



**Indian Institute of Management Calcutta**  
**Working Paper Series**  
**WPS No841/May 2020**

**Oil price and its impact on firms' return volatility**

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# Oil price and its impact on firms' return volatility

Vivek Rajvanshi<sup>1</sup>

## Abstract

We examine the effect of oil price on return volatility for 519 firms listed in Indian market from a period from Jan 2009 to Dec 2018. We use GARCH (1,1) model to examine the oil price – return volatility relationship. Our findings suggest that the effect of oil price on return volatility of firms is heterogeneous, negative effect of oil price on return volatility dominates positive effect of oil price on return volatility in most of the sectors. Automobile & Components, Banks, Capital Goods, Consumer Durable and Apparel, Diversified Financials, Energy, Food Beverage & Tobacco, Materials, Pharmaceuticals & Biotechnology, Software and Services are the major sectors where positive impact of oil prices on return volatility is found in more than 25% cases. Further we examine the lagged oil price effect on return volatility to understand the underreaction of the equity market. We find that only in around 10% cases lagged oil price are significant which shows that Indian equity market is efficient to the information arrival from oil prices. We also find that larger firms are more impacted by the oil prices and around 60% significant firms belong to largest quartile.

Key Words: Crude oil, Volatility, Emerging Markets

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Author acknowledge the data support provided by the Financial Research and Trading Laboratory of IIM Calcutta and research grant by IIM Calcutta

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## **Introduction**

Literature on oil price and its impact on overall economy conclude that change in oil price negatively impact the output of the overall economy as oil is a direct or indirect contributor of firms' cost (e.g, Hamilton, 1983; Christini 1998). However, impact of oil price may vary from industry to industry depending upon whether oil price creates value for the industry or it is a cost to the firm. Jones and Kaul (1996) examine the impact of oil price on the GDP of four developed economies and conclude that oil price has negative impact on the economy. Chen et al. (1986) find that oil price has significant impact on the stock market. However, studies looking at the impact of oil price on individual firms are limited. Recently, Narayan and Sharma, for US listed firms, find that oil price impact firms' return differently depending upon the industry they are in and argue that results of the previous studies may be because of the dominance of some sectors over others (Narayan and Sharma, 2011).

India is a major importer of crude oil and imports around 70% of its crude oil requirements. Therefore, studies on crude oil always gets attention of regulators, practitioners and academicians. Studies in Indian context finds that increase in crude oil price results in sudden increase in inflation (e.g, Bhattacharya et al. 2001 among others). The central bank of India, point out that for a dollar increase in crude oil price, WPI (whole sale price index) increase by 30 basis points (Aparna, 2013).

This study is proposed to investigate the impact of oil price on firm's return volatility. The motivation of the study comes from the fact that investors invests in specific sectors and firms depending upon their risk appetite and requirements. Therefore, idiosyncratic volatility is very important (e.g, Campbell et al., 2001). If crude oil has explanatory power over the firms' return volatility, then it may help investors in taking informed decision about idiosyncratic risk and accordingly they can rebalance their portfolio. Further, if stock market is not efficient and there is a lag effect of oil price on firms return and volatility then investors may formulate trading strategies in order to get economic gains based on publicly available historical oil price.

In short, we examine the effect of oil price on return volatility for 519 firms listed in Indian market from a period from Jan 2009 to Dec 2018. Our study contributes to the extant literature in several ways. First, studies on oil price and its effect on stock return volatility are very limited. Second, India is a major importer of crude oil and

oil price change has great impact on Indian Economy. Firm level analysis will provide better understanding of effect of oil price on stock return volatility. Third, India is an emerging market and in the last two decades because of several economic reforms India has attracted lots of foreign direct investment and attracted foreign portfolio investors for investment in India. Impact of oil price on stock return volatility will help them better understanding of the risk associated with this firm. In this study, we propose to test that whether oil price has explanatory power over the stock return volatility

## **Literature Review**

Oil price and its impact on the economy has received a great amount of interest by both academicians and researchers (e.g., Hamilton, 1983). Jones and Kaul (1996) extend the research and examine the impact of oil prices on the equity market. Main finding of the study is that oil increases the inflation and therefore present value of cash flow expected by investors from a firm will be low and suggest a negative association between oil price and equity market. However, his study is limited to three developed countries viz. United States, United Kingdom, Canada and Japan and they examine the relationship at aggregate level of equity markets of the corresponding countries. Kollias et al. (2013) argue that investors see increase in oil price as an indicator of booming economy and therefore there should be a positive effect of oil price on stock market. Chen, Cheng, and Demirer (2017) also find positive relation between oil price momentum and stock market.

