Final Report

Subsidies Discipline on Natural Resource Pricing

Report Submitted to

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Preface

This is the final version of the Report of the research study on 'Subsidies Discipline on Natural Resource Pricing' commissioned by the United Nations Conference on Trade and Development (UNCTAD-India Programme). It provides an assessment of the likely increase in demand for natural resources and natural resource based products in India in the next ten years, the natural resource subsidies currently being given by the government in India and how India is impacted by the natural resource subsidies being given by other countries. We are thankful to the UNCTAD for asking the Institute of Economic Growth to do this study and providing financial support.

In the initial stages of this research project, Mr. Santosh Debta worked with us. In the later stages, Mr. Manoj Pandey and Mr. Nongthombam Nando Singh have worked with us. They have made significant contributions to data collection, estimation and analysis. We thank them for their unstinted support for the research project.

We have received from Dr. N.R. Bhanumurty valuable advice on econometric methods of forecasting. For the project, we had also consulted other colleagues at the Institute, particularly Dr. Pravakar Sahoo and Dr Vikram Dayal. We sincerely thank them for the advice and help we have received from them.

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Executive Summary

Submissions relating to pricing of natural resources that the US and the EC have made to the Negotiating Group on Rules (in the context of negotiations aimed at clarifying and improving disciplines under the Agreements on Anti Dumping and Subsidies and Countervailing Measures) can have far reaching implications on flexibility of countries for pricing their natural resources and energy for domestic use and exports. The different submissions that have been made target broadly two practices: dual pricing of natural resources prevalent in certain countries which favors the resource intensive down-stream industry in those countries and the practice of maintaining a system of controlled price for refined/ processed products based on natural resources. In view of the concerns about trade distorting effects of subsidies in natural resource pricing, an important question from India's perspective is whether the practices of dual pricing of natural resources and price control of natural resource based products are prevalent in the country, particularly in the power, mines and minerals sector. Another important, related question is whether such practices by other countries are adversely affecting India's export interest or leading to increased domestic cost of refined products, so that India could benefit from the imposition of subsidies discipline on natural resource pricing in those countries. These issues are addressed in this study.

One part of the analysis presented in the Report is focused on India's requirements of natural resources and natural resource based products in the coming years and the extent of India's import dependence. For this purpose, econometric models have been developed based on the standard product demand theory, and estimated from time series data for the period, 1980-81 to 2004-05. The estimated models have been used to forecast demand for the next ten years. What portion of the demand will be met by imports has also been estimated. This is done on the basis of observed trends in the proportion of domestic requirement met by imports in the period 1980-81 to 2004-05. In all, 18 resources/products have been covered in this component of the study: Iron Ore and Finished Steel; Bauxite and Aluminum; Copper Ore/Concentrate and Copper; Chemicals (Acetic Acid, Ethylene Glycol and Methanol); Coal; Crude Oil, Kerosene, High Speed Diesel, Fuel Oil and Naphtha; Electricity; and Fertilizers (Di-ammonium Phosphate [DAP] and Urea). The estimates indicate that the demand for natural resources and resource-based products would grow rapidly in India during the next ten years, and for some of the products substantial increases in imports may take place.

Another component of the analysis looks at the prices of natural resources and natural resource-based products in India and how do these prices compare with the international prices of those resources and products. The purpose is to identify the natural resources and products in which the domestic prices in India are relatively low and consider whether this may be treated as a subsidy to the users of the resources/products arising from policies of and market regulations by the government. Another purpose of the analysis is to find out if the domestic prices of some of the natural resource based products are high in relation to international prices of those products and thus identify the

natural resource based industries that are enjoying significant protection from import competition. The analysis is confined to eleven resources/products: Steel, Iron Ore, Aluminium, Bauxite, DAP (Di-ammonium Phosphate), Rock Phosphate, Copper, Coal, Crude Oil, Gasoline (Petrol), and Natural Gas. In most cases, the domestic prices are found to be similar to the international prices, at least there are no marked differences. However, in two cases, there are indications of a subsidy being given. The analysis indicates that a system of dual pricing for natural gas is prevailing in India and that an implicit subsidy is being given to the domestic users of coal. The domestic prices of copper are found to be significantly higher than the international prices, though the source of protection is unclear since there are no licensing requirements on imports of copper and the tariff rate on imported copper is very low. As regards the question whether domestic production of natural resource based products is protected through a system of price control, this does not seem to apply to any of the resource based products included in the study of price differences. DAP is perhaps an exception. Although the present system of pricing of DAP provides for some degree of competition, the government can ensure some protection to domestic DAP manufacture by giving a higher rate of concession to domestic DAP compared to imported DAP (as was done during April 2000 to June 2004, and more recently in January-June 2006). One clear case of price control (along with other controls) protecting domestic industry in India against import competition is that of urea, especially the units using naphtha and FO/LSHS as feedstock.

To assess how India is impacted by dual pricing of natural resources in other countries, two case studies relating to natural gas has been done. One case study, dealing with petrochemicals, comes to the conclusion that the elimination of natural gas subsidy in Oman, Qatar, Russia, Saudi Arabia and UAE (United Arab Emirates) and a 50% fall in exports of petrochemicals of these countries due to enhanced cost of petrochemicals production will lead to an increase in the domestic production of petrochemicals in India by about 2.2% which is obviously not a large favorable impact. The second case study dealing with urea finds that if natural gas subsidy in Oman is eliminated, then subsidy outgo on urea of the Indian government will go up by about 2.2 per cent and there will be little effect on domestic production or imports of urea. In case, natural gas subsidy gets eliminated in Russia, Saudi Arabia, Oman, Qatar and other such countries, and this happens also in India, then the overall increase in urea subsidy will be about Rs 30 billion (due to increased cost of imported urea and increased cost of gas based production of domestic urea), which implies approximately a 20% increase in urea subsidy.

In overall assessment, it seems from the analysis that the benefits to India from the elimination of natural resource subsidies in other countries will not be as large as the costs that India may have to bear if she has to eliminate the subsidies on natural resources, particularly the subsidies on natural gas and coal in India. The present natural resource subsidies in India are contributing significantly in keeping the power rates for industries low (and containing fertilizer subsidy). There is a view that the competitiveness of Indian industry is circumscribed by the relatively high cost of power in India. The elimination of gas and coal subsidies will make the power rate for industries go up significantly and would thus adversely affect the competitiveness of Indian industries.

While elimination of gas and coal subsidies do not seem to be in India's interest, elimination of crude oil subsidies in other countries seems to be in India's interest, since India is poised to become a major center of crude oil refining in the coming years.

1. Introduction

1.1 The Context

The Doha Ministerial Conference of the WTO, in 2001, provided for negotiations aimed at clarifying and improving disciplines under the Agreements on Anti Dumping and Subsidies and Countervailing Measures, while preserving the basic concepts, principles and effectiveness of these Agreements. Various countries have subsequently made submissions to the Negotiating Group on Rules identifying provisions for negotiations. Among these, the submissions made by the United States and the European Communities assume a great deal of significance since these could have far reaching implications on flexibility of countries for pricing their natural resources and energy for domestic use and exports.

In the submission made by the US,[1] concerns have been expressed that preferential natural resource pricing has been and, if not addressed, will continue to be a source of considerable trade distortion and friction. It has been pointed out that there is no difference between the government provision of a natural resource at less than fair market value and the government provision of a cash grant allowing the purchase of a natural resource at less than fair market value. Attention has been drawn particularly to the practice of dual pricing which is one of the various forms government interventions in the natural resource and energy sectors can take. Under dual pricing, there is one price of the natural resource for exports, and another (relatively lower) controlled price for domestic consumption, benefiting thereby domestic producers and exporters, especially those who use the resource intensively in their own manufacturing processes. According to the US, the advantage provided to domestic producers in this situation unfairly magnifies the comparative advantage that would otherwise be determined by market forces and production efficiencies. While Members made progress in addressing these

[1] WTO document TN/RL/W/78 dated 19 March 2003.

issues during the Uruguay Round, the US has suggested that further clarification and improvement of the rules and remedies in this area are warranted.

Similar concerns find expression in the submission made by the European Communities (EC).[2] It has been noted that certain government practices in some countries favour their domestic industries and make available to domestic users some important inputs at a price substantially lower than the international market price. In EC's view such practice confers an evident benefit to the domestic users as compared to their foreign competitors who have to purchase their supplies at the (higher) international price. The EC has also observed that other practices can also unfairly favour domestic operators as compared to their international counterparts. These actions impact on the availability of raw materials to the disadvantage of operators outside the country taking such actions. Accordingly, it has been argued that specific remedies should be envisaged to deal with this type of situation.

Different submissions on natural resources that have been made seek to target broadly two types of practices relating to natural resources and energy pricing. The first one relates to dual pricing of natural resources prevalent in certain countries, which as explained above favors the resource intensive down-stream industry in those countries. Such a practice is normally accompanied by some form of restraint on the export of the natural resource inputs. The second practice relates to a system of controlled price for refined/ processed products based on natural resources. This practice is accompanied by some form of restraint on imports of the refined/ processed final product.

The Chair of the WTO Negotiating Group on Rules has recently released draft consolidated texts of the Anti-dumping (AD) and Subsidy and Countervailing Measures (SCM) Agreements (on November 30, 2007),[3] in the context of the Doha Round of trade negotiations. An important proposed revision to the SCM Agreement concerns dual pricing arrangements. The revised text recognizes that there may be a subsidy to input

[2] WTO document TN/RL/GEN/135 dated 24 April 2006.
[3] http://www.wto.org/english/news_e/news07_e/rules_draft_text_nov07_e.htm (accessed March 1, 2008)

users if domestic regulated input prices are lower than the inputs' market value. Thus, the existence of subsidy may be ascertained by comparing the regulated input price with the unregulated price. However, if there is no unregulated price, or if the unregulated price is distorted because of the predominant role of the government in the market as a provider of the same or similar goods or services, comparison of the regulated price could be made with the export prices or market determined prices in other countries.

1.2 Objectives of the study

In view of the concerns about trade distorting effects of subsidies in natural resource pricing raised in the submissions made by the US, the EC and other countries to the Negotiating Group on Rules and the possibilities of the rules being changed to address these concerns, an important question from India's perspective is whether the practices of dual pricing of natural resources and price control of natural resource based products are prevalent in the country, particularly in the power, mines and minerals sector. Another important, related question is whether such practices by other countries are adversely affecting India's export interest or leading to increased domestic cost of refined products, so that India could benefit from the imposition of subsidies discipline on natural resource pricing in those countries. It is these questions and some other related questions that the present study addresses itself to. Specifically, the objectives of the study are:

1. To assess whether measures and practices by countries other than India identified as creating a dual pricing system are adversely affecting India's export interest or leading to increased domestic cost of natural resource-based refined products, particularly of fertilizers.
2. In respect of measures and practices prevalent in India identified as those that enable domestic manufacturers of natural resource-based refined products maintain higher domestic prices compared to world prices, assess whether these were initially implemented for according protection to 'infant industry' and whether such protection continues to be warranted in current economic scenario.
3. To make a quantitative assessment of India's requirement of natural resources and related products such as steel, coal, copper, aluminum, chemicals, petroleum, energy and fertilizers etc. over the next ten years; and to estimate the extent to which India would be dependent on imports of these products to meet its requirement.

4. To make an overall assessment of India's interest in negotiations on issues related to strengthened disciplines on natural resources, as proposed by the EC and the US.

1.3 Methodology

The empirical analysis presented in the Report has three components: (1) estimation of requirements of natural resources and natural resource based products in India over the next ten years; (2) examining the existence of dual pricing of natural resources and price control on natural resource based products in India; and (3) assessing how India is affected by the adoption of dual pricing practice for natural resources by some of the other countries. Different methodologies have been adopted for each of these components of the analysis.

To make a quantitative assessment of India's requirement of natural resources and natural resource based products such as steel, coal, copper, aluminum, chemicals, petroleum, energy and fertilizer, econometric models have been developed based on the standard product demand theory, estimated from time series data for the period, 1980-81 to 2004-05. The details of the econometric methodology are provided later in the Report. Suffice it to note here that for each natural resource or natural resource based product selected for the study, demand has been taken a function of an economic activity variable and the relative price of the commodity. In some cases, the relative price variable had to be dropped and some other explanatory variable was included in the estimated model. To predict the import requirement, trend equations have been fitted to the data on the proportion of domestic requirement met by imports in the period 1980-81 to 2004-05, and then on the basis of the trend equations, the prediction of import requirement has been made for the next ten years.

The other two aspects have been studied for a small set of selected products. The issue of the existence of dual pricing and price control in India has been examined for 11 selected products. The analysis is primarily based on comparisons of domestic prices of these products with international prices and with India's export and imports prices (unit values). The general information available about the trade restrictions, functioning of the domestic markets and the prevailing system of price determination of the selected products is also utilized for ascertaining whether there is dual pricing, subsidy in some other form, and price control.

To assess how India is impacted by the practice of dual pricing of natural resources in other countries, data are needed on the prices of the selected resources in the domestic markets of other countries. Since very little data on domestic prices of natural resources could be obtained except for natural gas, two illustrative case studies relating to natural gas pricing have been undertaken and some estimate of the expected increase in production and exports of two Indian industries has been made.

1.4 Organization of the Report

The next section presents the estimates of demand function for natural resources and natural resource based products in India and forecast of India's requirements in future years. Section 3 presents a comparison of domestic prices of 11 selected natural resources and natural resources based products in India with international prices aimed at ascertaining if there are practices of dual pricing of natural resources and price control of natural resource based products. Section 4 takes up the issue of how India is impacted by the practice of dual pricing in other countries. Finally, in Section 5, an overall assessment of India's interest in the current negotiations on subsidies discipline on natural resources pricing is given.

2. Forecast of India's Requirements of Natural Resources and Natural Resource Based Products

2.1 Method and Model Specification

To make a quantitative assessment of India's requirement of natural resources and resource based products such as steel, coal, copper, aluminum, chemicals, petroleum, energy and fertilizer etc, econometric models have been estimated based on the standard product demand theory. The theory postulates that product demand is a function of an economic activity variable and prices of commodities. In a majority of cases, the real GDP (Gross Domestic Product) has been taken as the activity variable. In other cases, a different economic activity variable has been used such as the GDP in agriculture or the production level in the user industry. Price of the commodity has been incorporated in the model as the relative price of the commodity to price of substitute product if relevant, or the price of the commodity relative to the general price level. It is hypothesized that demand for a commodity will be positively associated with the growth in economic activity i.e., the Gross domestic product or the production level of sector where that commodity is used (for example, agricultural production in the case of fertilizers). On the other hand, demand will be negatively associated with the increase in relative price of the commodity to a substitute commodity.

Thus, the demand model for natural resource based products, in general, may be specified as:

$$\ln(D)=f(\ln Y, \ln P) \qquad \ldots(1)$$

where, D is the commodity demanded in physical units, Y is a measure of economic activity, P is the price of the commodity (relative to price of a substitute or relative to the general price level).

Demand (D) has been measured as:

$$D = P - (E - M) \qquad \ldots (2)$$

Where,

D= Domestic demand for the commodity,
P= Domestic production of the commodity,
E=Exports of the commodity,
M=Imports of the commodity.

The models have been estimated from time series data for the period 1980-81 to 2004-05. The following products have been covered:

- Iron Ore and Finished Steel
- Bauxite and Aluminum
- Copper Ore/Concentrate and Copper
- Chemicals (Acetic Acid, Ethylene Glycol and Methanol)
- Coal
- Crude Oil, Kerosene, High Speed Diesel, Fuel Oil and Naphtha
- Electricity
- Fertilizers (Di-ammonium phosphate [DAP] and Urea)

As mentioned above, in most cases, real GDP is taken as the activity variable. In the case of fertilizers, the agricultural GDP is taken as the activity variables. In the cases of iron ore and copper ore, production of finished steel and copper respectively is taken as the activity variable.[4]

The specified models have been estimated using cointegration analysis as cointegration regressions show the long run or equilibrium relationship between economic variables. The existence of a stable long run relationship helps to make the quantitative assessment about the anticipation of future demand from the observation of changes in economic variables.

The basic steps in the estimation method are as follows. First, Augmented Dickey-Fuller (ADF) tests are carried out to check the order of integration of the variables, ln D, ln P and ln Y. If all of them are found to be integrated of order one, then

[4] Aluminium production could have been taken as the activity variable in the model for Bauxite. It was felt, however, that bauxite is used also by other industries, and therefore taking GDP as the activity variable is more appropriate.

Johansen's cointegration test is applied. If the variables are found to be cointegrated, then the normalized cointegrating coefficients are obtained and the vector autoregression model is estimated to study the relationship among variables.

The forecasts of demand presented in the study are based on the ARDL (Autoregressive Distributed Lag) approach to cointegration.[5] This approach has some distinct advantages over the conventional approach (based on Johansen's cointegration test). The first advantage is that this is a bound test procedure and simple to follow. The test can be applied irrespective of whether the variables are all integrated of order zero or all integrated of order one. It has been shown that ARDL based estimators are 'super-consistent' and valid inferences on the long-term parameters can be drawn using the standard normal asymptotic theory.[6] Also, appropriate modification of the orders of the ARDL model is sufficient to correct simultaneously the residual serial correlation and the problem of endogenous regressors.

The ARDL model has been estimated using time series data on ln D (demand), lnY (activity, commonly GDP) and ln P (relative price) for the period 1980-81 to 2004-05,[7] which has subsequently been used for forecasting the dependent variable (i.e. demand for natural resources or refined products) for the ten-year period beyond 2004-05.

To forecast demand for years 2005-06 to 2014-15, the activity variable and the price variable need to be forecast for years beyond 2004-05. The activity variable has been forecast on the basis of projections/targets for the 11th Five Year Plan. The growth rate of aggregate GDP has been taken as 9 per cent per annum while that for agriculture

[5] This approach is developed by M.H. Pesaran, Y. Shin and R.J. Smith (Testing for the Existence of a Long-Run Relationship, *DAE Working Paper* no. 9622, Department of Applied Economics, University of Cambridge, 1996; Bounds Testing Approach to the Analysis of Level Relationships, *Journal of Applied Econometrics*, 16(3), pp. 289-326).
[6] M.H. Pesaran and Y. Shin, An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, in S. Strom (ed.), *Econometrics and Economic Theory in the 20th Century*, The Ragner Frisch Centennial Symposium, 1998, Chapter 11, Cambridge University Press, Cambridge, 1999.
[7] In the case of Coal, results improved considerably when the model was estimated with data for the period 1988-89 to 2004-05. Therefore, for this product, a shorter period has been used for model estimation.

has been taken as 3 per cent per annum. Although the 11th Plan aims at a growth rate of agriculture of 4 per cent per annum, the proposed growth rate for the crops sub-sector (which is more relevant in the context of the present study with its focus on fertilizers) is 2.7 per cent per annum.[8] In the cases of iron ore and copper ore, the forecast for the activity variable is generated from the models estimated for steel and copper respectively and the forecast of demand for steel and copper generated therefrom.[9]

In most cases, the relative price variable has been generated by taking the ratio of the wholesale price index for the commodity to that of all commodities. For aluminium, the ratio of wholesale price indices for aluminium to copper has been taken, and for coal, the ratio of prices of coal to fuel oil has been taken. For projecting real prices/ relative prices for future years, a trend equation has been fitted to the data for the period 1980-01 to 2004-05, and on that basis the price variable has been forecast for subsequent years.

Having estimated the future demand for the products listed above, the imports have been estimated on the basis of projected ratio of imports to demand. The projection of import to demand ratio for years beyond 2004-05 has been done with the help of observed trends in this ratio in the period 1980-81 to 2004-05.[10]

2.2 Data Sources

For estimating the abovementioned model, data are needed on production, imports and exports of natural resource and natural resource based products in India. Also, data are needed on the activity variables such as gross domestic product and prices of natural resources/ products. For iron ore, bauxite, aluminium, copper ore (including copper concentrate) and copper, data on production, import and export have mainly been taken from *Indian Mineral Yearbook*. In the case of finished steel, *Statistics for Iron and Steel*

[8] Report of the Steering Committee on Agriculture and Allied Sectors for Formulation of the Eleventh Five Year Plan (2007-2012), Planning Commission, Government of India, April 2007, Table 11, p. 34.
[9] The model provides the forecast of demand. The ratio of production to demand observed in the period 1980 to 2004 is extended to the period beyond 2004 based on past trend and this is multiplied with the demand forecast to generate forecast of production.
[10] In the cases of urea and DAP, trends in the period 1980-81 to 2006-07 are considered since there were marked increases in imports of urea and DAP in 2005-06 and 2006-07.

