



Effects of energy price rise on investment: Firm level evidence from Indian manufacturing sector

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ABSTRACT

This paper analyses the effects of the rising prices of energy products on the investment of a large panel of manufacturing firms in India during 1993–2013. The prime motivation behind this study is the absence of an empirical study into this research issue exclusively on Indian economy. The empirical results obtained by estimating an Error Correction Model (ECM) using Generalized Method of Moments (GMM) show that energy price rise has negative effect on the investment of firms in the manufacturing sector. The negative effect is transmitted to the firm's investment through both demand-side and supply-side factors. The transmission also depends upon factors such as the energy intensity of production. The results also show that the sales–growth–investment relationship becomes weak in the face of the rising prices of the energy which could be due to the cautious approach to investment adopted by the firms. Therefore, it calls for the attention of the policy makers to evolve a comprehensive energy-policy to ensure continuous supply of energy at affordable prices to the manufacturers.

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1. Introduction

The rising prices of energy products such as electricity, coal and crude oil are major sources of worry for modern economies in general and developing economies like India in particular, as it results in the increase of fiscal deficit caused by the hike in the subsidy bill.¹ Higher fiscal deficit will be followed by macroeconomic instability in the form of high inflation and widening the current account deficit, causing deceleration in the overall growth of the economy (Mohanty, 1997). The Report of Task Force (2004) appointed by the government of India for the implementation of 'Fiscal Responsibility and Budgetary Management (FRBM) Act' 2003 has referred to the link between fiscal

imprudence and performance of the economy while observing that "the persistent fiscal deficits, and the steadily growing Debt/GDP ratio, constitute the most important challenges affecting India's growth prospects".

A close look at the dismal performance of Indian economy in the recent years appears to be a testimony to this view point. For instance, while Indian economy registered a growth rate of 8.6% and 9.3% in 2009 and 2010 respectively, it declined to 6.2% and 5% in 2011 and 2012, respectively. Meanwhile, the reverberations of this decline in the growth rate were also felt on the fiscal front of the economy. The fiscal deficit declined from over 6% in the preceding two years to 4.8% of the GDP in the high-growth year in 2010. Subsequently, fiscal deficit increased to 5.8% of the GDP in the year 2011 as growth rate faltered into 6.3%. As mentioned in the Economic Survey of 2013–14 (ES, 2013–14), the moderation in growth after 2010 has been primarily attributable to the weakness in the industry. The growth-rate of industry consisting of mining and quarrying, manufacturing, electricity, gas and water supply, and construction sectors registered only 3.5% and 3.1% during 2011 and 2012, respectively, while it was 9.2% during the high growth years in 2009 and 2010. Within the industrial sector, the manufacturing sector—which is known for its high intensity of energy consumption—was surging ahead of all the other sectors in the economy with an average growth rate of 10.5% during the year 2009 and 2010. Therefore, these statistics

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¹ As Rao (2002) has pointed out that, apart from achieving broader economic objectives of stabilization and growth, certain necessary modifications are needed in fiscal policy, keeping in tune with the peculiarities—such as sharp income inequality, higher marginal propensity to consume, and low savings—of the developing countries. And therefore, given the mixed economy set-up in India, where the state plays a dominant role, fiscal policy has evolved as an important macroeconomic instrument to achieve national objective of growth with equity.

reinforce the observation found in [ES, 2013–14](#) that for growth to be strong, the contribution from the industrial sector, and in particular from the manufacturing sector, has to increase in the years to come.

The performance of the Indian economy in the future, as it was in the past, is heavily contingent upon the availability of energy resources, especially for its industrial sector at affordable price. Hence, there exists an explicit case to be empirically analyzed to understand how energy price rise in the past has affected the investment decisions of the firms in the Indian economy. Incidentally, the Twelfth [Five Year Plan \(2012–17\)](#) document has noted that a GDP growth rate of about 8% requires a growth rate of about 6% of total energy use from all sources. Unfortunately, the capacity of the economy to expand domestic energy supplies to meet this demand is severely limited. In spite of being one of the countries in the world with largest reserves of energy products like coal, India's overall energy deficit of about 8.6% registered in 2012–13 actually corroborates this view. Moreover, the official government sources have projected that India's heavy reliance on the import of crude oil will be exacerbated to about 78% of the total use by 2016–17, causing further dismay to the already precarious energy situation in the country. Therefore, this paper primarily investigates the empirical fallout of the rising prices of energy products on the investment decisions of the manufacturing firms in India. Towards this end, we have estimated an Error correction Model (ECM) in a panel data framework using Generalized Method of Moments (GMM) proposed by [Arellano and Bond \(1991\)](#).

