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Implications of energy subsidy reform in India

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ABSTRACT

This paper analyses welfare impact of energy subsidy reform in India based on the data from 1970- 71 to 2014-15. To this end, Auto Regressive Distributed Lag (ARDL) model and Error Correction Model (ECM) have been estimated to quantify the short-run and long-run price and the income elasticity of various energy products. The results show that the price elasticity of demand for all fossil fuels is low, but the respective income elasticity is higher. Therefore, an increase in the general price level caused by the subsidy reform will lead to the erosion of real income and will have related welfare implications in India. The results also reveal that energy expenditure will obviously increase and hence energy consumption will decline depending upon the extent of the withdrawal of subsidy. Therefore, policy makers in India, while undertaking further reforms, must ensure that the subsidy reaches to those who truly deserve, so that the socioeconomic casualty of reforms can be minimized along with achieving fiscal goals.

1. Introduction

The intervention of government in the functioning of modern market economies to influence the process of resource allocation with policy tools, such as subsidy, remains to be a bone of contention in the discourse of political economy. However, the market for non-renewable energy resources is one of the areas that have witnessed active intervention of governments all over the world, especially in developing countries through comprehensive subsidization of energy consumption. For instance, the total global fossil fuel subsidy was $550 billion in 2013 (World Energy Outlook, 2014). With the intention of achieving socioeconomic goals such as eradication of the energy poverty, fair distribution of national resources, and protection of price competitiveness of domestic firms, the governments have started intervening in the energy market (Liu and Li, 2011) and (International Institute for Sustainable Development (IISD), 2012a). However, the subsidization policy has attracted global scrutiny in the recent past due to various reasons[1] (Lin and Jiang, 2011; Anand et al., 2013) and Solaymani and Kari (2014). For example, the burgeoning demand for non-renewable energy resources has resulted in the increase in the subsidy bill of the government. It causes fiscal strain on the exchequer and has also led to macroeconomic issues such as crowding out of private investment, inflation, and inadequate allocation to social spending (Saunders and Schneider, 2000). That is why the Parikh Committee report[2] (2010) and Kelkar committee report[3] (2012), for instance, have suggested a gradual phasing out of energy subsidy to deal with its negative macroeconomic implications in India.

According to WEO (2014), the global demand for energy resources is projected to increase by 37% with the increase in per-day demand for oil from 90 Million Barrels (MB) in 2013 to 104 MB/day by 2040. Nearly 60% of the total global energy demand by 2030 will be accounted by Asia (except Japan and Korea) along with South America, the Middle East, and Africa. There are issues such as the poor implementation of the subsidy scheme in the form of extending the benefit to the non-poor, often either driven by political considerations or due to institutional deficiencies. These are the major reasons for making subsidy regime unsustainable (World Bank, 2008; Lin et al., 2009; Lahoti et al., 2012; Dartanto, 2013).

WEO (2014) has observed that the total world fossil fuel subsidy to the tune of $550 billion in the year 2013- which is four times more than

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[1] For instance, leaders of G20 Countries in its meeting in Pittsburgh in 2009 had vowed to rationalize fossil fuel subsidy programs all over the world and in connection with translating this commitment into tangible results, it asked all countries to adopt measures to remove fossil fuel subsidy in a gradual manner without hurting poor and it also asked international agencies, viz. World Bank, OPEC, IEA and OECD to jointly analyze the scope of subsidy reform measures and provide proper direction to achieve successful implementation of the reforms. Efforts reaffirming its commitment to rationalize energy subsidy was closely followed by G20 in the subsequent meetings such as in Toronto in 2010 and in France in 2011.

[2] (Ministry of Petroleum and Natural Gas, 2010), "Expert Group on a Viable and Sustainable System of Pricing of Petroleum Products" is popularly called as Parikh Committee report (2010).

[3] (Ministry of Finance, 2012). "Report of the Committee on Roadmap for Fiscal Consolidation" is popularly called as Kelkar committee report (2012).

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the subsidy provided to renewable energy resources ($120 billion) – is holding back the investment in improving the energy efficiency and renewable resources. It is against this background that various governments all over the world have initiated reform measures to do away with the practice of subsidizing the use of non-renewable energy resources (Bazilian and Onyeji, 2012). Okigbo and Enekebe (2011) and Clements et al. (2013) have argued that energy subsidy reforms across the world are successful only in such countries where certain optimal approaches have been adopted. For example, the comprehensive assessment of costs and benefits, reforming in phases, public campaign to educate the people, and sufficient welfare programs to mitigate the impact of reforms on deserving people were all a part of the optimal approaches.

The government of India has initiated several measures since 2010 to reform its non-renewable energy subsidy program. These measures are expected to have an impact on various sections and sectors of the economy which are outlined in the next section (Gangopadhyay et al., 2005). In this paper, we make an overall assessment of the welfare implications of the energy subsidy reforms in India (Coady et al., 2015). Specifically, we examine the impact of reform on the general price level, the volume of energy consumption, and the expenditure incurred on energy resources. Compared to the previous studies, this study is all the more important as it is the most comprehensive study of the impact of energy subsidy reform in India to date as the variety of energy resources examined here. Also, it provides the extent of the likely impact of energy subsidy reform, and thereby enables the policy makers to take informed decisions while undertaking reform measures (Clements et al., 2013).

To this end, we have estimated an Auto Regressive Distributed Lag (ARDL) model and an Error Correction Model (ECM) to determine price elasticity of demand for various energy products covering the period from 1970–71 to 2014- 15. The results show that with the complete removal of energy subsidy, the general price level increases in the range of 3.8% and 1.38% respectively during the high and low oil price regime. Therefore, the price of the crude oil in the international market will determine the impact of subsidy reform on the welfare of the people. Due to the inelastic demand for all energy products, a reduction in subsidy results in a marginal reduction in the consumption, and a substantial increase in the amount spent on these products.

The organization of the remainder of the paper is as follows. Section 2 presents the review of literature. The background of energy reforms in India is outlined in Section 3. The details regarding data and empirical model used here are furnished in Section 4. The Section 5 presents empirical results. Section 6 presents the discussion of the results, and the Section 7 that concludes the paper.

