The Dynamic Effects of Crude Oil and Natural Gas Prices on Iran's Methanol

Delavari, Majid and Gandali Alikhani, Nadiya

Science and Research Branch, Islamic Azad University, khouzestan, (IRAN), Science and Research Branch, Islamic Azad University, khouzestan, (IRAN)

12 January 2013

The Dynamic Effects of Crude Oil and Natural Gas Prices on Iran's Methanol

Majid Delavari

Assistant Professor of Economics Science and Research Branch, Islamic Azad University, khouzestan, (IRAN), Email: Mjd_delavari@yhoo.com

Nadiya Gandali Alikhani

Corresponding author, MA of Economics Science and Research Branch, Islamic Azad University, khouzestan, (IRAN), Email: N.Alikhani@khouzestan.srbiau.ac.ir

ABSTRACT

Petroleum and petrochemicals prices movements have always been at the core of economic research agenda not only because of its crucial effect on the cash flows of oil-related businesses, but also due to the far-reaching implications of oil price uncertainty on the macro-economy and the financial markets. It is not surprising therefore that in the energy economics literature there is a plethora of empirical studies examining the issue of modeling movements and risk management. As a case study, this paper investigates the dynamic relationship between Iran's crude oil price, natural gas price and methanol price which is one of the most important non-oil exports of the oil-exporting country. To do so, the weekly data from first week of 2005:1 to the third week 2013:5 in a VECM framework is applied. The results show that in the long-run, oil and gas prices hikes leads to proportional increase in methanol price while in the short-run, this impact is not significant.

Keywords: Methanol Price; Crude Oil Price; Natural Gas Price; VECM Model

JEL Classifications: Q43; C1; C32

1. Introduction

In recent years, numerous studies have been devoted to worldwide Energy prices, since this energy commodity is a fundamental driver of most economic activities (Cheong, 2009). Petroleum and petrochemicals prices movements have always been at the core of economic research agenda not only because of its crucial effect on the cash flows of oil-related businesses, but also due to the far-reaching implications of oil price uncertainty on the macroeconomy and the financial markets (Nomikos and Pouliasis, 2011). It is not surprising therefore that in the energy economics literature there is a plethora of empirical studies examining the issue of modeling movements and risk management. Because, Modeling and forecasting energy movements are important inputs into macro-econometric models, option pricing formulas, and portfolio selection models (Kang et al., 2009).

Crude oil as one of the main sources of energy is also the main source of income for members of OPEC. This is most noticeable in Iran because income obtained from oil and gas comprises about 60 percent of the Iranian government's revenues and 90 percent of its export earnings (Farzanegan, 2011). Therefore, volatilities in oil price has an important role in creating economic fluctuations in oil-producing countries including Iran (MehrAra and Niki Oskuyi, 2006). The reason might be the high sensitivity of oil price to political, economic and cultural issues worldwide and consequently its volatility on the one hand, and the high influence of the volatile prices on macroeconomic variables (Kang et al., 2011). This is the reason why the Iranian economy is always exposed to receiving blows from foreign currency income and the danger of sudden changes in oil revenues. The continuous and lasting effect of this process on Iran's economy especially during the recent years calls for a pressing need to make correct decisions in macroeconomic policies. Therefore, the dependence of Iran's economy on revenues from selling fossil resources and the instability caused by their price volatility has made Iran prioritize non-oil exports (Mehrara and Mohaghegh, 2012). A remarkable portion of Iran's non-oil exports include petrochemical products; methanol is one of the important petrochemical products. Furthermore, the relative advantage of producing and exporting petrochemical products, i.e., in its potential for creating jobs and increasing current earnings, can mitigate the negative effects of oil shocks (Mehrara and Oskui, 2007) .

