SPILLOVER EFFECT OF MEAN AND VOLATILITY IN ALTERNATIVE INVESTMENTS: STUDY FOR PAKISTANI FUND MANAGERS

1. Urooj Akram*
National University of Modern Languages (NUML) Islamabad ,Pakistan.

2. Hassan Raza
Shaheed Zulfikar Ali Bhutto Institute of Science and Technology Islamabad, Pakistan.

ABSTRACT

The main purpose of the study is to find out the hedging capabilities between alternative assets (Gold, Crude oil, Currencies, MSCI Global, and Mutual Funds) and stock returns of Pakistan Stock Exchange (PSX). ARCH (1,1) and and GARCH (1,1) models are applied to determine the mean and spillover effect between alternative assets returns and PSX index returns. The results of the study reveal that volatility spillover exists in all alternative investments except MSCI Global Index because MSCI indicates insignificant results. Therofre, it is better opportunity for fund managers to invest in MSCI Global or Emerging Index as it will provide more hedging opportunities.

Keywords: Alternative Investments, Mean volatility, Volatility Spillover, ARCH (1,1), GARCH (1,1), Gold, MSCI Global Index, Crude oil, Mutual Funds, Dollar , KSE

* Corresponding author.
E-mail address: mehar.urooj60@yahoo.com (Akram, U. R., Hassan.)

1. Introduction

Alternative assets class or investments have gained much attention in the last few years. In 2009, investments in alternative assets increases to US$9 trillion (Investopedia). Alternative asset class is differ from conventional investmement class as conventionl asset class includes bonds, stocks, and cash. So investment done othan than bonds, stocks and cash is considered as alternative invesmtment. Alternative assets sometimes show highly correlated or negative returns with traditional asset classes. However, there are also some fund managers or investors who want to get a relative return on alternative assets.

Interconnection of financial markets has been important topic in center of research agenda since the 1990s. Because of many economic and financial factors, volatility exists in

many markets and financial markets are interlinked with each other. According to Liu & Tsyvinski (2008), there are some economic factors e.g weather, war, and political issues which affect the prices of alternative assets. So, for Pakistani fund managers and international investors, it is very necessary to study time- varying volatility between different types of markets. The volatility spillover effect among financial markets and different stock markets is studied by many researchers. (e.g., Diebold & Yilmaz, 2012). Five assets have explained in this research as alternative investments or assets e.g Gold, MSCI Global index, Crude oil, Mutual funds, and Currencies.

Gold is considered as an alternative asset as it provides a good return to investors and it is a very trusted investment. It is very important to study Gold price fluctuations or volatility for making hedging decisions or to understand the economy and financial markets (Malik, 2010). According to research done by Lucey & Tully, (2006) to understand the economy and financial markets in a better way, investors need to study gold price volatility or fluctuation. There are many studies in literature which indicates the effect of uncertain macroeconomic factors on gold volatility .When prices of gold fluctuate, then it creates a risk for investors. Crude Oil is also considered an alternative asset or investment. Prices of crude oil are highly linked with prices of other commodities or goods therefore by raising the prices of crude oil, the cost of transportationsi and heating costs tends to increase. So, according to Hooker (2002) and Hamilton (2000) when crude oil prices increase it will generate inflation and negatively affect the overall economy. .Likewise decrease in oil prices also leads to decline in prices of other commodities ,as during COVID-19 crises, oil prices collapse. Decline in oil prices leads to decrease oil demand and as a result demand for coal, aviation fuel and energy products also tends to decrease. Research done in (2020), introduced 'The International Monetary Fund' which specified that a global crises or recession is expected and it will be as bad as 2007-8 world financial crises.

MSCI Global index and MSCI Emerging Stock are also treated as alternative investment. MSCI Global and Emerging is also affected by volatility in the stock market. Any uncertain event or crises can creates volatility in MSCI indexes. Currencies (e.g Dollar) is another alternative investment option. Because many investors prefer to invest in the dollar as it also provides a good return. It is very important to explore the volatility spillover effect between US dollar exchange rates and Stock market prices as there exists a strong relation between them. Mutual Funds are another alternative investment class for investors and fund managers. There exist many studies in the literature that shows the association between

mutual funds & market volatility. When there is more volatiltity in markets then flow of mutual funds reduced (Cao, Chang, & Wang, 2008) . Therefore this study investigates that what benefits investors can derive by investing in mutual funds and how they are affected from volatility spillover.

