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Size Effect And Macroeconomic Factors: Evidences From Pakistan Stock Exchange

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Abstract

This study analyzes the size effect of stock market predictability in the presence of macroeconomic factors in the Pakistan Stock Exchange (PSX) for 16 years, from January 2001 to December 2016. Arbitrage pricing theory tested using various macroeconomic factors and the size impact of the stocks in the Pakistan Stock Exchange. VECM is applied to test the short and long run association among size based portfolios and macroeconomic variables. The outcomes show that large companies perform better than small companies. Besides, it is also observed that selected macroeconomic variables are not an accurate predictor of stock return in the context of Pakistan. As a result of regression analysis and granger causality, two macroeconomic variables (Exchange Rate and Interbank Rate) out of six are significant, and extensive-size portfolios are more affected by the change in macroeconomic variables than small portfolios.

Key Words: Size, PSX, Macroeconomic factors, Stocks Returns, VECM.

JEL Classification: C32, E31, F32 and G14.

1. Introduction

The stock market is a platform for the equity market where investors can play through their money by forecasting tools and investment strategies. Also, investors use different techniques to manage the risks attached to investment (Gay, 2016). Diverse macroeconomic factors and financial conditions of the economy affect the Stock Market. Stock market fluctuation depends on changes in the macroeconomic scenario of the country; according to financial literature, these can be measured through money supply, interbank rates, Treasury bill rates, oil prices, IPI, CPI, etc. Investment decisions depend on certain factors, including price fluctuations and changes in prices and volatility. These changes affect the investor's decision to invest in different sectors invest or not support and so forth (Shaharudin and Roselee, 2009).

Are macroeconomic variables perform as a critical indicator of developing market equity returns? Various researchers' viewpoints on macroeconomic conditions' role in emerging markets presented in the study. Different studies have been conducted in developed economies. One of the main reasons for attraction toward the emerging market is that the growth rate tends to be high compared to developed countries. Two major problems in the investigation were found: the firm effect's first size and macroeconomic variables affecting the stock returns. Previous studies on developed economies have established that a firm's size is a significant pointer to stock returns. The stocks of small capital firms have given high average returns than big capital firms stocks—assets pricing theory and capital assets pricing model are not fully successful in explaining the size effect.

Various researchers have tried to explain the impact of size as an outcome of differences in transaction cost, liquidity, information uncertain tax loss, etc. Few researchers defined that small capital companies perform better because they have a low price-earnings ratio. Jacobs and Levy(1989) explain that the effect of firm size is anticipated only in a broader macroeconomic framework. There were some particular periods when small stack performed well and sometimes lagged. Annuar and Shamsher (1993) also explain the size impact but concluded with insignificant results. Further studies by Lai, Lim, and Yap (1999) indicate that influence of firm size is connected to the output of the country's economic condition as a whole. The bearish and bullish trends also affect the size of the firms to perform. There is no clear evidence that smaller firms outperform in the bullish direction. Instead, researchers concluded that smaller firms suffer more in a bearish market. However, their study did not focus on the macroeconomic factors that affect the stock return of the firms. Few studies have found how stock market indices in less advanced economies react to changes in fundamental economics. This study based on Pakistan stocks, their macroeconomic variable, and size effect. Arbitrage pricing theory given by Ross (1976) that the expected returns of a financial asset can be modeled as a linear function of various macroeconomics. The systematic forces that stimulus returns are the variation in discount factors and probable cash streams by Chen, Roll, and Ross. (1986).

The major purpose of the study is to find out the stock return predictability of diverse-size portfolio companies registered in the Pakistan stock exchange from January 2001 to December 2016. The study intended to determine the effect of macroeconomic variables that significantly associate with stocks in the previous studies. Mainly study examine the impact of macroeconomic factors on the Pakistan stock exchange stock returns. Secondly, to explore the association among the stock return and diverse size of firms with macro-economic factors, including Consumer price index, Exchange rate, Industrial production, Money supply, interbank rates, and oil prices.

The study contains three primary research questions. What is the size effect in the Pakistan stock exchange based on the Market capitalization of the stocks? What key macroeconomic variables affect the stock market return in the case of the Pakistan stock exchange? What is the impact of stock returns of different sizes of firms with macroeconomic factors (Consumer price index, Exchange rate, Industrial production, Money supply, interbank rates, and oil prices in the Pakistan stock exchange)? This study investigates not only the primitive association of macro-economic factors on the stock market returns in the Pakistan stock exchange and also explain the association with the different size of the stocks in the form of portfolios based on their capitalization. The study comprises multiple factors that reflect the price of the store, Consumer price index, Exchange rate, Industrial production, Money supply, interbank rates, and oil prices. The study will contribute to the body of knowledge by using evidence from a developing economy like Pakistan. Portfolios will be designed based on small-capital to large-capital firms. To diversify the investment and avoid idiosyncratic risk, the investor can opt for the portfolio based on sensitivity toward the macroeconomic variables.

2. Literature Review

There are encompassing indications found on firm size and stock market returns. Various studies indicate that macroeconomic aspects could affect stock prices even though they cannot fully account for the movements of returns. The nexus involving macroeconomic essentials and returns of the stock market has become a significant issue to discuss within the financial economics encircle (Ouma and Muriu, 2014). Chen, N.F (1986), reported that arbitrage pricing theory was first developed to identify the asset pricing in stock exchanges and explain their impact of macroeconomic variables on stock returns. The theory first considers the variables, money supply, and industrial production's effect on stock returns. Some researchers also worked on macroeconomic variables to measure the stock's return impact based on the capital assets pricing model (CAPM) presented by William F. Sharpe (1964).