After Oil, natural gas as the Main feedstock of petrochemical products is the second energy resource in the world. Today it has a particular advantage over other energy carriers especially in terms of environmental factors. Changes in demand for energy during the last few decades from fossil fuels to fuels with low carbon such as petrochemical products confirm this fact (Masih et al., 2010a). Accordingly, during the recent years, the need for energy has changed from wood to coal and from coal to oil and currently to natural gas (methane with 65 percent carbon). In line with this process, the share of natural gas as a fuel is increasing. In fact, natural gas produces 24 percent lower pollution compared to crude oil and 42 percent lower than coal. This indicates that we can consume more energy and produce a lower level of pollution compared to crude oil and coal (Komijani et al., 2013). Natural gas is not only a huge and almost clean energy resource but also a cheap one. Furthermore, the international attempt to decrease greenhouse gases and CO2 clearly shows the advantage of natural gas over other fuels. There is evidence to show that an increase in consuming this commodity in 1990s among European countries (30 percent in Germany, 50 percent in Italy, and 100 percent in England) led to a decrease in production of CO2. In addition, due to its relation with other economic institutions (especially in petrochemical industries or final products) and sections, natural gas has a considerable role in the process of making economic decisions and meeting developmental goals of the countries (Schroder et al. (2011), Olivier et al. (2012)).

The importance of natural gas is not just due to its value as a fuel or its cleanness. Gas is, in fact, the most important raw material for different industries especially the petrochemical industry. One of the most important features of the petrochemical industry which is based on gas materials is its very high added value in the sense that with chemical and physical changes in oil and gas hydrocarbons, the value of their products can be increased about 10 to 15 percent (Lissek and Muller, 2012). Another feature of this industry is its high variety and its potential for providing raw materials for thousands of manufactories and factories in its downstream industries which plays an influential role in the economy of a country in terms of creating jobs and increasing current earnings and reducing dependence .

Methanol is one of the three important products of petrochemical industries in the world and it has many derivatives such as MTBE, DME, Acetic acid, Resins, polyamides, Formaldehyde, solvents, adhesives, anti-ices, toxins and pesticides (Masih et al., 2010b). Therefore, this industry as one of the best alternatives for increasing exports plays a very significant role in improving and promoting economy, localizing technology and developing side industries. Considering the important role of this industry, improving the level of productions and promoting exports of this commodity can help to increase currency earnings, improve economic growth, and decrease rate of unemployment.

Considering the potential effects of Methanol price on Iran economy, this paper studies the relationship between methanol and Iran heavy crude oil price. To do so, two broadly used econometric models, Vector Autoregressive (VAR) and Vector Error Correction

Model (VECM), are applied to analyze this relationship based on the weekly data from 18 Jan. 2009 to 18 Sep. 2011. The remaining part of this paper is organized as follows; section 2, briefly reviewing previous papers which have studied this subject matter, refers to some theoretical basis for the relationship between oil and methanol prices. Section 3 introduces the data and explains the empirical findings of this study and eventually, section 4 proposes some policy implication and conclusions.

2. Natural Gas, Crude Oil Price and Methanol Price

Though all kinds of energy are essential inputs for production processes; crude oil and natural gas play a distinguishable role. Oil price whether as an important manufacturing input -for energy importers- or a valuable source of income –for energy exporters- has significant effects on the macroeconomic situation in almost all countries. In particular, oil price not only affects major economic indicators i.e. GDP, unemployment and exchange rate but also has direct and indirect impacts on its rare alternatives like gas (Ji, 2011). Various dependant downstream industries, increasing demand for energy (caused by both rapid population and economic growth rate) as well as technological limits has made oil a strategic substance which hardly can be substituted. As Bachmeier and Grifen (2006) argue, the only substance that may replace oil in the modern economies is natural gas because it not only is more productive but environmentally speaking is less polluting than oil. However, in addition to its applications as a fossil fuel, several petrochemical -including methanol- are derived from natural gas. And more interestingly, the majority of the economic value is related to the role natural gas plays in petrochemicals industry (Liu et al., 2011.(

In comparison with other industrial petrochemical products, the very simple chemical structure and its application in producing a great number of goods have made methanol an important product. Though natural gas is the main source for producing methanol, it can be produced from other substances such as wood, crude oil, coal and carbon dioxide. Therefore, considering the global concerns about carbon dioxide emissions, developing CO2-based methanol production technologies is a potential solution for improving environmental quality (Methanex, 2011 .(

The volume of methanol production doubled in less than 25 years, has increased from 15.9 million tons in 1983 to more than 32 million tons in 2006 (Vora et al., 2009). This demand enlargement proves the rising inclination toward and demand for methanol in the world market. So, determining the factors which affect methanol price has a significant importance. According to Nexant (2009), these factors can be classified to three categories:

Technological Changes

Market Condition

Natural Gas Price (as the main source of methanol)

This paper investigates the relationship between oil price and methanol. So, considering the Nexant (2009) classification, oil through two channels may affect methanol price; market condition and natural gas price.

