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By John L Simpson

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Area of Research Excellence in Oil & Gas Management

School of Economics and Finance

Curtin Business School

Curtin University of Technology

GPO Box U1987, Perth WA 6845 AUSTRALIA

Email: [OGM@cbs.curtin.edu.au](mailto:OGM@cbs.curtin.edu.au)

Web: <http://www.cbs.curtin.edu.au/ogm>

# **OIL PRICE HIKES: BLAME CARTEL BEHAVIOUR OR POLITICAL RISK?**

**By**

**John L Simpson<sup>1</sup>**

## **ABSTRACT**

This study covers a period of relative stability in oil prices and in global politics from 1997 up to late 2003. Though the body of evidence is inconclusive in differentiating between cartel and competitive behaviour, the evidence does support strong “cooperation” among OPEC members. This paper firstly finds that the assumptions of weak-form efficiency are violated in OPEC, World (All Countries) and US oil markets in prices. In addition, it is evident that the markets are cointegrated and that the driving forces of global and USA oil prices emanate from OPEC. This suggests that oil supply has been manipulated through pre-agreed production levels over the period of the study to late 2003, and may have resulted in the initial price hikes in mid 2004. Political risk factors causing production fears may have since played a more important role in steeply rising prices. The major global players should remember that the impact of the oil price triggered Latin American debt crisis in the 1980s on developing countries, Western banking systems and on global financial stability.

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<sup>1</sup> Dr John Simpson is a senior member of the academic staff at the School of Economics and Finance, Curtin University, GPO Box U1987, Perth, Western Australia, 6001. email: [simpsonj@cbs.curtin.edu.au](mailto:simpsonj@cbs.curtin.edu.au)

## **INTRODUCTION**

United States oil prices rose to \$40.97 a barrel in early July 2004. The price had already hit a record of \$42.33 on 1<sup>st</sup> June 2004. Reasons provided by the financial media at the time were that an unexpected fall in stocks of crude caused fears to be rekindled regarding security and supply in the Middle-East. Bullish factors claimed were the fear of terror, a strong growth in demand and that OPEC may not have had much spare capacity to increase production. Traders in New York said that oil buyers had emerged in force as key resistance levels were broken in crude and gasoline contracts. At this point there was no problem with the stocks of heating oils. Nevertheless, strong demand in crude and gasoline had underpinned oil's price strength leaving the market sensitive to supply disruptions. After July 2004 OPEC producers raised formal production targets. Any increase would have little effect if the OPEC cartel were already pumping at well above official limits. As at mid 2006 the price had reached US\$75 a barrel.

The OPEC members, over the period of this study, included Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela. These members supplied around 38% of the world's oil. Membership of OPEC and market shares had not changed as at mid 2006. The Members of OPEC are developing countries. They are net energy exporters. Non-OPEC countries supply around 62% of global oil. Most non-OPEC countries are net oil importers. Most have private oil sectors. Their governments therefore have little control over production levels. Major exceptions to this situation are Mexico and Russia. In Russia, although the oil companies are private sector, the government controls the export pipeline network. Private sectors do not hold back profitable and efficient production. They maintain little excess capacity. Non-OPEC production is

more vulnerable to price collapses. Non-OPEC oil producers thus tend to focus on geographical areas where lifting costs are less (Energy Information Administration 2004).

Several non-OPEC countries share some of the characteristics of OPEC countries. At times they coordinate production policies with OPEC. Mexico has attended most OPEC meetings since 1997. Mexico has made several promises to OPEC to limit exports. Mexico has influenced major OPEC members, such as Saudi Arabia and Venezuela, in voting for OPEC production cuts. Russia too, has attended many of OPEC's meetings since 1997. During its current restructuring phase, Russia still has the potential to again be the leading world oil producer. There remains a lack of transparency in Russian reduction pledges. The questions are whether the pledges are for production or export cuts. According to the Energy Information Administration (EIA) (2004), it was ambiguous as to what the current Russian production levels were and for how long they would operate. Norway has adjusted its production levels by agreement with OPEC on several occasions since 1998. The Norwegian oil industry until recently has been State owned<sup>2</sup>. Oman, a smaller non-OPEC country, has attended most OPEC meetings. It has also made several commitments to reduce production in collaboration with OPEC. Angola, prior to its joining OPEC in 2007, has previously attended OPEC meetings and has agreed on one occasion to reduce production by agreement with OPEC (Energy Information Administration, 2004).

