SAMVAD: SIBM Pune Research Journal, *Vol X, 32-41, June 2016*
ISSN (Print) : 2249-1880
ISSN (Online) : 2348-5329

Effect of Reduction of Fuel Subsidies on Poverty and Inequality in Developing Countries - The Case of India

Amrita Ganguly[1,3]* and Dr. Koushik Das[2]

[1]Indian Institute of Foreign Trade, Kolkata-700016, India; amrita.ganguly@in.ey.com
[2]Assistant Professor in Economics, Shyampur Siddheswari Mahavidyalaya (Affiliated to University of Calcutta, Howrah, West Bengal 711312, India; koushik10in2001@gmail.com
[3]Ernst & Young LLP, India.

Abstract

We use the Computable General Equilibrium (CGE) framework to show that there is a positive relationship between crude prices and the extent of poverty and inequality in India. We further show that any removal of subsidies on fuels such as petrol, diesel and Liquid Petroleum Gas (LPG), even when it is done during periods of declining crude prices, is anti-poor. Importantly however when removal of these subsidies are coupled with targeted pro-poor transfers (as proposed, for instance, in the next phase of the Direct Benefit Transfer of LPG (DBTL) scheme in India) results in improvement of inequality and poverty indicators and thus mitigates the negative effects of removal of subsidy.

Keywords: CGE, Crude Oil Price, Energy Subsidy, Poverty, SAM

1. Introduction

World Bank estimates show that Indian poverty rates have been falling since the last two decades. Poverty head count ratio at national poverty line decreased from 55.5% in 1981 to 21.9% in 2011[15]. Poverty gap index also reduced from 19.6% in 1981 to 7.5% in 2010[16]. India had a higher head-count ratio as compared to emerging economies like Brazil (11.1%), Russia (12.7%) and lower headcount ratio as compared to Mexico (52%) and South Africa (53.8%) in 2011[17]. On the other hand India ranks 135 in terms of inequality (measured using income Gini Coefficient) among 195 countries [18]. However among the emerging market economies, India has performed relatively better. Inequality rose sharply in China from 27% in 1980 to 45% in 1990 and then fell slowly to 40% in 2013. In case of Brazil inequality fell from 56% in 1980 to 54.7% in 2013 with a spike in between -65% in 1990. For Mexico, inequality increased from 40% in 1980 to 47.2% in 2013. Inequality remained almost unchanged in India in the last two decades[a]. Inequality, indicated in terms of Gini Coefficient, for India stood at 33.9% in 2013, down from 36.8% in 2004[19]. Between 1973 and 2013, rural inequality has reduced; urban inequality has increased. Rural Gini Coefficient varied from 28.1% in 1973 to 28% in 2011. Urban Gini Coefficient varied from 30% in 1973 to 36.7% in 2011.

It is clear therefore that poverty is a major problem in India especially due to the sheer number of the poor though the situation as far as inequality is concerned is not that severe compared to other emerging economies. Reduction or removal of poverty and inequality therefore remains one of the prime concerns of the Indian government. Subsidies especially energy subsidies can impact the poverty and inequality parameters of any country. In India, in recent years the government has taken several steps to reduce subsidies on fossil fuels like LPG, petrol and diesel, which has resulted in increase of price of these

*Author for correspondence

a World Economic Outlook, IMF, October 2007

fuels in India compared to what would have happened had subsidies not been reduced.

Fuel subsidies in India did not distinguish between the rich and the poor. The net amount of subsidy that a particular set of people got depended entirely on the amount of consumption of fossil fuels. For example, petrol is consumed by the relatively richer sections of the population. On the other hand kerosene is consumed by only the poor, while diesel is mostly used by industry and the transport sector. Thus, removal of petrol subsidies are expected to have lesser adverse impact on poverty and inequality as compared to kerosene or diesel subsidies

It appears from the above discussion that it is important to determine the particular fuel that is targeted for removal of subsidies. The Indian government considered this while removing fuel subsidies in India. For example subsidy on kerosene was not removed at all; subsidy on petrol was reduced the fastest while subsidy on diesel was reduced at a slower pace.

