

**Exploring policy options to include petroleum, natural gas and electricity
under the Goods and Services Tax regime in India**

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Exploring policy options to include petroleum, natural gas and electricity under the Goods and Services Tax regime in India

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Abstract

The study analyses the impact of keeping crude petroleum, natural gas, motor spirit (gasoline/petrol), high speed diesel (diesel), aviation turbine fuel (ATF) and electricity out of the Value Added Tax (VAT) scheme. Specifically, the study finds that keeping these items out of the input tax credit mechanism (either partially or fully) would result in cascading. Through an input-output framework, this study proposes some alternatives to the proposed design of GST and assesses the implications for cascading and prices. It captures the degree of cascading across 48 sectors under different scenarios and explores alternative policy options to phase out under-recoveries of oil market companies on account of sales of diesel and petrol under the administered pricing mechanism.

Keywords: goods and services tax, value added tax, tax cascading, tax incidence analysis, ad valorem tax, input-output analysis, revenue neutral rates, taxation of petroleum products, India.

Exploring policy options to include petroleum, natural gas and electricity under the proposed Goods and Services Tax (GST) regime in India

1. Introduction

Various taxes, duties, levies and cesses on petroleum products and natural gas generate substantial revenues to the Central and State Governments.¹ The tax on petroleum products and corresponding change in prices generates both direct and indirect effects across the sectors. Petroleum products directly enter as an input into a large number of economic activities (e.g., transportation, electricity generation, fertilizer production). Apart from such direct uses, there are number of indirect uses as well; for instance, since most commodities need to be transported for use by the final consumer, petroleum products enter into the picture. Therefore, changes in prices (or taxes) of petroleum products would have significant impact on the economy both through direct as well as indirect or cascading routes.

The present regime of taxation of petroleum products and electricity results in cascading of taxes. Built in invisible taxes are expected to increase prices in the domestic economy and adversely affect competitiveness of Indian exports as well. Given that the country is working towards the introduction of a comprehensive GST regime, it is an opportune moment to ask whether the proposed GST design is appropriate or whether significant degree of cascading remains. This paper seeks to explore alternative configuration of the tax regime, with specific reference to petroleum products and evaluate the extent of cascading under each. Given that these goods provide a major share of the revenues of central and state governments in indirect taxes, the comparison is attempted assuming revenue neutrality under all scenarios.

The other significant aspect of petroleum sector is that, the present administered pricing mechanism does not allow full price pass through for some refinery products (domestic LPG, PDS kerosene, diesel and petrol). This results in under-recoveries for oil marketing companies (OMCs). However, the Government has not been providing full

¹ If not specifically mentioned, by petroleum products we mean all petroleum products (Motor Spirit, High Speed Diesel, Aviation Turbine Fuel and other petroleum products), crude oil and natural gas.

compensation to OMCs for such under-recoveries in sales of diesel and petrol. While part of the under recovery is absorbed by the upstream oil companies, the rest remains stranded costs for the OMCs. The present system of disallowing compensation not only costs Central Government exchequer (in terms of loss of dividend income), as most of the oil companies are under Central Public Sector, but also provides a perverse incentive for not saving fossil fuels thereby polluting environment. The benefits of improving energy efficiency cannot be harvested without raising the prices of energy sources.² Therefore, the present study explores the configuration of revenues and prices resultant from alternative tax/ subsidy regimes to understand whether elimination of price control in addition to streamlining the tax regime could be feasible, given the multiple objectives of reducing cascading, keeping a check on prices and protecting revenues.³

In the next section, a brief overview of the petroleum sector is presented. Section 3 provides an overview of the present structure of indirect taxes on petroleum products and electricity sector is presented. Section 4 describes the methodology and data sources for analysing the impact of the alternative tax and subsidy strategies, and section 5 summarises the results. This is followed by concluding remarks in section 6.

2. Overview of Petroleum Sector

Petroleum products play an important role in India's energy security. While coal is predominantly used as input for thermal power plants, petroleum products are major inputs for the transport sector (including railway, water and air transport), apart from being feedstock for fertilizer industries. Of the total final consumption of energy (excluding consumption of biofuels and waste), the share of oil products and natural gas together contributes 52.38 percent.⁴

² With the improvement in energy efficiency, if energy prices (or energy taxes) are not increased, the demand for energy will go up and will offset the impact of the efficiency gain in fuel use. The underlying phenomenon is known as rebound effect (Greening et al., 2000).

³ For India, price elasticity of demand for crude oil, diesel and petrol are -0.41, -0.56 and -0.85 respectively which implies that demands are not very elastic but decline to some extent with rising prices (Agrawal, 2012).

⁴ Energy Balance of India: 2011, International Energy Agency (IEA). Available online at: <http://www.iea.org/statistics/statisticssearch/report/?country=INDIA&product=balances&year=2011> (last accessed on 22 April 2014).

In India, crude petroleum is predominantly imported, where import constitutes 81.3 per cent of total availability in 2010-11. In absence of price control, it is expected that volatility in international crude oil prices would put pressure on domestic prices of refined petroleum products. This would have been further aggravated by exchange rate volatility. However, the present petroleum pricing system does not allow full price pass through for a few petroleum products (PDS kerosene, domestic LPG, diesel and petrol).⁵ Due to the price control, the demand does not adjust the changes in the prices and therefore the demand for import of crude oil remains unchanged even in the face of rising international prices.

2.1. Pricing of Petroleum Products

Prices of diesel, PDS kerosene, and domestic LPG, are administered in India.⁶ The oil companies cannot freely change the market prices of these petroleum products in response to volatility of international crude oil prices, exchange rate volatility and/or their other costs of production. Therefore, domestic market prices of these petroleum products do not necessarily reflect either the international crude oil prices or other costs of production (excluding the international crude oil prices).⁷ Whenever there is a need to adjust fuel prices (in response to international crude oil prices, exchange rate volatility or other costs of production) in the country, any government has the following options: (i) to transfer the entire burden of price hike to the consumers, (ii) to cut tax rates and share the burden in terms of tax revenue loss, or (iii) to finance the under recoveries in prices of petroleum products through budgetary provisions. In India, for a few petroleum products governments have used both the 2nd and 3rd options, so as to reduce the extent of price increase. Under-recoveries of the OMCs are partly met out of budgetary or extra-budgetary transfers in the form of bonds from government or transfers from upstream oil companies,⁸ or are partly reflected in lower profit margins of the

⁵ High prices and/ or rapid increases in the prices of these products, it is argued would result in inflation and have adverse consequences for quality of life of people in the country.

⁶ Even if petrol price is decontrolled in India since June 2010, the price is neither entirely linked to international crude oil prices nor linked to domestic costs of production (including taxes). Periodic revision of petrol price depending on the under-recoveries of the oil companies is still in practice.

⁷ Cost of production also includes refinery margin, taxes, levies, transportation costs and dealer's margin.

⁸ Any absorption of under-recoveries by upstream oil companies causes revenue erosion for the Government in the form of lower dividend receipts as most of the oil companies are Central PSUs.

OMCs (Table 1).⁹ Therefore, any attempt to decontrol the prices of petroleum products could increase the retail prices.¹⁰

Table 1: Financing Pattern of Fuel Subsidy in India

Year	Under-Recoveries (Rs. Crore)					Financing Pattern of Under-Recoveries (Rs. Crore)					
	Domestic LPG	PDS Kerosene	Diesel	Petrol	Total	Upstream Companies	Oil Bonds/Cash Subsidy	Borne by OMCs	Total		
2005-06	10,246	14,384	12,647	2,723	40,000	14,000 (35)	11,500 (29)	14,500 (36)	40,000		
2006-07	10,701	17,883	18,776	2,027	49,387	20,507 (42)	24,121 (49)	4,759 (10)	49,387		
2007-08	15,523	19,102	35,166	7,332	77,123	25,708 (33)	35,290 (46)	16,125 (21)	77,123		
2008-09	17,600	28,225	52,286	5,181	103,292	32,000 (31)	71,292 (69)	-	103,292		
2009-10	14,257	17,364	9,279	5,151	46,051	14,430 (31)	26,000 (56)	5,621 (12)	46,051		
2010-11	21,772	19,484	34,706	2,227	78,190	30,297 (39)	41,000 (52)	6,893 (9)	78,190		
2011-12	29,997	27,352	81,192		138,541	55,000 (40)	83,500 (60)	41 (0.03)	138,541		

Notes: Figures in the parenthesis show the percentage share in total under-recoveries.

