Middle-East Journal of Scientific Research 23 (9): 2035-2050, 2015
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2015.23.09.22015

Oil Price Fluctuations and Industry Stock Returns

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Abstract: This study investigates the impact of oil price variation on 14 industries in six markets, including Canada, China, France, India, the United Kingdom and the United States. Panel weekly data were collected from June 1998 to December 2011. The results indicate that price fluctuations primarily affect the Oil and Gas as well as the Mining industries and have the least influence on the Food and Beverage industry. Furthermore, in three out of six of these countries (Canada, France and the U.K.), oil price changes negatively affect the Pharmaceutical and Biotechnology industry. One possible reason for the negative relationship between oil price changes and the Pharmaceutical and Biotechnology industries in the above-mentioned countries is that the governments of these countries fund their healthcare systems. Portfolio managers and investors will find the results of this study useful because it enables adjusting portfolios based on knowledge of the industries that are impacted the most or the least by oil price fluctuations.

JEL Classification: E44, F3, G12, G15, Q43, Q47

Key words: Oil price · Oil and sector return · Industry return volatility · Stock market · Portfolio management · Panel data

INTRODUCTION

The Oil and Gas industry has been the engine of economic growth for most countries, directly affecting public development projects, governments' annual budgets and most foreign exchange sources. The demand for oil in recent decades, which has increased because of the growth of the Indian and Chinese economies, has resulted in a rapid pace of oil extraction by oil-exporting countries. The U.S. and China are among the major oil producers, consumers and importers. The U.S. is the 11th of major oil exporters, while China is not a major oil exporter. This means that even though the U.S. is the largest oil consumer and importer in the world, it still exports oil to other countries. India is the fourth largest oil consumer and importer (Source: The CIA World Factbook).

As the global population increases, oil consumption increases, which leads to an increase in oil prices. Due to rising oil prices, the production cost of goods increases and leads to an adverse impact on economic growth and GDP while also increasing the rate of inflation; previous studies have confirmed this relationship (Bruno and Sachs, 1982 [1], Burbidge and Harrison, 1984 [2], Gisser and Goodwin, 1986 [3], Hickman *et al*., 1987 [4], Brown and Yücel, 2002 [5], Cologni and Manera, 2005 [6], Gronwald, 2008 [7], Kilian, 2008b [8], Lardic and Mignon, 2006 [9], Lardic and Mignon, 2008 [10], Lescaroux and Mignon, 2008[11], Rasche and Tatom, 1977 [12], Rasche and Tatom, 1981 [13]). In other words, as the price of oil increases, stock returns tend to decline considerably (Driesprong *et al*., 2008 [14], McSweeney and Worthington, 2008 [15]). Regarding the importance of oil as a macroeconomic force and its impact on economic growth, this paper aims to investigate the relationship between oil price fluctuations and industry returns in six countries: Canada, China, the United States, France, India and the United Kingdom. The remainder of the paper is organized as follows. Section 2 provides a summary of the literature review. Section 3 presents the data and industry

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classifications, followed by the methodology in section 4, empirical results in section 5, analysis and discussion in section 6, implications for managers in section 7 and concluding remarks in section 8.

Literature Review: A vast body of literature exists on stock price determination. This study, however, focuses on asset pricing theories, which imply that the value of a stock is equal to the sum of discounted, expected cash flows to be generated in the future. The discounted cash flow is affected by economic conditions such as inflation, interest rates, production costs, etc., which all reflect the changes in macroeconomic factors as the price of oil changes. Oil price shocks cause supply-side and demand-side effects (Hamilton, 1983 [16], Jones *et al*., 2004 [17]). The body of literature pertaining to the relationship between oil price and stock price changes does not reach any unanimous conclusions. Kling (1985) [18] concluded that increases in oil prices lead to stock market declines. Chen, Roll and Ross (1986) [19], in contrast, suggested that oil price changes have no effect on asset pricing. C.M. Jones and Kaul (1996) reported a negative relationship between oil price changes and aggregate stock returns. Huang, Masulis and Stoll (1996) studied the relationship between stock returns and changes in the price of oil futures and found no such negative relationship. Wei (2003) [20] concluded that the decline of the U.S. stock prices in 1974 could not be explained by oil price increases during that time period.

There are also country-specific studies; Apergis and Miller (2009) [21] investigated the impact of structural oil-market shocks in eight developed countries and found that international stock markets are not affected by oil price shocks. C. M. Jones and Kaul (1996) studied the relationship between oil prices and stock returns in developed countries and their results reveal the negative effects of oil price changes on stock returns in the U.S. and Canada, while finding positive effects in the Japanese and the U.K. markets. Park and Ratti (2008) [21] studied twelve European countries; they suggested that oil price changes have negative effects on stock returns, with one exception. Norway, as an oil exporting country, was shown to have a positive relationship between oil prices and stock returns.

Investigating time-line effects, Huang, *et al*., (1996) [22] found that there is no relationship between oil prices and the S&P500 market index in the short run. However, in a similar study conducted by Sadorsky (1999) [23], a negative short-term effect of oil price volatility on the aggregate stock returns was indeed reported. Studying the U.S market, Kilian (2008a) found that increases in oil prices caused by unexpected global economic growth positively affected stock returns within the first year of the expansionary shock. This result might be because growth in a global business cycle will stimulate the U.S. economy directly, but at the same time, the price of oil would increase, thereby indirectly slowing U.S. economic activity.

Other studies have investigated the relationship between oil prices and stock returns in different industrial sectors. Several scholars found that increases in oil prices have a positive impact on the stock returns of Oil and Gas companies (Sadorsky, 2001, El-Sharif *et al*., 2005, Boyer and Filion, 2007). On the other hand, Nandha and Brooks (2009) found that these relationships between oil prices and stock returns of individual industries was not significant for Asian or American countries.

Similar studies also discovered significant responses to oil demand shocks in the automotive industry, the retail industry, in consumer goods and in tourism-related sectors, namely, restaurants and lodging (Hamilton, 1988, Dhawan and Jeske, 2008, Edelstein and Kilian, 2007 [24]).

Furthermore, stock price responses to oil price shocks depend on the underlying causes of the oil price shocks. Kilian (2008a) [investigated the U.S. financial market and their study revealed that the response of aggregate stock returns differs greatly depending on whether the increase in the price of crude oil is driven by demand shocks or by supply shocks in the crude oil market. In addition, Kilian (2008a) suggested that higher oil prices necessarily cause lower stock prices, which is shown to apply only to oil-market specific demand shocks such as increases in the precautionary demand for crude oil that reflect concerns regarding future oil supply shortfalls. In contrast, positive shocks to the global demand for industrial commodities cause both higher oil prices and higher stock prices. However, oil supply shocks have no significant effect on returns. Moreover, other researchers related the stock price changes to studies emphasizing the endogenous monetary policy response to oil price shocks (Bernanke *et al*., 1997).

One limitation of existing work on the link between oil prices and stock prices is that the price of crude oil is often treated as exogenous with respect to the economy. In recent years, there has been a consensus that the price of crude oil since the 1970s has responded to some of the same economic forces that drive stock prices, making it necessary to control for reverse causality (Barsky and Kilian, 2004, Barsky and Kilian, 2002, Hamilton, 2003, Hamilton, 2005).

Regarding the various methodologies, Huang, Masulis and Stoll (1996) applied an unrestricted vector autoregressive in their study of the relationship between oil price movements and the U.S. financial market. They discovered a strong relationship between oil price movements and some of the U.S. oil companies. However, they did not find any significant relationship between oil price changes and stock indices. Similarly, Sadorsky (1999) used the unrestricted VAR for the U.S. market and found a significant relationship between the oil price shocks and the stock market returns. Zarour (2006) also applied VAR as the methodology in discovering the relationship between oil prices and stock markets in the Persian Gulf Countries and the results that study suggested that the reaction of stock markets in the Persian Gulf Countries increased as the price of oil rose. By using different methodologies, such as the GARCH model, several scholars found that an increase in the price of oil would lead to lower stock returns mainly in oil and oil-related industries (Choi and Hammoudeh, 2010, Hammoudeh *et al*., 2010).

A number of scholars have examined the firm-specific responses to oil price fluctuations (Al-Mudhaf and Goodwin, 1993, Boyer and Filion, 2007, Sadorsky, 2001). However, several scholars investigate the effect of oil price shocks on industry returns, including El-Sharif, Brown, Burton, Nixon and Russell (2005), who investigated the impacts of oil prices on the Oil and Gas sector of the U.K. and found a significant causal relationship. Another study by Maghyereh and Al-Kandari (2007) found that the behavior of financial markets in the Gulf Cooperation Council (GCC) countries against oil price changes follows a nonlinear approach (Hamilton, 2003, Mork *et al*., 1994). Moreover, several scholars showed that responses to oil price shocks depend upon the industry and might differ from one industry to another (Davis and Haltiwanger, 1999, Lee and Ni, 2002, Lee *et al*., 1995). Faffa and Brailsfordb (1999) examined the Australian market sensitivity to oil price changes and found that not only is the price of oil a prominent factor in analyzing the market movements, but the sensitivity towards the oil price shocks also depends heavily on the specific industry (Nandha and Faff (2008)).

