

Long-Run Relationship between Oil Price and Macroeconomic Indicators using Johansen Co-integration Test: A Case of Pakistan

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ABSTRACT

This paper aims to analyze the co-integration among the Oil Prices, KSE-100 Index, Consumer Price Index and the Exchange Rate (US-Dollar) in the context of Pakistani Economy and in order to accomplish the objectives the Augmented Dickey Fuller (ADF) test is used to check the stationary of data that we achieve at first difference and then Johansen Co-Integration Test is applied to identify the association among these variables and according to both Trace Statistic and Max-Eigenvalue Statistic criteria we have identified that there is at most one co-integrated equation among these variables i.e. Oil Prices, KSE-100 Index, CPI and the value of US-Dollar against PKR have a no long-term association. This research has a great contribution in the literature as well as may prove beneficial for the individual and institutional investors who trade in the stock and forex market.

1. INTRODUCTION

Oil is considered as the essence of life for many economies that produce and consume it. With its history of booms and busts, now the oil industry is pamper in a new downturn. A year ago, the international prices of oil was about \$103/barrel. But now, it seems to be rapidly turning into an ever-cheaper economic curse i.e. price of oil has been fallen by more than 50% over the last few months and is hovering around \$45 to \$60 a mark for barrel (Shahjehan, 2014). This plunge in oil price has most directly affected the oil exporting countries like Russia, a leading oil producer, where consumers are expending far greater for imports, largely due to reducing the value of their currency. In Venezuela and Nigeria that almost depend completely on export of oil, the panic of unrest

and economic uncertainty are building. Eventually in Saudi Arabia, where the sovereign family spends oil money excessively in order to preserve their legitimacy, the government has been spending through around \$10 billion/month in foreign exchange reserves to pay their expenses. In Persian Gulf other Arab countries like Kuwait, Oman and Bahrain are also persistently rely on export of oil, for the first time facing a fiscal deficits in two decades. Former secretary general of the Organization of Petroleum Exporting Countries (OPEC) René G. Ortiz has projected that all major oil exporting countries had a loss of \$1 trillion in oil sales due to decline in price over the previous year (KRAUSS, From Venezuela to Iraq to Russia, Oil Price Drops Raise Fears of Unrest, 2015).

In contrast, the low prices of oil are favorable for the economies of other countries i.e. for those countries that import oil and their balance of payments is possibly unfavorable. Fall in oil prices proposed to improvement in balance of payments and appreciation of their currency (KRAUSS, From Venezuela to Iraq to Russia, Oil Price Drops Raise Fears of Unrest, 2015).

This decline in oil prices is also favorable for the economy of Pakistan because it is also an oil importing nation and a fall in international oil prices will have a positive influence on the import bill, thus appreciate the value of rupee, improving the balance of payments of the country and foreign reserves too. This plunge in oil prices will also cut the cost of inputs (Maheshwari, 2014). Empirical study exists on association between oil prices and corporate profits in Pakistan (Hassan & Nasir, 2008). It has been observed that in Pakistan the cost of manufacturing is directly affected by the changes in prices of oil because of low Energy cost that is considered a major cost of production in industrial and agriculture sector of Pakistan. The major revenue of Pakistan's economy is relied on the agriculture and textile sector and the cost of manufacturing in such sectors are greatly influenced due to the changes in prices of oil. A decline in the cost of manufacturing would result in reduction of inflation in the country that is reflected in the CPI during the current year. According to Pakistan Bureau of Statistics, August 2015, CPI is increased by 1.8% year-on-year basis in August 2015 as compared to 7.0% in August 2014. Hence the CPI is very essential indicator in order to analyze the economic condition of any country and also because the investors who invest their money in stocks they keep an eye on the inflation rate of the country because it influences the investors investment and their rate of return (Maheshwari, 2014).