Source: Compiled from PPAC online resources

2.2. Revenue Generation from Petroleum Products

The contributions of petroleum products in Central Government exchequer (indirect tax revenue) are through customs duties, cess on crude oil, excise duty and service tax charged on input of services. The contributions to the State Government exchequer (indirect tax revenue) are through sales tax/ VAT and central sales tax (see Appendix I for detailed table). In addition to Central and State taxes, Octroi and Entry tax are revenues that accrue to local bodies usually.

The estimated contribution of indirect tax revenue from petroleum sector to the Central Government exchequer has gone up from Rs. 46,533 Crore in 2002-03 to Rs. 99,928

⁹ However, private sector oil marketing companies are not entitled to claim any non-price compensation for under-recoveries which curtails their business prospects to invest in petroleum refineries unless they find international prices are remunerative to export refined petroleum products.

¹⁰ The benefit of subsidy is also reaped by all downstream companies which use subsidized products/ outputs as inputs for their production. The existing subsidy system reduces the unit price of input and therefore the final incidence of subsidy will be dispersed through several markets (Srivastava et al., 2003).

crore in 2010-11 (Table 2).¹¹ For State Government exchequer, the revenue collection from petroleum companies has gone up from Rs. 30,493 Crore in 2002-03 to Rs. 1,05,384 Crore in 2011-12. Of total indirect tax collection of centre and states put together, petroleum taxes account for 32.51 percent.¹²

Table 2: Estimated Contribution of Petroleum Companies to Central and State Government Exchequer through Indirect Taxes (in Rs. Crore)*

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Central Exchequer										
Customs Duty	7,953	9,552	11,697	9,157	10,043	12,626	6,299	4,563	24,136	10,013
Cess on Crude Oil	5,213	4,766	4,891	4,884	6,899	6,924	6,758	6,559	6,810	7,108
Excise Duty	32,964	35,364	38,150	47,180	51,922	54,761	54,117	62,480	68,040	61,954
Others (includes service tax)	403	425	439	347	666	944	870	982	942	1,033
Sub total	46,533	50,107	55,177	61,568	69,530	75,255	68,044	74,584	99,928	80,108
State Exchequer										
Sales Tax	29,166	32,080	38,935	46,667	53,949	56,445	63,349	64,999	78,689	96,945
Octroi and Others (includes Entry Tax)	1,327	1,440	2,047	2,368	2,416	2,788	2,466	3,717	5,651	8,439
Sub total	30,493	33,520	40,982	49,035	56,365	59,233	65,815	68,716	84,340	1,05,384
Total	77,026	83,627	96,159	1,10,603	1,25,895	1,34,488	1,33,859	1,43,300	1,84,268	1,85,492

Notes: *- Royalties and direct taxes (corporate tax, tax on dividend) are excluded

Data Source: PPAC (2012,¹³ 2010, 2009, 2008)

3. Structure of Taxes

The proposed regime of taxation under the Goods and Services Tax system is to be a comprehensive VAT regime on goods and services with a few caveats. Some goods and services are proposed to be kept outside the base for GST. The proposed exclusions are natural gas and crude petroleum, petrol, diesel and aviation turbine fuel, alcoholic beverages, some essential goods and services for basic consumption. While the essential items are exempted in the proposed regime,¹⁴ the other goods are subject to tax but are kept out of the

¹¹ The fall in revenue in 2011-12 on account of customs duty collection is mainly due to complete exemption from customs duty on crude oil.

¹² In 2010-11, combine revenue receipts of the centre and the states on account of customs duty, union excise duties and general sales tax is Rs. 566,769.78 crore (see Appendix I).

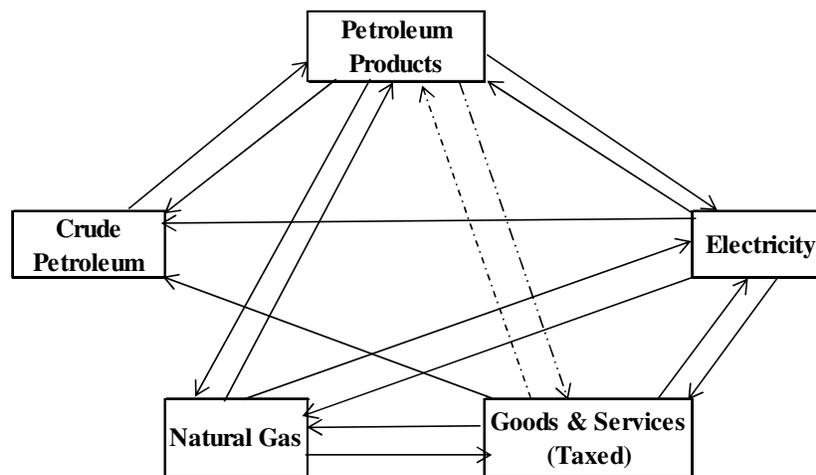
¹³ http://ppac.org.in/writereaddata/RS_5_Cont_to_Exch.xls (last accessed on 20 November 2013)

¹⁴ In the present study we have considered agriculture and allied activities (including fishing), forestry and logging, water supply, education and R&D, public administration, social security and health & social work as exempt goods and services (see Annexure I)

purview of the tax credit mechanism. This would mean that there is no mechanism for input tax credit for taxes paid on the inputs used for producing these goods. Further, there is no option of input tax credit for taxes paid on these goods for activities which use them as inputs either. In other words, inputs going into the extraction of crude petroleum would remain embedded in the costs of exploration and production of crude and passed on to refineries. Similarly, when petrol, diesel and ATF are kept out of the VAT/ GST system, the taxes associated with inputs used for production of these goods would remain embedded. This results in cascading. Since petroleum products are used as inputs in a large number of industries in the economy cascading would have wide spread impact.¹⁵ Flow of uncredited input taxes in the proposed regime of GST is demonstrated in Figure 1 below.

Like petroleum sector, subsidy-cum-tax system is also prevailing in electricity sector. State Electricity Boards (SEBs) are obliged to pay electricity duty to State Governments and the State Governments provide subsidy to electricity utilities. The tax rate on electricity varies over the years and for 2010-11, it is 9.38 percent (PFCL, 2013; Ministry of Finance, 2013). However, since electricity duty is separate levy not integrated with VAT/ GST, taxes on goods and services being used as inputs for generation and distribution of electricity would remain embedded and further, electricity duty on supplies to GST dealers too would remain embedded. Both these contribute to some more cascading in the economy.

Figure 1: Input Tax Credit Pass-through Mechanism (6 Sector Model)



¹⁵ In the present regime, there is some input tax credit available to refineries within the state regimes. These are state specific rules and vary across states.

Note: Directions of arrows show the flow of uncredited input taxes. Partial input tax credit is available for petroleum products sector for purchase of inputs from Goods & Services (Taxed) Sector and vice versa.

The above figure shows that there are quite a few sources of embedded taxes, which could dilute the potential gains from moving to a GST regime.

4. Methodology and Data Sources

To capture the economy-wide cascading impact of any change in taxes of petroleum products, we have estimated the direct and total tax incidence for each of the sectors under alternative policy scenarios. We have adopted the Input – Output (I-O) Analysis Framework to capture the impact of limited pass through under VAT system. The analysis is based on Input-Output Transaction Table (Commodity by Commodity) for 2007-08 released by CSO (2012a).¹⁶

4.1. Methodology for Estimation of Direct and Total Tax Incidences

The methodology adopted for the present exercise is presented using a six sector model. The sectors considered are natural gas, crude petroleum, petroleum products, electricity, exempted goods and services and other goods and services which are taxed, since these are distinct segments in terms of the tax treatment accorded to them. The same methodology is adopted to the 48 sector model to get the results for the study.

The chief characteristics of the proposed GST regime are incorporated as follows:

- (i) There is no tax associated with intra-sector transactions.¹⁷
- (ii) Except diesel, petrol and ATF, other petroleum products are under the present VAT system and for them full input tax credit is admissible.

¹⁶ The Central Statistical Organisation (CSO) has released the Input Output Transaction Table (Commodity x Commodity) at Factor Cost (Rs. Lakh) for 2007-08 and it covers 130 items (CSO, 2012a). For the purpose of this study, these 130 items are clubbed into 48 sectors (Annexure I). The Input-Output Coefficient Matrix (Commodity x Commodity) is derived from the Input – Output Transaction Table (see detailed methodology provided in Appendix II). Each cell in Input – Output Coefficient Matrix (Commodity x Commodity), say a_{ij} , shows the amount (in Rs.) of i th good required to produce Re. 1 value of j th good.

