

Crude oil price affects sector indices: A case study of Pakistan Stock Exchange

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Abstract

Aim of this study is to explain about the responses on the sector indices of the Pakistan stock exchange of crude oil prices fluctuation. Because a little bit variation in oil prices impact the world economy which is ultimately left its effect on country's economy and especially on oil importer country. Different sectors of Pakistan stock exchange such as chemical sector, cement sector, technology sector, automobile, oil & gas and power generation has been taken to examine the impact of crude oil prices. Monthly data has been taken from June 2012 to June 2016. ADF test has been applied to check either the data is stationary or not. After taking the first difference, ADF again apply and data become stationary. Co-integration test is applying and results shows that there is 2 co-integration and long run association and VECM is apply when data is co-integrated. Results in VECM, about all variables has shown no long run causality but, in some variables, there is short run causality. Sectors which are more sensitive to oil show strong impact if oil price changes. Consequently, investors should keep an eye on the oil prices while investing their money in stock exchange.

Keywords: Crude oil prices, Market indices, Co-integration, VECM

1 Introduction

Oil prices undoubtedly influence the world economy (Abaalzat et al. [2021](#); Al-Sulaiti [2022](#); Iorember & Jelilov [2018](#); Iorember et al. [2021](#); Jelilov et al. [2020](#)). This impact varies from country to country either developing or developed (Abachi & Iorember [2017](#); Al-Sulaiti [2007](#); Al-Sulaiti et al. [2021](#); Al-Sulaiti & Almwajeh [2007](#); Goshit & Iorember [2020](#); Ismail et al. [2009](#); Sulaiti et al. [2006](#)). As the population increases, the usage of energy is increasing day by day (Al-Sulaiti & Baker [1998](#); Goshit et al. [2020](#); Khalid & Baker [1997](#); Khalid & Fontenot 2004; Khalid et al.

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2005). And production of energy is the main problem (Dabwor et al. 2020; Iorember et al. 2019; Iorember et al. 2020; Iorember & Jelilov 2018). Fossil energy is rare source which bear the burden of this increased demand (Al Halbusi et al. 2022; Jaffar et al. 2022; Jaffar et al. 2021; Mansourian et al. 2019; Zhuang et al. 2022). Most important fossil source of energy is oil. Shocks in oil prices adversely affect the economy of country and especially when the country is oil import country (Balsalobre-Lorente et al. 2023; Jaffar 2020; Jaffar et al. 2019; Li et al. 2022; Shah et al. 2023). Therefore, the decision and the policy makers have great attention on fluctuations in the prices of oil (N. Khan et al., 2023).

If we look in the past years, there is immense variation of oil prices world-wide (S. Khan et al., 2022). After July 2014, there are more than 50% decline in prices (Ali et al. 2015; Jaffar 2020; Jaffar et al. 2019; Jawad et al. 2023; Jiakui et al. 2023). And this change attract the investor because it is main input which is directly impact the economy of the country (Lebni et al. 2021; Mohammadi et al. 2021; Mubeen et al. 2021; Shoib et al. 2022; Soroush et al. 2021). Generally, Oil was used for only fundamental purposes, but the time passed the importance of oil has been increased and it became more attractive for the investors (M. H. Khan et al., 2022). Crude oil as the basis for the development of a modern economy (Hafeez et al. 2023; Iorember et al. 2022; Local Burden of Disease 2021; Micah et al. 2023; Peter et al. 2017). Because oil is used for generating electricity, in transportation, in industries, machineries (Farzadfar et al. 2022; Liu et al. 2021; Moradi et al. 2021; Yu et al. 2022; Zafar et al. 2022). Crude oil price is set by the demand and supply in worldwide, Organization of Petroleum Exporting Countries strategies and oil contracts in future market (Aqeel et al. 2022; Ge et al. 2022; Hussain et al. 2017; Schmidt et al. 2022; Zhang et al. 2022).

Now question is that how the oil price fluctuation affect the economy (Burhan & Baber, 2022). In general sense, if the oil price increases, ultimately the production cost will also increase and all those commodities prices will increase in which oil is the basic input (Asad et al. 2017; Azadi et al. 2021; Li et al. 2022; Mubeen et al. 2021; NeJhaddadgar et al. 2022). Inflation factor increase in country and purchasing power of consumers increase and wealth transfer from consumer to producer (Aqeel et al. 2021; Azhar et al. 2018; Geng et al. 2022; Li et al. 2021; Zeidabadi et al. 2022). It can affect the interest rates and on other side due to high cost of production it may cause of low production, unemployment and low GDP growth (Ahmed & Mohammad, 2022). In another prospective, if the country is oil import country there is chances of increase in trade deficit, reduction in government earnings .and affect the stock returns of major oil consuming industries (Aman et al. 2022; Aqeel et al. 2021; Paulson et al. 2021; Toqeer et al. 2021; Yao et al. 2022).

