On the interaction between energy price and firm size in Indian economy

Rajesh H Acharya* and Anver C Sadath**

*Assistant Professor, School of Management, National Institute of Technology Karnataka, Surathkal Srinivasanagar Post, Surathkal, Managluru 575025, India. Email: rajeshacharyah@gmail.com
**Assistant Professor, Department of Economics, Central University of Kerala, Tejaswini Hills, Periye Post, Kasaragod District, Kerala, India. Email: anver.omanoor@gmail.com

Abstract

This paper examines the connection between oil price changes and size of firms listed in Indian stock market. A three-factor Fama–French model along with oil price variables is estimated using data from a panel of 1535 firms. Results show that there is a positive relationship between growth in oil price and stock return. Similarly, the size of the firm is also positively related to stock return. However, oil price uncertainty shows a negative relationship with stock return. Overall, these results imply that targeted measures should be put in place by the policy makers to safeguard the interests of the small and medium size firms in India.

1. Introduction and background

The dynamics of the response of business firms to the changes in the price of energy resources such as oil is an extensively documented issue in the literature. For instance, while a strand of research examined the implications of the oil price uncertainty or changes on the investment of the firms (see for example, Davis and Haltiwanger, 2001; Edelstein and Kilian, 2007; Lee *et al.*, 2011; Yoon and Ratti, 2011 and Sadath and Acharya, 2015), another strand of literature has focused on the impact of oil price changes on the stock markets (see for example, Huang *et al.*,1996; Jones and Kaul, 1996; Cong *et al.*, 2008; Aloui and Jammazi, 2009; Arouri and Nguyen, 2010) or on the overall macroeconomic performance of the economy (see for example, Hamilton, 1983, 1996, 2003; Hooker, 1996; Barsky and Kilian, 2004 and Klian and Vigfusson, 2011). However, scant attention was paid to analyse whether size of the firm has any role in determining its response to changes in the energy prices such as oil price. In this paper, therefore, we examine whether size of the firm matters in the formulation of response to the oil price changes by Indian manufacturing firms.

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It appears that the size of the firm ought to be regarded as a crucial factor, inter alia, in determining the response of a firm to changes in the prices of energy resources. As Sadorsky (2008) observed based on the review of extant literature that impact of energy price changes is felt more on middle-sized firms compared to small and large firms. This is due to the fact that larger firms are believed to be equipped to deal with such business challenges and thereby mitigate negative impacts, whereas, small firms will be flexible enough to adapt themselves according to the warranty of the situation. Bardazzi *et al.* (2015), for instance, in their study about the response of the Italian manufacturing firms to energy price changes taking into consideration the heterogeneity of firm size argued that energy resources are substitutes in the low-technology sector and weak complements in all other sectors. Sahu and Narayana (2011) in their research to understand the determinants of profitability and energy intensity of Indian manufacturing industries found a non-linear relationship between profitability and size of the firm indicating an inverted U-shaped relationship. This indicates that bigger firms and smaller size firms are less profitable as compared to the medium-sized firms.

Moreover, large firms with greater market power and economies of scale will be more efficient (Oczkowski and Sharma, 2007; Sadath and Acharya, 2015). This implies that such firms will be in a position to absorb changes in the prices of intermediary energy inputs and therefore ensure that increase in the cost of production as a result of short-term aberrations of energy prices did not affect prices of their output and thereby decrease in the demand. In other words, large firms will have more flexibility in the use of energy resources compared to other firms. This kind of reasoning implies that small or medium-sized firms will be hit by the changes in the price of energy products as they will be unable to absorb prices of their inputs. Kleijweg *et al.* (1990) in their analysis of whether large firms have more flexibility in energy use and thereby reduce the energy cost than small firms in the Dutch manufacturing sector found that large firms have a relative advantage compared to small firms in terms of the reduction of the energy cost in the total cost of production.

