

THE RELATIONSHIP BETWEEN COMMODITIES AND PAKISTANI CURRENCY EXCHANGE RATE

Sharif Ullah Jan, Said Wali and Muhammad Asif

ABSTRACT

A major portion of Pakistan's imports consists of crude oil and gold which has a strong impact on the PKR/USD exchange rate. This paper aims to explain this relation between commodities prices (i.e. Oil and Gold) and PKR/USD exchange rate for the period of Jan 1996 to June 2012 on monthly basis. To check the relationship between the PKR/USD exchange rate and commodity prices we initially applied simple OLS model with no lagged data. And as expected this showed a spurious relationship among them. The results improved when first difference data is used and applied "VAR" model. The results showed that when the change in Oil prices occurs, it also changes the exchange rate and the relation is positive. However, the relationship between gold prices and exchange rate is proved to be negatively significant.

Key Words: Commodities and Currency Exchange Rate

INTRODUCTION

The term commodities (non-financial) in national accounting is defined as the essential raw material that comes from the primary sector, which includes agriculture and mining and it also refers to the semi-finished products used by the producers and consumers. The financial view of commodities signifies that investor looks at all transportable natural resources, raw material and production which are traded with competitive bids and offers all over the world such as energy i.e. (oil, natural gas), precious metals consisting of gold, silver, platinum or agriculture products (Heidorn & Menzel, 2007). A country's currency is affected by many recognized factors; such as the political situation of a country, its economic growth, and the prevailing interest rates etc. Many economists have tried to examine and have focused on various factors that have significantly influenced the currency market, with the commodities that are gold and silver as main key factors. The currencies and commodities are highly correlated due to the involvement of risk and yield dynamics of the world economy. However, the relationship of currencies with commodity can help us understand and predict the market movement for traders and investors (Ixiang & Tang, 2011). By observing the market conditions during the past few years, it is not clear that the dollar and commodities have a negative correlation in the long run. When an economy shows upward trend the dollar will fall and the commodities will rise which is a more straight forward expression; while the dollar trend will be low when the economy is slow as when the dollar trend will be bullish then the commodities trend will be bearish. The commodities that have a high effect on currencies are mainly gold and oil (crude oil). The prices of gold have also observed volatilities e.g. the boom period was 1033 dollar an ounce in March 2007 and fell to 700 dollar an ounce in June in the same year.

Commodities are the basic necessities of life particularly, the oil, as nowadays life without oil is hard to imagine. It is argued that if a good investor wants to invest or trade in currencies, the most suitable way is to keep an eye on the movements of oil and gold markets. Similarly, if we look at the situation in Pakistan, the prices of commodities (oil and gold) are increasing day by day and show high volatility. The price of commodities in Pakistan has badly affected the Pakistani currency. Since, the past recent years the oil prices are increasing rapidly it is observed that there is more volatility in oil prices as compared to other commodities. Pakistan being a non-oil producing country depends mainly on importing oil from the Middle East like United Arab Emirates. Similarly, Pakistan also imports gold from other countries to meet the market demand of consumers.

The aim of the present study is to focus on the relationship of Pakistani currency with commodities in exchange to US dollar and examine the correlation between the Pakistani currency and commodities.

REVIEW OF LITERATURE

Bloomberg and Harris (1995) found that there is no long-run relationship between the commodity and consumer prices, rather there is a co-integrating relationship between the two. The Vector Auto Regression model (VAR) was used for the purpose to view that the prices are useful in predicting the movement in both the PPI and CPI (finished goods producer price index and consumer price index the core that is nonfood and non-energy). The commodities that are more sensitive to large supply (oil and food) have more explanatory power than those used for inflation hedging such as gold or by inputs demand that is industrial materials. Moreover, an empirical relationship between changes in commodity prices and inflation taking the non-oil commodity prices under observation seeing their performance matching with inflation by Furlong (1996). The results indicated that commodity prices were relatively strong and statistically robust leading indicators of overall inflation in the 1970s and early 1980s, but they have been poor stand-alone indicators of inflation since the early 1980s period and the commodity prices and inflation have changed dramatically over the period of time which was shown by the empirical link between the commodities prices (non-oil) and inflation (Furlong, 1996). Lafrance et al.,(2004) computed an equation NEMO (a nominal bilateral exchange rate equation built around a long-run relationship between the real exchange rate and real non-energy commodity prices) for commodity and dollar relationship stated that there is a strong link between the key variables and the equation has positive correlation between real per capita incomes and real exchange rates that vary across countries at different levels of per capita income, but only to the extent that the productivity increase is relatively greater in the aggregate economy than in the manufacturing sector. Guillemette et al., (2004) stated in their research that there was dramatic rise in Canadian dollar's and the main factors were demand for Canadian exports, and the general depreciation of the U.S. dollar against all major floating

currencies. They stated that at the time there was need to fix the exchange rate for world investors to invest in commodities market who ever there were effects of monetary responses to the strong currency could distract attention from reforms to Canadian tax, industrial and regional policies and also volatility in economic variables.