2. Literature review

The focus of the previous studies on energy subsidy was largely on the impact of the removal of consumer subsidy on the economy. Since the consumer subsidies were dominant in the developing countries compared to the producer subsidies in the developed countries, the literature reviewed here are mostly on the developing countries. In an early study, Burniaux et al. (1992) have found that the abolition of energy subsidy will reduce the demand for and the price of the non-renewable energy resources in the international market by 2050. Birol et al. (1995) shows that Algeria, Iran and Nigeria have benefited from subsidy reform via enhanced oil saving capacity which can be used in the future. The increased oil revenue due to this policy could be used for the purpose of development in the country. In addition to finding that the fossil fuel subsidy reforms facilitate carbon emission reduction (Anderson and McKibbin, 2009), have also reported that the efficiency in the use of the energy resources could also be achieved by the reduction of energy subsidy. Evidence from developing and transition economies cited by Saunders and Schneider (2000) shows that the subsidy reform influences the price, and this price effect is transmitted to consumption, production and trade in these economies, and along with it, this effect is being transmitted to other countries having external linkages with the reformed countries.

The estimates of Saboohi (2001) from Iran have indicated that the cost of living of households in different expenditure groups is increased both in rural and urban areas as a result of the subsidy reform, and the impact is substantial on low-income groups in the rural area. Similar evidence is provided by Battacharya and Batra (2006) while observing that freeing of the domestic energy prices from a government controlled pricing system with a massive subsidization will lead to a sustained impact on the general price level, and thereby will have a negative impact on the economic agents like households and industry. Likewise, Clements et al. (2003) have showed, based on the evidence from Indonesia, that poor urban households are the most affected by the petroleum price liberalization. In the short run, the reform results in the increase in price level and a decrease in the household consumption, and this leads to the decline in the output of firms in sectors other than petroleum. Gangopadhyay et al. (2005) have reported that the benefits of LPG and kerosene subsidy in India are largely enjoyed by people in higher expenditure groups than the lower expenditure groups in urban as well as rural areas. Moreover, the urban area received more subsidy on a per-capita basis than the rural area, implying that the subsidy has failed to affect the practice of the biomass usage. A considerable diversion of subsidized kerosene to rural areas has also been noted.

Ref. Burniaux et al. (2009) have shown that the gradual removal of fossil fuel subsidies in 20 non-OECD countries will enable these countries to reduce their demand for such energy resources by 2050, apart from their contribution to environmental pollution. However, the reduced demand in these countries will lead to a decrease in the price of these resources in the global market as a result of which the demand for them may increase elsewhere, mitigating the beneficial impact of the energy subsidy reform on the environment. Lin and Jiang (2011) have analyzed the energy subsidy reform in China based on the price-gap approach. The Empirical results of the study have shown an increase in the price of the energy resources and a decrease in the energy consumption. In addition, Liu and Li (2011) have found, in this regard, that a gradual removal of subsidy on a priority basis will be more desirable for China. For example, the rolling out the removal of subsidy for coal first, and after that undertaking the removal of other subsidies on fuel items like oil.

Striking a different note, Bazilian and Onyeji (2012) have analyzed the impact of the subsidy reform on business in Nigeria. They argue that in an environment characterized by severe electricity constraint, the energy subsidy removal, all on a sudden, will affect the firms's ability to access energy services. It further increases the already existing high cost of production, and reduces demand followed by an increase in the price level on account of the subsidy removal. Moreover, the energy subsidy reform will be detrimental to the business, if the government does not undertake alternative measures in the form of ensuring quality, energy supply or other services. Therefore, they suggest that sufficient preparatory initiatives, such as the development of adequate energy infrastructure, should be undertaken before the subsidy reform measures are rolled out. Lin and Li (2012) have assessed the potential impact of the energy subsidy reform on China as well as on other countries closely integrated with China to find out possible ways to mitigate the impact. The study has reported that the subsidy removal would have a negative impact on the overall output in China and a positive impact on the overall output of other regions of the world giving the subsidy. In fact, they found that the measures such as export subsidy and reduction in capital tax would help mitigate the negative impact of the fuel subsidy removal on Chinese output.

According to Anand et al. (2013), elimination of the subsidies would entail a substantial increase in the retail price level in India, particularly for kerosene and LPG, and the subsidy reform would also result in the decrease in the real income of both the lower income and higher income groups. In a related study on China, Jiang and Tan (2013) have found that the energy subsidy reform adversely affect the energy intensive industries such as power generation and transportation. Consequently, the general price level has also been found to be increasing in the post-reform scenario. Dartanto (2013) has emphasized the need to phase out the energy subsidy as it is inefficient as well as worsening the fiscal balance in Indonesia, even though the removal of the subsidy would increase the incidence of poverty. To tackle the negative counter effects of the reforms, an increased social sector spending with the resources saved through the reforms has been suggested. Siddiq et al. (2014) have also come up with similar results from Nigeria, where the removal of the energy subsidy of imported petroleum products has resulted in the increase in their prices. It would cause a structural shift in the energy consumption of the people in favor of the domestically produced petroleum products causing a rise in its price too. All these will lead to a decrease in the level of consumption as well as of the household welfare in Nigeria.

Ref. Schwanitz et al. (2014) have conducted a study using consumer subsidy data from 37 countries and have found that the subsidy removal will lead to the raise of the prices of fuels, as a result of which the demand for fuels will decline (energy saving). The level of consumption taken as a proxy for the global welfare improves in the post-removal scenario. However, the impact of the subsidy removal depends on factors like regional interplay, the goal of the subsidy removal, the extent of the subsidies that prevails in regions under consideration, and whether the region is an exporter or importer of the energy resource. In addition to this, they advocate taking adequate complementary initiatives for sustaining the short-term benefits of the subsidy removal in the long-run.

Ref. Coady et al. (2015) provide similar evidence of an increase in the global welfare to the tune of about 2% of global GDP in the period after the energy market liberalization scenario. In addition to the finding that subsidy reform in Malaysia has decreased energy consumption and household welfare, Solaymani and Kari (2014) have also found increase in real investment and real GDP and decrease in exports and imports. Owing to the increase in the cost of intermediate input, the transportation sector also is negatively affected. Based on a disaggregate level study on Iran, Moshiri (2015) suggests that price elasticity of demand for different types of energy are very limited particularly in rural areas, whereas, the income elasticity of demand for various fuels are significantly greater both in urban and rural areas. Therefore, mere removal of subsidy will not guarantee the fulfillment of varying objectives. Therefore, subsidy removal not only affects the poor adversely but also will not have the desired impact on energy consumption.

