

Testing Lead-Lag Relationship Between Small and Large Capitalization Portfolio-Evidence from Karachi Stock Exchange (KSE)

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Abstract: The purpose of this study was to test Lead-Lag relationship between small Cap and large Cap portfolio in Karachi stock exchange (KSE). The empirical results of this study are based on monthly observation of the large cap and small cap indices published by Karachi Stock Exchange. First ranking companies based on their average market capitalization weight were selected. Moreover, five large cap and small cap portfolios are selected with highest and lowest market capitalization of Stock Exchange. Computations of stock returns are calculated by monthly closing prices and opening price from the period of 1-Jan 2000 to 31-December 2009. Cross auto correlation structure was examined in small cap and large cap portfolio. The results indicated that all orders of auto correlation function are negatively correlated. However, first order of autocorrelation indicates that there is a significant lead-lag relation between small cap portfolios and large cap portfolios. The second order autocorrelation become gradually inferior but showing the same level of statistical significance for both portfolios. The second test of cross auto correlation particularly indicates and confirms that small cap portfolios are lead by large cap portfolio. The study suggests that stock market analyst especially individual and institutional investors who want to scrutinize the stock market conditions in perspective of the changing socio-economic condition in Pakistan are supposed to comprehend relationship of large cap portfolios and small cap portfolios returns and thus could lead themselves to better decisions in terms of selection of stocks because of availability of relevant information.

Key words: Small Capitalization Portfolio • Large Capitalization Portfolio • Cross- Auto Correlation • KSE(100)

INTRODUCTION

The stock market is the essence and hub of the financial sector. It is a medium whereby capital is endowed and channelized for economic growth. It performs an eminent role in devising domestic funds and in corrugating them expediently to the ascendant ingenious investments. A commodious stock market can also bequeath a wide range of magnetic opportunities for both the domestic and foreign investors. In Pakistan, the Karachi Stock Exchange is improvising a robust and derogatory role in harmonizing the savings and investment climate; as it is the core window to ensure that market is lingering to magnify the attentions of investors both within the country and abroad. The movement on the Karachi Stock Market (KSE-100) is mainly empowered by many selected large market capitalization businesses

including; (Hub Power, Pakistan Telecommunication company limited (PTCL), Pakistan State Oil (PSO), Sui Northern Gas, FFC Jordan and National Bank of Pakistan (NBP), Muslim commercial bank (MCB), Oil and Gas development co. Ltd etc). These large-capitalization portfolios constitute more aggregate market capitalization in the KSE than small- capitalization stock that inconclusively leads the entire stock market at the forefront. These large capitalization companies earned after tax profits of Rs 141.99 billion in the fiscal years 2008-09 [1]. Whereas, at the same time several small capitalization businesses are listed on the KSE Such as (Kohinoor Textile Limited, Askari Bank limited, Lakson Tobacco Co, Abbot Labs and Bank Al Habib etc) girded coherently in engendering the concentration of investors. In addition, small capitalization- portfolios surrogating parallel movement with large cap portfolios in integration

to stock prices and their earnings pattern. However the positive or negative outcomes on large cap portfolios governed corporeal consequences on small cap portfolios. Moreover, the study of [2] reveals that due to presence of stock concentration in KSE (100) the Karachi Stock Exchange is still away from the concept of diversification investment. In this scenario it is very convoluted for investors to go for diversification of investment in stock to minimize risk associated with it. This established the base for lead-lag relationship between large and small cap portfolios.