It has been found that non-fuel commodities help to predict headline CPI. A 1% increase in non-fuel commodity prices is linked with a 0.5 % increase in headline US CPI inflation (Cutler et al., 2005). Kock (2006) discussed the interrelationships between commodity prices, the exchange rate and domestic inflation and its impact on the South African economy. He took the commodity price index including food and industrial commodities (non-food agricultural and metals). The data comprised of a period of 5 years (1994-1999). While South Africa's exports have become increasingly diversified along time, the commodities contributed major portion to export earnings. During 2002 to 2004 the increase in South African commodity prices were examined in terms of US dollars. There was little volatility seen in them as the US dollar was on decline during this period. The return on investment depends on the demand and supply of the commodities. In the period of 1990's to the present, the role of commodities in traditional portfolios has changed depending on the macroeconomic and financial environment and further development is expected in commodity marked in future because of increase in the number of available commodity-based products in investable commodity indices in recent time. The commodity is taking popularity due to future contract liquidity and their usage. Institutional asset managers are showing interest in growing investment of commodities because of the excess capital that is to be invested (Menzel & Heidorn, 2007). The impact of energy and non-energy commodity prices is also felt on the Canadian dollar. Maier & DePratto (2008) used the Bank of Canada's exchange rate equation and found that the differences between the actual value of the Canadian exchange rate and the simulated values observed in 2007 are not historically large but there is some evidence that change in energy and non-energy commodities are due to change in the sensitivity of the exchange rate equation over the period. Specifications that consider the importance of energy and non-energy commodities in Canada's export or production basket may yield more stable coefficient estimates, particularly over recent times, i.e. from 2008 to 2015. Iran sells less amount of oil and stores it for their future consumption due to which Iran has more stable prices as compared to other countries (Verleger, 2008). The right and accurate forecasting for medium-term commodity prices are important for resource companies to plan future capital expenditures. Supply and demand are important factors affecting short-term commodity prices but changes in currency movement has also main role. Some of the investors see the historical data and performance and then they forecast for future price understanding with the trend of US dollar appreciation and depreciation movements. Short-term commodity price trends as for example, the oil price surge and decline during 2005 to 2009, are not controlled by currency but speculators. The most rational approach for price control is to assign probabilities with comparing US dollar current

valuation with the long-term median (Moriarty, 2009). Daryl Guppy (2009) worked on the relationships between commodities, stocks, and cash and explained that when the rates rise, the activities in the market become slow and there is relationship between share prices and interest rates. Gold strength and US Dollar weakness are two sides of the same coin meaning that when gold gains strength then weakness in the US dollar is observed. The move by the Australia dollar towards parity with the US dollar is not matching by commodity price moves and these activities has great effect on the country economy. Canary Wharf (2009) stated that investment in commodities reduce the risk through an improved diversification and may help portfolios to outpace inflation. The commodities have received much attention because of price behavior in the longer term constrained in supply and demand, global economic development and commodity prices that affect the cost of food and energy whole world. In rapidly emerging economies like China and India there is long term expected increase in the demand of commodities. Bank (2010) stated that the commodities mainly depend on the supply and their usage by considering the economy of United Arab Emirates and taking the example of oil and raw material. At the time when the world's central banks start to withdraw liquidity from the market and the global recovery matures there is expected to be a close relationship between the global business cycle, commodity prices and other assets. The commodities have moved in line with other assets although it was crisis but there was a dramatic change in oil prices due to political situation in different countries as compared to other commodities in the year 2010.

DATA AND VARIABLES

3.1 CONSTRUCTION OF VARIABLES

The variables used in the research are PKR/USD exchange rate, gold prices, and oil prices.