Likewise, the size of the firm has to be figured in while analysing the efforts of firms to achieve energy efficiency and thereby tackle the problems of global warming and climate change caused by the greenhouse gas emission. This aspect is demonstrated by Cost-Cambi *et al.* (2015) who found that size is an important variable in explaining the energy efficiency innovations of the firms. Similar results are reported by DeCanio and Watkins (1998), DeMarchi (2012) and Veugelers (2012). Therefore, there exists a case for an empirical examination to determine whether the response of firms to changes in energy prices varies according to their size? Towards this, this study has analysed a panel of Indian firms by using a dynamic panel data model based on Generalized Method of Moments (GMM) developed by Arellano and Bond (1991). Results show that there is a positive relationship between growth in oil prices and stock return. Similarly, size is also positively related to stock return. However, oil price uncertainly shows a negative relationship with stock return. The prime motivation for this study is the fact that this is the first study on this empirical issue in Indian context and no study other than Sadorsky (2008) is seen at the global level. Energy-related studies on India is important considering the fact that India ranks 4th on the CO_2 emissions after China, United States, European Union based on Emissions Database for Global Atmospheric Research (EDGAR) created by the European Commission and Netherlands Environmental Assessment Agency. Further, India's quest for becoming a manufacturing hub adds to the relevance of this study even at the global level. Further, Chortareas and Noikokyris (2014) have reiterated the importance of this kind of study in the light of their findings about the nexus between energy prices and stock market in the US. Besides, this study draws significance because in the absence of specific evidence about the influence of the size of the firms in determining their response to the energy price changes in a country like India with heavy dependence on import of energy resources, policy makers will find it difficult to design appropriate policy decisions to salvage firms in general and small and medium firms in particular.

The rest of this paper is organised as follows. Section 2 describes the theoretical underpinning of the study followed by the review of relevant literature in section 3. Details of the data and estimation method are presented in the sections 4 and 5 provides the discussion on the empirical results. Paper concludes with policy implications in section 6.

2. Theoretical base of the study

As far as theoretical support is concerned, this study is developed on the strong conviction that the performance of a firm in the capital market is contingent upon, inter alia, the size of the firm represented by its sales revenue in this study. That is, higher the sales revenue of the firm (larger the market served by the firm), market price per share of the firm will also be higher (see, for e.g. Chen *et al.*, 1986 and Ferson and Harvey, 1994). The unforeseen turbulence in the energy market and consequent abrupt sway in the energy prices will certainly cause pressure on the investors (see for e.g. Hamilton, 1983, 1996, 2003 and Yang *et al.*, 2002). The recession and inflationary pressure in the economy will undoubtedly affect the planned aggregate expenditure in the economy via deteriorating consumer and investor confidence which will finally reflect in the stock prices (Chen, 2010). However, as mentioned above, large firms with economies scale will be in a better position to deal with such business-related chaos without getting their business prospects diminished. For example, if energy price rises enormously due to some external factors, it will cause an increase in the cost of production and thereby causing natural decline in the profitability. However, large firms with extensive market power may absorb such short-term drifts in the market without passing the burden to final consumers so that they can sustain their business momentum. Indeed, this kind of development in the real sector of the economy will be reflected in the performance of the firm in the capital market via its market value (Ross, 1989; Basher and Sardosky, 2006 and Chortareas and Noikokyris, 2014).

Moreover, following the principles of the conventional equity pricing models (Bodie *et al.*, 2006), one can argue that changes in the price of energy resources would influence people's expectation about the potential future earnings as changes in the price of energy resources alters the contours of cost of production of the firm. For example, an increase in the price of oil would increase the cost of production using oil and thereby diminish its stock price. Besides, the dynamics of the macroeconomics of the current world are highly dependent on the price of energy resources like oil indicating that policy makers would be alert to fine tune the economy with adequate policy prescription to deal with the emerging macroeconomic situation. This implies that in the face of an increase in the price of energy resources like oil, for instance, and consequent increase in the general price level in the economy, monetary authorities would be forced to contain inflation and thereby adjust the rate of interest through appropriate monetary policy as suggested by the fisher equation. This means that changes in the interest rate in the economy would change the discount rate used in the pricing of stocks and thereby is capable of affecting the value of the shares of the firms traded in the stock market as suggested by the equity pricing model or standard discounted cash flow models. However, there is lack of research examining whether the size of the firm is a determinant of the nature of the response of the firm and thereby the market value of the shares of respective firms to changes in the energy prices. This paper, therefore, tries to bridge this gap based on a study of one of the major emerging economies, India.