Kilian and Park (2009) decompose oil price as a demand shock (due to uncertainty in future oil supply shortfalls) and supply shock (oil price rise if economy is booming and there is a high demand of oil) and argue that depending upon the type of shock (demand shock or supply shock) the association between oil price and stock market (negative or positive) need to be explained. Several studies examine the effect of oil price on stock market and aggregate level and find inconclusive results. (Driesprong et al., 2008; Jones and Kaul, 2006) find negative effect of oil price on aggregate stock returns, whereas (Narayan and Narayan, 2010; Zhu et al., 2014) find positive effect of oil on aggregate stock returns. Several studies examine the effect of oil price on stock return for export/import oriented economies as the rise in oil price is beneficial for the net oil exporter countries (Le & Chang, 2015; Bouri et al., 2016).

Mollick and Assefa (2013) argue that mixed results about the effect of oil price and aggregate stock returns need to be reexamine at micro level as different sectors within an index may vary depending upon the dependence among firms of these

sectors on oil. Countries where stock indices are not very well diversified and lead by few sectors consisting of large firms, studies based on aggregate stock market may not reveal the true picture of the association between oil price and stock market. (Elyasiani et al., 2011; Arouri & Nguyen 2010; Lee et al., 2012) examine the impact of oil price at sector level and find that oil price effect sectoral indices heterogeneously. Studies show that impact of oil price on manufacturing and transport is negative as the cost of production increases with oil price rise, whereas the impact is positive for oil and gas sector as they are able to pass the price to the consumers and get benefited because of higher inventory value (Nandha and Faff, 2008).

(Narayan and Sharma, 2011; Tsai, 2015) examine the effect of oil price on stock market at firm level. These studies find that negative effect of oil price on stock return dominates the positive effect of oil price on stock return and also depend upon the size of the firm. Studies examine the impact of oil price on return volatility at firm level is very limited. Narayan and Sharma (2014) examine the role of oil price in stock return volatility. They find a heterogeneous effect of oil price on stock return volatility. Choi & Hammoudeh (2010) examine the relation between oil price volatility and stock return. Arouri and Nguyen (2010) find strong spillover effect from oil market to stock market.

## Methodology

We use GARCH (1,1) model to examine the effect of oil price on firm return volatility. GARCH(1,1) model is run for all 519 firms from the period from Jan 2009 to Dec 2018. GARCH model simultaneously estimates the parameters of return and variance equation.

$$R_t = \alpha_1 + \varepsilon_t$$

$$h_t = \omega + \alpha * gOP_t + \beta \varepsilon_{t-1}^2 + \gamma h_{t-1}$$

Where  $R_t$  is stock return at time t and calculated as the difference in log prices at time t and t-1.  $\varepsilon_t$  is an error term which is assumed to be iid  $N(0, h_t)$ .  $gOP_t$  is the growth rate in oil prices calculated as the difference in log prices at time t and t-1. In our model variable of interest is  $\alpha$ , coefficient of  $gOP_t$ .

## Results and Discussion

Descriptive Statistics of daily oil returns given in Table 1 shows that oil remains very volatile during the study period with daily return standard deviation of 2.1%. Skewness is positive but not statistically different than zero. However higher kurtosis shows the presence of high peaked distribution of oil returns.

**Table 1:** Descriptive Statistics of daily oil returns (all numbers are in %, except Skewness, Kurtosis and Obs.)

Variable	Mean	Median	SD	Skewness	Kurtosis	Obs.	Min	Max
Ret_Oil	0.0109	0.0100	2.1291	0.0422	4.2006	2464	-5.8572	6.7441

**Figure 1:** Graph of daily oil returns from 01 Jan 2009 to 01 Jan 2019

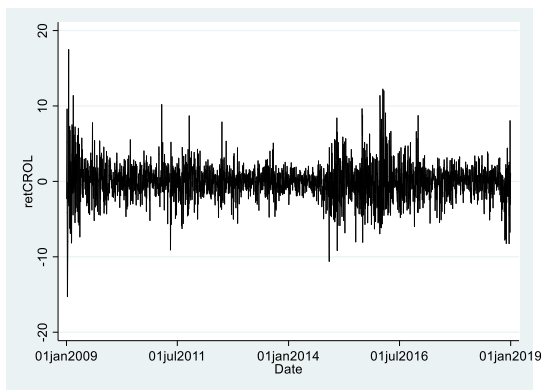


Figure 1 provides the returns of oil series from Jan 2009 to Dec 2018. There are deep spics and troughs after 2015 as compared to the period from Jan 2009 to 2015 which shows that return distribution has changed after 2015 and clearly return distribution in not constant during the study period.

