World Journal of Social Sciences
Vol. 3. No. 1. January 2013 Issue. Pp. 109 – 118

How Crude Oil Price is Formed: Exploration, Production, Refining and Sale

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The liberal market economy would not have reached today's level without a strong incentive for development. During the last century the oil industry has become the foothold fuelling market with oil commodities for trading which turned out to be a highly demanded product as industrial revolution proceeded into new phase requiring more energy. Oil as hydrocarbon is not found everywhere and therefore its movement around the globe became business with vast amount of financial flow. This paper is reviewing and assessing the price formation mechanism for crude oil. It is illustrated that the crude oil price is not reflecting either cost of production or cost of refining, the speculative activity in this sphere of economy established unfair market conditions redirecting the price formation from the basic market principle based on supply and demand conception. It is therefore the task for world wide energy institutions, government bodies and big business players to establish market with fair price for crude oil which is considering cost of production and further processing.

Field of Research: Crude oil price formation on the basis of production and refining cost

1. Introduction

The oil business is one of the biggest markets in the world where 160 countries are executing trading everyday. There are 45 crude oil exporting countries and 145 importing this vital energy commodity (Smil 2005). The price of crude oil is the major driver of GDP whereas it is calculated that 10 per cent adjustment of price of oil may at the end lead to change in GDP between 2 to 6 per cents. It must also be underlined that 66 per cent of world energy generation depends on crude oil and therefore price fluctuation in this instance has tremendous importance for national governments and for economic performance overall (Movagharnejad 2011). The scale of significance of this industrial sector grows since the speculative activity in the market begins to impact on price formation. It is demonstrated by Blas (2011) that interests for 'put options' (setting minimum sale price of crude oil) at price 45-60 US dollars rose in December 2011 by 33 per cent as risk reduction measure taken by major market players in NYMEX.

It is the fact that any price movement of oil has noteworthy impact on economic activities whereas government subsidies in many countries directly impact on consumer market and thus inflation, interest rate and unemployment. The empirical analysis provided by Wu and Ni (2011) highlight direct connection between price of oil with monetary policies of national governments setting interest rates which are reflected in inflationary pressure and rate of unemployment.

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This paper is reviewing and estimating impact of oil price fluctuations on economic indicators of countries with particular attention to GDP, inflation and unemployment rate. The analysis follows with study of cost formation of crude oil from the moment of exploration and continues with indication of cost of refining process. This research concludes that oil price fluctuations are the result of trading activity at commodity exchanges directly putting financial burden on different economies both on exporting and importing crude oil countries. The price is impacting on major economic indicators whilst cost of oil production and refining has not been changing at the time when price of oil fluctuated between 30 and 140 US dollars during financial crisis.

2. Literature Review

It is basically recognized fact that the oil industry is to certain extent a balanced market among countries exporting crude oil and those that are importing it. According to latest research results studying reserve/production ratio, it is estimated that globally, there is enough oil for the next forty years whereas currently physical supply meets existing demand (Spill 2011). On the basis of this conception, it is perceived that the price of crude oil and economies of different countries are reflecting the existing balance of the market and therefore the price around 100 US dollars per barrel is believed to be true market price. According to some estimations the world's largest crude oil exporter, Saudi Arabia, needs the price of oil to settle at level no less than 74 US dollars per barrel so that to sustain economic growth and cover social programme obligation (Al-Rikabi 2011). However, there are very specific characteristics of the market which should also be taken into account before making conclusions regarding truthfulness of the price.