Stock exchange of any country play very crucial role in growth and development

of the economy for that country. Stock exchange allows all the investors and provides them a platform to fully participate. It's a place where not only the local investor but also outside investors are participating and investing that result in the existence of new businesses and signifies a favorable sign for the growth and development of the country. In Pakistan there are 3 stock exchanges Islamabad Stock Exchange (ISE), Lahore Stock Exchange (LSE) and the Karachi Stock Exchange (KSE). Amongst these of 3 stock exchanges KSE is the leading stock exchange in terms of number of companies listed and the capitalization of market and also contribute a crucial role in progress of the economy (Irshad et al., 2014). The movement in the stock market is basically a result of variability in stock prices of the companies that is affected by the internal factors of the company as well as the external macroeconomic indicators. The company's profit margin, earning pattern, new inventions, market share, cash flow streams and the expansion of company w.r.t. portfolio of their products and geographic diversification along with the reputation of management are all the main internal factors that influence the movements in the stock price of the companies. On the other hand, external macroeconomic factors are also evidenced to have a very strong impact on the share prices of the companies. The country related factors such as inflation, GDP, interest rate, exchange rate, money supply, industrial productivity not only affect the stock exchange index but also the global factors like variation in global interest rate, fluctuation in value of USD, trade liberalization, oil prices and gold prices have a significant effect on the stock market of any country (Siddiqui, 2014).

Among all these external factors, the variation in international prices of oil took the interest of researchers and is considered as a significant factor influencing the macroeconomic activities and ultimately the stock exchange indices in different patterns and in different parts of the globe exclusively due to the experience of first oil crisis in 1973 (Siddiqui, 2014). However, all such scholarly articles and research were focused on association of oil prices with different macroeconomic measures in different phases and focused different economies of the globe. Most of such papers stated a negative association between oil prices and other macroeconomic variables like (Pierce & Enzler, 1974; Rasche & Tatom, 1981; & Draby, 1982). Further studies conducted by Hickman et al., (1987), Jones and Leiby (1996) Hooker (1999), Hammes and Wills (2003) and Leigh et al., (2003) also stated an inverse relationship between oil prices and the macroeconomic variables. However there are limited research studies that report the

interrelationship between oil prices shock and the return of equity market. Most of the prior studies just focused on relationship of macroeconomic variables and oil prices in developed economies of the world. Therefore, in Pakistan there is still a necessity for these types of research that particularly focuses on this relationship in emerging economies of the world. So, the intention of this research is to analyze the impact of international oil price movements on the Stock Market of Pakistan (KSE-100 Index), Consumer Price Index (CPI) and the Exchange Rate (US-Dollar).

1.1 Research Problem

The fall in international oil prices will have a positive influence on the import bill of the economy thus appreciate the value of the Rupee and improve the foreign reserves too. In addition, the prices of oil also play a crucial role in determining the cost of production of various industries i.e. Reduction in oil prices leads to the decrease in the cost of the companies that eventually leads to fall in inflation of the country as well as have a positive impact on the stock prices of the companies. The purpose of this research is to analyze the long-run relationship between international oil prices, KSE-100 index, CPI and exchange rate in Pakistan.

The objective of this research is to analyze the association between the fluctuations in the international oil prices, Stock Market (KSE-100 Index), Consumer Price Index and the Exchange Rate (US-Dollar). The scope of this study is quite diverse. In order to gain the maximum return, the investors keep on swapping their investment in various investments opportunities so this study can be extended to see the impact of oil prices on other investment opportunities such as Forex Market, Commodity Market (i.e. Gold and Silver) and other stock exchanges of the economies that would be beneficial for the individual and institutional investors, policy makers and the brokerage houses of all the economies of the world.