Generally, investors bear two types of risks, explicit, unsystematic (diversifiable), and systematic (non-diversifiable). Unsystematic risk is the factor of risk in the portfolio, which is possible to reduce by increasing the number of securities in the portfolio because the risks particular to individual safety, like financial or business risk, might be reduced by creating a well-diversified portfolio. Systematic risk is related to the overall activities in the whole market or economy; hence, it is frequently stated as a market risk. The market risk is the factor of the entire risk that investors cannot reduce by diversifying the portfolio.

Sharpe (1964) and Lintner (1965) formed the CAPM, which links an individual security's expected rate of return to an index of its systematic risk. The CAPM (capital asset pricing model) is now an essential tool in finance to assess the cost of capital, portfolio diversification, and portfolio performance, find the value of investments and choose portfolio strategy, among others. In the previous half-century, many empirical studies have been conducted to test the validity of the CAPM. A large number of researches explored that the cross-asset difference in expected returns might not be explicated through systematic risk only. Hence, several different models have been formed to anticipate asset returns. This article is structured as follows. The subsequent segment briefly explains two fundamental relations related to the CAPM. After that, the traditional CAPM and its variants are discussed that are used in empirical research. At last, its final part concludes the paper.

Several empirical studies have supported the Fama and French three-factor model. Faff (2001), Maroney and Protopapadakis (2002), Drew and Veeraraghavan (2002, 2003a, 2003b), and Gaunt (2004) explore that there is a strong relationship between stock return, book-to-market equity, and size in countries that have diverse market formation such as France, Australia, Germany, Canada, Japan, the U.K., China, the U.S., Malaysia, Philippines, and Hong Kong. The purpose of sorting out the portfolio return based on firm characteristics like book-to-market (B.M.) ratio, price-to-earning (P.E.) ratio, and market equity (M.E.) is to assess the effect of firm-specific determinants on stock return as well as the relations between various firm-specific determinants and macroeconomic factors. Commonly, a small portfolio size (low M.E.) does better than a portfolio with large size (high M.E.) concerning stock return; a Portfolio with a greater B.M. outperforms a portfolio with low B.M. in terms of stock return.

Banz (1981) reported the size effect for the first time in his seminal paper; he concluded that stocks of less-equity firms earn more on average compared to firms with high equity value. This effect looks status of an anomaly. The problem needs to be solved based on such findings: given that size of company had an impact on stock returns, there is a need to examine and explore the association between size and stock returns and macroeconomic variables.

Shubita and Sharkas (2010) extended the work on the size effect and multiple macroeconomic factors of stock return by examining various variables based on different tools. Many studies have been performed to identify the long-term equilibrium association among stock and macroeconomic variables for the USA, Japan, and other developed states. In their study, the primary purpose is to look at the size effect, the impact of stock return and size factor in a given model, show a negative association between the assets return and inflation, they applied a generalized impulse response function and further extended it and applied vector error corrections model is utilized to determine the impact of macro-economic variables on NYSE. Results show that size impacted the stock returns.it also shows that level of economic activities positively affects the prices. They also found a negative association between interest rates in the model.

Grigoris et al. 2007 studied Greek data from 1970 to 2003, and they concluded that few factors like size, beta and E/P could be considered factors for explaining the stock returns. In a study conducted by U.K. data, Morelli (2007) found out different aspects by reporting that beta and book-to-market equity were valuable factors for the stock return. A study conducted on Malaysian socks by Roselee and Fung (2009) found that other macro factors should be attached to size to get a deeper understanding of the stock returns. In a a similar kind of study related to this, Shubita and Al-Sharkas (2010) identify that the return for the fifth and tenth deciles are vital factors for macroeconomic performance.

Various studies have found an association between stock prices and relevant macroeconomic factors in contemporary literature. Chen, Roll, and Ross (1986) added to evidence that a long-term association was found between stock prices and the relevant macroeconomic factors. They revealed that asset prices change and react sensitively to economic news, particularly to unanticipated news. Hamao (1988) replicated the Chen, Roll, and Ross (1986) investigation using multiple factors. He found that Japanese stock returns are affected by inflation and interest rate change. Mukherjee and Naka (1995) test the association between six macroeconomic variables and stocks in the Japanese market. They applied a vector error correction model to contain macroeconomic factors. They indicate relationship exists between exchange rate, inflation, industrial production, bonds rate, and money supply with stocks in the Japanese market. Sadorsky (1999) concludes that industrial production reacts positively to stock returns, and oil prices also affect the stocks. The macroeconomic factors affect the stock market because the market sentiments change by the macroeconomic factors in the economy.

Mohd et al. (2012) studied on Malaysian data, Kuala Lumpur Syariah Index (KLSI), using key macro-economic factors, Industrial production index, aggregate money supply (M3), consumer price index, Islamic inter bake rate and exchange rate of Malaysia against U.S. dollar. They used monthly data for April 1999 to October 2007; the finding of this study indicate stock prices are cointegrated with the macroeconomic factors used in this study, In which IPI and CPI factors are positively related to stock return, and M3 and MYR variables are negative and significantly related to the stock return. But the IRR variable is not significant in their study. After analyzing Granger's causal association, it is found that factors are interlinked.