The first mechanism is elaborately studied in the literature. In fact, numerous researchers have studied the effects of oil price changes on economic activity and discussed the mechanisms through which these effects transmit to other macroeconomic indicators (e.g. Hamilton, 1983, 1996; Pindyck and Rotemberg, 1983; Bernanke et al., 1997; Bernanke, 2004; Devlin and Lewin, 2004; Cologni and Manera, 2007). In addition to these papers which are focused on industrialized oil importing economies, some have studied developing -or recently developed- oil importing countries (e.g. Ziramba, 2010 in South Africa, Bashiri and Manso, 2012 in Portugal, Ghosh, 2011 in India and Ou and et al., 2012 in China) as well as oil exporting countries (e.g. Dibooğlu and Aleisa, 2004 in Saudi Arabia; Mehrara and Oskui, 2007 in four oil exporters; Lescaroux and Migno, 2008 in OPEC members; and Mehrara and Mohaghegh, 2012 in oil exporting countries). All these studies have confirmed that oil price change is an important source of macroeconomic fluctuations both in national and global level. In brief, as He et al. (2010) assert, oil price movements systematically change economic indicators in the world market in both short- and long-run (He et al., 2010). So, evidently oil price affects both supply and demand sides of the methanol world market.

On the other hand, since gas-driven petrochemicals like ethanol and methanol are substitutes for oil-driven fuels such as petroleum and gasoline, there is a mutual relationship between oil price and gas-driven petrochemicals – including methanol. Joets and Mignon (2006) show that oil and gas act as substitutes in the market. Masih et al. (2010a) have investigated the interconnection between oil price and ethylene price in the US and confirmed the existence of such a substitution relationship. Masih et al. (2010b) also, highlight the role of oil price as the major instigator of methanol price movements in Europe, US and Far East. Moreover, some researchers suggest that oil price affect gas price which as a main source for producing methanol affects its price. Stephen et al. (2008) claim that oil price variations are the major source of gas price movements. Highlighting this relationship, Rosthal (2010) confirms that in the US there is a long-run relationship between oil and gas prices. So, we can conclude that oil prices -via affecting natural gas price or by determining the price of its substitutes- has a significant impact on methanol price.

3. Empirical Results

A. Data

In this research Weekly data from the first week of 2005:1 to the third week 2013:5 related to the price of crude oil, natural gas and methanol were used. These data were obtained from the website for U.S. Energy Information Administration (EIA), International Energy Agency (IEA) and Fannavaran Petrochemical Company. It should also be mentioned that the abbreviations for the applied variables in thus study include LOIL representing logarithm of heavy crude oil price, LGAS which represents logarithm of the natural gas price and LMETHANOL which indicates logarithm of the methanol price.

Before going through the different stages of the modeling, in order to avoid creation of a false regression, stationary of the variables of the study should be first considered in the models based on the time series data otherwise the results will not be reliable. Therefore, stationary test was first carried out based on Augment Dickey- Fuller and Philips-Pron tests (see Table 1 for the results).

Table 1: The Study Variables Stationary Tests

Test	Critical Value	Accounting Value	Result
LMETHANOL			
[1]ADF	-1.94	-0.26	Non-Stationary
PP[2]	-1.94	-0.64	Non-Stationary
LOIL			
ADF	-1.94	-1.37	Non-Stationary
PP	-1.94	-1.23	Non-Stationary
LGAS			
ADF	-1.94	-1.02	Non-Stationary
PP	-1.94	-1.06	Non-Stationary

Source: The Finding of the Study

As shown in Table 1, all the research the level of variables is non-stationary based on the ADF and PP tests. Indeed, all these variables are co-integrated with first order (i.e., I(1)) and in order for a correct modeling of the relationship between these models differencing is required because otherwise the results of forecasts will not be reliable. Therefore, considering

[1] Augmented Dicky-fuller Test
[2] Phillips-Perron Test

the performance of different models of the time series is influenced depending on the different data, before doing anything the descriptive statistics related to differencing the dependent variable, as shown in Table 2, will be examined.