¹⁷ Though intra-sector inter-companies transactions are subject to Central and State taxes, for simplicity, we exempted such transactions from taxation.

(iii) The I-O table however does not differentiate between different outputs produced by refineries. Given the available disaggregation, it is not possible to separate the refinery products into two baskets (VAT and non-VAT items). In order to capture the impact of partial credit available to their users, in the present paper, it is assumed that all petroleum products are homogenous. The impact of differential treatment of the products is captured in the form of partial tax credit –

(1- μ) is the extent of partial credit available to refineries and

(1- σ) is the partial credit available to users of petroleum products

The system of price equations for the sectors can be written as:

$$\begin{aligned}
 P_g &= P_g a_{11} + P_c(1+\beta) a_{21} + P_p(1+\gamma) a_{31} + P_e(1+\delta) a_{41} + P_{oe} a_{51} + P_{ot}(1+\tau) a_{61} + V_g \\
 P_c &= P_g(1+\alpha) a_{12} + P_c a_{22} + P_p(1+\gamma) a_{32} + P_e(1+\delta) a_{42} + P_{oe} a_{52} + P_{ot}(1+\tau) a_{62} + V_c \\
 P_p &= P_g(1+\alpha) a_{13} + P_c(1+\beta) a_{23} + P_p a_{33} + P_e(1+\delta) a_{43} + P_{oe} a_{53} + P_{ot}(1+\mu\tau) a_{63} + V_p \\
 P_e &= P_g(1+\alpha) a_{14} + P_c(1+\beta) a_{24} + P_p(1+\gamma) a_{34} + P_e a_{44} + P_{oe} a_{54} + P_{ot}(1+\tau) a_{64} + V_e \\
 P_{oe} &= P_g(1+\alpha) a_{15} + P_c(1+\beta) a_{25} + P_p(1+\gamma) a_{35} + P_e(1+\delta) a_{45} + P_{oe} a_{55} + P_{ot}(1+\tau) a_{65} + V_{oe} \\
 P_{ot} &= P_g(1+\alpha) a_{16} + P_c(1+\beta) a_{26} + P_p(1+\sigma\gamma) a_{36} + P_e(1+\delta) a_{46} + P_{oe} a_{56} + P_{ot} a_{66} + V_{ot}
 \end{aligned}$$

Where
Prices

P_g : Producers' price of *natural gas*
 P_c : Producers' price of *crude petroleum*
 P_p : Producers' price of *petroleum products*
 P_e : Producers' price of *electricity*
 P_{oe} : Producers' prices of *other goods and services which are exempted from taxes*¹⁸
 P_{ot} : Producers' prices of *other goods and services which are taxed*

Input-Output Coefficient

a_{ij} : to produce Re. 1 value of output in the j th sector, input requirement from the i th sector

Taxes

α : tax on natural gas (i.e., State sales tax etc.)
 β : tax on crude petroleum (i.e., State sales tax etc.)
 γ : tax on petroleum products (e.g., Central excise duty and State sales tax etc.)
 δ : tax on electricity (e.g., State electricity duty)
 τ : tax on goods and services (other than on natural gas, crude petroleum, petroleum products and electricity) (e.g., Central excise duty and State sales tax/ VAT etc.)
 μ : the percentage of tax (τ) which is not setoff as input tax credit for petroleum sector. For example, if 60 per cent of ITC is availed, $\mu = 0.40$.

¹⁸ The exempted goods and services are - agriculture and allied activities (including fishing), forestry and logging, water supply, education and R&D, public administration, social security and health and social work

σ : is the portion of petroleum tax (γ) which is not setoff as input tax credit for using petroleum products in sectors which under the VAT system. For 2010-11, VAT sales of oil companies is Rs. 106,453.03 crore (sales of petroleum products other than petrol, diesel and ATF), whereas total sales of all petroleum products (including sales of petrol, diesel and ATF) is Rs. 478,905.00 crore (NIPFP, 2011). The ratio of VAT sales to total sales is 0.22. Therefore, the value of σ is 0.78 (i.e., 1-0.22) and shows the portion input tax which is not set off. In other words σ implies the proportion input petroleum products for which ITC is not admissible.

Value added

V_g : gross value added per unit of output of natural gas

V_c : gross value added per unit of output of crude petroleum

V_p : gross value added per unit of output of petroleum products

V_e : gross value added per unit of output of electricity

V_{oe} : gross value added per unit of output of tax exempted other goods and services

V_{ot} : gross value added per unit of output of other taxed goods and services

In matrix notation, we could write the above set of price equations as follows:

$$\begin{aligned}
 & \begin{pmatrix} P_g \\ P_c \\ P_p \\ P_e \\ P_{oe} \\ P_{ot} \end{pmatrix}^T \\
 &= \begin{pmatrix} P_g \\ P_c \\ P_p \\ P_e \\ P_{oe} \\ P_{ot} \end{pmatrix}^T \\
 & * \text{diag} \left[\begin{pmatrix} 1 & 1+\beta & 1+s\gamma & 1+\delta & 1 & 1+\tau \\ 1+\alpha & 1 & 1+s\gamma & 1+\delta & 1 & 1+\tau \\ 1+\alpha & 1+\beta & 1 & 1+\delta & 1 & 1+\mu\tau \\ 1+\alpha & 1+\beta & 1+s\gamma & 1 & 1 & 1+\tau \\ 1+\alpha & 1+\beta & 1+s\gamma & 1+\delta & 1 & 1+\tau \\ 1+\alpha & 1+\beta & 1+s\sigma\gamma & 1+\delta & 1 & 1 \end{pmatrix} \begin{pmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{62} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{pmatrix} \right] \\
 & + \begin{pmatrix} V_g \\ V_c \\ V_p \\ V_e \\ V_{oe} \\ V_{ot} \end{pmatrix}^T \\
 & \Rightarrow P^T = [I - \text{diag}[\hat{T}A]]^{-1} * V^T \quad (1)
 \end{aligned}$$

where P is the price vector, A is the input coefficient matrix, V is the value added vector and \hat{T} is tax matrix and represents the input tax pass forward mechanism of the economy. In perfect VAT or GST system (full input tax credits, without exempted goods and services), all

elements of the \hat{T} matrix will be one and the tax will be on final consumption alone. Cascading in the tax regime is therefore captured by the elements of the \hat{T} matrix which are higher than one.

To estimate the direct tax incidence of a sector, we need to multiply the tax vector with the final demand vector (FD).¹⁹

$$\text{Direct Tax Incidence (DTI)} = T * FD$$

Where T is the tax rate vector on final use and FD is the Final Demand vector
[FD=C+I+G+(X-M)]

With reference to price equation presented above,

$$T = \begin{pmatrix} \alpha \\ \beta \\ s\gamma \\ \delta \\ 0 \\ \tau \end{pmatrix}, \text{ where } s \text{ is the extent of under-recovery in petrol and diesel}^{20}$$

To take into account the extent of subsidy provided (either directly and/or indirectly) to oil companies on account of sales of diesel and petrol below the desired market price, we have estimated the value of 's' as follows:

$$s = \begin{cases} 1, & \text{if there is no under-recovery of OMCs} \\ \left(1 - \frac{UR_{2010-11}}{VOP_{2010-11}}\right), & \text{if the government provides the subsidy to compensate the} \\ & \text{under-recoveries of OMCs on account of} \\ & \text{sales of diesel and petrol below the desired market price.} \end{cases}$$

Where,

¹⁹ It is to be mentioned here that Input Flow Matrix provides information for 130 items on Private Final Consumption Expenditure (C), Government Final Consumption Expenditure (G), Gross Capital Formation [I, comprises of Gross Fixed Capital Formation (GFCF) and Change In Stock (CIS)], Export (X) and Import (M). According to national accounting framework, the output (Y, final demand) or Total Final Use is determined by Y (or FD) = C+I+G+(X-M). We adopted the same framework and found that for a few sectors either import (M) is substantially higher than C+I+G+X and/or Change In Stock is negative (implies depletion of stock) and therefore FD is negative. For those sectors, we have taken FD as zero. To get final demand for 48 sectors from 130 sectors we have followed the same methodology as discussed in Appendix II.

²⁰ The present study only explores the policy option of withdrawing petroleum subsidy on account of sales of diesel and petrol below the desired market price and assumes that petroleum subsidy on account of sales of PDS kerosene and domestic LPG will continue under the GST regime as well. Though petrol price has been decontrolled since June 2010, OMCs cannot change the price automatically. For our empirical analysis, we have considered the year 2010-11, when petrol price was not decontrolled.

