Dynamic Relationship between Gold Prices, Oil Prices, Exchange Rate and Stock Returns: Empirical Evidence from Pakistan

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Abstract

This study aims to analyze the dynamic relationship between key macroeconomic indicators of Pakistan including gold prices, stock market returns, and exchange rate and oil prices. Significant variations or shocks have been observed over time especially in the past decade among the stated macroeconomic variables. It is essential to validate the relationship between them periodically and this study will help investors who want to diversify their investment into various assets classes including financial assets and real assets. This study is based on monthly time series data from January 2005 to December 2015. To analyze the shocks or variations, vector auto regression model has been used. Augmented Dickey fuller and Phillips–Perron tests are performed to check the random walk behavior in the different data series. The results of impulse response have shown significant variation or shock in gold prices, oil prices, exchange rates due to stock returns whereas as impulse of other macroeconomic variable do signify any specific trend in stock return except exchange rate shock has significant negative impact on stock returns. Results of variance decomposition test have revealed that stock returns causes variation in other variables as much as 17.77% in oil price, 8.58% in gold price and 6.6% in exchange rate, whereas percentage change in stock returns due to shocks in other macroeconomic variables is as much as 18.1% due to exchange rates, 6.9% due gold price and 6.5% due to oil price shock. This study expands the door of future investment for rational investors who should not invest in stock market only, but also they should invest in other commodities markets like gold and forex.

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Introduction

Investors are always attracted to those sectors of economy where they get maximum return at acceptable level of volatility and where increase in price shows a consistent trend. Investors want to identify those opportunities so that they can exploit these rising price trends to maximize their profits and wealth. There are many opportunities for investors to invest and secure their future revenues. The main avenues of investments are equity market, debt market and the commodity market. In the equity markets, the main financial instrument is share whereas in the debt market bond of different maturities

and types. In commodity markets gold is considered the most valuable commodity. Crude Oil futures are also traded in commodity market and investors also trade in currency in Forex or foreign exchange market which is considered as the world largest financial market. These markets hold extreme importance to economy of any country. In this research we have examined the dynamic relationship between gold prices, oil prices, exchange rates and stock returns (KSE 100 index). Focal point of this study is stock market and how volatility of gold price, oil price and exchange rate influence stock market behavior and vice versa.

Importance of stock market

Stock market of any country is regarded as an essential instrument of the economy of a country. Stock market of a country plays the important role in the development of industry and other contributes to the success and development of the economy of the country. It is imperative for every country in the holes to put on the exhibition and observe factors affecting the stock market performance. Scholarship is important for both investors and companies whether they are listed or not listed on the stock exchange. Stock market plays important role in the growth of industry in all countries by providing liquidity or investment they need to expand their operations and improves employment, GDP, etc. that is a good sign for any country economically. Fair provides a common platform for buyers and sellers to trade securities or shares in listed companies. The prices of shares determine supply and demand mechanism based on the performance of businesses and the sentiments of investors in the direction of the company shares. Stock market indices are extremely sensitive to changes in economic fundamentals variables. Karachi Stock market of Pakistan which is now merged with Islamabad and Lahore stock and now labeled as Pakistan stock exchange is considered as one the best stock market in recent times. When analyzing Karachi Stock Exchange 100 index, the top 100 companies listed in Pakistan it has worked wonders in the past ten years in term returns which it gives to the investors. According to the article in the Express Tribune (2014) Karachi stock exchange was considered 10 best exhibition in 2013 around the world with its benchmark index i.e. KSE-100 posts annual return of 49.4 percent or 37 percent in US dollars per year. According to the Daily times Pakistan (2015) Karachi stock market ranked third in the world and first in Asia in 2014. In times of crisis Karachi Stock Exchange (KSE), faced sharp decline in bases points and in these circumstances investors lost confidence in stock market and putting all money into valuable metals like gold which leads to rising trend in gold prices as they no fear of future losses in this investment. This behavior of investors not only affects stock market of developed countries but also developing countries like Pakistan, Sri Lanka and India.