As discussed above, fluctuation in crude oil prices positively or negatively impact on stock exchange. So, our focus on this study to check the effect of this change on sector indices of Pakistan stock exchange.

After studying the literature, different authors check the association between crude oil price & sector indices of different stock exchanges.

1.1 In Pakistan

Pakistan is oil import country but some portion of its consumption is produced locally. According to economic survey of Pakistan, national production of crude is 24.02 MB (million barrel) in July-March financial year 2016. Economic Survey 2012 indicates that transport consume 49% and energy sector consume 40% on oil. And in 2015, it has been reached to 50% in transport sector and 42% for energy sector and in same period in 2016 the share of transport is 55% and in energy sector is 35% Decline in consumption of oil in energy sector is due to shifting to gas from oil because gas is cheaper than oil.

Imports of crude petroleum are a financial burden on public finances of nearly 17.2 per cent of

expenditures on imports of petroleum products (Aman et al. [2021](#); Mamirkulova et al. [2022](#); Rahmat et al. [2022](#); Wang et al. [2021](#); Zhou et al. [2021](#)). In July there were 4.9 million metric tons imported in 2016, and in same duration last year it is 4.81 million metric tons. This is increase about 3.5 percent, the value of US \$ 1.95 Billion were imported, compared to US \$ 3. 59 billion during this period. This is about 47% decline and this decline also decline the trade deficit.

Recent fluctuations in oil prices have made us re-analyze the impact of oil and re-examine

Price and its impact in Pakistan's market. Pakistan is a developing country and import oil to fulfill its consumption level. After analyzing this scenario, variation in prices of oil globally affect the stock prices (Aman et al. [2019](#); Fattahi et al. [2020](#); Khazaie et al. [2021](#); Pouresmaeil et al. [2019](#); Yoosefi Lebni et al. [2021](#)). In general sense, whenever oil prices increases, production cost ultimately increases which financial burden on the consumers is due to raise of inflation in the country (Aman et al. [2019](#); Hussain et al. [2021](#); Hussain et al. [2019](#); Mamirkulova et al. [2020](#); Mubeen et al. [2020](#)). And when inflation increases ultimately value of foreign exchange is decreases and investment also decreases in country (Anjum et al. [2017](#); Azizi et al. [2021](#); Lebni et al. [2020](#); Moradi et al. [2020](#); NeJhaddadgar et al. [2020](#); Shuja et al. [2020](#); Yoosefi Lebni et al. [2020](#)). Our research is beneficial for different sectors and industries by which they can analyze how much they suffer by changing the oil prices.

1.2 Problem Statement

As discussed above that fluctuation in crude oil prices positively or negatively impact on stock exchange. So, our focus on this study to check the effect of this change on different sectors of Pakistan stock exchange.

1.3 Research Questions

What is relationship of crude oil prices and indices of Pakistan stock exchange?

What effects on different sectors of economy if Crude oil prices changes?

1.4 Research Objective

Purpose of research is to analyze impact of crude oil prices on different sectors of the Pakistan stock exchange.

1.5 Significance of Study

This study is helpful for the market participants who are related to Pakistan stock exchange and they are invested in different sectors of Pakistan stock exchange. They can balance their portfolio with their views in coming changes in oil prices. Oil prices is an international commodity and Pakistan is the oil importer country so fluctuation in oil prices positively or negatively impact on different sectors of Pakistan stock exchange.

2 Literature Review

Research is conducted to explain the Indonesian stock index short-term responses to variations in oil prices by linear & asymmetric models and study the association of crude oil and stock prices. Weekly data has been taken from August 6, 2007 to October 19, 2015, the results show that the power and sensitivity of that partnership among sectors are different and shows positive affects in entirely industries. They find a strong value of asymmetric responses in the profits of agriculture and consumer goods in connection with the development of oil prices (Rahmanto, Riga et al. [2016](#)).