Industry in India has been used. For crude oil, kerosene, high speed diesel, fuel oil and naphtha, data have been taken from *Indian Petroleum and Natural Gas Statistics*. In the case of chemicals (acetic acid, ethylene glycol and methanol which have been selected for the study), *Industrial Market size and Shares* (published by the Centre for Monitoring Indian Economy, CMIE) and *Monthly Abstract of Statistics* (Central Statistical Organisation, Government of India) have been used. For fertilizers, DAP and urea, *Fertiliser Statistics* has been utilized. For coal and electricity, CMIE's publication *Energy* and CSO's publication *Energy Statistics* have been used. Data on real GDP have been taken from *Handbook of Indian Economy*, Reserve Bank of India. For prices, the official price series, *Index Number of Wholesale Prices in India* has been considered. Further gaps in the data have been filled from *Industrial Data book* of CIER, *Monthly Statistics of Foreign Trade of India*, *Monthly Abstract of Statistics*, Annual Reports of various Ministries, Indiastat.com and CMIE's Beacon software. The remaining gaps, very few, have been filled by interpolation or extrapolation to generate the complete time series.

The complete list of Data sources is as mentioned below:

1. Indian Minerals Yearbook, Indian Bureau of Mines, Government of India, Ministry of Mines.
2. Statistics for Iron and Steel Industry in India, Steel Authority of India Limited, New Delhi.
3. Indian Petroleum and Natural Gas Statistics, Ministry of Petroleum & Natural Gas, Government of India, New Delhi.
4. Energy, Centre for Monitoring Indian Economy.
5. Energy Statistics, Central Statistical Organisation, New Delhi.
6. Industrial Market Size and Shares, Centre for Monitoring Indian Economy.
7. Fertiliser Statistics, The Fertiliser Association of India, New Delhi.
8. Handbook of Statistics on Indian Economy, Reserve Bank of India, New Delhi
9. Industrial Databook, Centre of Industrial and Economic Research, New Delhi.
10. Monthly Statistics of Foreign Trade of India, DGCIS, Kolkata.
11. Monthly Abstract of Statistics, Central Statistical Organisation, Government of India, New Delhi.
12. Index Number of Wholesale Prices in India, Office of the Economic Advisor, Ministry of Industry.
13. Web sources, indiastat.com.
14. CMIE's Beacon Software.
15. Annual Reports, various ministries.

2.3 Estimates of Models

The results of ADF test are presented in Annex 2.1 and that of Johansen's cointegration test in Annex 2.2. The parameter estimates of the ARDL model are presented in Table 2.1 below.

Table 2.1: Estimated ARDL Model, Demand for Natural Resource and Natural Resource Based Products in India

Product	Long-run coefficient of ln Y (activity)	Long run coefficient of ln P (relative price)	Coefficient of the error correction term	F	R^2 (error correction model)
Iron ore	0.82*** (10.9)	-0.34** (-2.3)	-1.0	5.3***	0.46
Finished steel	1.23*** (18.5)	-0.80** (-2.4)	-1.0	4.74***	0.51
Bauxite	1.03 (1.7)	-0.11 (-0.2)	-0.19 (-1.4)	5.9***	0.50
Aluminum	1.22*** (5.6)	-0.89 (-1.4)	-0.52** (-2.6)	2.4*	0.27
Copper ore	-0.14 (-1.3)	-0.03 (-0.04)	-0.36** (-2.60)	7.4***	0.55
Copper	1.01***(14.1)	-2.59 (-0.2)	-0.07 (-0.2)	3.6**	0.62
Acetic Acid	2.01*** (15.5)	-0.26 (-1.1)	-0.79*** (-3.3)	2.9*	0.39
Ethylene glycol	2.21*** (6.9)	-0.64*** (-3.3)	-1.0	7.8***	0.54
Methanol	2.02*** (10.8)	-0.24 (-0.9)	-1.0	5.9***	0.47
Coal@	0.59*** (4.6)	-0.48 (-1.3)	-0.21 (-1.6)	5.0**	0.53
Crude oil	1.31*** (3.4)	0.75* (2.0)	-0.34* (-1.8)	2.6*	0.29
Kerosene	0.30 (1.4)	-0.37** (-2.6)	-0.29* (-1.8)	5.8***	0.48
HSD	1.18*** (17.1)	-0.71*** (-5.8)	-0.47*** (-3.2)	8.1***	0.57
Fuel Oil	0.76*** (9.5)	-0.25 (-1.0)	-0.52*** (-3.4)	6.4***	0.68
Naphtha	1.31*** (3.4)	0.75* (2.0)	-0.34* (-1.8)	2.6*	0.29
Electricity	1.18 (1.6)	-1.65 (-1.1)	-0.06 (-0.9)	4.6**	0.42
DAP	2.05*** (4.5)	-0.94* (-2.0)	-0.63*** (-3.7)	3.7**	0.45
Urea	0.89*** (4.0)	-0.68*** (-3.4)	-1.00	4.5**	0.42

Note: t-values given in parentheses.
Significance: ***at 1% level of significance, **at 5% level of significance, *at 10% level of significance.
@ Estimated from data for the period 1988-89 to 2004-05.

The results of the ADF tests (presented in Annex 2.1) indicate that most variables are integrated of order one, i.e. the variable are I(1). The Johansen's cointegration test has been carried out for 14 products out of the 18 selected for the study (in the remaining four cases, aluminium, electricity, kerosene and naphtha, one of the variables considered is not I(1) and therefore Johansen's cointegration test cannot be applied). In all 14 cases, the results of Johansen's cointegration test (given in Annex 2.2) indicate that the three variables considered, demand, activity and relative price, are cointegrated.

Turning to the results of the ARDL model, these indicate that the three variables considered for each product, demand, activity and relative price, are cointegrated in all the 18 cases. This may be seen from Table 2.1; the F statistics shown in the table provides a test of cointegration. One estimation problem encountered in applying the ARDL model is that in five cases the estimated coefficient of the error correction term turns out to be –1. These products are ethylene glycol, finished steel, iron ore, methanol, and urea.

The estimated long run coefficient of the activity variable (ln Y) in the ARDL mode is positive in 16 cases (out of 18) and statistically significant in most of them. It is about one in numerical value in a majority of cases. The estimated coefficient is well above one for acetic acid, ethylene glycol and methanol. In all these cases, real GDP is taken as the activity variable. Thus, the demand for these products is expected to grow faster than GDP. The coefficient for DAP is also well above one. In this case, agricultural GDP is the activity variable. Thus, the demand for DAP is expected to grow faster than the growth rate in agriculture.

The coefficient of the price variable is found to be negative in 16 out of 18 products. For two products, the estimated coefficient of the price variable is found to be positive. It would be noticed that in many cases, the coefficient of the price variable is low in numerical value and statistically insignificant. It may be inferred accordingly that the demand for a majority of products considered for the demand forecasting study, the price elasticity is low.

In the estimated ARDL model, the coefficient of the activity variable or the coefficient of the price variable is found to be incorrectly signed in three cases out of 18. These are copper ore, crude oil and naphtha. The demand function for these products has therefore been re-estimated by the OLS (Ordinary Least Squares) method. However, the price coefficient remained positive (incorrectly signed) even after changing the method of estimation. The price variable was therefore dropped, and a simple regression of the demand for the product on the activity variable and some other variables was done and the estimated equation so obtained has been used to predict demand. These estimated equations are presented in Annex 2.3. For ethylene glycol, iron ore, methanol, steel and urea, the coefficient of the error correction term is –1, signaling presence of some econometric estimation problem. For copper, the coefficient of the error correction term has low t-value. Thus, for these six products, the demand function has been re-estimated by the OLS method, which has been used for forecasting demand. The estimates of demand function obtained by the OLS method are presented in Annex 2.3.

2.4 Forecast of India's requirement for the next ten years

Based on the estimated models for the period 1980 to 2004, presented in Table 2.1 and Annex 2.3, India's requirements have been forecast for the period 2005 to 2014. This is shown in Table 2.2. A graphic presentation is made in Figure 2.1.

Table 2.2: Domestic Demand for Natural Resources and Resource Based Products, 1980-2014

Year/period	Iron ore	Finished steel	Bauxite	Aluminium	Copper Ore/ concentrate	Copper
	Million Tonne	Million Tonne	Million Tonne	Million Tonne	Million Tonne	Million Tonne
Average 1980-1990	18.98	11.39	2.74	0.24	3.93	0.13
Average 1991-2000	43.55	22.65	5.73	0.53	4.54	0.23
Average 2001-2004	58.72	39.15	9.16	0.72	3.74	0.33
Average 2005-2014	95.43	78.61	24.66	1.54	4.76	0.57
2005	70.65	46.84	12.80	0.93	3.83	0.38
2006	75.25	52.03	15.00	1.03	4.04	0.42
2007	80.16	57.79	17.30	1.14	4.21	0.45
2008	85.39	64.19	19.80	1.27	4.42	0.49
2009	90.96	71.30	22.40	1.40	4.62	0.53
2010	96.89	79.19	25.30	1.55	4.85	0.58
2011	103.21	87.97	28.30	1.72	5.07	0.63
2012	109.94	97.71	31.60	1.91	5.29	0.68
2013	117.11	108.53	35.10	2.11	5.53	0.74
2014	124.74	120.55	39.00	2.34	5.77	0.80

Note: The figures for the periods 1980-1990, 1991-2000 and 2001-2004 are actual and those for 2005 to 2014 are forecast based on estimated models.

(Table 2.2 continued)

Year/period	Acetic Acid	Ethylene Glycol	Methanol	Coal	Crude Oil	Kerosene
	Million Tonne	Million Tonne	Million Tonne	Million Tonne	Million Tonne	Million Tonne
Average 1980-1990	0.05	0.04	0.10	163.10	41.33	6.56
Average 1991-2000	0.18	0.32	0.40	286.24	67.56	10.30
Average 2001-2004	0.33	0.64	0.75	374.53	106.56	10.32
Average 2005-2014	1.44	6.20	3.05	490.26	181.92	12.46
2005	0.50	1.52	1.20	417.27	122.25	10.19
2006	0.73	1.96	1.43	429.21	132.72	10.79
2007	0.90	2.53	1.71	442.96	144.09	11.33
2008	1.00	3.27	2.05	458.37	156.43	11.83
2009	1.11	4.22	2.45	475.31	169.83	12.30
2010	1.31	5.45	2.94	493.69	184.37	12.75
2011	1.62	7.04	3.51	513.45	200.17	13.19
2012	1.99	9.09	4.20	534.56	217.31	13.62
2013	2.39	11.70	5.02	557.00	235.92	14.05
2014	2.83	15.20	6.01	580.76	256.13	14.49

(Table 2.2 continued)

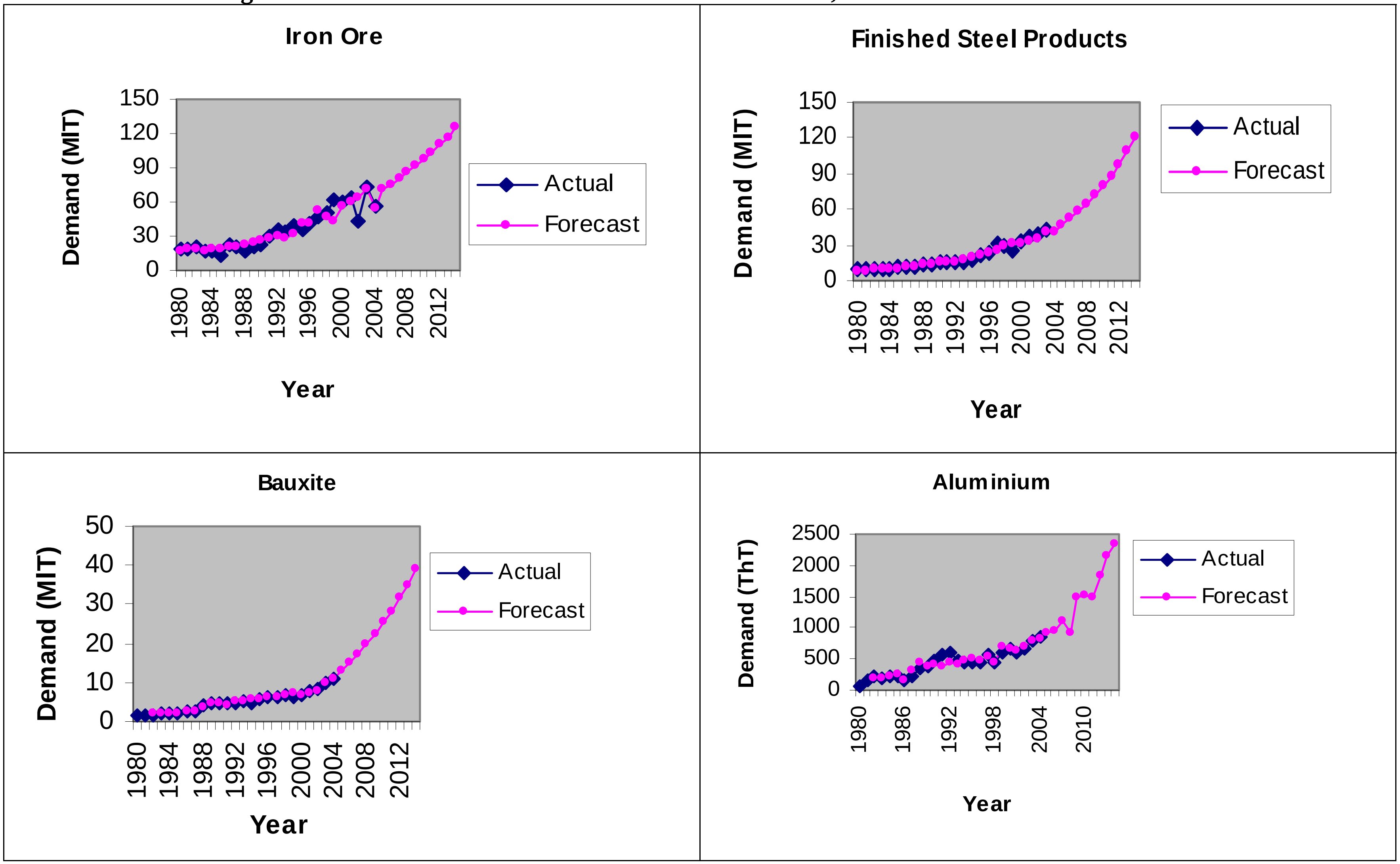
Year/period	HSD	Fuel Oil	Naphtha	Electricity	DAP	Urea
	Million Tonne	Million Tonne	Million Tonne	Billion KWH	Million Tonne	Million Tonne
Average 1980-1990	15.52	4.31	2.99	129.05	2.31	9.82
Average 1991-2000	32.55	6.46	5.11	273.30	4.73	17.80
Average 2001-2004	37.71	8.50	12.00	356.29	5.72	19.48
Average 2005-2014	72.31	12.35	32.45	506.28	11.32	31.02
2005	42.09	9.66	13.84	405.45	7.24	24.69
2006	48.93	9.20	16.32	424.24	8.66	25.92
2007	55.24	10.10	19.25	444.26	9.55	27.21
2008	61.40	10.93	22.70	465.57	10.12	28.56
2009	67.67	11.74	26.77	488.25	10.71	29.98
2010	74.26	12.56	31.57	512.37	11.44	31.48
2011	81.30	13.42	37.24	538.02	12.33	33.04
2012	88.90	14.32	43.91	565.30	13.32	34.69
2013	97.14	15.28	51.78	594.28	14.37	36.41
2014	106.11	16.31	61.07	625.07	15.48	38.23

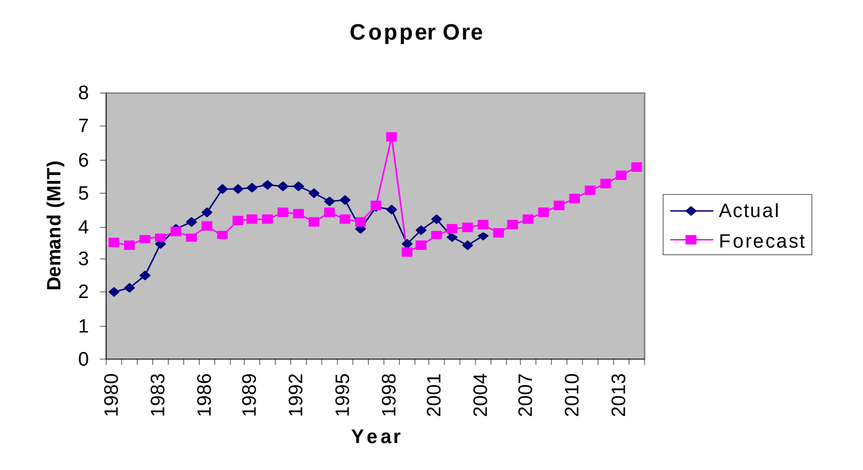
As the Indian economy is expected to grow at a rapid rate in the Eleventh Five Year Plan and beyond, the domestic demand for natural resources and natural resource based products are expected to rise substantially. Indeed, the forecasts based on the models indicate a substantial rise in domestic demand. In a majority of the products studied, the average domestic demand during 2005-2014 is expected to be about double or more than double of the average domestic demand in the period 2001-2004. Significant increases are expected in energy demand. The domestic demand for electricity is expected to increase from 356 billion KWH per year during 2001-04 to 506 billion KWH per year in the period 2005-14. The annual demand for coal is projected to rise from about 375 million tonnes during 2001-04 to about 490 million tonnes during 2005-14. In crude oil, the annual demand is projected to increase from about 107 million tonnes during 2001-04 to about 182 million tonnes during 2005-14. Among petroleum products, a significant increase in demand is projected for HSD and FO, compared to which the increase in demand for Kerosene is projected to be much smaller.

Significant increases in demand are projected for alumunium and steel and also in the basic minerals on which these are based, namely bauxite and iron ore. Interestingly, while a significant increase is projected in copper demand, the demand for copper ore (including concentrate) is not projected to increase much. The explanation probably lies in the increasing share of imported copper ore (which is relatively better quality than the domestic ore) and concentrate, so that in terms of volume of ore requirement, the increase is less.

Among the products selected for the study, a relatively smaller increase is projected in the demand for urea. By contrast, a relatively larger increase in projected in the demand for DAP.