Prior to mid 2004, speeches at OPEC meetings and conferences seemed to be characterised by rhetoric that economically rationalised decisions relating to production levels. Many of the meetings repeated a statistic that there were only

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<sup>2</sup> Norsk Hydro is no longer majority State owned and Statoil was 18% privatised in 2001; however, it is proposed that the two merge to form a new entity which would then be 62.5% government owned.

enough proven oil reserves to last for the next 45 years. The Minister of Energy and Mineral Resources for Indonesia, Dr Purnomo Yusgiantoro, at the 131<sup>st</sup> extraordinary meeting of the OPEC Conference in Beirut in June 2004 (OPEC (2004)) stated as follows:

“Given the high and volatile prices and prevailing concern regarding supply security, and in order to ensure continued, robust, global economic growth, especially in the economies of fellow developing countries, the conference decided to increase the OPEC production ceiling (excluding Iraq) ..... in order to ensure adequate supply and give a clear signal of OPEC’s commitment to market stability and to maintaining prices at acceptable levels to both producers and consumers”.

Ironically, in the opening address the same speaker at the same meeting had already said:

“Oil prices, however, have continued to rise during this quarter to levels that have exceeded expectations. This is in spite of the market remaining well supplied with crude at all times and our Member countries producing above our organisation’s agreed levels - something that we have not discouraged in the light of the present situation. The fact of the matter is that the high price of oil we have seen in recent weeks has not reflected upstream market fundamentals.....The high prices have been caused by a combination of factors over which OPEC has no control - speculation on futures markets, tightness in the US gasoline market, geopolitical concerns and the higher than expected oil demand growth, especially in China and the USA”.

On one hand, the lifting of production limits would have solved supply problems and on the other hand the high price of oil was due to external factors.

It is estimated that OPEC production will increase as a proportion of world production over ensuing years. This is because the smaller reserves of non-OPEC countries are being depleted more rapidly. Their overall reserves to production ratio<sup>3</sup> is lower than that for OPEC countries (EIA 2004). In short, OPEC is the most powerful force in global oil supply. There is the strong possibility that it has been wielding that power to limit production and manipulate supply through cartel and collusive behaviour.

The objectives of this paper are to investigate oil prices and relationships in prices in key global markets. The investigation utilises regression analysis of

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<sup>3</sup> Showing how long proven reserves will last at current production rates.

unlagged data and then optimally lagged data are analysed in a vector autoregressive model to test for cointegration and exogeneity. The results of this analysis add to the body of knowledge that makes comment on oil market efficiency and cartel behaviour.

## **LITERATURE AND THEORY**

Waller (2000) questioned whether it was possible to sue the major oil companies and OPEC for unlawful conspiracy in causing record gasoline prices, large regional price disparities and shortages in various parts of the United States during the year 2000. The last paragraph of Waller's conclusion states, "To paraphrase President Nixon, our Chief Executive at the time of the first energy crisis, you can do it but it would be wrong". The rationalisation behind such a glib statement, after some 59 pages of legal argument, was that due to the US Foreign Sovereign Immunities Act and the Act of State Doctrine, foreign policy and diplomacy were deemed the appropriate means to deal with antitrust behaviour rather than lawsuits. It is apparent that legal practitioners as well as economists felt unable, perhaps due to a lack of transparency in the OPEC group, to speak frankly.

In the numerous investigations into the OPEC group, differentiation needs to be made between economic studies into market structure and financial economics studies into market efficiency. The investigations have centred on testing whether or not OPEC engages in cartel behaviour or competitive behaviour. That is, testing hypotheses as to whether or not member States comprise a frictionless production syndicate that seeks to maximise its total profit. Output levels would be expected to move together on a pro rata basis in terms of reserves or production limits set. In the case of competitive behaviour, output levels of member States would also be expected

to move together in response to demand shocks and cost fluctuations that impact the entire industry. The results of such studies have been inconclusive and mixed.

