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THE IMPACT OF MARKET INSTABILITY OF FIRM VOLATILITY

Shahid Iqbal[1] Sharif Ullah Jan[2] & Muhammd Asif[3]

ABSTRACT

This paper analyzed volatility association of individual firm with the collective stock market for the period of January 2011 to December 2015. Using daily basis data, GARCH model was applied for volatility measurement of 121 listed companies in Pakistan Stock Exchange. The current study found significant evidence of volatility co-movement between firms and market. The results show that return variation of 74 companies out of 121 are positively correlated with aggregate market volatility. However, 24 firms come up with negative significant results. Considerable evidence for size-based effect was initiated through market capitalization. The results show that large size firm volatility was significantly correlated with aggregate market volatility i.e. up to (75%) in comparison with small size firms. Finally, the study concludes with a recommendation for all relevant stakeholders to consider the firm-market volatility in making strategic organizational decisions especially the ones relevant to risk management.

INTRODUCTION

The market return has seen a key variable by CAPM for return estimation. However, industry level shocks and idiosyncratic risk of the firm also contribute effectively in individual stock valuation. All three risk factors (Market, Industry & firm specific) are correlated with each other and market volatility tends to increase the rest two volatility series along with it. In economic downturns, the co-movement of all three volatility series leads to recessions. The stock return volatility varies over time along with market variation and industrial instability. Therefore, market volatility is considered a major factor for return measurement. Different studies have been conducted on market volatility and unsystematic risk of the firm (Damodaran and Lim, 1991; Campbell et al. 2001; Xu et al., 2003) but interestingly no attention has been paid to the co-movement of firm volatility along with market volatility.

Volatility represents a risk of an asset in financial literature. It's the degree of variation in share prices of a market measured by the standard deviation of return (Allen, L. et al. 2004). A higher value of standard deviation shows enormous dispersion in expected return and indicates the higher risk associated with an investment. The volatility of a price return is not just like risk, as some abnormal increase in share price can be seen more volatile, yet the shareholders enjoy higher profit in that particular investment. However, return volatility of the firm can divert financial decisions of stockholders as the volatile nature of a firm can puzzle overall portfolio return.

[1] Department of Management Science, PEF University College, Peshawar.
Email: shahidyousafzai@hotmail.com

[2] Department of Management Science, COMSATS Wah Cantt.

[3] Assistant Professor, City University, Peshawar. E-mail: asifbaloch@cusit.edu.pk

The financial risk management gained much importance after the establishment of Basle Accord in 1996. The worldwide financial institutions were structured for risk management and volatility forecasting to avoid future uncertainty. The VaR (value at risk) was implemented on the financial institution to keep reserve capital at the minimum level of three times their expected losses for being on the safe side in the worst future scenario. This VaR basically forecasts the volatility (expected total change in assets value). In fact, volatility plays the main role for return measurement and risk estimation. Volatility also contributes a major role in derivative valuation, one of the hot issues of current era for financial institutions. The volatility of a concerned option is computed for the complete time period before pricing an option. The price of an option may evaluate in term of volatility. In fact, volatility is considered an underline asset for derivative contracts.

Volatility Stylized facts

The stock prices of several companies in the market come up with a dramatic decline in time of market crashed. The share price fluctuation is concerned with numerous reasons. The cause of this extreme decline can be speculative bubble arrived at its end or revised market expectation by investors and some other firm-specific factors like change in risk aversion police, new information arrival to market or reaction to economic policies changes. This economic uncertainty in association with financial crashes appears with high volatility of the stock market. Volatility basically reflects these fluctuations in term of share price changes. Higher volatility of a security indicates high price change but that change can be in either direction, negative or positive. Whereas, lower volatility show a small variation in expected future price. Schwert (1989) worked on the relationship between market volatility and economic activities. Market volatility was observed higher in economic recessions to enlighten the economic recession as the main factor to explain market volatility. In short, the economy of an overall county can be upset by financial market volatility.

Volatility is considered as a barometer by financial experts for estimation of return. The Federal Reserve also consider the volatility of different financial instruments like stock, bonds, currency and some other commodities for the establishment of their monetary policy (Nasar Sylvia, 1992). The Bank of England considered different market implied options and other market sentiments to develop its monetary policy.

For this study, we consider daily price return of 121 non-financial firms listed in Pakistan Stock Exchange. The co-movement of firm volatility along with overall market variation is measured through GARCH model. The data period covers five calendar years from 2011 to 2015 having 1264 days of trading. This volatility relation explains only normal market condition covering no recession or market crash period.