In short, there is near unanimity among previous studies reviewed here emphasising that removal of subsidy will lead to increase in the price of fuel and thereby reduce its consumption. Thus, removal of subsidy may compel the poor households to use the inefficient hazardous biofuels such as dung cake or firewood with fatal consequences such as increased health problems for women. As per the recent estimates of the International Energy Agency (IEA) reported in its India Energy Outlook (2015), even though India is the home of 18 per cent of the world population, India uses only 6 per cent of the total primary energy resources globally consumed. Moreover, removal of subsidy on fuels in a vast country like India will lead to an increase in the price of essential commodities like food due to the increased transportation cost.

This study improves, compared to the previous studies, the understanding of the implications of subsidy reforms, especially those based on Indian experience, as the data used in this study belongs to a period when oil price in the international market has suffered a drastic decline since June 2014. It has essentially enabled to cushion, as empirical evidence has shown, the negative impact of the removal of subsidy such as a rise in general price level on the household budget. The importance of the timing of energy subsidy removal, when oil price is low, is also demonstrated by Coady et al. (2015). Thus, this study points to the significance of a stable and secure energy market in designing better administrative and economic system for the progress of the society.

Although previous studies have found almost similar results regarding welfare implications of energy subsidy reform, they leave scope for further studies on a country like India. The impact of energy subsidy reform will be conditional on such things as the specific socioeconomic context of the country, the specific nature of reform policies introduced, and whether a country is a net importer or exporter of energy resources. Therefore, this study is an attempt to fill such a gap, providing empirical evidence on the likely welfare implications of energy subsidy reforms introduced in India.

3. Background of energy price reform in India

International Energy Agency (IEA) (1999) has defined energy subsidy as any government action concerning primarily the energy sector that lowers the cost of energy production and raises the price received by energy producers or lowers the price paid by energy consumers. Like elsewhere, energy resources are subsidized in India to enable consumers, especially poor and needy, to access the energy resources like petroleum products and electricity in the form of the lower price charged from the end-use consumer.[4] However, the tremendous increase in the population coupled with an increase in the economic affordability of rising population has given a spurt in demand for energy resources. For example, during the last four decades ranging from 1970-71 to 2010-11, the Compound Annual Growth Rate (CAGR) of per-capita energy consumption was at 4.1 per cent in India (Economic Survey, 2013–14). Thus, growing demand for subsidized energy resources has pushed the fiscal health of the economy into an alarming state in India in the post-financial crisis period as shown in Table 1. It is a fact acknowledged by the Government of India in Economic Survey (2013–14) that the build- up in subsidy is one of the major reasons for the increase in India's fiscal deficit since 2008–09. A hefty amount to the tune of more than 2 per cent of the GDP was earmarked for financing the total subsidy bill of the country and out of which about 1 per cent was used for subsidizing petroleum products alone. Indeed, the fiscal burden of subsidy can be seen decreasing in the recent past as shown in Table 1. It is attributed to the reform measures like the deregulation of petrol price since 2010, diesel price since 2014 and fall in the crude oil price in the global market in the second half of the year 2014.

Since India meets more than 75 per cent of its petroleum requirements through import, subsidy burden of the government will be increasing in accordance with the petroleum price hike in the international market.[5] That is why, for instance, India had to spend about 2.5 per cent of GDP in 2012–13 on subsidy as the crude oil price in the global market was above $100 per barrel. The continuing political uncertainty in the Middle East region and consequent volatility in the crude oil market is a matter of concern for oil importing countries like India.

Apart from growing explicit financial liability to the government, leakage of subsidy is also a major cause of concern for India.[6] For example, the subsidy given to energy products was enjoyed by all without any restriction based on the income of the beneficiaries. A study by Anand et al. (2013) have observed that the quantum of subsidy benefits enjoyed by the 10 per cent richest of India is seven

[4] See International Institute for Sustainable Development (IISD) (2012a) and International Institute for Sustainable Development (IISD), 2012c) for a detailed exposition on India's subsidy program.

[5] See, Anand et al. (2013) for a detailed background showing why subsidy reform is required in India.

[6] Leakage is defined by Economic Survey (2014-15) as the difference between total allocation of subsidized goods via public distribution system (PDS) and actual household consumption.

Table 1
Extent of Subsidies in India.
Source: Various Economic Surveys and *Indiastat*. RE=Revised Estimate, BE=Budget Estimate, PA= Provisional Actual.

Year	Total Subsidies (in crores)	Petroleum Subsidy (in crores)	Petroleum subsidy as % of total subsidy	Total subsidy as % of GDP	Petroleum Subsidy as a % of GDP
2009–10	141351	14951	10.5	2.2	–
2010–11	173420	38371	22.1	2.2	–
2011–12	217941	68484	31.4	2.4	0.76
2012–13	257079	96880	37.6	2.5	0.96
2013–14	255516(RE)	83998(PA)	33.4	2.2	0.75(RE)
2014–15(BE)	260658	63427	24.3	2	0.49

times higher than that of the 10 per cent poorest. The Economic Survey (2012–13) has observed that the bulk of the under-recoveries of the oil marketing companies (OMC) are accounted for by two subsidized products, viz. diesel and LPG.[7] Further, according to the Economic Survey of 2014-15, the leakage in subsidized kerosene distributed through the public distribution system (PDS) is 54 per cent. These figures shed light on the misdirection of subsidy toward the undeserving sections of the society.

This study has significance not only for the Indian economy but also for the global economy. For example, the International Energy Agency (IEA) in its special report titled India Energy Outlook (2015) has argued that policy initiatives such as '24×7 power for all' and 'Make in India' will reshape the future global energy scene. Due to these policy initiatives, India would have a larger influence over the international energy system in the future as India currently accounts for only around one-third of the world average energy demand on a per-capita basis. The report says that India, projected with a more than double increase in the demand for energy resources and as a nation that is likely to become the world's most populous country by 2040, will emerge as a major driving force in global trends in the energy sector. Considering India's reliance on oil import, the report states that oil import would rise more than 90 per cent of its total use by 2040, making India the second largest oil importer in the world after China. Therefore, the findings of this study concern the global economy also.