To examine the long-term impact of oil price changes, Miller and Ratti (2009) applied the long-term relationship between oil price variations and stock market indices of several countries from 1971 to 2008. Their results suggested that an oil price increase would have an adverse effect on stock market indices. Another study by Fayyad and Daly (2010) compared the behavior of stock market returns towards the changes in oil prices in the U.K. and the U.S. with the behaviors exhibited in the GCC countries. They applied the VAR technique in their research and used daily data from 2005 to 2010. Their main finding indicated that the predictability of stock movements would increase when oil prices rise as well as during financial crises.

Moreover, Scholtens and Yurtsever (2011) examined the impact of oil price shocks at the industry level for European countries from 1983 to 2007 and discovered differences in the behaviors of the individual industries as a result of oil price shocks. However, the significance of their results depended on the industries characteristics.

Recently, Elyasiani, Mansur and Odusami (2011) inspected the impact of variations of oil returns and oil return volatility on excess stock returns and return volatility in the U.S. market for several industries. They found that the oil price variation comprises a systematic asset price risk at the industry level. Their findings indicate that industries in the U.S. are affected either by oil returns, oil return volatility, or both.

Data Collection and Industry Classification: This study investigates the impact of oil price variation on 14 industries in the six markets of Canada, China, France, India, the U.K. and the U.S. This research covers 14 industries, including Oil and Gas, Chemicals, Mining, Construction and Material, Industrial Goods and Services, Automobiles and Parts, Food and Beverage, Pharmaceutical and Biotechnology, Travel and Leisure, Electricity, Water and Multitudes, Banks, Financial Services and Software and Computer Services. These industries are classified into four major industry types in terms of oil. Oil-substitutes consist of alternative electricity companies that generate and distribute electricity from renewable sources, namely, solar, water, wind and geothermal. In fact, most of the industries are oil-users, including the Chemical industry, Mining, Construction and Material, Industrial Goods and Services, Automobiles and Parts, Food and Beverage, Pharmaceutical and Biotechnology, Travel and Leisure, Conventional Electricity, Software and Computer Services, Gas, Water and Multitudes. The oil-related category refers to the oil and gas industry and finally the financial category includes the Banks and Financial Services industries (Elyasiani *et al*., 2011). For each industry, the market index and the price of oil were collected from Datastream on a weekly basis from June 1998 until the end of 2011.

The exogenous variable is the oil price of light crude oil futures, traded on the New York Mercantile Exchange (NYMEX) and in order to smooth the fluctuations, the logarithm of the oil price was calculated (Boyer and Filion, 2007). This study uses future oil prices for several reasons. First, spot prices of crude oil are affected more by random noise issues than future prices are (Sadorsky, 2001). Second, the returns of the companies in the industry of oil-exploration, refinery and marketing are heavily co-integrated with one-month and four-month future oil prices (Hammoudeh *et al*., 2004). Third, if a company hedges its position, the variation of future oil prices indicates whether said position was effective (Elyasiani *et al*., 2011).

For each industry, the return of the industry index was calculated to measure the return of that particular industry. Similar to the price of oil, the return of each industry is measured by the logarithm of the price index of each market [25-50].

MATERIALS AND METHODS

To investigate the impact of oil price movements on different industries, regression analyses were carried out to test the relationships. For example, the regression equation for the Mining industry of Canada will be as follows:

$$MINING_{CANADA} = \alpha + \beta OP + \varepsilon$$

where Mining Canada denotes the return of the Mining industry of Canada, α is the intercept, β is the coefficient of the variable Oil Price (OP) and ε presents the error term.

Regarding statistical tests, the unit root tests were first carried out for each industry classification separately, which amounted to a total of 84 unit root tests conducted (6 countries, each with 14 industries). As the data of this study consist of time series, there is a probability for the existence of auto-correlated errors (serial correlation in the error term). Hence, Breush-Godfrey's and Durbin-Watson's autocorrelation tests were used to control for the possible serial correlation in the data set. The methodology used is the Linear Regression Least Squares and it is carried out in STATA software. However, in STATA, it is possible to run the Cochrane-Orcutt regression in the presence of serial correlation instead of a Least Squares regression to correct the serial correlation error so that the results are not biased by auto-correlation in the error term.

RESULTS

Impact of oil price variation on 14 industries in six markets from June 1998 to December 2011 is investigated in this study. The analysis begins with descriptive statistics followed by the causality test of the data and finally regression results are provided.

Descriptive Statistics: Descriptive statistics are illustrated in Tables 1, 2, 3, 4, 5 and 6 separately for each market. The total number of observations for the six markets is 4,248 and the total number of weeks for the sample size was 708. The sample mean, standard deviation (Std. Dev.), Skewness, Kurtosis, Jarque-Bera test for normality, Ljung-Box Q statistic (QS) test for serial correlation and Augmented Dickey-Fuller (ADF) unit root test are provided. Since the return of each industry as well as the oil price is measured by the logarithm of the price index of each market, the mean values of the industries are close to zero. As illustrated by the tables, Ljung-Box Q statistics are conducted at the level with one lag included and the results reveal the presence of serial correlations for several industries in the sample. Furthermore, the Ljung-Box Q statistics of China and India indicate the minimum number of serial correlations compared to other markets. The Augmented Dickey-Fuller (ADF) unit root test is applied to Fisher Chi-Square distribution and the results reveal that the null hypothesis of the unit root test is rejected and as a result, all of the data are stationary.

Wiener-Granger Causality Tests: Wiener-Granger Causality tests were conducted to examine the relationship between the Oil price changes and the returns of industries. Results are presented in Tables X through W. Since the result of Wiener-Granger Causality test is sensitive to the number of lags, this test was carried out for different lags including 1, 2, 3, 4, 6, 8, 10 and 12.

Table 7 presents the Granger causality results for Canada. Based on the results, bidirectional causality relationships are significant for Banks (for lag 10), Construction (for lags 8, 10 and 12), Financial (for lag 12) and Travel and Leisure (for lag 2).

Unidirectional Granger causality from Industry returns to Oil Price is significant for Automobiles and Parts (for lags 3, 4, 8, 10 and 12), Banks (for lags 3, 4 and 8), Chemicals (for lags 3 to 12), Construction and Material (for lags 3 and 4), Financial Services (for lag 3), Industrial Goods and Services (for lags 3, 8, 10 and 12), Oil (for lags 8,10 and 12) and Travel and Leisure (for lags 1and 3 to 12).

Table 1: Descriptive statistics for Canada

Canada	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	-0.001	0.020	-0.371	7.272	554.592	0.000	0.058	0.000
BANKS	0.000	0.015	0.033	7.973	729.724	0.000	0.000	0.000
CHEMICALS	0.001	0.021	-0.988	11.399	2195.931	0.000	0.081	0.000
CONSTRUCTION	0.000	0.017	-1.322	16.738	5773.826	0.000	0.002	0.000
ELECTRICITY	0.000	0.011	-0.229	10.701	1755.833	0.000	0.000	0.000
FINANCIAL	0.000	0.011	-0.758	10.565	1755.980	0.000	0.336	0.000
FOOD AND BEVERAGE	0.001	0.013	-0.119	6.250	313.265	0.000	0.000	0.000
GAS AND WATER	0.001	0.010	-0.320	8.757	989.804	0.000	0.000	0.000
INDUSTRIAL	0.000	0.015	-0.377	5.028	138.172	0.000	0.233	0.000
MINING	0.001	0.022	-0.162	7.020	479.784	0.000	0.001	0.000
OIL	0.001	0.017	-0.629	7.976	777.039	0.000	0.000	0.000
OP*	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.000	0.023	-0.645	7.541	657.339	0.000	0.507	0.000
SOFTWARE	0.000	0.022	-0.060	9.826	1375.127	0.000	0.000	0.000
TRAVEL AND LEISURE	0.000	0.015	-0.270	6.505	370.925	0.000	0.263	0.000

*OP denotes the Oil Price. The total number of observation is 4,248. J-B is the Jarque–Bera joint normality test statistics. QS is the Ljung–Box Q statistic. ADF is the Augmented Dickey-Fuller test of unit root.