Motivation Factors

The motivation factor of this study to examine market volatility co-movement along with firm variation is borrowed from the idea of commonality in liquidity by Chordia et al. (2000) where firm's liquidity was measured on basis of market liquidity. Literature indicates that firm and market volatility are individually studied thoroughly, however,

both issues are not seen together which leaves a space for exploring further possibilities. The average firms and market (KSE-100) volatilities were plotted over the period of 03 January 2011 to 31 December 2015 (See figure 1). We found the same behavior of the market and firm volatilities both move together in the same fashion over the selected time period. This co-movement further boosts up our curiosity to analyze market volatility impact on individual firm return variation.

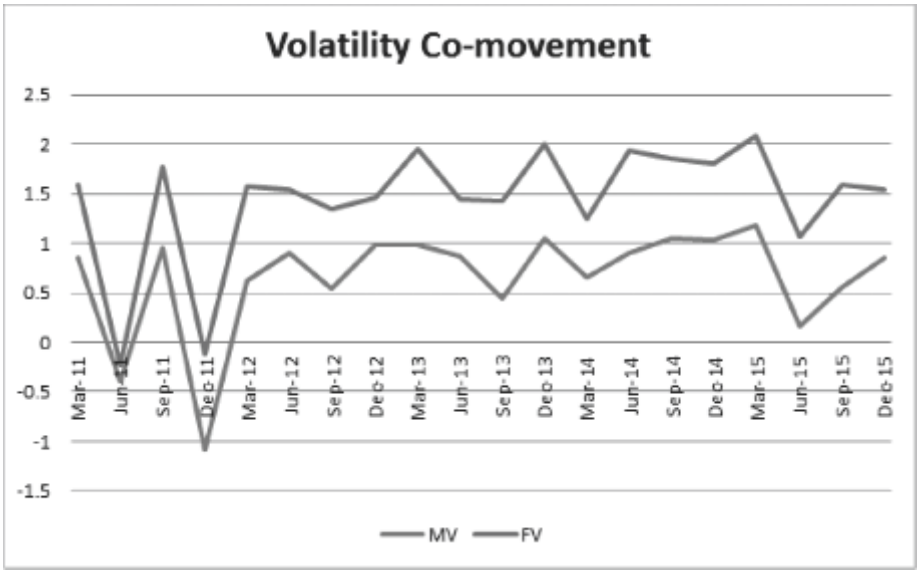

Fig.1: Market and firm average volatilities for 121 listed firms in PSX. The graph shows the average firm volatility with the aggregate market over the period 03 January 2011 to 31 December 2015.

Firm-market volatility correlation is a major issue that confines investors' knowledge of uneven return and factors behind these varied returns. The objective of this study is to examine commonality in volatility between individual firms and aggregate stock market in Pakistan. It is been noticed that market volatility (KSE-100) has a strong impact on firms' return variation over the time. Significant positive effect of market volatility on non-financial firms around 61 percent was studied. However, 24 firms out of 121 produce negative co-movement results. More precisely size of a firm has also influenced the relationship of firm-market volatility. It is noticed that large size companies are more effectively fluctuate with aggregate market variation in comparison with small firms.

Literature Review

A number of studies conducted to evaluate market volatility and firm's uneven return during recent decades. The return volatility of a firm is most likely affected by aggregate market variation. However, market volatility alone can't explain complete variation, firm's specific uncertainty, and industry level risk also plays a major role in individual

stock variation.

Several studied have been conducted for the idiosyncratic volatility of firm and its correlation with other volatility series. Xu et al. (2003) analyzed firm-specific uncertainty and its co-movement with other stocks. The study realized low co-relation among market volatility and firm-specific variations. The cross-sectional analysis defined the institutional ownership as a key factor for idiosyncratic volatility. Return variation of the firm with respect to market volatility was studied by Comin and Mulani (2006) using time series data for 1950 to 2002. An upward trend in firm volatility was observed in comparison with market return variations. Different macroeconomic variables were realized to affect market volatility which was found stable for the period, while at the micro these variable were more volatile which may cause increased in firm-level volatility. Duarte et al. (2012) worked on a common component of idiosyncratic volatility. A new systematic risk factor (PIV) missing from Fama and French (1993) was suggested to explain almost 32 percent variation of idiosyncratic volatility.