Thus, India has pressing reasons to embark on energy subsidy reforms in the light of the factors mentioned above without compromising on the entitlements of truly deserving poor. It is against such a background that the Government of India has initiated various energy subsidy reforms such as deregulation of petrol price since June 2010 and of diesel since October 2014. Further, fixing LPG subsidy on per kilogram basis instead of per cylinder and the introduction of direct transfer of subsidy into the bank accounts of consumers should be seen in this light. The initiative to transfer subsidy benefit directly to the bank account of the consumer is expected to plug the leakages of subsidy to a great extent along with cushioning the poor against the possible fallout of energy subsidy reform.

4. Data and empirical model

Indiastat[8] database, Reserve Bank of India[9] (RBI) (Reserve Bank of India (RBI), 2015) Database on Indian Economy, Ministry of Petroleum and Natural Gas, Government of India and Export Import Data Bank[10] are the major sources of data used in the study. The study considers three broad categories of energy products, namely, coal, petroleum, and electricity. Metric tons per year are the unit of measurement for coal and petroleum products. Petrol, high-speed diesel (HSD), kerosene, and LPG are treated separately under the petroleum category. Electricity is classified based on different uses, namely, domestic, agriculture, industry, commercial and railway. Consumption of electricity is measured Gigawatt Hour per year. Indiastat database is the source of data on energy consumption of all three major categories and subcategories. We take product specific Wholesale Price Index[11] (WPI) data as the price of the energy products and Gross Domestic Product (GDP) at Market Prices as the proxy for income. WPI is an official publication of the Ministry of Commerce and Industry, Government of India and GDP at market prices is the official publication of the Central Statistics Office (CSO).[12] Both are in the 2004- 05 constant prices and collected from the RBI database on the Indian economy. The study period extends from 1970-71 to 2014- 15 and the frequency of data is annual, measured at the end of March every year.

Per-unit subsidy on the petroleum products is collected from the Ministry of Petroleum and Natural Gas website as on the end of March and December 2015. Indiastat database provides the information of subsidy on electricity. However, there is no direct information on per unit subsidy on coal. Therefore, we arrive at an approximate measure of the subsidy based on the difference in the price of imported and domestically produced coal after accounting for the difference in the quality of coal from these sources.

Microeconomic theory states that factors such as the price of the product, the income of the consumer, prices of related products, taste, climate, etc. influence the demand for a product. In the context of the demand for the energy products, we concentrate on three primary factors viz. price of the product, income of the consumers and prices of related products. The demand for an individual energy product (D) is taken as the exponential function of the real price of energy product (P) and real income (Y) (Sterner, 2007). Further, the price of related products (P1 and P2) is added to measure the cross price elasticity. The equation is specified as follows:

$$D_{it} = \beta_0 P^{\beta 1} Y^{\beta 2} P1^{\beta 3} P2^{\beta 4} e^{\mu it} \quad (1)$$

where, indices i and t stand for different energy products and year respectively.

Eq. (1) can be directly used for the estimation of the price and income elasticity for various energy products by taking the log on both sides; the empirical model is specified as follows:

$$D_{it} = \beta_0 + \beta_1 P_{it} + \beta_2 Y_t + \beta_3 P1_{it} + \quad \beta_4 P2_{it} + \mu_{it} \quad (2)$$

where, D_{it} is the consumption of the energy product i at time t, P_{it} is the real price of the energy product i at time t, Y_t is the real GDP, $P1_{it}$

[7] Under-recovery of OMC is the difference between cost-price and selling price which widens as selling (subsidized) price does not vary according to the cost price determined by global price and therefore, under-recoveries of OMCs will increasing with increase in global crude oil price.

[8] Indiastat.com is a database providing secondary level on socio- economic data about India at aggregate as well as state, region, and sector level.

[9] Reserve Bank of India is India's central bank, offers data on various macroeconomic aggregates through its database on Indian Economy.

[10] Export Import Data Bank is offered by the Department of Commerce, Ministry of Commerce and Industry, Government of India.

[11] Wholesale Price Index (WPI) is a broad based measure of inflation in India. More details about WPI are available at WPI Manual Office http://www.eaindustry.nic.in/WPI_manual.pdf

[12] CSO is responsible for coordination of statistical activities in the country and for evolving and maintaining statistical standards.

and $P2_{it}$ stand for the prices of related energy products, and μ_{it} is the random error term. Three major categories of the energy products considered in the study are coal, petroleum, and electricity. While estimating the demand equation for one category, prices of the remaining two categories are considered as related products. For example, in the case of the demand equation for coal, prices of petroleum and electricity are considered as related products and in the same manner for electricity and petroleum as well. Petroleum and electricity are further classified and therefore, the following individual energy demand equations are estimated for coal, petrol, LPG, diesel, kerosene, and various heads of electricity uses such as commercial, industrial, domestic, agriculture and railway. All variables in the equation are in natural logarithms. Therefore, the partial slope coefficients are interpreted as elasticity.

Prices and consumption of different energy products as well as GDP may not be stationary in the level form. Therefore, to test the stationary status of the variables, we use two methods, namely, Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) test and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) (Kwiatkowski et al., 1992) test. The ADF and KPSS tests differ from each other in their null hypothesis. The former considers a null hypothesis that the series in question is non-stationary, whereas, in the latter, series is hypothesized to be stationary.

All variables considered in the study namely, price and consumption of various energy products as well as the real GDP, are not stationary in the level form.[13] First differencing the variables makes them stationary and therefore the variables are integrated in the order one I (1). If a linear combination of I (1) variables results in I (0) residuals, the variables are said to be co-integrated. Therefore, there is a possibility of a long-run relationship among the variables considered in the study. We test for the possible co-integration among energy consumption, energy price, income and cross prices using Johansen co-integration test (Johansen and Juselius, 1990).

First differencing the variables may not be the viable option because changes in the demand and prices are not linear (Lewbel and Ng, 2005). Further, electricity prices under commercial and railway category are stationary at 5 per cent level of significance, whereas coal price is at 10 per cent level of significance as per the ADF test. The electricity consumption under domestic and agriculture category is stationary at 10 per cent level of significance as per the ADF test. However, KPSS test contradicts both results and all variables are non-stationary at the level and first differencing will make them stationary. Therefore, the study proposes to use the Auto Regressive Distributed Lag (ARDL) approach. Eq. (2) is rewritten as follows:

$$D_{it} = \beta_0 + \sum_{l=1}^{L} \beta_1 D_{it-l} + \sum_{r=0}^{R} \beta_2 P_{it-r} + \sum_{s=0}^{S} \beta_3 Y_{t-s} + \sum_{u=0}^{U} \beta_4 P1_{it-u} + \sum_{v=0}^{V} \beta_5 P2_{it-v} + \mu_{it} \quad (3)$$

Appropriate lag lengths for variables in the equation are chosen based on the Schwarz criterion (SIC).