As Efficient Market Hypothesis stated that, when there is a change or fluctuation in the price of one asset or security it will affect the price of other assets or securities. When there were certain financial crises, the stock market shows movements and volatilities. However, it is very difficult to understand the association between different alternative assets. As no asset class remains in isolation and it is coming closer to each other over time. As alternative assets are strongly linked with each other so this research study helps investors to find the mean and a volatility spillover effect in alternative investments and PSX. This study also explored how alternative assets are affected by regional and global spillovers. As previous studies were done in this context to explain volatility spillover with co-integration analysis but this study has analyzed the volatility spillover between the PSX and alternative assets with the help of the advanced methodology e.g by using GARCH and ARCH models, hence it also fulfilled the gap. These models are appropriate to estimate future points and for time series analysis. This research provides a gateway to investors that thes alternative assets are volaile and correlation is dynamic because of certain events in the country.

Objectives of our current study are to determine the relationship between alternative investments and stock returns, to determine the hedging capibilities of alternative assets and to determine the effect of alternative assets or investments (MSCI Global Index, Oil, Gold, Currencies e.g Dollar and mutual funds) on Pakistani Fund Managers or investors. Results of this study are obtained by using recent methodology e.g ARCH (1,1) and GARCH (1,1) models. As this study used the most suitable and recent methodology e.g GARCH and ARCH models so it is the main contribution of the study. According to the results of this study, Crude oil is the most volatile alternative asset as it shows significant results. Any shock in PSX creates volatility in oil sector. While MSCI Global index shows no volatility so it is best option for investors to invest in MSCI. With the help of this study, investors can know how to invest in different alternative asset classes. This study also provides insights and benefits to decision-makers and policymakers in decision making regarding investment.

The remainder of this paper is organized as follows: Chapter 2 includes literature review, whereas Chapter 3 includes research methodology. Chapter 4 discusses the results and intrpretration and Chapter 5 consists of conclusion and implications.

2. Literature Review

In the last few years, alternative investments have gained much attention. At the beginning of the 1980s, it was very common to invest in alternative assets in financial institutions for example in insurance companies or banks. When investors invest other than cash, bond or stock   then such investments are known as Alternative investments. Alternative investments or assets have different attributes or traits as compared to the traditional asset class (Kitches, 2012). According to Schneeweis & Spurgin, (2009), most investors prefer to invest in alternative assets because they provide better risk and return opportunities or benefits to investors and these opportunities are not available in other asset classes.

Interconnection between alternative assets is very important to study. Therefore the volatility spillover effect in alternative assets is determined in this study. Volatility spillovers mean when there are fluctuations in one market then it creates fluctuations in other markets as well. There is high volatility in financial markets. According to Frijns & Schotman, (2006) nonlinearities in the markets show volatility. King & Wadhwani, (1989) and Susmel & Engle, (1994) also studied mean and volatility spillovers. According to these researchers, the spillover effect that starts from the United States market will affect other markets as well. Five alternative investments or assets have been discussed in this study for example e.g Gold, MSCI Global Index, Currencies like Dollar, Oil, and Mutual Funds, their mean and volatility spillovers effect is also is studied in this research. Returns of all these assets are linked with PSX index returns. The effect of the Pakistan Stock Exchange (PSX 100) on these assets is analyzed in this study.

Gold is one of the main alternative asset class which provides god returns. There are three main attributes of gold, for example, it is treated as a medium of exchange, source of wealth, and unit of value. According to Batten, Ciner, & Lucey, (2014) gold is also considered as a source of investment. Gold is also a good diversifier as it is negatively correlated with other assets. Michaud & Pulvermacher, (2014) studied that there exists zero correlation between gold and other stocks.When gold is added to any portfolio, it shows a negative or zero correlation with other assets because the volatility of gold is low and has