PKR/USD exchange rate:

The currency value of one country is determined through the exchange rate with comparison to other major currencies like US dollar, New Zealand dollar, Australian dollar and Japanese yen. The Pakistani rupee exchange rate determines the country currency value relative to US dollar, which is one of the major currencies in index and used by many other countries.

Gold prices:

Gold is a natural existing element and used everywhere in the world. Pakistan imports large quantity of gold which is mainly used for jewelry and many other purposes. Gold is used in many countries as an indicator of currency and thus determines the country exchange rate. The "gold prices" show the prices of gold that are traded in a country i.e. imported or exported and used for other purposes.

Oil rate:

Oil is also a natural resource. The country may have their own oil resources or they will have to import it from other countries. Oil is used by different groups and the main usage is in manufacturing industry and for transportation. The price of oil depends on the demand and supply of the oil.

3.2 DATA SOURCE

This study examines the data for a period of 22 years (i.e. from 1990 to 2012). The data was collected for exchange rate of PKR/USD, gold prices, and oil prices from Economic Survey of Pakistan, State Bank of America and from Federal Bureau of Statistic of Pakistan.

THEORETICAL CONCEPT AND ECONOMETRIC METHODOLOGY**4.1 Theoretical Concept:**

The aim of this study is to investigate that what is the effect of gold prices and oil prices on the Pakistani currency exchange rate. Every county in the world has their own exchange rate system and in the past period many countries have used their exchange rate relative to gold. Though the concept is now changed and there is no more need of gold reserves for issuing more currency; however from the literature review it is evident that the gold still has some role in the exchange rate determination. Hence, the first hypothesis of the study is:

H1: There is an association between gold prices of Pakistan and the PKR/USD exchange rate.

The oil prices also affect the country's currency; the oil price is determined by its production, supply and demand. Now, in recent times the public transport is increasing day by day leading to demand in oil. When the demand rises it will affect the industry side so in-turn it will affect the country economy and cause inflation and thus volatility in currency and exchange rate. Hence, the second hypothesis of the study will be:

H2: There is an association between oil prices of Pakistan and the PKR/USD exchange rate.

4.2 Econometric Methodology:

To examine the time series trend of the PKR/USD exchange rate and commodities prices the vector autoregressive model (VAR) is applied to forecast the relationship which is the basis of forecasting of historical data and in patterns and having regularities (Griffiths & Judge, 1997). So the relationship is taken between PKR/USD exchange rate with gold price and oil prices separately.

To observe the relationship of PKR/USD exchange rate with commodity price, the

regression equation is set as:

$$ER_t = \beta_1 + \beta_2 C_t + e_t$$

Where, ER_t is the exchange rate at time (t), C_t is the commodity price at (t)

If investigation shows that data is not stationary and there is variation then it is expected that the equation $e_t = ER_t - \beta_1 - \beta_2 C_t$ will also be non-stationary.

The error term properties show that OLS is not a suitable procedure of estimation. The least square will produce highly significant relationship between PKR/USD exchange rate and commodity prices in such circumstances even when $\beta_2=0$. If the prices of the variables i.e. exchange rate of PKR and commodities are integrated rather than co-integrated then estimating the variable relationship can lead to spurious regression and should be detected by (DW) low Durbin Watson statistics (Durbin and Watson, 1971).

The PKR/USD exchange rate and the prices of commodities may be non-stationary as it may happen that the error term is stationary and the variables are co integrated which shows that both variables (exchange rate and commodities) have similar stochastic trend and define a long term equilibrium relationship. It's always a good idea to plot the time series against time before pursuing a formal test of stationarity (Gujarati, 2004; p.816).

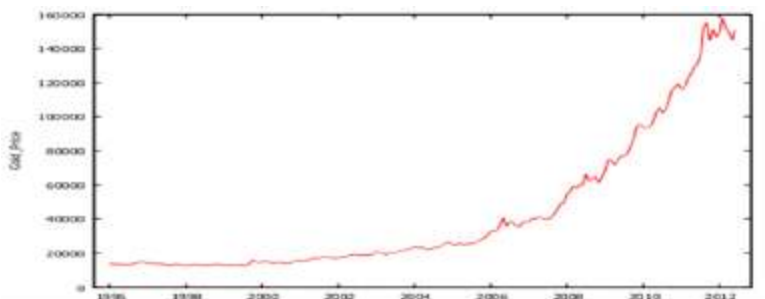


Figure 1: Oil Price per barrel (in Pak Rs.), Jan 1996-June 2012 (Monthly)