The chosen ARDL model is rewritten as an equivalent Error Correction Model (ECM) as follows:

$$\Delta D_{it} = \delta_0 + \gamma(D_{t-1} - \lambda_p P_{t-1}) + \sum_{l=1}^{L} \delta_1 \Delta D_{it-l} + \sum_{r=0}^{R} \delta_2 \Delta P_{it-r} + \sum_{s=0}^{S} \delta_3 \Delta Y_{t-s} + \sum_{u=0}^{U} \delta_4 \Delta P1_{it-u} + \sum_{v=0}^{V} \delta_5 \Delta P2_{it-v} + \mu_{it} \quad (4)$$

The coefficients in the error correction term are equal to long-run elasticity

$$\lambda_p = \frac{\sum_{r=0}^{R} \beta_2}{1 - \sum_{l=1}^{L} \beta_1} \quad (5)$$

The short-run elasticity is equal to the coefficient of the first difference term Δp_t

$$\delta_{2,0} = \beta_{2,\ 0} \quad (6)$$

We consider four scenarios of energy subsidy removal, wherein scenario −1 stands for the 100 per cent removal of energy subsidy, scenario −2 for 75 per cent reduction, scenario −3 for 50 per cent reduction and scenario −4 for 25 per cent reduction. The logic behind the creation of scenarios is that India is expected to embark on a series of subsidy removal program over the years. For example, the subsidy for petrol and diesel were removed completely in the year 2010 and 2014 respectively. However, subsidies on kerosene, LPG, coal, and electricity still continue although at different proportions. Based on these scenarios, the impact of the removal of energy subsidy on the price level, energy consumption, and total energy outlay are analyzed. Since the removal of energy subsidy leads to an increase in the energy price, the impact on WPI is calculated by taking the weight of each energy product in WPI. Further, based on the estimated elasticity coefficients, we calculate the effect of energy subsidy removal on the consumption of different energy products and total outlay on these products. (Table 2).

5. Empirical results

Table 3 shows the mean and standard deviation of WPI and consumption of the energy products. The average WPI and standard deviation are relatively high for coal, diesel and petrol compared to LPG and kerosene, which is understandable because the latter two are still highly subsidized. The mean consumption and standard deviation of consumption of diesel are substantially higher compared to petrol, kerosene, and LPG. In the case of electricity, the mean and standard deviation of WPI for the agriculture sector is much higher than the rest of the consumer categories. Industry is the largest consumer of electricity, followed by agriculture and domestic consumption. Commercial firms and railway account for the relatively less consumption of electricity.

The preliminary diagnostic checks for the time series data, namely unit root tests are conducted on all variables used in the study and the results are reported in Table 4. It is evident from the table that KPSS test rejects the null hypothesis of stationarity for all variables in the level form, whereas the null hypothesis is not rejected in the first difference. Therefore, variables are integrated of order one (I (1)). ADF test also confirms the finding of the KPSS test in most cases at 5 per cent level of significance. However, electricity price for commercial use and railway use seems to be stationary at the level as per the ADF test. Further, first differencing the variables makes them stationary as per the ADF test, reinforcing the findings of the KPSS test.

The variables may be non-stationary in the level form. However, in a linear combination of such variables, the residual may be stationary, indicating a long run relationship among the variables. Therefore, we test for the possibility of co-integration using Johansen test and the resultis presented in Table 5. An unrestricted co-integration rank test based on trace statistic and maximum eigenvalue criteria rejects the null hypothesis of no co-integrating vector, whereas at most 1–4 co-integrating vectors are not statistically significant at 5 per cent level of significance.

Driven by the basic microeconomic theory, we have estimated the coefficients of respective price and income elasticity of six major energy resources as a stepping stone to the core empirical analysis. ARDL model is applied to the data in the level form, and an equivalent ECM is estimated. We present the full details of the ARDL and ECM estimates in the appendix. Table 6 reports the price and income elasticity of

[13] A detailed note on the unit root tests used and the results are presented in the section for empirical results.

Table 2
Per unit energy subsidy in India.

Energy Product	Unit of Measurement	2014–15		December 2015	
		Subsidized Price	Subsidy	Subsidized Price	Subsidy
Petrol	Per Litre	63.94	Nil	62.69	Nil
Diesel	Per Litre	53.17	Nil	48.97	Nil
LPG	14.2 kG per Cylinder	432	409.72	417.82	167.18
Kerosene	Per Litre	15.24	27.93	14.96	12
Electricity	Per Unit (KWH)	4.79	0.43	4.79	0.43
Coal	Per Tonne	3625	725	3625	725

Note: Petrol subsidy has been removed since 25th June 2010 and Diesel since 18th October 2014. Price and subsidy data is pertaining to 2014–15 whereas, electricity data is pertaining to 2013–14. Coal price is the average price of the coal purchased by the electricity producers including transportation costs. Subsidy is calculated as the difference between imported and domestic coal by equating the kilocalorie (Kcal).

Table 3
Summary statistics.

Energy Product	Statistic	WPI	Consumption
Coal	Mean	69.13	264.1
	Std. Dev.	61.95	157.26
Diesel	Mean	58.45	28854.77
	Std. Dev.	63.61	19504.93
LPG	Mean	54.8	5339.71
	Std. Dev.	51.21	5439.02
Petrol	Mean	63.43	5716.93
	Std. Dev.	55.81	4861.71
Kerosene	Mean	53.3	7469.86
	Std. Dev.	49.65	2723.98
Electricity- Overall	Mean	54.1	287308.7
	Std. Dev.	48.22	236162.8
Electricity- Commercial	Mean	52.46	22522.95
	Std. Dev.	42.86	22412.02
Electricity- Industry	Mean	53.75	119377.7
	Std. Dev.	45.47	95887.73
Electricity- Domestic	Mean	56.85	60733.97
	Std. Dev.	44.42	58330.86
Electricity- Agriculture	Mean	60.29	63291.78
	Std. Dev.	55.32	46164.87
Electricity- Railway	Mean	54.45	6360.35
	Std. Dev.	47.32	4223.95