3. Literature survey

The literature abounds with studies on the link between oil price changes and stock markets especially from developed industrial countries. Some of the relevant studies are reviewed here. Aloui and Jammazi (2009) based on their study from France, UK and Japan found that oil price increases are statistically correlated with real equity returns and response of stock returns to oil price changes varies according to the business cycle. Contrary to this, Apergis and Miller (2009) reported that stock market returns do not respond in a large way to oil market shocks in eight industrial countries. Arouri and Nguyen (2010) analysed the relationship between oil prices and the stock markets in Europe by testing for short-term links both at aggregate and sectoral levels. Results show strong linkages between oil price changes and stock markets for most of the European countries. However, the nature and sensitivity of the reaction of stock returns to oil price shocks vary considerably across sectors. Basher *et al.* (2012) examined the relationship between oil price shocks, exchange rate and stock prices in emerging markets and reported that stock prices respond negatively to a positive oil price shocks and that oil prices respond positively to a positive emerging market shock. Chen (2010) found strong evidence in support of the claim that rising oil price does push the stock market into bear territory in the USA.

Cong *et al.* (2008) showed that impact of oil price shock on Chinese stock market is diverse that while most of the indices are not affected by the oil price shocks, positive effect was noticed on stock returns of oil-intensive manufacturing sector and some oil companies. Cunado and Gracia (2014) examined the impact of oil price shocks on stock returns in 12 oil importing European economies. They found that the response of the European real stock returns to an oil price shock may differ greatly depending on the underlying causes of the oil price change and the results suggested that the existence of a negative and significant impact of oil price changes on most European stock market returns and stock market returns are mostly driven by oil supply shocks. Elyasiani *et al.* (2011) examined the impact of both changes in the oil return and oil return volatility on excess stock return and return volatilities of 13 U.S. industries and found strong evidence in support of the view that oil price fluctuations constitute a systematic asset price risk at the industry level. Gupta and Modisem (2013) investigated the dynamic relationship between different oil price shocks and stock returns in South Africa and evidences showed that stock returns only increase with oil prices when global economic activity improves. In response to oil supply shocks and speculative demand shocks, stock returns and the real price of oil move in opposite directions. Oil supply shock contributes more to the variability in real stock prices and different oil price shocks affect stock returns differently, and policy makers and investors should, therefore, always consider the source of the shock before implementing a policy and making investment decisions.

Hammoudeh *et al.* (2004) examined long-run relationships among five S&P oil sector stock indices and five oil prices in the U.S. oil markets. They found that oil price systems have a few common trends, suggesting little potential for long-run portfolio diversification. In the S&P oil sector stock index system, the five indices are not cointegrated, suggesting that there exists no index integration and strong opportunities for gains from diversification. On a daily basis, none of the oil industry stock indices explains the future movements of the NYMEX oil futures prices, while these prices can explain the movements of independent oil companies engaged in exploration, refining, and marketing and their results in general reveal that the oil exploration companies and refiners take their cues from the oil market. Miller and Ratti (2009) analysed the long-run relationship between the world price of crude oil and international stock markets and found clear long-run relationship between these series for six OECD countries, suggesting that stock market indices respond negatively to increases in the oil price in the long run.

Evidences of research by Nandha and Faff (2008) into the analysis of the extent of the adverse impact of oil price shock on stock returns indicated that oil price rises have a negative impact on equity returns for all sectors except mining, oil and gas industries. Narayana and Narayana (2010) revealed that stock prices, oil prices and nominal exchange rates are cointegrated, and oil prices have a positive and statistically significant impact on stock prices in Vietnam. Oberndorfer (2009) examined the relationship between energy market developments and the pricing of European energy stocks and results indicated that oil price hike had a negative impact on stock returns of European utilities, even though they lead to an appreciation of oil and gas stocks. However, the relationship between coal and stock returns is small compared to oil price impacts. They also found that forecastable oil market volatility negatively affects European oil and gas stocks implying profit opportunities for strategic investors. In contrast, the gas market does not play a role in the pricing of Eurozone energy stocks. Finally, results suggested that for the European stock markets, the oil price is the main indicator for energy price developments as a whole.