Importance of gold in an economy

Gold has always been one of the most precious commodity exists in this world and it is considered as symbol for wealth, power and prosperity. In the past gold has fascinated most culture and also desire for having it destroyed many cultures in wars. Countries and Individuals, Especially in the East, are diversifying their Assets with Gold. From an economic and financial point of view, movements in the price of gold are both interesting and important. Gold has its significance in financial world and investors whom have solid investment plans also consider gold in their portfolio. Global markets monitor gold prices and keep a close look on its prices and evaluate its position. Gold has its significance for number of reasons. Currencies of many countries around the world are backed with gold. Gold is universal and no matter which country you go or whatever the currency markets are doing, gold has the same value and it is great acceptance.

Importance of oil price in an economy

Impact oil has on growth is quite striking. Many companies are forced to take up new oil, change the mode to use aspects of its production and also do away with unprofitable sectors. This reduces the profitability of industries. It can also cause a worldwide recession due to a reduction in real money that the government increase their protectionism on the import and export. Major price shifts can also occur, especially in economies that have many monopoly. Various policies around the world are not appropriate and not to deal with the impact of oil prices. Governments of some developing countries have set up surveillance systems that protect consumers and businesses from price increases. However, these controls only protect growth in a short time; in the long run, it affects financial stability and the resulting government debt. Governments should focus on both short and long-term oil market fluctuations

Importance of exchange rates in an economy

Apart from factors such as interest rates and inflation, the exchange rate is one of the main determinants of the relative level of the economic health of a country. Exchange rates play a crucial role in the level of trade of a country, which is crucial for most every free market economy in the world. For this reason, the exchange rates are among the most viewed, analyzed and manipulated by the government economic measures. But exchange rates applicable to smaller scale as they affect the real return of the portfolio of an investor.

Gold prices and stock returns

The international investors sought a safe haven in the precious metal like gold in the global recession in the history. Economic theory suggests that in a time of crisis, as equity prices fall the price of gold rises. With the more uncertain economic environment, attention focused on gold as a safe haven.

Gold also termed as safe heaven assets in times of crises. Several studies reveal that metals like gold tends to be a good hedge against inflation and it moves in opposite direction to shares and bonds, also unlike any other financial assets like stocks, bonds and derivatives it is not dependent on performance of any company nor it is represent any liability of assets, many financial analyst has upgraded their perception regarding price trends. Trend in stock investment has sharply declined and many stock markets in the world have been crashed. Financial markets and the variety of financial instruments have grown steadily in both volume and value in recent decades. This growth has raised the risks of the financial system and potentially established the need for a safe haven for investors. This finding suggests that investors buy gold on days of extreme negative returns and sell it when market participants regain confidence and volatility is lower according to Baur et al., (2010). Gold prices are supposed to become the attractive sector in the time of negative stock market returns.

Currently in Pakistan, political government is instable, economic indicators are lowering down and stock returns are diminishing due to doubtful activities in stock exchange and poor economic decisions made by government. Therefore, investors in this great uncertainty are investing in gold bullion rather investing in stock market of Pakistan. In result demand of gold has been increased and Pakistan has become one of top ten consumers of gold.

Exchange rate and stock market

During crises the countries affected observer turmoil in currency and stock markets. If there is a relation in stock market and exchange rates then the crises of stock market can be prevented by controlling the exchange rate. If the stock market and exchange rates are related then investors can use information of one to predict the behavior of other.

According to Abbas (2010) in study shown that there exist positive associations that will yield shares in exchange rates is justified as follows. If stock returns are higher, local investors sell their assets abroad and will buy domestic assets. This conversion of foreign assets in domestic will increase demand for local currency in the foreign exchange market, putting upward pressure on its price.

Oil prices and stock returns

The relationship between Oil price and Stock market is depends on the importance of oil to that country and whether the country is oil importer or oil exporter. Since, industry daily operations are largely depends on Oil consumption so theoretically oil price shocks have impact on profitability of company which will reflect in its stock price. Historically, Oil price has showed an increasing trend and so are the stock market returns have also

increased. Hence, it was observed in various researches due to oil price volatility stock market behave differently in different parts of the world.

Research Problem

In this paper we tried to analyze the economic theory to know the relationship between stock market of Pakistan and other macroeconomic variable like gold price, oil price and exchange rates. We tried to find the impact of shock in each variable on stock market return and stock market return shock impact on other variables. So following are the *research question* in this regard.