Note: Wholesale Price Index (WPI) is in 2004- 05 prices. Consumption volume of LPG, Kerosene and Coal are measured in Thousand Metric Tonnes and Electricity in Giga Watt Hour. Average and Standard Deviation are calculated for the full period from 1970 to 71 2014-15.

demand in the short run as well as long run. The products under the petroleum category exhibit statistically significant highly inelastic demand concerning their price in the short run as well as in the long run. However, the elasticity coefficients marginally increase in size in the long-run. The petroleum products are necessities of life mostly used in the transportation sector of a vast country like India and for cooking in both rural and urban areas. The highly statistically significant elasticity coefficients of diesel and kerosene, specifically, drive home this point as far as the Indian economy is concerned. Further, they do not have close substitutes. The price elasticity of demand for electricity is highly inelastic in the short run for overall use as well as the category- wise use of electricity. However, while the elasticity coefficients of agriculture and domestic use are statistically insignificant, the coefficient attached to industrial use is highly significant. It shows that the use of electricity for agriculture or domestic purpose is not affected by the changes in the electricity tariffs, whereas industrial use is responsive to tariff changes. Hence, these results indicate the possibility of inefficient use of the energy resources in the face of blanket subsidization. Contrary to the relationship expected between price and quantity demanded, electricity use for the railway has a positive elasticity coefficient as well as statistically significant both in the short run and long run. Providing connectivity throughout the country for both travel and transportation of cargo is the major driving force of the demand for electricity in the railway. A similar result is recorded for coal as well. In the long run, electricity use under agriculture and industry turn relatively elastic. The remaining categories of electricity use remain inelastic, though we find a marginal increase in the long run. Finally, electricity use under railway is positive and statistically significant in the long run as well.

Income elasticity of demand in the short run is positive for most of the energy products except HSD and agriculture use of electricity. However, coefficients are insignificant in case of coal, HSD, kerosene, LPG, and electricity use for the domestic purpose. In the long run, kerosene shows statistically significant negative income elasticity and it may be said that the demand for kerosene is negatively influenced by the level of economic affordability of the people to purchase other energy resources such as LPG, say, for cooking purpose. Income elasticity coefficients of coal, LPG, domestic and agriculture use of electricity are statistically insignificant. HSD, electricity overall use, railway, and industrial use have positive income elasticity coefficient as expected and demand is relatively inelastic. Energy products like petrol and commercial use of electricity have positive income elasticity and the coefficients are unit elastic.

6. Discussion

As outlined at the outset, the idea of energy subsidy was adopted with the aim of enabling less privileged sections of the society to use these resources at affordable prices and thereby ensure a given standard of living. Therefore, the rise in the price of energy resources due to the removal of subsidy would unleash both direct and indirect effects in the economy. The direct effect manifests in the form of an increase in the cost of energy resources like the cost of cooking using kerosene or LPG. The indirect effect manifests in the form of an increase in the cost of production of goods and services produced using energy resources as intermediary inputs and consequent increase in the price of final goods and services. Accordingly, there would be a sense of high inflationary pressure in the economy as a whole (Saboohi, 2001; ArzedelGranado et al., 2012; Solaymani and Kari, 2014). Hence, to analyze whether energy subsidy removal has any impact on the welfare of the people, we have analyzed the response of general price level, the volume of energy consumption and its expenditure to subsidy removal in the post-subsidy reform scenario in Indian economy.

As per the general price level measured by WPI in India, empirical results furnished in Table 7 show that the removal of subsidy on energy

Table 4
Unit Root Test Result.

Variables	Level			First Difference		
	ADF Test	Prob	KPSS Test	ADF Test	Prob	KPSS Test
Coal Consumption	−1.484	0.533	0.852	−4.377	0	0.222
High Speed Diesel (HSD)Consumption	−2.579	0.105	0.850	−5.353	0	0.473
Petrol Consumption	1.284	0.998	0.840	−5.923	0	0.820
Kerosene Consumption	−1.487	0.531	0.649	−3.696	0.008	0.488
Liquefied Petroleum Gas (LPG)Consumption	−1.010	0.741	0.847	−3.293	0.021	0.278
Electricity Consumption- Overall	−0.812	0.806	0.855	−3.568	0.011	0.079
Electricity Consumption- Agriculture	−2.897	0.054	0.819	−3.631	0.009	0.550
Electricity Consumption- Domestic	−2.898	0.054	0.851	−3.707	0.007	0.410
Electricity Consumption- Industry	0.614	0.989	0.836	−4.520	0	0.204
Electricity Consumption- Commercial	0.074	0.960	0.853	−6.474	0	0.068
Electricity Consumption- Railway	−1.091	0.711	0.856	−6.106	0	0.341
Coal Price	−2.711	0.080	0.830	−5.384	0	0.564
High Speed Diesel (HSD) Price	−1.044	0.729	0.844	−6.579	0	0.102
Petrol Price	−2.098	0.246	0.842	−5.424	0	0.464
Kerosene Price	−1.337	0.604	0.820	−4.534	0	0.092
Liquefied Petroleum Gas (LPG) Price	−1.704	0.422	0.844	−5.607	0	0.253
Electricity Price- Overall	−2.345	0.163	0.839	−4.766	0	0.376
Electricity Price- Agriculture	−1.253	0.642	0.850	−5.278	0	0.168
Electricity Price- Domestic	−2.232	0.198	0.843	−4.859	0	0.274
Electricity Price- Industry	−2.433	0.139	0.831	−4.773	0	0.520
Electricity Price- Commercial	−2.970	0.046	0.829	−4.655	0	0.575
Electricity Price- Railway	−3.095	0.034	0.825	−4.710	0	0.632

Asymptotic critical values for KPSS Test at 1%, 5% and 10% level are 0.739, 0.463 and 0.347 respectively

Table 5
Johansen Cointegration Test Result.