To understand the dynamics of oil prices and its impact on equity market, before moving to firm level analysis we examine the correlation structure between oil returns and first two moments of various sectors of equity market to understand the impact of information flow from oil market to equity market. We classify 519 firms into 24 sectors based on Global Industry Classification Standard (GICS). Table 2 report the correlation between oil returns and sector returns and sector returns volatility with the t-statistics. Sector return volatility is estimated by GARCH (1,1) model.

**Table 2:** shows the correlation between the growth in oil prices and sector returns, oil prices and sector return volatility

Sector	Stock Returns		Return Volatility	
Automobiles & Components	0.0732	(3.6435)	0.0320	(1.5875)
Banks	0.0455	(2.2611)	0.0272	(1.3521)
Capital Goods	0.0799	(3.9792)	0.0249	(1.2373)
Commercial & Professional Services	0.0456	(2.2651)	0.0081	(0.4041)
Consumer Durables & Apparel	0.0638	(3.1732)	0.0378	(1.8780)
Consumer Services	0.0544	(2.7047)	0.0307	(1.5247)
Diversified Financials	0.0701	(3.4847)	0.0294	(1.4602)
Energy	0.0425	(2.1103)	0.0350	(1.7363)
Food & Staples Retailing	0.0244	(1.2112)	0.0161	(0.7982)
Food, Beverage & Tobacco	0.0570	(2.8328)	0.0199	(0.9863)
Health Care Equipment & Services	0.0611	(3.0389)	0.0304	(1.5103)
Household & Personal Products	0.0631	(3.1355)	0.0275	(1.3641)
Insurance	0.0567	(2.8185)	0.0285	(1.4169)
Materials	0.0782	(3.8926)	0.0347	(1.7213)
Media & Entertainment	0.0579	(2.8795)	0.0401	(1.9912)
Pharmaceuticals, Biotechnology	0.0756	(3.7603)	0.0177	(0.8781)
Real Estate	0.0598	(2.9723)	0.0320	(1.5895)
Retailing	0.0485	(2.4102)	0.0185	(0.9193)
Software & Services	0.1089	(5.4334)	0.0417	(2.0732)
Technology Hardware & Equipment	0.0758	(3.7711)	0.0107	(0.5302)
Telecommunication Services	0.0404	(2.0060)	0.0228	(1.1330)
Transportation	0.0195	(0.9653)	0.0202	(1.0034)
Utilities	0.0660	(3.2831)	0.0203	(1.0097)

t-statistics are given in parenthesis

Correlation between oil returns and sector returns suggest that most of the sectors are positively correlated but the magnitude of association is not very strong, whereas correlation between oil returns and sector return volatility is very weak and in most of the cases it is insignificant. This analysis gives us primary indication that the association between oil and different sectors is heterogeneous which motivates us for further in-depth analysis. We looked at the impact of oil returns on number of firms within different sectors to understand the relationship between oil returns and equity market.

Table 3 provides impact of oil returns on firms' return volatility. We run GARCH (1,1) model for all 519 firms filtered for this study with oil growth in variance equation of GARCH model. Results show that oil returns have negative impact on

firms' volatility, it means if oil prices rise it is expected that total risk in firm's stock prices increases. However, results are not homogeneous and the degree of association varies among sectors.

**Table3:** Association of firms within different equity sectors with oil. Number of firms and their percentage in the corresponding sector is provided in the parenthesis.