2. LITERATURE REVIEW

2.1 Oil Price Movements and its impact on Macroeconomic Variables

The movement in the prices of oil has upraised serious concern among the strategy makers across the globe due to its substantial influence on the economies of the world. Especially the crunch of 1973 became the major reason that many researchers have focused on the area of oil prices, in recent past. Most of such papers have focused on association of international oil prices with different macroeconomic variables on different economies of the globe and in different time periods. Several studies conducted by Pierce and Enzler (1974), Rasche and Tatom (1981) and Draby (1982) had identified an inverse relationship among macroeconomic variables and prices of oil. Other research papers such as Hickman et al. (1987), Jones and Leiby (1996), Hooker (1999), Hammes and Wills (2003) and Leigh et al. (2003) also stated a negative relationship among macroeconomic variables and the international prices of oil. In the US, there is causal relationship has been recognized between variations in oil prices and the macroeconomic indicators including GNP and the rate of unemployment (Hamilton, 1983) and (Burnidge et al., 1984). In Greek economy one of the analyses conducted by Papapetrou (2001) in order to identify the impact of the CPI of petroleum products on the economy and have found a cause and effect relationships among the oil prices to the industrial production, employment rate and stock prices of the companies. In further studies, there is a long-term (co-integrating) relationship have been identified by Carruth, Hooker and Oswald (1998) and Hooker (2002) among the prices of oil, unemployment rate and the real interest rate. There is asymmetric co-integration have been identified between GDP and the oil prices in US and in the countries of Europe (Lardic et al., 2006). In India, Chakravarty (2006) have gathered the monthly time series data from the year 1991-2005 in order to analyzed the association between the share prices and the macroeconomic indicators and have found that there is no causal relationship between oil prices and the gold prices, further he identified that there is no causal linkage between the exchange rate and the stock prices of the companies. In contrast, research conducted by Hooker (2002) and Hunt (2006) have found that there is no direct relationship exist between the gold prices and the oil prices but gold prices and the oil prices are linked through the general level of prices in the economy and the upward pressure on oil prices leads to increase the general level of prices that eventually increase the prices of the gold in the

economy. However, a study conducted by Büyüksalvarcı (2010) have stated that interest rates, consumer price index, gold prices, oil prices, exchange rate, money supply and the industrial production are interconnected with each other.

2.2 Determinants of Stock Price Movements

Investment in Stock Market is always considered a risky proposition due to which the investors are hesitant to place the money in such markets. But if they classify the factors affecting the prices of stocks, their confidence will boost to invest in this market. So, in order to categorize the factors affecting the stock price movements, a numerous research studies have been accompanied across the globe for a variety of economies and the outcomes of such studies have also been varied.

The movement in the stock market is basically a result of variability in stock prices of the companies that is affected by the internal factors of the company as well as the external macroeconomic indicators. (Siddiqui, 2014)

2.2.1 Internal Factors Affecting Stock Prices

Numerous research studies have concluded that company's fundamentals are the key factors that influence the share prices of the organizations i.e. the company's profit margin, earning pattern, new inventions, market share, cash flow streams and the expansion of company w.r.t. portfolio of their products and geographic diversification along with the reputation of management are all the main internal factors that influence the movements in the stock price of the companies (Siddiqui, 2014). One study has identified that size of the organization, preceding behavior of the share prices, EPS of the company, Market to BV and stocks turnover ratio are the most significant factors affecting the share prices of the organization.

2.2.2 External Factors Affecting Stock Prices

On the other hand, a growing body of literature has also discovered the linkage between shares prices and the macroeconomic indicators i.e. external macroeconomic factors are also evidenced a very strong impact on the share prices of the companies. These include the country related factors such as inflation, GDP, interest rate, exchange rate, money supply, industrial productivity as well as the global factors like variation in global interest rate, fluctuation in value of USD, trade liberalization, oil prices and gold prices have a significant effect on the stock market of any country (Siddiqui, 2014).

2.3 Relationship between Oil Prices and Inflation Rate

From an experiential point of view, substantial research studies have found that oil price movements have significantly affect the output and the inflation rate of the economy (Hamilton, 1983; Tatom, 1988; Hamptom, 1990; Hooker, 1996). Sharma et al (2012) stated that oil prices and inflation rate are habitually seen as a cause and effect relationship with each other i.e. as the prices of oil step up or down, the inflation moves in the similar direction. Oil price variation has significant impact on the economy because the increase in the prices of oil leads to increase the inflation that significantly affects the reduction in the purchasing power of the people and adversely affect the overall economy.