Olson *et al.* (2014) examined the relationship between the energy and equity markets and found that low S&P 500 returns cause substantial increases in the volatility of the Goldman Sach's Energy Index; however, they found only a weak response from S&P 500 volatility to energy price shocks. Park and Ratti (2008) estimated the effects of oil price shocks and oil price volatility on the real stock returns of the U.S. and 13 European countries and their results suggested that oil price shocks have a statistically significant impact on real stock returns. Sadorsky (2008) employed data from a panel of firms over a 17-year period to investigate the relationship between oil price movements, firm size, and stock prices and found that the relationship between oil price movements and stock prices does vary with firm size and the relationship is strongest for medium-sized firms. El-Sharif *et al.* (2005) investigated the relationship between oil price risk and the equity returns earned by UK-listed oil and gas firms. Their results indicated that oil and gas stock returns are impacted by several risk factors such as changes in crude oil prices, the stock market as a whole, and marginally by the exchange rate. In particular, a rise in oil prices or the equity market as a whole tends to increase the return on the UK oil and gas equity index while an increase in the US dollar exchange rate typically decreases the return.

It can be deduced from the literature surveyed above that this study based on India, one of the major emerging economies will provide further useful information regarding the role of energy products in the economy as previous evidences are mixed. This could be due to the fact that results varies from situation to situation depending upon the influence of important factors such as the structure of the economy, whether the economy is a net importer or exporter of the energy resources etc.

4. Data and empirical model

The modern portfolio theory provides the foundation for describing the stock return as a function of various risk factors. For example, the Capital Asset Pricing Model (CAPM) of Sharpe (1964), and Lintner (1965) and Mossin (1966) explains the variability in stock return as a function of a diversified market portfolio, whereas Ross (1976) provided a general framework of multifactor model and Fama and French (1993) argued for a specific case of multifactor model. Considering the limitations of the standard CAPM (Basu (1977), Roll (1977), Banz (1981), Fama and French (1992, 1996, 2004)), Fama and French advocated that a broad-based market portfolio alone is not sufficient to explain the variability in the cross-sectional expected stock return. Sufficient explanatory power is added when additional variables viz. portfolio returns mimicking the difference in the returns of small and big market capitalisation companies and high and low book value to market value companies are included along with the market portfolio. This study proposes to combine the three-factor Fama–French model with oil price-related variables. This is in contrast with the earlier studies which tried to combine the CAPM with oil price variables viz. Faff and Brailsford (1999), Sadorsky (2001), El-Sharif *et al.* (2005), and Boyer and Filion (2007). Earlier studies like Sadorsky (2008) found that the impact of the oil price changes on the stock return also depends on the size of the firm. Therefore, the present study estimates the following equations:

$$R_{it} = C + \beta_1 R_{it-1} + \beta_2 IR_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 Std.\ Size_{it} + \beta_6 OPR_t + \varepsilon_{it} \quad (1)$$

where R_{it} is the return on stock i at time t and IR is the index return to represent the market, both are calculated as the first difference of the natural logarithm of stock price and stock index, respectively. *SMB* (small minus big) is the portfolio return to mimic difference in the return of the portfolio of small and big size stocks, *HML* (high minus low) is the portfolio return to mimic difference in the return of the portfolio of high and low book value to market value ratio companies. *Std. Size* is the standardised size variable calculated from sales with zero mean and unit variance. Finally, *OPR* stands for the oil price return calculated as the first difference of the natural logarithm of the oil price.