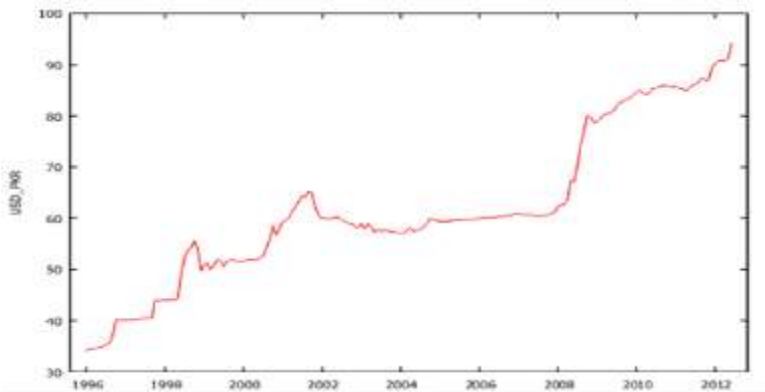


Figure 2: Gold Prices per Ounce (in Pak Rs.), Jan 1996-June 2012 (Monthly)

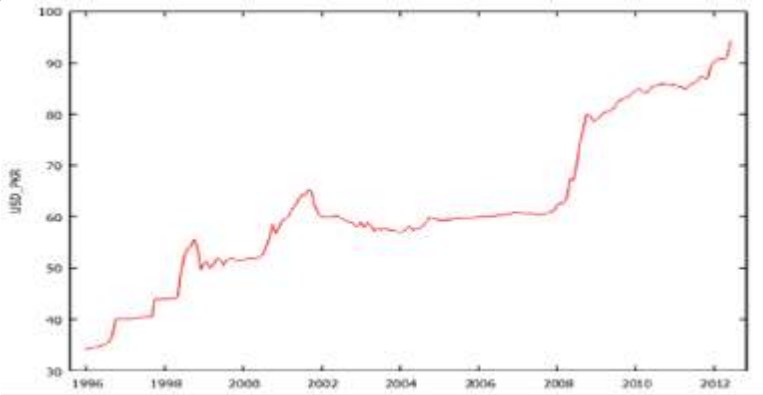


Figure 3: USD/PKR Exchange Rate (in Pak Rs.), Jan 1996-June 2012 (Monthly)

Figure 1, 2, and 3 show the data for Gold prices, Oil prices, and USD/PKR Exchange Rates respectively. A visual examination discovers that all these time series seemed to be trending “upward” against time, i.e. the mean of the time series is not constant over the period. Although the graphs show us that the data is “non-stationary”, but more formally we also have some statistical tests to check whether they are indeed stationary or non-stationary?

The $ER_t = \beta_1 + \beta_2 C_t + e_t$ and the error term represent the relationship of equilibrium as a short term deviation. To see whether the PKR/USD exchange rate and the gold or oil prices are co-integrated or not we estimate regression equation residuals and test it has a unit root. We could also use ADF test in order to know or test for a “unit root” test.

4.3 Unit root test:

It is also known as “dickey-fuller” unit root test or “stationary test” the Dickey fuller unit root test is used for time series data. This test is undertaken to find out the stationary attributes before testing the co integration and causality between the data variables.

The Dickey-fuller unit root test are based on three regression forms as follow:

1. Without constant and trend: $\Delta ER_t = \delta ER_{t-1} + \mu_t$
2. With constant: $\Delta ER_t = \alpha + \delta ER_{t-1} + \mu_t$
3. With constant and trend: $\Delta ER_t = \alpha + \beta T + \delta ER_{t-1} + \mu_t$ where $T = (- 1)$

For DF test the hypotheses are:

H₀: $\alpha = 0$ or $\delta = 1$ (Non stationary)

H₁: $\alpha < 0$ (Stationary)

If $t < ADF$ critical value, then we will reject our null hypothesis which means that unit root does not exist.

We change our lag means $t-1$ and can see that how it become stationary in ADF. When the data become stationary it means that the computed absolute t -statistic is lower than the absolute critical value thus we cannot reject our hypothesis.

The ADF model is based on following regression estimates.

$$\Delta y_t = \alpha + \beta T + \delta y_{t-1} + \gamma \Delta y_{t-1} + e_t$$

Where

$$\Delta y_{t-1} = y_{t-1} - y_{t-2} \text{ and } \Delta y_{t-2} = y_{t-2} - y_{t-3}$$

e_t is the error term.