An example of fuel subsidy removal is the Direct Benefit Transfer of LPG (DBTL) scheme launched in India in 2012. In the existing regime, domestic subsidized LPG cylinders were being diverted to the commercial sector due to dual pricing in the market. This also resulted in huge under-recoveries by the Oil marketing Companies and was a burden to the national exchequer. Under the DBTL scheme (phase 1), the consumers pay the market price for the domestic cylinder and the subsidy amount is transferred directly to their bank account, with a cap of 12 cylinders per household per annum. In the next phase, it is being proposed by the government to totally remove subsidies for household above a certain threshold income level and transfer subsidy directly only to a targeted segment of poor consumers.[b]

Given the above perspective the empirical strategy that we adopt is as follows: First we determine the effect of variation in crude oil prices on poverty and inequality in India (assuming that there was no change in subsidy). Our next step is to determine the differential impact of removing subsidies of different fossil fuels like petrol, diesel and LPG under three scenarios: 1. There is no transfer mechanism; 2. The resultant surplus income available to the government is equally distributed among all households and 3. The resultant surplus income available to government is transferred only to targeted poor households. Our discussion above clearly suggests that we expect removal of any form of subsidies to be regressive, while the impact would be negated somewhat if the subsidy removal is coupled with any kind of transfer mechanism. In case of individual fuels, it is expected that petrol subsidies would be least regressive in the sense that income will be transferred from richer households who consume more petrol and hence is the greatest beneficiary of the subsidy to relatively poorer households, given our assumption of distribution of the surplus by the government (by any mechanism). Diesel subsidy removal would be somewhat less or almost equally regressive as compared to petrol. For other fossil fuels especially LPG that are directly or indirectly consumed much more by the poorer households, the result of removal of subsidy is expected to be more regressive as far as poverty and inequality is concerned. Finally we also determine the situation arising out of the simultaneous removal of subsidies on all three fossil fuels after internalizing the DBTL mechanism in LPG. This situation is thus a kind of replica of the actual situation in India. Our next step will be to ensure a transfer mechanism as any form of subsidy removal us harmful for economic development and transfer mechanism can ensure at least a status quo as far as poverty and inequality is concerned.

Along with this, sensitivity analysis has been carried out to see how the results are impacted with change in elasticity of substitution[c] and elasticity of transformation[d] of all energy goods.

Since poverty and inequality are important concerns for India and similar developing countries, there is some literature available on poverty and inequality analysis for such countries. In Sri Lanka, it was found that urban low income households are the most adversely affected by high global oil prices, followed by low income rural households[2]. Developing a system to better target subsidies and

b Handbook on Direct Benefit Transfer For LPG Consumer (DBTL), Ministry of Petroleum and Natural Gas, Government of India. Also the proposal for total removal of subsidies for household above a certain threshold income level has been proposed by Government - available at http://indianexpress.com/article/business/commodities/fm-time-to-remove-lpg-subsidy-for-people-like-us/

http://articles.economictimes.indiatimes.com/2015-11-07/news/68089700_1_petroleum-subsidy-kerosene-subsidy-direct-benefit-transfer

c Percentage change in the relative consumption of two goods as a consequence of a change in the relative prices of the goods

d Applies to the export function

other government funds to poor households will involve both withdrawing entitlements from non-poor households that currently receive subsidies as well as including genuinely poor households that are currently excluded[7]. In case of Nigeria, an energy subsidy reduction accompanied with a transfer of government income (especially to rural households) promotes pro-poor growth and increases real income of such households by 2.3-7.6 %[5]. In Yemen, it was estimated that the amount saved by government due to fuel subsidy reform could be used for cash transfer to offset the negative impacts of subsidy removal on poor households (Breisinger et al. 2011). In South Africa, it was seen that oil price shocks resulted in an increase in income Gini Coefficient (and hence on inequality) and an increase in poverty levels (measured in terms of headcount ratio, poverty gap and poverty severity using income)[8]. In Indonesia, it was seen that 25% reduction of fuel subsidies increases poverty by 0.259% and if this money were fully allocated to government spending, the poverty would decrease by 0.27%. 100% removal of fuel subsidies and the reallocation of 50% of the amount to government transfers and other subsidies could decrease the incidence of poverty by 0.277%[1]. There is a study in India based on analysing usage and quantities of kerosene and LPG subsidies and concludes that removal of subsidies on household fuels like kerosene should be supported by other policies to limit the adverse effects[3]. However we could not find any work on the effect of crude oil prices and energy (LPG, petrol and diesel) subsidy removal on poverty and inequality for India using the CGE framework. This is an important motivation for this work.

The rest of the paper is arranged as follows: Section 2 traces the prices of crude oil and its derivatives. Section 3 provides the methodology of construction of SAM. Section 4 highlights the results of the research work. Section 5 shows the robustness of the results. Finally Section 6 concludes the paper.