As it is stated by Green (1976) even oil exporting countries which are taking advantage of high price must be divided into two categories. There must be made gradation for those countries that are totally dependent on oil revenue for economic growth and those which actually may allow themselves to release its dependence on petrodollars and therefore countries such as Iran or Venezuela due to their political conditions are sometimes excluded from the list of reliable oil supplying countries. Meanwhile, it is argued that once these countries become more liberalized or in another words more market oriented the price of oil shall automatically fall since there will be more competition in the market. However, this analysis does not take into account such fact as oil reserves that may bring into the market more than 2 million barrels per day and Saudi Arabia is playing the role of such reserve supplier in the market. During the shortage period of crude oil because of Syria uprising and Libyan civil war in 2011 and 2012, Saudi Arabia was the only OPEC member that increased the production rate to cover the gap between of physical supply and demand in the market. It is worth mentioning that despite seemingly positive development tendency in Iraq, the absence of oil law protecting investments and guaranteeing return of capital, the full scale expansion of the industry is limited due to lack of lawfully protective measures (The Economist 2009). Thus, the classification of two types crude oil export countries is not reflecting actual reality and balance of power in world oil market. First of all, countries supplying crude are often making politically motivated decisions, oppose to liberal market economy principles. Secondly, there is enough oil to drop into the market to reduce price. Finally, political or military turbulences occurring in oil exporting countries significantly affect market in terms of supply. In the frame of analysis of economic sectors impacted by volatile crude oil prices, there shall be made research of effect on

economic growth, unemployment and inflation rates. These there fundamental market indicators are demonstrating the extent of impact of crude oil price movement on economies and businesses. It must be noticed that the higher this effect is estimated, the stronger would be the case for fundamental change in price formation of crude oil.

3. Methodology

The topic of examination is quite broad and there significant amount of academic work studying the crude oil industry from different perspectives. There are three main areas (upstream, midstream and downstream) in this field which covers the process from the point of exploration and finishing the cycle with the sale of petroleum products to end user. Although, there were some studies in each of these areas, there are only few numerical analyses in relation to price formation of oil and its derivates in the market. This paper is relying on empirical evidence highlighting the scheme of oil movement in a complicated system of crude oil processing pointing out the price formation at every stage of the process. Oil price fluctuation studied by Ozbek and Ozlale (2010) conclude that the price formation and unpredictability of price movements is the reflection of stochastic changes in the market. Furthermore, it is argued that neither demand for oil nor for petroleum products is actually driving market prices. The basis for this argument lies in 2008-2010 sharp changes in the market when price fell down from 140 US dollars to less than 30 US dollars per barrel whereas the demand for crude oil has not been changing. Following this basic conception, it is demonstrated and stressed in this paper that price fluctuation in the market does not indeed based on cost-price relationship model, the market reflects the price of oil which is the result of speculative trading. The major focus point of this study would be the economic performance of the US as true indicator of impact of oil prices movement.

4. Why Crude Oil Price is Important?

Economic Growth

Rising cost of energy sources and crude oil in particular puts great financial burden on consumers through every service sector as all of them are energy dependant. In this regard, it would be relevant to look through the US market where mounting price of oil raised the debt of the US from 1.7 per cent GDP in 1981 to 2.8 per cent by 2002 (Leeb & Leeb 2004). It is stated by Farlow (2005) that fiscal excess existed during pre-Bush period of 2.4 per cent of GDP in relatively short period of time turned to be 5 per cent deficit of GDP. This tendency might be observed in the US mortgage market where debts were rising at the time of economic stagnation period of the country. In the beginning of 1970s the mortgage debts were estimated to be around 298 billion US dollars whereas in 2002 this number reached 6 trillion US dollars. It is shown by Leeb and Leeb (2004) that the beginning of market decline from 2000 led to 7 trillion US dollars losses in housing market. One of the important characteristics of the US housing market is that buying house is not a simple purchase, it is an investment and therefore the system, the business cycle, begins working from the moment of its sale. When interest rate is low, the real estate is becoming more affordable keeping the market alive assuming that economic growth would be secured. However, it is the fact that once buyers are not able to pay for their homes, the debts are began growing. All these discussions around real estate market are basically linked to energy market, import/export capabilities, tax regulations, etc. It is calculated that since 2006 the price of real estate in the US fell by more than 36 per cent whereas 2.9 million houses

received closure notices within 2011 alone. Furthermore, the rising energy cost means that householders shall be left with no option, but to cut its expenditures. Adding high rate of unemployment along with gloomy economic outlook of the US, it is predicted that with high oil prices real estate market does not have a potential for development neither in short or mid-term future (Alden, 2011). Considering the fact that almost 5 per cent in GDP of the US consists of construction sector, it is not surprising that falling activity in this segment of economy has led to decline GDP growth. According to FOMC (Federal Open Market Committie) the GDP of the US fell from 4 percent growth in 2007 to minus 1 per cent a year later (Economic Projection FOMC 2012). Thus, it should be noticed that it was the rising price of oil to 140 US dollars per barrel in 2008 that had devastating effect on GDP of the US through falling economic activity in housing and construction sector.