Table 2 reports the descriptive statistics for logarithm of oil, gas and methanol prices series. According to Jardue-Bera statistics for normality test, the all variables series is normally distributed in the sample period in 98% level of the significance. Besides, the correlation coefficient between oil and methanol is equal 0.82 that suggests a strong positive interconnection between these two varibles. Also, the correlation coefficient between gas and methanol is equal 0.56, that shows positive interconnection the same as oil price.

Table 2. Descriptive Statistics

	Oil Price	Methanol Price	Gas Price
Number of Obs.	439		
Mean	55.24	30.35	6.24
Median	54.00	27.50	5.96
Maximum	132.73	60.00	14.49
Minimum	20.86	16.25	2.18
Standard Deviation	24.37	17.07	0.39
Skewness	0.67	0.16	0.18
Kurtosis	3.14	2.94	2.89
Jarque-Bera (P-value)	0.78 (0.42)	0.64 (0.54)	0.56 (0.67)
Correlation	Oil & Methanol	0.82	
	GAS & Methanol	0.56	

Source: The Finding of the Study

B. Econometric Model

To reach our goals in this study, we have used the Vector Error Correction Model (VECM). This model, assuming a static long-run equilibrium, investigates the reactions of the model into short-run shocks which detour the model from its long-run path. VECM is a combination of Vector Autoregressive (VAR) model and the dynamic Error Correction Model (ECM). To estimate such a model, the numbers of lags included, stationarity of the time series and the result of the co-integration tests are of crucial importance. Eq. (1) shows the general specification of VECMs.

$$\Delta X_t = C + \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1} \Delta X_{t-(k-1)} + \Pi X_{t-1} + e_t \tag{1}$$

In this study, X_t is a 3×1 vector consisted of logarithm of Iran's methanol, heavy oil prices and natural gas price and X_{t-1} stands for error correction term which indicates the deviation from long-run equilibrium. In the first step, using ADF unit root test, the stationarity of the series (after log transformation) were examined. The result which are reported in Table 1, prove that all series are integrated of order one (I(1)). Econometric theory asserts that for non-stationary series, traditional regression analysis is not necessarily valid. To verify the existence of long-run relationship between non-stationary variables, co-integration tests are applied. In this study we implement Johansen-Juselius co-integration test. Since this test is sensitive to the number of lags assigned to the VAR specification, in the next step using information criteria, optimal lag length is estimated[1]. The Schwarz-Bayesian Information Criteria (SBIC) suggests 2 as the best lag length for our estimation.

Table 3. Johansen-Juselius Co-integration test

Null Hyp.	Maximum Eigen value Test			Trace Test		
	Stat.	**Critical value**	**P- value**	**Stat.**	**Critical Value**	**P-Value**
r = 0	23.85	21.13	0.02	34.76	29.79	0.01
r ≤1	8.99	14.26	0.29	10.91	15.49	0.22
r ≤2	1.91	3.84	0.16	1.91	3.84	0.16

Source: The Finding of the Study

Table 3 reports the results of Johansen-Juselius Co-integration test based on maximum eigenvalue and trace test statistics. As seen in the Table 3, both tests significance approve the existence of a long-run equilibrium between methanol, oil and gas prices in 99% of. Table 4 reports this equilibrium equation and the estimated VECM. As seen, the long-run coefficient of oil and gas prices on methanol price is positive and significant.

Table 4. Estimated Models

Equilibrium Equation: LMET(-1) = 5.4 + 0.95 LOIL(-1)+0.64LGAS t-stat: (7.43) (5.36)									
Variables	**D(LMETHANOL)**			**D(LOIL)**			**D(LGAS)**		
Satistics	**Coef.**	**t-stat.**	**P-Value**	**Coef.**	**t-stat.**	**P-Value**	**Coef.**	**t-stat.**	**P-Value**
C	0.009	5.47	0.000	0.002	2.09	0.045	0.004	2.11	0.043