- What the relationship between Gold price and KSE-100 returns?
- How Oil prices and stock returns influence each other?
- What relation exists between exchange rates and stock market returns?
- What is the percentage impact on oil price due to stock return shocks and vice versa?
- What is the percentage impact on gold price due to stock return shocks and vice versa?
- What is the percentage impact on exchange rates due to stock return shocks and vice versa?
- Is there any causal relationship between oil price, gold price, exchange rate and stock price?

Objectives of the Study

The objective to study to analyze trends prevails in Pakistan economy w.r.t to gold price, oil price, exchange rates and stock market. However, following are the specific objectives of the study

- To identify relationship between gold price and KSE100 returns.
- To know how oil prices and stock returns influence each other.
- To identify relation exists between exchange rates and stock market returns.
- To find is the percentage impact on oil price due to stock return shocks and vice versa.
- To find percentage impact on gold price due to stock return shocks and vice versa.
- To find percentage impact on exchange rates due to stock return shocks and vice versa.
- To know any causal relationship between oil price, gold price, exchange rate and stock price

The scope of the study is limited to Pakistan and ten years secondary data has been taken from 2005 to 2015. Data for this study has been taken from Yahoo Finance for KSE-100 Index, Exchange rates data has been taken from State Bank of Pakistan Website and Oil prices and Gold prices data has been taken from indexmundi.net. Results of this study help in generalizing the

trends between gold price, oil price, exchange rate and stock returns in Pakistan. This paper is comprised of multiple sections; the first section is on introduction, objectives and research questions. The second section is on the contribution under same area of research by researchers around the world, Asia and specifically Pakistan. The third and fourth sections are based on data and estimation methodologies and empirical analysis respectively. The last section is on conclusions, findings and future research directions. In the next section, the detailed literature review is given.

Literature Review

This paper purposes to analyze the dynamic relationship between key macroeconomic indicators of Pakistan including gold prices, stock market returns, and exchange rate and oil prices over the period from 2005 to 2015. Literature has proved that significant variations or shocks have been observed over time especially in the past decade among the gold prices, stock market returns and exchange rate and oil prices on national and international level.

As for as historical development in the literature related to gold, stock, oil and forex markets are concerned, the contribution and major findings are discussed one by one periodically. Muhammad et al., (2002) examines exchange rate and stock indices of developing countries like Bangladesh, India and Pakistan using monthly data from January 1994 to December 2000. In this study results of Vector Auto Regression econometric model revealed that there no short-run and long run association between stock market returns and exchange rates in Pakistan and India. Granger Causality test results showed that Stock market returns and exchange rates are unrelated and cannot be used to predict each other. According to the study undertaken by Abbas (2010), the researcher examined the behavior of exchange rate in five Asian countries namely Pakistan, India, Indonesia, Korea and Srilanka using monthly data from July 1997 to October 2009 of exchange rates and stock market of respective countries. Granger Causality test using Vector Auto regression model result revealed that there is no causality relationship between currency market and stock market in Long run. However, in short run currency market and stock exchange of Pakistan and Srilanka has causality relationship.

The literature supports that to check the shocks vector auto regression model must be used. Likewise, the study by Sari et al., (2006) examined oil price, stock market, interest rates and industry output of Turkey using monthly data from 1987 to 2004. Vector Auto Regression Econometric model was used is this study which revealed that Oil price changes doesn't seems to affect Turkey stock market return like developing countries. Furthermore, Kilian *et al.* (2009) used monthly data from 1973 to 2006 to examine the relationship between Oil price and Stock market using Vector Auto

Regression. There are various reasons of Oil price increase, the reason which has negative impact on stock market is precautionary demand concerning future oil supply.

Baur *et al.* (2010) in a study based on UK and US market analyze that whether gold is safe haven or hedge for stock. In this study he uses ten years daily data of MSCI stock and bond indices, along with US closing spot gold rates. Using GARCH method he revealed that Gold is both safe haven and hedge for stocks of US and UK market. However, statistically gold is generally not safe haven for US and UK bonds. This study also revealed that Gold is safe haven for stock only in short run, in the long run this relation doesn't hold. In this regard investors are advised to take long position on Gold at time of financial crises and sell it afterwards when stock market becomes stable. According to Bhunia *et al*. (2013) study gold and stock market of India based on the daily data from January 1991 to August 2012. Method that is used is Vector Auto Regression and the Granger Causality test revealed that there is no causality relation between Gold prices and stock prices. In India, gold is safe haven assets due to traditional and cultural value hence it price continue to rise.