Molero et al. ([2016](#)) analyze association of oil prices and stock volatility for Great 7 economies. It includes Canada, France, Germany, Italy, Japan, the UK and the US. VAR model is used for 1970 to 2014 data. Results concludes that when the prices of oil rise, stock prices of these countries shows a negative behavior. Findings also represents that when crude oil prices changes worldwide,

it more affects the stock market rather than change in national oil prices.

Vector Auto regression model is apply to analyze oil price shocks on macroeconomic factors in top 4(Japan, Korea, India, Indonesia) oil usage Asian countries. Oil shocks restrictions has been categorized into three different structures: Oil demand shock, oil supply shock and oil specific demand shock Price analysis suggests that economic activity to react very differently depending on the type of oil shocks. They suggest oil supply shock impact limited but demand shock which is running globally represents positive impact in these countries. Macroeconomic factors such as interest rate and exchange rate to mitigate impacts of supply shock in Japan and Korea. On the other side ,it can also use in response to demands of shocks.([Cunado, Jo et al. 2015](#))

In Pakistan 2015, Study is held for the purpose of examining gas and oil prices impact on stock returns. For this purpose, researchers had taken that companies which are more oil consuming companies. To conduct study quarterly data of 3 energy intensive industries, namely chemicals, fertilizer, and textile were obtained for the period of January, 2009-December, 2013. Based on the multifactor model and panel regression analysis, results highlighted that variation in oil prices negatively affect the stock of Chemicals, and textile, whereas the gas price factor was significant only in the case of textile. Furthermore, a significant impact of stock market index returns was observed on the stock returns of each industry. Finally, the general analysis was conducted; its findings showed that oil prices, gas prices, exchange rate, and interest rate inversely impact on stocks. However, effect of stock market index returns was significant with the positive coefficient.

(Cüppers and Smeets 2015) check how oil prices affect the German stock exchange. Eight year data from august 2007 to October 2015 was collected on weekly basis. This research mentioned that there are some industries which impacted by variation in crude oil prices and there are also some sectors which unaffected. These results also indicated about the most oil usage industries.

Research intends toward find relationship concerning shocks in oil price & industry sub-sectors of the Istanbul Stock Exchange in light of performance of the US stock market. The data span of the first part of this study is consistent with Eryigit's (2009) paper: January 4th 2000 – January 11th 2008. In order to confirm findings they expanded the data set in the second part of the paper to April 12th 2011. The study first uses the OLS approach to an extended market model as developed by Faff and Brailsford (1999). Later, the model includes S&P 500 index as a control variable to capture the effects of US markets. Study show that oil price shocks significantly impact some sectors while others are more driven by fluctuations of US stock market. While some of the findings were similar to previous research, others were significantly different ([Gormus 2013](#)).

Oil prices impact on Europe stock markets has been examined by Mohamed El Hedi Arouri. They use linear and asymmetric models and examine the relationship between stock indices and oil prices. ARCH and GARCH method is used to justify the results. They find that oil sensitive sectors are more affected by variation in oil prices and show strong response .And less sensitive to that sectors which are not oil sensitive.([Arouri 2011](#)).

In Turkey, Researcher analyze impacts of oil prices on sector indices of Istanbul stock exchange. Daily data was collected from 2-1-2009 to 15-2-2011. VAR used to check the relationship between ISE sector indices and crude oil prices. Results shows volatility in prices of crude oil that affect economy sharply. Industrial sector is the most impacted index and technology sector is not much responsive sector ([Toraman, Başarir et al. 2011](#)).

In India, GARCH model is used for about one and half year data from July 2007 to November 2008 to find crude oil prices impact on exchange rate. This research highlighted that when the prices of oil goes up the exchange rate becomes go down in comparison of US dollar. Findings also represents that shocks in oil prices either positive or negative same effect on exchange rate.([Ghosh 2011](#)).

[Cunado et al. \(2005\)](#) collect data from 1975 to 2002 of 6 Asian countries in order to check impact of oil prices on economy behavior and CPI. Findings represents positive response. The impact of it is not so much and for limited time period. Researchers also conclude that macroeconomic factors more impacted by variation in oil prices.

3 Methodology

To conduct my research, Impact of oil prices on sector indices of PSX by applying VECM using time series methods of co-integration. Variables have been explained first and after that different test of time series has been used.

3.1 Variables

Oil prices (Brent Oil prices per barrel in Pakistani rupees) and different sectors such as chemical sector, cement sector, technology sector, automobile, oil & gas and power generation has been taken to investigate our study.