Figure 2.1: Demand for Natural Resources and Products, Actual and Forecast




Copper Ore
Demand (MIT)
0
1
2
3
4
5
6
7
8
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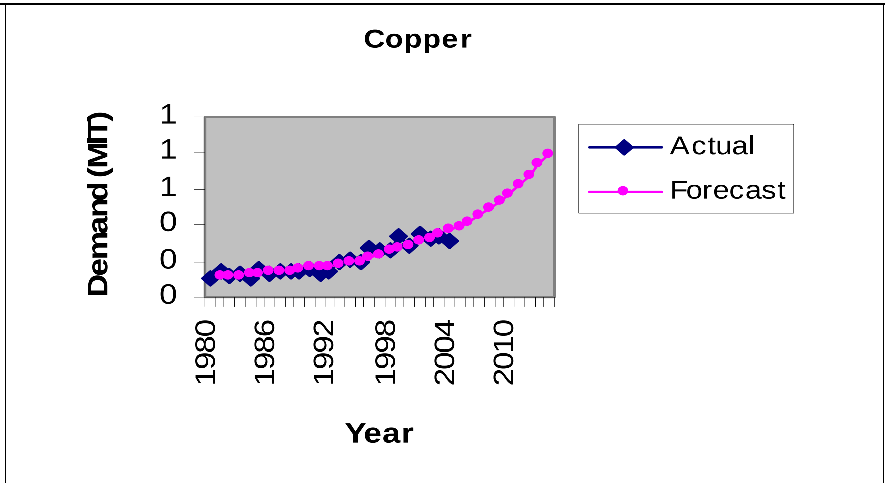
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Year
Actual
Forecast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1
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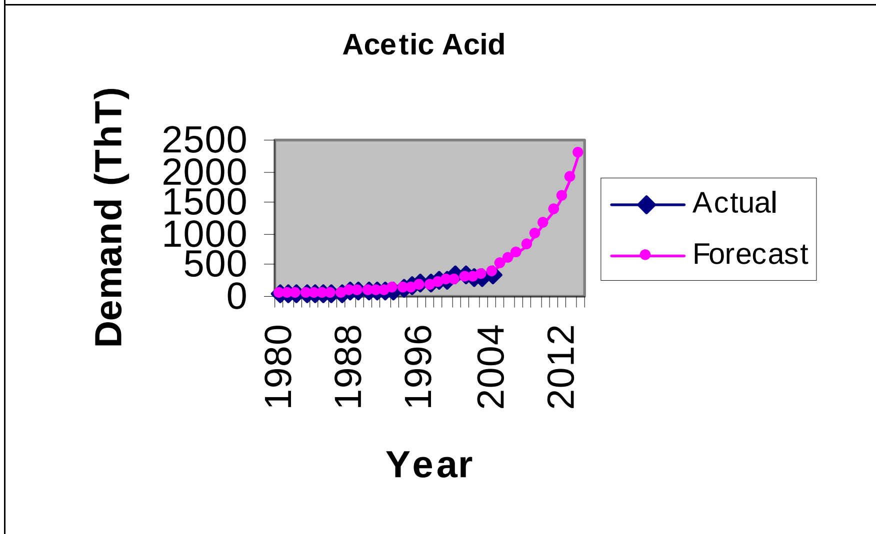
1980
1986
1992
1998
2004
2010
Year
Actual
Forecast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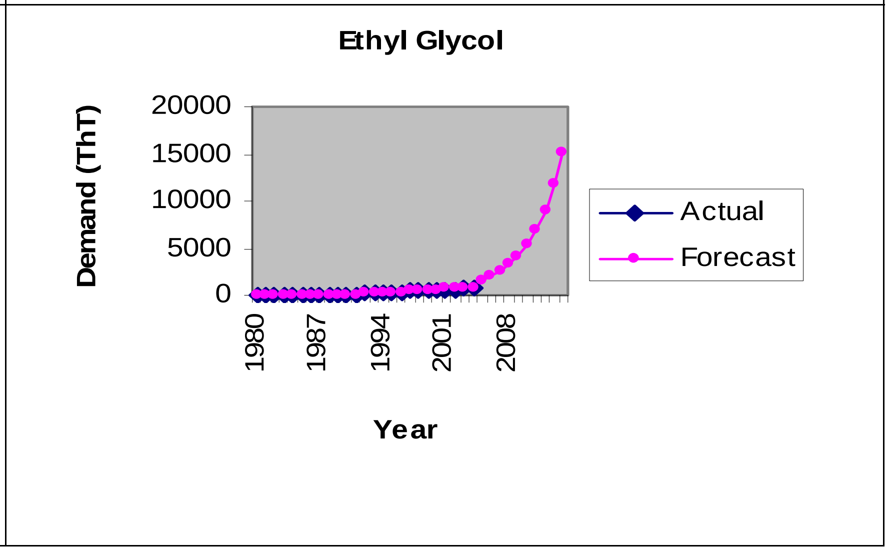
2000
2500
1980
1988
1996
2004
2012
Year
Actual
Forecast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Demand (ThT)
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20000
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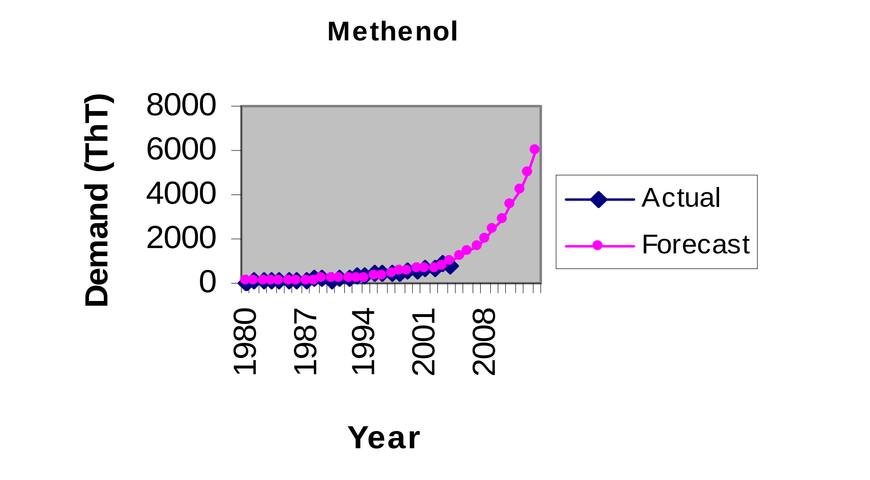
1987
1994
2001
2008
Year
Actual
Forecast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1987
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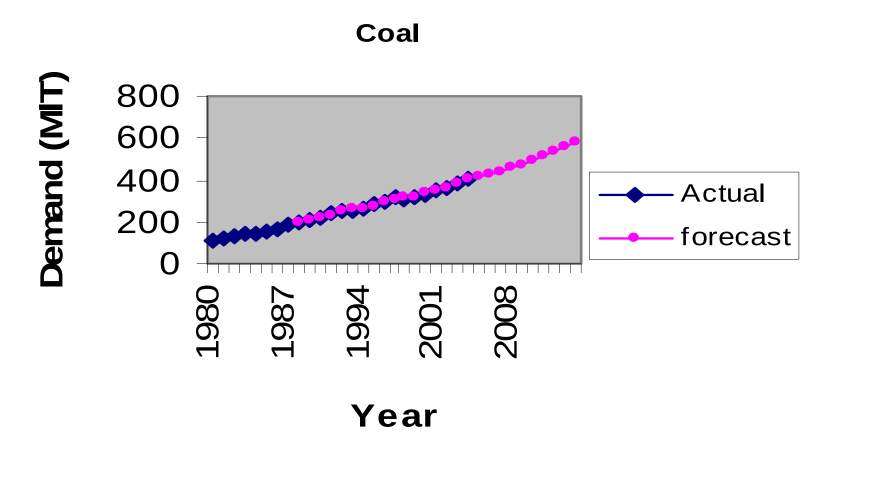
2001
2008
Year
Actual
Forecast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Demand (MIT)
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400
200
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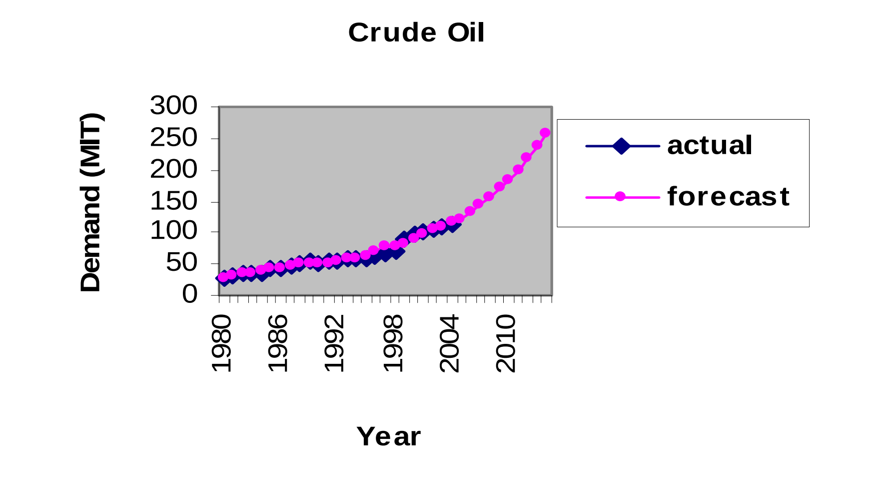
1980
1987
1994
2001
2008
Year
Actual
forecast


Crude Oil
Demand (MIT)
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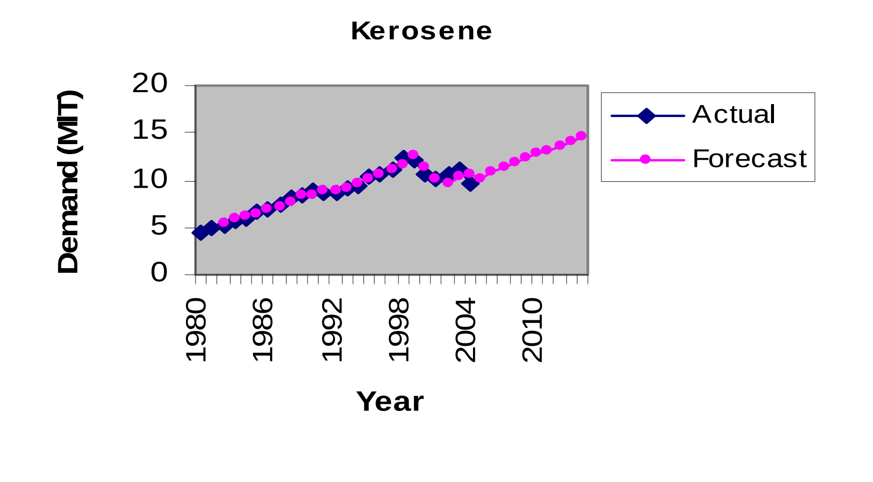
100
50
0
1980
1986
1992
1998
2004
2010
Year
actual
forecast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Demand (MIT)
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15
10
5
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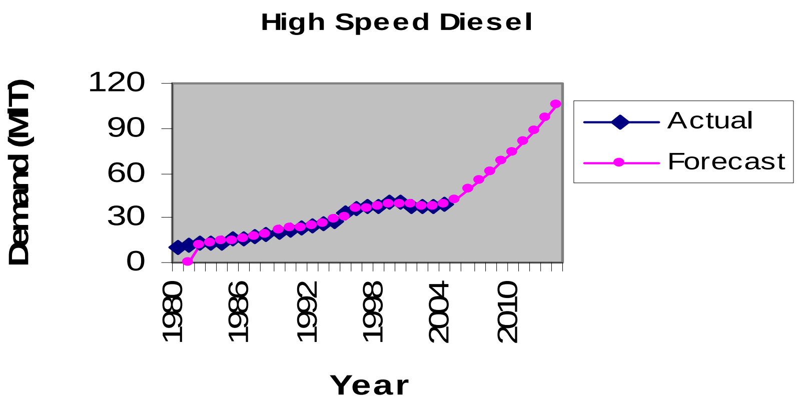
1986
1992
1998
2004
2010
Year
Actual
Forecast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Demand (MT)
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30
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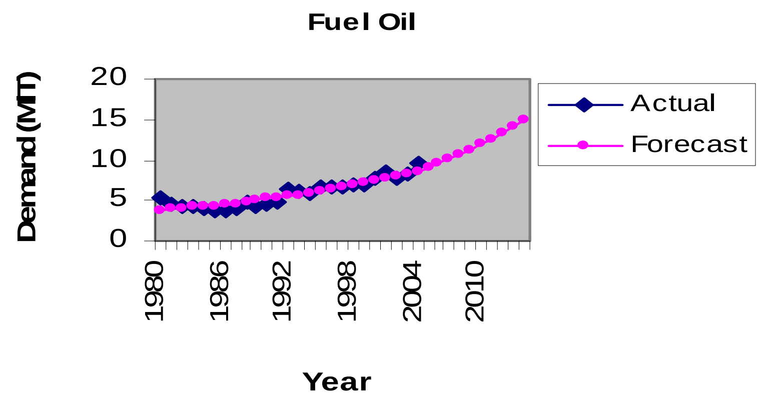
1986
1992
1998
2004
2010
Year
Actual
Forecast


Fuel Oil
Demand (MT)
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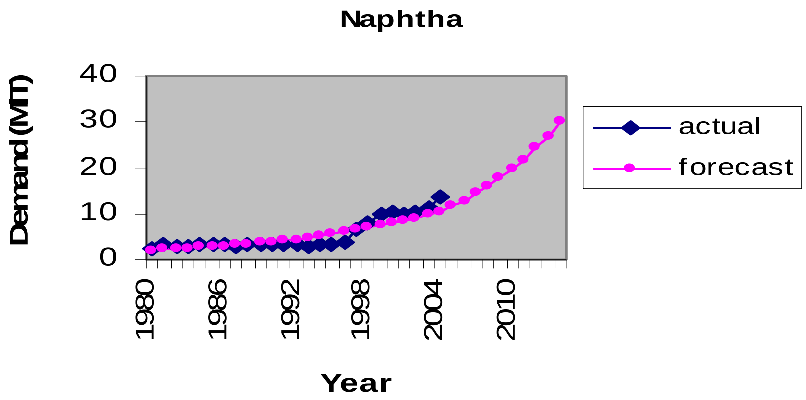
1986
1992
1998
2004
2010
Year
Actual
Forecast


Naphtha
Demand (MT)
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20
10
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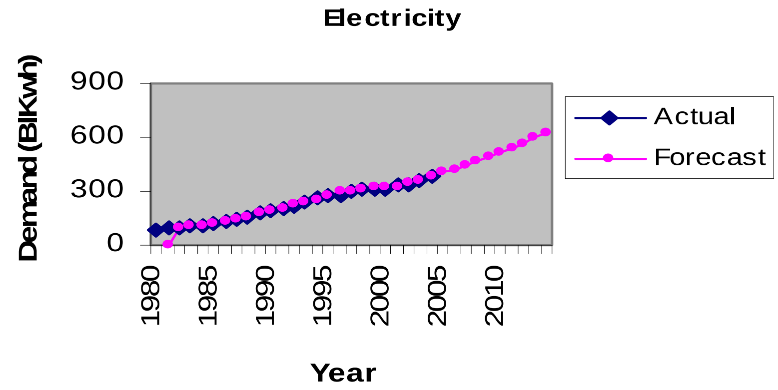
1986
1992
1998
2004
2010
Year
actual
forecast


Electricity
Demand (BIKwh)
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300
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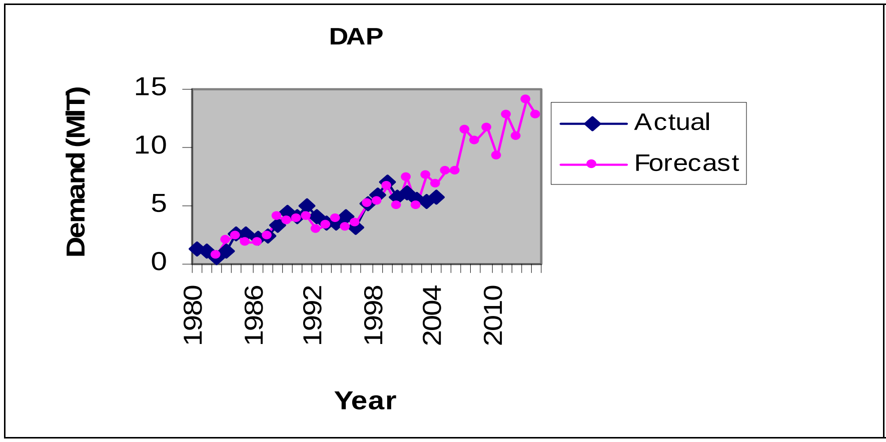
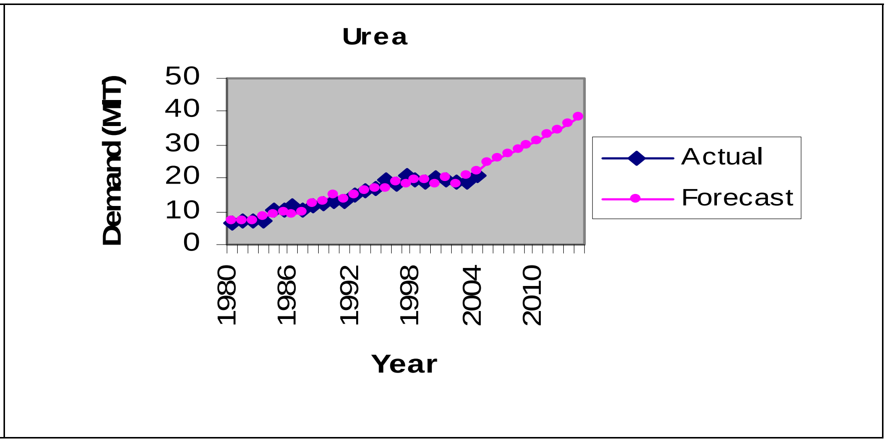
1980
1985
1990
1995
2000
2005
2010
Year
Actual
Forecast





Notes: MIT = million tonnes; ThT = Thousand tonnes

2.5 Dependence on imports

Projection of dependence on imports is based on the past trend. In most cases, a linear or a quadratic trend equation is fitted to the data on the extent of import dependence in the period 1980-81 to 2004-05, and the estimated trend equation is used to make projections for the period 2005-06 to 2014-15.[11] In some cases, the plot of the relevant ratio revealed that the trends were different in different sub-periods, and therefore the observed trend in the more recent period has been used for forecasting. The plots of the ratio of imports to requirement for the products studied are given in Figure 2.2. The graph of the trend equation is also given.

Across products, considerable diversity is observed in the trends in import dependence. In Aluminium and Steel, the import dependence has been on the rise, and this is expected to increase further. Imports of aluminum, for instance, met about 19 percent of domestic demand during 1991-2000, which rose to about 24 percent during 2001-04. This is expected to rise to 32 per cent during 2005-14. In Steel, similarly, import dependence is expected to increase from 6 percent during 1991-2000 and 11 percent during 2001-04 to about 14 per cent during 2005-14. Imports of bauxite and iron ore as a proportion to domestic use are very small and no marked increase in import dependence is expected.

[11] This analysis is not done for electricity because imports form a very low proportion.

Table 2.3: Ratio of Imports to Domestic Demand, Natural Resources and Products, 1980 to 2014

(percent)

Period	Aluminum	Bauxite	Steel	Iron Ore	Copper	Copper Ore/ Concentrate
1980 to 1990	5.54	0.002	0.74	0.17	76.32	0.35
1991 to 2000	18.90	0.464	6.32	1.20	64.59	3.42
2001 to 2004	24.45	0.428	11.37	1.22	32.80	18.50
2005 to 2014	31.83	0.397	14.35	1.25	29.23	35.12
2005	27.22	0.451	11.87	1.36	38.34	24.18
2006	28.25	0.439	12.42	1.35	36.32	26.61
2007	29.27	0.427	12.97	1.34	34.29	29.04
2008	30.29	0.415	13.52	1.32	32.27	31.47
2009	31.32	0.403	14.07	1.29	30.24	33.90
2010	32.34	0.391	14.62	1.26	28.22	36.33
2011	33.37	0.379	15.17	1.22	26.19	38.76
2012	34.39	0.367	15.72	1.17	24.17	41.19
2013	35.41	0.356	16.27	1.12	22.14	43.62
2014	36.44	0.344	16.82	1.07	20.12	46.05

(Table 2.3 continued)

Period	Urea	DAP	Coal	Crude Oil	Naphtha	HSD
1980 to 1990	17.80	48.82	1.20	41.91	3.03	15.39
1991 to 2000	10.13	32.36	4.15	54.31	10.97	27.59
2001 to 2004	1.40	11.73	6.11	81.29	24.21	0.68
2005 to 2014	1.76	13.71	8.30	81.65	28.07	1.47
2005	2.39	16.90	6.99	76.01	23.32	2.29
2006	2.22	16.10	7.28	77.38	24.37	2.05
2007	2.07	15.34	7.57	78.70	25.43	1.84
2008	1.92	14.61	7.86	79.98	26.48	1.65
2009	1.79	13.91	8.15	81.21	27.54	1.48
2010	1.66	13.25	8.44	82.40	28.60	1.32
2011	1.55	12.62	8.73	83.55	29.65	1.19
2012	1.44	12.02	9.02	84.67	30.71	1.06
2013	1.34	11.45	9.31	85.75	31.76	0.95
2014	1.24	10.91	9.60	86.80	32.82	0.85

(Table 2.3 continued)

Period	FO	Kerosene	Acetic Acid	Ethylene Glycol	Methanol
1980 to 1990	4.65	36.86	1.19	42.41	28.30
1991 to 2000	7.25	42.25	5.61	18.40	11.68
2001 to 2004	13.11	4.98	13.20	7.97	47.60
2005 to 2014	12.59	8.32	14.65	1.26	54.99
2005	11.15	11.12	12.13	2.54	47.99
2006	11.47	10.38	12.69	2.11	49.84
2007	11.79	9.69	13.25	1.75	51.56
2008	12.11	9.04	13.81	1.45	53.15
2009	12.43	8.44	14.37	1.21	54.64
2010	12.75	7.88	14.93	1.00	56.04
2011	13.07	7.35	15.49	0.83	57.37
2012	13.39	6.86	16.05	0.69	58.62
2013	13.71	6.41	16.61	0.57	59.80
2014	14.03	5.98	17.17	0.48	60.93

In Copper, a significant fall in import dependence occurred between the periods 1991-2000 and 2001-04. The ratio of imports to domestic demand fell from 65 to 33 percent. The project ratio for 2005-14 is about 29 percent. The fall in import dependence in copper between 1991-2000 and 2001-04 was accompanied by a significant rise in the share of imports in domestic use of copper ore/concentrate. This proportion rose from 3 percent to 19 percent between 1991-2000 and 2001-04, and is expected to rise further 35 percent during 2005-14. The copper industry seems to be undergoing a process of import substitution, where imported copper is being replaced by domestically produced copper based on imported copper ore and concentrate.

In urea and DAP, there has been clear downward trend in import dependence. The ratio of imports to domestic demand for urea fell from 10 percent during 1991-2000 to only about 1 percent during 2001-04. The proportion is projected to remain more or less at that level during 2005-14. In DAP, similarly, import dependence has gone down from about 32 percent during 1991-2000 to about 12 percent during 2001-04 and is projected to increase slightly to about 14 percent during 2005-14.[12] The fall in import dependence in DAP has been made possible by a significant increase in domestic production, which increased from about 1.9 million tonnes in 1990-91 to about 5.2 million tonnes in 2004-05. In this period, imports of DAP declined from about 2 million tonnes to about 0.6 million tonnes. There has been an upward trend in imports of rock phosphate and phosphoric acid, which seems to have helped in increased domestic production of DAP and replacement of imports. Between 1996-97 and 2005-06, imports of phosphoric acid increased from 1.7 million tonnes to 2.6 millions tonnes. Between 1997 and 2005, imports of rock phosphate increased from 2.7 million tonnes to 4.8 million tonnes.[13]

The ratio of imports to domestic requirement of coal has been increasing over time. The proportion in question increased from about 1 percent during 1980-1990 to about 4 percent during 1991-2000, and further to about 6 percent during 2001-04. This is projected to be about 8 percent during 2005-14 on the basis of the past trend. Import dependence ratio in the year 2011 is projected to be 8.8% as per the 11th Five-Year Plan[14] whereas it is projected as 10.6% in *Coal Vision 2025* based on coal demand assessed under 8% GDP growth scenario.