Unemployment

There were several very significant events within last several decades, two oil crises, establishment of OPEC, fall of USSR, etc. All these events had global and very strong impact on economies, especially the US as major economic super power of the world. According to Uri (1996) there is direct linkage between oil price movement and rising unemployment rate throughout this period of time. However, this connection does not seem to be obvious as per quantitative analysis since the price of crude oil rose by 1,54 per cent on annual basis unemployment rose only by 0.0078 per cent. Based on this stand, it might also be concluded that falling oil price shall not lead to growth in unemployment rate. However, neither rapidly growing nor falling oil prices will stimulate economic growth and therefore unemployment shall go up as it was during financial crises of 2008 when it increased from 4 per cent in 2007 to 10 per cent in 2010 in the US (Economic Projection FOMC 2012). The same is observed in the EU where the unemployment rate stands now at its highest level for the last ten years of 10.4 per cent of total labour force which equals to almost entire Holland population of 16.5 million people (Pignal 2012). There is no clear evidence that level of unemployment directly depends on crude oil price, however, it is the level of economic activity securing high employment level. It is therefore vital in the first instance to sustain economic growth at the time of fluctuating crude oil prices.

Inflation

This part analyzes the rising cost of living since it is stressed by Leeb and Leeb (2004) that the major effects of rising cost of oil is observed in inflation indicators. It is a constant problem for all countries when prices are soaring up whereas this tendency in the US is linked with rising energy and oil prices. It is believed that breakeven point for inflation rising at the rate of more than two per cent yearly, would be raising price of oil higher than 89 US dollars per barrel (Mackienze 2012). The only positive effect from financial crises of 2008 was constantly low rate of inflation observed in the US. The inflation rate went down from 3 per cent in 2007 to 1,5 per cent by 2009 (Economic Projection FOMC 2012) However, it should also be added that inflationary pressure is not always associated with oil prices, rising prices in China standing at the level of 6.5 per cent per annum, for example, is explained to be the result of food shortages rather than energy sector negative impact (Anderlini 2011). So, inflation is not direct result of rising crude oil prices, although, it must be stressed that price of this commodity consequently leads to rising price of dependant and related industries, such as transportation.

So, it seems that the price of crude oil has an impact on economic growth, unemployment rate and inflation which are mirroring economic performance of the country. On the basis of this analysis, it might be concluded that any dramatic shifts in crude oil price that regularly occurs in the market is leading to negative economic outcomes. The growing rate of unemployment, rising prices of goods and services and as a consequent of these outcomes, slow economic growth is the result of drastic changes in oil prices. The next part is covering the sequence of actions that actually must form the price of crude oil.

5. Cost of Exploration and Production

It is the basic law of economics when demand is growing and supply is going down, the price shall inevitably rise. However, there are specific certain characteristics of oil market where balance of supply and demand is very vulnerable and even slight changes might be hitting the market price at the pace higher than it occurs in other industries. One of widely discussed topics in the oil industry is the theory that the production shall sometime (if not yet) reach the point when it shall not be capable of producing more oil. This theory was grounded by King Hubbert who put forward the idea in 1956 which was later called 'Hubbert Peak theory'. It is argued by Deffeyes (2008) that this 'oil peak' moment has already passed and this theory is supported by dramatic oil price movement in 2008 when it reached all time high of 140 US dollars per barrel and further fell in a few month to the level of 30 US dollars per barrel. It was observed that while the price fluctuated so drastically, there were not any shifts in global production. Another fact supporting the argument of ‘peak oil’ conception is that oil sources are getting depleted. However, it is worth mentioning fact that subject to changes made in geological survey methods, the figure of actual crude oil volume beneath the ground is also constantly changing. Although, it was estimated by Hubbert that in the US there was between 150 and 200 billion barrels of oil, several decades later in 1997 it was announced that the world possess more than 1.8 trillion barrels of oil. However, even though there might be found more oil under the ground, there is no urgent demand for additional volume. Therefore 'peak oil' model is related only to existing production level since no other new resources are either known or is planned for exploration. The methodology of estimation of crude oil reserves presumes that only available for immediate exploration reserves are in this category. This assessment of available sources is always changes due to new discoveries.