Our model of regression for Exchange rate, oil prices and gold prices are as:

$$ER_t = \beta_{10} - \beta_{12} P_{gr} - \beta_{13} P_{ot} + \gamma'_{10} ER_{t-i} + \gamma'_{11} P_{gr-i} + \gamma'_{12} P_{ot-i} + u_{ERt}$$

$$P_{gr} = \beta_{20} - \beta_{22} ER_{gr} - \beta_{23} P_{ot} + \gamma'_{20} ER_{t-i} + \gamma'_{21} P_{gr-i} + \gamma'_{22} P_{ot-i} - u_{Pgrt}$$

$$P_{ot} = \beta_{30} - \beta_{32} P_{gr} - \beta_{33} P_{ot} + \gamma'_{30} ER_{t-i} + \gamma'_{31} P_{gr-i} + \gamma'_{32} P_{ot-i} + u_{Pot}$$

Where,

ER_t= Exchange rate at time t; P_{gt}= Price of gold at time t; P_{ot}= Price of Oil at time t

RESULTS AND FINDING

In this study we have used the “Augmented Dickey Fuller” test to determine the stationarity of the variables. The results of the data show the stationarity on the 2nd difference and show the significance on 5%. The ADF Test is significant when the ADF value is lesser than the critical value. In table-1 all the values i.e. Level, 1st Difference are given, greater than critical value at 5% hence we reject (H1) and we accept the Ho (means unit root exist) and accept at 2nd difference in which the value is lesser than the critical value.

That is if

ADF > critical accept Ho (means unit root exist.)

The data is non-stationary at level 1 and first Difference.

If ADF < critical accept Ha (means unit root does not exist)

Data is stationary at 2nd difference.

ADF Test:

The economic time series data are non-stationary in nature. To make the data stationary, ADF test has been applied. The following table shows the results of this test:

Table 1: ADF Test

Unit Root Test		PKR/USD	Gold	Oil
Level	Intercept	0.150066	4.186797	2.011333
First Difference	Intercept	-2.083983	1.271640	-2.482407
Second Difference	Intercept	-3.54321	-3.620692	-4.904816

Critical values of PKR/USD EXR = -3.0294 at (level). This value is -3.0400 at (first difference) and at (second difference) is -3.0521. The critical values of Gold at level are 3.0294, at first difference are -3.0400 and at second difference are -3.0521. These critical values of Oil at level, at first difference and second difference are -3.0294, -3.0400, and -3.0521.

The ADF test values at 5% significance are greater than the critical values at level are non-stationary because the ADF values are greater than the critical values. These values are also greater than the critical values at first difference. It means that the data are non-stationary at level as well as first difference. Data is stationary at second difference because the ADF test values are less than the critical values at 5% significance.

The “VAR model” is used to forecast and analyze the multivariable time series based on historical data. It is the generalization of uni-variate autoregressive model. This model is used for forecasting and describing dynamic behavior of financial and economic time series normally. The Table 2 shows the results of “VAR” model for PKR/USD exchange rate and Oil prices, the Table 3 shows the results of “VAR” model for Gold and exchange rate.

Vector Auto Regression Model:

Table 2: Oil and Exchange rate

	OIL	ER
OIL(-1)	-0.050976	0.009007
	(-0.17863)	(4.94832)
OIL(-2)	1.136773	-0.007613
	(3.39889)	(-3.56900)
ER(-1)	-54.62559	1.655882
	(-1.42492)	(6.77216)
ER(-2)	75.65348	-0.844059
	(1.98246)	(-3.46778)

Table 3: Gold and Exchange Rate

	GOLD	ER
GOLD(-1)	1.062727	-0.000516
	(3.03768)	(-0.94649)
GOLD(-2)	0.610970	0.001041
	(1.21208)	(1.32653)
ER(-1)	-106.0846	0.969258
	(-0.47174)	(2.76777)
ER(-2)	-7.430891	-0.155995
	(-0.03311)	(-0.44632)

Response to One S.D. Innovations ± 2 S.E.