Mishra *et al.* (2010) examines stock and gold indices of India based on monthly 19 years data from January 1991 to December 2009 Using Vector Error Correction Model the results of Johansen's co-integration revealed that there is long term equilibrium relationship exists between Gold price and Stock Market in India. Granger Causality test revealed that there is causality relationship between Gold price and Stock market in India from the period of 1991 to 2009.

Sharma *et al*. (2010) used weekly data from January 2008 to January 2009 of exchange rate, foreign exchange reserve, inflation rate, and gold price to examine the impact of these variables on stock price in India. In this study multiple regression model is used and exchange rates, foreign exchange reserves, inflation rate and gold prices were used as Independent variables and stock price is used as dependent variable. The result of this study revealed that gold price and exchange rate has impact on stock price in India while foreign exchange reserves and inflation has no impact on stock prices.

Irshad *et al.* (2010) examined gold prices, oil prices and stock prices of Pakistan using monthly data from 2002 to 2010. In this study Vector Auto regression is used to determine long run relationship between these macroeconomic variables. Empirical evidence from this study revealed that there is no long run relationship exists between gold prices, oil prices and stock prices in Pakistan economy.

Shahzadi *et al*. (2012) examines Gold and stock market of Pakistan based on monthly five year data from 2006 to 2010 of stock returns and Gold

price using Vector Auto Regression econometric model. Correlation test revealed that Gold price and stock returns of Pakistan are negatively correlated and there is no long term relationship exists between Stock Market returns and Gold price in Pakistan economy.

With the passage of time, a new study in Pakistan considering stock returns and gold prices was undertaken by Bilal *et al.* (2013) and they studied Pakistani and Indian stock market and Gold market based on monthly data of starting from June 2005 to July 2011 of Gold and stock price of both countries. The method that was used is Vector Auto regression and Granger Causality test showed that there is no causality relationship between Gold and stock market of both India and Pakistan. According to this study the results also revealed that there is no long term relationship between Gold and Stock market in Pakistan however there is long term relationship between Indian Stock market and corresponding gold prices.

According to the study undertaken by Wang *et al.* (2013) researcher examined the various oil importing and oil exporting countries using monthly data from 1999 to 2011 of stock market and oil prices. In this study Vector Auto Regression econometric model is used. In this study it is revealed that magnitude, duration and direction of response of stock market of any country depends on the importance of Oil to that country regardless whether country is oil importer or oil exporter. Changes of oil prices are driven by demand and supply mechanism. Chkili *et al.* (2013) used weekly data from March 1997 to February 2013 of stock prices and US dollar exchange rates to analyze relationship of exchange rates and stock prices of BRIC countries. In this study Markov Exchange Vector Auto regression revealed that exchange rate volatility doesn't affect stock market returns of BRIC (Brazil, Russia, India and China) countries. On the flip side stock market volatility has impact on exchange rate in BRIC countries.

Guntner (2014) examines oil import and oil exporter countries using monthly data of Oil price and Stock price from 1974 to 2011 respectively. In this study Vector Auto regression econometric model were used and results of this study showed that unexpected oil price shock have no significant impact on stock market of Oil exporter and importer countries. It is observed that with time Oil price have increased and with that cumulative stock returns also shown an increasing trend. However, precautionary demand shock in oil price has negative impact on stock market return in most countries. Nadeem *et al.* (2014) examined the impact of Inflation rate, exchange rate, Oil price and stock price on Gold prices in Pakistan using monthly data from 2000 to 2012. Using GMM method the results showed that Inflation rate has positive impact on Gold prices. Stock prices have statistically negative impact on gold price in Pakistan. In next section, research methodology is discussed.

Dhaoui *et al.* (2014) examines the data of eight develop countries including France, UK, US, Australia, Japan, Canada, Singapore, and Switzerland. The data is from Januray 1991 to September 2013 monthly of stock Market and Oil price and EGARCH econometric model were used to examine this data. Results of this study revealed that there is extreme negative connection between oil price and stock market return in developed countries except Singapore as an exception where there is no significant impact of Oil price fluctuation on its Stock market.

Cenedese *et al*. (2015) examines that international stock returns and foreign exchange returns using portfolio approach from period starts from November 1983 to September 2011 of sample data of 42 countries. This study revealed that exchange rates don't hamper country level equity returns in any country that were examined in this research.