Various other studies are conducted in developing countries to measure the macroeconomic variables and stock return performance. These studies include Naik (2013), who researched on Indian stock exchange to check the macroeconomic variables and stock return in the Indian market. He used the Indian stock market index and IPI. Wholesale price index, money supply, exchange rate, and treasury bills rates. Osamuonyi and Evbayiro-Osagie (2012) find the association between macroeconomic variables and Nigerian capital market index to proxy stock return performance. (Ouma, July 2014) conducted a study to investigate the macroeconomic factors of stock market performance, measured as the NSE-20 index. He used 10-year monthly data from January 2003 to December 2013 by using Money supply, inflation, exchange rate, and interest rate as macroeconomic variables. He concluded that money supply inflation and exchange rate significantly affect the stock market in Kenya; however, exchange rates negatively impact the returns. Zhu,(2012) performed a study on the impact of macroeconomic factors on the return of the shanghai stock exchange (SSE); it contains on money supply (M2), inflation rate, industrial production, exchange rate, bonds rate, unemployment rate, foreign reserves, import, and export. He finds that the exchange rate, foreign reserve, exports, and unemployment rate significantly impact the shanghai stock market return of the energy sector.

Ming-Hua Liu (2011) conducted a study to investigate the association between Chinese stock market returns and multiple macroeconomic variables, i.e., money supply, inflation, exchange rate, industrial production, and interest rate. He finds that a co-integrating association exists between stock prices and macroeconomic variables used in the study. Detailed findings indicate a positive association of macroeconomic variables in the long run in the Chinese stock market. A study by (Husam Rjoub, 2009) investigated the performance of arbitrage pricing theory in the Istanbul Stock Exchange (ISE) by using monthly data; he concluded that different portfolios react differently to multiple factors of arbitrage pricing theory. Higher inflation can affect stock returns in two ways: weak economic performance in the future that results in lower profitability of the corporate sector and lower stock returns. Second, inflation can enhance the risk attached to investment in stocks and indirectly affect stock returns. Most of the studies indicate a negative association between inflation and stock returns. Spyrou (2001) identifies that stock returns and inflation are negatively linked until 1995, when it becomes insignificant.

The impact of the exchange rate on stocks may vary for some reasons. It might be changed because of the country's economic condition, geographical location, relations with other countries, domestic circumstances, etc. There can be different reasons for inconsistency in the relationship because of trade volume, risk management, and economic relationship differences. The direction of the relationship of both variables is difficult to predict as it may be one-directional, two-directional or multidirectional. Ali Kemal and Haider (2005) did a study on Pakistani firms in the short run to find the change in the exchange rate. They indicate that the exchange rate changes are related to the stock prices. Mahedi (2012) studied the long-run association and short-run link between stock returns and macroeconomic variables. He found IPI as a significant determinant and positively associated with the stock returns in Germany and U.K.

Arango (2002) found little evidence of a nonlinear negative association between share prices and interest rates. Zordan (2005) explained that historical events clarify that the price of stocks and interest rate is oppositely associated.

Hsing (2004) used a structural VAR model for the simultaneous prediction of various endogenous; there is a negative association between interest rate and stock returns. From the point of view of Maskay (2007), a change in the supply of money or decision related to the Monterey policy impact the country's economic activity. Below mention authors discuss the most significant macroeconomic element that stimulates the behavior and expansion of stock prices.

There is no direct specific theory to explain the impact of oil prices on the stock price. Nevertheless, on the assumption basis, the oil price could be a critical determinant that can affect the revenue and profitability of a firm and, consequently, its stock return. In their study, Chen, Roll and Ross (1986) found that oil price does not significantly affect the stock return. Besides, Al-Fayoumi (2009), in his study on oil-importing countries, investigated that oil prices had no significant impact on stock return. But, the study of Narayan and Sharma (2011) expresses that oil prices have specific effects on a company's return, and more substantial support could be possible with the varying size of the firm. While Le and Chang's (2011) study found that from 1986 to 2011, the stock market reacted in a positive direction in Japan but remained negative in Malaysia, and an incompetent stock market reacted less to the upset of oil prices.

3. Research Methodology

Assets pricing theory begins with the multiple factors affecting the returns, called return generating factors. Assuming that market is efficient and frictionless, the return of each asset is linearly related to K factors plus its idiosyncratic disturbance.

$$R_i = \lambda_0 + \lambda_1 b_{1i} + \lambda_2 b_{2i} + \ldots + \lambda_k b_{ki} + \varepsilon_0$$

(1)

If there is no risk (or a zero Beta), then its returns will be λ_o : λ_k taken as the risk premium against the element k, and b_{ik} is the sensitivity of the returns of the particular assets (I) to the factor (k). An equation can be expressed:

$$R_i = a + b'\lambda + \varepsilon_i$$

(2)

$$E[\varepsilon_i \mid \lambda] = 0$$

(3)

Where Ri is the returns for the particular assets I, a is the intercept for the model, n is a (k,l) vector of assets sensitivities for the assets I, λ is a (k,l) vector of a common factor, and I ε is the error or disturbance term. Based on the stock valuation model, macroeconomic variables can have systematic impacts on the prices of the stocks through their effect on anticipated discounted cash flows of the future.