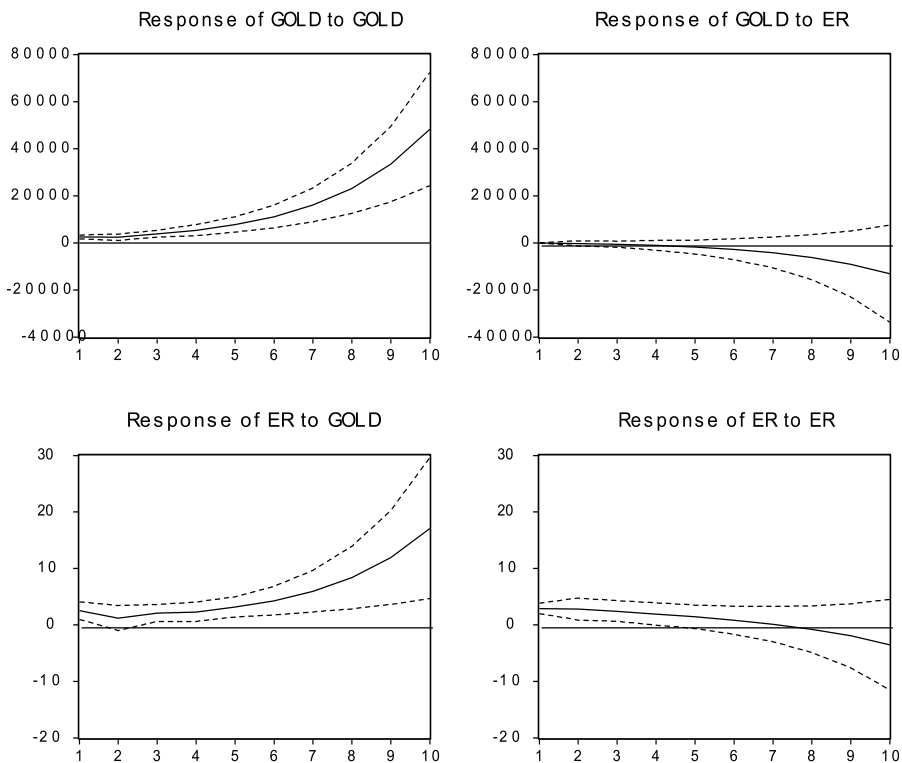


Figure 4: Responses

In graph 1 it shows if an external shock occurs in gold to gold goes up to year 3 consistently with mean value after year t it shows divergence continuously. In graph 2 if an external shock occur in gold how much it diverge or converge the exchange rate from the mean value up year 4 goes with mean value and after that up to year 5 shows divergence and consistently diverge from mean value. In graph 3 if an external shock occurs in the exchange rate how much response the gold in the first 5 years goes consistently with mean value and then after that shows divergence continuously. Graph 4 shows if an external shock occurs in exchange rate how much the exchange rate response from the start show convergence toward mean at year 7 converge to mean and at year 8 starts divergence and diverge continuously.

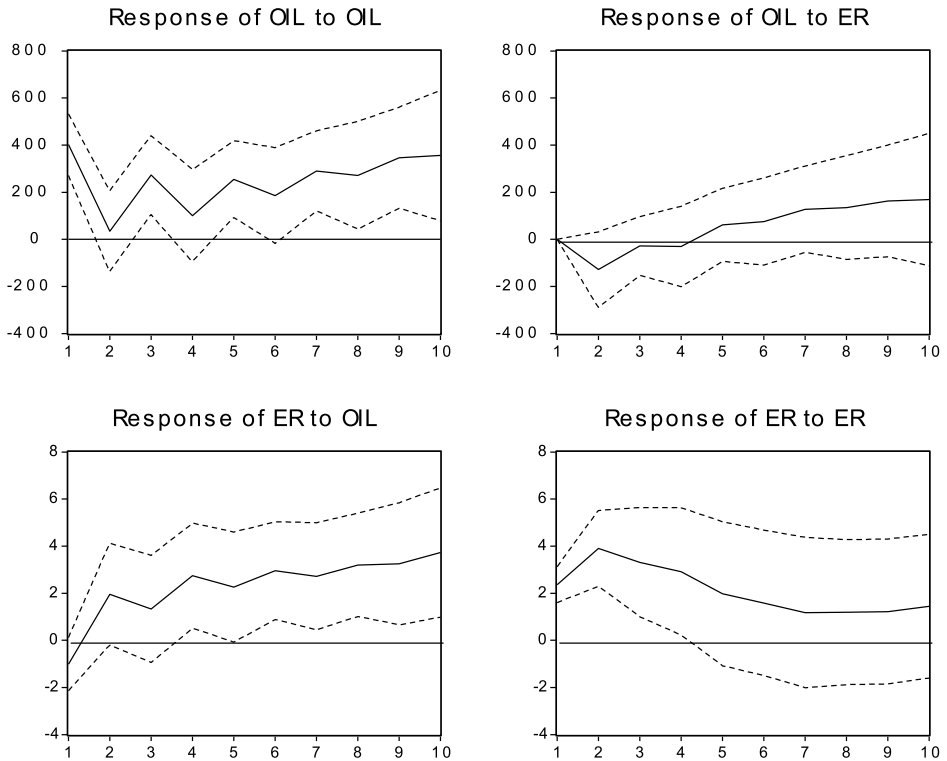
Response to One S.D. Innovations ± 2 S.E.