2. Price of Crude and Its Derivatives

Since India imports 85% of her crude from OPEC countries, we here consider only the OPEC crude oil price.[e] International crude price fluctuations are presented in Figure 1. During the period of study crude oil prices fell from $69.04 (2007) per barrel to $52 per barrel (2015) a decrease of 25%. However there have been great fluctuations (standard deviation is 22). The difference between the peak rates of $109.45 to the barrel (2012) to $52 to the barrel (2015) is a decline of 52%.

Figure 2 shows the net subsidy (which includes subsidy less tax) trend of the petrol, diesel and LPG in India. The net subsidy on petrol reduces from around 11% in 2004 to 0 in 2010 while the net subsidy on diesel reduced from around 32% in 2004 to 0 in 2013. The subsidy on LPG was still relatively higher - around 25% in 2015 having reduced from around 75% in 2004. In fact, until 2010, the central government controlled the prices of LPG, petrol and diesel. In June 2010, the government deregulated the price of petrol and in October 2014, price of diesel was deregulated. This process was made easier for the government as global crude oil prices fell greatly.

3. Construction of the Social Accounting Matrix

We base our calculations on the Social Accounting Matrix (SAM) for India for the year 2007-08 following Pradhan, Saluja and Sharma[f]. This SAM consists of 78 sectors and nine categories of households which are based on occupation and location (i.e. rural and urban). The gross value added has been divided into three factors of production, i.e. labour, capital, and land. Further, labour has been divided into three types, i.e. unskilled, semi-skilled, and skilled.

To construct our SAM, relevant sectors from the above SAM were aggregated into primary (agriculture sector consists of all agricultural products, minerals, primary products such as iron ores, crude petroleum and agro process activities), secondary (Manufacturing sector comprised mainly of all manufacturing activities such as cotton and textile, plastic, rubber and leather products, cement, different chemical products, etc. without crude

e Other crude oil benchmark prices available are: Brent crude and US West Texas Intermediate (WTI). On an average there is a 5-10 % difference between OPEC price and Brent crude price. The difference between Brent crude price and WTI price is 1-5%.

f In Indian context I/O table is published by the Central Statistical Office in every five years gap. Pradhan, Saluja and Sharma (2013) constructed SAM for India using the I/O matrix for the year 2007-08. The main data sources used in the construction of this SAM are CSO's I-O table 2007-08, NSSO's 66th round survey on consumer expenditure, and NCAER's Income-Expenditure Survey 2004-05.

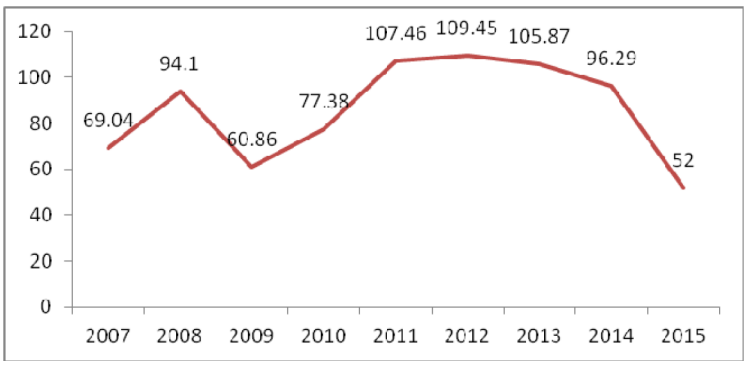

Figure 1. International crude oil price – Average OPEC crude price (in USD/bbl).
Source: http://www.ft.com/cms/s/0/517b2aa4-0acd-11e5-9df4-00144feabdc0.html#axzz3sCckeV74

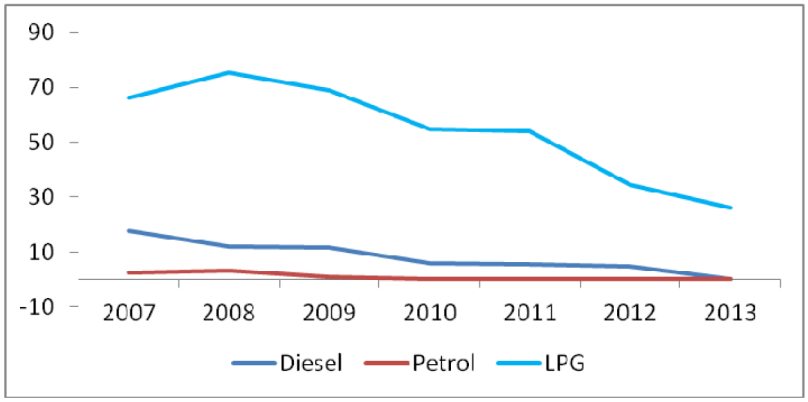

Figure 2. Subsidy (net of tax) rates of selected fossil fuels for last 10 years (in %).
Source: Indian Oil Corporation Ltd.