The extent of import dependence in crude oil declined between 1980 and 1985, but in subsequent years there was a clear upward trend in import dependence. The share of imports in domestic demand increased from 54 percent during 1991-2000 to 81 percent during 2001-04. Based on the trend equation fitted to the data for the period 1985 to 2004, it seems that the import dependence will remain at about 82 percent during 2005-14. However, from an examination of the graph, it seems that the extent of import dependence might even be higher, say about 85 to 90 percent.

[12] There have been marked increases in imports of urea and DAP in 2005-06 and 2006-07. The projections of import proportion based on data for the period up to 2004-05 may therefore understate somewhat the extent of import dependence in urea and DAP in future. Hence, for these two products, trend equations have been fitted to the data for the period 1980-81 to 2006-07.

[13] Fertiliser Statistics, 2005-06.

[14] Coal Directory of India 2005-06, part 2: Coal Statistics, Coal Controllers Organisation/ Ministry of Coal, January 2007.

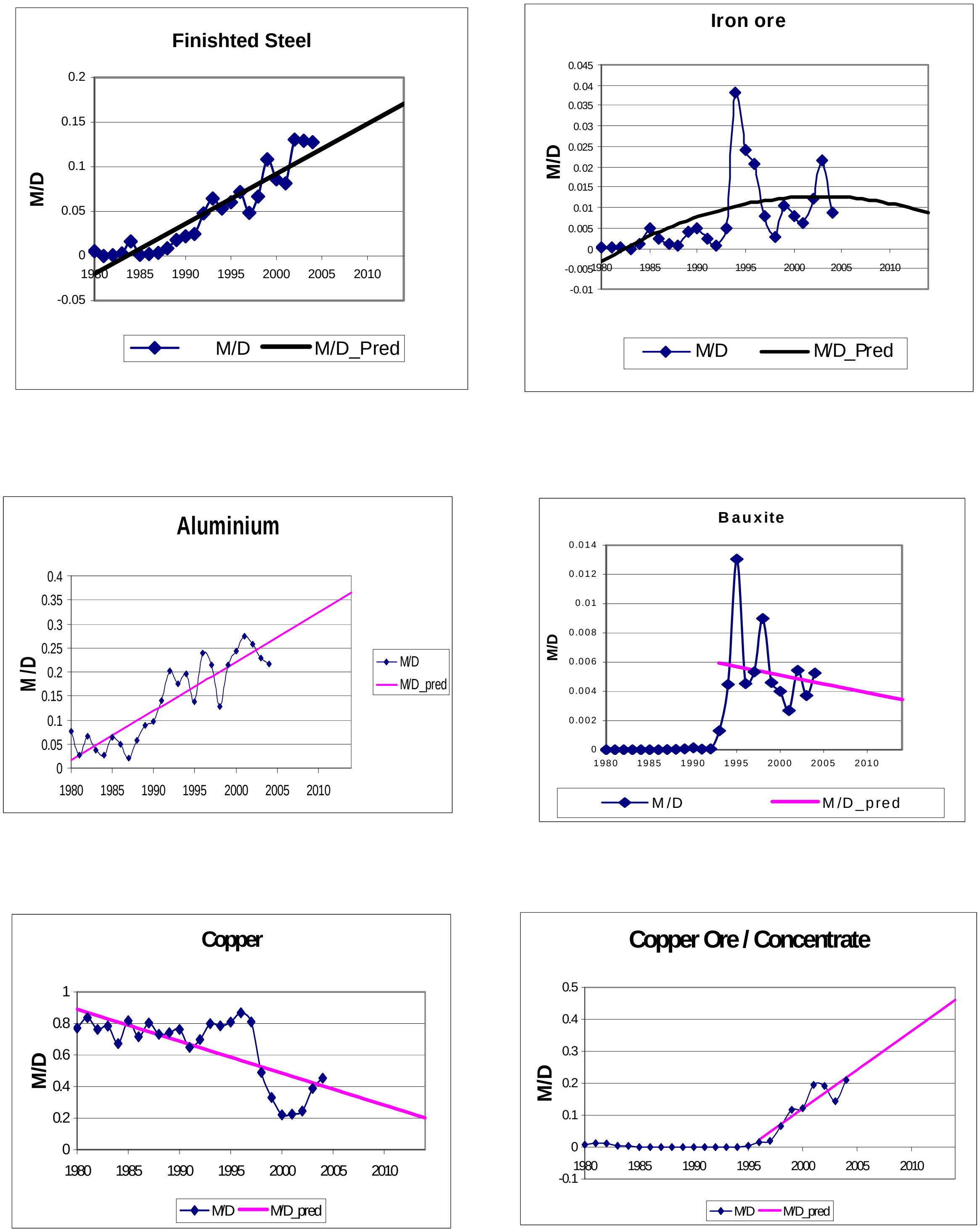
Of the four petroleum products considered for the study, two exhibit an upward trend in import dependence. These are Fuel Oil and Naphtha. Import dependence in Naphtha had increased from about 11 percent during 1991-2000 to about 24 percent during 2001-04. This proportion is projected to increase further to about 28 percent during 2005-14. Import dependence in Fuel oil increased from about 7 percent during 1991-2000 to about 13 percent during 2001-04. The proportion is projected to remain at that level during 2005-14.

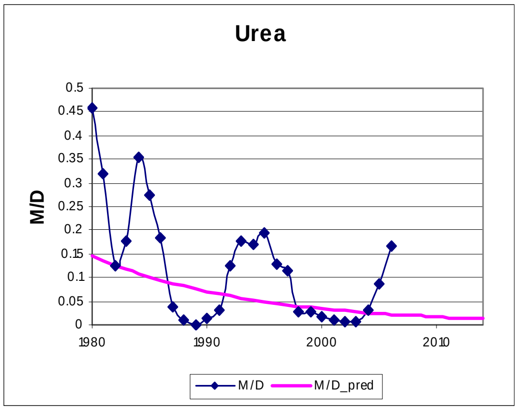
By contrast, there has been a downward trend in import dependence in HSD and Kerosene. The ratio of imports to domestic demand in HSD fell from about 28 percent during 1991-2000 to about one percent during 2001-04, and that in Kerosene fell from about 42 percent during 1991-2000 to about 5 percent during 2001-04. The extent of import dependence in these two petroleum products is expected to remain low during 2005-14.

Of the three chemical products included in the study, there was an upward trend in important dependence in two cases, acetic acid and methanol, and a downward trend in import dependence in one case, ethylene glycol. The ratio of imports to domestic demand of ethylene glycol fell from 42 percent during 1980-1990 to 18 percent during 1991-2000 and further to 8 percent during 2001-04. The projection for import dependence for the period 2005-14 is about one percent.

In acetic acid, the ratio of imports to domestic demand increased from about 6 percent during 1991-2000 to about 13 percent during 2001-04, and is projected to be about 15 percent during 2005-14. In methanol, import dependence increased from about 12 percent during 1991-2000 to about 48 percent during 2001-04. It is projected to increase to about 55 percent during 2005-14.

Figure 2.2: Ratio of Imports to Domestic Demand (per cent) 1980 to 2014, Actual and Trend

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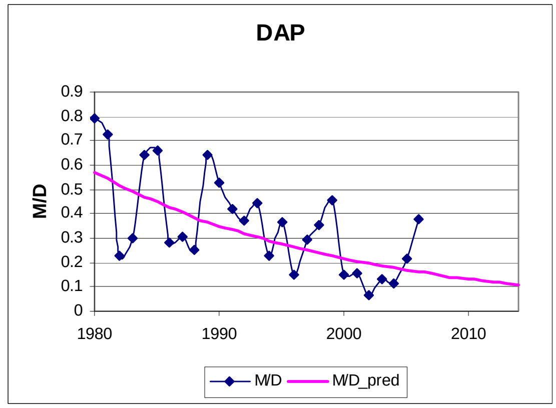
M/D
M/D_pred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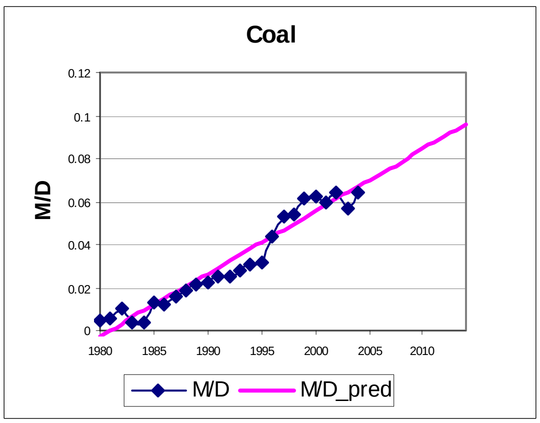
M/D
M/D
M/D_pred


Coal
M/D
M/D
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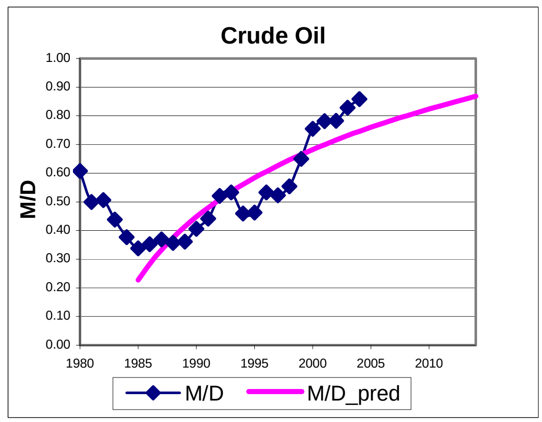
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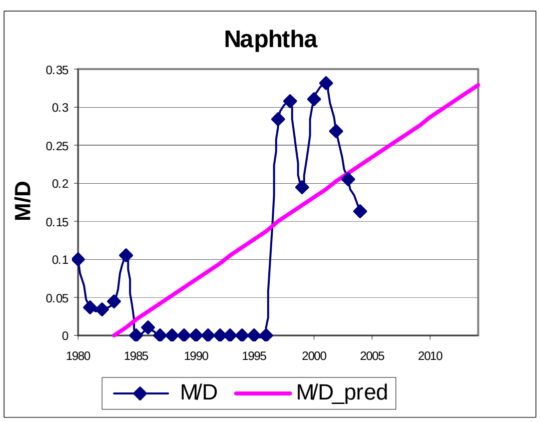
M/D
M/D_pred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M/D
M/D
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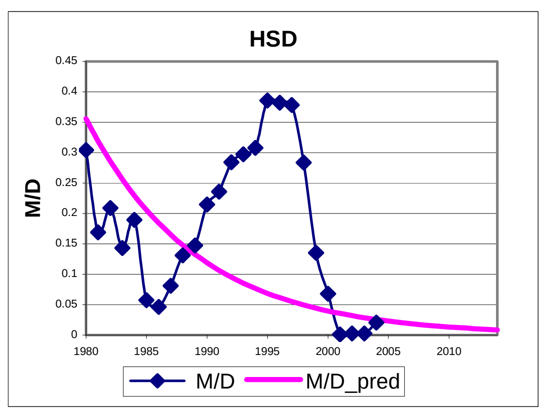
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M/D
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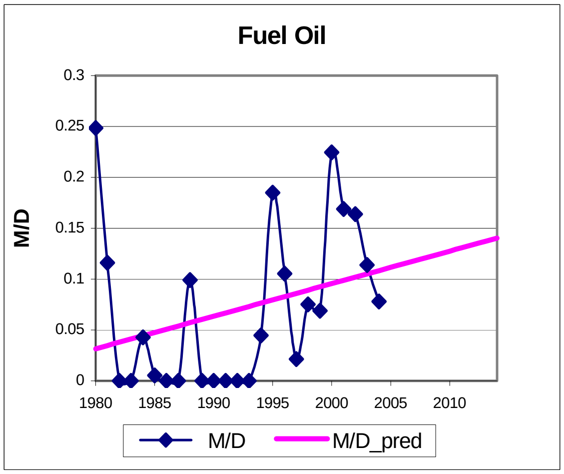
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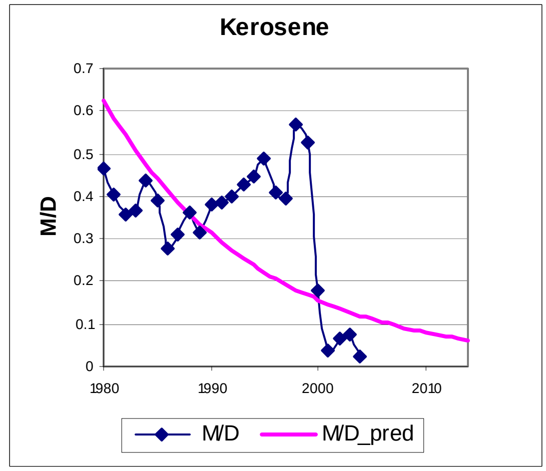
1980
1985
1990
1995
2000
2005
2010
M/D
M/D_pred


Kerosene
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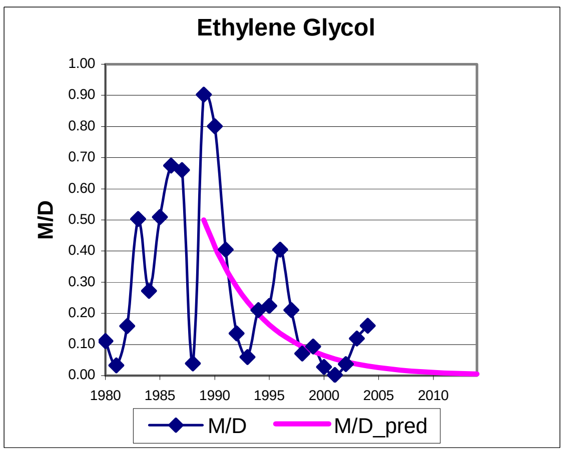
2010
M/D
M/D_pred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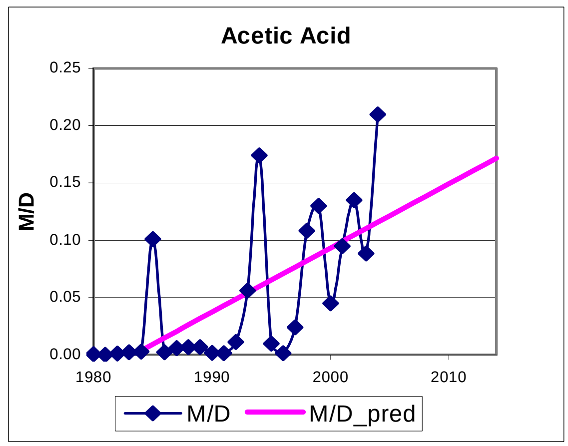
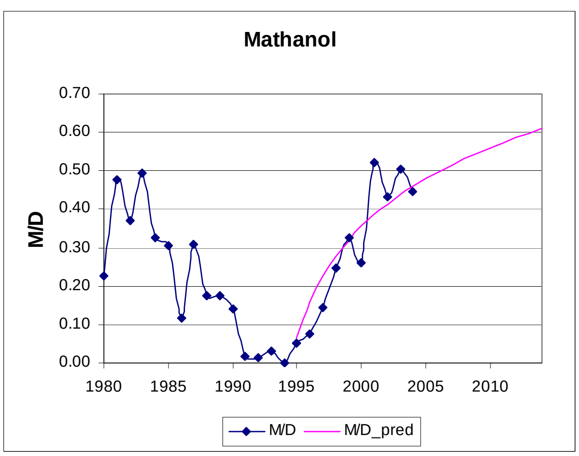
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1980
1985
1990
1995
2000
2005
2010
M/D
M/D_pred


Acetic Acid
M/D
0.25
0.20
0.15
0.10
0.05
0.00
1980
1990
2000
2010
M/D
M/D_pred


Mathanol
M/D
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1980
1985
1990
1995
2000
2005
2010
M/D
M/D_pred

Using the forecast of domestic requirement of natural resources and resource based products during 2005-14 and the projection of the extent of import dependence, an estimate of likely imports has been made. This is presented in Table 2.4. A comparison is made between average imports during 2001-04 and that predicted for the period 2005-14.

Table 2.4: Imports of Natural Resources and Resource-based Products, 2001-04 (actual) and 2005-14 (forecast)

Product	Unit	Average imports, 2001-04	Average imports, 2005-14 (forecast)	% increase
Iron ore	000 MT	747	1193	60
Finished steel	000 MT	4082	11281	176
Bauxite	000 MT	40	98	145
Aluminum	000 MT	175	490	180
Copper ore & concentrate	000 MT	697	1715	146
Copper	000 MT	170	126	-26
Acetic Acid	000 MT	44	211	380
Ethylene glycol	000 MT	54	78	44
Methanol	000 MT	357	1679	370
Coal	Million MT	23	41	78
Crude oil	Million MT	87	149	71
Kerosene	000 MT	526	1037	97
HSD	000 MT	263	1063	304
Fuel Oil	000 MT	1093	1555	42
Naphtha	000 MT	2669	9108	241
DAP	000 MT	673	1552	131
Urea	000 MT	281	546	94

In terms of physical volume of imports (tonnage), significant increase in imports is expected to take place in finished steel, aluminium, copper ore/concentrate, coal, acetic acid, methanol, crude oil, kerosene, HSD, fuel oil, naphtha DAP and urea.[15]

[15] Large increases in petroleum refining capacity in India are being planned for future years. In case, these additions to capacity materialize, the increase in imports of petroleum products may not be as high as projected in Table 2.4.

3. Prices of Natural Resources and Resource-Based Products in India

In the previous section, demand forecast for some natural resources and resource-based products were presented for the period 2005-2014 based on estimated demand functions. A forecast of the portion of demand that would be met by imports was also presented which was based on the past trend. The estimates indicated that the demand for natural resources and resource-based products would grow rapidly in India during the next ten years, and for some of the products substantial increases in imports may take place.

This section is concerned with the question, how do the prices of natural resources and resource-based products in India compare with the international prices of those resources and products. The purpose is to identify the natural resources and products in which the domestic prices in India are relatively low and consider whether this may be treated as a subsidy to the users of the resources/products arising from policies of and market regulations by the government. Another purpose of the analysis is to find out if the domestic prices of some of the natural resource based products are high in relation to international prices of those products and thus identify the natural resource based industries which are enjoying significant protection from import competition. The analysis is confined to the following set of products: steel, iron ore, aluminium, bauxite, DAP (Di-ammonium phosphate), rock phosphate, copper, coal, crude oil, gasoline (petrol), and natural gas. The analysis of price differences and related aspects is presented in Section 3.1 through 3.7 below. For each of the products selected for study, the current tariff and trade policy is outlined first, followed by a comparison of domestic and international prices for the period 2000-01 to 2005-06. The issues of protection and subsidy are taken up next, drawing primarily on the comparison between domestic and international prices.

3.1 Iron Ore and Steel

3.1.1 Current Tariff and Trade Policy

Imports of steel are freely allowed (only two lines at 8-digit HS are restricted out of a large number of lines). Basic import tariff is 5 percent (in 2007-08). However, with CVD (countervailing duty) and special CVD, total duty on imports on steel is about 28 per cent. There are no restrictions on exports of steel products.

Iron ore is one of the basic natural resources used in steel production. Imports of iron ore into India are freely allowed. The basic duty rate is 2 percent and special CVD 4 percent. Exports of iron ore of Fe content up to 64 percent are free. But, for iron ore of higher Fe contents, exports are canalized through a specified state-trading agency namely, MMTC limited. This, however, does not apply to iron ore of Goa origin exported to specific markets such as China, Japan and Europe, and to iron ore of Redi (Maharashtra) origin exported to any market. There is at present an export tax on exports of iron ore. The rate of duty is Rs 300 per tonne.[16] [17]

3.1.2 Price comparisons – steel products

Lack of data poses a serious problem in making a comparison of domestic steel prices with international steel prices. The products for which domestic prices are available do not match with the commodities for which prices in international markets are available. Price comparisons that could be made with the limited available data suggest that the ratio of steel prices in India to that in international markets has been varying from year to year. For some products, it seems, the price in India were more than the international

[16] In 2007-08, the export price of Indian iron ore was about Rs 2700 per tonne. Thus, export tax comes to about 11%. According to information obtained from a document available at www.Indiansteelalliance.com (accessed February 22, 2008), the mining cost of iron ore is about Rs 250 per tonne while freight, loading and unloading cost is about Rs 900 per tonne. The exporters are getting a margin of about Rs 1250 per tonne even after paying an export tax of Rs 300 per tonne.
[17] Initially, a tax of Rs 300 per tonne was imposed on all exports of iron ore. Later, the tax for inferior quality iron ore was reduced.

steel prices during the years 2001-02 to 2003-04. But, more recently, the prices of steel products in India have been similar to or less than the international prices.