1. In Addition, to estimate VAR/VECM model, we need this optimal lag length.

D(LMETHANOL (-1))	0.38	8.37	0.000	0.05	0.97	0.249	0.07	1.05	0.229
D(LOIL (-1))	0.17	0.44	0.362	0.76	4.85	0.000	0.72	3.68	0.001
D(LGAS (-1))	0.09	0.34	0.376	0.17	2.71	0.010	0.88	4.42	0.000
ECT(-1)	-0.11	-3.76	0.000	0.01	0.59	0.335	0.03	0.66	0.321
Log likelihood	833.114			748.126			675.283		
Normality	0.574 (0.69)			0.261 (0.97)			0.633 (0.58)		
Schwarz criteria	-3.74			-3.35			-3.12		
White test	4.371 (0.237)								

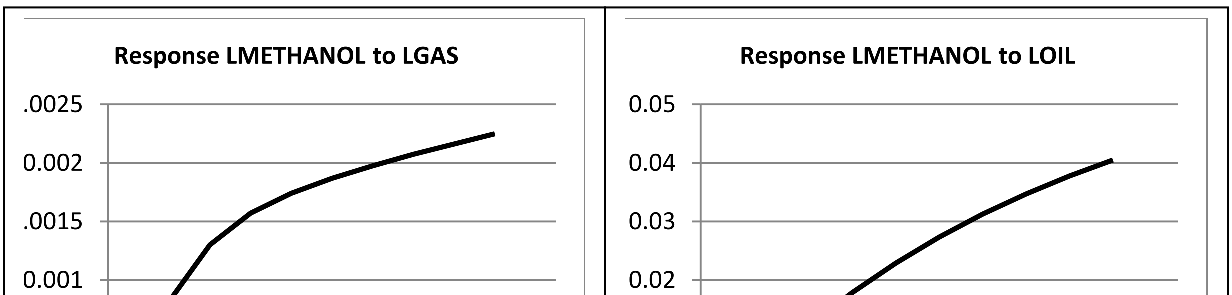
Source: The Finding of the Study

Following these findings, the normalized equilibrium equation is estimated. As Table 4 reports, the estimated long-run elasticity of methanol price with respect to oil and gas prices are significant and their numeric value of 0.95 in line with theoretical expectations, suggests that any increase in oil and gas prices lead to proportionate increase in methanol price.

On the other hand, according to short-run VECM model estimations, oil and gas prices effect on methanol price in short-run are not significant. Besides, the coefficient of error correction term significantly equals -0.11 which approves that if any shock detours methanol price from its equilibrium path, damping approximately 10 percents of the deviation, in long-run, methanol price returns to its equilibrium path. Moreover, in short-run, methanol price, expectedly, does not have any significant impact on oil and gas prices.

In the final step, to study the dynamics of the effects of oil and gas prices shocks on methanol price, we have used Impulse Response Function (IRF) Analysis. Figure 1 depicts the Impulse Response Function of methanol price to one generalized standard deviation shock in oil and also gas prices. Takaendesa (2006) specifies that if IRF of a variable to an exogenous variable's shock is strictly increasing (or decreasing), one can conclude that such a shock has permanent effects on endogenous variable. Knowing this, we can say that according to Figure 1, a positive oil and gas prices shock, though in short-run do not affect methanol price, after one period, leads to long-lasting increase in methanol price. This finding, in line with estimation results, suggests that, only in long-run, oil and gas shocks effects on methanol price will be significant.

Figure 1. IRF of methanol price to oil and gas prices shock



Source: The Finding of the Study

4. Conclusion

This paper, using the weekly data of oil and methanol from the first week of 2005:1 to the third week 2013:5 in a VECM framework, studied the dynamic short-run and long-run effects of Iran's heavy crude oil and natural gas prices on methanol price in Iran. ADF unit root test result showed that (logarithm of) the mentioned variables have unit root in the level but after first differencing all become stationary. So, the Johansen-Juselius Co-integration test was applied. The result approved the existence of one equilibrium equation in 99 % of significance. The normalized long-run equation confirmed that expectedly, there is a significant positive relationship between crude oil natural gas and methanol prices such that if one percent increase in oil price, ceteris paribus, leads to approximately 0.95 percent increase in methanol price and it is 0.64 for the long-run effect of gas price on dependent variable. This implies that an increase in crude oil price has more effects on methanol price compared to when there is a rise in the price of natural gas. The reason can be sought in the price setting structure of these two products, i.e., crude oil and natural gas; the previous is determined in the competitive markets all over the world and has higher volatilities in response to economic and political issues and international changes; the second, on the other hand, is presented by the Iranian government and as subsides to petrochemical companies and undoubtedly it is less affected by economic events and consequently can be less effects on other related variables.