Stocks prices can be transcribed as:

$$p = \frac{[E(c)]}{K}$$

(4)

Through mathematically we can derive as:

$$(5) \Rightarrow \frac{1}{p} = \frac{K}{[E(c)]}$$

(5)

Differentiate Equation 5

$$dp = \frac{d[E(c)]K - dK[E(c)]}{K^2} \qquad (6)$$

$$\frac{dp}{p} = \frac{d[E(c)]K - dK[E(c)]}{K^2} \times \frac{K}{[E(c)]}$$

$$\frac{dp}{p}=\frac{d[E(c)]K-dK[E(c)]}{[E(c)]K} \quad (7)$$

$$\frac{dp}{p}=\frac{d[E(c)]K}{[E(c)]K}-\frac{dK[E(c)]}{[E(c)]K} \quad (8)$$

$$\frac{dp}{p}=\frac{d[E(c)]}{[E(c)]}-\frac{dK}{K} \quad (9)$$

Add $\frac{c}{p}$ on both sides.

$$\frac{dp}{p}+\frac{c}{p}=\frac{d[E(c)]}{[E(c)]}-\frac{dK}{K}+\frac{c}{p}$$
(10)

C is the cash flows stream in the form of the dividend, and k is the discount rate:

$$\frac{dp}{p}+\frac{c}{p}=\frac{d[E(c)]}{[E(c)]}-\frac{dK}{K}+\frac{c}{p}$$
(11)

The systematic forces that stimulus returns are variation discount factors, k, and probable cash streams, E(c) (Chen, Roll, and Ross, 1986).

The emphasis of the study is on firm size and macroeconomic variables on the Pakistan stock exchange stock return. Data was obtained through the Thomson router stream, and the Pakistan stock exchange published data. Data of all activities listed firms registered in the Pakistan stock exchange is obtained for the 16 years from January 2000 to December 2016. KSE 100 index is used as a proxy for the performance of the equity market in Pakistan. These indicators used in the study as exogenous/Independent variables: Aggregate of price level measure through the Consumer price index (CPI), Exchange Rate (E.R.), Industrial Production Index (IPI), KYBER three-month rate interbank rate by the state bank of Pakistan (Interest Rate), Money supply M3, Oil price (O.P.).This study contains 16 years, from January 2001 to December 2016, with 903 listed companies in the Pakistan stock exchange. These companies pass through a data cleaning process that contains on following standards; Firms dead during the sample period, the shares of the companies suspended at any time between sample periods, and the share of the delisted during the period of study.

Monthly discrete returns is calculated for all companies registered in the Pakistan stock exchange from 2001 to 2016. All 903 companies are selected for the portfolio construction. Before portfolio construction treatment/data cleaning process of the dead, merged, and suspended companies is performed to avoid the survival ship bias. Excess returns are found by subtracting the risk-free rate of return (6-month t bill rate). Portfolios are constructed on the basis of market value or market capitalization by ordering the companies according to their market value. In Result 10, diverse-size portfolios are constructed from low capital to high capitalization, such as P1 to P10. These ten portfolios and KSE 100 index are used as dependent variables in the study. Given study practice, the methodology developed by Chen, Roll, and Ross (1986). They present the Arbitrage Pricing Theory (APT) as a multiple-factor model to allow the researcher to use all those factors to explain the data best.

Six variables are obtained through the empirical literature to get wide exposure to the economic conditions in the Pakistani economy. All the assumptions, like serial correlation, homoscedasticity, stationarity, etc., are tested. Data observation of the same characteristics for multiple periods is collected through the Thomson router data stream. Portfolios are constructed on the basis of market capitalization from low cap to large cap. Descriptive analysis and analysis of variance are applied to test the means and variance differences in small and large-size portfolios. The number of companies in each portfolio for the particular months is attached in the appendix. All non-stationary macroeconomic variables convert into the first difference for the stationarity requirement. Correlation analysis is applied to check the correlation between the return of size-based portfolios and macroeconomic variables. Jonson co-integration, VECM and Granger Causality Tests, Wald test, and variance decomposition test are used to check the association between macroeconomic variables and size-based stock returns. Shubita, M.F., Al-Sharkas, A.A used the same approach in which Jonson co-integration, VECM, and Granger Causality Test to check the causality and long-run association between Macro-Economic variables and size-based portfolios for the U.S. stock market.

4 Data Analysis

All stocks registered in the Pakistan stock exchange since 2000 are sorted in ascending order according to their market capitalization and are assigned into 10 portfolios.P1 is the portfolios of the companies with the lowest market value and p10 with the highest market value companies. The average per month returns of the portfolio p1 are low at .007 compared to the large portfolio p10 .02. The difference between large and small is .013. Portfolios are designed based on equally weighted and rebalanced based on value-weighted. Market value is the average market share in each portfolio that is significantly different in large and small sizes. Equally, weighted portfolios indicate large companies earn higher than small companies, and their difference is significant. The value-weighted of large companies is significantly different from that of small companies. Value-weighted large portfolios are generating high as compared to small companies. CAPM beta shows the estimate of each portfolio's Returns.