2.4 Relationship between Oil Prices and Exchange Rate

Different studies conducted by Throop (1993), Zhou (1995) and Dibooglu (1995) indicate a long-term association between the exchange rate and number of macroeconomic variables comprising international oil prices. In addition, studies of McGuirk (1983), Golub (1983), Krugman (1983) and Rogoff (1991) have been documented a potential significance of oil price movements for exchange rate. Robert A. Amano and Simon van Norden (1993) observed the existence of association between movements of oil prices and the real effective US exchange rate and have concluded that these variables are seem to be co-integrated and the causality goes from oil prices to the exchange rate and not from the exchange rate to the oil prices. Further they stated that oil price movement is also a significant long-term determinant of Canada-U.S. real exchange rate. The prior research studies just focused on the association of oil prices and macroeconomic variables in developed economies of the world. And the results from such studies cannot be generalized in the economic settings of other countries. Another point is that the economic conditions are also dynamic that's why there is always a time gap that needs to be addressed. Therefore the intention of this research is to determine the empirical relationship between the international oil prices, KSE-100 index, CPI and the Exchange Rate that allow us to analyze, how the change in international prices of oil affect the performance of KSE-100 index, CPI and the value of US-Dollar against PKR.

Study conducted by Throop (1993) indicate a long-term association between the exchange rate and number of macroeconomic variables comprising international oil prices. In addition, studies of McGuirk (1983), Golub (1983), Krugman (1983) and Rogoff (1991) have been documented a potential significance of oil price movements for

exchange rate. Amano et al., (1998) concluded that these variables are seem to be co-integrated and the causality goes from oil prices to the exchange rate and not vice versa.

After a thorough review of the literature, we have established that oil prices are the significant factor in order to determine the industrial production that eventually leads to the Stock Market performance, the CPI as well as the value of the currency. It influences all the segments of the economy directly or indirectly.

3. RESEARCH METHODOLOGY

This study is grounded on the philosophy of positivism as it is the quantitative analysis of international oil price movements, stock price movements, change in CPI and the change in the value of US-Dollar against PKR. The deductive approach is applied because all the variables have tested in the prior research. Mono-Method is used as data is collected from the secondary sources only (Monthly 11 year's data from October, 2004 to September, 2015). And this study is cross-sectiononal due to limited time period. To analyze the long-run relationship among the oil prices, performance of KSE-100 index, the CPI and the Exchange Rate several articles and research papers were reviewed. 11 years monthly data is being collected from the secondary sources to see the relationship between fluctuation in international oil prices, the performance of KSE-100 index, CPI and the Exchange Rate by applying the Augmented Dickey Fuller Test and Johansen Co-integration Test. 11 years Monthly data of oil prices (Closing Price US\$/Barrel), KSE-100 index (Monthly Closing Index), CPI (Monthly Percentage Change Year-on-Year Basis) and the US-Dollar (Monthly Average PKR/US\$ is collected from the period of October, 2004 to September, 2015 from secondary sources (Official Website of Karachi Stock Exchange, State Bank of Pakistan and US Energy Information Administration).

Hypothesis

H₀₁: There is no significant relationship between oil prices and the performance of KSE-100 index

H₀₂: There is no significant relationship between oil prices and the CPI of Pakistan

H₀₃: There is no significant relationship between oil prices and the value of US-Dollar against PKR