Time series return predictability surfacing from seasonal patterns of large and small cap portfolios returns and these predictabilities have been emerging from returns autocorrelations and cross-autocorrelations [3]. On one side it has been postulated that lead-lag effects annotated by Lo and MacKinlay are spurious and can be explained in terms of the assets' own autocorrelations [4]. On the other side the structure of cross-autocorrelations has been consented and acreage of lead-lag relationship along with size has been observed. Various studies have discovered volume to be imminent compunction of returns in frontier market. [5] Found high volume portfolio returns to lead low volume portfolio returns. Volume and size co-movement are reported to exist independently from each other, but [6] reported that the size effect is stronger than the volume effect. The purpose of this study is to test the lead-lag relationship between large-cap portfolio and small-cap portfolio returns analysis in the Karachi Stock Market. This study is unique in a numbers of aspects. First, all previous researches had been conducted in US and other European financial markets, second, other research work in Pakistan was mainly confined on stock price volatility, time varying expected return etc. Hence, the purpose behind this study is to ensure the lead-lag relationship amid at selected Portfolios in Karachi Stock Exchanges and to seek the answer of the research question that does the large capitalization portfolios lead small capitalization portfolio in Karachi Stock Exchange.

Literature Review: The assets' returns relationship predictability of has long been captivated the interest of both practitioners and academics researchers. Different types of predictabilities have been probed for; cross-sectional return expectedness rely on the equilibrium model like, cross auto-correlation and auto-regression time-series predictability patterns. The lead-lag relationship in portfolio return have been analyzed and investigated in major capital markets of the world by different researcher at different time by the means of

different methodologies. Most prominent methodology used in several research studies is cross-autocorrelations pattern in portfolio return and reported different results. Efficient market theory teaches that stock earnings should not be predictable based on all publicly attainable data. However, the presence of cross-autocorrelation and asymmetry between small and large market capitalization portfolios has been well captured in U.S. capital markets by [7]. The results of their study pointed that due to lag-lead effect large market capitalization portfolio stock better predict small market capitalization portfolios but not vice-versa. Closed trends have been indentified in others capital markets; such as in Asia [8] and the UK [9].

[10] Contributed throng of testable descriptions for lead-lag cross-autocorrelation mould and economic rationale for the cross-autocorrelation patterns in stock returns incorporating the microstructure model in which investors have inadequate knowledge. Their analysis demonstrated that in a market in which investors are omniscient about only a sub-set of stocks, the commencement of lead-lag, cross-autocorrelations is an exertion of trading cost in other stock keeping in view the information about sub-set of stock. [11] Analyzed the lead-lag relationship in the Turkish and German frontier markets by segmenting stocks in sub-periods. He found that large cap portfolio leads small cap portfolio in first sub periods in Turkish Stock Exchange whereas large cap portfolios have a lead effect on small cap portfolios in both sub periods of German frontier market. He documented the association of market-wide information content with lead-lag relation in lagged large cap portfolio returns. [12] Investigated autocorrelation return variations in the Spanish and French Stock Markets on day-to-day basis. His study articulated the significance of non-trading periods return autocorrelation anomalies even on overnight closings. Daily returns on an open-to-close basis do not exhibit a significant level of autocorrelation, whereas, close-to-close stock returns are highly autocorrelated especially on Mondays. [13] Examined the lead-lag relationship between large and small cap companies through the use of a number of different market capitalization characteristics in Indian Equity Index Series. They found that large capitalization index leads small capitalization index. Pure thin trading effect and interacting effort were found significant to lead-lag effect and large capitalization index have higher rate of adjustment towards the intrinsic values. [7] Found that returns on large portfolios leads returns on small

portfolios but not vice versa due to the lead-lag association. This cross-autocorrelation composition has been accredited on the compulsions and eminence of own vs. cross autocorrelations in returns.