As an illustration, a comparison of domestic price of CTD (Cold Twisted Deformed) bars to the price of Steel Rebars in Japanese market is made in Table 3.1.1. It is seen from the table that between 2000-01 and 2005-06, the price of Steel Rebars in Japan increased from US$244/tonne to US$423/tonne. The price of Steel CTD bars in India also increased in this period, from US$351/tonne to US$556/tonne. The ratio of domestic price of CTD bars to the price of Steel Rebars in Japanese market was in the range of 1.3 to 1.7 in various years during 2000-01 and 2005-06. It may be pointed out here that the figures on the domestic price of CTD bars that could be obtained from the data source used include domestic indirect taxes. The CVD (equal to excise duty) on steel products in the period 2000-01 to 2005-06 was around 16 percent. Thus, it may be inferred from Table 3.1.1 that, in the period 2000-01 to 2003-04, domestic price of CTD bars net of excise was higher than the international price of such products, but in 2004-05 and 2005-06 the difference in prices was small.

Table 3.1.1: Price of Steel Bars, India and Japan, 2000-01 to 2005-06

Year	CTD bars, India (US$/tonne)	Steel Rebars, Japan (US$/tonne)	Ratio of price in India to that in Japan
2000-01	351	244	1.44
2001-02	348	221	1.57
2002-03	353	204	1.73
2003-04	438	265	1.65
2004-05	571	428	1.33
2005-06	556	423	1.31

Note : Data on price of CTD bars in India taken from Indian Mineral Yearbook.
Data on price of Steel Rebars in Japan taken from CMIE's, Beacon Software.

A similar comparison of domestic prices of hot rolled coil sheet and cold rolled coil sheet in India and Japan is presented in Tables 3.1.2 and 3.1.3 respectively. It can be seen from Table 3.1.2 that between 2000-01 and 2005-06, the price of hot rolled coil sheet increased in both Japan and India. In Japan, it increased from US$296/tonne to

US$633/tonne with a minimum of US$217/tonne in the year 2001-02, whereas in India it increased from US$351/tonne to US$556/tonne during that period. The ratio of domestic price of hot rolled coil sheet in Indian market to that in the Japanese market was in the range of 1.1 to 1.7 during 2000-01 to 2005-06. Taking into account the fact that excise duty (about 16%) is included in the quoted Indian price, it may be inferred from Table 3.1.2 that in most years of the period 2000-01 to 2005-06. the price of hot rolled coil sheet in India (net of excise) was not higher than or not much higher than the price in Japan. However, a significantly higher price prevailed in India during 2001-02.

Table 3.1.2: Price of Steel Hot Rolled Coil Sheet, India and Japan, 2000-01 to 2005-06

Year	Hot rolled coil sheet, India (US$/tonne)	Hot rolled coil sheet, Japan (US$/tonne)	Ratio of Price in India to that in Japan
2000-01	359	296	1.21
2001-02	377	217	1.74
2002-03	331	247	1.34
2003-04	460	320	1.44
2004-05	558	503	1.11
2005-06	720	633	1.14

Note : Data on price of hot rolled coil sheet in India taken from CMIE’s, Beacon Software.
Data on price of hot rolled coil sheet in Japan taken from CMIE’s, Beacon Software.

Table 3.1.3: Price of Steel Cold Rolled Coil Sheet, India and Japan, 2000-01 to 2005-06

Year	Cold rolled coil sheet, India (US$/tonne)	Cold rolled coil sheet, Japan (US$/tonne)	Ratio of Price in India to that in Japan
2000-01	456	386	1.18
2001-02	456	299	1.53
2002-03	410	328	1.25
2003-04	536	445	1.21
2004-05	638	607	1.05
2005-06	770	733	1.05

Note: Data on price of cold rolled coil sheet in India taken from CMIE’s, Beacon Software
Data on price of cold rolled coil sheet in Japan taken from CMIE’s, Beacon Software.

The situation in respect of price of cold rolled coil sheet in the Indian and Japanese market is quite similar to that of hot rolled coil sheet. Table 3.1.3 reveals that during 2000-01 to 2005-06 the domestic price of cold rolled coil sheet in Japan increased from US$386/tonne to US$733/tonne with a minimum of US$299/tonne in the year 2001-02. In India, there was an increase in price of cold rolled coil sheet from US$456/tonne in 2000-01 to US$770/tonne in 2005-06. The ratio of Indian price to the Japanese price ranged from 1.1 to 1.5 in various years during 2000-01 and 2005-06. Once the excise duty applicable on cold rolled coil sheet (about 16%) is taken into account, it seems that in most years the prices of cold rolled coil sheet was more or less equal in the two markets or the price in India was lower.

3.1.3 Price comparisons – Iron ore

Comparisons between domestic and international prices made for iron ore indicate that the domestic price is lower than the international price. Table 3.1.4 presents for the period 2000-01 to 2005-06 a comparison of iron ore prices in India with those in international markets. For the purpose of comparison, the price of Brazilian ore exported to Europe is considered. Price in India is found to be about 70% of the price of Brazilian ore.

Table 3.1.4: Price of Iron Ore, India and Brazil, 2000-01 to 2005-06

Year	Price of iron ore in India (fines, 63% Fe, FOB Marmugao), US$/tonne	Price of iron ore, Brazilian to Europe, Carzas fines, 67.5% Fe content, FOB US$/tonne	Ratio of price in India to that in Brazil (adjusted for differences in Fe content)
2000-01	13.7	19.4	0.704
2001-02	14.3	20.3	0.704
2002-03	13.9	19.8	0.704
2003-04	15.2	21.6	0.704
2004-05	18.0	25.7	0.702
2005-06	30.9 (P)	43.9	0.704

P = Provisional

Note: Data on price of iron ore in India taken from Indian Mineral Yearbook. Data on price of Brazilian iron ore exported to Europe taken from International Financial Statistics, Yearbook 2005 and World Bank Commodity Price Data, http://siteresources.worldbank.org/INTPROSPECTS/Resources/pnk_0805.pdf

Table 3.1.5 presents a comparison between domestic price of iron ore and unit export value in different years during the period 2000-01 to 2005-06. The comparison shows that the domestic prices of iron ore were consistently less than the unit value of exports. The ratio of domestic price to unit export value during 2000-01 to 2005-06 was about 0.9 on an average. Thus, considering Tables 3.1.4 and 3.1.5, it may be inferred that the domestic prices of iron ore in India is lower than the international prices.

Table 3.1.5: Price of Iron Ore and Unit Value of Exports, India, 2000-01 to 2005-06

Year	Domestic price of Iron ore (fines, 63% Fe, FOB, Marmugao), (Rs/ tonne)	Unit value exports, FOB (Rs/ tonne)	Ratio of domestic price to unit value of exports, (a)/(b)
	(a)	(b)	(c)
2000-01	626	691	0.906
2001-02	682	787	0.867
2002-03	673	853	0.789
2003-04	698	721	0.969
2004-05	809	945	0.856
2005-06	1368	1561	0.876

Note: Data on price of iron ore in India taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India.

3.1.4 Subsidy and Protection

Indian steel producers have the advantage of a relatively lower price of iron ore compared to the international prices. In China, for instance, the CIF prices of iron ore imported from Australia, Brazil, South Africa, and India[18] ranged from US$ 58 to US$ 89 per tonne in 2005.[19] The domestic prices of iron ore in China were about US$ 89 per tonne.[20]

[18] China imports about 390 million tonnes of iron ore, out of which 155 million is imported from Australia, 115 million tonnes from Brazil and 90 millions from India. Imported iron ore constitutes about half of total consumption in China.

[19] Information source: Iron Ore Market Update, Presentation to Analysts, June 2005, BHPbilliton, document available at www.bhpbilliton.com (accessed February 22, 2008).

Price of iron ore in India in 2005 was about US$ 31 per tonne. This price was lower than the international prices of iron ore; for instance, the price of Brazilian ore exported to Europe was about US$44 per tonne. An important question that arises here is whether the prevalence of a relatively lower price of iron ore in India amounts to a subsidy to the domestic steel industry. It seems that the difference in the price of iron ore should not be treated as a subsidy because it was not caused by any administered price mechanism. The canalization of exports and the export tax may have created a wedge between export price and domestic price of iron ore in India. But, the difference is small (probably about 10 per cent at present), and it seems reasonable to conclude that no significant subsidization of iron ore in respect of domestic users is taking place due to these policies.

Yet, in the current situation, there is an implicit subsidy on iron ore. To explain this point, attention may be drawn here to the issue of exhaustibility of natural resources. At present, a large part of the iron ore production (about 60 percent) in India is exported, and this proportion has been increasing over time. The relatively low price of iron ore in India has attracted new investment in steel making and a huge addition to steel making capacity is likely to take place in the coming years.[21] According to some estimates, if the current trends continue, the resource may be exhausted in 20 years time or so.[22] This aspect is, however, not finding reflection in the pricing of iron ore. Royalty rate at one percent of sales value is very low. To reflect the fact that the high and medium grade iron ore reserves in India will get exhausted in 20 years to so, the price of iron ore in India needs to be enhanced by imposition of a tax on iron ore mining (see Box 3.1). Till such a tax is imposed, there would be an implicit subsidy to the producers and users of iron ore in India equivalent to the amount of tax.

[20] In 2007, spot prices of imported iron ore in China were about US$ 180 per tonne including cost, insurance and freight. The landed cost of Australian iron ore imported in China on a contract basis was more than US$ 100 per tonne. The price of iron ore in India was about US$50 to 60 per tonne.

[21] According to media reports, steel firms are making large investments to quadruple the countries steel production to about 200 million tonnes by 2020.

[22] The basis for this statement is a study undertaken by the National Council of Applied Economic Research (NCAER) (2007). According to the NCAER study, the high and medium grade iron ore reserves may not last more than 19 years even if exports of these grades are frozen at the current level or the targets set out in the draft steel policy are to be met.

Box 3.1: Depletion premium

Valuation of depletable resources requires that an explicit opportunity cost component be included in addition to the normal market value or marginal extractions cost. The opportunity cost is often referred to as depletion premium. The premium is based on the present value of the opportunity cost of extracting the resource at some time in future compared to the current economic price. The depletion premium at time t (DP_t) may be defined as:

$$DP_t = \frac{(PS_T - EC_T)(1+r)^t}{(1+r)^T} \qquad \ldots (1)$$

where,

PS_T is the price of substitute at the time of complete exhaustion, T,
EC_T is the extraction cost at time T, and
r is the rate of discount.

To apply the above formulae to the case of iron ore resource in India as an illustration of the concept, it may be assumed that the resource (i.e. high and medium grade iron ore) will be completely exhausted by 2027 if the current trends in rate of extraction continue. For the domestic steel mills to continue production in that year and beyond, iron ore will therefore have to be imported in 2027 as domestically mined iron ore will not be available. The cost of imported iron ore (at 2007 prices), say from Australia, may be taken as US$ 100 per tonne (including the transport cost and other related costs from ports to the steel mills in India). The cost of extraction of iron ore in India in 2007 along with the cost of transport and loading/unloading may be taken as about Rs 1200 per tonne (or US$ 29 per tonne, taking the exchange rate as Rs 42 per US$). Taking t as zero (for 2007), T as 20 (for 2027) and the social rate of discount as 9% (based on a study of national parameters done recently at the Institute of Economic Growth, Delhi), and applying the formulae in (1) above, the depletion or exhaustibility premium is found as US$ 12.7 per tonne which comes to about Rs 530 per tonne. Currently, there is an export tax on iron ore in India at the rate of Rs 300 per tonne (for better quality ore). This partly helps in imposing a depletion premium on iron ore exported from India. The rate of tax seems to be less than what is required to reflect adequately the exhaustibility of iron ore resources of the country. A similar premium should be added also to the price paid by domestic users of iron ore. Evidently, a substantial increase in the royalty rate is required. Or, a tax on the ground of resource exhaustibility is needed on iron ore mining.

Turning to the situation in the steel industry, the current tariff rate is 5 percent and imports are freely allowed. From the price comparisons made above it appears that in general the domestic prices of steel products net of excise duty are similar to or less than the international prices. It may accordingly be inferred that the Indian steel industry is not enjoying any significant protection from import competition.

3.2 Aluminium and Bauxite

3.2.1 Current Tariff and Trade Policy

Imports of aluminium are freely allowed. The current rate of basic tariff is 5 percent. Along with CVD and special CVD, the total import duty is about 28 percent. There are no restrictions on exports of aluminium.

Bauxite is the basic raw material used in the production of alumina, which is used in the production of aluminium. Imports of bauxite are freely allowed. The basic rate of tariff is 2 percent. Imports are subject further to special CVD of 4 percent. Exports of bauxite are not subject to any restriction.

3.2.2 Price comparisons – Aluminium

A comparison between domestic and international prices of aluminium ingot is presented in Table 3.2.1. The table shows that the price of aluminium ingot in India (Mumbai) was about 20 to 40 percent higher than the price of high-grade aluminium in London Metal Exchange (LME) in different years during the period 2000-01 to 2005-06. The figures on the domestic price of aluminium taken from the data sources used are inclusive of domestic indirect taxes. The rate of excise on aluminium ingot in the period 2000-01 to 2005-06 was about 16 percent. Net of such taxes, the domestic price of aluminium in the period 2000-01 to 2005-06 was close to or slightly higher than the price quoted in the LME.

To probe further the differences between the domestic and international prices of aluminium ingot, a comparison of domestic price of aluminium ingot with unit export value and unit import value has been made for the period 2000-01 to 2005-06, which is presented in Table 3.2.2. It is seen from the table that the price of aluminium in the domestic market exceeded both unit import value and unit export value. Domestic price was on average about 25 percent higher than unit value of imports and about 30 percent higher than the unit value of exports. It has been mentioned above that the figures on domestic price are inclusive of domestic indirect taxes. Net of such taxes, the domestic price was higher than the unit values of imports and exports by 10 to 20 percent. Thus, the price comparisons presented in Tables 3.2.1 and 3.2.2 reveal that the domestic price of aluminium in India is higher than the international price, but the difference is small.

Table 3.2.1: Comparison of Price of Aluminium, Mumbai (India) Market and London Metal Exchange, 2000-01 to 2005-06

Year	Price of aluminium ingot in India (Mumbai), US$/tonne	Price of high grade aluminium in London Metal Exchange, US$/tonne	Ratio of price in India to that in London Metal Exchange
2000-01	1855	1549	1.20
2001-02	1956	1444	1.35
2002-03	1915	1350	1.42
2003-04	1981	1431	1.38
2004-05	2076	1716	1.21
2005-06	2266	1898	1.19

Note: Data on price of aluminium ingot in India taken from CMIE's, Beacon Software. Data on price of aluminium ingot in the London Metal Exchange taken from UNCTAD Commodity Price Statistics On-line, http:/www.unctad.org/Templates/Page.asp?intItemId=1889&lang=1.

Table 3.2.2: Price of Aluminium Ingot and Unit Value of Imports and Exports, India, 2000-01 to 2005-06

Year	Domestic price (Rs/ tonne)	Unit value imports (Rs/ tonne)	Unit value exports (Rs/ tonne)	(a)/(b)	(a)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	84736	70995	62589	1.19	1.35
2001-02	93282	78038	72405	1.20	1.29
2002-03	92686	73493	69635	1.26	1.33
2003-04	91027	71692	73655	1.27	1.24
2004-05	93275	72481	67772	1.29	1.38
2005-06	100316	82441	82636	1.22	1.21

Note: Data on price of aluminium ingot in India taken from CMIE's, Beacon Software. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India.

3.2.3 Price comparisons – Bauxite

While the domestic aluminium price in India is slightly higher than the international price, the prices of bauxite in India are found to be lower than the international prices. A comparison of Indian and Chinese bauxite prices is given in Table 3.2.3. Price of A grade bauxite ex-mine Udgiri (Maharasthra, India) is compared with price of bauxite in China for the years 2000-01 to 2005-06. It should be pointed out that the Indian bauxite considered for price comparison has 54 percent AL_2O_3 while the Chinese bauxite considered has 87 percent AL_2O_3, i.e. the Chinese bauxite is superior in quality.[23] Also, the quoted price for Indian bauxite is ex-mine, while that for Chinese bauxite is F.O.B.T. Thus, to make a proper comparison, transport cost and loading/unloading costs has to be added to the quoted price of Indian bauxite. It seems, however, that even if adjustments are made for these differences, the price of Indian bauxite is lower than that of Chinese bauxite.

Table 3.2.3: Price of Bauxite, India and China, 2000-01 to 2005-06

Year	Price of Bauxite in India (A grade, Ex mine, Udgiri), 54% AL_2O_3, US$/tonne	Price of Bauxite in China, 87% AL_2O_3, US$/tonne, F.O.B.T.	Ratio of price in India to that in China
2000-01	9.3	77	0.12
2001-02	9.4	75	0.13
2002-03	9.3	79	0.12
2003-04	9.5	97	0.10
2004-05	9.7	148	0.07
2005-06	9.9	148	0.07

Note: Data on price of bauxite in India taken from Indian Mineral Yearbook. Data on price of bauxite in China taken from Indian Mineral Yearbook.

One problem with the price comparison in Table 3.2.3 is that the qualities of the Indian and Chinese bauxite considered are quite different. Available information on international bauxite prices indicates that the prices of metallurgical grade bauxite (which

[23] Availability of data on prices has dictated the price quotation for Indian bauxite to use for price comparison. Price quotation for all six years between 2000-01 and 2005-06 is available for only a few bauxite mines, and among them, the quotation for best quality of bauxite has been used.

has relatively lower AL_2O_3 content) in international markets are much lower than the prices of refractory grade bauxite. According to some estimates, the global price of metallurgical grade bauxite in 2006 was in the range of US$25 to US$35 per tonne (FOB).[24] By comparison, the price of refractory grade bauxite in 2006 was much higher. For instance, the price of refractory grade bauxite (min 87% AL_2O_3) from Guyana was US$ 207.5 per tonne (CIF Rotterdam) in January 2006.[25]

Bulk of the bauxite produced in India has AL_2O_3 content in the range of 40 to 45% or below 40% (Indian Mineral Yearbook, 2006).[26] Therefore, to make a more appropriate price comparison, the price of Indian bauxite should be compared with metal grade bauxite prices in international markets.

The average price (FAS) of bauxite imported by the US in the period 2000 to 2006 ranged between US$ 19 and 28 per tonne.[27] It seems this is the price of metal grade bauxite (at source) imported by the US. The price of bauxite imported by the US is compared with the price of Indian bauxite in Table 3.2.4. For this purpose, the price of metal grade bauxite mined at Lohardaga (Jharkand, India) has been used. The quoted figures on prices of metal grade bauxite of Lohardaga are ex-mine, and the bauxite has 40-45% AL_2O_3 content.

[24] Cape Alumina press release, August 15, 2006.
[25] Commodity price information, brought out by Bundesnstalt fur Geowissenscaften und Rohstoffe, section Mining Economics, Hannover.
[26] According to Indian Mineral Yearbook, 2006, about 86% resources are of metallurgical grade.
[27] The source of this data is the US Geological Survey, Mineral Commodity Summaries. According to this data source, the source-wise distribution of US imports of bauxite during 2003-06 was as follows: Guinea (29%), Jamaica (23%), Brazil (20%), Guyana (12%) and other countries (16%).

Table 3.2.4: Prices of Bauxite in India and Bauxite Imported by the US, 2000 to 2006

Year	Price of metal grade Bauxite in India (Ex mine, Lohardaga), 40-45% AL_2O_3 US$/tonne	US Import Price of Bauxite, US$/tonne, FAS	Ratio of price in India to the US Import price
2000	NA	23	NA
2001	NA	23	NA
2002	4.8	20	0.24
2003	5.0	19	0.26
2004	5.5	22	0.25
2005	5.5	26	0.21
2006	NA	28	NA

Note: Data on price of bauxite in India taken from Indian Mineral Yearbook. Data on price of bauxite imported in the US taken from US Geological Survey, Mineral Commodity Summaries.
NA = not available.

It is evident from Table 3.2.4 that compared to the US import prices of bauxite, the prices in India are low. The ratio of the two prices is about 0.24 on an average. It should be noted that the Indian prices given in the table are ex-mine while the US price are FAS. For making a proper price comparison, the cost of in-land transport and the cost of loading and unloading needs to be added to the ex-mine price of bauxite of Lohardaga shown in the table. Once that is done, the gap between the two prices will reduce. However, it seems that even after making such adjustments, the Indian price will be found to be lower than that international price of metal grade bauxite.

Table 3.2.5 presents a comparison of domestic prices of bauxite with unit value of export for the years 2000-01 to 2005-06. Unit value of exports has been compared with both the price of Udgiri A-grade bauxite and the price of Lohardaga metal grade bauxite. It is seen that the Udgiri bauxite price is less than unit value of exports by a substantial margin in several years during this period. The average of the ratio of Udgiri bauxite price to unit value of exports is about 0.5. Similarly, the price of metal grade bauxite of Lohardaga is substantially lower than the unit value of exports. In this case, the ratio of domestic price to unit export value is found to be about 0.23 on average. Since the prices at Udgiri and Lohardaga are ex-mine, cost of in-land transport and handling need to be added to make a proper comparison with FOB export price. It seems that even after such adjustments are made, the domestic price of bauxite is lower than the export price.