4. EMPIRICAL ANALYSIS AND FINDINGS

4.1 Graphical Representation of Data

4.1.1 Oil Prices

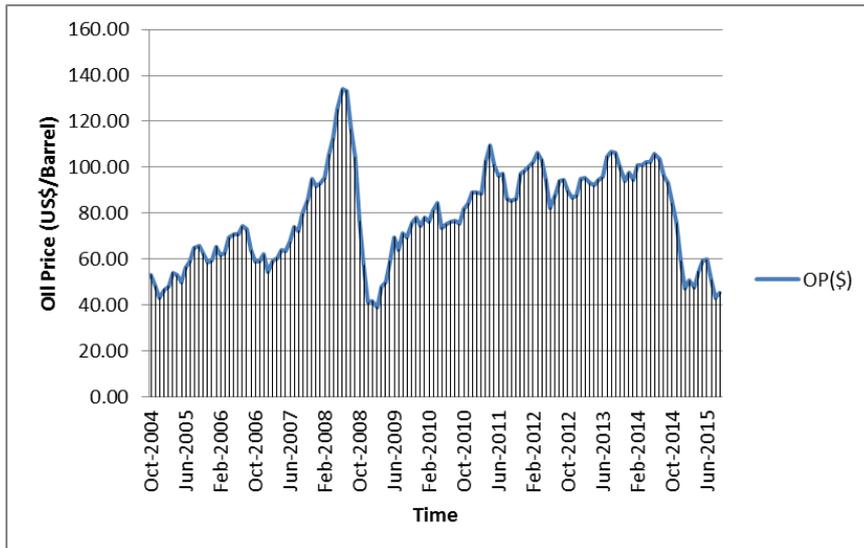
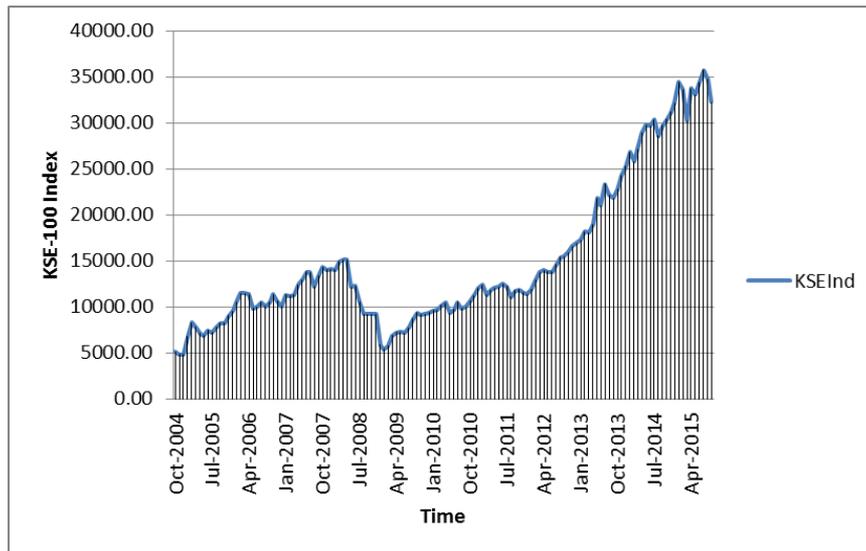


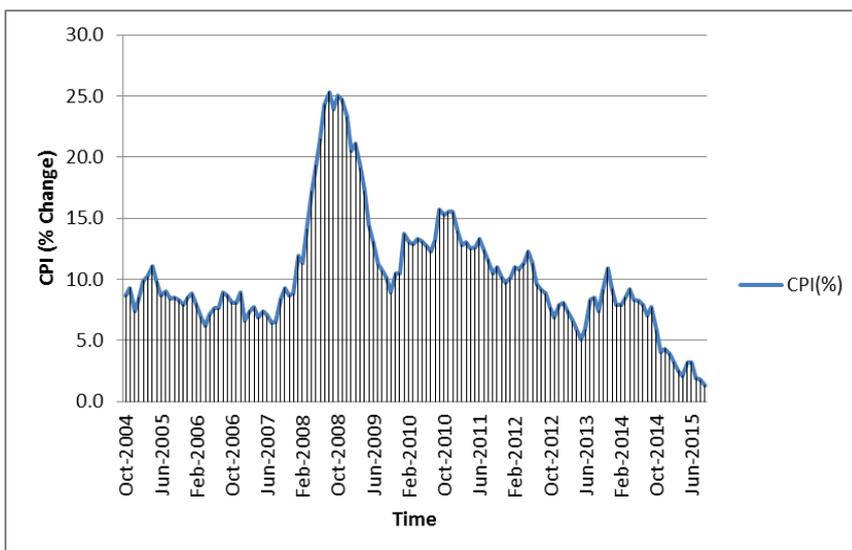
Figure 4.1.1 shows the graphical representation of the Oil Prices (US\$/Barrel) that depicts that the prices of oil moves in range from Oct 2004 to Feb 2007 i.e. the value of Oil was \$53.28/barrel in Oct 2004 and in Feb 2007 it was \$54.51/barrel only a difference of 2.3% over the 2.5 years, after that the prices of oil increases very rapidly and reached to maximum the level of \$133.37/barrel on July 2008 an increase of 144.67% within a span of 1.5 years, since then the prices of oil moves in downward direction and has reached to the minimum level of \$39.09/barrel on Feb 2009 this downfall may be due to the 2008 crisis of mortgage industry. Currently the main reason of decline in oil prices is due to the over-supply of oil in the world market, proxy wars in the Middle East and a clash between Iran and other OPEC member countries.