Several studies have been carried out in different markets under assumptions of price limitations, differential information set, sentiment asymmetry, market microstructure and in term of anomalies. [14] Postulated that the price-limit restriction is a significant microstructure of the Taiwan Stock Market. They found no evidence of price adjustments of small capitalization stock portfolio that are slower than those of large capitalization stock portfolios. They documented no evidences to articulate a positive leading role of large capitalization portfolio returns on small capitalization portfolio returns. [15] Demonstrated that that individual investors essentially impound small firms stocks, whereas, institutional investors consummately grasp large firms stocks. The sentiment asymmetry between investors in small and large firms could drives large stock returns to counter with a lag to adjust in small stock returns when macroeconomic is information of the respective firm release or the onset of a recession cause, small stocks investors to revise and partially reveal their sentiments. This lagged feedback is fostered by the fact that firm-specific news about small firms tends to drive slowly due to contoured coverage [16]. The differential information hypothesis by [17,18] certitudes that information formulation proliferated with organization size. Additionally, if the prices of information pursuit are fixed and coherent across business size, then it is more plausible to embark research for mispricing in large firms than in Small ones. Hence, earnings due to insider information's trading are smaller for smaller business than of for large business. [19] Conducted asset pricing model under asymmetric information and assented that asymmetric lead-lag patterns in stock returns cannot be solely justified by information asymmetry. Adjoining frictions are imperative to cause asymmetry in return cross-autocorrelations. [20] Investigated relationship between serial correlation in daily stock return and aggregate stock market trading volume. They found that Individual large stocks of both stock indexes at first-order daily return autocorrelation tend to decline with trading volume. [9] Found the evidence of co- integration among the size-sorted portfolio prices in the UK stock market. It is stated that Large Cap portfolio returns lead Small Cap portfolio returns but not vice versa. [21] Provided a new idiosyncratic of the data in rationalizing the lead-lag relation between Small and Large Cap portfolio returns.

They implemented methodology of directional asymmetry in order to ensconce a deeper analysis of the cross-correlation structure. By anatomizing the asymmetric reactions of Small Cap Portfolios to common good and bad news, it is commented that Small and Large Cap Portfolios' reactions to bad news are fast but the reactions of Small Cap Portfolios to good news are slower. [22] Documented cross autocorrelation in Chinese Stock market by segmenting stocks in Share A and Share B. They articulated evidence of less information barriers for foreign investors. They further stated that price movement of share B will reflect the common information that foreigners have this will in turn lead the return of Share A. [23] Argued that transaction costs, low transactions and market microstructure are the reasons of the cross-autocorrelation [24] concluded that the Information set-up cost is another factor which is highly correlated with firm size. The main objective of the study to is to investigate broader aspects of lead-lag relationship in small and large cap portfolio return in Pakistani capital market and to provide insights and a gateway to investors while diversifying their portfolio in various circumstances of economy.

Method: The study has been undertaken to determine the lead-lag relationship between the large capitalization portfolios and small capitalization portfolios in Karachi Stock Exchange. The study is predictive in nature and is entirely depend upon secondary data to observe the applications of auto-correlation and cross-autocorrelation. The empirical results of this study are based on monthly observations of the large cap and small cap indices published by Karachi Stock Exchange. First ranking companies based on their average market capitalization weight were selected. Moreover, five large cap and small cap portfolios were selected with highest and lowest market capitalization of stock exchange. However, to ensure full market representation the company with at least 1% weight is being included in assortment of five large cap portfolios. In addition, Twenty-five companies account for 72.30% weight in KSE however, being prefer for the selection of five large cap portfolios which accounts 37.6% overall in stock market. Similarly, five small caps are selected with having market capitalization lesser than 1%. Computations of stock returns are calculated by monthly closing prices and opening price from the period of 1-Jan 2000 to 31-December 2009 formed 119 data points. During this period, Karachi stock markets have undergone through substantial changes of major upsets and breakthroughs.

Procedure and Econometric Modeling**In this Study Researchers Used the Following Simple Rate of Returns:**

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

Where R_t shows the return of each portfolio.

P_t = Closing price of the particular month.

P_{t-1} = Represent the opening price of the stock.

Monthly returns are then computed on the base of logarithm price indices. In order to analyze the cross-autocorrelations between small cap portfolios and large cap portfolios on the KSE, several models of the lead-lag relation were tested accordingly. The first analysis is the estimation of the general cross-autocorrelation structure between small and large cap portfolios on the Karachi Stock markets. In the second stage, the implementation of the effective model has been taken up in order to ensure the validity of lead-lag relationship among the variables.