To provide balance to arguments that accuse OPEC of unlawful conspiracy, Smith (2002) finds that statistical tests of OPEC behaviour were inconclusive in distinguishing collusive from competitive behaviour, given the lack of suitable data on demand and costs. However, those findings and those of other macroeconomic researchers generally, indicate strong “cooperative” behaviour among OPEC members. Smith (2002) commented on some of the literature, saying that much of the research work demonstrated behavioural patterns of OPEC that could be discerned as consistent with multiple hypotheses. He may have been suggesting an eclectic or multidisciplinary approach (including behavioural theory), casting doubt on purely econometric approaches that utilise only quantifiable and historical economic or financial or market generated data.

Smith found the approach of Gulen (1996), Alhajji and Huettner (2000) inconclusive. Libecap (1989) and Dahl and Yucel (1991) also demonstrated the ambiguity of market predictions when they felt that the core of a cartel (eg. Texas Rail Road Commission in the United States or OPEC’s prominent member, Saudi Arabia) would be expected to exhibit greater proportional changes in production than the rest of the market. Other works by Griffin (1985) and Jones (1990) were unable to reject the hypotheses that the shares of cartel members should be expected to move with the price level in accordance with the differential elasticities of cartel member’s individual marginal cost schedules. Smith also noted that the work of Loderer (1985) was inconclusive in that OPEC could be an effective cartel or it could be a gathering of oligopolists who were noncooperative. Even when behavioural studies, such as those by Geroski, Ulph and Ulph (1987) and Griffin and Nielson (1994) are taken into

account, the notion is reinforced that it is possible to find pieces of behavioural evidence in the historical records that are inconclusive.

In contrast to studies on OPEC market structure it is difficult to find recent financial economics studies. Gulen (1996) recognised the importance of cointegration and causality analysis to verify the partial specification of an unlagged time series model by verifying long-term equilibrium relationships and examining the short-run dynamics in exogeneity in optimally lagged data. Although the model differs, these forms of time series analysis are employed in this study. The mere suggestion of cooperation among OPEC members is sufficient reason to investigate oil market efficiency, cointegration and causality. Strong cooperation amounts to restriction of information.

This paper tests the efficient markets hypothesis (EMH)<sup>4</sup> and its associated rational expectations hypothesis (RE). The EMH was initially hypothesised for securities markets but there is no reason why similar assumptions and analysis may not be applied to other markets such as oil markets. The three major oil markets are examined in prices over the period from 1997 to late 2003. At its semi-strong form level, the EMH maintains that current prices should reflect all public information. At its strong form level, the EMH posits that current prices should reflect all public and private information. At its weak-form level, the EMH commences with RE where in the case of oil markets, a time series of oil prices is a random walk. At all levels of testing, the EMH thus holds that if oil markets are informationally efficient, abnormal returns cannot be achieved.

In accordance with this basic form of the EMH, where oil prices rather than oil market returns are examined, the oil price today ( $P_t$ ) incorporates all relevant

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<sup>4</sup> The EMH was originally proposed by Fama (1970) for security markets.

information. Price changes between  $t$  and  $t + 1$  will occur because of the arrival of news. At any level of oil market efficiency, news on oil demand conditions and on supply costs itself is a random variable, being sometimes “good” and sometimes “bad”. Forecast errors ( $e_{t+1}$ ) that are represented by the difference between  $P_{t+1}$  and  $E_t P_{t+1}$ , should equal zero on average and should be uncorrelated with today’s information available at the time forecasts are made.

Thus;

$$e_{t+1} = P_{t+1} - E_t P_{t+1} = 0 \quad 1)$$

The implication of zero forecast errors ( $E_t e_{t+1} = 0$ ) is that the forecast of  $P_{t+1}$  is unbiased. This is the property of orthogonality. That is, on average, actual price equals expected price and  $e_{t+1}$  represents unexpected profit or loss between  $t$  and  $t + 1$ . If  $e_t$  is serially correlated ( $\rho e_t$ ), the orthogonality property is violated, and is a first order autoregressive process represented by;

$$e_{t+1} = \rho e_t + v_t \quad 2)$$

Where;

$v_t$  is white noise (the random element and independent of information at time  $t$ ).