$UR_{2010-11}$ is the Under Recovery on account of Sales of Diesel and Petrol in 2010-11= Rs. 36,933.16 Crore (Table 1)

$VOP_{2010-11}$ is the Value of Output of Petroleum Products (registered and unregistered) in 2010-11= Rs. 714,044.04 Crore²¹

Therefore, $\frac{UR_{2010-11}}{VOP_{2010-11}} = 0.05$ and $s = \left(1 - \frac{UR_{2010-11}}{VOP_{2010-11}}\right) = 0.95$

The provision of subsidy reduces prices of petroleum products and at lower prices a higher tax rate is required to meet a certain revenue target. Subsidy adjusted tax rate on petroleum products is expected to be lower than the nominal tax rate and the present study takes into account this divergence by suitably adjusting the tax rate. The withdrawal of subsidy is expected to increase the prices of petroleum products.

Total Tax Incidence (TTI) is estimated as follows:

Total Tax Incidence (TTI) = Direct Tax Incidence (DTI) + Tax Cascading (TC)

Tax Cascading = Tax on total (direct and indirect) input use + final tax on total input use

Tax Cascading = $(I+T)*diag[Z]*FD$

Where, Z is defined as follows:

$$Z = (\hat{T} - U)^T [(I - A)^{-1} - I]$$

In equation above, U is a matrix consisting of all 1s and having same order as \hat{T}

We can define a matrix K, where $K = (I - A)^{-1}$. The vector $K_j = \sum_{i=1}^m K_{ij}$ captures the levels of output across all the sectors that are required to sustain a unit increase in final demand in the jth sector (m is the number of sectors considered). Similarly, $K_i = \sum_{j=1}^m K_{ij}$ captures the increase in gross output levels of the ith sector required to sustain a unit increase in the final demand for each of the sectors considered (Hazari, 1970).

²¹ National Account Statistics provides value of output (at current prices) for 'rubber and petroleum products' (CSO, 2012b). To estimate the value of output for petroleum products from combined value of output of rubber and petroleum products, we have used the same percentage share petroleum products in sum total value of output of rubber and petroleum products, as separately available in Input-Output Table 2007-08 (CSO, 2012a).

For comparing the alternative scenarios, it is assumed government gets the same TTI as in the baseline scenario. The tax rate on one or more commodities is adjusted to ensure revenue neutrality. Here it should be noted that revenues under all alternative scenarios are derived under the assumptions that all economic activity in a taxed sector will be subject to tax, i.e., there are no turnover based exemptions and there is full compliance. While these are strong assumptions, the Input-Output (I-O) framework adopted for the study does not allow for further calibration to incorporate these structural features of the tax system. Further, this framework does not permit calculation of revenues for Central Government and State Governments separately.²²

For the present exercise proposed GST design is considered as the baseline. Since the revenue streams from the proposed GST regime are not yet known, in the present analysis, we work with total revenues that could be derived from the economy provided all economic activity is subject to tax. The Revenue Neutral Rates (RNRs) for the alternative scenarios therefore are the rates which yield the same computed revenues as the baseline scenario for the study, i.e., the revenue subsequent to introduction of proposed GST. It should be noted that these would correspond to the total revenues for centre and states put together, but would not incorporate the effects of specific features such as exemptions, thresholds, differential tax rates, and less than full compliance etc.

4.2. Baseline and Alternative Scenarios

Baseline Scenario: Natural Gas, Crude Petroleum, Petroleum Products and Electricity are out of GST. Goods as well as services sectors attract harmonized tax rate of 20 percent and there are some exempted goods and services. The Government compensates under-recoveries of OMCs on account of sales in diesel and petrol. Partial ITC is available for petroleum product sector and for other sectors which use petroleum products and are under GST regime.

²² The Input-Output system for the entire country would not be representative for I-O system for individual States. The structure of production, any specialization etc. could alter the I-O for individual States. Assuming these differences away would not be correct. Further, the Final Demand (FD) vector for individual States is unknown.

Following equation 1, Baseline Price (P_b) can be estimated. The taxes for this scenario can be represented by T_b and \hat{T}_b and they are as follows:

$$T_b = \begin{pmatrix} \alpha \\ \beta \\ s\gamma \\ \delta \\ 0 \\ \tau \end{pmatrix} \text{ and } \hat{T}_b = \begin{pmatrix} 1 & 1 + \beta & 1 + s\gamma & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 & 1 + s\gamma & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 & 1 + \delta & 1 & 1 + \mu\tau \\ 1 + \alpha & 1 + \beta & 1 + s\gamma & 1 & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 + s\gamma & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 + s\sigma\gamma & 1 + \delta & 1 & 1 \end{pmatrix}$$

The regime in the baseline scenario corresponds to the GST regime as proposed by The Empowered Committee of State Finance Ministers (2009). Further, it is assumed that there is no change in the price regime of petroleum products. Under-recoveries in the petroleum sector persist at the present levels.

Scenario 1: Proposed Design of GST with no under-recoveries in petroleum sector

The tax structure remains same as baseline. However, it is assumed that OMCs charge the desired market price and there are no under-recoveries on account of sales in diesel and petrol.

Following equation 1, price in scenario 1 (P_1) can be estimated, and T_1 and \hat{T}_1 can be presented as follows:

$$T_1 = \begin{pmatrix} \alpha \\ \beta \\ \gamma_1 \\ \delta \\ 0 \\ \tau \end{pmatrix}, \text{ and } \hat{T}_1 = \begin{pmatrix} 1 & 1 + \beta & 1 + \gamma_1 & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 & 1 + \gamma_1 & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 & 1 + \delta & 1 & 1 + \mu\tau \\ 1 + \alpha & 1 + \beta & 1 + \gamma_1 & 1 & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 + \gamma_1 & 1 + \delta & 1 & 1 + \tau \\ 1 + \alpha & 1 + \beta & 1 + \sigma\gamma_1 & 1 + \delta & 1 & 1 \end{pmatrix}$$

In order to ensure that the revenue needs of governments are not compromised, the tax rate for petroleum products in this scenario is calibrated to yield the same amount of net revenue as in the baseline scenario, i.e., γ_1 is altered both in the T_1 vector and \hat{T}_1 matrix. Since the under-recoveries are borne by public sector enterprises alone, it is assumed that increase in prices (due to withdrawal of subsidy) would result in higher revenues for these companies which in turn would translate into higher revenue for the government as dividends. The revenue that is sought from the tax regime in this scenario would therefore be lower to this extent. We estimate the γ_1 such that total tax incidence for scenario 1 (TTI_1) exactly matches

the total tax incidence for baseline scenario net of under-recoveries of OMCs (i.e., $TTI_b - TTI_1 - UR = 0$, where UR is the under-recovery on account of sales in diesel and petrol).

Scenario 2: GST covering petroleum refineries with subsidy in place

In this scenario, natural gas, crude petroleum, petroleum products and electricity are brought under the GST system. This would mean that both for natural gas and crude petroleum, the taxes on inputs would be set off and similarly other sectors will get full ITC for purchase of natural gas and crude petroleum as inputs. Further, for refineries, there will be full ITC available. For electricity sector, while it gets partial ITC for refined petroleum products used as inputs, for all sectors using electricity as an input, full ITC would be available. Full ITC for purchase of petroleum products as inputs by other activities however is not allowed. Goods as well as services sectors attract harmonized standard GST rate of 20 percent (including natural gas and crude petroleum) and there are some exempted goods and services. The tax on electricity is increased to 10 percent and petroleum products sector attracts a differential tax (higher than the standard GST rate). Compensation on account of under-recoveries of OMCs is provided by the Government.

Following equation 1, price in scenario 2 (P_2) can be estimated, and T_2 and \hat{T}_2 can be presented as follows:

$$T_2 = \begin{pmatrix} \tau \\ \tau \\ s\gamma_2 \\ \bar{\delta} \\ 0 \\ \tau \end{pmatrix} \text{ and } \hat{T}_2 = \begin{pmatrix} 1 & 1 & 1+s\sigma\gamma_2 & 1 & 1 & 1 \\ 1 & 1 & 1+s\sigma\gamma_2 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1+s\sigma\gamma_2 & 1 & 1 & 1 \\ 1+\tau & 1+\tau & 1+s\gamma_2 & 1+\bar{\delta} & 1 & 1+\tau \\ 1 & 1 & 1+s\sigma\gamma_2 & 1 & 1 & 1 \end{pmatrix}$$

To estimate the revenue neutral condition for a shift from baseline to Scenario 2, we estimate the γ_2 such that total tax incidence of Scenario 2 becomes equal to that of the Baseline Scenario (i.e., $TTI_b - TTI_2 = 0$). Tax rate on petroleum products is likely to be higher than the baseline scenario and it would be cascading type tax.