Table 1

Portfolio Characteristics

Full 2001-2016	Average Return	E.W. %	V.W. %	MV (m)	CAPM beta
p1	0.007	-0.940	0.885	173.915	0.052
p2	0.050	68.101	59.895	1025.133	-0.228
p3	0.024	30.884	29.068	3845.037	0.026
p4	0.008	9.998	10.079	10139.612	0.043
p5	0.035	42.030	41.906	25036.402	-0.033
p6	0.013	15.018	15.531	57729.132	0.009
p7	0.032	44.619	38.344	112387.148	0.173
p8	0.019	22.997	23.371	216713.468	0.094
p9	0.022	25.517	26.027	462112.152	0.085
p10	0.020	25.803	24.469	1961261.218	0.053
p10-p1	0.013	26.744	23.585	1961087.302	0.001
t stats		3.810	1.196	20.339	
2001-08 Sample	Average Return	E.W. %	V.W. %	MV (m)	CAPM beta
p1	0.000	-1.147	0.014	127.832	0.055
p2	0.074	10.939	8.902	453.441	-0.283
p3	0.021	2.653	2.525	1355.030	0.103
p4	0.005	0.654	0.605	3367.950	0.123
p5	0.057	6.821	6.889	9729.408	0.050

p6	0.013	1.498	1.604	21611.520	0.063
p7	0.045	6.718	5.400	46363.727	0.271
p8	0.022	2.582	2.619	103701.025	0.142
p9	0.026	2.950	3.070	244723.891	0.163
p10	0.021	2.861	2.523	1085986.965	0.063
p10-p1	0.021	4.008	2.509	1085859.133	0.007
t stats		3.484	3.171	13.780	
2009-16 Sample	Average Return	E.W. %	V.W. %	MV (m)	CAPM beta
p1	0.020	-0.730	1.760	220.000	0.030
p2	0.030	2.680	3.080	1596.830	-0.010
p3	0.030	3.520	3.290	6335.050	-0.220
p4	0.010	1.350	1.410	16911.270	-0.220
p5	0.010	1.590	1.490	40343.400	-0.260
p6	0.010	1.510	1.500	93846.740	-0.160
p7	0.020	2.210	2.270	178410.570	-0.120
p8	0.020	2.020	2.060	329725.910	-0.060
p9	0.020	2.150	2.140	679500.410	-0.160
p10	0.020	2.300	2.370	2836535.470	0.020
p10-p1	0.010	3.030	0.620	2836315.470	-0.010
t stats		2.090	0.270	23.120	

Table 1 reports the Characteristics of size portfolio during January 2001-December 2008 as a sub-sample to confirm the mean difference in large and small capital companies. P1 is the portfolio of companies with the lowest market value, and p10 with the highest market value companies. Results are similar to the full sample of 2001-2006. The average per month returns of the portfolio p1 is low, .000, compared to the large-size portfolio p10 .021. The difference between Large to small is .021. Portfolios are designed based on equally weighted and rebalanced based on value-weighted. Market value is the average market share in each portfolio that is significantly different in large and small forms. Similarly, weighted portfolios indicate large companies earn higher than small companies, and their difference is significant. The value weight of large companies is significantly different from that of small companies. Value-weighted large portfolios are generating high as compared to small companies. CAPM beta shows the estimate of each portfolio's Returns. This table also reports the Characteristics of the size portfolio during January 2009-December 2016 as a sub-sample to confirm the mean difference in large and small-capital companies. P1 is the portfolio of companies with the lowest market value, and p10 with the highest market value companies. Results are similar to the full sample of 2001-2006. The average per-month returns of the portfolio p1 is low. 0.015 As compared to the large-size portfolio p10. 0.020. The difference between Large to small is .005. Portfolios are designed based on equally weighted and rebalanced based on value-weighted. Market value is the average market share in each portfolio that is significantly different in large and small sizes. Equally, weighted portfolios indicate large companies earn higher than small companies, and their difference is significant. The value-weighted of large companies is significantly different from that of small companies. Value-weighted large portfolios are generating high as compared to small companies. CAPM beta shows the estimate of each portfolio's Returns. The full sample contains 2001-2016 monthly based on 192 time series observations of each portfolio, including the Mean value indicating the average return in each portfolio. Based on descriptive statistics, we can conclude that size reversal phenomena exist in the Pakistan stock market and that large companies generate more returns than small companies.

Table 2

Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
KSE100	0.015	0.023	0.192	-0.597	0.08	192
P1	0.007	-0.011	1.014	-0.361	0.137	192
P2	0.05	-0.006	4.386	-0.16	0.337	192
P3	0.024	0.004	0.348	-0.137	0.091	192
P4	0.008	0.005	0.233	-0.18	0.069	192
P5	0.035	0.007	3.491	-0.187	0.266	192
P6	0.013	0.014	0.185	-0.156	0.064	192
P7	0.032	0.012	2.966	-0.195	0.224	192
P8	0.019	0.018	0.21	-0.182	0.073	192
P9	0.022	0.023	0.278	-0.212	0.077	192
P10	0.02	0.017	0.271	-0.27	0.079	192

Dependent variable Returns of KSE 100 index and all size base portfolios p1 to p10 are already calculated at the difference, and we can say it is stationarity at first difference as all values augmented d Augmented Dickey-Fuller test statistic is significant at 1% level. If the p-value is less than .01, we can reject the null hypothesis that the series has a unit root. The stationarity of the returns series can be seen in the graphs attached in the appendix.