Cross-autocorrelation Structure: This study incorporated the Iterated Seemingly Unrelated Regressions (ITSUR) econometric model to test the lead-lag relationship. Other research studies like Li, [25] executed this method to test the lead-lag relation between A Shares and H Shares in the Chinese stock market. [22] Also executed the ITSUR method to analyze cross-autocorrelation between A shares and B Shares in the Chinese stock market followed by [11] by testing Cross-Autocorrelation between Small and Large Cap Portfolios in the German and Turkish Stock Markets. The simultaneous estimation of system by the ITSUR method is shown to be more efficient than the ordinary least squares method [11]. The simultaneous equation model system for this study is given below.

$$RL_t = \alpha_{0L} + \alpha_{1L}RL_{t-1} + \alpha_{2L}SRS_{t-1} + e_{Lt} \dots Eq(1).$$

$$RS_t = \alpha_{0S} + \alpha_{1S}SRS_{t-1} + \alpha_{2S}SLRL_{t-1} + e_{St} \dots Eq(2)$$

Where RL_t is the large Cap portfolio return of at time t , α_{AS} and α_{al} is constant regression co-efficient. α_{1LL} and α_{1SS} α_{1SS} are the first-order autocorrelation coefficients of Large and Cap portfolio return respectively. α_{2SL} is the sensitivity of Large Cap portfolio return to one-month lagged return of the Small Cap portfolio and is the sensitivity of Small Cap portfolio return to one-month lagged return of the Large Cap portfolio. ϵ_{Lt} and ϵ_{St} are the error terms of the Large Small and Cap Portfolios respectively.

RESULTS AND DISCUSSION

Stationary data is one of the most common and important assumption of time series analysis. In first step of data analysis the stationary of data is checked by mean of Augmented Dickey-Fuller Test (ADF) for possible unit root existences in data. Table 1 summarize the results of Augmented Dickey-Fuller Test, which test the Unit root in series of log return of small and large cap portfolio. The result divulges that the associated critical values and ADF statistics of both series are satisfactory and hence reported stationary series where by taking the first difference of log arithmetic return.

After securing the assumption of data Stationarity, preliminary descriptive statistics of portfolios return and autocorrelation are executed. The descriptive statistics are given in Table 2. Table 2 reveals mean return of the portfolio, the standard deviation of portfolio; N is the number of observation, skewness, kurtosis and Jarque-Bera statistics. Table 2 further depicts that the small Cap portfolios have merely higher average return than large Cap Portfolios in the selected period. However, the total risk of small cap portfolios demonstrate lower than the total risk of large cap portfolios, nevertheless, the average returns of small and large Cap portfolios comprise moderate differences. It represents that the large firms are risky as compared to small firms.

Table 3 depicts autocorrelation structure of small and large cap portfolio. Table demonstrates orders of autocorrelation for the small cap portfolio and large cap portfolio, Q-Statistics (Box Ljung) and S.E (Standard Error). Table 3 also summarizes the evidence on the first order autocorrelation of the index return. For each of the sample stock, the table reports the autocorrelation with a consistent standard error. The Autocorrelation function can be observed after taking first differences of Log of return on both large and small cap portfolios, because due sufficient number of observations data has been transformed in order to get smoothen. Statistics of the both stocks in Karachi Stock Market show that the all orders of autocorrelations coefficient are statistically significant except third order of autocorrelation. However, the highest first-order autocorrelation coefficient is observed which is -0.3747 for large cap and -0.310 for small cap with p-value (0.008) and (0.028), significant even at 1% respectively. All the orders of autocorrelation coefficients are negative. The second-order autocorrelations are also statistically significant with having coefficients -0.11329 (Large Cap) -0.137 (small Cap), p-value (0.021), (0.056) significant at 5% respectively

Table 1: Augmented Dickey-Fuller Unit Root Test (ADF) of SCP and LCP

Log Return of Series	ADF Test Statistics	Critical Values	Results
Small Capitalization (SCP)	(-12.31768)	1% 3.57783 5% -2.92557 10% -2.60047	Stationary
Large Capitalization (LCP)	(-10.38601)	1% 3.35081 5% -2.83247 10% -2.41025	Stationary