The production of crude oil has been rising since the beginning of 1970s when oil business became part of global economy with immense influence on economic performance of different countries. According to BP Statistical Review (The Economist 2011) the daily production rose from 58 million barrels per day in 1985 to 82 million barrels per day in 2010. It should also be underlined that Middle East region still keeps the first place in production with the volume of more than 22 million barrels per day. At the same time, it must be noticed that in Europe (particularly North Sea region) production volume has been falling, it went down from almost 16 million barrels per day in 2005 to 9 million barrels per day by 2010 (Vestifinance 2012).
The price of the crude that is published everyday is assumed to be formed on the basis of cost of production as it happens in every sector of economy. However, the distinctive characteristic of this business sphere is demonstrating that cost of production varies and this is putting the first brick on the ground of inequality between countries exporting or importing crude oil. According to the statistical info from World

Energy Outlook (European Environmental Agency 2012) the cost of production of conventional oil fluctuates between 5 and 40 US dollars per barrel whereas the second biggest oil producer Saudi Arabia spends around 5-6 US dollars for exploration of one barrel. The cost of deriving oil from deep and ultra deep water fields varies between 40 and 60 US dollars whilst production in Alaska costs more than 100 US dollars per barrel.

The price of crude has been fluctuating between 96 and 110 US dollars within last several years whereas the latest maximum was reached in April 2011 when the price was 126 US dollars (Vestifinance 2012a). There has not happened any significant event pushing cost of production higher except certain short term supply disruptions. Thus, oppose to generally accepted rule that the cause of rising price presumes increased cost of production, this has not been observed in crude oil industry business where price moves with no connection to production process. Moreover, as it is quite rightly stated by Deffeyes (2008) simple increase in production would not mean that demand is met. The cost of exploration and production varies whereas the price of crude oil linked with benchmark pricing mechanism is universal for market participants depending on regions (European, the US and Asian).

So, there is enough crude oil to meet the demand globally for this unique energy commodity. In spite of shortages occurring from time to time leading to short price spikes, the market is generally stable. Although, the cost of production varies depending on physical difficulties in exploration process, the cost is not building the price of crude oil. Instead, the price traded in major market exchanges becomes the only reference point for exporters and purchasers of crude oil.

Crude oil itself is not required by any company, organization or any structure since the value for humanity it has only after refining. However, the refining capacities are not estimated for bigger than existing quantities of crude oil. The next part evaluates refining capabilities and its impact on crude oil price formation.

6. Cost of Refining

This industrial sector is characterized with high-volume work and low-margin whilst keeping the role of important segment of the market both for crude oil sellers and petroleum product distributors (The Economist 1997). It is estimated that refinery margin increased very significantly from 1980s when their working efficiency was used only by 78 per cent whereas now this figure equals to 92 per cent (Peterson & Manovski 2003). In another words, refineries are now able to take more products from the same volume of crude oil and thus deriving more profit. The research conducted by Peterson and Manovski (2003) offers for consideration some very fundamental key factors. First of all, based on existing figures of oil supply and demand, population, etc. it is calculated that the biggest economy of the world, the United States has sufficient refinery capacity to sustain itself with petroleum products in the near and even long term future. There are 148 refineries in the US whereas in the UK there are only eleven refineries (The Economist 2011a). It is further concluded that refineries capacity increased lately and therefore even import of oil from outside sources such as Europe, Caribbean, Canada or West African region would not have big impact on supply and production in the US.

It is vital to estimate the cost of production of petroleum products as this cost is included into the final price of petroleum product. The rising or falling price of crude oil does not impact on the cost of refining, it fluctuates only when feedstock material for processing increases. Cohen (2011) shows that only 5 per cent of gasoline price which is equal to 0.14 US dollars calculated based on 2.86 US dollars on average for the US sold in 2010 is actual cost of refining whereas 71 per cent of petrol price is shaped from crude oil price. Further statistical data from 2011 demonstrate that cost of refining reached its maximum of only 10 per cent (0.28 US dollars) from total price of leaded gasoline sold in the US during the same period (Energy Almanac 2012).