3.2 Sample and Data collection

Monthly data have been collected from June 2012 to June 2016 to concrete my study. Data is taken from Business recorder, World Bank and Pakistan stock exchange etc. Some facts have also taken from economic survey of Pakistan.

3.3 Variables

Variable	Definition	
oil	Crude oil Prices	Brent Oil price per barrel for crude oil in Pakistani Rupees
Chem	PSX chemical index	
Power	PSX power generation indices	
OG	PSX Oil & Gas indices	
Tech	PSX Telecommunication indices	
Automobile	PSX Automobile indices	
Cement	PSX cement indices	

3.4 Methods

The main step in this analysis is the stationarity analysis of oil prices and sector indices of PSX. The most commonly used test for sationarity analysis is the Augmented Dickie-Fuller (ADF) test (Dickey and Fuller 1979). After that, cointegration test is apply to check that either relationship of variables are long run or short run. This is completed by applying the co-integration test ([Johansen 1988](#)). In the end, in such cases where relationship of co-integration is indicated, VECM is assessed.

4 Tests and Results - Unit Root Test

In time series analysis testing unit root is significant. A time series is said to be stationary when its mean, variance, & auto-covariance are time invariant. When there is unit root in time series, it is known as non-stationary, which is

As stated, the ADF test employed in this paper to evaluate the stationarity of the time-series data used in this analysis. ADF is a unit root test for stationarity.

When we run the ADF test, we see that our variables are not stationary. Trace statistics is less than 5% critical value which makes the data non-stationary. Details of these results are given in Table

1. To make the data stationary, we take first difference and again we run the ADF test and we can see that our data is stationary now. Trace statistics value is more than 5% critical value and that is desirable.

4.1 Johansen Co-integration Test

The co-integration concept is established on the assumption that numerous financial and economic time series may contain a unit root. Engle and Granger (1987) were the first to draw attention to that a linear combination of two series (or more) that contains a unit root may be stationary. If such combination is, initial time series are said to be co-integrated. This stationary linear combination is defined as “the co-integrating equation and may be interpreted as the long-run equilibrium relationship between the variables. “In this paper, Johansen co-integration test [Johansen et al. \(1988\)](#) will be used to test the following hypotheses:

H0: 0 there is no co-integration among variables

H1: there is co-integration among variables

In order to investigate the impact of oil price shocks on different Pakistani stock exchange indices—PSX chemical index (Chem), SX power generation indices (Power), PSX Oil & Gas (OG), PSX Telecommunication indices (Tech), PSX Automobile indices (Automobile), PSX cement indices (Cement). Estimating the Co-integration model:

$$A_0X_t = A_1X_{t-1} + \dots + A_pX_{t-p} + \varepsilon_t$$

Where X_t represents: $X_t = [\Delta \text{oil}; \Delta \text{Chem}; \Delta \text{Power}; \Delta \text{OG}; \Delta \text{Tech}; \Delta \text{Automobile}; \Delta \text{Cement}]$ and ε_t is the structural disturbances denoted by $[\varepsilon_{\text{oil}}; \varepsilon_{\text{Chem}}; \varepsilon_{\text{Power}}; \varepsilon_{\text{OG}}; \varepsilon_{\text{Tech}}; \varepsilon_{\text{Automobile}}; \varepsilon_{\text{Cement}}]$

When we go to results in table 3, we can see that there is 2 co-integration among the variables. Trace statistics value is 66.4284 and 5% critical value is 68.52 in rank 2. It indicates, null hypothesis (H0) is rejected by us and accept alternative hypothesis (H1). It indicates there is a long-term partnership among variables and variables moving together in long run, And when variables showing co-integration then we run VECM.

4.2 Vector Error Correction Model (VECM)

After running the co-integration test, we conclude that our variables co-integrated and move long run together and, in that situation, we use VECM. the advantage of VECM is that sub information of the series is given in long run and short run. When we run the vector error correction model we may face two kind of issues:

- Long run causality
- Short run causality

When we run the VECM test, we get the results which has been shown in the Table 4.

When the results taken oil prices as a dependent variable, we see error correction term L1, here is coefficient is negative value and p value is insignificant its mean that no long run causality and when we analyze all other independent variables to dependent variable there is also no short run causality.