No serial correlation in  $e$  is subsumed under the EMH assumption that news today should be of no use in forecasting tomorrow’s price. The EMH/RE assumption places no restrictions on the form of the second and higher moments of the distribution of  $e_t$ . That is the variance of  $e_{t+1}$  may be related to the variance of its past value (the variance of  $e_t$ ) without violating RE, which only places restrictions on the behaviour of the first moment (that is, the expected value) of  $e_t$  (Cuthbertson, 2002).

In addition, regression models of unlagged level series in ordinary least squares (OLS) are run with OPEC prices ( $O_t$ ) as the dependent variable and World ( $W_t$ ) and US prices ( $U_t$ ) as the independent variables.

$$O_t = \alpha + \beta_1 W_t + \beta_2 U_t + e \quad 3)$$

The objectives are to ascertain explanatory power of such an unlagged model and to lead to more advanced time series analysis of optimally lagged data in a Vector Auto Regressive (VAR) model. An autoregressive conditional heteroskedasticity (ARCH)<sup>5</sup> model is also applied to unlagged data so that greater credence may be placed on the results. Cointegration and Causality tests<sup>6</sup> of appropriately lagged data can then be undertaken in the VAR. This analysis may help to describe the interrelationship of oil markets, but also it may explain which oil market is the major influence over the others.

Based on the theory of efficient markets the following hypotheses are stated in the null format:

H01: Price movements in each of the major oil markets are independent of each other.

H02: The major oil markets are not interrelated in prices.

H03: OPEC market prices are not exogenous in a three-market model of major oil markets.

## **METHODOLOGY AND DATA**

Weekly crude oil price data on the major oil markets are examined for the period 1/1/1997 to 10/11/2003. The price series investigated are 1) OPEC countries spot price for crude oil FOB (free on board) weighted by estimated export volume in

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<sup>5</sup> These models may be specified in lieu of OLS when heteroskedasticity of an unknown form is present in regression errors.

<sup>6</sup> Granger (1988).

US dollars per barrel; 2) All country spot price for crude oil FOB weighted by estimated export volume in US dollars per barrel; 3) United States spot price for crude oil FOB weighted by estimated import volume in US dollars per barrel. It should be noted that World or All Country prices include non-OPEC countries that currently produce around 62% of global oil. The data have been obtained from the United States Department of Energy, Energy Information Administration (USDOE, 2003) and have been analysed using the Eviews4 (2001) statistical package.

The unlagged level price series are tested for normality, stationarity and autocorrelation. Serial correlation and heteroskedasticity are tested in the errors of the associated regression. Testing is also undertaken for structural breaks in the data<sup>7</sup>. Due to the presence of heteroskedasticity in the errors, the OLS is respecified into an ARCH model to re-examine the explanatory power of the unlagged model. First differences are also analysed as the level series of prices and the error of the associated regression are found to be non stationary. First differencing produces stationary series and errors. On the basis of integrated non stationary series a VAR is specified to test cointegration (interrelationship) and causality (exogeneity) in optimally lagged data.

## **FINDINGS**

The findings are summarised under the respective headings of tests of independence of prices, tests of interrelationship of markets in prices, and tests of causality in market prices. A limitation of the study is that the F statistic and the log likelihood ratios in Chow structural break tests are not significant and the null hypothesis of zero breaks in the data cannot be rejected.

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<sup>7</sup> The “9/11” terrorist attacks on the World Trade Centre is a logical date to test, using Chow breakpoint tests.

## Tests of independence of prices

**Table 1**  
**Descriptive statistics and tests of normality of the distributions of each level series**

Market	Mean	Median	Standard Deviation	Skewness	Kurtosis	Jarque Bera	Probability
OPEC	20.9743	22.7900	5.9633	-0.3270	2.0003	21.4636	0.0000
World	20.9264	22.3220	5.9429	-0.2844	2.0345	18.8911	0.0001
USA	20.3926	21.8220	5.8618	-0.2443	2.0348	17.6054	0.0002

Table 1 shows that the series are not normally distributed, with problems of skewness and kurtosis according to Jarque-Bera test statistics. With the similarity in results for skewness and kurtosis for each market there exists the strong possibility that oil prices in each market are serially correlated. The mean, median and standard deviation for each series are also similar.