The role of refineries in composition of crude oil price and petroleum products is supposed to be the most important since its major factor supposing to form crude oil price in the market. Running refinery is costly project which requires constant financial flow to maintain business successively whereas investments aiming to increase efficiency provide positive results only after certain period of time. The case study of Brazilian refinery which invested 1.3 billion US dollars in upgrading of its facilities demonstrated that it managed to increase efficiency and production of more light products that are valued and demanded higher in the market (Lima & Schaeffer 2011). According to Tavarez et al. (2006), the demand for gasoline and gasoil rose by more than 4 per cent in Brazil since the beginning of 1990s. As a net importer of petroleum products and based on the assumption of constantly rising demand for gasoline, gasoil and jet fuel, the increase in production of these type of products change the budget structure of the country and positively impacted on balance of payments. Moreover, it was estimated that energy consumption at refining dramatically fell reflecting the significance of investment into refining utilities. Further research reveals that since investments were made, the refinery utilization rose sharply in Brazil in comparison with those in the US. According to the statistics provided for the period between 1988 and 2008 the refinery utilization dropped in the US from more than 84 per cent to 78 per cent whereas opposite picture is observed in Brazil where this index rose from 82 per in 1988 cent 86 per cent in 2008 (Lima & Schaeffer 2011). Following the discussion of the refining process as well as the policy adopted in Brazil, it is also worth mentioning another fact concerning CO2 emission regulations. In addition to all those factors regarding increasing efficiency of work of Brazilian refinery, there was also observed reduction in carbon emissions. The characteristic of crude oil with high sulfur content is a challenge for refineries whereas extraction of it from oil is the first task as desulfurization of petroleum products is the requirement imposed by many developed countries including the EU and the US (Szklo 2007).

The refining process is the most complex one presuming to form the price of crude in the market depending on petroleum products demand, cost of refining and efficiency of refining process. Market structure has been changing extensively during last several decades whilst raising demand for light petroleum products. This tendency has led to growing investments into this industrial sector reducing marginal profit in short term. It should be stressed, nevertheless, that the observation of the US market and price formation of gasoline demonstrated that impact of refining cost on final crude oil price is minor. Thus, it must be concluded that refining cost does not have any imperative impact on crude oil price formation. There is no visible connection between crude oil price and cost of refining whilst it was not observed in the past and it is not expected to change in the future considering existing market conditions and principle of crude oil price formation.

7. Conclusion

The price of crude oil cost of production and final price of petroleum products have dramatic impact on living standards, expenditures and certainly to overall economic performance. The changing price of crude oil has considerable effect on economic growth, unemployment and inflation rate. Whilst inflation rate is falling with declining price of oil in the market, increasing rate of unemployment does not have any direct link with oil price volatility in the market. Nevertheless, risk of economic growth is jeopardizing entire economic performance. Stagnation or economic downturn period provoked by high oil prices leads to growing unemployment as well as uncontrollable inflation rate putting pressure of monetary policy of the states.

The analysis conducted in the sphere of crude oil exploration and production showed that cost varies depending on place whereas the cheapest source is Middle East deserts and the most expensive one is in Arctic region. It was highlighted that this cost fluctuates between 40 and 100 US dollars per barrel. The calculation of cost of refining on the basis of the US market figures for unleaded gasoline revealed that 5-10 per cent of the price of petroleum products is the actual cost of refining. The case study showed that this cost equals to 0.14 US cents per barrel whereas 71 per cent of the cost of petrol is formed on crude oil price. Table 1 presents actual petroleum price formation in the market summarizing arguments that crude oil price is not reflecting production and refining cost.