oil, LPG, petrol and diesel) and tertiary (Service sectors such as education, health care services, public administration, bank and insurance, postal services etc.) sectors. Crude oil has been taken as a separate sector. LPG, petrol and diesel have been proportionately taken out from the sector – petroleum products. Thus, the SAM that we work with has three energy sectors (LPG, petrol and diesel) where subsidies have varied over the years, one energy sector (crude oil) where there is no subsidy and three non-energy sectors (agriculture; manufacturing and services) where there is no subsidy as well. Four types of agents in the economy have been considered, namely, (a) household, (b) firm, (c) government and (d) Rest of World (ROW). The three types of labour (unskilled, semi-skilled and skilled) were aggregated into one sector – labour. Households have been disaggregated into nine types based on occupation as given below:

3.1 Rural

- Non-agricultural Self-Employed (RHH1).
- Agricultural Labour (RHH2).
- Non-agricultural Labour (RHH3).
- Agricultural Self-Employed (RHH4).
- Other households (RHH5).

3.2 Urban

- Self-Employed (UHH1).
- Salaried Class (UHH2).
- Casual labour (UHH3).
- Other households (UHH4).

The nine types of households included in this study helps to highlight the impact of subsidy removal and government transfers on all major categories of households (as classified by the National Sample Survey Organisation,

Department of Statistics, Government of India based on occupation) Table 1 shows the SAM of India developed for this study.

In our SAM we have a total of seven sectors. The conventional sectors are: 1. Primary sector (C1), 2. Secondary sector (C2) and Tertiary service sector (C3) and the energy sectors i.e. 3. Crude oil (C4), 4. LPG (F1), 5. Petrol (F2) and 6. Diesel (F3) sectors. We have constructed SAM of India for the year 2007-08 based on the SAM constructed by Pradhan, Saluja and Sharma.

The SAM was used for the calibration of the CGE model and considering an open economy and perfect competition. Subsidy rates are supplied exogenously. Our benchmark CGE model is based on perfect competition and constant returns to scale assumption both in commodity market and factor market[g]. Figure 3 gives the flowchart of calibration of the CGE model.

The base year of this study has been taken as 2007-08.

4. Results

In this section we will implement the empirical strategy laid out in the introduction. Our first step, as we noted is to find the impact of changing crude prices on poverty and inequality in India assuming that subsidies are not tampered with at all and government transfers to households in the same ratio as in 2007-08. Both poverty and inequality increases with a rise in crude prices and decreases with a fall. Between 2007 and 2015, when international crude oil prices decrease by 25%, the Gini Coefficient also decreases by 3.05% and the poverty gap index reduces by 3.9%. The reason for this is as follows: The increase in crude oil prices (and no subsidies), tends to increase the disparity between rich and poor. For example for 35% increase in crude price, income of the poorest household decreases by 6% while income of the richest household decreases by 1%, so on a net level, the income of the poorest households decreases much more as compared to that of rich households. With increase in prices, the income required to sustain the same standard of living also increases, resulting in a decrease in income. This proportion of decrease in income is higher for the poorer sections of society as compared to the richer sections of society, resulting in increased inequality in society.

One of the implications of this result is that any government policy that increases the market price of fossil fuels is regressive as far as poverty and inequality is concerned. However a change in crude price can only be a rough indicator of what is going on in the economy. Hence the next step of determining the impact of subsidy removal of individual fuels without any transfers is done. In this case, we see that the values of inequality stand at 30.8563% (petrol), 30.8564% (LPG) and 30.8563% (diesel) in 2015. Thus inequality is higher in case of reduction of LPG subsidies as compared to petrol or diesel - indicating that removal of LPG subsidies are more regressive. However, there is not much change observed in case of poverty reduction when comparing the subsidy removal of individual fuels without any household transfers.

Bringing together all the results reported so far we have: 1. Crude price has a positive relationship with poverty and inequality, 2. Reduction in energy subsidy has an adverse impact on poverty and inequality, and 3. Reduction in energy subsidy coupled with equal transfer to all households decreases the adverse impact on inequality and has negligible effect on poverty.