Table 3.2.5: Price of Bauxite and Unit Value of Exports, India, 2000-01 to 2005-06

Year	Price of A grade Bauxite in India (Ex mine, Udgiri), 54% AL_2O_3, Rs /tonne	Price of metal grade Bauxite in India (Ex mine, Lohardaga), 40-45% AL_2O_3, Rs /tonne	Unit value exports, non-calcined bauxite, fob (Rs/ tonne)	Ratio of domestic price to unit value of exports, (a)/(c)	Ratio of domestic price to unit value of exports, (b)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	425	NA	532	0.80	NA
2001-02	450	NA	1251	0.36	NA
2002-03	450	230	668	0.67	0.34
2003-04	437.5	230	844	0.52	0.27
2004-05	437.5	245	1862	0.23	0.13
2005-06	437.5	245	1338	0.33	0.18

Note: Data on price of bauxite in India taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

In this context, some information on price of bauxite at company level may be presented. From the available company level database (*Capitaline*), it is found that in 2005-06, MALCO (Madras Aluminium Company) bought about 328 thousand tonnes of bauxite at an average price of Rs 353 per tonne, which is much lower than the unit export value for 2005-06.

3.2.4 Subsidy and Protection

The low price of bauxite in India as compared to the international prices of bauxite provides a cost advantage to the domestic aluminium industry. However, the price of bauxite is not administered or controlled by the government, and therefore this should not be interpreted as a subsidy. At the same time it needs to be recognized that there is a significant gap between the domestic price of bauxite and the export price of bauxite which hints at the market forces not being able to play themselves out fully. One possible reason for this divergence in prices is that a portion of the bauxite reserves are under lease with firms that produce alumina and aluminium in the country and the interest of the firms lies in exporting alumina or aluminium rather than exporting bauxite.

The existing bauxite reserves are large in relation to the current rate of extraction. Annual production of bauxite in 2006-07 was about 13 million tonnes (Source:Annual Report of Ministry of Mines, 2006-07, http://mines.nic.in/), while proved and probable reserves are about 899 million tonnes (Indian Mineral Yearbook, 2006, Indian Bureau of Mines, Government of India, Ministry of Mines). The depletion premium may therefore be taken as small at present.[28]

Information on royalty on bauxite mining is not readily available. Available limited information suggests that the rate of royalty and cess on bauxite in Orissa was about Rs 64 per tonne a few years ago. This was more than 25 percent of the raising cost of bauxite (Rs 225 per tonne) of a major aluminium producing company in Orissa, namely NALCO. According to more recent information, the Orissa government got about 7.5 percent over sale of bauxite as royalty, which is based on the valuation done by the Indian Bureau of Mines (at Rs 2300 per tonne).[29] Considering all these, it seems that the rate of royalty on bauxite is higher than that on iron ore.

Turning to aluminium, the domestic prices are found to be not much different from the international prices after making adjustments for domestic indirect taxes. Also imports of aluminium are free and the basic tariff rate on imports is only 5 percent. It seems therefore that the domestic aluminium industry is not enjoying any significant protection from import competition.

[28] Although depletion premium may not be a big issue in the pricing of bauxite at present, there are environmental and social concerns associated with bauxite mining and the price of bauxite needs to reflect these costs that mining imposes on the society.
[29] "Orissa blames Mines Bureau for low price of bauxite", Economic Times, 16 September 2007.

3.3 DAP (Di-ammonium phosphate) and Rock Phosphate

3.3.1 Current Tariff and Trade Policy

DAP is freely importable. The basic import duty rate is 5%. There is no CVD. Thus, total import duty is 5%. There are no non-tariff barriers on imports of DAP. Exports of DAP is subject to export license and a further restriction that no concession/subsidy is claimed for the quantity exported.

Imports of Rock phosphate (natural calcium phosphate, ground and un-ground, HS 25101010 and 25102010) are free. The basic import duty rate is 5%, and there is no CVD. There are no restrictions on exports of rock phosphate.

Phosphoric acid is made from rock phosphate and it is used for manufacture of DAP. Imports of phosphoric acid are free. The basic duty rate is 7.5 percent. There is a CVD of 16.48 percent and special CVD of 4%. Thus total import duty rate on phosphoric acid is about 31%. However, phosphoric acid imported for manufacture of fertilizer is subject to a basic import duty of 5% and there is no CVD or special CVD. Thus, the import duty rates applicable to rock phosphate, phosphoric acid used in fertilizer production and DAP are the same (5%). There are no export restrictions on phosphoric acid.

3.3.2 Price comparison – DAP

Price of DAP realized by manufacturers of DAP in India is not readily available. An estimate of DAP price has been made on the basis of the retail price of DAP and the concession or subsidy being given to DAP manufacturers per tonne of DAP. Since data on actual retail price is not available, the maximum retail price (net of VAT, sales tax etc) is considered. A comparison of the domestic price of DAP with international price for different years during 2000-01 to 2005-06 is presented in Table 3.3.1.

Table 3.3.1: Comparison of Price of DAP, Price in India and in the US Gulf, 2000-01 to 2005-06

Year	Price of DAP in India*, US$/tonne	Price of DAP in US Gulf Coast, US$/tonne	Ratio of price in India to that in the US
2000-01	283	154	1.84
2001-02	272	148	1.83
2002-03	245	158	1.55
2003-04	274	179	1.53
2004-05	316	221	1.43
2005-06	346	247	1.40

* This is based on maximum retail price (excluding VAT, sales tax etc) and the rate of concession (subsidy) per tonne.

Note: Data on the price of DAP in India taken from Fertilizer Statistics, Fertilizer Association of India, New Delhi and the price in US Gulf coast taken from International Financial Statistics, Yearbook 2005 and World Bank Commodity Price Data, http://siteresources.worldbank.org/INTPROSPECTS/Resources/pnk_0805.pdf

Table 3.3.1 reveals that the price of DAP in India differs significantly from the international price. The Indian price exceeded the international price by 40 to 84 percent in the period 2000-01 to 2005-06. The average ratio of the Indian price to the international price was 1.6.[30]

Next, a comparison is made between the domestic price of DAP and the unit import value. This comparison for the period 2000-01 to 2005-06 is presented in Table 3.3.2. From the comparison, it is found that the price of DAP realized by domestic producers exceeded the unit import value by about 60% in 2000-01 and 2001-02. In more recent years, the gap has narrowed. Thus, in 2004-05 and 2005-06, the gap between the price realized by domestic producers and the unit import value was 15% and 18% respectively. The gap narrows further once it is recognized that the domestic price of DAP used for the price comparison is at the retail level and includes distribution cost (say, somewhere around Rs 500 to 1000 per tonne).

[30] It should be noted that the Indian price is at the retail level and thus includes distribution cost. The excess of the Indian price over the international price is therefore somewhat exaggerated.

Table 3.3.2: Comparison of Domestic Price of DAP with Import Unit Value, 2000-01 to 2005-06

Year	Price of DAP in India* Rs per tonne	Unit Value Imports Rs per tonne	Ratio of price in India to unit value imports
2000-01	12938	8127	1.59
2001-02	12950	8039	1.61
2002-03	11876	8835	1.34
2003-04	12604	9574	1.32
2004-05	14176	12338	1.15
2005-06	15303	12972	1.18

* This is based on maximum retail price (excluding VAT, sales tax etc) and the rate of concession (subsidy) per tonne.
Note: Data on the price of DAP in India have been taken from Fertilizer Statistics, Fertilizer Association of India, New Delhi. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

The relatively large gap between the price of DAP realized by domestic producers in India and the international price of DAP in 2000-01 and 2001-02, as evident from Tables 3.3.1 and 3.3.2, is traceable partly to the difference in the rates of concession given to imported and indigenous DAP. This may be seen from Table 3.3.3.

In 2000-01 and 2001-02, the concession given to indigenous DAP ranged from Rs 3400 to Rs 4450 per tonne, while the concession given to imported DAP ranged from Rs 1050 to 2550 per tonne. From July 2004, the rates of concession given to indigenous and imported DAP were equalized. However, a gap between the rates of concession given to indigenous and imported DAP reappeared in January 2006. During 2006-07, the rates of concession were fixed at Rs 5,206 per tonne for imported DAP and Rs 6,355 for indigenous DAP.[31] For 2007-08, the rate of concession was raised substantially to Rs 9398 per tonne for both indigenous and imported DAP.[32] The increase in the international price of DAP seems to have necessitated the increase in concession. The

[31] "Supply situation tight for DAP this year", article by Harish Damodaran, Business Line, June 21, 2007.
[32] A Brief on Fertilizer Sector for Economic Editors' Conference held on 14.11.2007, available at http://pib.nic.in (accessed February 23, 2008).

average international price of DAP increased from US$ 290/tonne in 2005-06 to about US$ 390/tonne in the fourth quarter of 2006-07 and to US$ 500/tonne in the first quarter of 2007-08.[33] By September 2007, the international price of DAP reached US$ 534/tonne.

Table 3.3.3: Concession (subsidy) given to domestically produced and imported DAP, 2000 to 2006

(Rs per tonne)

Year/month	Concession to Imported DAP	Concession to domestically produced DAP
April 2000	1050	4450
July 2000	1350	3700
October 2000	1550	3900
January 2001	2550	4100
April 2001	1650	4100
July 2001	1700	3600
October 2001	1350	3400
January 2002	1750	3450
April 2002	1773	2598
July 2002	1702	2591
October 2002	1687	2425
January 2003	1589	2694
April 2003	2346	2817
July 2003	2120	2987
October 2003	2061	3234
January 2004	2007	3979
April 2004	2739	4215
July 2004	4250	4250
October 2004	5181	5420
January 2005	5417	5417
April 2005	5394	4546
July 2005	5268	5596
October 2005	6148	6494/6545*
January 2006	6088	7127/7178*
April 2006	5206	6173/6355*

Source: Fertilizer Statistics, 2005-06, page I-181 to I-183 (Fertilizer Association of India, New Delhi).
* Concession given to Group I and Group II producers. Group I comprise units with natural gas as feedstock. Group II comprise units using predominantly naphtha as feedstock.

[33] Ibid.

A price of about US$500 for DAP in international markets in the early part of 2007-08 implies that the cost of imported DAP was about Rs 22,000 (exchange rate, Rs 44/US$). To this should be added, the basic customs duty of 5% and distribution cost, together coming to say Rs 1500 to 2000, bringing the total cost to Rs 23,500 to 24,000 per tonne. The permissible price of imported DAP including concession granted was only about Rs 18,748 per tonne. Evidently, the price regulations on DAP hinder DAP imports being made on a commercial basis.

3.3.3 Price comparison – Rock Phosphate

Domestic production of rock phosphate in India in 2005-06 was 1560 thousand tonnes.[34] Imports of rock phosphate during 2005 were 4816 thousand tonnes (two major sources, Jordan and Morocco). Thus, imported rock phosphate formed the dominant part of the consumption of rock phosphate in the country. It may be added here that, in 2005-06, domestic production of phosphoric acid was 1013 thousand tonnes P_2O_5 while imports of phosphoric acid were 2572 thousand tonnes P_2O_5 (three major sources, Morocco, Senegal and South Africa). The implication is that domestic production of DAP was mostly dependent on imported phosphoric acid or imported rock phosphate (used for making phosphoric acid) rather than on indigenously produced rock phosphate. Nonetheless, a comparison of the price of indigenous rock phosphate with the international prices may be instructive, and such a comparison of prices for the period 2000-01 to 2005-06 is therefore presented in Table 3.3.4.

The price comparison brings out that during 2000-01 to 2003-04, the price of rock phosphate in India was in the range of 1.1 to 1.2 of the price in Morocco, i.e. the price in India was higher but the gap was small. In 2004-05 and 2005-06, the price of rock phosphate in India exceeded the price in Morocco by 30 and 24 percent respectively. As a check on the price comparison presented in Table 3.3.4, a comparison of the domestic price of rock phosphate has been done with the unit import value. The comparison is presented in Table 3.3.5.

[34] Fertiliser Statistics, 2005-06, Fertiliser Association of India, New Delhi. Other data on imports of rock phosphate and production and imports of phosphoric acid reported here are from this data source.

Table 3.3.4: Comparison of Price of Rock Phosphate, Prices in India and Morocco, 2000-01 to 2005-06

Year	Price of Rock Phosphate in India, concentrate 34% P_2O_5, ex-mines, Jhamarkotra (Rajasthan), US$/tonne	Price of Rock Phosphate in Morocco, 70% BPL, Casablanca, US$/tonne	Ratio of price in India to that in the Morocco**
2000-01	50.0	43.8	1.14
2001-02	46.1*	41.8	1.10
2002-03	45.5*	41.0	1.11
2003-04	48.2*	40.5	1.19
2004-05	53.4*	41.0	1.30
2005-06	57.1	46.0	1.24

* Price does not include royalty at the rate of 11% ad valorem.
** Adjustments made for phosphate content.
BPL= Bone Phosphate of Lime = 2.1852* P_2O_5
Note: Data on the price of rock phosphate in India is taken from Fertiliser Statistics, Fertiliser Association of India, New Delhi and the price of rock phosphate in Morocco is taken from International Financial Statistics, Yearbook , 2005. The price of Moroccan rock phosphate for 2005-06 has been taken from Commodity price information, brought out by Bundesnstalt fur Geowissenscaften und Rohstoffe, section Mining Economics, Hannover

Table 3.3.5: Comparison of Price of Rock Phosphate, Prices in India with Unit Import Value, 2000-01 to 2005-06

Year	Price of Rock Phosphate in India, concentrate 34% P_2O_5, ex-mines, Jhamarkotra (Rajasthan), Rs/tonne	Unit Value of Imports (Rs/tonne)	Ratio of price in India to unit import value
2000-01	2285	2340	0.98
2001-02	2198*	2185	1.01
2002-03	2200*	2286	0.96
2003-04	2215*	2605	0.85
2004-05	2400*	3162	0.76
2005-06	2528	3107	0.81

* Price does not include royalty (at the rate of 11% ad valorem).
Note: Data on the price of rock phosphate in India is taken from Fertilizer Statistics, Fertilizer Association of India, New Delhi. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

Price of rock phosphate in India was close to the import unit value in the years 2000-01 to 2002-03. During the period 2003-04 to 2005-06, the price of rock phosphate in India was lower than the unit value of imports by about 20% on average.

3.3.4 Subsidy and Protection

Since the use of indigenous rock phosphate for production of DAP in India is relatively small as compared to the use of imported rock phosphate and imported phosphoric acid for producing DAP in the country, the issue of subsidy for indigenous rock phosphate is not so important. The price of rock phosphate sold by the Rajasthan State Mines and Minerals Limited (which is the main producer of rock phosphate in India) is lower than the unit import value. But, it is not clear if this amount to a subsidy, since the quoted price is ex-mines (Jhamarkotra mines). An element of subsidy cannot, however, be ruled out because it may be noted from Table 3.3.5 that the quoted price indigenous rock phosphate has grown between 2000-01 to 2005-06 at a rate much lower than the growth rate in unit import value.

Import and tariff policy for DAP does not provide any significant protection to domestic DAP production. However, during 2000-01 to 2003-04, the price regulations (differential concession on indigenous and imported DAP) created a situation that encourages domestic production to replace imports. Indeed, there was a downward trend in the ratio of imports to domestic production in the period 2000-01 to 2004-05, as may be seen from Table 3.3.6.

In 2005-06, there was a marked increase in imports of DAP. In 2006-07, there was a further increase in imports of DAP. The domestic production of DAP, on the other hand, declined between 2004-05 and 2006-07. As result, the ratio of imports to domestic production has gone up substantially (Table 3.3.6). The fact that the rates of concession for indigenous and imported DAP were equalized in 2004 must have helped in raising the share of imports in domestic consumption of DAP.

Table 3.3.6: Production and Imports of DAP in India, 2000-01 to 2005-06

Year	Production of DAP	Imports of DAP	Ratio of imports to domestic production of DAP
2000-01	4882	680	0.14
2001-02	5091	622	0.12
2002-03	5236	215	0.04
2003-04	4709	677	0.14
2004-05	5172	511	0.10
2005-06	4554	1284	0.28
2006-07	4851	2983	0.61

Note: Data on production of DAP in India has been taken from Fertiliser Statistics, Fertiliser Association of India, New Delhi. Data for 2006-07 have been taken from ‘A Brief on Fertilizer Sector for Economic Editors’ Conference, 2007’ cited earlier. Data on imports of DAP have been taken from the website of the Ministry of Commerce, Government of India.

The domestic DAP manufacturing industry does not enjoy any significant protection. Rather, the industry is probably dis-protected at present in the sense that the price realized by domestic manufacturers of DAP is somewhat less than the price they would have realized by selling in international markets. Average international price of DAP had reached US$ 530 per tonne in September 2007 which translates into a rupee-equivalent price of about Rs 21,000. The price realization in domestic market was about Rs 19,000.

3.4 Copper

3.4.1 Current Tariff and Trade Policy

Copper ore and concentrate are freely importable. Copper basic metal and products are also freely importable (only a few product line at 8-digit HS are restricted). There are no restrictions on exports of copper ore and concentrate and on copper base metal and products.

The basic rate of duty on imports of copper ore and concentrate is 2 percent and special CVD is 4 percent. The basic rate of duty on copper base metal is 5 percent. Along with CVD (16.48 percent) and special CVD (4 percent), the total rate of duty on imports is about 28 percent.

3.4.2 Price comparisons

Table 3.4.1 presents a comparison of price of copper in the Indian markets with that in the London Metal Exchange for the period 2000-01 to 2005-06. Price of copper cathodes and wire bars (average of the two) in India is compared with the price of A-grade copper in the London Metal Exchange. The comparison reveals that the Indian prices were significantly above the price quoted in the LME. A part of the difference is due to the indirect taxes included in the domestic prices (excise duty rate was about 16 percent during the period 2000-01 to 2004-05). But, even after taking into account the domestic indirect tax on copper, the difference between the price in India and that in LME is significant (particularly in the period 2000-01 to 2003-04).

Table 3.4.1: Comparison of Price of Copper between Mumbai and Delhi (India) Markets and London Metal Exchange, 2000-01 to 2005-06

Year	Price of copper cathodes and wire bars (average) in India (Mumbai), US$/tonne	Price of A grade copper in London Metal Exchange, US$/tonne	Ratio of price in India to that in London Metal Exchange
2000-01	2890	1813	1.59
2001-02	2696	1578	1.71
2002-03	2556	1559	1.64
2003-04	3262	1779	1.83
2004-05	4081	2865	1.42
2005-06	4930	3678	1.34

Note: Data on price of copper cathodes and wire bars in India have been taken from Indian Mineral Yearbook. Data on price of A grade copper in the London Metal Exchange have been taken from UNCTAD Commodity Price Statistics On-line, http:/www.unctad.org/Templates/Page.asp?intItemId=1889&lang=1.

A comparison of domestic price of copper with the unit values of imports and exports is presented in Table 3.4.2. The domestic prices are for copper cathodes and wire bars (average). The unit values of imports and exports are also for such products. It is observed from the table that the domestic prices are well above the unit values of imports and exports. A significant gap remains even if adjustments are made for domestic indirect taxes on copper.

Table 3.4.2: Price of Copper and Unit Value of Imports and Exports, India, 2000-01 to 2005-06

Year	Domestic price cathode and wire bar (average), Mumbai (Rs/ tonne)	Unit value imports (Rs/ tonne)	Unit value exports (Rs/ tonne)	Ratio of price in India to unit import value (a)/(b)	Ratio of price in India to unit export value (a)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	132040	68996	90885	1.91	1.45
2001-02	128570	91777	88863	1.40	1.45
2002-03	123690	83530	75793	1.48	1.63
2003-04	149880	84576	83031	1.77	1.81
2004-05	183365	102189	90365	1.79	2.03
2005-06	218290	151176	136161	1.44	1.60

Note: Data on price of copper cathodes and wire bars in India have been taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

3.4.3 Subsidy and Protection

The price comparison presented in Section 3.4.2 above indicates that the domestic copper industry was enjoying significant protection against import competition during the period 2000-01 to 2005-06. This is particularly brought out by the fact that the domestic prices of copper cathodes and wire rods were much higher than the unit value of imports of these products. Given that imports of copper are freely allowed and the basic import duty is low, the source of protection of domestic industry is unclear.

It may be pointed out that in 2006 there was a sharp rise in the price of copper in international markets. The price of A grade cathode increased from US$3678/tonne in

2005 to US$ 6607/tonne in January-September 2006.[35] During April-July 2006, the price of cathodes in Mumbai markets was about Rs 300 per kg, which comes to about US$ 6800/tonne (taking the exchange rate as Rs 44/US$). Evidently, the gap between domestic and international price was considerably narrowed by the middle of 2006.