Sectors	Sig_plus	Sig_minus	Insig_plus	Insig_minus
Automobiles & Components	5 (13.5%)	18 (48.6%)	6 (16.2%)	8 (21.6%)
Banks	4 (11.1%)	9 (25.0%)	4 (11.1%)	19 (52.8%)
Capital Goods	7 (8.8%)	29 (36.3%)	15 (18.8%)	29 (36.3%)
Commercial & Professional Services	1 (25.0%)	0 (0.0%)	1 (25.0%)	2 (50.0%)
Consumer Durables & Apparel	4 (11.1%)	14 (38.9%)	8 (22.2%)	10 (27.8%)
Consumer Services	0 (0.0%)	0 (0.0%)	5 (83.3%)	1 (16.7%)
Diversified Financials	2 (7.1%)	8 (28.6%)	11 (39.3%)	7 (25.0%)
Energy	1 (7.7%)	6 (46.2%)	5 (38.5%)	1 (7.7%)
Food & Staples Retailing	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)
Food, Beverage & Tobacco	4 (16.0%)	7 (28.0%)	5 (20.0%)	9 (36.0%)
Health Care Equipment & Services	1 (20.0%)	1 (20.0%)	0 (0.0%)	3 (60.0%)
Household & Personal Products	0 (0.0%)	4 (44.4%)	0 (0.0%)	5 (55.6%)
Insurance	0 (0.0%)	2 (66.7%)	0 (0.0%)	1 (33.3%)
Materials	17 (17.2%)	34 (34.3%)	19 (19.2%)	29 (29.3%)
Media & Entertainment	3 (21.4%)	4 (28.6%)	2 (14.3%)	5 (35.7%)
Pharmaceuticals, Biotechnology	4 (11.4%)	15 (42.9%)	7 (20.0%)	9 (25.7%)
Real Estate	3 (16.7%)	6 (33.3%)	2 (11.1%)	7 (38.9%)
Retailing	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)
Software & Services	4 (15.4%)	8 (30.8%)	5 (19.2%)	9 (34.6%)
Technology Hardware & Equipment	0 (0.0%)	5 (55.6%)	2 (22.2%)	2 (22.2%)
Telecommunication Services	3 (75.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
Transportation	1 (10.0%)	5 (50.0%)	1 (10.0%)	3 (30.0%)
Utilities	1 (8.3%)	4 (33.3%)	6 (50.0%)	1 (8.3%)



Among major sectors, where there are more than 25 firm's data is available, we find that Automobiles and Components (18,48.6%), Materials (34, 42.9%) , Pharmaceuticals and Biotechnology (15, 42.9%), Capital Goods (29, 36.3%), Consumer Durables & Apparel (14, 34.3%) and Bank (9, 25%) sectors report strong negative association between firms' stock return volatility with oil growth. Almost in all sectors number of firms whose stock return volatility is affected negatively with rise in oil prices are higher than the firms for which stock return volatility is affected positively with rise in oil. Energy sector is very much affected by the change in oil prices and increase in oil prices increase expected cash flows for such firms. Around 46.2% firms in Energy sector shows negative relationship between oil growth and stock return volatility. Heterogeneous effect of oil price on return volatility can which varies from one sector to another can be explained with the characteristics of the sectors. As firms in some sectors required more capital than the firms in other sectors, their operating leverage, financial leverage also varies.

Among major sectors, we find that Automobiles and Components (5,13.5%), Materials (17, 17.2%), Pharmaceuticals and Biotechnology (4, 11.4%), Capital Goods (7, 8.8%), Consumer Durables & Apparel (4, 11.4%), Bank (4, 11.1%) sectors report strong positive association between firms' stock return volatility with oil growth. Results suggest that when we examine the association between oil returns and stock return volatility at an aggregate level (through index or sectoral indices) does not give the true picture and therefore previous studies provide mixed evidence (Driesprong et al., 2008; Jones & Kaul, 1996; Narayan & Narayan, 2010, Zhu et. Al., 2014).

Further, as our results suggest that there is a heterogeneous relationship between oil prices and firms' return volatility, we need to examine this relationship based on the firms' characteristics and the efficiency of information flow from oil market to stock market.

To examine the efficiency of information flow from oil prices to stock market we added lagged oil returns in the GARCH variance equation. We added oil growth lags up to order of eight. Results are reported in Table 4. We use following GARCH (1,1) model to examine oil price – return volatility relationship.

$$R_t = \alpha_1 + \varepsilon_t$$

$$h_t = \omega + \alpha_1 gOP_{t-1} + \alpha_1 gOP_{t-2} + \alpha_1 gOP_{t-3} + \alpha_1 gOP_{t-4} + \alpha_1 gOP_{t-5} + \alpha_1 gOP_{t-6} + \alpha_1 gOP_{t-7} + \alpha_1 gOP_{t-8} + \beta \varepsilon_{t-1}^2 + \gamma h_{t-1}$$

We choose number of lags based on Schwartz Information Criterion (SIC). We use different order of lags and find that SIC is minimum at eight lags. SIC is normally

preferred over the Akaike Information criterion (AIC) as it imposed higher penalty for additional variable. We applied GARCH (1,1) model for all 519 firms. In some cases, there are issues of non-normality in returns of some the firms and there were presence of fat tails and high peakedness, and therefore we applied GARCH model Generalized Error Distribution (GED) so that out results would remain robust.