Table 3

Dependent Variable Stationarity Results

Null Hypothesis: Series has a unit root

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
KSE100	-12.697	0
P1	-13.819	0
p2	-14.433	0
p3	-12.95	0
p4	-12.95	0
p5	-12.206	0
p6	-11.81	0
p7	-13.234	0
p8	-7.241	0

p9	-11.843	0
p10	-12.766	0

Macroeconomic variables are used as independent variables in the study; those are non-stationary at the level and have a deterministic trend in series, as t-test statistics of Augmented Dickey-Fuller is less than 2 and the corresponding p-value is greater than .05, so we are unable to reject the null hypotheses that series has unit Root. The trend can be seen in below-given graphs as well, where the series is not mean reverting in nature. After converting all macroeconomic variables into the first difference series, they become stationary as the p-value is less than .05, and we can reject the null hypotheses Descriptive statistics of Macroeconomic variables indicate their average index value and deviation from the mean over time. The minimum value of all indices is from the beginning of the sample period, and the maximum value is at the end. On average CPI index is 124 in the sample period of 2001-2016. The standard deviation is 51.9 from the mean. The minimum value is 62, and the maximum value is 212, showing the lowest to high inflation trend in Pakistan. On average Exchange Rate was 77.98 from 2001-2016. The standard deviation is 57.2 from the mean. The minimum value is 57.2, around 2001 at their lowest level, and the maximum value is 108.475 in 2016, showing the lowest to high exchange rate trend in Pakistan. IPI has a similar trend and has the average Industrial production index. Similarly, all the values show descriptive statistics of macroeconomic variables.

The correlation table shows a weak negative correlation between the kse100 index and the Consumer price index. The relationship of CPI with portfolios is also negative, but the intensity of the relationship is very weak and needs further testing and other methods. The relationship between the Exchange rate and stock return is also negative in the Pakistan stock exchange, but it is also very weak. The correlation table of IPI shows a very weak negative correlation between the kse100 index and the Industrial production average. The relationship of IPI with portfolios is also indifferent that is not similar in all portfolios. Still, the relationship's intensity is very weak and needs further testing by other methods. The relationship between the Interbank rate and stock return is moderately negative in the Pakistan stock exchange. The correlation of money supply and the kse100 index is weakly positive and indifferent with all portfolios. The relationship between oil prices and stock returns in Pakistan is weak and negative. As a result of correlation analysis, we do not have strong evidence that determines the intensity of the stock returns of the size portfolios and macroeconomic variables.

Table 4

Correlation Analysis

	CPI	ER	IPI	KB3	M3	OP
KSE100	-0.007	-0.013	-0.025	-0.157	0.017	-0.081
p1	0.026	0.021	0.003	-0.015	0.037	-0.098
P2	-0.101	-0.093	-0.124	-0.186	-0.085	-0.157
P3	0.003	0.002	-0.003	-0.08	0.016	-0.057
P4	0.06	0.056	0.02	-0.152	0.08	-0.044

P5	-0.088	-0.095	-0.103	-0.202	-0.068	-0.096
P6	0.015	0	0.001	-0.212	0.056	-0.06
P7	-0.024	-0.049	0.015	-0.03	0.009	0.047
P8	-0.01	-0.035	-0.026	-0.256	0.045	-0.136
P9	-0.067	-0.073	-0.095	-0.238	-0.034	-0.141
P10	-0.069	-0.071	-0.088	-0.155	-0.046	-0.132

OLS regression is applied to determine the impact of the macroeconomic variable on size-based portfolios. For regression analysis, we converted all variables into stationary and then estimated the 11 multivariate models KSE 100 index and size portfolios p1 to p10. OLS result depicts no significant relationship between CPI and stock returns in any of the size portfolio or KSE 100 index. Similarly, IPI is also insignificant in all the size portfolios. Money supply and oil prices are also not significantly affecting Pakistan's stock return and size-based portfolios. As a result of these four macroeconomic variables, their t statistics are less than 2, and their corresponding p value is greater than .05.So we cannot say any significant relationship exists. On the other hand, two macroeconomic variables, the exchange rate, and the interbank rate, negatively affect stock returns. In KSE 100 index exchange rate and interbank both are significant. The exchange rate is significant in large portfolios but insignificant in small portfolios. This indicates that large companies are more concerned about exchange rates as they are more involved in import and export activities. Similarly, the interbank rate is significant in all large-size portfolios p8, p9, p10, which indicates large companies have more leverage in their capital structure compared to small companies.

Table 5

			Regression Results				
	Portfolios	CPI	ER	IPI	kb3	M3	OP
KSE100	Tstats	0.386	-3.285	0.962	-2.443	-0.776	1.347
	pvalue	0.7	0.001	0.337	0.016	0.439	0.18
P1	Tstats	-0.974	-1.224	-0.547	1.55	1.325	-0.588
	pvalue	0.331	0.223	0.585	0.123	0.187	0.557
p2	Tstats	-1.009	-0.188	0.055	0.499	-0.167	-0.232
	pvalue	0.314	0.851	0.956	0.618	0.868	0.817
p3	Tstats	-0.829	-1.646	-0.01	-0.688	-0.372	-0.118
	pvalue	0.408	0.101	0.992	0.493	0.711	0.906
p4	Tstats	-0.98	-2.28	-0.673	-1.98	-0.287	0.825
	pvalue	0.329	0.024	0.502	0.049	0.774	0.411
p5	Tstats	-0.702	-0.746	-0.023	-1.417	-0.493	0.469
	pvalue	0.484	0.457	0.982	0.158	0.623	0.639
p6	Tstats	-0.693	-2.415	0.494	-0.837	-1.013	1.283
	pvalue	0.489	0.017	0.622	0.404	0.312	0.201
p7	Tstats	0.992	-0.317	1.662	0.317	1.339	0.106
	Value	0.323	0.752	0.098	0.752	0.182	0.916
p8	Tstats	0.157	-3.736	0.462	-2.32	-1.277	0.105