Scenario 3: GST for Petroleum Refineries without petroleum subsidy²³

The conditions of this scenario remain same as Scenario 2, except that there is no under-recovery of OMCs on account of sales in diesel and petrol (i.e., $s = 1$).

Following equation 1, price in Scenario 3 (P_3) can be estimated, and T_3 and \hat{T}_3 can be presented as follows:

$$T_3 = \begin{pmatrix} \tau \\ \tau \\ \gamma_3 \\ \bar{\delta} \\ 0 \\ \tau \end{pmatrix} \text{ and } \hat{T}_3 = \begin{pmatrix} 1 & 1 & 1+\sigma\gamma_3 & 1 & 1 & 1 \\ 1 & 1 & 1+\sigma\gamma_3 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1+\sigma\gamma_3 & 1 & 1 & 1 \\ 1+\tau & 1+\tau & 1+\gamma_3 & 1+\bar{\delta} & 1 & 1+\tau \\ 1 & 1 & 1+\sigma\gamma_3 & 1 & 1 & 1 \end{pmatrix}$$

To estimate the revenue neutral condition for a shift from baseline to Scenario 3, we estimate the γ_3 such that total tax incidence under Scenario 3 becomes equal to total tax incidence of Scenario 1, which is baseline scenario net of under-recovery of OMCs (i.e., $TTI_b - TTI_3 - UR = 0$).

Scenario 4: GST for Petroleum Refineries with Additional Regulatory Levy on Petroleum Products without Petroleum Subsidy

This is an extension of Scenario 3, except that full ITC is allowed up to standard GST rate for purchase of petroleum products as inputs. In other words, the tax on petroleum products is assumed to have two components, a GST and a non-rebatable levy. In this scenario, the non-rebatable levy is calibrated to satisfy revenue neutrality.

Following equation 1, price in Scenario 4 (P_4) can be estimated, and T_4 and \hat{T}_4 can be presented as follows:

²³ Subsidy (or compensation) on account of under-recovery of OMCs for sales of petrol and diesel are not allowed in this scenario.

$$T_4 = \begin{pmatrix} \tau \\ \tau \\ \gamma_3 \\ \bar{\delta} \\ 0 \\ \tau \end{pmatrix} \text{ and } \hat{T}_4 = \begin{pmatrix} 1 & 1 & 1+\sigma(\gamma_4-\tau) & 1 & 1 & 1 \\ 1 & 1 & 1+\sigma(\gamma_4-\tau) & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1+\sigma(\gamma_4-\tau) & 1 & 1 & 1 \\ 1+\tau & 1+\tau & 1+\sigma(\gamma_4-\tau) & 1+\bar{\delta} & 1 & 1+\tau \\ 1 & 1 & 1+\sigma(\gamma_4-\tau) & 1 & 1 & 1 \end{pmatrix}$$

To estimate the revenue neutral condition for a shift from baseline to Scenario 4, we estimate the γ_4 such that total tax incidence under Scenario 4 becomes equal to total tax incidence of baseline scenario net of under-recovery of OMCs (i.e., $TTI_b - TTI_4 - UR = 0$).

Scenario 5: Comprehensive GST with uniform rates of tax and with no petroleum subsidy

The conditions of this scenario are similar to Scenario 3, except that full ITC is allowed for purchase of petroleum products as inputs for sectors subject to GST. In this scenario, instead of a special tax on petroleum products we estimate a standard GST rate that will maintain revenue neutrality of the governments.

Following equation 1, price in Scenario 5 (P_5) can be estimated, and T_5 and \hat{T}_5 can be presented as follows:

$$T_5 = \begin{pmatrix} \bar{\tau} \\ \bar{\tau} \\ \bar{\tau} \\ \bar{\delta} \\ 0 \\ \bar{\tau} \end{pmatrix} \text{ and } \hat{T}_5 = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1+\bar{\tau} & 1+\bar{\tau} & 1+\bar{\tau} & 1+\bar{\delta} & 1 & 1+\bar{\tau} \\ 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

To estimate the revenue neutrality condition for a shift from baseline to Scenario 5, we estimate the $\bar{\tau}$ such that total tax incidence for Scenario 5 becomes equal to total tax incidence of baseline net of under-recovery of OMCs (i.e., $TTI_b - TTI_5 - UR$). It should be mentioned here that even in this scenario, the tax on electricity is held fixed at 10 percent, since it is expected that such a reform would face lot of resistance, because of increase in prices for electricity.

4.3. Assumptions on Tax Rates

To derive the tax rates on petroleum products for the baseline scenario, we used the effective tax rates for these products in the present regime, for taxes that are expected to be subsumed into GST – Central excise, sales tax and entry tax. The tax rates (ETRs) for six policy sectors are presented in Table 3.

Table 3: Effective Tax Rates as on 2010-11 and Assumptions*

Sl. No.	Description	Central Excise Duty (%) ^(a)	State Sales Tax (%) ^(b)	Central Sales Tax (%)	Entry Tax (%) ^(c)	Total ETR (%)
1	Natural Gas	Nil	12.15	1.75	2.78	16.68 Approximately 17.00
2	Crude Petroleum	Nil	0.94	0.05	0.17	1.17 Approximately 2.00
3	Petroleum Products	17.72	16.71	1.78	3.29	39.5 Approximately 40.00
4	Electricity ^(d)	Nil	9.38	--	--	9.38 Approximately 10.00
5	Goods and Services	10.00	10.00	--	--	20.00 ^(e)

Notes:

* - The taxes are on output. However, when output of a sector is going as inputs for other sectors the same tax rate will apply.

(a) - includes basic excise duty, additional excise duty and special additional excise duty

(b) - includes State sales tax and State cesses on all petroleum products

(c) - in estimation of ETR we did not take into consideration the Entry Tax paid to Bombay Municipal Corporation and Government of Maharashtra, as it will continue under GST regime.

(d) - Statutory tax rate on electricity (as electricity duty) across the States is 5.00%. Effective tax rate on electricity is estimated for 2010-11 as 9.38% or approximately 10.00%.

(e) - The effective tax rate on goods and services is taken as 20.00% with equal share of Central Excise Duty and State Sales Tax.

Source: NIPFP (2011)

4.4.1. Estimation of Input Tax Credit Claimed by Petroleum Refineries against Central Taxes and State Sales Tax/ VAT

Petroleum companies (refineries) are allowed to avail Input Tax Credit (ITC) against Central Taxes (Central excise duty and Service tax). Table 4a shows the percentage of ITC claimed against Central Taxes during 2010-11. Since crude oil and natural gas are exempted from Central excise duty, there are no provision for Exploration and Production companies to avail ITC against Central Taxes paid on input goods and services. Table 4a shows that, 61.4 per cent of the ITC is claimed against Central Taxes.

Andhra Pradesh, Bihar, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Delhi, Uttar Pradesh and West Bengal allow petroleum companies to avail the ITC against their State purchases of inputs (goods). The details of value of purchase and VAT and CST paid to State Governments are presented in Table 4a. The percentage of setoff availed by the companies vary depending on the States where the companies are operating and their input and output baskets. In aggregate, available data suggests that 47.6 per cent of the State taxes that the companies paid are availed off as ITC.

From Table 4b, we could conclude that petroleum companies on an average claim 59.48 or approximately 60 percent of the taxes paid to Central and State Governments as ITC, the rest is their stranded costs. This ratio is assumed to remain constant in the baseline as well as in any other scenarios and is captured in the parameter μ (1-0.60).