Stock return may react differently to oil price volatility vis-a-vis changes in oil prices. Therefore, to document the same, we estimate the following equation:

$$R_{it} = C + \beta_1 R_{it-1} + \beta_2 IR_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 Std.\ Size_{it} + \beta_6 OPVol_t + \varepsilon_{it} \quad (2)$$

where, *OP Vol* stands for the volatility in the oil price. Following Sadorsky (2006), it is measured as the square root of the sum of squared monthly returns to arrive at annual oil price volatility measure.[1]

Equation (1) and (2) are dynamic panel data models. In this model, lagged dependent variable, i.e. stock return is added as independent variable in both equations (1) and (2) to take care of possible autocorrelation in stock return. This may lead to the dynamic panel data bias due to the possibility of correlation between lagged stock return and unobservable fixed effects. To overcome this problem, although a fixed effect model can be used to control for unobserved fixed effects, it will not remove the possible correlation between idiosyncratic error term and the lagged dependent variable. As an alternative, transforming the series by first differencing or orthogonal deviation can be adopted to solve the problem. However, first differenced lagged dependent variable may still be correlated with the first differenced error term. Instrumental variables in the form of deeper lags of the regressors can be used for the transformed dependent variable since it is uncorrelated with the error term. This could lead to the loss of degrees of freedom and therefore, a trade-off has to be struck between sample size and the efficiency of the estimates. Still, it may not satisfy the homoscedasticity assumption required for the idiosyncratic error term of the first differenced data for the two-stage least squares estimators (2SLS).The difference Generalized Method of Moments (GMM) developed by Arellano and Bond (1991) can be used to address the trade-off problem as well as the problem concerning the error term. This method does well in situations having more cross sections compared to the time period as well as when independent variables are not strictly exogenous. The dataset used in the study also has similar features and therefore, difference GMM of Arellano and Bond (1991) is used in the present study. Stock return is instrumented with deeper lags.

Data for the study are collected from two sources viz. Centre for Monitoring Indian Economy (CMIE) Prowess database and Reserve Bank of India (RBI) database on Indian Economy. Firm-level data on equity return, sales revenue, expenditure on fuel and power and total expenditure are collected from the CMIE Prowess database. Further, inputs required for constructing Fama–French model viz. Market Capitalization, Book Value (BV), Index Return are also collected from the CMIE Prowess database. Oil price information is taken from the Wholesale Price Index (WPI) on Mineral Oils which is collected from the RBI database on Indian Economy. Study period extends from financial year 1998–99 to 2014–15 for all the listed companies (1795 companies) in the National Stock Exchange of India[2] (NSE). Though the study uses the annual data for 17 years, due to missing observations, the final dataset consists of 1535 companies and 14,038 observations.

5. Empirical results

Table 1 presents the summary statistics of the variables incorporated in the model. As expected, size variable viz. standardised sales has a zero mean and unit variance. The mean stock return is substantially small compared to the index return, whereas standard

Table 1 Summary statistics

Variable	Observations	Mean	SD
Standardised sales	22,972	0	1
Stock return	20,741	0.004	8.328
Index return	30,515	0.119	0.276
SMB	30,515	0.112	0.278
HML	30,515	0.101	0.104
Oil Price growth	30,515	0.079	0.062
Oil Price volatility	30,515	0.002	0.002

SMB, small minus big; HML, high minus low.

deviation is high in the former compared to the latter. It is also on the expected lines considering the fact that companies can have large negative returns among all the listed companies, whereas the index is only a subset of a relatively small number of representative firms. Variables viz. SMB and HML have positive mean return. This confirms the findings of the earlier studies that small market capitalisation and high book to market value ratio companies having a higher return compared to the big market capitalisation and low book to market value ratio companies. Oil price increases during the study period which is higher than the stock return but less than the index return.

Table 2 presents the unit root test statistics for the variables used in the model. Levin, Lin and Chu t statistic and Im, Pesaran and Shin W-statistic and the respective

Table 2 Unit root test statistics

	Levin, Lin & Chu t		Im, Pesaran and Shin W-stat	
Variable	Statistic	Prob.	Statistic	Prob.
Standardised sales	−29.91	0	−5.12	0
Stock return	−1947.8	0	−217.50	0
Oil price volatility	−155.18	0	−110.69	0
Oil price growth	−102.99	0	−128.80	0
CNX NIFTY Return	−168.72	0	−169.59	0
SMB	−165.94	0	−168.94	0
HML	−85.424	0	−76.72	0

Note: Unit Root test statistic is calculated with individual intercept.
SMB, small minus big; HML, high minus low.

probability values are reported in the table. It is clear from the table that all the variables used in the model are stationary.