Variable	Unrestricted Cointegration Rank Test (Trace)					Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Coal	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Electricity										
Overall Use	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Agriculture	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Commercial	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Domestic	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Industrial	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Railway	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Petroleum Products										
HSD	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Kerosene	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
LPG	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4
Petrol	None[a]	At most 1	At most 2	At most 3	At most 4	None[a]	At most 1	At most 2	At most 3	At most 4

Note.
[a] denotes rejection of the hypothesis at the 0.05 level of significance for both Trace test and Maximum eigenvalue test. Variables in each equation includes the consumption of the energy product in question, its own price, Gross Domestic Product (GDP) at market prices, and the cross prices. The cross prices for coal for example includes the prices of petroleum and electricity. In the same manner, for electricity and petroleum products, the prices of remaining two energy categories are included as cross prices. Cointegrating equations are estimated with Quadratic deterministic trend and lag lengths are selected based on Schwarz criterion (SIC).

resources would cause an increase in the general price level in the economy. We have estimated the impact of energy subsidy removal on WPI at two periods, as on 31st March 2015 and 31st December 2015, to facilitate the comparison of the impact of subsidy removal in high and low crude oil price regimes. Based on the 31st March 2015 calculation, complete removal of energy subsidy will result in a 3.8 per cent increase in the WPI, whereas a partial removal will lead to 1.9 per cent increase. These results are consistent with findings of Anand et al. (2013) who found that the Consumer Price Index (CPI) would increase by 4 per cent in the event of elimination of fuel subsidy in India. Solaymani and Kari (2014) from Malaysia also report similar results. Positive correspondence between prices of energy resources and general price level of such a degree in India is not surprising given the fact that India heavily depends on the import of these resources. In addition to this, in a vast country like India, a major share of imported petroleum products like diesel is used in the transportation sector in which inter-fuel substitutability is limited. It implies that any change in the price of fuel and consequent increase in transportation cost will have to be passed on to the final consumers (Andriamihaja and Vecchi, 2007).

Incidentally, the role of the major energy resources such as petroleum products in determining the price level in the domestic economy is corroborated by the recent price decline of crude in the international market since June 2014 that has resulted in the considerable easing of inflationary pressure on Indian economy. As demonstrated by Tapsoba (2013), choosing the appropriate macroeconomic environment to initiate economic reform measures is also crucial not only from the point of mitigating potential short-term pains of reform to the society but also to achieve fiscal consolidation. Therefore, we have quantified the impact of subsidy removal as on 31st December 2015 to know the inflationary impact due to subsidy removal in a low oil price regime. As shown in Table 7, a complete

Table 6
Short run and long run elasticity coefficients.

Energy Product	Price Elasticity of Demand				Income Elasticity of Demand			
	Short Run		Long Run		Short Run		Long Run	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Coal	0.113	0.04	0.401	0.01	0.144	0.47	0.198	0.43
High Speed Diesel	−0.167	0	−0.437	0.03	−0.062	0.79	0.763	0
Petrol	−0.114	0.02	−0.416	0.01	0.561	0	1.004	0
Kerosene	−0.096	0	−0.452	0	0.151	0.51	−1.242	0
LPG	−0.119	0.04	−0.401	0.03	0.056	0.83	0.471	0.15
Electricity- Overall	−0.125	0	−0.643	0.08	0.128	0.06	0.658	0
Electricity- Agriculture	−0.036	0.73	−3.191	0.02	−0.142	0.08	−0.820	0.14
Electricity- Domestic	−0.043	0.61	−0.233	0.63	0.049	0.43	0.263	0.37
Electricity- Industry	−0.227	0	−1.075	0	0.720	0	0.689	0
Electricity- Commercial	−0.061	0.31	−0.047	0.61	0.754	0.01	1.068	0
Electricity- Railway	0.126	0.06	0.354	0.04	0.210	0.07	0.588	0.01

Note

Table 7
Impact of Energy Subsidy Reform on WPI.

Scenarios	**Definition of Scenarios**	**Increase in WPI 2014-15**	**Increase in WPI December 2015**
Scenario- 1	Complete Removal of Subsidy	3.80%	1.38%
Scenario- 2	75% Removal of Subsidy	2.85%	1.03%
Scenario- 3	50% Removal of Subsidy	1.90%	0.69%
Scenario- 4	25% Removal of Subsidy	0.95%	0.34%

Note: Impact of energy subsidy removal is calculated by taking the percentage rise in per unit energy prices due to the removal of subsidy under four scenarios and multiplied by the weight of the individual energy product in the Wholesale Price Index (WPI).

removal of subsidy will lead to 1.38 per cent increase in WPI, whereas a 50 per cent reduction in subsidy leads to a 0.69 per cent increase in WPI. Considering the difference in the inflationary impact of subsidy removal, the present low crude oil price regime offers an excellent opportunity to oil subsidizing countries in general and India in particular to remove or substantially reduce the subsidies.

Broadly, results show that welfare implication of the subsidy reform is contingent upon the price of crude oil in the global market since the estimated increase in WPI is relatively lower when oil price is lower. For instance, the higher negative long-run income elasticity of resources like kerosene and agriculture use of electricity compared to their respective short run counterparts indicates that the timing of subsidy reform is very crucial. In the subdued current oil price regime, it would be relatively less painful as far as the general economic welfare is concerned.

Results of a further investigation to unravel the impact of the rise in the general price level on account of subsidy reform on energy consumption and its expenditure are presented in Table 8. Unsurprisingly, these results show that on account of rise in price level owing to subsidy removal demand for energy resources declines even though marginally and at the same time, the volume of expenditure on energy resources increases substantially (Saboohi, 2001; Lin and Jiang, 2011). Here also we find a close correspondence between the extent of subsidy removal and decrease (increase) in the energy consumption (expenditure). It is worth highlighting that the impact of energy subsidy reform is more pronounced on products like kerosene and LPG which would have considerable welfare implications. For example, complete removal of subsidy under scenario-1 will lead to a decline of about 4.12 per cent in the consumption of kerosene and a potential rise in the nominal household expenditure on it would be a hefty 218 per cent. Similarly, LPG consumption would decline by 4.86 per cent, while expenditure on it would rise by 111 per cent. At the same time, the potential impact is relatively small on the demand for and expenditure on coal and electricity. These results have far-reaching welfare implications in India, where still about 50 per cent of the households are yet to be electrified which indicates that such households are heavily dependent on products like kerosene for various essential purposes such as lighting and cooking (Gangopadhyay et al., 2005). In a similar vein, Vagliasindi (2012) has reported that in developing countries like India, the welfare casualty on account of the loss of real income followed by energy subsidy reform takes place in the form of reduced consumption of kerosene to the extent of 50 per cent. Thus, one can deduce that given the current socioeconomic state of the affair in the Indian economy, the removal of subsidy will certainly hit the poor and vulnerable section of the society.