Table 1

<table>
<tr><td rowspan="3">2.81 USD price per gallon gasoline</td><td rowspan="2">71% = 2.03 oil cost</td><td rowspan="3">85.26 barrel price</td><td>Convent oil</td><td>Deepwater oil</td><td>Arctic oil</td><td>Difference</td></tr>
<tr><td rowspan="2">40 USD</td><td rowspan="2">60 USD</td><td rowspan="2">100 USD</td><td rowspan="2">+45.26 and +25.26 ave:35.26</td></tr>
<tr><td>5% = 0.13 refining cost</td></tr>
</table>

According to the figures presented in Table 1 summarizing arguments of this research paper, the crude oil is overpriced in the market by an average of 35.26 US dollars per barrel. The sale price of crude oil is almost twice as much as the cost of production. Moreover, the refining cost keeps the lowest percentage in price formation of petroleum products. Thus, it must be drawn conclusion at this stage that cost of crude processing is not building price of oil. The existing price as well as its fluctuations therefore does not reflect changes in cost, it is the outcome of speculative trading activities.

Whilst neither oil production nor refining cost changes significantly, the price fluctuation occurring in crude oil seriously puts pressure on consumer market consequently increasing risk of economic downturn. There is need for establishment of price settlement mechanism guided by various international institutions so that stabilize market as the market cost of price fluctuation is high since it is reducing economic incentives. The purchase price of crude therefore must be referring to production and refining cost rather than speculative activity or the conception of ‘availability’ in the market.

References

Alden, W 2011, 'Oil prices Raise Cost of Homeownership, Threatening Housing Recovery', *Huff Post Business*. Viewed 16 March 2012, http://www.huffingtonpost.com/2011/03/08/oil-prices-housing-market_n_832973.html

Al-Rikabi, R & Smith, G 2011, 'Oil Trades Near Two-Week High on Speculation U.S. Recovery to Boost Demand', *Bloomberg*. Viewed 16 March 2012, http://www.bloomberg.com/news/2011-12-26/oil-futures-open-at-99-92-a-barrel-24-cents-higher-in-new-york-trading.html

Anderlini, J 2011, 'China Acts After Inflation Rises', *Financial Times*. Viewed 16 March 2012, http://www.ft.com/intl/cms/s/0/69aa5fcc-670d-11e0-8d88-00144feab49a.html#axzz1p7Wzskf5

Blas, J 2011, 'IEA Urges OPEC to Maintain Supplies', *Financial Times*, viewed 16 March 2012, http://www.ft.com/intl/cms/s/0/714eb786-2568-11e1-9c76-00144feabdc0.html#axzz1p7Wzskf5

Chang, Y and Wong, JF 2003, 'Oil price Fluctuations and Singapore Economy', *Energy Policy,* vol. 31. pp. 1151-1165

Cohen, K 2011, 'Gas Prices and Industry Earnings: A few Things to Think About the Next Time You Full Up', *ExxonMobil Perspectives*, Viewed 16 March 2012, http://www.exxonmobilperspectives.com/2011/04/27/gas-prices-and-industry-earnings-a-few-things-to-think-about/.

Deffeyes, KS 2009, *Hubbert's Peak: The Impeding World Oil Shortage,* Oxfordshire, Princeton University Press

Downey, M 2009, *Oil 101.* New York, Wooden Table Press

European Environmental Agency 2012, 'Cost of Oil Production: Production Cost Comparison Between arctic Oil, Deep and Ultra-Deepwater Oil, Heavy Oil and Bitumen, Conventional Oil', *European Environment Agency*, Viewed 16 March 2012 http://www.eea.europa.eu/data-and-maps/figures/cost-of-oil-production.

Energy Almanac 2012, 'Estimated 2012 Gasoline Price Breakdown and Margins Details', *The California Energy Commission*, Viewed 16 March 2012, http://energyalmanac.ca.gov/gasoline/margins/index.php.

Farlow, A 2005, 'UK House Prices, Consumption and GDP, in a Global Context', *The Economist*, Viewed 16 March 2012, http://www.economics.ox.ac.uk/members/andrew.farlow/Farlow%20Housing%20and%20Consumption.pdf.

Federal Open Market Committee 2012, 'Economic Projections of Federal Reserve Board Members and Federal Reserve Bank Presidents', *The Federal Reserve*, Viewed 16 March 2012, http://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20120125.pdf.

Green, EA 1976, 'Can Expanded Exploration Lower Oil Prices?', *Energy,* vol. 1. pp. 25-32.