In contrast to the extensive studies on the macroeconomic implications of energy price rise in the past, firm level evidence on the effect of energy price movements on the investment of firms has overriding significance as it helps discern the sectoral impact of energy price changes since the energy intensity varies across various sectors. Studies by [Davis and Haltiwanger \(2001\)](#) and [Elder and Serletis \(2010\)](#) have acknowledged this fact while observing that the effect of oil price shocks manifested in the form of decline in the investment, job creation and destruction etc. has got sectoral dimensions. [Bernanke \(1983\)](#) has also underlined the importance of micro-level study while arguing that micro-level investment decisions of firms can create macro-level cyclical fluctuations for two reasons. Firstly, the macro economy may not be sufficiently diversified from certain large industries like automobiles so as to become immune from industry level fluctuations. Secondly, under imperfect information, agents may be unsure of the permanence of the initial shock to investment and may thereby convert a transitory shock into a more persistent disturbance. Additionally, [Pindyck and Rotemberg \(1983\)](#) have stated that to understand the macroeconomic impact of changing energy prices requires an understanding of the response of investment at the micro level.

The prime motivation for this study is the fact that, as [Kilian \(2008\)](#) noted, unlike rise in the price of other goods, energy price rise matters more because of the comparatively inelastic demand for energy resources such as oil and gas. For example, households in general and those households in urban areas in particular, cannot vary their demand for, say, cooking gas in response to changes in its price. Further, empirical evidences show that energy price rise is followed by macroeconomic disturbances such as rise in unemployment and inflation (for e.g., see [Davis and Haltiwanger, 2001](#); [Barsky and Kilian, 2004](#)). Given these insights linked to the energy price rise, it is a matter of curiosity to know what would be the response of business firms to the energy price rise in India. Specifically, given the inelastic demand doctrine, does energy price-rise force firms to cut-down their investment expenditure? Consistent with this view, [Kilian \(2008\)](#) has noted that there are two main channels through which energy price shocks affect investment. Firstly, an increase in the price of energy raises the marginal cost of production – cost effect. This cost effect depends on the share of cost of energy in the total cost of production. Secondly, the reduced demand for the firm's output as consumer expenditure falls in response to rising energy prices – income effect. Therefore, it is pertinent to conduct an empirical study in the context of India to determine the nature of the interrelationship between market for energy products and business investment at the firm level.

This study tries to enrich already-existing literature on the economics of energy and investment. To the best of our knowledge, this is the first empirical analysis of how energy price-rise impacts the investment decisions of the manufacturing firms in India. The findings of this research will be of paramount importance to Indian policy makers for the following reasons. Firstly, India faces a vulnerable situation in energy sector as it heavily relies on the rest of the world for its energy security. Secondly, mounting criticism of government for neglect of public interest over pricing of domestic natural gas and mismanagement of domestic energy sources such as coal. Thirdly, affordable energy security is inevitable for achieving a growth-rate of about 8 to 9% so that millions who are still below the poverty line can be pulled up, as emphasized by [Cantore et al. \(2012\)](#). Finally, this study is also significant from the view point of fulfilling aspirations of the burgeoning young population of present India by guaranteeing employment opportunities in the industrial sector with the active participation of the private sector.

The empirical findings reveal that there exists a negative relationship between energy price rise and investment decisions of manufacturing firms in India. It is further observed that firms hold-up their investment plans either on the supply side or demand side of the business in the face of rising energy prices.

The remainder of this paper is organized as follows: [Section 2](#) reviews the existing literature specifically on the effect of energy price shocks on firm's investment. The details of econometric model employed in the empirical analysis are presented in [Section 3](#) followed by [Section 4](#) which outlines the nature and sources of the data used in the study. [Section 5](#) presents the empirical results and [Section 6](#) concludes the paper.

2. Review of literature

Most of the existing literature on the effects of energy price changes on investment focuses on the macroeconomic aggregates such as GDP and financial aggregates such as stock prices. There are few studies conducted exclusively on the relationship between energy price and firm level investment which are reviewed here. [Uri \(1980\)](#) conducted a study to examine the role of the energy price as a determinant of the investment. The study uses the annual data—from 1950 to 1977—pertaining to four US industries of which two are high energy-intensive industries such as chemicals and allied products and other two are less energy-intensive industries such as textile industries and rubber and plastic products. The results obtained from the estimation of a distributed lag model show that energy is a significant determinant of investment behavior reaching its high impact after one period in the case of paper industry and after two periods for chemicals. Further, changes in energy prices have an immediate impact as well as one that lasts through the next three years. The study concludes that energy price has crucial role in explaining the investment behavior of energy intensive industries. Moreover, the effect of energy price on investment behavior of industries is more pronounced over the period of dramatic rise in energy prices.

In an attempt to study the dynamic effects of oil price shocks on demand and supply of 14 industries in US, [Lee and Ni \(2002\)](#) estimated Vector Auto Regression (VAR) models with both macroeconomic variables such as money stock (M2), interest rate, Consumer Price Index (CPI), and oil price and industrial variables such as industrial output and price. The study has found considerable similarity of output responses to oil price shocks in most industries in the form of output decline which occurs after a 10-month delay, even though the decline is short-lived. Both demand and supply of industries were affected by oil price rise. However, while oil price rise reduced the supply of oil-intensive industries such as petroleum refinery and industrial chemicals, it reduced the demand for many other industries, especially for automobile industry. The study does not observe any correlation between the output response to oil price shock and energy intensity of industries. The findings are in line with the views already expressed by the business press on this issue.

[Jimenez-Rodriguez \(2008\)](#) has analyzed the effects of oil price shocks on the output of the main manufacturing industries in six

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