Iqbal (2017) has undertaken the study on three countries including USA, Pakistan and India using EGARCH model and the simple period was from 1990 to 2013. According to his study, robust evidence was found that investment in gold is performing better than the investment in forex market specifically for India and Pakistan. In continuation of the above contribution in literature, Mishra *et al.* (2017) conducted the study on India by using GARCH model. The results have revealed that increase in oil price tends to decrease the Indian rupee and concluded that the oil prices and Indian rupee are interdependent in relationship.

The next section of the paper is based on data and estimation methodology used to assess the shock and percentages change among the stated macroeconomic variables.

Data and Research Methodology

This research follows positivist philosophy with deductive approach using secondary time series data from January 20005 to December 2015 on monthly frequency. For stock returns, the compounding rate of returns of KSE-100 is calculated by using that formula,

$$Rt = \ln (Pt/Pt\text{-}1)$$

Where, Rt = Return on day't'
Pt = Index closing value on day't'
Pt-1 = Index closing value on day t-1
Ln= Natural log

To achieve the objectives of the study Vector Auto regression (VAR) model has been applied (See Killian 2009; Shahzadi *et al*., 2012; Bhunia *et al*., 2013; Bilal *et al.,* 2013; Chkili *et al.,* 2013). Primarily, correlation matrix is computed to check the relationship between variables. With first step, Augmented Dicky Fuller and Phillip-Perron unit root test are applied to

examine random walk behavior in the series (variables) and then impulse responses output are generated to trace out the response of current and future values of oil prices, stock returns, gold price and oil price. Afterwards, variance decomposition function is used to identify the percentage of information each variable contributes to the other variables. At the end, the Granger Causality test or Wald Test has been used to determine whether one time series is useful in forecasting another thereby finding out the direction of relationship between the variables of the study

The main variables that have been taken are gold prices and stock prices. A monthly average Gold price is taken in Pakistani rupee (PKR) per troy ounce and monthly closing values are also taken in PKR, Dollar exchange rates from Dollar to PKR and Oil prices per barrel in PKR. The next section exhibits the estimation methodologies outputs of the data

Empirical Analysis and Findings

This section is on detailed analysis and findings of the results. It is given in various sub-headings below:

Correlation Matrix

Below correlation matrix signifies the correlation between macroeconomics variables gold price, oil price, exchange rate and stock returns.

Table 1: *Correlation Matrix*

	DGPRICE	DOPRICE	DEXRATE	SRETURNS
DGPRICE	1.000	0.126	0.237	-0.186
DOPRICE		1.000	0.127	0.035
DEXRATE			1.000	-0.391
SRETURNS				1.000

This table shows the correlation between all the stated variables.

Table 1 shows that gold price and oil price is positively correlated whereas, gold price and exchange rates are also have positive correlation and correlation is also positive between oil price and exchange rates. Stock returns and gold price has negative correlation whereas, oil price and stock returns have positive correlation. Stock return and exchange rates have negative correlation.

Unit Root Test

Augmented Dickey Fuller (1979) and Phillip-Perron test are used to test stationarity of data at level and 1st difference. See footnote[1] for definition. Following two hypotheses are being assumed to make data stationary.

Table 2: *Unit Root Test*

Variables	Order of Integration	ADF Test	PP Test	Hypothesis
SRETURNS	I(0)	0.000	0.000	Null hypothesis is rejected.
GPRICE	I(0)	0.486	0.506	Null hypothesis is not rejected.
DGPRICE	I(1)	0.000	0.000	Null hypothesis is rejected.
EXRATE	I(0)	0.847	0.882	Null hypothesis is not rejected.
DEXRATE	I(1)	0.000	0.000	Null hypothesis is rejected.
OPRICE	I(0)	0.309	0.398	Null hypothesis is not rejected.
DOPRICE	I(1)	0.000	0.000	Null hypothesis is rejected.

This table shows the order of integration through augmented dickey fuller and Philip=Perron test of stationary or unit root.