Table 2: Descriptive statistics for China

China	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	0.000	0.022	-0.073	4.564	72.780	0.000	0.390	0.000
BANKS	0.000	0.020	0.675	6.393	393.292	0.000	0.596	0.000
CHEMICALS	0.000	0.020	-0.007	4.086	34.815	0.000	0.659	0.000
CONSTRUCTION	0.000	0.019	-0.128	5.007	120.807	0.000	0.989	0.000
ELECTRICITY	0.000	0.019	-0.086	5.263	151.946	0.000	0.768	0.000
FINANCIAL	0.000	0.024	-0.022	5.500	184.456	0.000	0.245	0.000
FOOD AND BEVERAGE	0.002	0.027	0.183	6.037	276.100	0.000	0.651	0.000
GAS AND WATER	0.000	0.023	-0.362	5.787	244.510	0.000	0.895	0.000
INDUSTRIAL	0.000	0.019	-0.072	5.090	129.471	0.000	0.526	0.000
MINING	0.002	0.034	-0.034	8.698	957.943	0.000	0.004	0.000
OIL	0.000	0.020	0.220	6.280	323.157	0.000	0.567	0.000
OP	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.000	0.019	0.379	5.485	199.022	0.000	0.422	0.000
SOFTWARE	0.000	0.023	0.406	5.512	205.684	0.000	0.714	0.000
TRAVEL AND LEISURE	0.000	0.023	-0.345	4.851	115.103	0.000	0.594	0.000

Table 3: Descriptive statistics for France

France	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	0.000	0.022	-0.475	7.596	649.749	0.000	0.123	0.000
BANKS	0.000	0.022	-0.174	6.818	433.550	0.000	0.401	0.000
CHEMICALS	0.000	0.015	-0.046	5.317	158.682	0.000	0.000	0.000
CONSTRUCTION	0.000	0.018	-0.146	4.873	105.971	0.000	0.035	0.000
ELECTRICITY	-0.001	0.027	-0.862	11.181	2062.089	0.000	0.098	0.000
FINANCIAL	0.000	0.012	-0.641	7.678	694.151	0.000	0.046	0.000
FOOD AND BEVERAGE	0.000	0.011	0.015	5.634	204.664	0.000	0.002	0.000
GAS AND WATER	0.000	0.018	-0.227	6.791	429.989	0.000	0.192	0.000
INDUSTRIAL	0.000	0.015	-0.479	5.692	240.746	0.000	0.079	0.000
MINING	0.000	0.019	-0.135	5.180	142.353	0.000	0.283	0.000
OIL	0.000	0.016	-0.129	5.055	126.577	0.000	0.001	0.000
OP	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.000	0.016	-0.439	4.516	90.498	0.000	0.000	0.000
SOFTWARE	0.000	0.023	-0.624	8.183	838.440	0.000	0.085	0.000
TRAVEL AND LEISURE	0.000	0.017	-0.672	7.317	603.229	0.000	0.702	0.000

Table 4: Descriptive statistics for India

India	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	0.001	0.019	-0.350	4.905	121.562	0.000	0.149	0.000
BANKS	0.001	0.024	-0.335	7.340	568.983	0.000	0.198	0.000
CHEMICALS	0.000	0.025	-5.563	86.925	211431.000	0.000	0.575	0.000
CONSTRUCTION	0.001	0.024	-0.310	5.526	199.551	0.000	0.254	0.000
ELECTRICITY	0.001	0.024	-0.728	10.503	1723.224	0.000	0.017	0.000
FINANCIAL	0.001	0.025	-0.045	7.677	645.553	0.000	0.001	0.000
FOOD AND BEVERAGE	0.001	0.016	-0.422	6.828	453.230	0.000	0.149	0.000
GAS AND WATER	0.002	0.024	0.420	6.786	443.645	0.000	0.337	0.000
INDUSTRIAL	0.001	0.022	-0.628	6.152	339.661	0.000	0.972	0.000
MINING	0.001	0.038	0.201	4.827	103.192	0.000	0.633	0.000
OIL	0.001	0.022	-0.461	8.236	833.943	0.000	0.509	0.000
OP	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.001	0.017	-0.675	6.958	515.833	0.000	0.291	0.000
SOFTWARE	0.001	0.028	-0.200	6.791	428.648	0.000	0.084	0.000
TRAVEL AND LEISURE	0.000	0.022	-0.058	6.730	410.886	0.000	0.508	0.000

Table 5: Descriptive statistics for the U.K.

U.K.	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	0.000	0.026	-0.517	9.099	1129.080	0.000	0.443	0.000
BANKS	-0.001	0.020	-1.426	18.247	7097.844	0.000	0.021	0.000
CHEMICALS	0.000	0.016	-0.119	5.973	262.455	0.000	0.871	0.000
CONSTRUCTION	0.000	0.014	-0.205	5.380	172.088	0.000	0.056	0.000
ELECTRICITY	0.000	0.011	-0.267	6.453	360.161	0.000	0.229	0.000
FINANCIAL	0.000	0.012	-0.663	5.559	245.079	0.000	0.817	0.000
FOOD AND BEVERAGE	0.000	0.011	-0.129	5.554	194.406	0.000	0.021	0.000
GAS AND WATER	0.000	0.011	-0.455	7.748	689.625	0.000	0.001	0.000
INDUSTRIAL	0.000	0.012	-0.480	5.714	244.518	0.000	0.843	0.000
MINING	0.001	0.024	-0.322	5.222	157.914	0.000	0.000	0.000
OIL	0.000	0.015	-0.225	5.697	220.567	0.000	0.112	0.000
OP	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.000	0.014	-0.056	5.145	136.067	0.000	0.001	0.000
SOFTWARE	0.000	0.023	-0.394	8.034	765.870	0.000	0.885	0.000
TRAVEL AND LEISURE	0.000	0.014	-0.475	5.775	253.794	0.000	0.706	0.000

Table 6: Descriptive statistics for the U.S.

U.S.	Mean	Std. Dev.	Skew.	Kurt.	JB	JB (P-value)	QS (P-value)	ADF (P-value)
AUTOPARTS	0.000	0.020	-0.014	6.109	285.119	0.000	0.848	0.000
BANKS	0.000	0.022	0.234	9.186	1135.452	0.000	0.000	0.000
CHEMICALS	0.000	0.017	-0.460	7.377	589.998	0.000	0.001	0.000
CONSTRUCTION	0.000	0.019	-0.400	6.729	429.072	0.000	0.002	0.000
ELECTRICITY	0.000	0.012	-0.556	5.895	283.590	0.000	0.024	0.000
FINANCIAL	0.000	0.019	-0.132	6.880	446.058	0.000	0.000	0.000
FOOD AND BEVERAGE	0.000	0.010	-0.202	8.078	765.437	0.000	0.005	0.000
GAS AND WATER	0.000	0.014	-0.882	7.537	698.972	0.000	0.343	0.000
INDUSTRIAL	0.000	0.015	-0.272	5.744	230.892	0.000	0.076	0.000
MINING	0.001	0.026	-0.561	8.525	937.594	0.000	0.000	0.000
OIL	0.001	0.016	-0.522	5.842	270.398	0.000	0.000	0.000
OP	0.001	0.024	-0.629	5.935	300.910	0.000	0.010	0.000
PHARM AND BIO	0.000	0.013	-0.347	7.661	655.148	0.000	0.000	0.000
SOFTWARE	0.000	0.019	-0.267	5.741	230.034	0.000	0.004	0.000
TRAVEL AND LEISURE	0.000	0.017	-0.250	5.195	149.503	0.000	0.029	0.000