An overall analysis of the results of this study indicates that there are two reasons for the positive relationship between crude oil and methanol prices; first, an increase in crude oil price leads to an increase in demand for alternative commodities such as natural gas (as the most important Main feedstock of methanol production) which naturally leads to an increase in methanol price (Arman and Aghajari, 2009); Secondly, previous studies have shown that in oil-dependent economies, oil price hikes, usually leads to high inflation rates (e.g. Dibooglu and Aleisa, 2004; Jimenez-Rodriguez and Sanchez, 2005). So, oil price rise via inflation, increases the production costs and results in higher methanol prices.

Besides, the estimated VEC models suggested that oil, gas and methanol prices, in short-run, do not significantly affect each other while analyzing the coefficients of error correction terms in two possible ECMs proved that methanol price, if being deviated by any oil and gas shocks from their equilibrium path, will return to their equilibrium value, roughly, after 9 periods. Moreover, IRFs of methanol price to oil and gas shocks, confirming these findings, showed that a positive oil and gas prices shocks, having no effect in the first period, leads to permanent increase in methanol price.

Another interesting finding of this study is that though oil and gas prices in long-run, in spite of short-run, significantly affect methanol price. To explain the reason why there is such a considerable difference between various times spans, one can refer to some facts. Firstly, it should be noted that though petrochemicals, in essence, are substitutes for oil; due to technological limits, replacing oil with such chemical substances, in practice, in short-run, is impossible. So, oil price hike, in first year, does not increase the demand for methanol while in long-run, does. Secondly, as stated in the paper, market situation is one of the channels through which oil affects methanol price. This process, as explained in section 2 of the paper, takes time and postpones these impacts to long-run.

Based on the results, although petrochemical products can replace oil products, due to lack of appropriate infrastructures for using these products (as a production factor) and the fact that making the required technological changes is not cost-effective, they will replace oil products with an increase in oil price (which is possible in the long term). Furthermore, as the price of natural gas which is used as Main feedstock of petrochemical products is reduced as the result of subsides in Iran, the claim about the susceptibility of methanol price to changes in crude oil price through the channel of natural gas seems illogical. Therefore, considering the explanations about the channels of influence of changes in oil price on the methanol price in the theoretical background changes in crude oil price through the channels of market and changes in the price of production factors will influence methanol price and considering the time consuming nature of this influencing process, it can be found that the findings of this study in terms of the lasting nature of the effects of shocks from the research variables (crude oil and natural gas) on methanol price and the existence of a strongly significant relationship between these variables in the long term are totally consistent with the reality.

As petrochemical products form the major part of Iran’s non-oil exports and because methanol is one of the most important petrochemical products in Iran, an increase in the crude oil and natural gas prices lead to an increase in methanol price and consequently a decrease in Iran’s non-oil exports based on the findings; therefore, under such conditions due to movement in the price of crude oil and natural gas and consequently instability of Iran’s oil revenues, the stability of foreign exchange earnings from methanol as one of non-oil export items will be threatened. This situation will mitigate and reduce the consequences and risks of macroeconomic decisions in Iran.

Furthermore, as a policy implication, co-movement of oil price and methanol price can be used as a way to reduce Iran’s export income. When oil price hikes, methanol price also hikes; then the volume of methanol exports which is one of the most important non-oil exports of Iran, decreases. On the other side, when oil price decreases, though the methanol price decreases, too; since oil exports are limited by international agreements, Iran can earn more money by increasing the volume of its methanol exports. In sum, increasing the share of methanol exports can hedge Iran’s income volatility.