Table 2: Descriptive Statistics of Monthly Portfolio Return

Series	Mean	S.D	N	Skewness	Kurtosis	J-B stat	Sig
Large Cap. Portfolio	0.01563	0.12207	119	0.076	2.605	14.546	.1204
Small Cap. Portfolio	0.02006	.083340	119	-0.308	2.947	21.675	.1125

Table 3: Auto- correlation Structure of Portfolio return (Level of Significance =5 %)

Orders	Small Cap Portfolio	Large Cap Portfolio
1st Order (ρ_1)	-0.310	-0.3747
S.E	0.141	0.142
Box-Ljung (Q-Stat)	4.803	7.032
p-value	.028	.008
2nd Order (ρ_2)	-0.137	-0.1132
S.E	0.143	0.140
Box-Ljung (Q-Stat)	5.762	7.688
p-value	.046	.021
3rd Order (ρ_3)	-0.039	-0.037
S.E	0.138	0.139
Box-Ljung (Q-Stat)	5.841	7.759
p-value	.120	.051

Table 4 General Lead-lag Relation between Small and Large cap portfolios

Model -1	$Rs,t = \alpha_{0S} + \alpha_{1SSRS,t-1} + \alpha_{2SLRL,t-1} + eS$		
	Constant	α_{1SS}	α_{2SL}
Coefficient	0.0229	0.4551	0.57089
t-statistics	(1.6238)	(2.3277)	(2.213)
P-value		(0.0230)	(0.0304)
R-squared		0.18719	
Model -2	$RL,t = \alpha_{0L} + \alpha_{1LLRL,t-1} + \alpha_{2LSRS,t-1} + eL$		
	Constant	α_{1LL}	α_{2LS}
Coefficient	0.0105	-0.4199741	0.19380
t-statistics	(0.5615)	(2.1345)	(-1.30012)
P-value	(0.03663)	(0.19822)	
R-squared		0.2823622	

** Level of Significance =5%

Because of the possible slow adjustment of asset prices to new information, increase or decrease in stock prices is followed by new increases or decrease and this can be seen as an explanation of the autocorrelations in portfolio

returns. The third order represents the significance at 5% only for large cap with p-value (0.051). So, the only insignificant third-order autocorrelation (-0.039), P-value (0.120), for the small cap portfolios may be explained by the possible fast adjustment of small portfolios prices to new information. The summary statistics show that there is a general tendency of the negative orders autocorrelation structure of portfolio returns in Karachi stock market it is observed that the third-order autocorrelation is not significant for small cap portfolios. Thus, it is convenient to accept the importance of the first-order autocorrelation in KSE.

The empirical result in Table 4 presents beta's estimations of sample stocks in Karachi Stock Exchange. We get the evidence of the statistically significant one-month lagged effect of large cap portfolio returns on small cap portfolio returns, t-statistics (2.213). There is also an effect of one-Month lagged small cap portfolio returns on large cap portfolio returns at a lower significance level. Moreover, it is observed that although the effect of one-month lagged large cap portfolio return on the small cap portfolio return is positive ($\alpha_{2SL} = 0.57089$), the effect of one-month lagged small cap portfolio returns on the large cap portfolio returns is not significant even at 10 % level and its t-statistics is also negative ($\alpha_{2SL} = 0.1938$). For the large cap portfolio, one-month lagged effect (-0.4199) is found significant at 5% level. This negative coefficient can be interpreted as a contrarian effect of the small cap portfolio on large cap portfolio [11.] Similarly, for the small cap portfolio, one-month lagged effect on its own is found significant (0.4551) at 5% level.