Unlike prior studies market volatility was analyzed by (Bekaert & Harvey 1997). It was realized that capital market liberalization has increased cross relation of domestic market with international markets and the volatility of the fully integrated market is influenced by international factors. However, the volatility of the segmented market is more likely inclined by domestic factors. Wachter.J.A (2013) studied reason behind high equity premium and stock volatility. He explained time-varying risk as the main factor of aggregate stock market volatility. The risk aversion policy was analyzed as the second factor to explain market instability. Barinov (2015) argued that aggregate market is composite of various firms where individual firm volatility forms the aggregate market variation. Therefore individual firm volatility is the mean factor that can explain whole market return variation.

The following studies evaluate the correlation of volatility series and its impact on the overall economy. Schwert (1989) analyzed stock volatilities co-relation using monthly data of S&P (NYSE). He analyzed that beside leverages some other factors like industrial risk and unsystematic risk of the firm also contribute to market volatility. The growth of industrial production was analyzed by (Hamilton and Line, 1996) and found volatile results in a time of recessions. They argued that 60 percent of industrial return variation can be explained by aggregate market variation. Campbell et al. (2001) decomposed the stock volatility in all three levels and noticed an increase in firm-level volatility with respect to market-level variation for 1962 to 1997. They found a strong co-movement between all three volatility series and one can lead to boost others. This compound volatility increase lead to economic downturn and recessions. Volatility spillover can be defined as "Volatility of dominated market leads to change in dominated firms". The effect of volatility spillover occurs regardless of significant correlation between firm and market. Wongswan (2006) argued that volatility spillover effect can be seen because of advanced technology, financial reforms, and information processing. The strong link between firm and market assure the market shocks impact on the firm. . The interdependence of Asian equity market was examined by Yilmaz (2009). Emerge market economies were considered as the main reason behind the co-movement of the financial crisis. Islam et al. (2013) analyzed volatility spillover of fifteen countries from Asia and Europe. The results confirmed inside market variation

"volatility spillover" and a cross-market variation known as a contagion for the long term as well as for short term. A study was conducted on developed and developing countries by Li & Giles (2015) showing strong volatility correlation across the markets and firm-market co-movement within the market.

The size of a firm can also affect the relation of firm-market volatility. For example, one way or the other, large sized firm may largely be affected by market instability in comparison with small firms. Song et al. (2005) conduct study on volatility-volume and size of trade relation. The results showed that large-sized trades in Shanghai Stock Exchange effects market volatility more effectively in comparison with small firms. Francis et al. (2010) analyzed the performance of large and small sized firms'. They studied that large firms adjust faster to newly arrived information whereas small firm has most of the uninformed investors. Narayan et al. (2011) examined the size effect of the firm with a change in oil prices. They studied increasing significant positive size effect rises from small firms towards large.

DATA & METHODOLOGY

The market is composite of different firms and its logical structure normally bound variation of individual security with the aggregate market. The link between various sectors of Pakistan Stock Exchange with KSE-100 index may define its movement of direction with the overall market. Volatility spillover hypothesis can be defined as "Dominated market effect leads to change the return of dominated firm". Regardless the statistical significance between firm and market this relation ties both with each other. The existence of this firm-market relation could be the effect of same information possessing, capital market liberalization, financial reforms, and advance technology. These factors restrict boundaries of firm isolation from the comprehensive market and toughen their association. The robust link between the firm and the market increases the probability of market shocks impact on the firm abnormality.

To measure the impact of market volatility on firm instability GARCH model is used. Market volatility is considered as the price variation of KSE-100 index. Literature shows that efficient financial markets use monthly base volatility to incorporate weekend effect and reflects market information (Pástor & Pietro. 2003; Mohamed, A. 2012; and Beirne et al. 2013). However, PXS is recognized as the semi-strong market (Haque at al. 2011) and monthly base volatility results were observed insignificant to incorporate newly arrived information. Therefore, KSE-100 historical volatility was measured on a quarterly basis to determine significant results.