4.1.2 KSE-100 Index



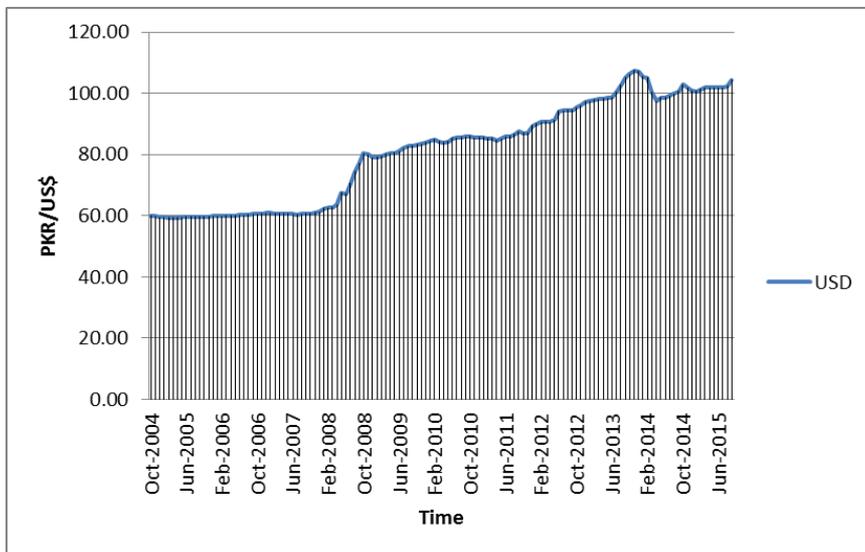
The graph of KSE-100 Index depicts a sudden decrease in index points from the level of 15122.47 on April 2008 to 5722.56 on February 2009 a decrease of 62.16% mainly due to the financial crisis of U.S. and other developed countries that had a disastrous result for the economies of the world. After that the KSE-100 index shows the bullish trend with minor corrections and has reached to the maximum level of 35742 points on July 2015 that is the positive sign for the growth of the economy.

4.1.3 Consumer Price Index



The graph of Consumer Price Index depicts that CPI moves in range or the line slightly steeper in downward direction from Oct 2004 to Aug 2007 i.e change in CPI was 8.7% in Oct 2004 and 6.5% in Aug 2007, after that it moves in the upward direction and reached to the level of 25.3% in Aug 2008 within a span of only 1 year then we can see bearish trend of CPI that at lowest level of 1.3% on Sep 2015 that is also a positive sign for the economy of Pakistan. The graph of Oil Prices and CPI of Pakistan depicts some positive relation between each other.

4.1.4 Value of US-Dollar



The value of US-Dollar against PKR was stable over the period of 3 years from Oct 2004 to Oct 2007 mainly due to the favorable economic indicators. Since then it shows the bullish trend and has reached to the average level of 107.47 on Nov 2013, that depicts the depreciation of Pakistani Rupee against the value of US-Dollar that negatively influence the economy of the country in terms of balance of trade and other indicators.