For automobile sector, results shows positive coefficient and p-value is insignificant its mean no long run causality running from independent variables to dependent variables. Results indicates that crude oil prices is not significantly impact on automobile sector because if prices of oil increase consumers makes the alternative approaches such as oil prices increases then consumers move to hybrid vehicles. Sale of vehicles is not so much impacted by oil prices.

For technology and communication sector, coefficient L1 is positive and p value is not significant its mean no long run casualty among the variables and in short run coefficients all the variables' p value is insignificant. We can analyze that in technology sector is non-oil sensitive sector, there is not so much use of oil and that's why when the oil price changes there is not so much effect on technology sector.

For chemical sectors, coefficient L1 is positive and p value is significant but the problem is that coefficient is positive that's why no long causality running from independent to dependent variables run. And when we see short run coefficient of oil the first lag is negative and p value is insignificant it means there is no influence of oil prices on chemical sector. Chemical sector is influenced by oil price variation because in chemical sector oil is used as basic consumption.

For power generation sector, coefficient L1 is negative but p value is not significant it means there is no long run causality among the variables. When we see oil prices in short run coefficients, it is positive coefficients and p values is insignificant it means there is no influence of oil prices on power sector. Because power sector is organized in different sectors in Pakistan. And different sectors set the prices according to their will.

For oil and gas, the coefficient L1 is positive and p-value is significant no long run casualty among the variables. Here is the point that when any fluctuation in oil prices happen, there is sudden impact on oil and gas sector but it recovers early and become in equilibrium. Results represent strongly positive relationship with oil prices and oil and gas sector because it is most sensitive oil consuming sector. Increase in oil prices increase the stock prices of oil and gas sector which is positive response.

Last sector which is chosen is cement and same results we see again. Variables has no long run causality among the variables and coefficient of oil prices is negative but p value in not significant it means that oil prices is influencing on cement sector negatively.

5 Conclusion

Pakistan as mentioned above is an oil importer country and facing many problems regarding oil price fluctuations and especially increase of demand in almost every sector of the economy.

Whenever there is variation in oil prices worldwide, economy of Pakistan is impacted by that, this impact may be positive or negative. Oil prices impacted strongly on oil sensitive sectors and vice versa. This affect is small in some sectors and sometime shock in oil prices impact highly significant for a short span of time. When we see our co-integration test, it shows variables are in long run relationship and variables are move together in long run. In VECM results, all the variables are taken as dependent variable one by one and we can see all the variables have no long run causality and some variables are impacted for short time period by fluctuation in oil price. If we examine the previous studies, indices are impacted by oil prices at some level. And our study is also indicating that oil price fluctuation doesn't not move together with sector indices but at some points it move together in short run.

Researchers, regulators and investors of stock exchange may interest in our results. Our findings suggest that when the oil prices increase they should invest in sector such as oil and gas because it is more positively sensitive to oil prices. When oil prices high the stock prices of oil and gas sector also increases. And when oil prices expected to be low they can invest in less oil sensitive sectors

or take derivatives related to oil. Another suggestion can be taken from our results in portfolio building. Sectors in Pakistan has different aspects regarding to oil prices it indicates that there is great risk diversification opportunities across sectors. Portfolio managers can predict effect on sectors by expecting the rise or fall of oil prices

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7 Appendix

Table 1.1. .dfuller oil, lags (0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller

	Test	1% Critical	5% Critical	10% Critical
Z(t)	-0.438	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.9035

Table 1.2

.dfuller automobile, lags (0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller

	Test	1% Critical	5% Critical	10% Critical
Z(t)	-1.194	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.6761

Table 1.3

.dfuller oil, lags(0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller

	Test	1% Critical	5% Critical	10% Critical
Z(t)	-0.438	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.9035

Table 1.4

.dfuller chem, lags (0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller

	Test	1% Critical	5% Critical	10% Critical
Z(t)	-1.690	-3.594	-2.936	-2.602

MacKinnon approximate p-value for Z(t) = 0.4360

Table 1.5

.dfuller power, lags (0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller

	Test	1% Critical	5% Critical	10% Critical
Z(t)	-1.873	-3.594	-2.936	-2.602

MacKinnon approximate p-value for $Z(t) = 0.3451$

Table 1.6

.dfuller og, lags(0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
$Z(t)$	-1.713	-3.594	-2.936	-2.602

MacKinnon approximate p-value for $Z(t) = 0.4246$

Table 1.7

.dfuller cement, lags (0)