Table 7: Results of the Granger causality tests for Canada

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.7545	0.5516	0.0587	0.0408	0.1106	0.023	0.0054	0.0142
OP	→	AUTOPARTS	0.8305	0.651	0.8298	0.8841	0.968	0.9727	0.9051	0.7112
BANKS	→	OP	0.9423	0.9515	0.0599	0.0974	0.1869	0.0735	0.0985	0.1407
OP	→	BANKS	0.333	0.5132	0.7537	0.235	0.4424	0.1542	0.0982	0.0013
CHEMICALS	→	OP	0.2891	0.6142	0.0763	0.023	0.0674	0.0161	0.039	0.0057
OP	→	CHEMICALS	0.1007	0.279	0.4178	0.5295	0.7055	0.7044	0.8364	0.8006
CONSTRUCTION	→	OP	0.2828	0.5381	0.0799	0.0629	0.138	0.0041	0.0002	1.00E-05
OP	→	CONSTRUCTION	0.2687	0.4967	0.6747	0.2798	0.0174	0.036	0.083	0.0571
ELECTRICITY	→	OP	0.2218	0.4349	0.6743	0.7889	0.2804	0.1949	0.2693	0.1345
OP	→	ELECTRICITY	0.809	0.9443	0.2898	0.229	0.2938	0.0446	0.0322	0.0083
FINANCIAL	→	OP	0.4631	0.6897	0.0945	0.16	0.2398	0.1283	0.1478	0.0254
OP	→	FINANCIAL	0.6782	0.2938	0.4319	0.4173	0.1091	0.1666	0.1149	0.0599
FOODBEVERAGE	→	OP	0.4051	0.5604	0.1763	0.2424	0.4754	0.5799	0.5212	0.5804
OP	→	FOODBEVERAGE	0.7425	0.9526	0.8121	0.9208	0.9386	0.9306	0.4864	0.5321
GASWATER	→	OP	0.8806	0.9456	0.8186	0.9339	0.7591	0.6227	0.6955	0.6342
OP	→	GASWATER	0.0248	0.075	0.057	0.0723	0.1124	0.1267	0.0354	0.0179
INDUSTRIAL	→	OP	0.2121	0.2778	0.0696	0.1329	0.2311	0.0849	0.0442	0.0574
OP	→	INDUSTRIAL	0.8698	0.8461	0.9512	0.9887	0.9263	0.9666	0.9855	0.8331
MINING	→	OP	0.1058	0.0839	0.1907	0.1457	0.2671	0.2809	0.1329	0.1173
OP	→	MINING	0.4992	0.4652	0.3895	0.5678	0.2702	0.4385	0.0151	0.0104
OIL	→	OP	0.9867	0.9847	0.1481	0.233	0.2859	0.0076	0.0223	0.0457
OP	→	OIL	0.7962	0.7807	0.4433	0.5388	0.5009	0.3604	0.3028	0.2483
PHARMBIO	→	OP	0.5374	0.5035	0.6493	0.781	0.6672	0.4376	0.4958	0.4728
OP	→	PHARMBIO	0.661	0.9008	0.943	0.9451	0.8548	0.9534	0.8803	0.9027
SOFTWARE	→	OP	0.6804	0.7697	0.8512	0.8393	0.6141	0.8512	0.8861	0.687
OP	→	SOFTWARE	0.157	0.2292	0.3718	0.616	0.0481	0.0816	0.2061	0.1455
TRAVELLEISURE	→	OP	0.0982	0.0054	0.008	0.0149	0.0107	0.0096	0.0023	0.0013
OP	→	TRAVELLEISURE	0.6779	0.089	0.107	0.2722	0.1099	0.2054	0.2352	0.1213

The numbers in the table are the p-values of the Granger causality test. Those in bold face present the p-values less than 0.1.

Moreover, the unidirectional Granger causality from Oil Price to Industrial returns is significant for Banks (for lag 12), Construction and Material (for lag 6), Electricity (for lags 8, 10 and 12), Gas, Water and Multitudes (for lags 1 to 4, 10 and 12), Mining (for lags 10 and 12) and Software and Computer Services (for lags 6 and 8).

Table 8 demonstrates the Granger causality results for China. Bidirectional causality relationship between Oil Price and Industrial return is significant for Automobiles and Parts (for lags 8, 10 and 12), Chemicals (for lag 12), Financial (for lags 8 and 10), Gas, Water and Multitudes (for lag 10) and Industrial (for lags 8 and 10).

Unidirectional Granger causality from Industrial return to Oil Price is significant for Automobiles and Parts (for lags 2, 3, 4 and 6), Chemicals (for lags 3, 4, 6, 8 and 10), Gas, Water and Multitudes (for lags 4 and 8), Industrial (for lag 4), Pharmaceutical and Biotechnology (for lags 2 to 12), Software (for all lags) and Travel and Leisure (for lag 4).

Unidirectional Granger causality from Oil Price to Industrial return is significant for Construction (for lag 12), Financial (for lags 1 to 6 and 12), Food and Beverage (for lags 3 to 12), Gas, Water and Multitudes (for lag 12), Industrial (for lag12), Mining (for lags 1, 6, 8, 10 and 12).

Regarding the market in France, bidirectional causality is significant for Banks (for lags 8, 10 and 12), Chemicals (for lags 10 and 12), Electricity (for lag 12) and Food and Beverage (for lag 10).

Unidirectional Granger causality from Industrial return to Oil Price is significant for Automobiles and Parts (for lags 4 to 12), Construction (for lags 4 to 12), Electricity (for lags 6, 8 and 10), Financial (for lags 3 to 12), Food and Beverage (for lag 2), Industrial Goods and Services (for lag 12), Mining (for lag 12), Pharmaceutical and Biotechnology (for lags 2 to 12) and Travel and Leisure (for lags 2, 3, 4, 8, 10 and 12). Unidirectional Granger causality from Oil Price to Industrial return is significant for Chemical (for lag 8), Food and Beverage (for lags 6, 8 and 12), Gas, Water and Multitudes (for lags 10 and 12).

In India, only one bidirectional causality relationship exists and it is for Software at lag 1. Unidirectional Granger causality from Industrial return to Oil Price is significant

Table 8: Results of the Granger causality tests for China

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.165	0.0383	0.0211	0.0066	0.0183	0.0013	0.0046	0.0108
OP	→	AUTOPARTS	0.7011	0.8863	0.6549	0.7913	0.2575	0.0962	0.026	0.0069
BANKS	→	OP	0.2276	0.5423	0.6345	0.3415	0.5985	0.3257	0.5079	0.6419
OP	→	BANKS	0.4243	0.4213	0.4708	0.6459	0.7743	0.1091	0.1675	0.1557
CHEMICALS	→	OP	0.3494	0.1579	0.0847	0.021	0.0672	0.0154	0.0389	0.0782
OP	→	CHEMICALS	0.5536	0.5581	0.4651	0.6164	0.4736	0.2952	0.1023	0.0501
CONSTRUCTION	→	OP	0.2416	0.4136	0.2093	0.2191	0.3033	0.2089	0.3505	0.4415
OP	→	CONSTRUCTION	0.7065	0.9062	0.3934	0.5046	0.5913	0.1444	0.1593	0.0368
ELECTRICITY	→	OP	0.7475	0.6992	0.6372	0.508	0.6469	0.443	0.4597	0.5573
OP	→	ELECTRICITY	0.8319	0.7497	0.6919	0.8295	0.6858	0.5176	0.6491	0.4175
FINANCIAL	→	OP	0.1246	0.233	0.3034	0.1855	0.2841	0.032	0.0922	0.1688
OP	→	FINANCIAL	0.0612	0.0228	0.0139	0.0194	0.0274	0.0215	0.0222	0.0106
FOODBEVERAGE	→	OP	0.536	0.2376	0.2506	0.3729	0.6415	0.2367	0.2951	0.3203
OP	→	FOODBEVERAGE	0.9067	0.5578	0.0327	0.0926	0.0849	0.0183	0.0354	0.0437
GASWATER	→	OP	0.961	0.8184	0.4647	0.0429	0.1292	0.048	0.0854	0.1161
OP	→	GASWATER	0.5082	0.7324	0.525	0.4123	0.1861	0.1218	0.0476	0.0099
INDUSTRIAL	→	OP	0.2839	0.2234	0.1181	0.0564	0.1342	0.021	0.0662	0.1197
OP	→	INDUSTRIAL	0.6844	0.4417	0.382	0.5185	0.3788	0.0846	0.0608	0.01
MINING	→	OP	0.6164	0.5682	0.5945	0.3944	0.4173	0.4905	0.3981	0.3763
OP	→	MINING	0.0839	0.1556	0.2641	0.4211	0.0915	0.0329	0.0063	0.0125
OIL	→	OP	0.8836	0.9649	0.9003	0.2569	0.3755	0.5195	0.5987	0.6794
OP	→	OIL	0.85	0.4815	0.645	0.7852	0.9142	0.4046	0.2536	0.2585
PHARMBIO	→	OP	0.6663	0.0336	0.0146	0.0323	0.0613	0.0151	0.0358	0.0497
OP	→	PHARMBIO	0.6719	0.9171	0.9368	0.9384	0.2988	0.24	0.2501	0.3361
SOFTWARE	→	OP	0.0466	0.002	0.0005	0.0008	0.0015	0.0004	0.001	0.0022
OP	→	SOFTWARE	0.9102	0.4989	0.5311	0.7326	0.5552	0.1843	0.2739	0.1705
TRAVELLEISURE	→	OP	0.567	0.7815	0.3034	0.065	0.1905	0.1207	0.2378	0.3225
OP	→	TRAVELLEISURE	0.3859	0.4784	0.5689	0.6507	0.6602	0.2817	0.1033	0.1071

for Automobiles and Parts (for lag 1), Financial (for lags 1, 6, 8 and 10), Food and Beverage (for lags 4 to 10), Gas, Water and Multitudes (for lags 1 and 2), Industrial Goods and Services (for lags 1 to 4), Pharmaceutical and Biotechnology (for lags 1 and 2) and Software (for lags 2 to 12).

Unidirectional Granger causality from Oil Price to Industrial return is significant only for Gas, Water and Multitudes (for lags 4 and 6).