The introduction of effective measures to improve the energy efficiency can go a long way in helping the ordinary citizens to deal with the negative impact of energy reform. Hence, the government may adopt policies such as incentivizing the use of energy efficient equipment like LED/CFL bulbs and awareness campaign to educate the general public on energy conservation. Further, improvement in the physical infrastructure like roads which can increase the average speed of transportation and thereby reduce the use of energy resources and promoting use of public transport system on a war footing basis are other measures. In the case of electricity, in addition to rationalizing subsidy regime, concrete measures have to be adopted to expand the access to electricity by way of building more infrastructures to produce adequate power, improve operational efficiency and modernization of production, transmission, and distribution. Further, cleaner energy sources need to be promoted while also encouraging agricultural practices using less water and modern irrigation techniques like drip irrigation which could prevent the wasteful use of energy resources like electricity and diesel.

Indeed, one has to turn one's attention to another side of the reality that energy subsidy in India is highly regressive as its benefits are enjoyed mostly by the rich when compared to the poor. For example, Anand et al. (2013) have documented that while poor households spend 1.6 per cent of their total expenditure on fuel, it is 6 per cent of the total expenditure in rich households. Therefore, the estimated negative impact of energy reforms on the household consumption of products like electricity should be viewed in the best interest of the nation as it enables to reduce the subsidy leakages and thereby attain fiscal balance.

Based on the interim report of the task force appointed by the Ministry of Finance, Government of India in 2011 (Ministry of Finance, 2011) and International Institute for Sustainable Development (IISD)

Table 8
Impact of Energy Subsidy Reform on Energy consumption and Expenditure.

Energy	Current Consumption and Expenditure	Estimated Decline in Consumption			Estimated Increase in Expenditure	
		Scenarios	Volume	Percent	Amount (Rs)	Percent
LPG	16391 and 47932.13	Scenario–1	796	4.86	53303.98	111
		Scenario–2	597	3.64	40510.32	85
		Scenario–3	398	2.43	27361.77	57
		Scenario–4	199	1.21	13858.33	29
Kerosene	6997 and 11107.73	Scenario–1	289	4.12	24248.89	218
		Scenario–2	216	3.09	18385.97	166
		Scenario–3	144	2.06	12390.17	112
		Scenario–4	72	1.03	6261.52	56
Coal	791 and 3804447	Scenario–1	−17.9	−2.26	864066	22.71
		Scenario–2	−13.4	−1.69	644825	16.95
		Scenario–3	−8.9	−1.13	427734	11.24
		Scenario–4	−4.5	−0.57	212792	5.59
Electricity	742457 and 356260.4	Scenario–1	8353	1.12	27694.8	7.77
		Scenario–2	6264	0.84	20838.7	5.85
		Scenario–3	4176	0.56	13937.6	3.91
		Scenario–4	2088	0.28	6991.3	1.96

Note: Decline in consumption is calculated based on the estimated elasticity coefficients and percentage price change due to subsidy removal. For example: decline in LPG consumption in Scenario-1 is 4.86%, it is calculated as ((−0.119*40.8%)*16391). In Scenario 2, 3 and 4, percentage change in price due to subsidy removal will be 30.06%, 20.04%, 10.2% respectively. In the same manner, Kerosene, Coal and Electricity consumption change are calculated. For Coal, decline in consumption is shown as negative because consumption is increasing due to positive relationship between price and quantity demanded.
Consumption volume of LPG, Kerosene and Coal are measured in Thousand Metric Tonnes and Electricity in Giga Watt Hour. Expenditure is measured in thousand Rupee crore (1 crore=10000000). Since Diesel and Petrol prices are already decontrolled, change in consumption and amount spent calculations are not applicable

(2012b), the government introduced a scheme in 2013 to transfer all governmental benefits including subsidies directly to the bank accounts of the beneficiaries. Measures like this can go a long way in ensuring that subsidies reach the most deserving segment of the society. However, one of the major lacunae lies in the identification of the true households deserving subsidy like any other government sponsored benefits. For example, excessive political interference has already marred the process of identifying Below Poverty Line (BPL) and Above Poverty Line (APL) households with related fiscal consequences. Hence, the government must ensure that free and fair methods are adopted to identify the potential deserving households for energy subsidy.

7. Conclusion and policy suggestions

Driven by the socioeconomic considerations, Indian government has always intervened in the market for the energy resources in the form of subsidizing the energy resources for a long time. However, it has resulted in several pitfalls; for example, the extensive use of fossil fuel results in the degradation of the ecology, and destabilizes the fiscal balance of the economy on account of swelling the energy subsidy liability. In line with the concerted effort at the global level to reduce the fiscal burden caused by the inefficient subsidy regime, and the use of hazardous fossil fuels, India has embarked on initiatives such as the energy subsidy removal, and the consequent deregulation of prices of various energy products. In this paper, therefore, we have examined the potential impact of the energy subsidy reforms introduced on Indian economy.

As a first step in the empirical analysis, the estimated coefficient of the price elasticity of the energy resources reflects the socioeconomic significance of the different energy resources in a diverse and vast economy like India. The results show that the welfare implications of the deregulation of the prices of the energy resources depend on the timing of the reform introduced taking the price of crude oil in the international market into account. Specifically, the impact of the reforms on the general price level measured by WPI is found to be lower, while the crude oil price is also lower and vice-versa. These findings will have far-reaching socioeconomic welfare implications in the contemporary India that houses largest number of starving people in the world today. Specifically, the finding that the general price level will remain subdued when the oil price is on decline essentially underlines the fact that the majority of the poor citizens of India will have some leeway to spend their precious income on the necessities of life such as health care and education. Hence, it may be argued that the current situation with lower oil price offers an ideal opportunity to Indian policy makers to go ahead with the subsidy reform so that the subsidy can be directed to the needy in a more efficient manner. A similar opinion is expressed by Coady et al. (2015) as well.

The energy subsidy regime riddled with inefficiency can no longer be taken forward sustainably, and therefore should be weaned off in a gradual manner. In such a pursuit, following policy suggestions made by this study, based on the empirical findings of this study, will be of great use for the policy makers. First, the government must make efforts to do the required homework regarding identifying the subsidy target group in a fool-proof manner before the liberalization of the market for energy resources like kerosene and LPG, so that the subsidy can be targeted to those who truly deserve it. Second, the government should spend at least a part of the savings generated through the subsidy reforms on social welfare programs and thereby ensure the increased flow of resources, especially to rural India to compensate the likely fallout of the subsidy reform.

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