It should be noted that in the time period under investigation in this study, the price of natural gas used for methanol production was subsidized; therefore, by enacting the law of targeting subsidies and removing subsides for energy carriers, changes in oil price can be expected to influence the price of methanol through the channel of natural gas. Therefore, as a suggestion the results of this study can be reanalyzed after enacting the law of targeting subsides.

References

1. Arman, A., Aghajari, J., (2009), "Oil Revenue, Inflation and Growth in Iran: A Pre-Exchange Rate Reform Examination of Dutch Disease", Quarterly Journal of Quantitative Economics, Vol. 6, No. 2, PP. 37–62.

2. Bachmeier, L.J., Grin, J.M., (2006), "Testing For Market Integration: Crude Oil, Coal, and Natural Gas", The Energy Journal, Vol. 27, No. 2, PP. 55-72.

3. Bashiri Behmiri, N., Manso, J.R.P., (2012), "Does Portuguese Economy Support Crude Oil Conservation Hypothesis?", Energy Policy, Vol. 45, PP. 628-634.

4. Bernanke, B.S., (2004), "Oil and the Economy Remarks at the Distinguished Series", Darton College, Albany, Georgia.

5. Bernanke, B.S., Gertler, M., Watson, M., (1997), "Systematic monetary policy and the effects of oil price shocks", Brookings Papers on Economic Activity 1, 91–142.

6. Cheong, C.W., (2009), "Modeling And Forecasting Crude Oil Markets Using ARCH-Type Models", Energy Policy, No. 37, PP. 2346–2355.

7. Cologni, A., Manera, M., (2007), "Oil Prices, Inflation and Interest Rates in a Structural Cointegrated VAR Model for the G-7 Countries", Energy Economics, Vol. 30, PP. 856–888.

8. Devlin, J., Lewin, M., (2004), "Managing Oil Booms and Busts in Developing Countries", Draft Chapter for Managing Volatility and Crises, A Practitioner's Guide.

9. Dibooglu, S., Aleisa, E., (2004), "Oil Prices, Terms of Trade Shocks, and Macroeconomic Fluctuations in Saudi Arabia", Contemporary Economic Policy, Vol. 22, No. 1, PP. 50-62.

10. Farzanegan, M.R., (2011), "Oil Revenue Shocks and Government Spending Behavior in Iran", Energy Economics, Vol. 33, PP. 1055–1069.

11. Ghosh, S., (2011), "Examining Crude Oil Price–Exchange Rate Nexus for India during the Period of Extreme Oil Price Volatility", Applied Energy, Vol. 88, Issue. 5, PP. 1886-1889.

12. Hamilton, J.D., (1983), "Oil and the Macro-Economy since World War II", Journal of Political Economy, Vol. 91, PP. 228–248.

13. Hamilton, J.D., (1996), "This is What Happened to the Oil Price Macro-Economy Relationship", Journal of Monetary Economics, Vol. 38, PP. 215–220.

14. He, Y., Wang, SH., Lai, K.K., (2010), "Global economic activity and crude oil prices: A cointegration analysis", Energy Economics, Vol. 32. No. 4, PP. 868-876.

15. Ji, Q., (2011), "System Analysis Approach for the Identification of Factors Driving Crude Oil Prices", Computers & Industrial Engineering, In Press, Corrected Proof, Available Online.

16. Jimenez-Rodriguez, R., Sanchez, M., (2005), "Oil Price Shocks and Real GDP Growth: Empirical Evidence for Some OECD Countries", Applied Economics, Vol. 37, PP. 201–228.

17. Joets, M, Mignon, V., (2011), "On the Link between forward Energy Prices: A Nonlinear Panel Cointegration Approach", Universities De Paris Ouest Nanterre La Defense, No. 7235, PP. 1-16.

18. Kang, S.H., Cheong, C., Yoon, S.M., (2011), "Structural Changes and Volatility Transmission in Crude Oil Markets", Physica A, Vol. 390, PP. 4317–4324.

19. Kang, S.H., Kang, S.M., Yoon, S.M., (2009), "Forecasting Volatility of Crude Oil Markets", Energy Economics, Vol. 31, PP. 119–125.

20. Komijani, A., Alikhani, N.G., Naderi, E., (2013), "The Long-Run and Short-Run Effects of Crude Oil Price on Methanol Market in Iran", International Journal of Energy Economics and Policy, Vol. 3, No. 1, PP. 43-50.