Dickey-Fuller test for unit root Number of obs = 48

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
$Z(t)$	-1.807	-3.594	-2.936	-2.602

Table 2.1

.dfuller L_oil, lags(0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
$Z(t)$	-4.698	-3.600	-2.938	-2.604

MacKinnon approximate p-value for $Z(t) = 0.0001$

Table 2.2

.dfuller L_automobile, lags(0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
$Z(t)$	-8.553	-3.600	-2.938	-2.604

MacKinnon approximate p-value for $Z(t) = 0.0000$

Table 2.3 .dfuller L_tech, lags(0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical

	Statistic	Value	Value	Value
Z(t)	-7.416	-3.600	-2.938	-2.604
MacKinnon approximate p-value for Z(t) = 0.0000				

Table 2.4

.dfuller L_chem, lags(0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
Z(t)	-6.957	-3.600	-2.938	-2.604
MacKinnon approximate p-value for Z(t) = 0.0000				

Table 2.5

.dfuller L_power, lags (0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
Z(t)	-7.994	-3.600	-2.938	-2.604
MacKinnon approximate p-value for Z(t) = 0.0000				

Table 2.6

.dfuller L_og, lags(0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
Z(t)	-7.471	-3.600	-2.938	-2.604
MacKinnon approximate p-value for Z(t) = 0.0000				

Table 2.7

.dfuller L_cement, lags (0)

Dickey-Fuller test for unit root Number of obs = 47

Interpolated Dickey-Fuller				
	Test	1% Critical	5% Critical	10% Critical
Z(t)	-7.796	-3.600	-2.938	-2.604
MacKinnon approximate p-value for Z(t) = 0.0000				

Table 3

Johansen tests for cointegration

Trend: constant Number of obs = 47

Sample: 2012m8 - 2016m6

Lags = 2

5%					
maximum	trace critical				
rank	parms	LL	eigenvalue	statistic	value
0	56	754.56387	.	160.6877	124.24
1	69	781.39057	0.68068	107.0343	94.15
2	80	801.69352	0.57851	66.4284*	68.52
3	89	817.59909	0.49178	34.6172	47.21
4	96	825.89372	0.29740	18.0280	29.68
5	101	831.76422	0.22105	6.2870	15.41
6	104	834.00658	0.09101	1.8023	3.76
7	105	834.90771	0.03762		

5%					
maximum	max critical				
rank	parms	LL	eigenvalue	statistic	value
0	56	754.56387	.	53.6534	45.28
1	69	781.39057	0.68068	40.6059	39.37
2	80	801.69352	0.57851	31.8111	33.46
3	89	817.59909	0.49178	16.5893	27.07
4	96	825.89372	0.29740	11.7410	20.97
5	101	831.76422	0.22105	4.4847	14.07
6	104	834.00658	0.09101	1.8023	3.76
7	105	834.90771	0.03762		

Table 4.

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
D_oil						
_ce1						
L1.	-.0019417	.0144002	-0.13	0.893	-.0301656	.0262822
oil						
LD.	.1771511	.2115669	0.84	0.402	-.2375124	.5918147
L2D.	-.170921	.2196413	-0.78	0.436	-.60141	.2595679
automobile						
LD.	-.3391732	.393131	-0.86	0.388	-1.109696	.4313494
L2D.	-.5114592	.3813038	-1.34	0.180	-1.258801	.2358824
tech						
LD.	-.1159601	.228455	-0.51	0.612	-.5637238	.3318036
L2D.	-.1286209	.2086913	-0.62	0.538	-.5376485	.2804066
chem						
LD.	-.2253648	.294556	-0.77	0.444	-.802684	.3519544
L2D.	-.1529476	.2797844	-0.55	0.585	-.701315	.3954197
power						
LD.	.1250562	.5241001	0.24	0.811	-.9021611	1.152273