Table 2 results showed that Stock returns time series is stationary at level as probability value is 0.00 for augmented dickey fuller test and Phillip-perron test, so null hypothesis is rejected in this case and alternate hypothesis is accepted i.e. Series is stationary. Gold price time series is not stationary at level as ADF and PP test p-value is greater than 0.05 so in this case null hypotheses is not rejected. At first difference p-value of both ADF and PP test showed value 0.0000 which implies that series is stationary at 1st difference and alternate hypothesis is accepted. Exchange rate time series is not stationary at level as ADF and PP test p-value is greater than 0.05 so, in this case null hypotheses is not rejected. At first difference p-value of both ADF and PP test showed value of 0.0000 which implies that series is stationary at 1st difference and alternate hypothesis is accepted. Oil price time series is not stationary at level as ADF and PP test p-value is greater than 0.05 so, in this case null hypotheses is not rejected. At first difference p-value of both ADF and PP test showed value of 0.0000 which implies that series is stationary at 1st difference and alternate hypothesis is accepted.

[1] A time series is said to be stationary if its mean and variance are constant and, the covariances depend on upon the distance of two time periods. The unit root test is used to test stationarity of variables and the order of integration. The Dicky-Fuller unit root test (DF), Augmented Dicky-Fuller unit root test (ADF) (Dicky and Fuller, 1979) and the Phillips-Perron unit root test (PP) (Phillips and Perron, 1988) are often used to test stationarity. For the VAR estimation all the variables included in the model should be stationary.

Vector Auto Regression

Vector Auto Regression (VAR) econometric model is used in this research. See complete definition of VAR model in footnote[2]. The mathematical form of VAR is as follows.

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + Bx_t + \varepsilon_t$$

Where, $\boldsymbol{Y_t}$ is *k* vector of endogenous variable

$\boldsymbol{X_t}$ is a *d* vector of exogenous variable

$\mathbf{A_1}$ ……$\mathbf{A_p}$ and **B** are coefficient matrix of to be estimated

ε_t is a vector of innovation which probably correlated contemporaneously with each other but are uncorrelated with their own lagged value and uncorrelated with other right hand side variables.

Impulse Response Function

Impulse response function is used to make the time path of the response of one variable to the shocks of other explanatory variables. See complete definition on footnote[3]. Below figure-1 is the graph of the impulse response function of gold price, oil price, exchange rate and stock returns.

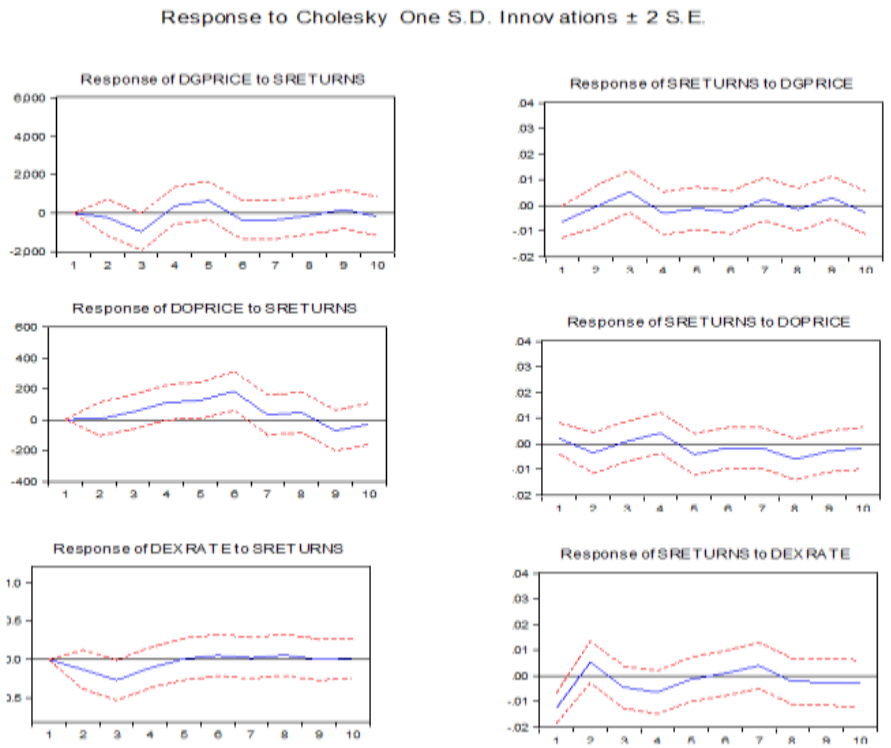
Impulse response function of from the above figure 1 starting left to bottom illustrate that 1 S.D shock of stock return on gold price in first three period is significantly negative as per graph and after third period it becomes positive which remain positive till fifth period and become stable after that. If 1 standard deviation shock is given to stock return the response of Oil price in short run is stable and later showed strong positive response which is continue till eight period and after that it will become negative. Impact to positive shock of stock returns is significantly negative on Exchange rate which means local domestic currency appreciate due to positive shock in stock returns but