Each level series and the error for the associated regression is found to be non-stationary according to Augmented Dickey-Fuller (ADF) tests for a unit root using 4 lagged differences. These results are summarised in Table 2.

**Table 2**  
**ADF tests for stationarity of level series**

Oil Market Price Series	t Statistic
OPEC	-1.5230
WORLD	-1.6222
USA	-1.6746

NOTE: In each case the test statistic lies to the right of all MacKinnon<sup>8</sup> critical values for the rejection of the hypothesis of a unit root. The critical values are -3.4507, -2.8699 and -2.5712 for each of the 1%, 5% and 10% levels.

The main tests for independence (or lack thereof) of prices in each market are provided through correlogram tests with the focus on the significance of the Q statistic in each case as an indication of the existence of autocorrelation and partial correlation. These results are summarised in Table 3.

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<sup>8</sup> MacKinnon (1991).

**Table 3**  
**Correlogram of the level price series**

<b>Market</b>	<b>Q statistic range over selected lag order</b>
OPEC	353.7400 to 7745.1000
World	353.7700 to 7635.7000
USA	352.7600 to 7398.5000

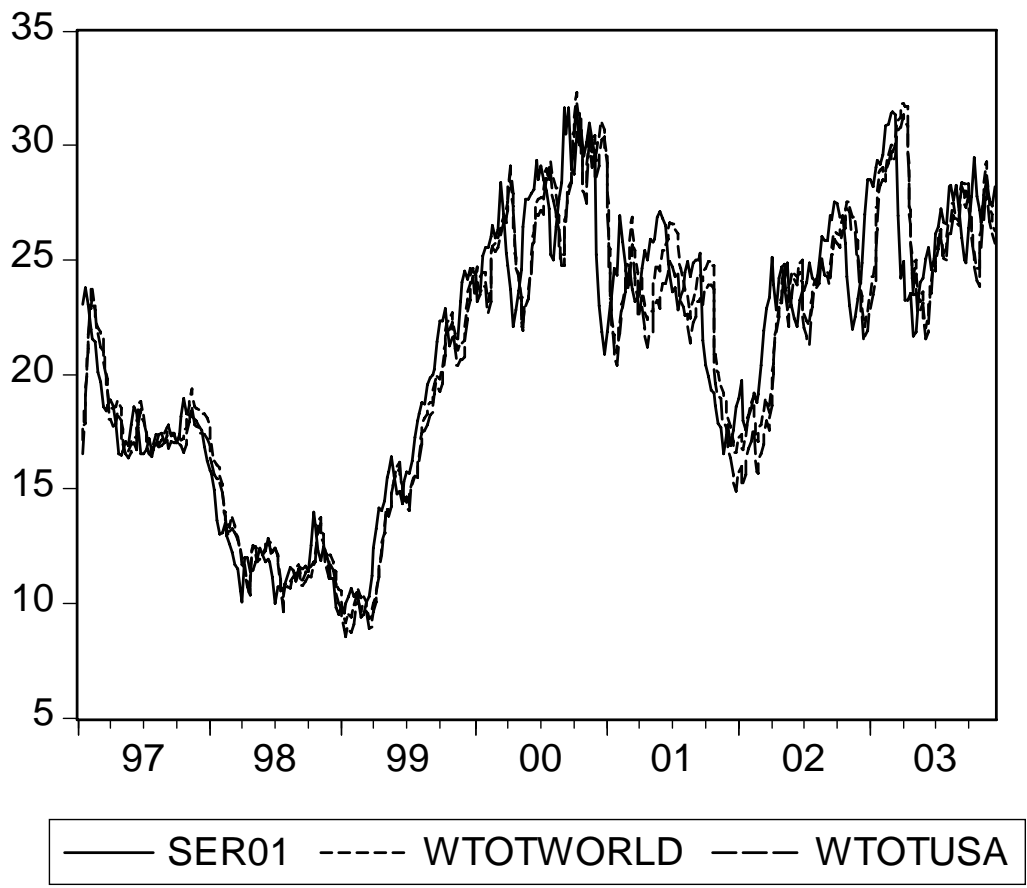
**NOTE:** Autocorrelation and partial correlation were tested over lag orders of 1 to 36. The results of the lag order of 36 are reported herewith and the results are all highly significant with  $p = 0.0000$  in each case.