diversification properties (Lucey & Tully, 2006). There exists a negative correlation among gold and equities and a negative relationship is also studied among gold and dollar (Ciner et al., 2014). According to research done by Lawrence, (2003) there exists no correlation among gold returns and GDP, interest rates, and inflation. Batten et al., (2014) also found a negative correlation between gold and interest rates. Study was done by Mccown, (2006) considered gold as zero beta asset while (Michaud & Pulvermacher, 2014) examined negative beta between S & P 500. Gold is added to any portfolio because it will increase returns and lessen the risk. As WGC declared that when gold is added to any portfolio with 9 percent or proportion then the portfolio's risk will be reduced by 13%.The purpose behind this is to reduce the risk. Therefore, gold must be added to a portfolio because it can provide a risk premium. Investors can get more benefits by adding gold to a portfolio as it will provide good returns. Michaud & Pulvermacher, (2014) stated in their study that gold must be added to the portfolio in the same way as other alternative assets, small-cap stocks, and emerging markets are added for e.g there must be small unusual addition in the core portfolio. According to Chua et al. (1990), the performance of a portfolio is more effective when gold is added. Hillier, Draper, & Faff, (2006) suggested that when investors add precious metals into a portfolio then S&P 500 investors can take more benefit.

As gold provides many benefits for example hedging and diversification opportunities but gold is also affected by many volatility factors. Lucey & Tully, (2006) stated that investors can understand financial markets in a better way by understanding gold volatility. There are different studies and according to their results there exists a strong relationship between the stock market, gold, and other variables. Certain macroeconomic factors affect gold prices. There are many studies in literature which indicates the effect of uncertain macroeconomic factors on gold volatility .Inflation and interest rates play an important role. When there is high inflation, gold prices tend to increase then it is the best time for investors to invest in this asset class as gold is a safe haven against inflation. While a dollar is also an important factor that affects gold prices. When the dollar increases its value the prices of gold tends to decrease and vice versa. COVID-19 pandemic dramatically impact on financial markets and stock markets. Investors suffer from losses in financial terms. Markets become more volatile due to uncertainty of this pandemic and economic losses .During this pandemic gold prices increases and investors rush to invest in gold as it will safe their investment for longer time. From different studies it can be concluded that gold creates less volatility and it performed well as compared to other assets. At initial stages, in March gold prices fall but

such drop in prices was mild as compared to collapse in oil prices. So it play an important role in COVID-19 as portfolio diversifier and safe haven.

Crude oil is another alternative asset and option for an investor to invest. Investing in crude oil stocks is a good option. Investors can invest in stocks by taking part in the ownership of an organization. By taking ownership in oil companies then their exposure tends to increases with crude oil. There are many top oil companies in which investors want to purchase shares e.g Royal Dutch Shell Plc, Petroleo Brasileiro, Transocean Ltd, Anadarko Petroleum, Exxon Mobil, Apache Corporation, Halliburton Company, etc.

But it is important to study volatility spillover effect in crude oil .Many factors create volatility in crude oil prices. Main factors like geopolitical and weather play role in create volatility. Many researchers investigate in their studies and find the relationship between crude oil prices and economic variables. Many researchers explored developing and developed countries in their studies and found out the effect of change in oil prices on economic conditions (Hamilton, 2000; Du et al., (2009), Ono, (2011); Lardic & Mignon, (2008)). Likewise, after the crises of COVID-19, oil prices collapse. Georgieva, (2020) studied that in March The International Monetary Fund specified that a global crisis or recession is expected and it will be as bad as the 2007-8 world financial crises. After the outbreak of COVID-19, there is a reduction in oil demand. As there are travel restrictions due to city lockdowns so the demand for coal, aviation fuel, and energy products decreases. As a result oil prices decrease. To determine the spillover effect between alternative assets, the relationship between crude oil and gold is studied. The volatility spillover effect exists between Crude oil and Gold according to the literature. Co-integration approach and error correction model are used by (Andersen et al., 2002). Data is collected from Jan 2000-Mar 2008 and results show the link between crude oil and gold markets and a correlation between them 0.929 (Aruga & Managi, 2012). By taking monthly data the association among real estate assets, financial assets, and commodities are studied by applying the Markov Switching Model, (Chan et al., 2009). There are two rules which identified 'crises' rule which shows when volatility is high it will affect negatively on stock indices while the second rule is a 'tranquil' rule which shows when there is low or no volatility then it effect positive on stock returns.