Results reported in the **Table 3** show that stock return is positively related to its own lag. Further, market return is positively related to individual stock return and this finding is in conformity with the standard asset pricing models. Similarly, coefficients of SMB and HML are positively related to the stock returns and are highly statistically significant. Positive and statistically significant coefficient of oil price may be interpreted as the influence of the highly subsidised regime prevailed in the energy sector in India. Results seem to suggest that the firms' cost of production, pricing and subsequent distribution of the return among shareholders are not affected by the developments in energy market such as price upheaval. In other words, firms are enough insulated from the negative impact of the supply side shocks brought about by the oil price increases.

The coefficient associated with standardised size which is of prime interest in this study indicates a statistically significant positive relationship between size of the firm and stock return which means that as the firm becomes larger in terms of the sales, its stock returns also increases. This kind of empirical evidence is along the expected lines because while a firm expands its reach in a market via its sales, such a firm will be enjoying a host of economies of scale (for example, in terms of diverse portfolios of various goods and services), lower transaction costs and less information asymmetry enabling to absorb business challenges such as energy price shocks without such shocks necessarily being passed on to the consumers. However, small firms will not be in a position to absorb such business challenges as they cannot afford the same kind of flexibilities and leverages as large firms do which may even cease their business

Table 3 Effect of oil price growth on firms

Variable	Coefficient	SE	*Z*	*P*>|*z*|	95% Conf. Interval	
Stock return (−1)	0.0378	0.0093	4.04	0	0.0195	0.0562
Index return	0.0162	0.0023	6.93	0	0.0116	0.0208
SMB	0.0109	0.0023	4.8	0	0.0064	0.0153
HML	0.0252	0.0049	5.11	0	0.0155	0.0349
Standardised size	0.0051	0.0020	2.54	0.011	0.0012	0.0091
Oil price growth	0.0591	0.0083	7.09	0	0.0427	0.0753
Constant	−0.0064	0.0011	−5.58	0	−0.0086	−0.004

Note: Instrument adequacy is tested using Sargan test *j* statistic which has a null hypothesis of 'test of over identifying restrictions are valid'. It returns the value of 53.025 and a probability value of 0.152. Deeper lags of regressors are used as instruments.
SMB, small minus big; HML, high minus low.

prospects for ever (see, for e.g. Kadapakkam *et al.*, 1998). Thus, the result indicates the dominant position of the larger firms and their consequent financial security in the face of turbulence in the energy sector. Moreover, for a commodity exporting economy like India, in the face of improvement in the global economic condition, export of firms would also improve implying an increase in the wealth of the people translating into higher stock returns (Gupta and Modisem, 2013). Firms in the sector which are heavily driven by oil such as airline industry will be using hedging methods to ward off oil price risk implying that major firms in such industries will not be affected by the changes in the prices of energy resources. Going by this rationale, small or medium firm need not be in a position to hedge its energy risks and therefore would be hit by energy prices (Elyasiani *et al.*, 2011).

In order to shed further light on the relationship between energy price and size of the firm, we have estimated basic model including the volatility of the energy price along with other relevant variables. The results are reported in the following **Table 4**. Despite the inclusion of the energy price volatility as a control variable, estimated coefficients of other variables remains statistically significant without changes in their sign. However, in sharp contrast with the relationship between oil price growth and stock return, the coefficient associated with volatility of energy price is negative and statistically significant, implying that the energy price uncertainty is a matter of concern for business enterprises. The size of the firm also appears to be an important variable in the analysis of the way in which firms deal with business uncertainties as small firms are often at the receiving end while dealing with uncertainties. For example, Ballantine *et al.* (1993) based on the empirical evidences observed that along with the size of the firm, other