L2D.		.0954068	.482874	0.20	0.843	-.8510088	1.041822
og							
LD.		.4011079	.3921579	1.02	0.306	-.3675075	1.169723
L2D.		.3938114	.401493	0.98	0.327	-.3931004	1.180723
cement							
LD.		-.0103817	.3183136	-0.03	0.974	-.6342649	.6135016
L2D.		.1594699	.317884	0.50	0.616	-.4635713	.782511
_cons		.0036257	.0094532	0.38	0.701	-.0149022	.0221537
-----+							
D_automobile							
_ce1							
L1.		.0071758	.0102364	0.70	0.483	-.0128871	.0272388
oil							
LD.		-.0939376	.1503924	-0.62	0.532	-.3887012	.200826
L2D.		.2351051	.156132	1.51	0.132	-.070908	.5411182
automobile							
LD.		-.2561947	.2794572	-0.92	0.359	-.8039206	.2915313
L2D.		-.0265894	.2710498	-0.10	0.922	-.5578372	.5046585
tech							
LD.		-.1554535	.1623973	-0.96	0.338	-.4737463	.1628393
L2D.		-.063036	.1483483	-0.42	0.671	-.3537932	.2277213
chem							
LD.		.2201852	.2093852	1.05	0.293	-.1902022	.6305726
L2D.		.0589845	.1988848	0.30	0.767	-.3308225	.4487915
power							
LD.		.1617203	.3725565	0.43	0.664	-.5684771	.8919177
L2D.		.249063	.343251	0.73	0.468	-.4236966	.9218225
og							
LD.		-.0756831	.2787655	-0.27	0.786	-.6220533	.4706872
L2D.		-.2154297	.2854013	-0.75	0.450	-.7748059	.3439466
cement							
LD.		-.1072969	.2262733	-0.47	0.635	-.5507844	.3361905
L2D.		-.1038988	.2259678	-0.46	0.646	-.5467876	.3389901
_cons		.0210103	.0067198	3.13	0.002	.0078397	.0341809
-----+							
D_tech							
_ce1							
L1.		.0205906	.0140925	1.46	0.144	-.0070303	.0482114
oil							
LD.		.2405774	.2070464	1.16	0.245	-.1652261	.646381
L2D.		.3468669	.2149483	1.61	0.107	-.074424	.7681578
automobile							
LD.		-.4790459	.3847311	-1.25	0.213	-.1233105	.2750132

L2D.	.0058407	.3731566	0.02	0.988	-.7255327	.7372142
tech						
LD.	-.2187307	.2235737	-0.98	0.328	-.6569271	.2194658
L2D.	-.2361232	.2042323	-1.16	0.248	-.6364112	.1641647
chem						
LD.	.5550597	.2882624	1.93	0.054	-.0099241	1.120044
L2D.	.2152614	.2738064	0.79	0.432	-.3213892	.751912
power						
LD.	.4972371	.5129018	0.97	0.332	-.508032	1.502506
L2D.	.5182909	.4725566	1.10	0.273	-.4079029	1.444485
og						
LD.	-.3393054	.3837788	-0.88	0.377	-1.091498	.4128873
L2D.	-.4581772	.3929144	-1.17	0.244	-1.228275	.311921
cement						
LD.	.0831411	.3115123	0.27	0.790	-.5274118	.6936941
L2D.	.2470232	.3110919	0.79	0.427	-.3627057	.856752
_cons	.0061827	.0092512	0.67	0.504	-.0119494	.0243148

D_chem						
_ce1						
L1.	.0709931	.0070037	10.14	0.000	.0572662	.08472
oil						
LD.	-.1430228	.1028974	-1.39	0.165	-.3446981	.0586525
L2D.	.0583901	.1068245	0.55	0.585	-.150982	.2677622
automobile						
LD.	-.7077771	.1912027	-3.70	0.000	-1.082528	-.3330267
L2D.	-.3905446	.1854505	-2.11	0.035	-.7540208	-.0270684
tech						
LD.	-.2950905	.1111111	-2.66	0.008	-.5128643	-.0773167
L2D.	-.0985972	.1014989	-0.97	0.331	-.2975313	.100337
chem						
LD.	.3751422	.1432599	2.62	0.009	.0943579	.6559265
L2D.	.2751216	.1360756	2.02	0.043	.0084183	.5418249
power						
LD.	.8365109	.2549007	3.28	0.001	.3369147	1.336107
L2D.	.7197448	.23485	3.06	0.002	.2594472	1.180042
og						
LD.	-.1039003	.1907295	-0.54	0.586	-.4777232	.2699226
L2D.	-.3238115	.1952697	-1.66	0.097	-.706533	.05891
cement						
LD.	.1817498	.1548147	1.17	0.240	-.1216813	.485181
L2D.	.0995539	.1546057	0.64	0.520	-.2034677	.4025755