The results presented above are all experimental in the sense that this is not what had actually happened in India. In India, between 2007 and 2015, subsidy was reduced on all the three fossil fuels simultaneously along with the crude oil price variation and transfers to households. The results of this aggregate situation are presented in Tables 2 and 3. Clearly reduction of energy subsidies has a greater impact on inequality and poverty as compared to the impact of international crude oil price variation Between 2007 and 2015, the Gini Coefficient and poverty gap index displays a reducing trend even though in some years crude prices have increased (which should have resulted in increase in Gini Coefficient). Overall the Gini coefficient reduces by 0.35% and the poverty gap index reduces by 5.6% between 2007 and 2015.

Finally we come to the policy alternatives in the hands of the government in the case above where poverty and inequality has increased. Note that poverty and inequality increases under the following circumstance: 1. Crude oil price increases and government transfers are done to the various households in the same ratio as in 2007-08, 2. Reduction of subsidy on individual fuels without any transfer, and 3. Reduction of subsidies on all fuels without any transfer.

Tables 4 and 5 show that under all these circumstances there is a simple tool available in the hand of the government: use the income generated by the removal of subsidy to transfer money to poorer households. If

g For a simple description of a CGE model see, for example, Lofgren et. al, 2002 or Das and Chakraborti (2013).

Table 1. SAM of India for 2007-08 (in INR billion)

Sector	C1	C2	F1	F2	F3	C3	C4	LAB	CAP	RHH1	RHH2	RHH3	RHH4	RHH5	UHH1	UHH2	UHH3	UHH4	PVT	PSE	GOV	IDT	INV	EXT	Total
C1	2388	2396	1	1	1	1048	1	1	1	727	923.7	604	1675.5	457.6	860	848	217.8	152	1	1	100	1	-6	280	12681
C2	604	14026	56	56	646	6451	83	1	1	719	680	511	1484	590	1160	1473	1290	1342	1	1	484	1	8418	4143	44220
F1	1	9	1	1	1	32	1	1	1	1.2	0.54	0.54	2.17	1.02	3.26	3.533157	0.37	0.50	1	1	1	1	4	9	79
F2	1	9	1	1	1	111	1	1	1	2.60	1.22	1.22	4.89	2.29	7.34	7.969527	0.82	1.13	1	1	2	1	9	21	193
F3	120	104	1	1	1	1190	1	1	1	0.76	0.36	0.36	1.43	0.67	2.15	2.331884	0.24	0.33	1	1	51	1	205	461	2149
C3	1218	7127	4	15	161	9303	12	1	1	982	607	615	1446	1361	3121	6152	354	1235	1	1	4378	1	9654	4668	52418
C4	1	2951	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-0.4398	42.6262	3018
LAB	4720	2219	1	1	17	15617	98	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-25	22664
CAP	3749	5794	8	17	374	13299	213	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-180	23289
RHH1	1	1	1	1	1	1	1	1720	1320	1	1	1	1	1	1	1	1	1	1	1	393	1	1	55	3507
RHH2	1	1	1	1	1	1	1	2500	8	1	1	1	1	1	1	1	1	1	1	1	312	1	1	74	2914
RHH3	1	1	1	1	1	1	1	1917	109.8	1	1	1	1	1	1	1	1	1	1	1	74	1	1	4	2124
RHH4	1	1	1	1	1	1	1	2755	3708	1	1	1	1	1	1	1	1	1	1	1	1073	1	1	45	7600
RHH5	1	1	1	1	1	1	1	109	2888	1	1	1	1	1	1	1	1	1	1	1	336	1	1	200	3553
UHH1	1	1	1	1	1	1	1	3235	3285	1	1	1	1	1	1	1	1	1	1	1	529	1	1	514	7583
UHH2	1	1	1	1	1	1	1	7990	487	1	1	1	1	1	1	1	1	1	1	1	796	1	1	391	9683
UHH3	1	1	1	1	1	1	1	852	114	1	1	1	1	1	1	1	1	1	1	1	48	1	1	18	1053
UHH4	1	1	1	1	1	1	1	482	1238	1	1	1	1	1	1	1	1	1	1	1	128	1	1	374	2243
PVT	1	1	1	1	1	1	1	1	2928	1	1	1	1	1	1	1	1	1	1	1	1921	1	1	1	4871
PSE	1	1	1	1	1	1	1	1	1142	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1165
GOV	1	1	1	1	1	1	1	1	987	251	1	1	418	152	415	494	1	73	1921	1	1	4050	1	1	8775
IDT	-326	1056	2	5	112	1113		1	1	45	42	24	97	39	104	123	12	24	1	1	114	1	735	728	4055
INV	1	1	1	1	1	1	1	1	4846	748	628	340	2428	1902	1849	2868	224	455	2928	1142	-1982	1	1	644	19029
EXT	198	9828	5.898124	13.30	292.69	2087.00	2550	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14992
Column Total	12687	45532	96	126	1620	50268	2973	21574	23071	3490	2898	2112	7572	4521	7537	11988	2115	3298	4871	1165	8766	4073	19035	12471	