Table 4a: Input Tax Credit Claimed against Central & State Taxes (Rs. Crore): 2010-11[#]

Central Taxes		States Taxes	
Value of Purchase of Goods and Services	61,719	Value of Purchase	10,004
Excise Duty (ED)/ Service Tax (ST) Charged	5,769	VAT & CST Paid	565.1
CENVAT setoff of Excise Duty/ Service Tax	3,342	Input Tax Credit (ITC) Claimed	285.2
Weighted ED/ ST Set off (%) [*]	61.4	Weighted VAT Setoff (%) [*]	47.6

Notes:

- this is based on company-wise information provided in NIPFP (2011)

*-Weights are based on company-wise share in Total Value of Purchase

Source: NIPFP (2011)

Table 4b: Weighted average of combined Central and State Taxes set off for 2010-11

Description (1)	Central Taxes (2)	State Taxes (3)	Total (4)=(2)+(3)
Value of Purchase of Goods and Services (Rs. Crore) (A)	61,719	10,004	71,723
Percentage Share in Total Value of Purchase (%) (B)	86.05	13.95	
Weighted Setoff of Taxes (C) (from Table 4a)	61.4	47.6	
Final Weighted Effective Tax Rate (%) ^{**} (D) [(B)*(C)/100]	52.84	6.64	59.48

Note: ^{*}- Weights are based on share in Total Value of Purchase (Column 4)

Source: NIPFP (2011)

5. Results and Analysis

5.1. Revenue Neutral Rates Corresponding to Alternative Scenarios

In the baseline scenario, government provides compensation to OMCs on account of under-recoveries due to sales of diesel and petrol below the desired market price.

In Scenario 1, as an alternative to baseline, there is no under-recovery of OMCs. In this case, there will be upward pressure on prices of petroleum products but at the same time the revenue required to meet the revenue neutrality condition will be lower by the amount of under-recovery of OMCs as prevailing in baseline. These joint effects put a downward pressure on tax rate of petroleum products. The estimated tax rate on petroleum products in Scenario 1 is 29 percent which is considerably lower than 40 percent of baseline (Table 5).

To move from baseline to Scenario 2, tax rate on petroleum products would be 48 percent (Table 5). In Scenario 2, petroleum products sector will get full ITC against purchase of goods and services (including crude oil, natural gas and electricity) as inputs whereas partial ITC against purchase of petroleum products is allowed for sectors which are under the VAT or GST system. To move from baseline to Scenario 3, tax rate on petroleum products would be 36 percent to protect the revenues of the government.

Scenario 4 is an improvement over Scenario 3. To move from baseline to Scenario 4, tax rate on petroleum products would be 47 percent (Table 5). In this scenario, full ITC for purchase of input petroleum products is allowed up to standard GST rate of 20 percent. However to meet revenue neutrality condition, there will be an additional 27 percent regulatory levy (cascading type) on petroleum products. This scenario is in line with international experience of taxation of petroleum products where additional regulatory levy on petroleum products is proposed (Daniel et al., 2010). This scenario also has significant implications for operationalization of environmental fiscal reforms (UNEP, 2010).

In Scenario 5, we explore the possibilities for introduction of full-fledged GST including petroleum products. To move from Baseline Scenario to full-fledged GST,

Government has option either to put special cascading tax on petroleum products or to revise the standard GST rate and apply the same across all sectors (including petroleum products).²⁴ If the Government choose the first option, the tax rate on petroleum products will be 78 percent (not shown in Table 5). Alternatively, the standard GST rate needs to be revised to 23 percent (Table 5). Increasing the standard GST by 3 percent is adequate to compensate the revenue loss in terms of full ITC payment for all goods and services (including petroleum products).

Table 5: Alternative Scenarios and Revenue Neutral Rates

Subsidy	Scenario	Natural Gas (%)	Crude Petroleum (%)	Petroleum Products* (%)	Electricity (%)	Tax exempted Goods & Services (%)	Other Goods & Services (%)
With Subsidy	Baseline Scenario	17.00	2.00	40.00	5.00	0.00	20.00
	Scenario 2	20.00	20.00	48.00 (RNR)	10.00	0.00	20.00
Without Subsidy	Scenario 1	17.00	2.00	29.00 (RNR)	5.00	0.00	20.00
	Scenario 3	20.00	20.00	36.00 (RNR)	10.00	0.00	20.00
	Scenario 4	20.00	20.00	47.00 (RNR)	10.00	0.00	20.00
	Scenario 5	23.00 (RNR)	23.00 (RNR)	23.00 (RNR)	10.00	0.00	23.00 (RNR)

Notes: *-Petroleum Products includes Motor Spirit (also known as Gasoline/ Petrol), High Speed Diesel and Aviation Turbine Fuel and all other Petroleum Products. Separate Revenue Neutral Tax Rates are not calculated for the following two baskets – a) MS, HSD & ATF and b) other petroleum products. Input tax credit availed by refineries are taken into consideration in this analysis.

Source: Computed

Phasing out of petroleum subsidy will initially result in rise in prices of petroleum products. However, the higher prices mean that the same desired revenue can be raised with lower tax rates. Further, since higher prices provide a pay back to the government in terms of dividends, the revenue needs of the government would be lower, further decreasing the RNR. This is reflected in the results in Table 5. A shift from baseline to Scenario 2 would require a

²⁴ Standard GST rate is the rate at which most of the goods and services are taxed.

7 percent increase in tax rate on petroleum products whereas a shift from baseline to Scenario 3 could be achieved by reducing tax rate on petroleum products by 4 percentage points.

5.2. Cascading of Taxes

One of the reasons for seeking reform of trade taxes is to reduce the extent of cascading in the system. It is therefore important to check what the impact on cascading is in the alternative scenarios considered. Cascading of taxes varies across the scenarios and it can be captured by the difference between total and direct tax incidence. Extent of cascading for a sector depends not only on tax treatment of the sector but also on overall indirect tax structure of the economy. We have adopted the following ratio as a measure of extent of cascading of taxes:

$$\text{Degree of Cascading of Taxes under the } i\text{th Scenario} = (TTI_i - DTI_i) / FD_i * 100$$

Where, TTI_i and DTI_i are Total and Direct Tax Incidences for the i th sector respectively and FD_i is the final demand for the i th sector.

The ratio shows the cascading of taxes as percentage of final demand, higher the ratio the higher the extent of cascading of taxes. Table 6 shows that level of cascading of taxes goes down as we move away from the baseline scenario. The direct incidence of taxes goes up which shows that the tax system becomes cleaner.

Table 6: Tax Incidences across Scenarios (Rs. Crore)

Subsidy	Alternative Scenarios	Direct Tax Incidence (DTI) (A)	Cascading of Taxes (B)	Total Tax Incidence (C)	Additional Dividends (after removing under recovery) (D)	Total Revenue (E)=(A+B+D)
With Subsidy	Baseline Scenario	751,818.67	199,527.34	951,346.01		951,346.01
	Scenario 2	764,928.61	186,417.40	951,346.01		951,346.01
Without Subsidy	Scenario 1	737,304.48	177,108.37	914,412.85	36,933.16	951,346.01
	Scenario 3	750,082.93	164,329.92	914,412.85	36,933.16	951,346.01
	Scenario 4	767,567.01	146,845.84	914,412.85	36,933.16	951,346.01
	Scenario 5	821,229.89	93,182.96	914,412.85	36,933.16	951,346.01

Source: Computed by authors

Degree of cascading of taxes can be measured for individual sectors as well (for a detailed table of cascading across different scenarios, see Appendix III). For some of the sectors, like textiles (including apparels), petroleum products, chemicals, ferrous and non-ferrous basic metals, metal products (excluding machinery), machinery and machine tools (including tractors and agricultural implements), electronic and communication equipments and all transport equipments (excluding motor vehicles other than two-wheelers) cascading as a percentage of final demand (FD) is more than 2 percent (Baseline Scenario). These are sectors which have substantial share in India's total export (Table 7). Therefore, any change in prices (through elimination of cascading of taxes) of these products could increase their competitiveness in the international market.

Substantial reduction in cascading of taxes is observed for a shift from baseline to alternative scenarios.

Table 7: Share of Selected Sectors in India's Export of Principal Commodities and Degree of Cascading of Taxes

Industry Code	Commodity Description	Export as % of GVA:2007-08 ^(a)	% Share in Export of Principal Commodities: 2010-11 ^(b)	Cascading - Baseline ^(c)	Cascading - Scenario 3 ^(c)	Cascading - Scenario 4 ^(c)
6	Metallic minerals	59.6	1.9	1.4	1.1	0.8
10	Textiles (including apparels)	80.9	9.7	2.9	2.2	1.6
16	Rubber and plastic products	36.4	3.3	3.2	2.3	1.7
17	Petroleum products	118.1	16.5	8.7	0.0	0.0
18	Chemicals	73.7	8.2	4.9	3.5	2.6
20	Ferrous and non-ferrous basic metals	57.9	2.0	3.6	2.4	1.8
21	Metal products (excluding machinery)	24.8	3.4	3.0	2.1	1.5
22	Machinery and machine tools (including tractors & agri. implements)	45.8	8.1	2.6	1.8	1.3
24	Electronic and communication equipments	53.3	6.4	2.4	1.7	1.2

25	All transport equipments (excluding motor vehicles other than 2 wheelers)	85.0	3.3	2.7	1.9	1.4
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Sources:

- Estimated from Input-Output Table 2007-08 (CSO, 2012a)
- Estimated from Reserve Bank of India (RBI)'s *Handbook of Statistics of Indian Economy* (Table 130: Exports of Principal Commodities – Rupees, available at <http://www.rbi.org.in/scripts/PublicationsView.aspx?id=15251> (last accessed on 3 March 2014)
- See Appendix III for detailed Table.