_cons		-.0087842	.0045977	-1.91	0.056	-.0177954	.0002271

D_power							
_ce1							
L1.		-.004317	.0093228	-0.46	0.643	-.0225894	.0139554
oil							
LD.		.0059574	.1369705	0.04	0.965	-.2624999	.2744147
L2D.		.1010119	.1421979	0.71	0.477	-.1776909	.3797147
automobile							
LD.		-.0323514	.2545169	-0.13	0.899	-.5311953	.4664925
L2D.		.3137956	.2468598	1.27	0.204	-.1700408	.7976319
tech							
LD.		-.1294947	.147904	-0.88	0.381	-.4193813	.1603919
L2D.		-.1211654	.1351088	-0.90	0.370	-.3859739	.143643
chem							
LD.		.0898676	.1906985	0.47	0.637	-.2838945	.4636298
L2D.		.0082607	.1811352	0.05	0.964	-.3467577	.3632792
power							
LD.		-.2621195	.3393076	-0.77	0.440	-.9271501	.4029111
L2D.		.0522074	.3126174	0.17	0.867	-.5605114	.6649262
og							
LD.		-.027478	.2538869	-0.11	0.914	-.5250872	.4701312
L2D.		-.084158	.2599305	-0.32	0.746	-.5936125	.4252964
cement							
LD.		.1759491	.2060794	0.85	0.393	-.2279591	.5798573
L2D.		-.0496616	.2058012	-0.24	0.809	-.4530246	.3537014
_cons		.0087464	.0061201	1.43	0.153	-.0032488	.0207416

D_og							
_ce1							
L1.		.0344093	.0094416	3.64	0.000	.0159041	.0529145
oil							
LD.		-.0064178	.1387156	-0.05	0.963	-.2782953	.2654597
L2D.		.0611674	.1440096	0.42	0.671	-.2210862	.3434209
automobile							
LD.		-.6430461	.2577595	-2.49	0.013	-1.148245	-.1378468
L2D.		-.4432804	.2500049	-1.77	0.076	-.9332809	.0467202
tech							
LD.		-.3259156	.1497884	-2.18	0.030	-.6194955	-.0323358
L2D.		-.348832	.1368302	-2.55	0.011	-.6170142	-.0806498
chem							
LD.		.1415844	.193128	0.73	0.463	-.2369396	.5201083
L2D.		.1897359	.1834429	1.03	0.301	-.1698056	.5492774

power							
LD.	.4098698	.3436304	1.19	0.233	-.2636335	1.083373	
L2D.	.6424988	.3166002	2.03	0.042	.0219738	1.263024	
og							
LD.	.0250661	.2571215	0.10	0.922	-.4788828	.5290149	
L2D.	-.0139221	.2632421	-0.05	0.958	-.5298672	.5020229	
cement							
LD.	.2024592	.2087049	0.97	0.332	-.2065948	.6115133	
L2D.	.0378868	.2084232	0.18	0.856	-.3706151	.4463887	
_cons	.0058751	.0061981	0.95	0.343	-.0062729	.0180232	

D_cement							
_ce1							
L1.	.017429	.0099726	1.75	0.081	-.0021169	.0369749	
oil							
LD.	-.1056934	.146515	-0.72	0.471	-.3928575	.1814707	
L2D.	.1731356	.1521066	1.14	0.255	-.1249879	.471259	
automobile							
LD.	-.3493474	.272252	-1.28	0.199	-.8829515	.1842567	
L2D.	.2590346	.2640616	0.98	0.327	-.2585166	.7765858	
tech							
LD.	-.1024078	.1582103	-0.65	0.517	-.4124943	.2076787	
L2D.	-.1422038	.1445235	-0.98	0.325	-.4254648	.1410571	
chem							
LD.	.2574643	.2039867	1.26	0.207	-.1423422	.6572709	
L2D.	-.0411552	.1937571	-0.21	0.832	-.4209121	.3386017	
power							
LD.	.5488068	.362951	1.51	0.131	-.1625642	1.260178	
L2D.	.6108398	.3344012	1.83	0.068	-.0445746	1.266254	
og							
LD.	-.2070648	.2715783	-0.76	0.446	-.7393484	.3252188	
L2D.	.0333507	.2780431	0.12	0.905	-.5116036	.5783051	
cement							
LD.	-.0620542	.2204395	-0.28	0.778	-.4941077	.3699992	
L2D.	-.2510496	.2201419	-1.14	0.254	-.6825197	.1804206	
_cons	.0107972	.0065466	1.65	0.099	-.0020338	.0236283	