Table 4 further demonstrates positive and highly significant relation between small cap portfolio returns and lagged large cap portfolio returns ($\alpha_{2SL} = 0.057089$). The sensitivity coefficient of small cap portfolio return to its own one month lagged return is also found positive

and significant ($\alpha_{188} = 0.4551$). we observed that small cap portfolio return's sensitivity to one-month lagged large cap portfolio returns is greater than its one-month lagged own return ($\alpha_{2SL} > \alpha_{1SL}$). This result can be interpreted as an evidence of the importance of the information got from the lagged large cap portfolio returns in the price adjustment process of small cap portfolios. On the other hand, we could not get the evidence of any significant effect of one-month lagged small cap portfolio returns on large cap portfolio returns. Overall analysis of KSE shows a significant lead-lag relation between the small and large cap portfolios. We found significant and positive effect of lagged large cap portfolio return on small cap portfolio return but not vice versa. The empirical evidence of large cap portfolios lead small cap portfolios in KSE (100) is consistent with the previous studies of the cross-autocorrelation structure in the other stock markets. These results are largely consistent with the research work of [11] in which he documented that large cap portfolios lead small cap portfolios in both sub periods of German stock market. The findings of this study are consistent with the study of [22]. In which they documented cross autocorrelation in Chinese Stock market by segmenting stocks in Share A and Share B. They articulated evidence of less information barriers for foreign investors. They further stated that price movement of share B will reflect the common information that foreigners have this will in turn lead the return of Share and [13] for the US stock market in which small cap portfolio returns was lead by the large cap portfolio returns but not vice versa.

Conclusion and Recommendations: This study present an empirical research of the autocorrelation and lead-lag structure in Karachi Stock exchange consisted of monthly stock returns during the period of January1, 2000 to December 31, 2009. The results indicated that our all orders of auto correlation function are negatively correlated. However, first order of autocorrelation indicates that there is a significant lead-lag relation between small cap portfolios and large cap portfolios. The second order autocorrelation become gradually inferior but showing the same level of statistical significance for both portfolios. In addition, the third auto correlation is only significant for large cap but not for small cap, because, due to fast adjustment of small portfolios prices to new information. The second test particularly indicates and confirms the finding of lead- lag relationship between large Cap and small Cap portfolios, consistent with the empirical results. Provided by evidence the lead-lag relation between large cap and small cap portfolios is due

to the contemporaneous relationship between errors and heteroscedasticity This study is largely consistent with what [22] found about the lead-lag relation from B shares to A shares in shanghai stock exchange. The findings of this research are reliable with the previous findings of [7] for the US stock market in which the large cap portfolio returns lead small cap portfolio returns, but not vice versa. This study suggests that stock market analyst especially individual and institutional investors who want to scrutinize the stock market conditions in perspective of the changing Socio-economic condition in Pakistan are supposed to comprehend relationship of large cap portfolios and small cap portfolios returns and thus could lead themselves to better decisions in terms of selection of stocks because of relevant information available. The study also provide the economists and the policy makers with the latest information and the behavior of the stocks returns Eventually, it show the way to better understand the expected results of their polices on stock exchange.

Practical Implications: The study is significant for stock investors who will be able to comprehend the relationship of Large Cap Portfolios and Small Cap Portfolios returns and thus could lead themselves to better decisions in terms of selection of stocks because of relevant information available. This study will also be valuable for financial analysts and the financial institutions, investment bankers that daily deal with the buying and selling of stocks. The results of the study will provide precious data and information, which will helpful to conduct analysis and make prosperous buying and selling decisions. Finally, the study benefits researchers, who further interested near these topics. The study will not only endow with a detailed literature but also present with the real implications of the study on the data of stock returns in KSE. This will help them to enhance their knowledge and experience.

Limitations and Further Research: The study is entirely constituted on published secondary data and did not discuss any upward or downward trend in KSE index. Moreover this study did not focus on keeping the macroeconomic factors in research activities. This study is conducted in Pakistani capital market and its significance is widespread for all those practitioners, researchers and direct and indirect stakeholders of frontier market of Pakistan around the globe. This research can be further extended by incorporating macro economics factors and others factors like market efficiency and micro structure effect in future.

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