Figure 5: Various Responses

In graph 5 the first period is moving toward mean value and then diverges up to year three. After that show again diverging from mean value than slightly converge toward mean but the overall moving shows diverge from mean. In graph 6 shows the impulse response of oil on exchange rate at year first shows converges to mean value and then diverges. At year 4 shows again converging to mean and hereafter shows diverging. Graph 7 shows impulse response of exchange rate on oil at year 1 converges to mean value and after that shows consistently divergence from mean value. Graph 8 shows impulse response of exchange rate on exchange rate. At period first shows diverging and after that at year 2 starts slightly converging toward mean and here after moves consistently with mean value.

Table 5: Variance decomposition of Gold

Period	S.E.	GOLD	ER
1	2454.607	100.0000	0.000000
2	3406.354	99.19550	0.804505
3	5177.398	98.11302	1.886979
4	7488.338	96.75584	3.244161
5	10902.39	95.64704	4.352960
6	15788.43	94.75698	5.243017
7	22866.40	94.12374	5.876261
8	33090.88	93.68358	6.316416
9	47879.08	93.39086	6.609143
10	69263.40	93.19955	6.800446

The above table shows the variance decomposition of gold on ER, in the first period it has no variance decomposition at period 2 starts to increase consistently to year 6 and after that increases but with decreasing rate.

Table 6: Variance decomposition of oil on exchange rate

Period	S.E.	OIL	ER
1	401.9899	100.0000	0.000000
2	423.5199	90.76339	9.236614
3	504.3429	93.17145	6.828546
4	515.1258	93.10027	6.899727
5	577.9979	93.41866	6.581337
6	611.6627	92.62221	7.377790
7	688.8683	90.74014	9.259859
8	752.4842	89.04203	10.95797
9	844.0892	87.58641	12.41359
10	931.2188	86.53881	13.46119

The above table shows the variance decomposition of oil on exchange rate at period 1st it has no variance decomposition on exchange rate. Increase in decomposition starts from year 2 after 3 up to year 5 increase with a decreasing rate and at year 6 increase and after that increase consistently with an increasing rate up to year 10.

CONCLUSION

The present study focused on the relationship of Pakistani currency with commodities in exchange to US dollar and examined the correlation between the Pakistani currency and commodities for the period of 1990 to 2012 on annual basis. The data was collected as gold per ounce, oil per barrel and the Pakistani rupees exchange rate on the basis of US dollar to see the volatility in it. VAR technique was applied and the ADF model was used

to check and evaluate the data stationarity. The results show that when the change in oil prices occur it also changes the exchange rate which means that fluctuation in Pakistani rupee takes place. The main reason is that Pakistan imports oil from other countries thus it has a negative effect on Pakistani rupees. In the previous year a great shock was observed in oil prices which lead to inflation in many countries. The increase in oil could be due to the political and economic situation in oil producing countries. A weak relation was observed in gold prices. The gold prices also had a negative relationship with Pakistani rupees. As the prices of gold increased the increase in Pakistani rupee exchange rate had been observed with a decreasing rate. Overall these commodities had an effect on the PKR/USD exchange rate.

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Shareef Ullah: Lecturer (Finance), City University of Science & Information Technology, Peshawar. Ph.D (Research Scholar) Iqra National University, Peshawar. More than 2 years experience in teaching and research. Published one research papers. E-mail: sharifjn@gmail.com



Said Wali: Lecturer (Finance), City University of Science & IT, Peshawar. MS (Management Science) More than 5 years of research and teaching experience. E-mail: saidwali@cusit.edu.pk



Muhammad Asif: Lecturer (Finance), City University of Science & IT, Peshawar. MS (Management Sciences) More than 12 years of research and teaching experience. Published three research papers. E-mail: asif.baloch980@gmail.com