Table 4 Effect of oil price volatility on firms

Variable	Coefficient	SE	*Z*	*P*>|*z*|	95% Conf. Interval	
Stock return (−1)	0.0384	0.0094	4.08	0	0.0199	0.0568
Index return	0.0053	0.0024	2.21	0.027	0.0006	0.0101
SMB	0.0099	0.0022	4.43	0	0.0055	0.0144
HML	0.0272	0.0049	5.54	0	0.0175	0.0368
Standardised size	0.0052	0.0020	2.6	0.009	0.0013	0.0092
Oil price volatility	−0.5336	0.2821	−1.89	0.059	−1.0865	0.0192
Constant	0.0009	0.0012	0.8	0.425	−0.0014	0.0033

Note: Instrument adequacy is tested using Sargan test *j* statistic which has a null hypothesis of ‘test of over identifying restrictions are valid’. It returns the value of 40.166 and a probability value of 0.102. Deeper lags of regressors are used as instruments.
SMB, small minus big; HML, high minus low.

Table 5 Arellano–Bond serial correlation test result

Models	Test order	m-Statistic	rho	SE(rho)	Prob.
Oil price growth	AR(1)	−1.697	−12.124	7.145	0.050
	AR(2)	−0.766	−2.542	3.320	0.444
Oil price volatility	AR(1)	−2.417	−18.315	7.578	0.016
	AR(2)	−0.839	−2.614	3.115	0.401

characteristics of firms such as advertising intensity, the financial position of the firms, etc. also have crucial influence in determining the extent of the impact of uncertainties on firms and thereby determining their profitability and overall performance.

Moreover, this result also indicates the energy vulnerability of India as it is heavily dependent on the strife-torn Central and West Asian countries for importing oil products to meet its growing energy requirements.

Table 5 reports the Arellano–Bond serial correlation test for the oil price growth and oil price volatility models presented in the Tables 3 and 4, respectively. First-order autocorrelations of both models are negative and statistically significant. It indicates that model errors are not correlated in the levels. In the same manner, the second-order autocorrelations are statistically insignificant, indicates that errors are not correlated of order one. Further, the null hypotheses of the Sargan J test statistic viz. ‘test of over identifying restrictions are valid’ is not rejected in both the oil price growth and oil price volatility models.

6. Conclusion and policy implications

Size of firms along with many other institutional characteristics is an important factor determining the response of firms to, inter alia, changes in the price of energy resources and thereby the overall performance of the firms in the economy. In this paper, empirical investigation on the role of the firm size in determining the performance of the Indian firms is undertaken. Results generally reveal evidences consistent with existing literature showing that with the increase in the size of the firm measured by the sales, the performance of the firm in the stock market also improves and thereby ensures higher returns. At the same time, results indicate that the firms are negatively affected by the energy price volatility, which is consistent with the propositions of the theory of business uncertainty.

The empirical results of this study have important policy implications in a country like India as it prepares itself to launch into higher industrial trajectory through programmes like ‘Make in India’. Moreover, Indian economy has passed through a peculiar situation since the plummeting of crude oil price in the international market in

June, 2014. The decline in the oil price has given an enormous opportunity to promote growth and investment without worrying about the associated inflationary pressure. Thus, RBI—India's central bank—has reduced policy rates four times consecutively during a time span of about 9 months since January, 2014. Despite this, available evidences show that India's industrial performance in general and manufacturing sector in particular is far from satisfactory implying that the problem lies not on the supply side but the demand side of the business. Indian industry faces shortage of demand pointing to the fact that necessary affirmative action should be adopted by the government so that this demand deficiency is properly addressed.

In this context, the insights of this study come handy in the sense that India has an industrial profile mostly spotted with small and medium enterprises (SMEs) with associated obvious employment and related implications. Hence, any affirmative action by the government to improve the SMEs will certainly lead to the removal of the demand side bottlenecks of the Indian economy to a considerable extent and thereby pave way to the improvement of the performance of the core industrial sector.

Notes

1. Sadorsky (2006) used daily data for calculating oil price volatility. Since WPI is available only at monthly frequency, we used the same methodology on a monthly series to arrive at yearly volatility.
2. National Stock Exchange of India is a largest Indian stock exchange in terms of trading volume. Information about the exchange can be found in the website www.nseindia.com

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