	pvalue	0.875	0		0.645	0.021	0.203	0.916
p9	Tstats	-0.108	-3.041		0.032	-2.548	-1.309	0.553
	pvalue	0.914	0.003		0.975	0.012	0.192	0.581
p10	Tstats	-0.108	-3.041		0.032	-2.548	-1.309	0.553
	pvalue	0.914	0.003		0.975	0.012	0.192	0.581

Table 6

VECM Results

IV/DV	KSE	P1	P2	p3	p4	p5	p6	p7	p8	p9	p10
CPI(-1)	0.005	0.012	0.007	0.012	-0.008	-0.006	0.012	-0.021	-0.007	-0.009	-0.011
Std.E	-0.080	-0.011	-0.026	-0.011	-0.005	-0.021	-0.011	-0.018	-0.006	-0.006	-0.006
t.value	0.067	1.131	0.250	1.131	-1.399	-0.290	1.131	-1.202	-1.181	-1.445	-1.705
CPI(-2)	-0.090	0.010	0.018	0.010	0.002	0.000	0.010	-0.024	-0.007	-0.004	-0.009
Std.E	-0.078	-0.011	-0.026	-0.011	-0.005	-0.021	-0.011	-0.018	-0.006	-0.006	-0.006
t.value	-1.147	0.985	0.671	0.985	0.427	0.019	0.985	-1.377	-1.263	-0.682	-1.472
ER(-1)	-0.044	-0.010	-0.002	-0.010	-0.009	-0.005	-0.010	-0.006	-0.003	-0.010	-0.003
Std.E	-0.083	-0.011	-0.027	-0.011	-0.006	-0.022	-0.011	-0.018	-0.006	-0.006	-0.006
t.value	-0.531	-0.934	-0.077	-0.934	-1.625	-0.216	-0.934	-0.304	-0.583	-1.618	-0.455
ER(-2)	0.264	-0.014	-0.018	-0.014	0.004	0.011	-0.014	0.015	0.006	0.003	-0.002
Std.E	-0.079	-0.010	-0.026	-0.010	-0.005	-0.020	-0.010	-0.017	-0.006	-0.006	-0.006
t.value	3.325	-1.301	-0.679	-1.301	0.785	0.520	-1.301	0.848	1.015	0.483	-0.340
IPI(-1)	-0.018	-0.006	0.002	-0.006	0.003	-0.001	-0.006	0.001	0.000	-0.001	0.001
Std.E	-0.022	-0.003	-0.007	-0.003	-0.002	-0.006	-0.003	-0.005	-0.002	-0.002	-0.002
t.value	-0.844	-2.015	0.268	-2.015	2.080	-0.078	-2.015	0.108	-0.212	-0.754	0.541
IPI(-2)	-0.023	-0.004	-0.001	-0.004	0.000	-0.009	-0.004	0.003	-0.001	-0.001	0.000
Std.E	-0.022	-0.003	-0.007	-0.003	-0.002	-0.006	-0.003	-0.005	-0.002	-0.002	-0.002
t.value	-1.054	-1.451	-0.111	-1.451	-0.226	-1.602	-1.451	0.681	-0.800	-0.578	-0.248
KB3(-1)	0.123	-0.018	-0.058	-0.018	-0.003	0.034	-0.018	-0.023	-0.014	-0.011	-0.011
Std.E	-0.165	-0.022	-0.055	-0.022	-0.011	-0.043	-0.022	-0.036	-0.012	-0.012	-0.013
t.value	0.742	-0.805	-1.053	-0.805	-0.262	0.778	-0.805	-0.642	-1.232	-0.870	-0.854
KB3(-2)	0.187	-0.071	-0.074	-0.071	-0.008	0.000	-0.071	-0.033	-0.011	-0.001	0.006
Std.E	-0.163	-0.022	-0.055	-0.022	-0.011	-0.043	-0.022	-0.036	-0.012	-0.012	-0.013
t.value	1.146	-3.254	-1.343	-3.254	-0.732	0.005	-3.254	-0.936	-0.974	-0.065	0.474