DATA DESCRIPTION

To study firm-market volatility relationship secondary data of Pakistan Stock Exchange (PSX) was collected for the period of 3rd Jan 2011 to 31st December 2015. The historical data of 34 sectors of PSX have selected apart from the food sector, as literature shows that food sector has a low or inverse correlation with the aggregate market. Daily share prices of non-financial firms were sorted for five consecutive days of a week and surprisingly we have only 209 firms' complete data for 1264 days of market trading. To study the size based effect the Market Capitalization value of these firms for 03 Jan 2011 (First day of the sample period) was extracted from "Thomson Financial". Eighty-eight

firms were found missing out of already sorted companies which further reduce our sample size and finally we have 121 firms representing the non-financial sector of PSX. The data collection sources are "Yahoo Finance", "Business Recorder" and "Opendoor.com"

Model

The volatility of the market is accumulated volatility of the firms that formed the market. To formalize firm volatility link with market instability can be seen with the following model:

$$V_m = f(V_{f1}, V_{f2}, V_{f3}, \dots\dots, V_{fn}) \qquad \textit{Where } n = \textit{number of firms} \qquad (1)$$

The above function essentially represents firm-market volatility relationship. If "k" represents total number of firms in the market, that is $\sum k = m,$ Where V_m represent market volatility and V_f is volatility of the firm. In short, volatility of the market is a weighted sum of firms' volatility (Chordia et al. 2000; Sharma et al. 2014).

$$\sum_{n=1}^{k} V_{fn} = V_m \qquad (2)$$

This implies that factors behind market volatility are the same as firm and time series volatility model can be described as:

$$V_{ft} = \alpha_1 + \alpha_2 V_{mt} + \varepsilon_t \qquad (3)$$

Moreover, price variation of the market is the reason behind market volatility. Therefore, market return also contributes in this relation. Finally adding a market return in our model we have:

$$V_{ft} = \alpha_1 + \alpha_2 V_{mt} + R_{mt} + \varepsilon_t \qquad (4)$$

To examine potential volatility size effect, the total firms of our study are divided into 10 different groups utilizing market capitalization value of starting date of the sample period. The smallest firms were represented by the group first whereas larger firm was assigned to group 10. Utilizing above model the results were organized based on size category and measured market volatility significant positive or negative effects on the volatility of the firm in each size group.

EMPIRICAL RESULTS

Descriptive summary of daily return is summarized in below table selected from the sample size. Mean represent the average return for the sample period whereas skewness (SKW), kurtosis (KU) and Jarque Bera (JB) are used for data normality test. Augmented Dickey-Fuller (ADF) and Phillip Perron check the stationarity of data so called unit root test. The serial correlation is reported by Q statistics. The non-normality returns series exposed by descriptive statistics suggest a non-linear model for the study.

Table 1: Descriptive Statistics of individual firms

Symbol	Mean	SD	SKW	KU	JB	ADF	PP	LQ(12)	$LQ^2(12)$
ACPL	0.0007	0.044	-0.525	21.964	18923.850*	-1.723*	-1.477*	328.320*	490.480*
BERG	0.0011	0.085	0.421	35.985	56294.840*	-1.993*	-1.448*	316.110*	454.150*
CCM	0.0035	0.045	-0.014	7.123	386.720*	-1.229*	-1.229*	53.570*	122.950*
DOL	-0.0003	0.045	0.212	13.537	5842.560*	-1.488*	-1.132*	50.300*	128.650*
EXIDE	0.0013	0.205	-1.407	48.009	102109.30*	-7.355*	-1.252*	147.740*	194.030*
FFC	0.0000	0.022	-6.625	117.059	693859.10*	-1.076*	-1.076*	14.510	0.532
GLAXO	0.0007	0.056	-0.902	31.088	41688.230*	-1.942*	-1.385*	204.720*	279.290*
HINOON	0.0025	0.085	-0.618	31.543	40709.900*	-1.763*	-1.430*	260.770*	335.430*
ICI	0.0009	0.080	-1.277	35.934	56558.680*	-2.048*	-1.340*	156.300*	256.050*
JOPP	0.0009	0.083	0.495	20.788	11584.660*	-1.414*	-1.223*	81.630*	272.490*
KAPCO	0.0005	0.026	-0.827	34.338	51824.390*	-1.865*	-1.248*	116.830*	183.510*
LUCK	0.0015	0.046	-0.552	31.722	43477.260*	-1.972*	-1.338*	200.940*	200.940*
MARI	0.0013	0.127	-1.025	44.819	92254.290*	-1.891*	-1.340*	162.010*	273.540*
NESTLE	0.0012	0.046	-0.211	28.125	25178.960*	-1.434*	-1.303*	123.500*	290.120*
OGDC	-0.0002	0.032	0.051	34.664	52764.080*	-1.726*	-1.351*	187.680*	335.650*
PKGS	0.0012	0.109	-0.615	33.349	48051.190*	-2.309*	-1.449*	258.550*	402.710*
SEARL	0.0015	0.081	-0.645	34.027	49946.10*	-2.208*	-1.377*	217.710*	292.690*
TSPL	0.0004	0.096	0.304	8.479	1495.147*	-1.693*	-1.295*	122.920*	85.089*
WTL	-0.0004	0.067	0.786	23.769	22828.870*	-1.609*	-1.207*	-1.2070*	258.080*
YOUW	0.0005	0.112	0.029	14.297	5227.400*	-1.906*	-1.275*	97.930*	140.580*
ZIL	0.0004	0.078	0.783	25.246	18608.900*	-1.513*	-1.167*	116.220*	213.900*

