alpha	0.19 (1.95)*	0.09 (2.13)**	0.06 (1.84)*	0.07 (2.61)**	0.07 (-0.20)	-0.01 (1.83)*	0.04 (1.92)*	0.06 (1.76)*	-0.01 (1.94)*	-0.10 (2.31)**	0.29 (2.48)**	11.22 (0.03)

The P1 mentions decline portfolio stocks which have low assessed asset growth and the P10 indicates the last portfolio comprises of stocks which have highest calculated asset growth. Likewise, P1 to P10 is the spread among the low asset growth portfolio that start from P1 and last one that is highest portfolio for asset growth and mentions as P10. Here, CAPM alpha, FF5 alpha and FF3 alpha represent the annualized assessment of alphas that are obtained from CAPM, Fama-French model of three-factor and Fama-French model of five-factor respectively. Besides, findings of t-statistics are mentioned in parentheses that indicate the statistically significance at various levels (* at 10%, ** at 5% and *** at 1%). Lastly, the Wald test mention statistics for chi-square that refer to the hypothesis which is null and explain that ten alphas of decile portfolios are mutually equal at figure zero and there values of p that are in parenthesis are below the explained statistic.

The above Table 2 shows EW asset growth portfolio's Jensen Alpha. The values below Jensen alpha is the t-value of each portfolio with respect to each model. The results of this test on equally-weighted asset growth portfolio using CAPM model, Fama-French Factor 3 model and Fama-French 5 factor model that show P1 has Jensen alpha of 0.20, 0.19 and 0.19 with t- value of 1.92, 1.97 and 1.95 respectively. Whereas, P10 has negative Jensen alpha of -0.09, 0.09 and 0.10 and t-values of positive 3.15, 2.45 and 2.31 in CAPM model, Fama-French 3 factor model and Fama-French 5 factor model respectively. Technically, this indicates that equally weighted returns of P10 are lower than P1 in all three selected models and the chi-square test results are significant in all three models as its value is less than 0.05, this means there exists cross-sectional variation in return among equally weighted portfolios. Evidently, this clarifies that these models are mis-specified and unable to capture asset growth anomaly indicating asset growth as an additional factor through which asset returns can be predicted in PSX. Technically, the findings are in line with Fama and French (1993, 2015) results but contradicts with the output generated by FU (2014) in NYSE, AMEX, and NASDAQ markets.

Value Weighted Returns (VW Returns)

Table 3: Value Weighted (VW) Asset Growth Portfolios' Jensen Alpha

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	WALD-TEST
CAPM Alpha	0.14	0.05	0.02	0.04	-0.01	-0.05	0.04	0.03	-0.14	-0.10	0.24	12.63
	(1.32)	(1.98)**	(2.47)**	(0.71)	(2.04)**	(2.30)**	(0.72)	(1.86)*	(1.70)*	(2.00)**	(2.42)**	(0.02)
FF3 Alpha	0.16	-0.06	-0.04	-0.01	-0.03	-0.02	0.04	0.03	-0.16	-0.13	0.29	9.69
	(1.33)	(1.84)*	(2.46)**	(0.49)	(2.43)**	(2.45)**	(0.21)	(1.48)	(1.88)*	(1.86)*	(2.34)**	(0.04)
FF5 Alpha	0.15	0.01	-0.03	-0.01	-0.02	-0.05	0.05	0.08	-0.15	-0.14	0.29	9.25
	(1.30)	(1.96)**	(2.95)***	(0.72)	(2.68)***	(2.28)**	(0.01)	(1.41)	(1.82)*	(1.95)*	(2.20)**	(0.00)

The P1 mentions decline portfolio stocks which have low assessed asset growth and the P10 indicates the last portfolio comprises of stocks which have highest calculated asset growth. Likewise, P1 to P10 is the spread among the low asset growth portfolio that start from P1 and last one that is highest portfolio for asset growth and mentions as P10. Here, CAPM alpha, FF5 alpha and FF3 alpha represent the annualized assessment of alphas that are obtained from CAPM, Fama-French model of three-factor and Fama-French model of five-factor respectively. Besides, findings of t-statistics are mentioned in parentheses that indicate the statistically significance at various levels (*

at 10%, ** at 5% and *** at 1%). Lastly, the Wald test mention statistics for chi-square that refer to the hypothesis which is null and explain that ten alphas of decile portfolios are mutually equal at figure zero and there values of p that are in parenthesis are below the explained statistic.

The above Table 3 depicts Jensen alpha of VW asset growth portfolio and describe Jensen alpha for CAPM model, Fama-French 3 factor model and Fama-French 5 factor model. Statistically, the results demonstrate that P1 has Jensen alpha of 0.14, 0.16 and 0.15 and with t values of 1.32, 1.33 and 1.30 respectively. Whereas, P10 has Jensen alpha of -0.10, -0.13 and -0.14 and t-values of 2.42, 2.34 and 2.20 in CAPM model, Fama-French 3 factor model and Fama-French 5 factor model respectively. Evidently, the results indicate that returns of P1 are higher than P10 in all three models even value-weighted portfolios indicate cross-sectional variation in returns among value-weighted portfolios. Similarly, Chi-square test results demonstrate that results are significant and all three models are mis-specified. Hence, it can be concluded that these models have not captured asset growth anomaly even in value-weighted portfolios in PSX. The results are in line with the earlier study of Baloch (2015) who concludes the absence of asset growth anomaly in Pakistani market. However, the results are contradicted with the findings of Rehan et al. (2021) who deduce the existence of asset anomaly in PSX.

5.   CONCLUSIONS AND RECOMMENDATIONS

Evidently, the results depict that firms with lower asset base provide better stock returns as compared to those firms that have greater asset base. Notably, descriptive statistical analysis and the risk-adjusted performance of stocks in equally weighted and value weighted decile portfolios support the existence of asset growth anomaly in PSX. However, the Wald test and GMM clearly specify that well known asset pricing models like CAPM, FAMA 3 factor and FAMA 5 factors fail to provide evidence of existence of asset growth anomaly in market and are considered to be mis-specified in determining asset returns. Hence, it can be concluded that asset growth is an additional factor through which asset returns can be predicted in PSX.

The findings endorse for investors to invest in PSX and develop a portfolio in which firms with lower asset growth have greater weightage of their portfolio in comparison to the firms which have higher asset growth. Clearly, by following this strategy investors can get benefit and earn higher returns. Besides, the findings are beneficial for investors and support them to take advantage and decide for long term investment in lower asset size and higher asset size firms. Future research should consider various macro-economic variables that can also be incorporated with asset growth anomaly in asset pricing models to assess the persistence of asset growth anomaly even with shocks of macro-economic variables.

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