For the U.K., there is bidirectional causality between Oil price and three industries such as Banks (for lags 1, 8, 10 and 12), Construction and Industrials (both at lag 6). Unidirectional Granger causality from Industrial return to Oil Price is significant for Automobiles and Parts (for lags 3 to 12), Banks (for lags 2 to 6), Chemical (for lags 8 to 12), Construction and Material (for lags 2, 3, 4, 8, 10 and 12), Financial Services (for lags 2 to 12), Food and Beverage (for lags 10 and 12), Gas, Water and Multitudes (for lags 6, 8 and 12), Industrial Goods and Services (for lags 2, 3, 4, 8, 10 and 12), Mining (for lags 8 to 12), Pharmaceutical and Biotechnology (for lag 2), Software and Computer Services (for lag 2) and Travel and Leisure (for lags 2 to 12).

Unidirectional Granger causality from Oil Price to Industrial return is significant for Electricity (for lags 10 and 12), Food and Beverage (for lags 2 and 8), Pharmaceutical and Biotechnology (for lags 8 to 12) and Software and Computer Services (for lag 6).

About the market in the U.S., bidirectional causality is significant for Automobiles and Parts (for lag 12), Banks, Chemicals, Construction and Financial (for lags 8, 10 and 12), Gas, Water and Multitude (for lag 8), Industrial and Mining (for lags 10 and 12) and Travel and Leisure (for lag 12).

Unidirectional Granger causality from Industrial return to Oil Price is significant for Automobiles and Parts (for lags 4 to 10), Banks (for lags 1 and 3 to 6), Chemical (for lags 4 and 6), Financial Services (for lags 4 and 6), Software and Computer Services (for lag 12) and Travel and Leisure (for lag 10).

Unidirectional Granger causality from Oil Price to Industrial return is significant for Construction and Material (for lag 1), Electricity (for lags 8 to 12), Food and Beverage (for lags 6 to 12), Gas, Water and Multitudes (for lags 10 and 12), Industrial Goods and Services (for lag 8) and Mining (for lags 2, 3 and 6).

Table 9: Results of the Granger causality tests for France

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.7424	0.1427	0.1153	0.0813	0.063	0.0007	0.0005	1.00E-05
OP	→	AUTOPARTS	0.3561	0.5058	0.7026	0.8375	0.9187	0.6695	0.7184	0.5469
BANKS	→	OP	0.2888	0.2231	0.2794	0.2756	0.1297	0.0464	0.0468	0.0857
OP	→	BANKS	0.3912	0.7657	0.9146	0.9682	0.9905	0.0817	0.0929	0.0253
CHEMICALS	→	OP	0.853	0.175	0.3103	0.1584	0.215	0.1065	0.0747	0.0049
OP	→	CHEMICALS	0.8942	0.4435	0.5888	0.7249	0.2956	0.0349	0.0441	0.0534
CONSTRUCTION	→	OP	0.6831	0.3502	0.2608	0.0629	0.043	0.0037	0.0059	0.001
OP	→	CONSTRUCTION	0.8569	0.7062	0.8368	0.663	0.5702	0.1079	0.1441	0.2397
ELECTRICITY	→	OP	0.8529	0.8497	0.9156	0.8443	0.028	0.0487	0.0581	0.0754
OP	→	ELECTRICITY	0.8779	0.8792	0.6611	0.6188	0.7706	0.5128	0.2838	0.0713
FINANCIAL	→	OP	0.8867	0.2183	0.021	0.043	0.0077	0.0011	0.0023	0.0024
OP	→	FINANCIAL	0.9064	0.9557	0.9968	0.998	0.9946	0.6231	0.6542	0.6402
FOODBEVERAGE	→	OP	0.474	0.0973	0.1661	0.2707	0.4194	0.1742	0.0767	0.1041
OP	→	FOODBEVERAGE	0.5436	0.1527	0.2865	0.6171	0.0419	0.0268	0.0355	0.0217
GASWATER	→	OP	0.4322	0.5257	0.6489	0.633	0.5684	0.7566	0.5533	0.4174
OP	→	GASWATER	0.9679	0.1345	0.1841	0.417	0.4319	0.1009	0.0322	0.0474
INDUSTRIAL	→	OP	0.7234	0.1589	0.2755	0.142	0.1348	0.1403	0.1087	0.075
OP	→	INDUSTRIAL	0.9891	0.7024	0.8483	0.9087	0.6759	0.5992	0.7741	0.7019
MINING	→	OP	0.503	0.6348	0.2665	0.2117	0.2477	0.32	0.2893	0.0073
OP	→	MINING	0.9655	0.8491	0.6896	0.8024	0.9244	0.9458	0.8658	0.8722
OIL	→	OP	0.8965	0.1372	0.3354	0.4795	0.326	0.2561	0.1631	0.2227
OP	→	OIL	0.1643	0.3441	0.3364	0.5342	0.7309	0.514	0.5153	0.1788
PHARMBIO	→	OP	0.8076	0.0261	0.0541	0.0751	0.045	0.0147	0.0291	0.0074
OP	→	PHARMBIO	0.9673	0.9991	0.593	0.626	0.5283	0.1485	0.2565	0.1481
SOFTWARE	→	OP	0.9277	0.3536	0.547	0.6877	0.7515	0.716	0.4535	0.4021
OP	→	SOFTWARE	0.4338	0.1967	0.3151	0.5413	0.3853	0.5315	0.6695	0.7968
TRAVELLEISURE	→	OP	0.8859	0.0435	0.0756	0.0907	0.1999	0.0938	0.0349	0.0186
OP	→	TRAVELLEISURE	0.8494	0.1213	0.2163	0.3114	0.3976	0.3557	0.5717	0.4884

Table 10: Results of the Granger causality tests for India

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.0258	0.194	0.2041	0.2224	0.2047	0.3109	0.1301	0.2084
OP	→	AUTOPARTS	0.6943	0.8923	0.9127	0.8543	0.861	0.9645	0.8886	0.8467
BANKS	→	OP	0.2947	0.4478	0.4533	0.2472	0.1796	0.3063	0.2265	0.3337
OP	→	BANKS	0.4994	0.6454	0.8209	0.724	0.2664	0.273	0.332	0.3318
CHEMICALS	→	OP	0.5162	0.4492	0.5741	0.6478	0.797	0.8095	0.8066	0.8581
OP	→	CHEMICALS	0.919	0.9518	0.9732	0.9892	0.9958	0.9987	0.9997	0.955
CONSTRUCTION	→	OP	0.2308	0.3936	0.3842	0.4525	0.6818	0.8812	0.5535	0.3746
OP	→	CONSTRUCTION	0.3169	0.2527	0.3618	0.1609	0.2929	0.5224	0.6577	0.316
ELECTRICITY	→	OP	0.2515	0.2111	0.2695	0.2231	0.2407	0.3115	0.1961	0.3313
OP	→	ELECTRICITY	0.7295	0.5783	0.8102	0.7436	0.6258	0.7831	0.727	0.7105
FINANCIAL	→	OP	0.0686	0.2658	0.3727	0.1526	0.0761	0.0474	0.0855	0.1481
OP	→	FINANCIAL	0.9695	0.693	0.4623	0.5368	0.1511	0.2359	0.3097	0.1388
FOODBEVERAGE	→	OP	0.2679	0.7285	0.4186	0.0726	0.0531	0.0588	0.075	0.1489
OP	→	FOODBEVERAGE	0.7007	0.2128	0.2656	0.2849	0.2394	0.3558	0.3073	0.4219
GASWATER	→	OP	0.0224	0.0622	0.1078	0.1408	0.2965	0.4339	0.4705	0.6113
OP	→	GASWATER	0.5214	0.2971	0.4866	0.0285	0.0456	0.1371	0.1905	0.2082
INDUSTRIAL	→	OP	0.0077	0.0593	0.0801	0.0546	0.1293	0.1639	0.1131	0.1653
OP	→	INDUSTRIAL	0.9124	0.6471	0.7323	0.1068	0.2048	0.4262	0.4811	0.5346
MINING	→	OP	0.4185	0.6671	0.4944	0.337	0.5925	0.4206	0.5183	0.5784
OP	→	MINING	0.8569	0.6107	0.6281	0.8793	0.7623	0.7927	0.8255	0.5947
OIL	→	OP	0.297	0.7234	0.6785	0.7248	0.2765	0.4874	0.3456	0.4981
OP	→	OIL	0.5846	0.4703	0.331	0.3319	0.4583	0.7025	0.7853	0.6569
PHARMBIO	→	OP	0.0186	0.0891	0.1868	0.2552	0.17	0.1948	0.3008	0.2329
OP	→	PHARMBIO	0.4762	0.1532	0.1326	0.1208	0.2413	0.3252	0.3719	0.5558
SOFTWARE	→	OP	0.0014	0.003	0.0089	0.013	0.0209	0.0576	0.0065	0.0073
OP	→	SOFTWARE	0.0667	0.1514	0.3787	0.4372	0.5401	0.7584	0.6979	0.7828
TRAVELLEISURE	→	OP	0.7068	0.9571	0.8119	0.4452	0.5441	0.8729	0.9308	0.8344
OP	→	TRAVELLEISURE	0.4063	0.2748	0.2697	0.1768	0.1394	0.2401	0.1184	0.1651

Table 11: Results of the Granger causality tests for the U.K.