Results show that there is a strong relationship in lagged oil returns – return volatility of the firms in all 24 sectors. For the brevity of space, we are showing results of only 14 sectors, however, results may be obtained from the author on request. In some sectors, such as Automobile & Components, Capital Goods, Consumer Durables and Apparels Diversified Financials, Materials, Pharmaceuticals and Biotechnology, Software and Services lagged oil return – return volatility relationship is significant in more than 10% cases. Banks, Energy, Food Beverage & Tobacco, Media & Entertainment, Real Estate, Transport and Utilities lagged oil returns were significant in less than 10% cases. Results shows that there is a underreaction in equity market but limited to only few sectors. This shows that somewhat Indian market is efficient when information from oil market is concerned.

**Table 4:** effect of lagged

Lags	Automobiles & Components		Banks	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	1 (2.7%)	0 (0.0%)	0 (0.0%)	2 (5.4%)
2	0 (0.0%)	3 (8.1%)	2 (5.4%)	0 (0.0%)
3	2 (5.4%)	2 (5.4%)	0 (0.0%)	0 (0.0%)
4	2 (5.4%)	1 (2.7%)	2 (5.4%)	1 (2.7%)
5	0 (0.0%)	1 (2.7%)	1 (2.7%)	0 (0.0%)
6	0 (0.0%)	4 (10.8%)	3 (8.1%)	0 (0.0%)
7	3 (8.1%)	1 (2.7%)	1 (2.7%)	1 (2.7%)
8	3 (8.1%)	2 (5.4%)	0 (0.0%)	0 (0.0%)
	Capital Goods		Consumer Durables & Apparel	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	2 (5.4%)	0 (0.0%)	2 (5.4%)	0 (0.0%)
2	4 (10.8%)	5 (13.5%)	0 (0.0%)	2 (5.4%)
3	3 (8.1%)	2 (5.4%)	1 (2.7%)	5 (13.5%)
4	2 (5.4%)	2 (5.4%)	3 (8.1%)	0 (0.0%)
5	7 (18.9%)	4 (10.8%)	1 (2.7%)	1 (2.7%)
6	4 (10.8%)	4 (10.8%)	1 (2.7%)	0 (0.0%)
7	5 (13.5%)	3 (8.1%)	3 (8.1%)	3 (8.1%)
8	2 (5.4%)	1 (2.7%)	3 (8.1%)	1 (2.7%)

	Diversified Financials		Energy	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	1 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
2	2 (5.4%)	2 (5.4%)	1 (2.7%)	2 (5.4%)
3	0 (0.0%)	3 (8.1%)	1 (2.7%)	2 (5.4%)
4	1 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
5	1 (2.7%)	3 (8.1%)	1 (2.7%)	0 (0.0%)
6	3 (8.1%)	2 (5.4%)	2 (5.4%)	0 (0.0%)
7	1 (2.7%)	4 (10.8%)	0 (0.0%)	0 (0.0%)
8	3 (8.1%)	1 (2.7%)	3 (8.1%)	0 (0.0%)

	Food, Beverage & Tobacco		Materials	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	1 (2.7%)	0 (0.0%)	3 (8.1%)	0 (0.0%)
2	1 (2.7%)	3 (8.1%)	3 (8.1%)	3 (8.1%)
3	5 (13.5%)	2 (5.4%)	2 (5.4%)	1 (2.7%)
4	1 (2.7%)	1 (2.7%)	10 (27.0%)	6 (16.2%)
5	0 (0.0%)	1 (2.7%)	4 (10.8%)	1 (2.7%)
6	1 (2.7%)	0 (0.0%)	1 (2.7%)	8 (21.6%)
7	2 (5.4%)	2 (5.4%)	4 (10.8%)	5 (13.5%)
8	2 (5.4%)	1 (2.7%)	11 (29.7%)	7 (18.9%)

Lags	Media & Entertainment		Pharmaceuticals, Biotechnology	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	1 (2.7%)	3 (8.1%)	1 (2.7%)	0 (0.0%)
2	1 (2.7%)	0 (0.0%)	0 (0.0%)	2 (5.4%)
3	1 (2.7%)	1 (2.7%)	0 (0.0%)	1 (2.7%)
4	2 (5.4%)	0 (0.0%)	4 (10.8%)	2 (5.4%)
5	0 (0.0%)	0 (0.0%)	4 (10.8%)	1 (2.7%)
6	0 (0.0%)	0 (0.0%)	2 (5.4%)	0 (0.0%)
7	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.7%)
8	1 (2.7%)	2 (5.4%)	2 (5.4%)	3 (8.1%)