In this context, some facts about the domestic copper industry may be given here. There three major firms in the domestic industry: one in the public sector (Hindustan Copper Limited) and two in the private sector (Sterlite Industries Limited and Hindalco). Hindustan Copper Limited is a primary producer, which mines and refines copper. The other two firms are secondary producers; these process indigenous and/or imported copper concentrate. Hindalco has acquired copper mines in Australia.

Domestic capacity and production of copper production has grown rapidly. However, the consumption of copper has not kept pace. In consequence, India has emerged as an exporter of copper. In 2006, the value of imports of copper and copper products was about Rs 39 million while the value of exports of copper and copper products was about Rs 67 million.[36]

3.5 Coal

3.5.1 Current Tariff and Trade Policy

Coal is freely importable. The basic import duty rate on coking coal is nil at present. For coal other than coking coal, the basic import duty rate is 5%. Total duty including education cess is 5.15%. There are no non-tariff barriers on imports of coal. Also, there are no restrictions on exports of coal.

Coking coal is being imported by Steel Authority of India Ltd (SAIL) and other Steel Sector manufacturing units. However, coal-based power plants, cement plants, captive power plants, sponge iron plants, industrial consumers and coal traders are

[35] Average price for 2006 was US$ 6721 per tonne.
[36] *Indian Copper Industry*, October 2006, ICRA Information, Grading and Research Services, ICRA limited (www.icra.in).

importing non-coking coal. Coke is imported mainly by pig-iron manufacturers and Iron & Steel sector consumers using mini-blast furnace. Though, there are no restrictions on export of coal under the existing policy, India is not a major exporter of coal. It essentially caters to the demands of neighboring countries like Bangladesh, Nepal and Bhutan[37].

Import duty on imported coal in 2002-03 was 5 % for coking coal having ash up to 12% and import duty was 15 % for coking coal having ash above 12 %. But the duty on non-coking coal wish ash content up to 12 % was increased from 15 per cent to 25 per cent in 2002 at the instance of Coal India Ltd to provide support to domestic production of such coal against import competition. The duties were subsequently amended in 2004. The duty rate was set at 0% for coking coal having up to 12% ash[38] and 15% for coking coal having ash 12% and more. For non-coking coal and coke, the duty rate was set at 5%.[39] In 2006-07, the duty on coking coal, having ash content above 12%, was reduced to 5.1 per cent and the duty rate on non-coking coal and coke was set at 5% if used for metallurgical purposes.[40] As mentioned above, in the Central Budget 2007-08, Coking Coal was made duty free and duty on non-coking coal and coke was fixed at 5.2 per cent.

3.5.2 Price comparisons

Indian coal has high ash but is relatively low on sulphur. Also, Indian coal has low calorific values (ash content of 40% and above; and UHV[41] of average 4000 K.cal/kg).[42] On the other hand, imported coal has low ash content and high calorific value. For instance, the Australian thermal coal, for which the price data are available, has low ash (about 14%), low sulphur content (less than 1%) and high calorific value (UHV of 12000 BTU/lb on average).[43] Therefore, in order to make a proper price comparisons with Australian coal, for India, the price for non-coking coal grade A has been taken, which

[37] Ministry of Coal-Annual Report:2006-07, India.
[38] Coking coal having less than 12% ash content is mostly used by steel industry.
[39] http://coal.nic.in/eximp.html.
[40] Non-coking coal is also used in thermal power generation.
[41] UHV = Useful Heat Value.
[42] Overview of coal mining industry in India, Future Prospects and Possibilities, Partha S. Bhattacharya, 7 June 2007 available at http://www.fe.doe.gov/international/Publications/cwg_june07_ocmii.pdf.
[43] BTU/lb = British Thermal Unit per pound.

has UHV of 6200kcal/kg. Further since the UHV for Indian coal and imported (Australian) coal is different, both the Indian and Australian coal prices have been converted to standard units of US$/MMBTU.[44] The price comparison is presented in Table 3.5.1 for the years 2000-01 to 2005-06.

One point to be noted before making a comparison of the prices shown in Table 3.5.1 is that the Indian price shown in the table is ROM (Run-of-Mine) and the international price is at an international port. Thus, domestic price excludes royalty/cess/sales tax which comes out to be around 57%[45] and international price excludes freight to India. Keeping this in mind, it can be seen from the table that even after adjusting for the relatively lower heat value of Indian coal, the price of coal in India is lower than international price. Price of Indian coal was 70% to 90% of the price of Australian coal in the years 2001-02 to 2003-04, but after that it was around 60% of the price of Australian coal. This indicates that Indian coal is internationally competitive at mine mouth. Further it seems that the Indian coal is competitive also in most inland locations.

Table 3.5.1: Price of Coal, India and Australia (New Castle / Port Kembia), 2000-01 to 2005-06

Year	India US$/MMBTU*	Australia New Castle/Port Kembia) US$/MMBTU**	Ratio of Price in India to that of Australia
2000-01	1.03	0.99	1.03
2001-02	0.87	1.22	0.71
2002-03	0.88	1.02	0.86
2003-04	0.94	1.05	0.90
2004-05	1.11	2.00	0.56
2005-06(P)	1.13	1.80	0.63

P = Provisional

Note: Data on price of coal in India taken from Indian Mineral Yearbook. Data on price of Australian coal taken from CMIE's Beacon Software and World Bank Commodity Price Data, http://siteresources.worldbank.org/INTPROSPECTS/Resources/pnk_0805.pdf

[44] MMBTU = million BTU.

[45] Overview of coal mining industry in India, Future Prospects and Possibilities, Partha S. Bhattacharya, 7 June 2007 available at http://www.fe.doe.gov/international/Publications/cwg_june07_ocmii.pdf.

Tables 3.5.2 through 3.5.4 present a comparison of domestic price with unit value of imports and exports for coking, non-coking and semi-coking coal. It can be seen from the tables that the domestic price is in general lower than the unit value of imports as well as unit value of exports for all the varieties of coal. The domestic price of coal is expected to be lower than the price of imported coal because imported coal has higher calorific value. As regards the difference between domestic price and export price of coal, it should be noted that the former is run-of-mine while the latter is FOB. Thus, even if these two types of coal do not differ in terms of calorific value, the prices would differ because the unit export value would include the cost of inland transport and handling.

It may be noted further from the table that the margin between domestic price of coal and unit value of exports is relatively small in the cases of coking coal and semi-coking coal. By contrast, the domestic price of non-coking coal was well below the unit value of exports in most years during the period 2000-01 to 2005-06. As regards the gap between domestic price and import unit value, it is relatively bigger in the case of coking coal than in the cases of non-coking coal and semi-coking coal.

Table 3.5.2: Price of Coking Coal and Unit Value of Imports and Exports

Year	Domestic Price Rs/tonne	Unit value imports (Rs/ tonne)	Unit value exports (Rs/ tonne)	Ratio of price in India to unit import value (a)/(b)	Ratio of price in India to unit export value (a)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	1301	2131	1293	0.61	1.01
2001-02	1257	2514	1546	0.50	0.81
2002-03	1344	2622	1922	0.51	0.70
2003-04	1344	2825	1595	0.48	0.84
2004-05	1610	4280	1575	0.38	1.02
2005-06	1610	5646	1887	0.29	0.85

Note: Data on price of coal in India have been taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

Table 3.5.3: Price of Non-Coking Coal and Unit Value of Imports and Exports

Year	Domestic Price Rs/tonne	Unit value imports (Rs/ tonne)	Unit value exports (Rs/ tonne)	Ratio of price in India to unit import value (a)/(b)	Ratio of price in India to unit export value (a)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	1152	1579	1647	0.73	0.70
2001-02	1016	1807	1948	0.56	0.52
2002-03	1043	1534	1896	0.68	0.55
2003-04	1066	1518	1831	0.70	0.58
2004-05	1232	2393	1548	0.51	0.80
2005-06	1232	2404	1821	0.51	0.68

Note: Data on price of coal in India have been taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

Table 3.5.4: Price of Semi-Coking Coal and Unit Value of Imports and Exports

Year	Domestic Price Rs/tonne	Unit value imports (Rs/ tonne)	Unit value exports (Rs/ tonne)	Ratio of price in India to unit import value (a)/(b)	Ratio of price in India to unit export value (a)/(c)
	(a)	(b)	(c)	(d)	(e)
2000-01	1411	1923	1267	0.73	1.11
2001-02	1360	2020	1401	0.67	0.97
2002-03	1310	1682	1670	0.78	0.78
2003-04	1310	1588	1840	0.82	0.71
2004-05	1570	2643	1811	0.59	0.87
2005-06	1570	2552	1324	0.62	1.19

Note: Data on price of coal in India have been taken from Indian Mineral Yearbook. Unit values have been computed from trade data obtained from Monthly Statistics of Foreign Trade of India, Government of India

3.5.3 Subsidy and Protection

Coal prices were partially deregulated in 1997 (grades A to D) and completely deregulated in January 2000 (grades E to G).[46] Price of coal is fixed by two public sector companies, CIL and SCCL, which operate as exclusive producer cum trader of

[46] Ministry of Coal, Government of India, New Delhi, (Report, Part-I) December 2005.

coal in India. But, in fact, the price to be fixed by the companies is guided by the Ministry of Coal, Government of India. It is determined on the basis of costs incurred in its production from different coal mines of a coal company plus a reasonable profit margin. About 80% of the domestic production of coal is used for power generation (utilites plus captive). CIL supplies coal to its core sector consumers at a competitive price per energy unit at consumption point vis-à-vis imported coal.[47]

There is an element of subsidy in the pricing of coal in India. As mentioned above the price of coal is lower than the price of imported coal in terms of the standard units of US$/MMBTU. Price of coal is low also in comparison with the price of fuel oil expressed in standards units of US$/MMBTU.[48] The market is not able to play a significant role in determining price since there is a system of allocation of coal to the users. The rationale for the present system lies in the complex system of subsidies that exists in the power sector. Some discussion on the power sector would therefore be in order here.

At present, there are government subsidies including cross subsidies to the power sector in India. The electricity tariffs in India vary widely according to customer category. There are large cross subsidies between various categories. The tariffs for household and agriculture have been generally below actual supply costs, whereas for other categories, i.e., industrial, commercial and Railways, it has been above the utilities' average cost of supply. In 2006-07, direct transfers from state governments to the state electricity boards reached Rs. 138.7 billion. This is in addition to an uncovered subsidy of Rs. 212.01 billion.[49]

Large subsidies for power are being given to the agriculture sector and households. For instance, according to 1999-2000 data, the rate of subsidy as a proportion

[47] Overview of coal mining industry in India, Future Prospects and Possibilities, Partha S. Bhattacharya, 7 June 2007.

[48] Unit import value of fuel oil in 2005-06 was US$315 per tonne and unit export value of fuel oil, US$270 per ton. This translates into US$6.5 to 7.5 per million BTU (since the calorific value of one kg fuel oil is 41,430 BTU). The price of A-grade non-coking coal in India in standard units is about US$ 1 per million BTU.

[49] Information source: Ministry of Finance, Government of India.

of the full cost of supply reference price amounted to 93% for agriculture and 58% for households. As per an IEA study[50], using a –0.75 direct price elasticity of demand for the household, industry and agriculture sectors, total electricity use would be 40% lower in the absence of all subsidies. This in turn will lead to reduced use of fuel inputs, coal and oil in thermal power plants also to the extent of 40% assuming that the removal of subsidies on electricity sales will reduce the demand for fuel inputs to power generation in equal proportion. The government is also promoting a switch from coal-fired to natural-gas plants for power generation and cutting subsidies for low-quality coal -- part of a general move to market pricing for energy and anti-pollution measures.

As per recommendations of Integrated Energy Supply, 2006 Report, Coal will continue to be the dominant fuel till 2031-2032. This may have been because the cost of electricity generation as per 2003 data is 1.8 to 2.0 cents per kwh using coal as against 5.2 to 15.9 cents per kwh using natural gas. Also because the natural gas reserves are mainly offshore or natural gas is imported from neighbouring countries. The other issue which is important in making a choice between these alternate fuels, coal versus natural gas, is the difference in transportation cost for these two fuels, being 10% in case of coal and 1 % in case of natural gas up to a distance of 1000 km. Therefore, the cities which are close to cheap power sources based on coal rely on power generated by coal while cities like Bangalore rely on expensive natural gas based power[51].

Power tariffs in India particularly for industry, commercial and large households have been the highest in the world on purchasing power parity (PPP) basis. As per IEP2006 report[52], in 2002 it was 30.8 US cents per kwh in India as against 7.7 in US, 9.5 in Germany, 15.3 in Japan, 20.6 in China and 27.6 in Brazil. Thus power tariffs in India have to be brought down to ensure competitiveness of Indian industry. The implication is that if the current pattern of cross subsidization continues (with agriculture getting large electricity subsidy), a subsidy in coal will have to be maintained if the cost of power to industry and commercial users have to be reduced to ensure their competitiveness. The

[50] Electricity in India, IEA, 2002.
[51] Achal Augustine, Modelling Indian Power Sector, achal@cs.utexas.edu. .
[52] Eschborn, September 2007, Energy-Policy Framework Conditions for Electricity Markets and Renewable Energies, GTZ

other option is to remove coal subsidy (at present implicit in the pricing policy) and compensate it by giving a direct subsidy for power. This will only enhance the subsidy bill of the government. At present, a part of the electricity subsidy is kept hidden by under-pricing coal made possible by the domination of two public sector players in the market.

3.6 Crude Oil and Gasoline

3.6.1 Current Tariff and Trade Policy

Imports of crude oil are free. The basic duty rate applicable on imports of crude is 5%. Additional duty is fully exempt by Central Excise schedule. There is an additional duty under Oil industry (Development) Act, 1974 at Rs 2500 per tonne with effect from 01.03.2006, but this has also been exempted. Exports of crude oil are subject to the restriction that exports can be made only through Indian Oil Corporation Limited.

Imports of gasoline (motor sprit, HS 2710 11) is restricted. Imports are allowed through Indian Oil Corporation except for companies that have been granted rights for marketing of trasportation fuels in terms of Ministry of Petroleum and Natural Gas Resolution No. P-23015/2001 dated 08.03.2002. Applicable basic duty rate on imports of gasoline is 7.5%. The additional duty on gasoline includes: (a) basic additional duty of 6% plus Rs 5 per litre, (b) additional excise (road development) duty of Rs 2 per litre, and (c) special additional excise of Rs 6 per litre. There are no restrictions on exports of gasoline.

To provide some further information about the oil sector, customs duty on crude oil was reduced from 10% since 1.3.02 to 5% since 1.3.05.[53] The government allows 100 per cent foreign equity in private refining ventures. However, FDI in refineries promoted by public sector undertakings is restricted to 26 percent. Foreign equity participation in petroleum product marketing has been capped at 74 per cent. Foreign equity investment

[53] http:/www.indiastat.com.

in oil and gas pipeline projects is currently restricted to 51 per cent.[54] The government has allowed private companies to market petroleum products in the country under some conditions. Free imports are permitted for almost all petroleum products except petrol and diesel. The government imposes a cess on indigenously produced crude oil for providing financial assistance to state owned oil companies and is not applicable to private oil producers. The cess was doubled in 2002 from Rs. 900 a tonne to Rs. 1800 a tonne on the ground of providing subsidies on LPG and Kerosene. On 1.03.06 it was increased further to Rs. 2500 a tonne. Oil is a highly taxed sector. The taxes on crude oil and natural gas add to the production cost of Kerosene and LPG and inflate their subsidy bill. In addition, a part of the cost of LPG and Kerosene is made up of sales tax and excise duty which further inflates the petroleum subsidy bill. Compared with other Asian economies, India's levies on oil tend to be high.[55]

3.6.2 Pricing – Crude Oil

Price of crude oil in India has been based on a administered price mechanism (APM) prior to April 2002. APM has officially been dismantled since April 2002 to rationalize oil prices in India. However, the Government continues to play a major role in determination of prices. Now, crude oil price in India has a high correlation with the international market price. Even the prices of petroleum products are allowed to vary in the band of +/- 10% keeping in line with international crude price subject to certain government laid down norms keeping in mind economic and social considerations. The APM has thus yet to be fully dismantled and hence the shift to a market based pricing system is incomplete.

India imports about three-fourths of its crude oil requirements. Prices of crude oil in India are based on the principle of import parity. The composition of Indian crude basket represents average of Oman & Dubai for sour grades and Brent (dated) for sweet grade. The ratio of sour and sweet crude in terms of the price of Indian crude basket was

[54] Report of the Working Group on Petroleum and Natural Gas Sector for the XI Plan (2007-12); http://planningcommission.nic.in/aboutus/committee/wrkgrp11/wg11_petro.pdf
[55] http:/www.cuts-international.org/adv_PetroleumSubsidy.htm.

59.8: 40.2 for 2006-07, 58:42 for 2005/06 as against 57:43 in 2004/05[56]. Therefore, domestic price of crude oil has been taken as the price of crude oil of the Indian Basket.

Price of petroleum has usually reference to the spot price of either WTI/Light Crude as traded on the New York Mercantile Exchange (NYMEX) or price of Brent as traded on the Intercontinental Exchange (ICE, which the international Petroleum Exchange has been incorporated into)[57]. The price of oil is highly dependent on both its grade and location. The vast majority of oil will not be traded on an exchange but on an over the counter basis, typically with reference to a marker crude oil grade that is typically quoted via pricing agencies such as Argus Media Ltd and Platts. International petroleum exchange claims that 65% of traded oil is priced off their Brent benchmarks and other important benchmarks include Dubai, Tapis, and the OPEC basket. Thus the price considered here as the international price of oil for the purpose of price comparison is the weighted average of Dubai, Brent and West Texas Intermediate equally weighted, as this price has been reported by most of the international sources (International Financial Statistics, World Bank and UNCTAD).

Table 3.6.1: Crude Oil Prices (US Dollar/bbl), 2000-01 to 2006-07

Year	Indian Basket	Percent Change	International Price*	Percent Change	Ratio of prices India/Int.
2000-01	26.6		28.22		0.94
2001-02	21.9	-17.67	24.46	-13.32	0.90
2002-03	26.65	21.69	24.95	2.00	1.07
2003-04	27.97	4.95	28.90	15.83	0.97
2004-05	39.21	40.19	37.76	30.66	1.04
2005-06	55.72	42.11	53.37	41.34	1.04
2006-07 (up to 04/02/2007)	63.13	13.30	64.28	20.44	0.98

Source: 1).Rajya Sabha Unstarred Question No. 4056, dated 23.05.2006 for Indian Price.
2). UNCTAD http://stats.unctad.org/CPB/Table Viewer/table View.aspx for international price.
* International price is average of Dubai/Brent/Texas equally weighted.

[56] TEDDY, Report of the Energy & Resources Institute, New Delhi.
[57] Reported in Price of Petroleum-Wikipedia, the free encyclopedia, http://en.wikipedia.org/wiki/Oil_prices accessed on December 27, 2007.

A comparison of domestic and international price of crude oil (Table 3.6.1) shows that there has been considerable volatility in the prices of crude oil. Price of Indian basket of crude oil has increased continuously since the dismantling of APM in 2002-03. The price of both the Indian basket of crude as well as international price has increased steeply from 2004-05 onwards. The increase has been substantial during 2004-05 and 2005-06 at around 30-40%. However, in the following year, the prices increased by a lower margin.[58] The comparison between domestic price and international price confirms that there has been more or less a parity between domestic price and international price of crude oil.

A comparison of domestic prices of crude oil with unit value of imports shows that there has been an almost import parity pricing of crude oil in India. This may be seen from Table 3.6.2. In this context, it is interesting to make a comparison of the price of domestically produced crude oil with the international price. A comparison of prices is presented in Table 3.6.3. It is seen that the price of indigenous crude oil in 2004-05 was 16% higher than the international price. But, in 2005-06, the domestic price was 16% lower than the international price. There is an important difference between the figures on the price of domestic crude oil for the two years. The figure for 2005-06 is net of the subsidy that ONGC has provided to refineries. This represents more correctly the price that refineries have paid for the crude oil and the amount that the ONGC has received. It seems that a significant amount of subsidy is being paid by the ONGC to the refineries.[59]

[58] There was sharp increase in crude oil price in 2007.

[59] Under-recoveries of the oil marketing companies were Rs 92.7 million in 2003-04 and Rs 201.5 million in 2004-05. These under-recoveries were mostly on account of kerosene sold in the public distribution system and domestic LPG. Under-recoveries increased to Rs 400 million in 2005-06 and nearly Rs 500 million in 2006-07. Under-recoveries on account of sale of petrol and diesel formed about 40% of total under-recoveries in 2006-07. The burden of under-recoveries is being shared by various stakeholders. The upstream oil companies are sharing about one third of the under-recoveries.