Leeb, S & Leeb, D 2004, *The Oil Factor: Protect Yourself From Coming Energy Crises.* New York, Warner Business Books.

Lima, RS & Schaeffer, R 2011, 'The Energy Efficiency of Crude Oil Refining in Brazil: A Brazilian Refinery Plant Case', *Energy,* vol. 36. pp. 3101-3112.

Mackenzie, M 2012, 'Oil Fears Hit US inflation Expectations', *Financial Times*, viewed 16 March 2012, http://www.ft.com/intl/cms/s/0/08a3d6dc-621a-11e1-807f-00144feabdc0.html#axzz1p7Wzskf5.

Movagharnejad, K, Mehdizadeh, B, et al. 2011, 'Forecasting the Differences Between Various Commercial Oil Prices in the Persian Gulf Region by Neural Network', *Energy,* vol. 36. pp. 3979-3984.

Ozbek, L & Ozlale, U 2010, 'Analysis of Real Oil Prices Via Trend-Cycle Decomposition', *Energy Policy,* vol. 38. pp. 3676-3683.

Peel, M 2011, 'Saudi Arabia Halts $100bn Oil Expansion Programme', *Financial Times*, viewed 16 March 2012, http://www.ft.com/intl/cms/s/0/967a332a-146d-11e1-8367-00144feabdc0.html.

Peterson, DJ & Mahnovski, S. 2003, *New Forces at Work in Refining: Industry Views of Critical Business and Operations Trend,* Pittsburgh, Rand.

Pignal, S 2012, 'Eurozone Jobless Rate At Euro-Era High', *Financial Times*, viewed 16 March 2012, http://www.ft.com/intl/cms/s/0/dca5fe48-4bf3-11e1-98dd-00144feabdc0.html#axzz1p7Wzskf5.

Smil, V 2011, *Oil.* Oxford, Oneworld

Szklo, A & Schaeffer, R 2007, 'Fuel Specification, Energy Consumption and CO2 Emission in Oil Refineries', *Energy,* vol. 32, pp. 1075-1092

Tavarez, ME, Szklo, A, et al 2006, 'Oil Refining Expansion Criteria for Brazil', *Energy Policy,* vol. 34, pp. 3027-3040

The Economist 1997, 'Oil Refining: Grease is Good', *The Economist*, viewed 16 March 2012, http://www.economist.com/node/149726.

The Economist 2009, 'Iraq's Oil: Crude Calculations', *The Economist*, viewed 16 March 2012, http://www.economist.com/node/15099516.

The Economist 2010, 'Over a Barrel: Brazil's Oil Giant May be Paying Too Much to pump the Stuff', *The Economist*, viewed 16 March 2012, http://www.economist.com/node/16945222.

The Economist 2011, 'Oil Production and Consumption: Running Dry', *The Economist*, viewed 16 March 2012, http://www.economist.com/blogs/dailychart/2011/06/oil-production-and-consumption.

The Economist 2011a, 'Oil Reserves', *The Economist*, viewed 16 March 2012, http://www.economist.com/node/18805887.

The Economist 2011b, 'Oil Prices: Speculators Unburned', *The Economist*, viewed 16 March 2012, http://www.economist.com/blogs/freeexchange/2011/07/oil-prices.

The Economist 2011c, 'Oil Prices: Trading Away Cheaper Petrol', *The Economist*, viewed 16 March 2012, http://www.economist.com/blogs/freeexchange/2011/07/oil-prices-0.

Uri, ND 1996, 'Crude Oil Price Volatility and Unemployment in the United States', *Energy,* vol 21. no 1. pp. 29-38.

Vestifinance 2012, 'The production of oil in Europe', Vesti Finance, viewed 16 March 2012 http://www.vestifinance.ru/infographics/690.

Vestifinance 2012a, 'The Impact of Speculators on Brent Oil Price', *Vesti Finance*, viewed 16 March 2012, http://www.vestifinance.ru/infographics/680.

Wu, M-H & Ni, Y-S 2011, 'The Effects of Oil Prices on Inflation, Interest Rates and Money', *Energy,* vol. 36. pp. 4158-4164.