Table 1: Presents the estimation of average mean, standard deviation and skewness, kurtosis and Jarque-Berra for data normality check. Augmented Dickey-Fuller and Phillip-Perron for unit root and Least square for serial correlation. *, **, and *** represent 1%, 5%, and 10% significance level respectively.

Commonality in volatility

KSE-100 daily stock prices were utilized at first stage to measure market return. Quarter based market volatility was considered using each three months return separately. GARCH model was applied using time series data of 121 firms as mean equation whereas market volatility results of 20 quarters along with market return were used as variance equation to predict firm volatility.

The below table represent the results of only 25 firms' out of 121 are presented. The very first column shows symbols of the selected firms where the second column shows GARCH constant. The short-run volatility of lag one only, represents by 3rd column. The MR column shows market return and its co-movement with the firm. The last column shows market return volatility and its significant values indicate show positive volatility co-movement between firm and market on 99%, 95% and 90% confidence level with one, two and three strikes'.

Table 2: GARCH Model $V_{ft} = \alpha_1 + \alpha_2 V_{mt} + R_{mt} + \varepsilon_t$

Symbol	GARCH C	ARCH	GARCH	MR	MRV
AGIL	0.002529*	0.461982*	0.343955*	-0.047837*	0.001455*
AGTL	0.002195*	0.510784*	0.510022*	-0.121247*	-0.000086
BAPL	0.002374*	0.474347*	0.391302*	0.022166*	0.001470*
BGL	0.000443*	0.387086*	0.673889*	0.010833*	-0.000187*

CHBL	0.001340*	0.381873*	0.468553*	-0.061939*	0.000131
CSAP	0.000813*	0.375199*	0.370228*	0.042255*	0.000084**
DCL	0.000461*	0.315588*	0.604283*	-0.002365	0.000090*
DSFL	0.000693*	0.262843*	0.537121*	0.001275	0.000167*
EPCL	0.000273*	0.369729*	0.476952*	0.002116	0.000186*
FEROZ	0.000002*	2.246598*	0.582459*	-0.000377*	-0.000007*
GTYR	0.006821*	0.393438*	0.368861*	-0.269494*	0.001643*
HUBC	0.000006*	0.080395*	0.910010*	0.001017*	0.000004*
IBFL	0.000725*	0.415677*	0.581436*	-0.048031*	0.000059*

[1] All 121 firms results can be obtain from the author on request.

JPGL	0.000812*	0.352910*	0.534663*	0.006378	0.000036
KML	0.005503*	0.353526*	0.212284*	-0.109452*	-0.002086*
LINDE	0.000004*	0.204726*	0.784058*	0.000234*	-0.000002*
MTL	0.000065*	1.030837*	0.415873*	-0.00078**	0.000057*
NCPL	0.000005*	0.183155*	0.858633*	0.000143	0.000001
OTSU	0.001679*	0.515598*	0.349852*	0.062111*	0.001020*
POL	0.000379*	0.267787*	0.345968*	-0.018118*	0.000060*
SAPL	0.000719*	0.704909*	0.324864*	-0.026191*	0.000156*
THALL	0.000004*	0.180313*	0.873259*	0.000691**	0.000005
WTL	0.000827*	0.284921*	0.464841*	0.017120*	0.000325*
YOUW	0.000823*	0.297105*	0.685551*	0.044374*	0.000072***
ZIL	0.000439*	0.681936*	0.534130*	-0.035667*	0.000226*

In the mean equation, V_{ft} is individual stock volatility at time t, α is the intercept and V_{mt} is market volatility. The R_{mt} denotes the market return and ε_t is error term occurs in model.

Size Evidences

The motivation factor behind the size based study is the large firms' behavior to information adjustment by (Francis et al. 2010) and positive significant size based effect studied by (Narayan et al. 2011). The measured results of above section "commonality in volatility" were rearranged as per the size of the firm initiated through market capitalization. Our results for selected firms highlight strong evidence of size based volatility.