Source: Prepared by the authors

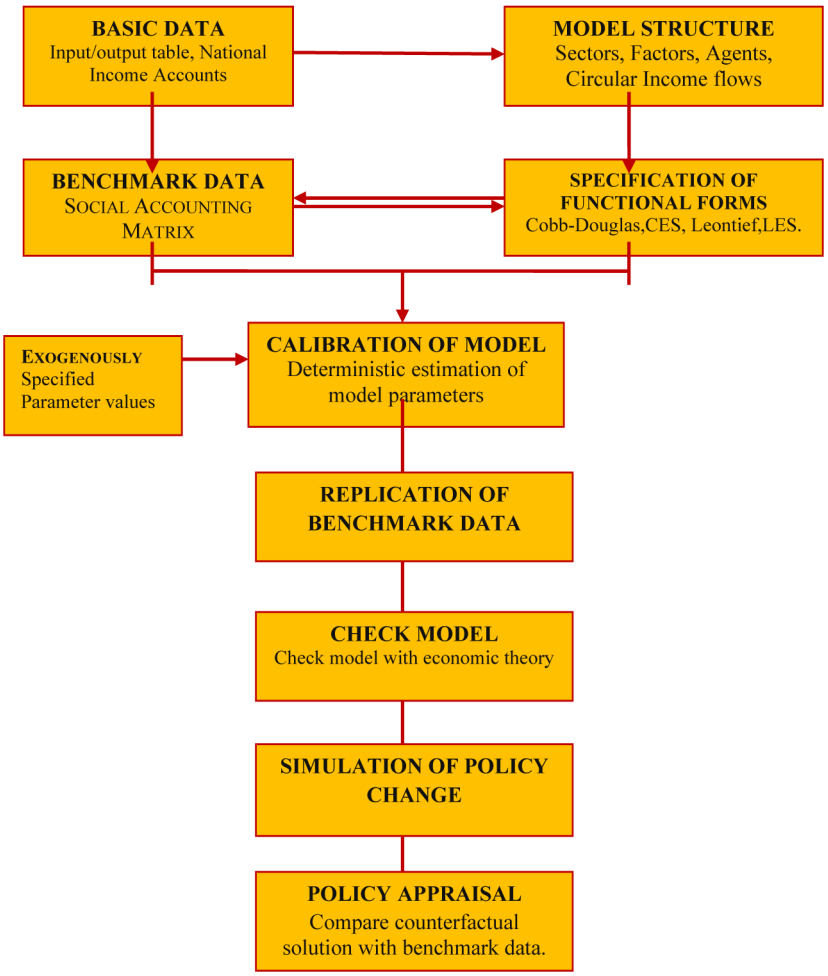

Figure 3. Flowchart of calibration.

Table 2. Change in Gini Coefficient and Poverty Index with removal of subsidy and variation in international crude oil price (without any transfer to households)

Year	Gini Coefficient	Poverty Gap Index
2007	31.0500%	8.5985%
2008	31.0500%	8.5985%
2009	31.0700%	8. 5987%
2010	31.0909%	8.6000 %
2011	31.0909%	8.6000%
2012	31.3488%	8.6300%
2013	31.8678%	8.6698%
2014	31.8678%	8.6698%
2015	31.8678%	8.6698%

Source: Prepared by the authors.

Table 3. Variation in Gini Coefficient and poverty gap index with variation in international crude oil price and removal of energy subsidies, assuming transfer ratios same as in 2007-08

Year	Gini Coefficient	Poverty Gap Index
2007	30.4081%	6.6762%
2008	30.398%	6.6746%
2009	30.3357%	6.6369%
2010	30.3265%	6.4066%
2011	30.3102%	6.3422%
2012	30.3089%	6.3362%
2013	30.3005%	6.3308%
2014	30.3001%	6.3036%
2015	30.3000%	6.3030%

Source: Prepared by the authors.

this surplus income is transferred to 20% of the poorest households, the inequality reduces to 28.0115% while the poverty gap index reduces to 2.875% in 2015 as compared to 30.4062% and 5.7163% respectively, in case of transfers to households done in the same ratio as in 2007-08. This results in the incomes of these households moving closer to the poverty line thereby reducing poverty levels. The income differentials between the rich and poor also reduce thereby reducing inequality levels.