MSCI Global Index is another investment option for investors or fund managers. Roon, Nijman, & Werker, (2001) studied the Morgan Stanley Capital International index (MSCI) in many studies. Volatility is observed in many markets of developing or emerging countries. Any macroeconomic factor which creates changes in any country creates volatility. Volatility is observed in many markets and this volatility is because of the global event, October 1987 crash. Likewise, the Gulf war also creates volatility. There are also some political events which creates volatility in markets (Bailey, Chung, The, Analysis, & Dec, 2015) .Investment in currencies like the dollar is also considered an alternative asset and option for investors to invest. So it is very important to study the spillover effect of a dollar because there exists long term relationship between US dollar exchange rates and stock market indices. Therefore literature explains the relationship between them. Samuelson, (1980); and Yau & Nieh, (2006) studied that it is a traditional approach when exchange rates determine stock market prices while when exchange rates are predicted by stock market prices then it is considered as a portfolio approach (Caporale et al., 2002). By taken daily data Wang et al. (2010) studied the changes in stock market prices of Germany, Japan, China, the US, and Taiwan due to fluctuations in crude oil, US dollar, and gold prices. Results suggest that a strong relationship exists among the US dollar, oil and gold prices, and stock markets of Japan, Taiwan, Germany, and China.

Mutual funds are also a good investment option for fund, managers, or investors. Therefore, this research tells the benefits of investing in mutual funds and determine how they are affected by volatility in other alternative assets.According to Engström et al, (2004) mostly fund managers or investors prefer to invest in funds that have a larger flow and have low search cost. Search costs can be decreased by more visibility and advertising, (Jain & Ghosh, 2013). When such funds are more visible in financial magazines then it can raise their flow of investment. The cost of information, transparency, and visibility process are less in companies that have a large flow of funds. As more benefits or services are offered by large companies. Sirri & Tufano, (1998) also studied that there is a direct link among funds visibility and mutual funds as these funds are related to large companies. To explore the association between flow-volatility there are very few studies. Ismail, & Gee, (2017), Qureshi, Kutan, and Gee Chan., (2017) also explored the relationship between market volatility and market returns but they ignored the effect of macroeconomic factors.

Results from these research studies are still ambigious or not clear, so this research finds the spillover effect of mean and volatility in alternative assets (Gold, MSCI Global, Currencies, Oil, and Mutual Funds). As previous studies were done in this context to explain volatility spillover with co-integration analysis but this study has analyzed the volatility spillover between the PSX and alternative assets with the help of the advanced methodology e.g by using GARCH and ARCH models, hence it also fulfilled the gap. These models are appropriate to estimate future points and for time series analysis. Also previous studies do not explain this concept because no such research is done before by taking all these assets together in a study. Therefore, this study will help in further research by investigating the behavior of the stock market by using more recent methodology. This study will also contribute in the future by providing information to fund managers about investment decisions..

3. Research Methodology

In order to find spillover effect between alternative investments and PSX daily data is taken. Because gold, MSCI, currencies exchange rate, oil, and mutual funds, and stock market are trading on daily basis. Returns of all these assets are compared or linked to PSX 100 returns. Two main models are used in the study, ARCH (1,1), and GARCH (1,1) models. Descriptive statistics is done to determine mean, standard deviation , kurtosos and skewness of data. Pairwise Corelation is also done to determine the relationship between assets and PSX returns. To find the stationarity of data , Phillip Perron and Augmented Dickey Fuller test is applied.

3.1 Data Description

The basic aim of this research is to determine the spillover effect among alternative assets. Data is taken from 2009-2018 and daily closing prices are taken to determine the effect of volatility spillover of one asset on other assets. The following formula is used to determine returns of assets

$$Return = \ln(\frac{P_t}{P_{t-1}}).$$

Where,

ln = natural logarithm

p_t = index price of current day

p_{t-1} = index price of previous day

The methodology applied by Liu and Pan (1997) and Bhar & Nikolova (2007) is used in this study, to find the relationhip between alternative assets (Gold, currencies, mutual funds oil, MSCI Global index, and PSX index). ARMA (1,1) and GARCH (1,1) models are used to calculate index returns of these assets

The econometric equation for gold is   given below,

$$r_{g,t} = \lambda_0 + \lambda_1 r_{g,t-1} + \lambda_2 v_{g,t} + \lambda_3 \epsilon_{g,t-1} + \epsilon_{g,t}, \epsilon_{g,t} \sim N(0, v_{g,t})\qquad(3)$$

$$V_{g,t} = \Psi_0 + \Psi_1 v_{g,t-1} + \Psi_{2\epsilon^2_{g,t-1}}\qquad(4)$$

Where:

$r_{g,t}$ = daily stock return of gold prices at time t

$\varepsilon_{g,t}$ = errors or residuals normally distributed with mean zero

$v_{g,t}$ = time-varying conditional variance

Mean and spillover effect of different assets are calculated by getting the standardized errors or residuals and then taking its square in the first stage and putting them into equations of mean and volatility of other markets indices as given below:

$$r_{g,t} = \beta_0 + \beta_1 r_{g,t-1} + \beta_2 v_{g,t} + \beta_{3 \epsilon_{g,t-1}} + \phi_1 \epsilon_{j,t} + \epsilon_{g,t}, \epsilon_{g,t} \sim N(0, v_{j,t})\quad(13)$$

$$v_{g,t} = \phi_0 + \phi_1 Z_{j,t-1} + \phi_{2 \epsilon^2_{g,t-1}} + \phi_3 DM * e^2_{j,t} + \phi_2 e^2_{j,t}\qquad(14)$$

 The equation given above shows subscript 'g' for gold & $\varepsilon_{j,t}$ shows residuals or standardized errors and it can calculate the impact of the KSE index on other assets (e.g. gold, mutual funds, oil MSCI, and currencies).To explore the effect of volatility spillover exogenous variable is e2j,t, it is the square of the standardized residual series and it is added to the conditional volatility equation. $\varepsilon_{g,t}$ can be calculated by using formula(εj,t / vj,t ^.05) .

4. Results and Discussion

 4.1 Descriptive Statistics

The table given below shows descriptive statistics of all assets returns and the table includes mean, standard deviation, kurtosis, skewness, minimum loss in a day and the maximum return earned in a day.

Table 1: Descriptive statistics for the period of 2009-2018

	GP	OP	CP	MF	MSCI	R_PSX
Mean%	0.015	0.007	-0.003	0.002	0.078	0.067
Standard Deviation% 0.010	0.010	0.022	0.006	0.003	0.064	
Kurtosis 5.752	9.345	14.637	86.876	352.788	1086.37	
Skewness 0.176	-0.355	0.615	-3.061	-17.041	-0.385	-
Minimum % 5.135	-9.596	-13.859	-13.705	-7.919	-224.039	
Maximum % 5.301	6.841	27.757	6.341	0.986	222.566	

While analyzing the results of the table given above, currency indices indicate a negative mean return while all other assets show positive mean return. MSCI indices indicate a high mean return. As the value of Kurtosis are greater than 3 so these distributions are leptokurtic and show higher peaks in data. Skewness results show all asset returns are negatively skewed.

Table 2: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) PSX	1.000					
(2) GP	-0.015	1.000				
(3) OP	-0.030	0.097*	1.000			
(4) MSCI	-0.013	-0.014	0.044*	1.000		
(5) CP	-0.040*	0.292*	0.160*	0.038	1.000	
(6) LMF	-0.006	-0.025	-0.007	-0.009	-0.035	1.000

* shows   significance at the .05 level

The relationship among different assets is shown in the above table. When correlation among assets is positive and high it shows less hedging and when correlation among assets is negative and low then there is more chance of hedging. Results of the table given above

shows there exist an insignificant and low relationship among assets. There exists a negative relationship among Gold prices and the PSX index and its value is -0.015 which indicates there exists an insignificant relationship between them. So these results suggest that by investing in these assets investors can get more diversification opportunities. Likewise, a negative relationship is shown by (PSX and MSCI) and (PSX and Oil prices) and they have an insignificant relationship. Similarly, (LMF and PSX) and (Currencies (dollar) and PSX) also indicate a negative and insignificant relationship. Therefore, fund managers can get more benefits in these assets as these assets are negatively correlated with each other and provide diversification opportunities.

4.3 Unit Root Tests

It is very important to understand the order of integration of variables while observing time series data. Therefore for time series, unit root tests are applied at the first difference and a level. In this study, stationarity of data is found by Unit roots tests. Data must be stationary as it is an important assumption or condition for unit root tests.