Table 3: Size based commonality in volatility.

	Positive Sig.	***Negative Sig.***	***Insignificant***
Size 1	7 (54 %)	2 (15 %)	4 (31 %)
Size 2	5 (42 %)	5 (42 %)	2 (17 %)
Size 3	7 (58 %)	4 (33 %)	1 (08 %)
Size 4	6 (50 %)	6 (50 %)	0 (00 %)
Size 5	9 (75 %)	2 (17 %)	1 (08 %)

Size 6	7 (58 %)	3 (25 %)	2 (17 %)
Size 7	7 (58 %)	1 (08 %)	4 (33 %)
Size 8	9 (75 %)	0 (00 %)	3 (25 %)
Size 9	9 (75 %)	0 (00 %)	3 (25 %)
Size 10	8 (67 %)	2 (17 %)	2 (17 %)

Table 4: The summary of commonality in volatility presents here for each size group. A total number of 121 listed firms in PSX for the period of January 2011 to December 2015 are categorized into 10 equal groups.

Considering the small firms from size group 1 to 2 we studied low commonality evidence from 42% to 50 % and same size based significance can be noticed in group 3 and 4 up to 58% and so on. Although group 5 appears to upsets the sequence a little, however, the overall size based effect show in increasing pattern with an increase in the size of the firm. The below table consider the minimum to a maximum percentage of the positive significant relationship between market and firm volatility.

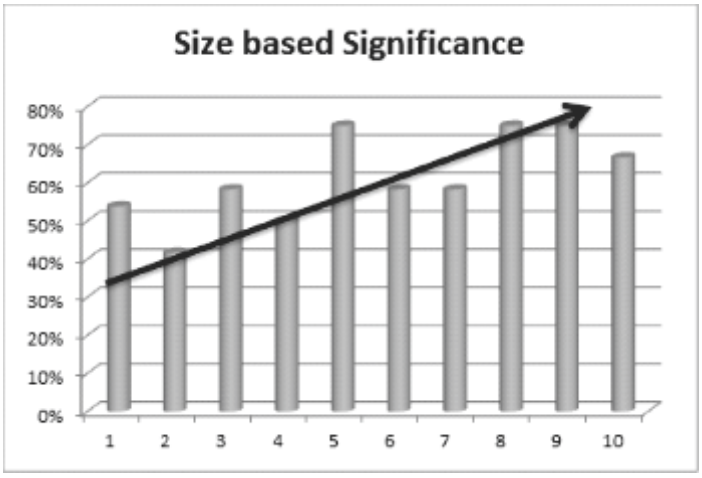

Fig. 2: The graph plots the summary of firm-market volatility significance, on basis of firm size.

CONCLUSION

An analytical framework has been developed to examine volatility associations of individual firms with the aggregate market (KSE-100 index). The daily basis time series data (i.e. Jan 2011 through Dec 2015) of 121 listed firms in Pakistan Stock Exchange was considered. Strong evidences were noticed for co-movement in volatility of firms and market. Significant positive effect of market volatility i.e. around 61% was analyzed on firms' volatility. However, 20% of the firms show negative volatility co-movement with KSE-100.

Furthermore, this paper provides substantial evidence of size based effect of volatility co-movement for firms-market relationship. In other words, commonality in volatility

increases with increase in the size of the firm. For current study, all the selected firms were divided into 10 equal sized groups based on market capitalization value (see empirical results for more details). The significance range starts from as low as 42% in case of small sized firm whereas large firms exhibits more significant co-movement e.g. up to 75%, thus, assuming high commonality with market volatility. Our findings appears be less aligned with the study of Francis et al. (2010), which argues that large sized firms absorb market shocks in an efficient manner and sustain its position in long run. However, our results support and is more aligned with the size-based analysis of Narayan & Sharma (2011), which suggests that those large size firm moves along with the cumulative market.

Finally, future research could explore further into the same area by focusing more on sectoral data of firms that will prove useful in finding sectoral implications of volatility of firm-market relationship. Similarly, the same grouping can be based on characteristics of the firm e.g. liquidity, momentum and/or growth rate of firms.

RECOMMENDATIONS

Investors, arbitrageurs and hedgers who invest in these firms can utilize the knowledge of firm's return sensitivities to market volatility for risk management strategies and relevant strategic decisions. Moreover, firms, on the other hand, can secure its position through various future contracts especially when market volatility starts giving early warning signals.

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