5. Sensitivity Analysis

5.1 50% Reduction in Elasticity of Substitution and Transformation

5.1.1 Inequality Measures

Even with reduction in elasticity of substitution and transformation, the Gini Coefficient displays a decreasing trend over the years. Between 2007 and 2015, the Gini Coefficient reduces by 0.2%. However, the change in Gini Coefficient is lower in this case as compared to the case (0.35%) where no elasticity of substitution and transformation is considered.

5.1.2 Poverty Measures

As in the base case (considering effects of both reduction of energy subsidy and variation of international crude oil price without any change in elasticities), the poverty gap index displays a decreasing trend over the period 2007-2015. Between 2007 and 2015, poverty gap index reduces by 3.5% as compared to 5.6% in the base case.

5.2 75% Reduction in Elasticity of Substitution and Transformation

5.2.1 Inequality Measures

Even with reduction in elasticity of substitution and transformation, the Gini Coefficient displays a decreasing

Table 4. Change in Gini Coefficient with targeted transfers to the poorest 20% of population

Year	Reduction of LPG subsidy only	Reduction of Petrol subsidy only	Reduction of diesel subsidy only	Reduction of subsidy on all 3 fuels
2007	28.0171%	28.0108%	28.0110%	28.0177%
2008	28.0171%	28.0108%	28.0108%	28.0177%
2009	28.0162%	28.0106%	28.0108%	28.0165%
2010	28.0137%	28.0106%	28.0107%	28.0138%
2011	28.0137%	28.0106%	28.0107%	28.0138%
2012	28.0119%	28.0106%	28.0107%	28.0120%
2013	28.0115%	28.0106%	28.0107%	28.0115%
2014	28.0115%	28.0106%	28.0107%	28.0115%
2015	28.0115%	28.0106%	28.0107%	28.0115%

Table 5. Change in poverty gap index with targeted transfers to the poorest 20% of population

Year	Reduction of LPG subsidy only	Reduction of Petrol subsidy only	Reduction of diesel subsidy only	Reduction of subsidy on all 3 fuels
2007	2.8750%	2.8750%	2.8750%	2.8750%
2008	2.8750%	2.8750%	2.8750%	2.8750%
2009	2.8750%	2.8750%	2.8750%	2.8750%
2010	2.8750%	2.8750%	2.8750%	2.8750%
2011	2.8750%	2.8750%	2.8750%	2.8750%
2012	2.8750%	2.8750%	2.8750%	2.8750%
2013	2.8750%	2.8750%	2.8750%	2.8750%
2014	2.8750%	2.8750%	2.8750%	2.8750%
2015	2.8750%	2.8750%	2.8750%	2.8750%

Source: Prepared by the authors.

trend over the years. Between 2007 and 2015, the Gini Coefficient reduces by 0.1%. However, the change in Gini Coefficient is lower in this case as compared to the case (0.35%) where no elasticity of substitution and transformation is considered and the case with 50% reduction in elasticities (0.2%).

5.2.2 Poverty Measures

As in the base case (considering effects of both reduction of energy subsidy and variation of international crude oil price without any change in elasticities), the poverty gap index displays a decreasing trend over the period 2007-2015. Between 2007 and 2015, poverty gap index reduces by 3.4% as compared to 5.6% in the base case and the case with 50% reduction in elasticities (3.5%).

6. Conclusion

This research shows that in order to undertake energy subsidy reform programs, the government has to simultaneously invest in social safety nets to ensure that the lives of poor and vulnerable people in the country are not impacted adversely. Subsidy removal in any form is regressive - in 2015, if no transfers are done, inequality values stand at 31.8678% and poverty stands at 8.6698%. The adverse impact on inequality and poverty are alleviated if subsidy removal is coupled with any form of transfer mechanisms. In case of targeted transfer to poorest 20% household, inequality and poverty stand at 28.0115% and 2.875% respectively while in the case of equal distribution; the numbers are 30.2485% and 6.4223%. Thus, subsidy removal with targeted pro-poor transfers is a better policy tool as compared to subsidy removal with equal distribution of the surplus income of the government or subsidy removal with government transfers in the ratio as in 2007-08. Further, the DBTL scheme which can be somewhat compared to the scenario of equal distribution has not impacted poverty and inequality majorly. The scheme might have been successful in achieving its other intended benefits of preventing diversion of domestic subsidized cylinders to the commercial sector; however this is beyond the scope of this research. Moreover, removal of subsidies on LPG is more regressive as compared to diesel or petrol.