5.3. Impacts on Prices of Policy Sectors

One of the primary reasons for sector specific policies for petroleum sector is an apprehension that reforms would raise prices, the latter being politically unacceptable. In proposing alternatives, therefore it is important to assess the likely impact on prices as well. Table 8 shows that prices across all scenarios fall for natural gas, crude petroleum, petroleum products and electricity (as compared to baseline scenario). For petroleum products, as compared to baseline scenario, price remains unchanged in Scenario 1 (due to withdrawal of petroleum subsidy), but starts falling from Scenario 2 onwards (due to combine effects of withdrawal of subsidy and introduction of GST). Table 8 shows that dismantling the administered pricing mechanism for petrol and diesel along with introduction of comprehensive GST for petroleum products benefits both upstream (crude oil and natural gas) and downstream (electricity) sectors. The prices in Scenario 4 lie in between Scenario 3 and 5 and it shows that the government could introduce an additional regulatory levy on petroleum products and allow full ITC for petroleum products up to standard GST rate.

Table 8: Percentage Change in Prices across Scenarios as compared to Baseline Scenario*

Sector Description	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Natural gas	-0.11	-3.62	-3.69	-3.77	-4.00
Crude petroleum	-0.30	-7.02	-7.23	-7.44	-8.05
Petroleum products	0.00	-12.96	-12.96	-12.96	-12.96
Electricity	-2.08	-16.77	-18.64	-20.97	-23.96

Note: * - Estimated by [(Price in Alternative Scenario – Price in Baseline Scenario)/Price in Baseline Scenario *100]

Source: Computed

6. Conclusions

This study shows that keeping crude petroleum, natural gas, petroleum products and electricity out of GST system will result in cascading across the sectors. The degree of cascading will vary across the sectors depending on their direct as well as indirect (inputs embedded in outputs of other sectors) input use. The present study documents that the extent of cascading is non-negligible and identifies alternative design for tax without compromising revenue considerations of government. Non availability or partial availability of input tax credit will result in stranded costs for some sectors (where direct use of out of GST items are high) but the costs will be spread across all sectors of the economy, through sectoral inter-linkages. Moreover, some sectors with considerable export presence are shown to be facing significant incidence of tax cascading, which could be detrimental for competitiveness in international market. The study explores various policy options and suggests alternative designs for GST. In none of the policy options the estimated revenue neutral rate (RNR) is beyond the level that could make the design of GST unacceptable. The results also show that in all improved designs of GST (as compared to proposed design of GST), the prices across the sectors either remain unchanged or decline (except for tax exempted sectors). These results suggest that there is little ground for separating out petroleum products for special treatment by keeping them out of the base for GST. GST reforms implemented alongside price correction could provide an interesting opportunity to reform without worries about price rise.

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Appendix I: Revenue Collection from Petroleum Products & Natural Gas (Rs. Crore)

Revenue from Petroleum Sector	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Average 2002-12
Central Excise Duty Collection from Petroleum Products (Rs. Crore)	32,964	35,364	38,150	47,180	51,922	54,761	54,117	62,480	68,040	61,954	50,693
Customs Duty Collection from Petroleum Products (Rs. Crore)	7,953	9,552	11,697	9,157	10,043	12,626	6,299	4,563	24,136	10,013	10,604
Sales Tax Collection from Petroleum Products (Rs. Crore)	29,166	32,080	38,935	46,667	53,949	56,445	63,349	64,999	78,689	96,945	56,122
Cess on Crude Oil and Others (including Service Tax, Octroi, Entry Tax and others) (Rs. Crore)	6,943	6,631	7,377	7,599	9,981	10,656	10,094	11,258	13,403	16,580	10,052
General Revenue Collection (Rs. '000 Crore)	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 (RE)	Average 2002-12
Total Union Excise Duty Collection	82.3	90.8	99.1	111.2	117.6	123.6	108.6	102.9	137.7	150.1	112.4
Total Customs Duty Collection	44.9	48.6	57.6	65.1	86.3	104.1	99.9	83.3	135.8	153.0	87.9
Total General Sales Tax Collection	83.8	98	116.2	136.5	162.3	167.7	190.8	231.5	293.3	358.6	183.9
Gross Domestic Product(GDP) at Factor Cost (at Current Prices) (2004-05 Series)	2,338.20	2,622.20	2,971.50	3,390.50	3,953.30	4,582.10	5,303.60	6,091.50	7157.4	8279.9	4,669.0
Percentage Shares	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11 (RE)	2011-12 (BE)	Average 2002-12
Collection of Central Excise Duty from Petroleum Products as % of Total Collection of Central Excise Duty	40.1	38.9	38.5	42.4	44.2	44.3	49.8	60.7	49.4	41.3	45.0
Collection of Sales Tax from Petroleum Companies as % of Total Sales Tax Collection	34.8	32.7	33.5	34.2	33.2	33.7	33.2	28.1	26.8	27.0	31.7

Collection of Customs Duties from Import of Petroleum Products as % of Total Customs Duty Collection	17.7	19.7	20.3	14.1	11.6	12.1	6.3	5.5	17.8	6.5	13.2
Collection of All Taxes & Duties from Petroleum Products as % of GDP	3.3	3.2	5.1	5.1	4.9	4.6	3.8	3.6	4.0	3.2	4.1
Collection of Taxes & duty on electricity as % of GDP	0.22	0.21	0.24	0.23	0.21	0.16	0.14	0.20	0.24	0.21	0.22

Data Source: Ministry of Finance (2013, 2012, 2011), PPAC (2010, 2009, 2008), CSO (Gross State Domestic Product)

Appendix II: Methodology for Construction of Input-Output Coefficient Matrix (Commodity x Commodity) for 48 sectors from 130 items

The methodology used to construct the I-O Coefficient Matrix from I-O Transaction Table (Commodity x Commodity) is as follows:

$$\sum_{i=1}^{130} X_{ij} + NIT_j + GVA_j = TO_j \forall j$$

Where, X_{ij} is the input flow from i th commodity to j th commodity in Rs. Lakh

$\sum_{i=1}^{130} X_{ij}$ is the total input/ commodity used by the j th commodity (in Rs. Lakh)

NIT_j is the Net Indirect Taxes of the j th commodity (in Rs. Lakh)

GVA_j is the Gross Value Added by the j th commodity (in Rs. Lakh)

TO_j is the Total Output of the j th commodity (in Rs. Lakh)

V_j is the value added vector for the j th commodity, where $V_j = GVA_j/TO_j$

First, we sum up X_{ij} across j at given i to combine 130 items under 48 sector and get X_{i*} . Then, we sum up X_{i*} across i at given j^* to get the input flow matrix for 48 sectors, i.e., X_{i*j^*} . Similarly, we also get the GVA_{j^*} and TO_{j^*} for 48 sectors. We estimate the I-O Coefficient Matrix for the 48 sector by dividing X_{i*j^*} for given j^* by TO_{j^*} and get a_{i*j^*} .