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.915	0.1809	0.0287	0.0188	0.0368	0.0222	0.0395	0.0001
OP	→	AUTOPARTS	0.1413	0.2221	0.2929	0.4517	0.6906	0.5838	0.3933	0.5471
BANKS	→	OP	0.0016	0.0021	0.0034	0.0018	0.0013	0.0005	0.0008	0.0018
OP	→	BANKS	0.0218	0.1077	0.1459	0.2646	0.2739	0.0403	0.0647	0.0613
CHEMICALS	→	OP	0.7033	0.5275	0.5705	0.2748	0.2144	0.023	0.0453	0.0003
OP	→	CHEMICALS	0.765	0.7469	0.8336	0.8755	0.7512	0.8378	0.5637	0.4828
CONSTRUCTION	→	OP	0.6798	0.0093	0.0209	0.0116	0.0022	0.0015	0.0012	0.0003
OP	→	CONSTRUCTION	0.8378	0.7488	0.2368	0.1667	0.0696	0.3759	0.49	0.5979
ELECTRICITY	→	OP	0.777	0.4097	0.7315	0.7814	0.5405	0.4321	0.4604	0.5351
OP	→	ELECTRICITY	0.1743	0.1676	0.3252	0.3014	0.2019	0.2057	0.099	0.0886
FINANCIAL	→	OP	0.6978	0.0418	0.0384	0.0607	0.0302	0.0015	0.0031	0.0024
OP	→	FINANCIAL	0.7131	0.9509	0.9011	0.8339	0.866	0.8495	0.8167	0.9077
FOODBEVERAGE	→	OP	0.5306	0.3041	0.5134	0.4529	0.2075	0.1356	0.0724	0.0135
OP	→	FOODBEVERAGE	0.8514	0.0928	0.123	0.215	0.2429	0.0873	0.1182	0.1008
GASWATER	→	OP	0.2682	0.6531	0.8272	0.9267	0.0531	0.0705	0.1397	0.0885
OP	→	GASWATER	0.847	0.5233	0.3443	0.5	0.4071	0.2478	0.2211	0.1401
INDUSTRIAL	→	OP	0.6643	0.0455	0.0786	0.0921	0.0256	0.0066	0.0059	0.0024
OP	→	INDUSTRIAL	0.8012	0.9216	0.6086	0.327	0.0463	0.1837	0.2642	0.4238
MINING	→	OP	0.3634	0.4079	0.3285	0.3366	0.1784	0.07	0.0209	0.0005
OP	→	MINING	0.8266	0.8057	0.9232	0.9026	0.9717	0.9712	0.9667	0.9757
OIL	→	OP	0.72	0.2189	0.3922	0.3202	0.2836	0.1126	0.1498	0.1401
OP	→	OIL	0.2579	0.2831	0.1426	0.3038	0.5872	0.5044	0.6764	0.662
PHARMBIO	→	OP	0.4674	0.0644	0.1537	0.1524	0.115	0.1586	0.2999	0.1383
OP	→	PHARMBIO	0.9318	0.439	0.1694	0.3212	0.21	0.025	0.0136	0.0237
SOFTWARE	→	OP	0.5729	0.0307	0.1029	0.1787	0.351	0.4722	0.4562	0.2824
OP	→	SOFTWARE	0.1572	0.1065	0.2247	0.2837	0.057	0.1668	0.2591	0.3957
TRAVELLEISURE	→	OP	0.2802	0.0192	0.03	0.0575	0.0724	0.0192	0.0043	0.002
OP	→	TRAVELLEISURE	0.37	0.3507	0.1676	0.3653	0.3841	0.6328	0.6486	0.6981

Table 12: Results of the Granger causality tests for the U.S.

Lags			1	2	3	4	6	8	10	12
AUTOPARTS	→	OP	0.7868	0.5548	0.1083	0.083	0.0689	0.0819	0.006	0.0058
OP	→	AUTOPARTS	0.2782	0.4001	0.449	0.5794	0.5738	0.1486	0.23	0.0381
BANKS	→	OP	0.0381	0.1217	0.0779	0.0256	0.0143	0.0092	0.0044	0.0083
OP	→	BANKS	0.9502	0.1221	0.2181	0.2848	0.4677	0.0033	0.0011	5.00E-07
CHEMICALS	→	OP	0.8984	0.3037	0.3467	0.0922	0.0553	0.0583	0.0435	0.0089
OP	→	CHEMICALS	0.2267	0.4195	0.5936	0.6589	0.1246	0.0048	0.006	0.0031
CONSTRUCTION	→	OP	0.4667	0.3309	0.3951	0.3843	0.4249	0.0639	0.0126	0.0011
OP	→	CONSTRUCTION	0.0677	0.1397	0.242	0.3105	0.1049	0.0785	0.0362	0.0244
ELECTRICITY	→	OP	0.5343	0.7134	0.3257	0.4704	0.3753	0.2245	0.3405	0.4749
OP	→	ELECTRICITY	0.9289	0.8651	0.935	0.9222	0.641	0.0434	0.0087	0.01
FINANCIAL	→	OP	0.3498	0.5147	0.1696	0.0682	0.0165	0.0219	0.0005	0.0001
OP	→	FINANCIAL	0.9546	0.3403	0.5021	0.4555	0.2537	0.026	0.0204	0.0012
FOODBEVERAGE	→	OP	0.3138	0.2495	0.3946	0.5568	0.7438	0.483	0.4196	0.4315
OP	→	FOODBEVERAGE	0.4702	0.7773	0.9054	0.8577	0.0322	0.004	0.0024	0.0005
GASWATER	→	OP	0.6645	0.8672	0.1874	0.2716	0.1351	0.0934	0.1495	0.2364
OP	→	GASWATER	0.8822	0.9466	0.9099	0.3365	0.2378	0.0178	0.035	0.0844
INDUSTRIAL	→	OP	0.7577	0.9079	0.6371	0.6826	0.3392	0.1182	0.0967	0.0143
OP	→	INDUSTRIAL	0.7723	0.8118	0.8124	0.7848	0.1763	0.017	0.0227	0.0094
MINING	→	OP	0.3914	0.3702	0.1508	0.2331	0.4301	0.139	0.0825	0.0301
OP	→	MINING	0.3308	0.0488	0.0555	0.1031	0.077	0.1704	0.0408	0.0502
OIL	→	OP	0.6874	0.8982	0.388	0.5422	0.484	0.3182	0.3901	0.2688
OP	→	OIL	0.23	0.3985	0.3263	0.4329	0.5527	0.2661	0.3336	0.4269
PHARMBIO	→	OP	0.7553	0.8282	0.86	0.9552	0.566	0.7086	0.792	0.7812
OP	→	PHARMBIO	0.4266	0.7324	0.9097	0.9419	0.5202	0.1871	0.1181	0.1028
SOFTWARE	→	OP	0.3738	0.5081	0.5917	0.7685	0.7831	0.6997	0.4383	0.0355
OP	→	SOFTWARE	0.3205	0.5223	0.4303	0.5156	0.282	0.3783	0.5005	0.5675
TRAVELLEISURE	→	OP	0.6182	0.7056	0.5251	0.5426	0.524	0.528	0.0449	0.0124
OP	→	TRAVELLEISURE	0.3551	0.533	0.7187	0.8514	0.5438	0.249	0.3378	0.0369

Regression Analysis: Tables 7 and 8 demonstrate the summary of the results for all of the markets and industries in terms of a coefficient of exogenous variables (Oil Price) and R-squared. The coefficient of the price of oil varies slightly from one industry to another. Thus, one might claim that it does not matter that oil price variation affects which particular industry the most or the least. However, managers and practitioners in stock markets invest large amounts of money to shape their portfolios based on different industries. Therefore, a small change in the return of an industry would cause a significant gain or loss. Hence, it is crucially important for investors to know that oil price fluctuations influence which industries the most or the least. This is referred to as the risk taking attitudes of investors. Risk-taking investors would consider those industries that have big movements in relation to oil price changes, while risk-averse investors prefer to be in a more comfortable state and follow those industry indices that would have a minimal loss if the price of oil changes.