[2] In VAR model all the variables are considered to be endogenous and each endogenous variable is explained by its lagged or past values and the lagged values of all other endogenous variables included in the model. There are no exogenous variables in the model and hence, by avoiding the imposition of a priori restriction on the model the VAR adds significantly to the flexibility of the model. The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by modeling every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. Johansen, S.(1991)

[3] The impulse response functions can be used to produce the time path of the dependent variables in the VAR, to shocks from all the explanatory variables. If the system of equations is stable any shock should decline to zero, an unstable system would produce an explosive time path.

after fourth period exchange rate will become stable and showed positive trend.

Figure 1 Impulse Response



Gold price shocks impact on stock returns is negative in short run but in later periods impulse response graph showed that stock returns will get stable as it doesn't show much variation due to gold price positive shock. Oil price shock response of stock return is mostly negative in short and long run. Stock returns response to exchange rate shock is mostly negative in short as well as in long run which means if local currency depreciates it will have negative impact on stock market returns.

Variance Decomposition

Variance decomposition signifies the percentage change in one variable due to the shock of other explanatory variables. See complete definition in footnote[4]. Below table 4 is the result of variance decomposition of this study.

[4] Variance decomposition function is used for examining the effects of shocks to the dependent variables. This technique determines how much of the forecast error

Table 3: Variance Decomposition

Period	DGPRICE	DOPRICE	DEXRATE
1	0.000	0.000	0.000
2	0.292	0.005	1.232
3	5.199	1.008	6.100
4	5.725	5.332	6.612
5	7.675	9.837	6.582
6	8.092	17.770	6.447
7	8.576	17.261	6.412
8	8.366	17.517	6.505
9	8.207	17.656	6.422
10	8.229	17.481	6.246
Variance Decomposition of SRETURNS:			
Period	DGPRICE	DOPRICE	DEXRATE
1	3.479	0.359	13.320
2	3.343	1.413	15.044
3	5.388	1.400	15.892
4	5.807	2.610	18.056
5	5.732	3.7701	17.643
6	6.040	3.8128	17.063
7	6.088	3.796	17.169
8	6.086	6.025	17.005
9	6.526	6.447	17.026
10	6.946	6.556	17.400

This table shows variance decomposition of DGPRICE, DOPRICE and DEXRATE w.r.t SRETURNS. Subsequently, the later rows of the table exhibits with following Cholesky ordering: DGPRICE DOPRICE DEXRATE SRETURNS

In short run stock return innovation or shock doesn't have any significant impact on gold price but later as much as 8.57%% percent variation in gold price is caused by shock in stock returns. Variance decomposition function of oil price signifies that in short run stock returns innovation doesn't cause significant variance in domestic oil prices but later as much as 17.77% variation in oil price was due to shock in stock returns. Exchange rate variation is as much as 6.6% due to stock return shock.

variance for any variable in a system, is explained by innovations to each explanatory variable, over a series of time horizons. Usually own series shocks explain most of the error variance, although the shock will also affect other variables in the system. It is also important to consider the ordering of the variables when conducting these tests, as in practice the error terms of the equations in the VAR will be correlated, so the result will be dependent on the order in which the equations are estimated in the model.

Variance decomposition stock return constitute that in short run more gold price volatility doesn't cause much variation in stock price but later it caused as much as 6.94% variation in stock returns. Oil price volatility have minimal impact on variation of stock returns in short run but in long run it has as much 6.5% variation in stock return is caused by oil price fluctuation. Exchange rate fluctuation has caused significant impact on variation of stock return and as much as 18.05% variation in stock returns is caused by oil price.

Granger Causality Test

Granger causality test is performed to identify whether one variable time series is useful to forecast other variables. See footnote[5] for complete definition. Below table-5 is granger causality test performed on time series.