Table 3
Augmented Dickey-Fuller and Phillips Perron tests at level and first difference

Series	ADF Level	ADF First Difference	PP Level	PP First Difference
GP	-52.026	-21.257	-52.056	-783.293
OP	-64.292	-24.160	-63.055	-737.053
MF	-51.760	-19.881	-51.881	-1667.869
MSCI	-29.834	-22.884	-165.793	-2187.754
CP	-50.991	-21.078	-50.934	-716.980
1% Critical value	-3.432	-3.432	-3.432	-3.432
5% Critical value	-2.862	-2.862	-2.862	-2.862
10%Critical value	-2.567	-2.567	-2.567	-2.567

Results of the table given above show that ADF and PP values at the level are less than the critical values however data is shown stationary at first difference as values at first difference are greater than critical values. Results show that null hypotheses are rejected as all series are

stationary at first difference. Hence, the first condition of the ARMA Model is fulfilled as data is stationary at first difference.

4.4 Mean and volatility Spillover Analysis

Mean and variance volatility spillover results from the PSX market to Equity markets of Gold, Currencies, Oil, Mutual Funds, and MSCI are reported in Table 4.

Table 4
Mean and volatility spillovers among Alternative investments estimated from ARCH(1,1)-GARCH (1,1) on daily stock return for the period of 2009-2018

	PSX	MF	MSCI	OP	GP	CP
$\lambda 0$ 0.0001	0.0010	0.0002	0.00026	0.0004	-0.002	
	(0.001)	(0.715)	(0.809)	(0.0006)	(0.465)	(0.773)
$\lambda 1$ 0.082	0.161	0.084	0.084	-0.026	0.178	
(0.523)	(0.001)	(0.5107)	(0.516)	(0.001)	(0.580)	
$\lambda 2$ 0.135	-0.189	0.097	0.100	0.0003	0.287	
(0.081)	(0.001)	(0.174)	(0.166)	(0.987)	(0.465)	
$\lambda 3$ 0.080	1	0.079	0.079	0.009	-0.050	
	(0.001)	(0.544)	(0.545)	(0.169)	(0.877)	(0.539)
$\Phi 1$ 7.193		0.057	-5.10E+14	1.267	-9.53E-05	-
	(0.459)	(0.624)	(0.001)	(0.727)	(0.141)	
$\Psi 0$ 3.88E06	5.91E-20	3.87E-06	3.04E-06	3.33E-07	0.0001	
(0.001)	(0.010)	(0.001)	(0.001)	(0.007)	(0.022)	
$\Psi 1$ 0.131	0.15	0.127	0.122	0.044	1.50E-01	
(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.029)	

	PSX	MF	MSCI	OP	GP	CP
$\Psi 2$ 0.831	0.6	0.836	0.845	-0.009	0.6	

(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.001)
$\Psi 3$		3.47E-07	6.40E-07	0.0004	-1.92E-10
3.90E-07					
(0.012)		(0.125)	(0.001)	(0.001)	(0.017)

*(Values in parentheses are p-values)

The results of the table given above suggest that GARCH and ARCH terms of some assets indicate insignificant results while some assets indicate significant results. The interpretation of each asset is given below.

According to the results of **Mutual funds (MF)** insignificant result is shown by the GARCH term which indicates that forecasted volatility cannot predict mutual funds returns. ARCH term ($\lambda 3$) also shows insignificant results which show past day shocks cannot predict market adjustments. **$\Phi1$ (**Standardized Residual Series) indicates insignificant results so there is no mean spillover effect in the mutual fund market. As there is no mean spillover effect in mutual funds so fund managers can get more diversification benefits. But Variance equation indicates significant results and it shows that current day volatility is affected by past prices of mutual funds. UTV also indicates that volatility exists in the mutual fund market because significant results are shown by UTV. Therefore, both lagged and current volatility affect the returns of mutual funds. High volatility affects highly on these funds.

The GARCH term of **MSCI** shows insignificant results so it indicates that forecasted volatility cannot predict the MSCI index. The Mean equation also indicates insignificant results which means that previous prices do not impact current day returns. Therefore no mean spillover exists. Similarly, UTV of variance equations shows insignificant results which suggest that no volatility spillover effect exists in the MSCI.The MSCI creates more diversification and hedging opportunities for fund managers as there is no effect of volatility on it.