For Canada, oil price fluctuations influence the Oil and Gas industry the most, followed by the Mining, Chemical and the Construction and Material industries. On the other hand, oil price variations influence the Travel and Leisure industry the least, followed by the Software and Computer Services industry. Moreover, oil price fluctuations influence Banks and Financial Services as well. The changes in the price of oil positively affect Canadian industries, which means that if the price of oil increases, the industry index would equally increase. The only exception in Canada is the Pharmaceutical and Biotechnology industry, which is affected negatively. The overall R-squared (the mean of R-squared for 14 industries) is 3.1 percent, which indicates that changes in the price of oil can explain 3.1 percent of the changes in industry indices. The Oil and Gas industry has the highest value of R-squared (0.2702) and the Travel and Leisure industry has the lowest value (0.0000).

For China, changes in the price of oil significantly affected the Mining industry, followed by the Oil and Gas industry, the Gas, Water and Multitudes industry and the Industrial Goods and Services industry. Conversely, the Automobiles and Parts industry is least affected by changes in the price of oil. In addition, Chinese banks are affected by oil price changes more so than the Financial Services industry is. Oil price fluctuations positively affect all of the industries in the Chinese market. The mean of R-squared for the 14 industries is 0.64 percent. The Mining industry has the largest value in terms of R-squared (0.0384) and the Automobiles and Parts industry has the lowest R-squared (0.0007), meaning that oil price variation can explain almost 3.8 percent of the changes in the stock returns for the Mining industry and approximately 0.07 percent of the changes in the Automobiles and Parts industry stock returns.

In France, changes in the price of oil affect the Oil and Gas industry the most, followed by the Electricity, Construction and Material and the Banks industries. On the contrary, oil price variations influence the Food and Beverage industry the least, followed by the Gas, Water and Multitudes, Software and Computer Services and the Chemical industries. The only industry that is negatively impacted by oil price fluctuations is the Pharmaceutical and Biotechnology industry. The overall R-squared (the mean of R-squared for 14 industries) is 2.38 percent. The changes in oil prices can explain approximately 14 percent of the changes in the Oil and Gas industry stock returns as this industry has the highest value of R-squared (0.144), while the Food and Beverage industry has the lowest R-squared (0.0015), followed by the Pharmaceutical and Biotechnology industry (0.0039).

In India, the Oil and Gas industry was most affected by oil price changes, followed by the Financial services, Construction and Material and the Mining industries. Conversely, the Automobiles and Parts industry was least affected by oil price fluctuations. Furthermore, oil price movements positively affected all of the industries in India. The mean of R-squared for the 14 industries is 1.2 percent. In India, the Oil and Gas industry has the largest R-squared (0.0269), which indicates that the changes in the price of oil can explain almost 2.6 percent of the changes in the Oil and Gas industry returns. In contrast, the Automobiles and Parts industry has the lowest value of R-squared (0.0002), followed by the Pharmaceutical and Biotechnology industry (0.004).

In the U.K., the Mining industry was most affected by oil price changes, followed by the Oil and Gas industry and the Automobiles and Parts industry. On the other hand, the Food and Beverage industry was least affected by the oil price variations. In the U.K., as in Canada and France, these price fluctuations negatively affect the Pharmaceutical and Biotechnology industry. The overall R-squared (the mean of R-squared for 14 industries) is almost 3 percent. The highest value of R-squared occurred for the Oil and Gas industry at approximately 14 percent, followed by the Oil and Gas and the Mining industries, which contain oil-related and oil-user sub

Table 13: Summary of regression results of Canada, China and France

	Canada		China		France	
Industries	Coefficient	R-squared	Coefficient	R-squared	Coefficient	R-squared
Oil and Gas	0.3524	0.2702	0.1067	0.016	0.2561	0.144
Chemicals	0.1824	0.0435	0.04829	0.0034	0.07855	0.0157
Mining	0.2816	0.0983	0.2745	0.0384	0.1011	0.0163
Construction and Material	0.122	0.0313	0.05287	0.0043	0.1233	0.0286
Industrial Goods and Services	0.066	0.0115	0.05936	0.0057	0.08873	0.0209
Automobiles and Parts	0.036	0.0019	0.02413	0.0007	0.1129	0.0149
Food and Beverage	0.044	0.0075	0.03795	0.0011	0.0178	0.0015
Pharmaceuticals and Biotechnology	-0.02583	0.0007	0.03859	0.0023	-0.03937	0.0039
Travel and Leisure	0.00105	0	0.04522	0.0023	0.08135	0.0133
Electricity	0.0432	0.0102	0.0422	0.0029	0.1419	0.0167
Gas, Water and Multitudes	0.04128	0.011	0.06478	0.0045	0.0637	0.0077
Banks	0.05166	0.007	0.05899	0.0052	0.1186	0.017
Financial Services	0.08977	0.04	0.03041	0.0009	0.0787	0.0269
Software and Computer Services	0.0219	0.0006	0.04291	0.002	0.07317	0.0058

All the p-values are less than 0.05.

Table 14: Summary of regression results of India, U.K. and the U.S.

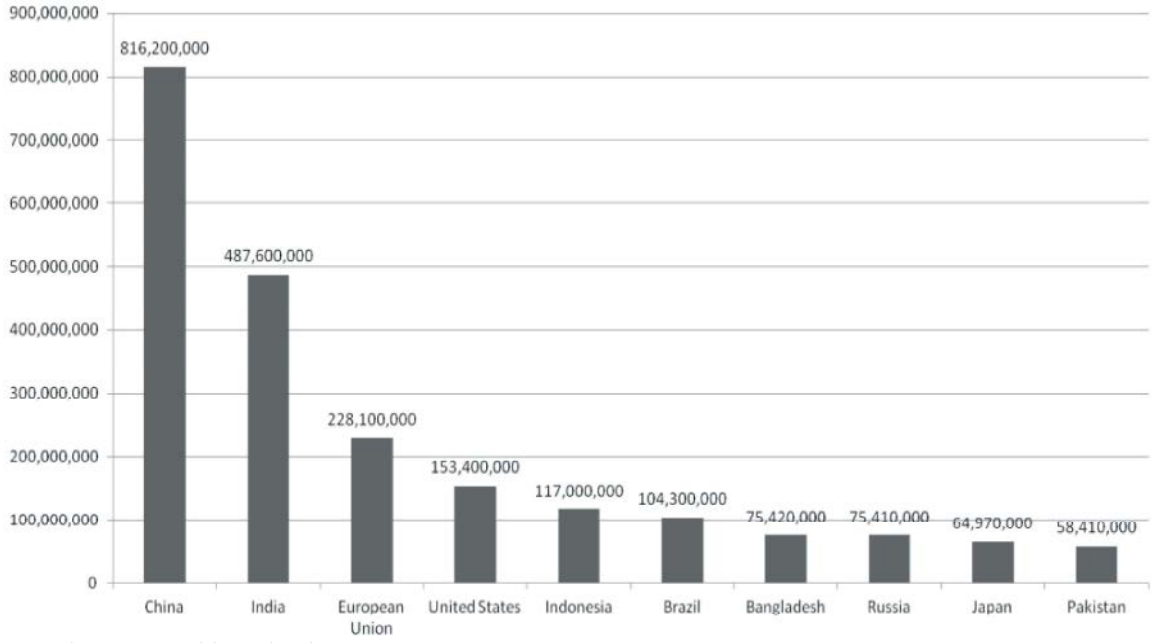
	India		U.K.		U.S.	
Industries	Coefficient	R-squared	Coefficient	R-squared	Coefficient	R-squared
Oil and Gas	0.1508	0.0269	0.2366	0.1409	0.3465	0.2746
Chemicals	0.1171	0.013	0.1097	0.0281	0.1519	0.0448
Mining	0.1323	0.0072	0.3322	0.1098	0.451	0.177
Construction and Material	0.1404	0.02	0.0665	0.0136	0.1564	0.0389
Industrial Goods and Services	0.09222	0.0102	0.0701	0.0188	0.103	0.0296
Automobiles and Parts	0.0107	0.0002	0.1429	0.0182	0.1374	0.027
Food and Beverage	0.0485	0.0052	0.0232	0.0024	0.0388	0.009
Pharmaceuticals and Biotechnology	0.04391	0.004	-0.0394	0.0048	0.0138	0.0007
Travel and Leisure	0.1295	0.0206	0.0632	0.0117	0.0734	0.01
Electricity	0.085	0.0072	0.0394	0.0072	0.0792	0.0268
Gas, Water and Multitudes	0.09872	0.0101	0.0241	0.0031	0.1718	0.0888
Banks	0.1142	0.0132	0.09344	0.0125	0.0969	0.0116
Financial Services	0.1507	0.0227	0.101	0.04	0.0987	0.0161
Software and Computer Services	0.1042	0.008	0.0811	0.0076	0.0891	0.0131

industries that have high values of R-squared at approximately 14 and 10 percent respectively. The Financial Services industry had an R-squared of 4 percent and the lowest value of R-squared is found for the Food and Beverage industry, as an oil-user industry, with approximately 0.24 percent.