	Real Estate		Software & Services	
	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	1 (2.7%)	1 (2.7%)	3 (8.1%)	0 (0.0%)
2	0 (0.0%)	2 (5.4%)	1 (2.7%)	2 (5.4%)
3	2 (5.4%)	1 (2.7%)	0 (0.0%)	1 (2.7%)
4	1 (2.7%)	1 (2.7%)	1 (2.7%)	0 (0.0%)
5	0 (0.0%)	0 (0.0%)	2 (5.4%)	1 (2.7%)
6	1 (2.7%)	2 (5.4%)	1 (2.7%)	2 (5.4%)
7	1 (2.7%)	1 (2.7%)	6 (16.2%)	0 (0.0%)
8	3 (8.1%)	0 (0.0%)	1 (2.7%)	2 (5.4%)

Transportation

Utilities

	Sig_Plus	Sig_Minus	Sig_Plus	Sig_Minus
1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
2	2 (5.4%)	1 (2.7%)	2 (5.4%)	1 (2.7%)
3	0 (0.0%)	0 (0.0%)	1 (2.7%)	0 (0.0%)
4	1 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
5	1 (2.7%)	0 (0.0%)	1 (2.7%)	0 (0.0%)
6	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
7	1 (2.7%)	0 (0.0%)	1 (2.7%)	0 (0.0%)
8	1 (2.7%)	1 (2.7%)	0 (0.0%)	0 (0.0%)

Results so far discussed suggest that there is no uniform oil return- firm return volatility. Positive association between oil return and firm return volatility dominates negative association between oil return and firm return volatility. Lagged oil return – firm return volatility also exists in some sectors and contributes by up to 20% the firms. Heterogeneous relationship between oil return and firm return volatility may be because of the size effect of the firms as smaller firms exhibits different characteristics than the large firms. Larger firms have better access to funds, market visibility etc. Finance literature also suggest that there is size premium available for smaller firms.

We divide all firms into four quartiles based on their market capitalization to test whether oil return – firm return volatility relation depends upon the size of the firm. Table 5 reports effect of oil price on return volatility by firm size. Quartile 1 represent smallest 25% firms available in our sample and Quartile 4 represent largest 25% firms.

**Table 5:**Effect of oil price on firm return volatility by firm size

Size Quartile	Significant Plus	Significant Minus
1	13 (10.0%)	46 (35.4%)
2	16 (12.3%)	47 (36.2%)
3	13 (10.0%)	36 (27.7%)
4	23 (17.8%)	57 (44.2%)

We conclude mainly two finding from the Table 5, First, negative effect of oil prices on firm volatility is almost three times than the positive effect of oil prices on firm return volatility. Second, number of firms significant at 10% level of significance increases as we move from quartile 1 (smaller firms) to quartile 4 (larger firms). More than 60% of the significant firms lies in fourth quartile. This shows that the effect of oil on firm return volatility is strong on larger firms as

compared to smaller firms. This may be explained due to the fact that larger firms are followed by the equity analysts very closely as compared to smaller firms and therefore effect of oil on firm volatility emerged immediately.

### **Conclusions**

We examine the effect of oil price on return volatility for 519 firms listed in Indian market from a period from Jan 2009 to Dec 2018. We use GARCH (1,1) model to examine the oil price – return volatility relationship. Our findings suggest that the effect of oil price on return volatility of firms is heterogeneous, negative effect of oil price on return volatility dominates positive effect of oil price on return volatility in most of the sectors. Automobile & Components, Banks, Capital Goods, Consumer Durable and Apparel, Diversified Financials, Energy, Food Beverage & Tobacco, Materials, Pharmaceuticals & Biotechnology, Software and Services are the major sectors where positive impact of oil prices on return volatility is found in more than 25% cases. Further we examine the lagged oil price effect on return volatility to understand the underreaction of the equity market. We find that only in around 10% cases lagged oil price are significant which shows that Indian equity market is efficient to the information arrival from oil prices. We also find that larger firms are more impacted by the oil prices and around 60% significant firms belong to largest quartile, which show that the reaction in the stock market is more efficient than the smaller firm as the characteristics of larger firms are different than the smaller firms and larger firms are followed by equity analyst very closely.

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