These results demonstrate strong autocorrelation and partial correlation in each level series of oil prices. This leads to rejection of the first null hypotheses that the level series prices in each market are independent series. These results demonstrate that the major oil markets are not weak-form efficient in that the prices are significantly serially correlated.

#### **Tests of interrelationship of markets**

An initial indication that the markets in prices are in fact highly interrelated is provided in Figure 1 and Table 4 where descriptive statistics also show that the series and therefore the markets in prices are strongly related.

**Figure 1**  
**The co-movement of oil market prices**



NOTE: SER01, WTOTWORLD and WTOTUSA denote OPEC, All Countries (World) and US prices series respectively.

Table 4 again shows evidence of interrelationship in a correlation matrix of the unlagged level series.

**Table 4**  
**Correlations of the level series**

Market	OPEC	World	USA
OPEC	1.0000	0.9201	0.9181
World	0.9201	1.0000	0.9974
USA	0.9181	0.9974	1.0000

The OLS regressions of unlagged data are initially used to similarly demonstrate the strong relationships between each market. However, whilst this method indicates strong explanatory power when OPEC market prices are regressed on World and USA market prices the results are spurious due to the existence of serial

correlation in the regression errors as revealed by Durbin-Watson tests. There is also significant heteroskedasticity in the error term as indicated by White tests.

First differencing of the level series converts the series to stationarity and reduces the problem of serial correlation, but heteroskedasticity of the error terms of the first difference regression remains and of course the first difference regression loses substantial explanatory power.

The model is therefore re-specified into an ARCH model and greater reliance can therefore be placed on the results, which are summarised in Table 5.

**Table 5**  
**Summary of results of the ARCH model specification for OPEC prices in first differences**

<b>Statistic</b>	<b>Value</b>
Adjusted R Square	0.8377
F Statistic (probability)	266.4531 (0.0000)
ARCH(1) coefficient in variance equation	0.7749
GARCH (1) coefficient in variance equation	-0.1883

**NOTE:** The strong explanatory power of the model in means and variances and that the sum of the ARCH (1) and GARCH (1) coefficients indicates that volatility shocks are not now persistent in the data. The Durbin-Watson statistic at 0.3118 is less than the adjusted R square value and not significantly greater than zero. Serial correlation remains a problem in the ARCH model error term and may still indicate spurious results.

Due to the strong explanatory power of the model it could be concluded that the oil markets are strongly related. Care needs to be exercised, as the Durbin-Watson statistic suggests that serial correlation of the error term is existent. The results of the ARCH regression may remain spurious.

### **Tests of Causality**

First differencing converted the series and the errors of the associated regression to stationarity and revealed integrated non stationary processes. A VAR was specified to enable testing for cointegration and causality of optimally lagged data. The VAR testing revealed the existence of cointegration and therefore interrelationship, where the various series experienced similar stochastic trends and achieved equilibrium together in the long-term over the period of the study.

Testing for exogeneity (causality) remained the major focus of this study. Granger causality tests reveal that, on an optimal lag of 2 (where the F statistics are highest and probabilities lowest), OPEC market prices Granger-cause world market prices and USA market prices. The Granger causality by OPEC of world prices is stronger than that for USA prices in terms of higher F statistics. In addition, it is found that USA prices are significantly Granger-caused by world prices (at a 1% level of significance). There is no significant two-way Granger causality from either world or USA prices to OPEC prices. Table 6 summarises the results.