According to the results shown by **Crude oil** mean equation shows that Φ_1 indicates significant results so mean spillover exists in the crude oil market. The Crude oil market is affected by any change or fluctuations in PSX. Variance equation also indicates significant results so there exists a volatility spillover effect in the crude oil market. ARCH and GARCH values indicate volatility spillover. High volatility is occurred because of large shocks and low volatility is occurred because of small shocks. All coefficients of **OP** are positive and significant which shows the existence of mean and volatility spillover. **GP(Gold Prices)** shows insignificant results for mean spillover which suggests that past prices of gold cannot

predict current day returns. So it provides more diversification benefits to investors. These results are also supported by the literature. Michaud & Pulvermacher, (2014) also studied that there exists zero correlation between gold and other stocks. Variance equation indicates significant results which show that volatility spillover exists in the gold market. The gold market is affected by volatility in PSX. Volatility in the exchange rate and oil also creates volatility in gold prices. Due to the increase in crude oil prices, inflation tends to increase, therefore gold prices increase so it best for fund managers to invest in gold. Economists and financial advisors also suggest that when the financial situation is not good then it best for investors to invest in gold. Certain macroeconomic factors also affect gold prices. There are many studies in literature which indicates the effect of uncertain macroeconomic factors on gold volatility .Inflation and interest rates play an important role.   When there is **high inflation**, gold prices tend to increase. and then it is best for fund managers to invest in this asset class as gold is a safe haven against inflation. According to the results shown by **CP** (Currencies prices e.g. dollar), Variance equation indicates that GARCH and ARCH term is significant, so volatility exists in the currencies market. Volatility in the dollar market has occurred when there are any shocks or fluctuations occur. As UTV Ψ_3 also shows significant and positive results so volatility spillover effect exists in the currencies market**.** According to the results, more volatility is observed in the Crude oil market as compared to other assets which shows that the crude oil market is more affected by economic and political factors therefore it is a more volatile sector among other assets.

5. Conclusion

The basic purpose of this research study is to explore the mean and volatility spillover between Alternative assets & the PSX index, for the period of 2009-2018 by using more recent methodology ARCH (1,1) and GARCH (1,1) models. Alternative assets explored in this study are   (OPEC Crude oil Prices, COMEX Gold closing prices, Currencies e.g dollar, LAKSON Mutual Fund, and MSCI Global Index). All prices of alternative assets are linked with PSX 100 index prices.

By using ARCH (1,1) and GARCH (1,1) models mean and volatility spillover is estimated. According to the results, MSCI shows insignificant results so there is no volatility exists in MSCI and it will provide more diversification benefits to investors. Shocks in the PSX market create volatility in all assets except MSCI. Wheras high volatility is shown by crude oil prices which shows that any fluctuation in the stock market created volatility in the crude oil market. Therefore, the objective of this study is fulfilled as it explores the association

between PSX and alternative assets. Results of this study indicate that crude oil shows high volatility so it not a good option for fund managers to invest in crude oil. High volatility creates a high risk for investors. But MSCI shows no volatility among all assets so it best option for investors to invest in MSCI. Hence the objective of this study is fulfilled by investigating the hedging capabilities of alternative assets.

5.1 Implications of the study

This study is significant as it will help investors in deciding which alternative asset is better for investment. There are the following implications for economic policy-makers and investors.

- As the results of pairwise correlation indicates that there is negative correlation between currencies, MSCI Global index, mutual funds and gold. So it provide more hedging benefits to investors . Therefore, this study helps investors who are risk averse.

- Some investors are risk takers because when there is high risk there is a high return. So this study recommends risk-takers to invest in Crude oil as it shows high volatility so it can provide a high return.

- For designing portfolio strategies and investment decisions, this study will help investors and fund managers in the commodity market and the financial market.

- Economists must understand the concept of the spillover effect of volatility among alternative assets and KSE. In order to protect their investments, investors and fund managers need to understand this study. When investors have some historical information then they can make better investment decisions.

Future Directions of the study

Five alternative assets are studied in this research but further study can be done by taking other alternative assets e.g real estate, hedge funds and private equity . Further study can be also done by taking cryptocurrency e.g bitcoin as an alternative asset and relate it to other alternative assets . Data of this study is limited to 2009-2018 so future studies can be done by takng more recent data.

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