M3(-1)	0.041	-0.008	-0.011	-0.008	0.002	0.016	-0.008	0.012	0.007	0.006	0.010
Std.E	-0.054	-0.007	-0.017	-0.007	0.000	-0.014	-0.007	-0.012	-0.004	0.000	-0.004
t.value	0.765	-1.063	-0.601	-1.063	0.561	1.119	-1.063	1.056	1.732	1.474	2.522
M3(-2)	0.111	-0.053	-0.048	-0.053	0.012	0.047	-0.053	0.028	0.020	-0.053	-0.048
Std.E	-0.550	-0.071	-0.180	-0.071	-0.037	-0.140	-0.071	-0.120	-0.038	-0.041	-0.042
t.value	0.200	-0.747	-0.270	-0.747	0.337	0.338	-0.747	0.233	0.537	1.261	1.503
OP(-1)	0.606	-0.017	-0.021	-0.017	0.001	0.015	-0.017	-0.060	-0.003	0.002	0.002
Std.E	-0.156	-0.021	-0.052	-0.021	-0.011	-0.041	-0.021	-0.035	-0.011	-0.012	-0.012
t.value	3.874	-0.770	-0.401	-0.770	0.118	0.372	-0.770	-1.727	-0.247	0.164	0.169
OP(-2)	0.398	-0.038	-0.047	-0.038	0.002	-0.004	-0.038	0.054	0.005	0.001	0.014
Std.E	-0.164	-0.022	-0.055	-0.022	-0.011	-0.043	-0.022	-0.037	-0.011	-0.012	-0.013
t.value	2.437	-1.752	1.000	-1.752	0.185	-0.088	-1.752	1.462	0.411	0.081	1.131

Results of variance decomposition depict the short-run and long-run association in the VAR environment. In the case of the small portfolio, after one period, only a 2.7% shock comes from all macroeconomic variables that increase after every month with little percentage; after one year, the ratio is increases to 18%, and maximum variation comes from interbank rate and oil prices in case of small companies.

The variance decomposition results depict the short-run and long run association in the VAR environment. In the case of KSE 100, after one period, a 9 % shock comes from all macroeconomic variables that increase every month with a small percentage; after one year, the percentage is increased to 20 %, and maximum variation comes from CPI and oil prices in the case of KSE 100. Results of variance decomposition of large portfolios depict the short-run and long-run association in the VAR environment. In the case of large portfolios, after one period, a 9 % shock comes from all macroeconomic variables that increase every month with little percentage; after one year, the percentage is increased to 15 %, and the maximum variation comes from CPI and oil prices in the case of large portfolio.

Table 7

Variance Decomposition

Period	S.E.	P1	CPI	ER	IPI	KB3	M3	O.P.
1	0.136	100.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.138	97.296	0.606	0.057	0.096	0.276	0.960	0.709
3	0.144	89.614	0.655	0.154	0.112	5.258	1.197	3.010
4	0.145	87.842	0.996	0.368	1.134	5.162	1.191	3.307
5	0.146	86.780	1.170	0.566	1.218	5.099	1.546	3.621

6	0.147	86.036	1.213	0.673	1.464	5.077	1.603	3.934
7	0.148	85.391	1.225	0.777	1.672	5.082	1.671	4.182
8	0.148	84.784	1.225	0.943	1.877	5.083	1.766	4.322
9	0.149	84.195	1.226	1.101	2.146	5.066	1.849	4.417
10	0.149	83.670	1.228	1.240	2.391	5.051	1.924	4.497
11	0.150	83.166	1.233	1.365	2.633	5.041	1.988	4.572
12	0.150	82.668	1.237	1.479	2.886	5.033	2.051	4.646
Period	S.E.	KSE	CPI	ER	IPI	KB3	M3	O.P.
1	0.077	100	0	0	0	0	0	0
2	0.081	91.545	2.811	0.001	0.05	0.69	4.87	0.033
3	0.084	85.016	4.255	0.836	0.065	1.613	5.118	3.096
4	0.084	83.771	4.23	1.575	0.126	1.63	5.518	3.15
5	0.085	82.569	4.163	3.029	0.137	1.605	5.409	3.087
6	0.086	82.11	4.27	3.164	0.292	1.612	5.49	3.063
7	0.086	81.881	4.302	3.305	0.303	1.633	5.524	3.051
8	0.086	81.682	4.312	3.438	0.326	1.658	5.51	3.073
9	0.086	81.441	4.307	3.566	0.372	1.678	5.494	3.142
10	0.086	81.229	4.302	3.671	0.406	1.691	5.479	3.222
11	0.086	81.026	4.297	3.769	0.439	1.702	5.468	3.299
12	0.087	80.813	4.291	3.866	0.474	1.713	5.457	3.386

5 Conclusion and Discussion

In the case of the Pakistan stock exchange, large companies perform better than small companies. We confirm these results on a sub-sample of 2001 to 2008 and 2009 to 2016 years data and found the same size reversal results: large companies perform better as they have more sources and better information about the market. Results are matched with other researchers who worked in developed and developing countries like Reinganum (1992), Dimson and Marsh (1999), Loughran and Savin (2000), L'Her, Masmoudi and Suret (2002), L'Her, Masmoudi and Suret (2002) and Mathijs A. Van Dijk (2007).

All results indicate macroeconomic variables are not true predictors of Pakistan's stock return. In a result of regression analysis and granger causality, two macro-economic variables (Exchange Rate and Interbank Rate) out of six are significant, and large-size portfolios are more affected by the change in macroeconomic variables as compared to small portfolios as large companies are involved in more leverage activities and imports and exports activities. Other macroeconomic variable show mixed results in all-size portfolios that we cannot generalize for any prediction. For Pakistan, we cannot find the true significant predictors of the stock market in the given data; therefore, we conclude that the Pakistan stock market is approaching informational efficiency with respect to macroeconomic variables. Our study ended with two findings: large capital companies outperform small capital. Secondly the basis of macroeconomic variables, we cannot predict the stock market in Pakistan. This phenomena further need to be tested by adding more macroeconomic factors.

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