In the U.S., the Mining and the Oil and Gas industries were most affected by oil price fluctuations (the coefficients are 0.451 and 0.3465 respectively), followed by the Gas, Water and Multitudes industry. On the other hand, the Pharmaceutical and Biotechnology, Food and Beverage and Travel and Leisure industries were least affected by oil price variations. Moreover, the changes in the price of oil positively affected all of the industries in the U.S. market. The overall R-squared (the mean of R-squared for the 14 industries) is 5.48 percent, which is the highest among all of the studied other markets. Therefore, the changes in the price of oil can explain approximately 5 percent of the variation in the U.S. market. The Oil and Gas industry has the highest value of R-squared (0.2746) and the Pharmaceutical and Biotechnology industry has the least (0.0007), followed by the Food and Beverage and the Travel and Leisure industries.

DISCUSSION

Oil price fluctuations positively affect the return of industries, except for the Pharmaceutical and Biotechnology industries in Canada, France and the U.K.



Source: The CIA World Factbook

Fig. 1: Top 10 countries in terms of total number of labor force

This positive relationship might exist because these industries can increase their share prices more easily when either oil becomes more expensive or its price becomes more uncertain. Therefore, the additional production costs caused by oil price increases are offset by an increase in share prices.

Two industries that are most affected by oil price variations are the Oil and Gas and the Mining industries. Oil and Gas is oil-related and is heavily affected by oil price movements. Conversely, oil price movements have the least impact on the Food and Beverage industry. Regarding the Automobiles and Parts sector, which includes motorcycles and passenger vehicle producers, manufacturers and distributors of new and replacement parts for motorcycles and automobiles, manufacturers and distributors of automobiles and truck and motorcycle tires, the results indicate that oil price changes affect the Automobiles and Parts industry the least in China and India. However, in the U.K., the Automobiles and Parts industry is one of the industries that is most affected by oil price fluctuations, after the Mining and the Oil and Gas industries. Therefore, the Automobiles and Parts industry in the U.K. is more sensitive towards oil fluctuations than do India and China. One possible reason for this occurrence is that China and India have the top two largest labor forces. As illustrated in Figure 1, China and India contain almost 60 percent of the total labor force among the top 10 labor-force countries. Consequently, during a period of rising oil prices, Chinese and Indian managers compensate the extra costs of expensive oil by cutting the fossil fuelled machinery and replaced by abundant laborers, which is harder to accomplish in the U.K. or in other developed countries.

In France and India, the Construction and Material industry is among the top three industries that are most affected by changes in the price of oil. Moreover, in India, the Financial Services industry is the next most heavily affected sector. In addition, in both Canada and the U.S., oil price fluctuations affect the Travel and Leisure industry negligibly. Furthermore, the Gas, Water and Multitudes industries are among the heavily affected industries in China and in the U.S., while these same industries in France are only slightly affected.

In Canada, France and the U.K., the Pharmaceutical and Biotechnology industry was negatively affected by oil price fluctuations, though the rest of the industries were positively affected. One possible reason for this negative relationship between oil price movements and the Pharmaceutical and Biotechnology industry returns in the above-mentioned countries is that the governments of these countries fund the their health-care systems. In these countries, the governments provide health care to all permanent residents, which is free at the point of use and it is paid either from the general taxation pool or by private entities (Lega, 2006, Etienne and Asamoa-Baah, 2010, Toth, 2010). When the price of oil increases, the

production cost would rise as well. Unlike other industries that can easily increase their prices to cover the extra production costs, the Pharmaceutical and Biotechnology industry cannot increase its share price because their products and services are free to the public. As a result, the Pharmaceutical and Biotechnology industry would be less attractive for investors and the stock returns of the industry would decline. Conversely, the health care systems in the U.S., India and China are not free to the public and residents have to pay for their products and services. Therefore, when the price of oil rises, the Pharmaceutical and Biotechnology industry raises its share prices and, the burden of the increase in oil prices rests on the people who pay to utilize the health care system.

Financial institutions are extremely monetarily strong and have expertise in risk management and as a result, they can take speculative and/or hedging positions and reap huge profits as the price of oil changes. Financial companies are not engaged in oil trading directly. However, they provide funds to firms that do trade crude oil directly. Moreover, they hold the bonds that were issued by firms in different industries related to oil. The financial firms are among the major investors and participants in the derivatives market and closely follow the movements of the oil-related and oil-user companies; thus, a financial firm undergoes losses if its clients suffer losses themselves. Therefore, the stock returns for financial firms can be affected indirectly by oil price fluctuations.

An Implication for Managers: The results of this study are helpful for institutional and private investors, portfolio managers and practitioners. Based on the result, Oil price fluctuations affect the Oil and Gas and the Mining industries the most, while they affect the Food and Beverage industry the least. Therefore, investors could consider these findings when diversifying their portfolios. Based on their own personal goals, investors are able to decide whether to invest in the Oil and Gas and the Mining industries or in the Food and Beverage industry. Furthermore, in three of the six countries studied (Canada, France and the U.K.), oil price movements negatively affect the Pharmaceutical and Biotechnology industry because the governments of these countries provide free health-care systems for their residents. Therefore, investors in these three countries would consider adjusting their portfolios based on the negative relationship between oil price fluctuations and the stock returns of the Pharmaceutical and Biotechnology industry.

More precisely, in Canada, risk-taking investors would reap huge profits by investing in the Oil and Gas, Mining and Chemical industries as the price of oil rises. Conversely, risk-averse investors would invest in the Travel and Leisure and the Software and Computer Services industries. Moreover, Canadian portfolio managers would consider investing in the Pharmaceutical and Biotechnology industry in order to possess a better-diversified portfolio due to its negative relationship with oil price variation. Chinese investors would invest in the Oil and Gas, the Mining and the Gas, Water and Multitudes industries as the price of oil rises in order to reap a large profit. Nevertheless, investors who are opposed to taking big risks would consider the Automobiles and Parts industry. In France, managers would invest in the Oil and Gas, Electricity and the Construction and Material industries as the price of oil rises in order to reap large profits. Conversely, risk-averse managers would invest in the Food and Beverage industry and the Gas, Water and Multitudes industry. Like the Canadian managers, French investors are able to diversify their portfolios by investing in the Pharmaceutical and Biotechnology industry. In India, portfolio managers would invest in the Oil and Gas, Financial Services and the Construction and Material industries as oil prices rise. However, those managers who are reluctant to take risky positions might invest in the Automobiles and Parts industry instead.

In the U.K. and the U.S., investors would invest in the Oil and Gas and the Mining industries when oil prices trend upwards. Moreover, British and American managers might consider investing in the Automobiles and Parts industry and the Gas, Water and Multitudes industry respectively because they are heavily affected by oil price variations. In both markets, risk-averse portfolio managers would invest in the Food and Beverage industry. Because oil price fluctuations negatively affect the Pharmaceutical and Biotechnology industry in the U.K., British investors would consider this industry in order to have a well-diversified portfolio.

CONCLUSION

This study inspects the impacts of oil price fluctuations on industry returns for the following six markets: Canada, China, France, India, the U.K. and the U.S. For each industry, the market index and the price of oil were collected from Datastream on a weekly basis from June 1998 until the end of 2011. In general, oil price variation positively affects all of the industries except for the Pharmaceutical and Biotechnology industry in

Canada, France and the U.K. The two industries most affected by oil price variations are the Oil and Gas and the Mining industries. Moreover, oil price movements have the least impact on the Food and Beverage industry. When the price of oil rises or the oil market is unstable, the production costs increase as well. Therefore, in order to compensate for the extra cost, managers would increase the stock share price.

In Canada, France and the U.K, the Pharmaceutical and Biotechnology industry is negatively affected by oil price fluctuations. One possible reason for the negative relationship between oil price movements and the Pharmaceutical and Biotechnology industry stock returns in the above-mentioned countries is that the governments of these countries fund the health-care systems of their countries. As a result, when oil prices increase, these industries will be less attractive to investors. The results of this study are useful for portfolio managers as well as for investors because they can guide portfolio adjustment based on the level of risk for certain industry investments in relation to fluctuations in the price of oil. Future research studies may classify countries as oil importers or exporters. In oil importing countries, the stock market reacts differently to oil price shocks compared to a stock market in an oil exporting country. Moreover, a comparison study between developed markets and Middle Eastern countries would be useful because Middle Eastern countries are very rich in oil.

ACKNOWLEDGMENT

We would like to express our gratitude to Mr. Amirhossein Taebi Noghondari, whose help, stimulating suggestions and encouragement helped us throughout our research. All errors are ours.

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