21. Lescaroux, F., Mignon, V., (2008), "On the Influence of Oil Prices on Economic Activity and other Macro-economic and Financial Variables", OPEC Energy Review, Vol. 32, No. 4, PP. 343-380.

22. Lissek, U., Muller, J., (2012), "The Benefits of Natural Gas", Nord Stream (The new gas supply route for Europe) Working Paper, December, PP. 1-5.

23. Liu, G., Williams, R.H., Larson, E.D., Kreutz, T.G., (2011), "Design/Economics of Low-Carbon Power Generation from Natural Gas and Biomass with Synthetic Fuels Co-Production", Energy Procedia, Vol. 4, PP. 1989-1996.

24. Masih, M., Algahtani, I., Demello, L., (2010 A), "Price Dynamics of Crude Oil and the Regional Ethylene Markets", Energy Economics, Vol. 38, PP. 1435-1444.

25. Masih, M., Albinali, K., Demello, L., (2010 B), "Price Dynamics of Natural Gas and the Regional Methanol Markets", Energy Policy, Vol 38, PP. 1372–1378.

26. Mehrara, M., Oskoui, N.K., (2007), "The sources of macroeconomic fluctuations in oil exporting countries: A comparative study", Economic Modeling, Vol. 24, PP. 365–379.

27. Mehrara, M., Mohaghegh, M., (2012), "Macro-economic Dynamics in the Oil Exporting Countries: A Panel VAR study", International Journal of Business and Social Science, Vol. 2, No. 21, PP. 288-295.

28. Methanex, November (2011), Methanex Investor Presentation, A Responsible Care Company.

29. Mostafaei. H & Sakhabakhsh. L., (2011), "Modeling and Forecasting of OPEC Oil Prices with ARFIMA Model", International Journal of Academic Research Vol. 3. No.1, Part Iii.

30. Nexant, November (2009), Methanol Strategic Business Analysis, Chemsystems.

31. Nomikos, N.K., Pouliasis, P.K., (2011), "Forecasting petroleum futures markets volatility: The role of regimes and market conditions", Energy Economics, Vol. 33, PP. 321–337.

32. Olivier, J.G.J. Janssens-Maenhout, G., Peters, J.A.H.W., (2012), "Trends in Global CO2 Emissions", PBL Netherlands Environmental Assessment Agency, No. (500114022), PP. 6-39.

33. Ou, B., Zhang, X., Wang, Sh., (2012), "How Does China's Macro-Economy Response to the World Crude Oil Price Shock: A Structural Dynamic Factor Model Approach", Computers & Industrial Engineering, In Press, Accepted Manuscript, Available Online.

34. Pindyck, R.S., Rotemberg, J.J., (1983), "Dynamic Factor Demands and the Effects of Energy Price Shocks", American Economic Review, Vol. 73, PP. 1066–1079.

35. Rosthal. J. E., (2010), "The Relationship between Crude Oil and Natural Gas Prices and Its Effect on Demand", A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy.

36. Schroder, M., Ekins, P., Power, A., Zulauf, M., Lowe, R., (2011), "The Kfw Experience In The Reduction Of Energy Use In And Co2 Emissions From Buildings: Operation, Impacts And Lessons For The Uk", Ucl Energy Institute And Lse Housing And Communities Working Paper, November, PP. 1-77.

37. Stephen P.A., Brown, M., Yucel, K., (2008), "What Drives Natural Gas Prices?", The Energy Journal, Vol. 29, No. 2, PP. 43-58.

38. Takaendesa, P., (2006), "The Behavior and Fundamental Determinants of The Real Exchange Rate in South Africa", Rhodes University, Masters in Commerce (Financial Markets).

39. Vora, B., Chen, J.Q., Bozzano, A., Glover, B., Barger, P., (2009), "Various Routes to Methane Utilization—Sapo-34 Catalysis Offers the Best Option", Catalysis Today, Vol. 141, PP. 77–83.

40. Ziramba, E., (2010), "Price and Income Elasticities of Crude Oil Import Demand in South Africa: A Cointegration Analysis", Energy Policy, Vol. 38, Issue. 12, PP. 7844-7849.