There needs to be further research to develop an inclusive economic growth model for India and to promote equitable access to resources and services. Several areas can be explored including innovative ways of generating GDP that reduce inequality, possibilities of promoting wage-led growth and employment-led growth as a counter to capital-led growth and role of technology in alleviating inequality and poverty.

There is a general perception among people that removal of subsidies on fossil fuels in India did not have adverse effects on the Indian economy as the removals came at a time when crude prices were falling internationally. In this paper we have clearly shown that, the perception is not correct. The argument presented here suggests that the government needs more proactive policies of economic development that transfer income to the poorer households to ensure that the damage caused by removal of fossil fuel subsidies is taken care of. Proactive policies of targeted pro-poor household transfers are needed even during a period of crude oil price fall.

References

1. Dartanto, T. (2013). Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis, *Energy Policy*, 58, 117–134.
2. Naranpanawa, A., Bandara, J. S. (2012). Poverty and growth impacts of high oil prices: Evidence from Sri Lanka, *Energy Policy*, 45, 102–111.
3. Gangopadhyay, S., Ramaswami, B. & Wadhwa, W. (2005). Reducing subsidies on household fuels in India: how will it affect the poor? *Energy Policy*, 33(18), 2326–2336.
4. India in Figures 2015, Government of India, Ministry of Statistics and Programme Implementation, New Delhi: Central Statistics Office, Research and Publication Unit. Retrieved from http://mospi.nic.in/Mospi_New/upload/India_in_figures-2015.pdf
5. Siddig, K., Minor, P., Grethe, H., Aguiar, A. & Walmsley, T. (2015). Impacts on Poverty of Removing Fuel Import Subsidies in Nigeria, Policy Research Working Paper 7376, World Bank Group, Development Research Group-Agriculture and Rural Development Team.
6. Beaton, C., Gerasimchuk, I., Laan, T., Lang, K., Vis-Dunbar, D. & Wooders, P. (2013). *A Guidebook to Fossil Fuel Subsidy Reform for Policy makers in South East Asia*, International Institute for Sustainable Development.
7. Anand, R., Coady, D., Mohommad, A., Thakoor, V., & Walsh J. P., (2013). The Fiscal and Welfare Impacts of Reforming Fuel Subsidies in India, WP/13/128, IMF Working Paper. Retrieved from https://www.imf.org/external/pubs/ft/wp/2013/wp13128.pdf
8. Essama-Nssah, B., Go, D. S., Kearney, M., Korman, V., Robinson, S., & Thierfelder, K. (2008). Economy wide and distributional impact of an oil price shock on the South African Economy, *The World Bank*

and Institute of Development Studies. Retrieved from http://siteresources.worldbank.org/INTPSIA/Resources/490023-1171551075650/3457768-1241469484668/AFRI_485-530_ch12.pdf
9. NSS 66th Round, Report No. 537: Employment and Unemployment Situation in India, 2009-10.
10. Census of India's 2011 Provisional Population Totals of Rural-Urban Distribution in the country, released by Union Home Secretary R. K. Singh.
11. Chen, S. & Ravallion, M. (2008). The developing world is poorer than we thought, but no less successful in the fight against poverty, Policy Research Working Paper 4703, *The World Bank*.
12. *World Economic Outlook 2007*. IMF. Retrieved from https://www.imf.org/external/pubs/ft/weo/2007/02/pdf/c4.pdf
13. Panagariya, A., More, V. (2014). Poverty by social, religious and economic groups in India and its largest states: 1993-1994 to 2011-2012. *Indian Growth and Development Review*, 7(2), 202–230.
14. Das, K., Chakraborti, P. (2013). General equilibrium analysis of trade and environment under alternative market structure: a computable general equilibrium study for India, DOI: 10.1007/s40622-013-0003-3.
15. Retrieved from http://data.worldbank.org/country/india
16. Poverty Database. (2012). The World Bank.
17. Retrieved from http://data.un.org/Data.aspx-?d=WDI&f=Indicator_ Code%3ASI.POV.NAHC
18. Retrieved from http://hdr.undp.org/en/content/income-gini-coefficient
19. Retrieved from http://data.worldbank.org/sites/default/files/section2.pdf