Table 4: *Wald Test*

Dependent variable: DGPRICE			
Excluded	Chi-sq	df	Prob.
DOPRICE	19.67682	12	0.0735
DEXRATE	10.63116	12	0.5608
SRETURNS	16.63362	12	0.1639
All	38.56181	36	0.3545
Dependent variable: DOPRICE			
Excluded	Chi-sq	df	Prob.
DGPRICE	9.331403	12	0.6744
DEXRATE	22.79050	12	0.0296
SRETURNS	16.58858	12	0.1657
All	54.18618	36	0.0263
Dependent variable: DEXRATE			
Excluded	Chi-sq	df	Prob.
DGPRICE	13.34615	12	0.3444
DOPRICE	8.926024	12	0.7092
SRETURNS	6.681136	12	0.8779
All	25.69366	36	0.8987

[5] Engle and Granger (1987) pointed out that The VAR can be considered as a means of conducting causality tests, or more specifically Granger causality tests. Granger causality really implies a correlation between the current value of one variable and the past values of others; it does not mean changes in one variable cause changes in another. By using a F-test to jointly test for the significance of the lags on the explanatory variables, this in effect tests for 'Granger causality' between these variables. It is possible to have causality running from variable X to Y, but not Y to X; from Y to X, but not X to Y and from both Y to X and X to Y, although in this case interpretation of the relationship is difficult. The 'Granger causality' test can also be used as a test for whether a variable is exogenous. i.e. If no variables in a model affect a particular variable it can be viewed as exogenous.

Dependent variable: SRETURNS			
Excluded	Chi-sq	df	Prob.
DGPRICE	5.395537	12	0.9434
DOPRICE	9.998075	12	0.6161
DEXRATE	10.66394	12	0.5579
All	26.19629	36	0.8850

Results of Wald test from above table 4 revealed that only exchange rate time series has causality relationship with oil price with significant result in probability value of 0.03 which is less than 0.05 which means exchange rate time series is useful in forecasting oil price Other variables in the model are exogenous variables and cannot be used to forecasting other variables in the system thus they don't have causal relationship between them.

Conclusion and Future Research Directions

This paper examined the dynamics relationship between gold price, oil price, exchange rates and stock market returns of Pakistan using Vector Auto regression (VAR) econometric model. The results based on monthly data from 2005 to 2015 revealed some important trends which are consistent prevail in this time period. This study has shown that when there is crises in stock market people invest in gold which puts upward pressure in gold prices but this relation is only true in short-run and the results are consistent with the results of Smith (2001), Dirk & Baur *et al.* (2010), Bhunia *et al.* (2013), Mishra *et al.* (2017). It has been observed from the results that there is positive shock of oil price on stock returns which means if oil price increases, it also causes probability of the profitability in developing countries like Pakistan. The results for exchange rate to stock returns are consistent with results of Abbas (2010) according to which if stock returns are higher, local investors will sell their foreign assets and will buy the domestic assets. This conversion of foreign assets into domestic ones will increase the demand for local currency in the foreign exchange market by putting upward pressure on its price.

So, it is established that changes in exchange rate has impact on cost and revenue which eventually have direct impact on profitability and thus impact stock market returns.The results of variance decomposition test revealed that stock return impulse causes variation in other variables as much as 17.77% in oil price, 8.58% in gold price and 6.6% in exchange rate, whereas percentage change in stock returns due to shocks in other macroeconomic variables is as much as 18.1% due to exchange rates, 6.9% due gold price and 6.5% due to Oil price shock. Impulse response function of gold price due stock market returns also proves from literature that gold is a safe haven assets for fairly short period of time until there is an extreme negative shock occurred which may be explained with the property that it can be hedge for stocks. Hence, literature compliments the finding in this study.

However, granger causality test doesn't signify any causality relation of gold price, oil price, and exchange rates with stock market or the other way around. On the basis of granger casuality test or Wald test it can be concluded statistically that neither oil price, gold price and exchange rates be used to forecast stock market trend nor stock market returns be used to predict these macroeconomic variables. The results of the study recommend and suggest that investors should diversify their investment into various assets classes or markets for better arbitrage opportunities.

The future research directions always give insights to the new researchers. It is suggested that more macroeconomic variables can be included which have direct impact on stock market. Macroeconomic variables like Consumer Price Index (CPI), Discount rates, Inflation etc. can be added to this research to see their impact on stock market. This study can be extended for Asian markets and the shocks can also be checked on industrial / sector wise returns while in this study only KSE 100 stock returns are considered.

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