4.1.5 Consumer Price Index

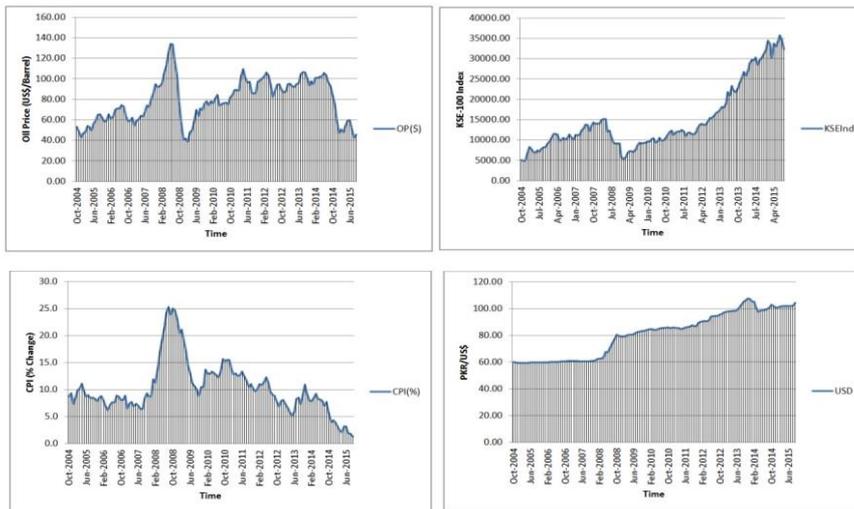


Figure 4.1.5 shows the combine representation of all the variables and according to this we can analyze that the graph of Oil Prices and the CPI are quite similar and depicts the positive relationship between Oil Price and the CPI of Pakistan. However, the graph of KSE-100 Index and the US\$ are moving in the upward direction with few corrections.

4.2 Descriptive Statistics

	OP	CPI	KSEIND	USD
Mean	78.72	10.29	14913	81.03
Median	77.30	8.95	11872	84.44
Maximum	133.88	25.30	35742	107.47
Minimum	39.09	1.30	4840	59.35
Standard Deviation	21.05	4.88	8142	16.42

4.3 Augmented Dickey Fuller Test (ADF)

4.3.1 Oil Prices at first Difference

Variable	Coefficient	Standard Error	t-Statistic	Probability
D(OP)	-0.576613	0.079944	-7.212672	0.0000
C	-0.10903	0.534267	0.020408	0.9837
Critical Values:	-3.481217 @ 1%	-2.883753 @ 5%	-2.578694 @ 10%	

Table 4.3.1 shows the ADF Test of Oil Prices at 1st Difference with an intercept criteria, according to this table the p-value is less than 0.05 or the absolute value of t-statistic is -7.212 which is greater than absolute critical value ± 3.481 (at 1% Level of significance) or ± 2.883 (at 5% Level of significance) that shows that the data of oil prices is stationary or has no unit root at 1st difference.

4.3.2 KSE-100 Index at first Difference

Variable	Coefficient	Standard Error	t-Statistic	Probability
D(KSE)	-1.037549	0.090615	-11.45002	0.0000
C	219.6923	93.02979	2.361527	0.0197
Critical Values: -3.481217 @ 1% -2.883753 @ 5% -2.578694 @ 10%				

Table 4.3.2 shows the ADF Test of KSE-100 Index at 1st Difference with an intercept criteria, according to this table the p-value is less than 0.05 or the absolute value of t-statistic is -11.450 which is greater than absolute critical value ± 3.481 (at 1% Level of significance) or ± 2.883 (at 5% Level of significance) that shows that the data of KSE-100 Index is stationary or has no unit root at 1st difference.

4.3.3 CPI at first Difference

Variable	Coefficient	Standard Error	t-Statistic	Probability
D(CPI)	-1.05375	0.179135	-5.88244	0.0000
C	-0.04680	0.090258	-0.518584	0.6051
Critical Values: -3.481217 @ 1% -2.883753 @ 5% -2.578694 @ 10%				

Shows the ADF Test of Consumer Price Index (CPI) at 1st Difference with an intercept criteria, according to this table the p-value is less than 0.05 or the absolute value of t-statistic is -5.882 which is greater than absolute critical value ± 3.481 (at 1% Level of significance) or ± 2.883 (at 5% Level of significance) that shows that the data of Consumer Price Index is stationary or has no unit root at 1st difference.