Therefore, $a_{i*j^*} = X_{i*j^*} / TO_{j^*}$

Annexure I: Reclassification of 130 Sectors (As per IO Table: 2007-08) into 48 Sectors

Original Sector Code	Commodity	Modified Sector Code	Remarks	Original Sector Code	Commodity	Modified Sector Code	Original Sector Code	Commodity	Modified Industry Code	Remarks
1	Paddy	1	Exempted	45	Tobacco products	9	89	Electrical wires & cables	23	
2	Wheat	1	Exempted	46	Khadi, cotton textiles(handlooms)	10	90	Batteries	23	
3	Jowar	1	Exempted	47	Cotton textiles	10	91	Electrical appliances	23	
4	Bajra	1	Exempted	48	Woollen textiles	10	92	Communication equipments	24	
5	Maize	1	Exempted	49	Silk textiles	10	93	Other electrical Machinery	23	
6	Gram	1	Exempted	50	Art silk, synthetic fibre textiles	10	94	Electronic equipments (incl.TV)	24	
7	Pulses	1	Exempted	51	Jute, hemp, mesta textiles	10	95	Ships and boats	25	
8	Sugarcane	1	Exempted	52	Carpet weaving	10	96	Rail equipments	25	
9	Groundnut	1	Exempted	53	Readymade garments	10	97	Motor vehicles	26	
10	Coconut	1	Exempted	54	Miscellaneous textile products	10	98	Motor cycles and scooters	25	
11	Other oilseeds	1	Exempted	55	Furniture and fixtures-wooden	11	99	Bicycles, cycle-rickshaw	25	
12	Jute	1	Exempted	56	Wood and wood products	12	100	Other transport equipments	25	
13	Cotton	1	Exempted	57	Paper, paper prods. & newsprint	13	101	Watches and clocks	27	
14	Tea	1	Exempted	58	Printing and publishing	14	102	Medical, precision & optical instru.s	27	
15	Coffee	1	Exempted	59	Leather footwear	15	103	Jems & jewellery	28	
16	Rubber	1	Exempted	60	Leather and leather products	15	104	Aircraft & spacecraft	25	
17	Tobacco	1	Exempted	61	Rubber products	16	105	Miscellaneous manufacturing	28	
18	Fruits	1	Exempted	62	Plastic products	16	106	Construction	29	
19	Vegetables	1	Exempted	63	Petroleum products	17	107	Electricity	30	
20	Other crops	1	Exempted	64	Coal tar products	3	108	Water supply	31	Exempted
21	Milk and milk products	1	Exempted	65	Inorganic heavy chemicals	18	109	Railway transport services	32	
22	Animal services(agricultural)	1	Exempted	66	Organic heavy chemicals	18	110	Land tpt including via pipeline	33	
23	Poultry & Eggs	1	Exempted	67	Fertilizers	18	111	Water transport	34	
24	Other liv.st. produ.	1	Exempted	68	Pesticides	18	112	Air transport	35	
25	Forestry and logging	2	Exempted	69	Paints, varnishes and lacquers	18	113	Supporting and aux. tpt activities	36	
26	Fishing	1	Exempted	70	Drugs and medicines	18	114	Storage and warehousing	36	
27	Coal and lignite	3		71	Soaps, cosmetics & glycerine	18	115	Communication	37	
28	Natural gas	4		72	Synthetic fibres, resin	18	116	Trade	38	
29	Crude petroleum	5		73	Other chemicals	18	117	Hotels and restaurants	39	
30	Iron ore	6		74	Structural clay products	19	118	Banking	40	
31	Manganese ore	6		75	Cement	19	119	Insurance	40	

Original Sector Code	Commodity	Modified Sector Code	Remarks	Original Sector Code	Commodity	Modified Sector Code	Original Sector Code	Commodity	Modified Industry Code	Remarks
32	Bauxite	6		76	Other non-metallic mineral prods.	19	120	Ownership of dwellings	41	Exempted
33	Copper ore	6		77	Iron, steel and ferro alloys	20	121	Education and research	42	Exempted
34	Other metallic minerals	6		78	Iron and steel casting & forging	20	122	Medical and health	42	Exempted
35	Lime stone	7		79	Iron and steel foundries	20	123	Business services	43	
36	Mica	7		80	Non-ferrous basic metals	20	124	Computer & related activities	44	
37	Other non-metallic minerals	7		81	Hand tools, hardware	21	125	Legal services	45	
38	Sugar	8		82	Miscellaneous metal products	21	126	Real estate activities	46	
39	Khandsari, boora	8		83	Tractors and agri. implements	22	127	Renting of machinery & equipment	47	
40	Hydrogenated oil(vanaspati)	8		84	Industrial machinery(F & T)	22	128	O.com, social & personal services	48	
41	Edible oils other than vanaspati	8		85	Industrial machinery(others)	22	129	Other services	48	
42	Tea and coffee processing	8		86	Machine tools	22	130	Public administration	42	Exempted
43	Miscellaneous food products	8		87	Other non-electrical machinery	22				
44	Beverages	8		88	Electrical industrial Machinery	22				

Appendix III: Cascading of Taxes under Different Scenarios

Industry Code	Commodity Description	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
1	Crops and livestock products (including fishing)	7.7	7.5	8.4	8.1	8.4	8.7
2	Forestry and logging	6.0	5.8	6.6	6.4	6.7	6.7
6	Metallic minerals	1.4	1.1	1.4	1.1	0.8	0.0
8	Food products & beverages (including Edible vegetable oils)	2.1	1.7	2.0	1.6	1.2	0.0
9	Tobacco products	1.1	0.9	1.1	0.9	0.7	0.0
10	Textiles (including apparels)	2.9	2.4	2.7	2.2	1.6	0.0
11	Furniture and fixtures-wooden	1.7	1.4	1.7	1.3	1.0	0.0
12	Wood and wood products (excluding Furniture)	1.6	1.3	1.6	1.3	1.0	0.0
13	Paper, paper prods. & newsprint	3.4	2.7	3.2	2.6	1.9	0.0
14	Printing and publishing	2.9	2.4	2.8	2.3	1.7	0.0
15	Leather products (including Footwear)	1.9	1.5	1.8	1.5	1.1	0.0
16	Rubber and plastic products	3.2	2.7	2.9	2.3	1.7	0.0
17	Petroleum products	8.7	8.1	0.0	0.0	0.0	0.0
18	Chemicals	4.9	4.1	4.3	3.5	2.6	0.0
19	Non-metallic mineral products (including cement)	5.8	4.7	5.5	4.4	3.3	0.0

20	Ferrous and non-ferrous basic metals	3.6	3.1	3.0	2.4	1.8	0.0
21	Metal products (excluding machinery)	3.0	2.5	2.6	2.1	1.5	0.0
22	Machinery and machine tools (including tractors & agri. Implements)	2.6	2.1	2.2	1.8	1.3	0.0
23	Electrical machinery & appliances	3.0	2.5	2.7	2.1	1.6	0.0
24	Electronic and communication equipments	2.4	2.0	2.1	1.7	1.2	0.0
25	All transport equipments (excluding motor vehicles other than 2 wheelers)	2.7	2.2	2.4	1.9	1.4	0.0
26	Motor vehicles	2.7	2.2	2.3	1.8	1.4	0.0
27	Medical, precision & optical instruments (including watches & clocks)	2.8	2.3	2.6	2.0	1.5	0.0
28	Jems & Jewelry, misc. manufacturing	2.5	2.0	2.4	1.9	1.4	0.0
29	Construction	2.6	2.1	2.4	1.9	1.4	0.0
30	Electricity	21.2	20.1	6.2	4.7	2.7	0.0
31	Water supply	15.6	15.1	16.8	16.3	16.9	17.6
32	Railway transport services	2.4	2.0	1.8	1.5	1.1	0.0
33	Land transport (including via pipeline)	9.6	7.5	10.5	8.4	6.3	0.0
34	Water transport	2.2	1.8	2.2	1.8	1.3	0.0
35	Air transport	4.9	3.9	5.2	4.1	3.1	0.0
36	Supporting and aux. transport activities (including storage & warehousing)	2.5	2.0	2.3	1.9	1.4	0.0
37	Communication	1.2	1.0	1.1	0.9	0.7	0.0

38	Trade	1.2	1.0	1.2	1.0	0.7	0.0
39	Hotels and restaurants	1.7	1.3	1.6	1.3	0.9	0.0
40	Banking and insurance	0.7	0.6	0.6	0.5	0.4	0.0
41	Ownership of dwellings	1.9	1.9	2.0	2.0	2.0	2.2
42	Education & research, medical & health, public administration	4.9	4.8	5.1	5.0	5.2	5.5
43	Business services	0.9	0.8	0.7	0.6	0.4	0.0
44	Computer & related activities	0.6	0.5	0.4	0.3	0.2	0.0
45	Legal services	0.8	0.7	0.5	0.4	0.3	0.0
46	Real estate activities	0.2	0.2	0.2	0.1	0.1	0.0
47	Renting of machinery & equipment	0.9	0.8	0.6	0.5	0.4	0.0
48	Other commercial, social and personal services, other services	0.5	0.4	0.5	0.4	0.3	0.0

Note: Sectors shaded are exempted sectors.

Source: Computed by Authors