**Table 6**  
**Granger pairwise causality tests in oil market prices**

<b>Null Hypothesis</b>	<b>F Statistic</b>	<b>Probability</b>
World prices do not cause OPEC prices	1.3534	0.2597
OPEC prices do not cause World prices	111.7040 *	0.0000 *
USA prices do not cause OPEC prices	1.9692	0.1411
OPEC prices do not cause USA prices	94.0481 *	0.0000 *
USA prices do not cause World prices	1.4934	0.2249
World prices do not cause USA prices	6.5797 **	0.0012 **

**NOTE:** Strong evidence is present that OPEC prices possess the major influence on world prices and to a lesser extent (yet still highly significantly) OPEC prices possess a major influence on USA prices. Also evident is that world prices are a significant secondary influence on USA prices.

Evidence is presented to enable the rejection of null hypotheses two and three. There is substantial interrelationship between the markets but Granger causality of firstly, the world market and then, the USA market lies with OPEC. That is the OPEC market in oil prices is the major influence over both the world market and the USA market.

## **DISCUSSION**

Antitrust behaviour is difficult to identify and indeed prove in courts of law. One of the problems relates to the inability to agree on a definition. Another issue is whether or not the law that applies in the developed world is appropriate for developing countries with legal, political, economic and cultural practices that are

vastly different. The concern by some countries in the developing country group is that antitrust legislation does more to promote the interests of the developed countries. There are of course many different arguments, opinions and philosophical bases associated with the international and domestic effects of cartel behaviour. This paper takes the view of economists that agree with the assumptions and positive outcomes of open market economies that encourage competition and allow market forces of supply and demand to freely interact to produce a fair clearing price for products.

That supply and demand forces should ultimately determine oil prices in the medium to long-term, is not an unreasonable proposition. We live in an age of rapid transfer of up-to-date and accurate data and news. This includes information on oil demand changes, however large they may be, from countries such as China and India. Up-to-date information should also be rapidly available on oil lifting, transport and other costs. Futures and options markets are available to assist in the management of excessive commodity price and currency risks. Less obvious, however, is the degree to which supply in oil markets was manipulated up to mid-2004, within production limits or ceilings that implied excess capacity.

The OPEC group of net energy exporting developing nations is a powerful oil-producing force. It is likely that the members of OPEC see no need to change the status quo in oil pricing mechanisms. From a legal standpoint, OPEC can't be or probably won't be attacked on an antitrust basis. The OPEC group has control over global markets and is winning at present with substantial price gains over the period from mid-2004 to mid-2006. The giant Western oil companies may be quite content with such a surrogate cartel arrangement when a more direct agreement among them would be in contravention of antitrust legislation. The evidence supplied by most economists reviewed for the literature of this study supports the notion that OPEC

members and some non-members cooperate in setting production levels. Strong cooperation may be a euphemism for collusion. Collusion amounts to cartel behaviour. Cartel behaviour is monopoly pricing. Monopoly markets are intrinsically inefficient.

## **CONCLUSION**

The study demonstrates that rational expectations and orthogonality conditions of weak-form efficiency in the major oil markets are violated for each oil market over the period investigated. In addition, regression analysis, cointegration and causality tests statistically prove that the key oil markets are strongly related and that they are highly interdependent. More importantly, it is proven that exogeneity lies with the OPEC market. That is, OPEC market in prices is the major influence on the world and then the USA markets.

No doubt political risk factors flow on to affect production risk. These factors have probably played a part in oil price rises particularly in 2005 and 2006 with renewed conflict in Iraq, Iran, Afghanistan, Israel and Lebanon. As at mid-2006 most global economies were experiencing increased inflationary expectations and interest rate pressures. More recently, to late 2006, oil prices have come back a little, yet OPEC has again decided to impose production limits. The world awaits a renewed rise in prices as a consequence. Whatever the reasons for the 2004 to 2006 spikes in oil prices, oil remains a vital global commodity and large price increases lead to inflationary pressure and hikes in official interest rates.

The world has already experienced the result of oil production level cooperation in the energy crisis of the 1970s, which led to the Latin American debt crisis of the 1980s. With a new third world debt crisis looming, and with impending

hardship to be revisited on developing oil dependent countries, it is not surprising that many media commentators have optimistically suggested that lower oil prices would provide a greater level of global economic stimulus than foreign aid to poorer nations or the writing off of their IMF or World Bank debt. Financial instability is not consistent with goals relating to shareholder wealth maximisation or more importantly to the creation of global wealth and to the well-being of both developing and developed economies.

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