4.3.4 USD at first Difference

Variable	Coefficient	Standard Error	t-Statistic	Probability
D(USD)	-0.579910	0.81158	-7.145462	0.0000
C	0.205002	0.087679	2.338079	0.0209
Critical Values: -3.481217 @ 1% -2.883753 @ 5% -2.578694 @ 10%				

4.4 Johansen Co-Integration Test

4.4.1 Trace Statistic:

Hypothesis (No of CEs)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None	0.209573	51.30879	47.85613	0.0229
At most 1	0.097999	21.44065	29.79707	0.3307
At most 2	0.062372	8.341978	15.49471	0.4296
At most 3	0.001282	0.162868	3.841466	0.6865

In Trace Statistic, p-value is 0.3307 (at most 1) which is greater than 0.05 concluding that at 0.05 level of significance there is no cointegration among Oil Prices, KSE-100 Index, CPI and PKR to US-Dollar series. Hence, null hypothesis is not rejected statistically which states that there is no relationship or long-run relationship among the said variables.

4.4.2 Max-Eigenvalue Statistic:

Hypothesis (No of CEs)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None	0.209573	29.86815	27.58434	0.0250
At most 1	0.097999	13.09867	21.13162	0.4432
At most 2	0.062372	8.179110	14.26460	0.3608
At most 3	0.001282	0.162868	3.841466	0.6865

Similarly, Max-Eigenvalue statistic, p-value is 0.4432 (at most 1) which is greater than 0.05 concluding that at 0.05 level of significance there is no cointegration among Oil Prices, KSE-100 Index, CPI and PKR to US-Dollar series. Hence, null hypothesis is not

rejected statistically which states that there is no relationship or long-run relationship among the said variables. The results have achieved the objectives of the study and in this study researchers are only interested to check the long run relationship among the said variables. Furthermore, to check the shocks or percentage shocks, the results of Johansen Cointegration Test suggest to run Vector Auto-regression model.

5. Conclusion

Oil is considered as the essence of life for many economies that produce and consume it. With its history of booms and busts, now the oil industry is pamper in a new downturn. A year ago, the international prices of oil was about \$103/barrel. But now, it seems to be rapidly turning into an ever-cheaper economic curse i.e. price of oil has been fallen by more than 50% over the last few months and is hovering around \$45 to \$60 a mark for barrel. This plunge in oil prices may directly or indirectly have an influence on other macroeconomic variables of developing and emerging economies of the globe. Therefore, the intention of this research is to analyze the co-integration among the Oil Prices, KSE-100 Index, Consumer Price Index and the Exchange Rate (US-Dollar) in the context of Pakistani Economy. In order to accomplish our objectives we applied the Augmented Dickey Fuller (ADF) test to check the stationary of data that we achieve at first difference and then we applied Johansen Co-Integration Test to test the association among these variables and according to both the Trace Statistic and the Max-Eigenvalue Statistic criteria we have identified that there is no co-integrated equation or long run relationship among CPI, Oil Prices, PKR/USD and KSE-100 Index. The results are quite similar to the study of Sharma et al (2012) who stated that oil prices and inflation rate are habitually seen as a cause and effect relationship with each other. Ansar et al. (2013) also analyzed the 'Influence of oil prices on the CPI and Stock Exchange (KSE-100 Index)' by using a Johansen co-integration tool and have found that long-term but weak relationship among the variables. Siddiqui (2014) also found that the oil prices, exchange rate and foreign private portfolio investment have positive correlation with stock market.

5.1 Future Research Directions

In order to gain the maximum return, the investors keep on swapping their investment in various investments opportunities so this study can be extended to see the

impact of oil prices on other investment opportunities such as Forex Market, Commodity Market (i.e. Gold and Silver) and other stock exchanges of the economies. In Pakistan, this study can also be extended to see the impact of Oil Prices on other macroeconomic variables such as GDP, Interest Rate. In addition we can also analyze the impact of Oil Price fluctuations on the profitability of the manufacturing companies because oil is one of the major element of manufacturing cost for the power and energy sector, textile, sector, FMCG sector etc. their profitability can be greatly influence due to the changes in the oil prices.

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