Table 3.6.2: Comparison of domestic price of crude oil with import unit value

Year	Domestic Price $/bbl	Unit value imports $/bbl	Ratio of Dom price to Unit value imports
	26.6	26.12	1.02
2001-02	21.9	21.57	1.02
2002-03	26.65	25.83	1.03
2003-04	27.97	27.15	1.03
2004-05	39.21	36.44	1.08
2005-06	55.72	52.42	1.06

Note: Unit value of imports have been computed from
Monthly Statistics of Foreign Trade of India, Government of India

Table 3.6.3: Price of Domestically Produced Crude Oil compared with International Price

Year	Price of Domestically Produced Crude oil (ONGC) US$/bbl	Unit value of Imports US$/bbl	Ratio: Price of Domestically produced crude to international price
	NA	28.22	NA
2001-02	NA	24.46	NA
2002-03	NA	24.95	NA
2003-04	NA	28.90	NA
2004-05	43.9*	37.76	1.16
2005-06	44.5**	53.37	0.84

Source: Price of domestically produced crude obtained from
Indian Petroleum and Natural Gas Statistics
* includes sales tax. Gross of subsidy given by ONGC to refineries.
** includes sales tax. Net of subsidy given by ONGC to refineries.

3.6.3 Pricing of Petroleum Products

There has been dismantling of APM for all petroleum products except kerosene and LPG from April 2002. In the new system put in place, the prices of petroleum products will be market determined and will reflect international oil prices. A range of products is produced from refining of crude oil: light distillates (e.g. LPG, Motor Spirit, and Naphtha), Middle Distillates (e.g. Kerosene and High Speed Diesel) and Heavy ends (e.g.

Fuel oil and lubricants). Thus after deregulation, domestic retail prices of petroleum products start reflecting international oil prices. The pricing mechanism of petroleum products is as follows:

The refining division of petroleum companies procures crude from international markets; processes it; and transfers the products to the marketing division at the refinery gate. Margins in the refining division are embedded in the inherent crude and product price differentials in international oil markets. Thus the transfer price for products at refinery gate reflects the international product price[60] referred to as the import parity price of that product. This refinery gate price becomes the base price for the final consumer. To this are added the distribution costs; excise duties; sales tax and other local levies; and finally the marketing margin. The most crucial element in this whole list of pricing is the marketing margin. In the APM regime, this marketing margin was fixed by Government and reimbursed through the oil pool account; but after deregulation these will be determined based on market prices.

India processes about 10 million tonnes of crude oil every month. Of this, it produces around 9.5 million tonnes of petroleum products, viz, petrol, diesel, kerosene, naphtha, etc. The annual production of petroleum products in India amounts to around 117.6 million tonnes, out of which 13 per cent is exported. Refineries export mainly petrol, diesel and naphtha. As mentioned above, for petroleum products manufactured by refineries, oil refineries are paid the ‘Import parity price’, i.e., the international price plus the insurance and freight cost plus the customs duty. An important implication of this is that changes in customs duty causes change in the price received by the products produced by a refinery. Also, the difference between the basic customs duty on crude oil and that on a particular petroleum product determines the level of effective protection enjoyed by the product. [61] Thus, even though India did not import petrol in 2002 or 2003, but a cut in customs duty would have reduced the domestic price of petrol (and hence effective protection of petrol production in the country). It may be noted that the customs

[60] MCX-Multi Commodity Exchange of India Ltd.-Crude oil Report.

[61] Ila Patnaik, Oil the economy’s problem, 6 November 2004, Ila Patnaik Writing for the Mass Media, available at http://Openlib.org/home/ila/Media (accessed 27 February 2008).

duty on petrol has been reduced from 20% on 1.3.02 to 15% on 19.8.04, 10% on 1.3.05 and finally 7.5% on 14.6.06.

Gasoline or Motor Gasoline or Petrol

Pricing of petrol has been changed to trade parity which would be a weighted average of import parity and export parity prices in the ratio of 80:20. Principle of trade parity will apply for the refinery gate price as well as determining the retail price[62]. Also the relative weights of exports and imports in estimating the trade parity will be reviewed and updated every year.

A comparison of domestic price of gasoline with the FOB gasoline price of other countries is presented in Table 3.6.4. Domestic price ex-storage is taken, since that will not include sales tax and levies and thus be comparable with the FOB price of other countries. The price comparison shows that domestic prices were on an average 20 to 30 percent higher than international spot FOB price during 2000 to 2004. In 2005 and 2006, however, the domestic prices were lower than the international spot FOB prices.

Domestic price of gasoline is compared with unit values of exports and imports in Table 3.6.5. There were no imports during 2000 to 2003; hence unit values of imports are not shown. It is seen from the table that the domestic price exceeded the unit value of exports by 20% or more during 2000-01, 2001-02 and 2003-04. In more recent years, the domestic price was lower than the unit value of exports. It was lower also in comparison with the unit value of imports.

[62] Report of the Working Group on Petroleum and Natural Gas Sector for the XI Plan (2007-12); http://planningcommission.nic.in/aboutus/committee/wrkgrp11/wg11_petro.pdf.

Table 3.6.4: Domestic Price of Motor Spirit in India (ex-storage) and International Price of Gasoline-spot Price FOB

Year	Domestic Price Ex Storage US$/bbl	US Gulf Coast, Spot Price FOB US$/bbl	Rotterdam Spot Price FOB US$/bbl	Price ratio: Dom/Int US Gulf Coast	Price ratio: Dom/Int Rotterdam
2000	43.57*	35.18	34.66	1.24	1.26
2001	36.07	31.09	29.00	1.16	1.24
2002	36.05	30.29	28.18	1.19	1.28
2003	51.77	36.59	34.28	1.41	1.51
2004	53.57	49.13	47.02	1.09	1.14
2005	57.66	67.04	62.51	0.86	0.92
2006	71.18	76.68	72.43	0.93	0.98

Source: Domestic price has been taken from Indian Petroleum and Natural Gas Statistics. Spot prices for US Gulf Coast and Rotterdam have been taken from Energy Information Administration Official Statistics from the US Government
http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html

* Ex-storage price is not available for 2000. From the retail price, sales tax etc has been reduced (assumed to be 54%) to derive the ex-storage price.

Table 3.6.5: Comparison of Domestic Price of Gasoline with Unit Values of Imports and Exports, 2000-01 to 2006-07

Year	Domestic Price Ex Storage US$/bbl	Unit value of Imports US$/bbl	Unit value of Exports US$/bbl	Ratio of Dom price to Unit value Imports	Ratio of Dom price to Unit value Exports
	43.57*	-	35.22	-	1.24
2001/02	36.07	-	30.05	-	1.20
2002/03	36.05	-	35.84	-	1.01
2003/04	51.77	-	39.52	-	1.31
2004/05	53.57	65.75	58.03	0.81	0.92
2005-06	57.66	81.02	73.06	0.71	0.79
2006-07	71.18	92.57	84.36	0.77	0.84

Source: Domestic price has been taken from Indian Petroleum and Natural Gas Statistics. Unit values of imports and exports have been computed from Petroleum Planning and Analysis cell, Ministry of Petroleum and Natural Gas Statistics, Government of India website, http://www.ppac.org.in/ppac0607/IMPORT_EXPORT_0607.htm.

* Ex-storage price is not available for 2000. From the retail price, sales tax etc has been reduced (assumed to be 54%) to derive the ex-storage price.

3.6.4 Subsidy and Protection

Since the domestic crude oil producers are subsidizing the refineries, the price of domestically produced crude oil is effectively lower than the international price of crude oil, and this involves a subsidization of crude oil used by the refineries in India. The extent of subsidy is difficult to ascertain. But, there are indications that the extent of subsidy may be about 16% or more.

As regards Gasoline, the domestic production of this petroleum product enjoyed significant protection during 2000-01 to 2004-05. The domestic price of Gasoline exceeded the international price while crude oil the key natural resource used in the production of Gasoline was available at international prices. From 2005-06, the domestic price of Gasoline (ex-storage) has fallen below the international price of Gasoline. Prima facie, it would appear that the protection enjoyed by Gasoline in the early part of this decade was eliminated since 2005-06. This may not, however, be true. The losses that the petroleum product marketing are bearing are being shared by the crude oil producers and also by the government (by issue of oil bonds). These gains need to be taken into account for a proper assessment of the effective protection enjoyed by Gasoline production. There is a possibility that while the level of effective protection has come down from 2005-06, it is not eliminated altogether.

3.7 Natural Gas

3.7.1 Tariff and Trade Policy

Imports of natural gas is free whether in gaseous state or in liquid form. The basic duty on imports is 5%. Additional duty under Central Excise Tariff is exempt for natural gas in gaseous state or in liquid form. However, additional duty of Rs 300 per thousand cubic meter is levied on natural gas under Oil Industry Development Act, 1974.

3.7.2 Natural Gas Pricing

The main producers of natural gas are Oil & Natural Gas Corporation Ltd. (ONGC), Oil India Limited (OIL) and JVs of Panna-Mukta, Tapti, and Ravva. Under the Production Sharing Contracts, private parties from some of the fields are also producing gas. Government have also offered blocks under New Exploration Licensing Policy (NELP) to private and public sector companies with the right to market gas at market determined prices. Import of natural gas in gaseous or liquid form (LNG) is under Open General License (OGL) category and FDI allowed is 100%.

The domestic price of gas in India is not uniform (TEDDY, 2005/06). With deregulation of the gas market both administered prices and market determined prices coexist in the country. Gas sold by national oil and gas companies, ONGC and OIL, from the pre-NELP blocks is under APM. This price of gas was to be linked with the import parity price of a basket of fuel oils. But in fact, the principle of parity has not been implemented because of imposition of a band on the floor price and ceiling price which has been Rs 3840/Th CM from 1.06. 2006. Before the recent hike in oil prices, gas prices had reached 85%[63] of the fuel oil prices thereby coming in close proximity with the import parity price of alternate fuels. For blocks awarded before the NELP, including PMT (Panna-Mukta and Tapti) and Ravva fields, the gas is priced partly under APM and is partly market determined as these fields are partly owned by National oil company (ONGC) along with private and multinational players. Gas from PMT is supplied at $4.75 per MMBTU. The gas produced under NELP blocks can be sold at market determined prices based on the production sharing contracts and the gas sales agreements. Regassified liquefied natural gas (LNG) is sold at market-determined prices. Each LNG contract has pricing based on the gas sales and purchase agreement (GSPA). For example, Petronet LNG has signed an agreement with RasGas Qatar for supply of 5MT LNG for a period of 25 years at a price of $2.53/MMBTU (FOB) for the first five years i.e., up to 2009 and thereafter it will be crude oil indexed. The Petronet

[63] Natural gas prices as percentage of LSHS/FO prices have increased from 55% in 1997/98 to 65% in 1998/99 and 75% in 1999-00.

LNG Limited (PLL) price has also become a benchmark for non-administered gas price either imported or domestically produced. Thus, the delivered price after adjusting the shipping cost, customs duty regassification charges, marketing cost, excise and sales tax etc. comes out to be $4.42 at 9880 GCV (Infraline). At this price, LNG is comparatively cheaper than alternative fuels/feedstocks, e.g. naphtha, Furnace Oil, LSHS, Light Diesel Oil, LPG, etc.

To make a comparison of domestic price of natural gas with that of international price, the price under APM has been considered because the data for the other prices (i.e. market determined prices) are not readily available for earlier years. For north eastern states, a relatively lower price is charged for gas. Since this is a special case, the prices considered for price comparison are the consumer prices for states other than the north eastern states. These are offshore (landfall point) and on-shore prices and are exclusive of royalty, sales tax, and other statutory levies. International price considered for price comparison is the price of gas in USA (export price, FOB). Price comparison is presented in Table 3.7.1. The table shows that prices of natural gas in India has increased from $1.57 /MMBTU in 2000 to $1.83/MMBTU in 2006 as compared to $4.31/MMBTU to $6.72/MMBTU for USA respectively. The domestic price, in fact the APM price, of natural gas in India is significantly lower than international prices being 31 percent on an average. However, gas from private and multinational players PMT is supplied at $4.75 per MMBTU whereas delivered price of RLNG at 9880 GCV is $4.42/MMBTU as per TERI report (TEDDY 2005/06, p101) and infraline report. Even this price is lower than international price, being 65-70 % of that of the international price.

Table 3.7.1: Price of Natural Gas, India and USA, 2000 to 2006

Year	Price of Natural Gas, India (US$/MMBTU)	Price of Natural Gas, USA (US$/MMBTU)	Ratio of price in India to that in USA
2000	1.57	4.31	0.36
2001	1.51	3.96	0.38
2002	1.48	3.35	0.44
2003	1.56	5.49	0.28
2004	1.60	5.89	0.27
2005	1.72	8.92	0.19
2006	1.83	6.72	0.27

Note : Data on price of Natural Gas in India are taken from Fertiliser Statistics and TEDDY (TERI ENERGY DATA DIRECTORY & YEARBOOK and data on price of Natural Gas in USA are taken from CMIE's Beacon Software.

3.7.3 Subsidy and Protection

Domestic price of natural gas in India has been linked to the price of basket of international fuels oil prices based on calorie equivalence. However, when crude oil prices and with it fuel oil prices started rising, since 2002, government did not permit domestic gas prices to rise proportionately, mainly to give protection to power and fertilizer sectors. Thus gas is being supplied to power and fertilizer sectors at APM price. But E&P (exploration and production) companies under the NELP (New Exploration and Licensing Policy) were allowed to negotiate the prices with consumers. For blocks awarded before the NELP, including PMT (Panna-Mukta and Tapti) and Ravva fields, the gas is priced partly under APM and is partly market determined as these fields are partly owned by National oil company (ONGC) along with private and multinational players. The implication of this is that certain sectors of the economy are getting gas at substantially subsidized price. Other users are paying a higher price, but even these consumers are getting an implicit subsidy since the price they pay is lower than the level of prices generally prevailing in other countries.

4. Natural Resource Subsidies given by Other Countries: Impact on India

The analysis of price comparison for India presented in Section 3 above covered seven natural resources: iron ore, bauxite, copper ore, rock phosphate, coal, crude oil and natural gas. Whether dual pricing of these resources is being done in India or a subsidy is being given to the users of these resources by some other means was investigated. The analysis indicated that a system of dual pricing for natural gas is prevailing in India and that an implicit subsidy is being given to the domestic users of coal. It was noted that the domestic price of iron ore is to some extent lower than the export price which is being caused by an export tax, probably reinforced by the canalization of exports of better quality iron ore. The natural next question to study is whether other countries are practicing dual pricing for one or more of the seven selected natural resources listed above (especially those countries that are well endowed in these resources) and the impact that such practice of dual pricing has on India. In the available literature, there is some discussion on the dual pricing of natural gas, particularly for Russia and Saudi Arabia. But, very little information could be found on dual pricing in other natural resources, and this has been a constraint in studying how India is impacted by the practice of dual pricing practices by other countries. This section therefore makes an attempt to provide some rough indication of the impact of dual pricing on India on the basis of two case studies, making use of whatever sketchy information is available. The cases considered are: (1) gas pricing in Saudi Arabia and its impact on India's petrochemicals production; and (2) gas pricing in Oman, and its effect on the cost of imported urea and hence on fertilizer subsidy in India.

4.1 Natural Gas Pricing in Saudi Arabia – Effects on India's Petrochemicals Industry

The petrochemicals industry in Saudi Arabia gets natural gas at a substantially subsidized price, which provides it a major cost advantage. The government provides subsidized feedstock (ethane) to the petrochemical industry at a price of 0.75 per MMBTU much lower than the natural gas price of US$ 5.5 – 7.5 MMBTU generally prevailing elsewhere in the world.[64] Due to the availability of subsidized feedstock, the cash cost per tonne of ethylene in Saudi Arabia is US$ 69 and total cost per tonne of ethylene is US$ 143 (Table 4.1). In India, production of petrochemicals is primarily naphtha based. The cash cost per tonne of ethylene in India is US$ 374 and total cost per tonne of ethylene is US$ 697.[65] Evidently, there is a huge difference in cost per tonne of feedstock (ethylene) between Saudi Arabia and India, and hence in the cost of petrochemical products.

Table 4.1: Cost of Ethylene, Saudi Arabia and India (US$ per tonne)

	Saudi Arabia	India (naphtha based)
Cash cost	69	374
Total cost	143	697

To assess the extent of subsidy in pricing of natural gas, the benchmark price of natural gas in Saudi Arabia may be taken as about US$ 3 per MMBTU (interpreted as unregulated price of natural gas in Saudi Arabia).[66] Of the cash cost of ethylene in Saudi Arabia, about three-fourths may be taken as the feedstock cost. Thus, if subsidized pricing of natural gas in Saudi Arabia is eliminated, the cash cost of ethylene will rise to US$ 224 per tonne and total cost will accordingly rise to US$ 298 per tonne. It seems therefore that even if natural gas subsidy is eliminated in Saudi Arabia, the cost of production of petrochemicals in Saudi Arabia will still be much lower than the cost in India.

[64] Report of the Working Group on Chemicals and Petrochemicals for the 11th Five Year Plan (2007-08 to 2011-12), Petrochemicals Sector, Department of Chemicals and Petrochemicals, Government of India, February 2007.

[65] Report of the Working Group on Chemicals and Petrochemicals for the 11th Five Year Plan (2007-08 to 2011-12) cited above.

[66] This is based on the cost of Liquified Natural Gas (LNG) to Dhabol Power Project in Maharashtra. According to a press agency report of 2005, State-owned gas utility GAIL (India) Ltd was negotiating in 2005 supply of LNG to the power project from Qatar and Australia. The cost of LNG supply from Qatar was expected to be US$ 3.2 to 3.5 per MMBTU while the cost of supply of LNG from Australia was expected to be US$ 3.6 to 3.8 per MMBTU. The cost of transporting LNG from Qatar to India was expected to be US$ 0.27 per MMBTU and that from Australia, US$ 0.9 to 1.0 per MMBTU. It seems reasonable therefore to assess the LNG supply cost from Saudi Arabia at US$ 3 per MMBTU.

How much will the export price of petrochemicals from Saudi Arabia increase as a result of the hike in the cost of production of petrochemicals in Saudi Arabia after the elimination of dual pricing? This is not easy to ascertain. Some indication may be obtained by comparing the export price of petrochemicals in countries that have different feedstock prices.

While the price of ethane is 0.75 per MMBTU in Saudi Arabia, it is slightly higher in most other countries of the middle-east. The prices are shown in the table below.[67]

Table 4.2: Ethane Price in GCC Counties

Country	Price, US$ per MMBTU
Saudi Arabia	0.75
Oman	0.80
UAE (Abu Dhabi)	1.1
Kuwait	1.00 – 2.00
Qatar	1.70 – 2.00
Baharain	2.00

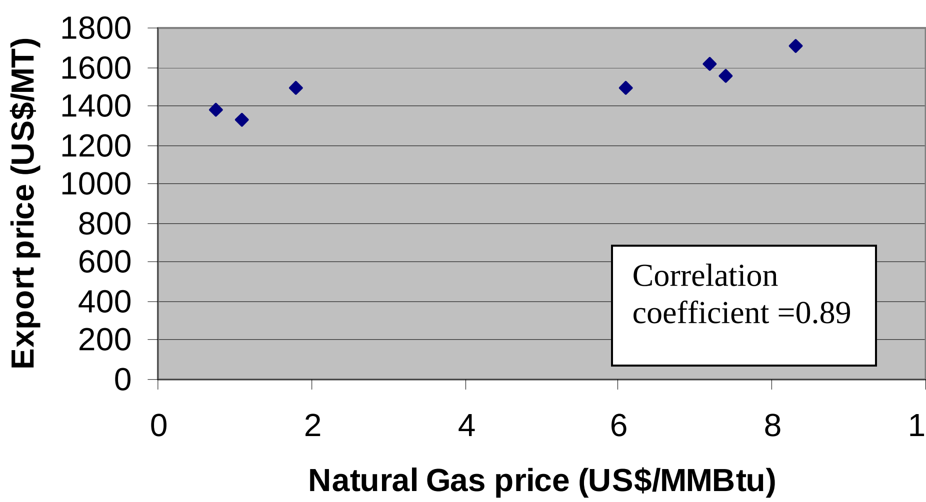
The price of feedstock in Qatar exceeds that in Saudi Arabia by about 140%. Examining unit value of imports of some important petrochemical products in India from these two countries, it is found that the unit value of imports from Qatar exceeds that from Saudi Arabia by about 4%. Extrapolating this relationship, it appears that the elimination of dual pricing of gas in Saudi Arabia will raise the export price of petrochemical products from Saudi Arabia by about 9%.

A similar comparison of natural gas price and the export price for LLDPE (linear low density polyethylene) has been done for seven countries (Canada, Germany, Japan, Qatar, Saudi Arabia, UAE, USA). This is shown in Figure 4.1 below. The export price

[67] The price information is taken from the Report of the Working Group on Chemicals and Petrochemicals for the 11th Five Year Plan (2007-08 to 2011-12) cited above

refers to the price at which LLDPE has been exported to India in the year 2006-07 (based on India's unit import value). The price of gas and export price of LLDPE has a correlation of 0.9. The estimated regression equation suggests that if the gas price in Saudi Arabia is raised from US$0.75/MMBTU to US$3/MMBTU, the export price should increase by about 6%. Thus, 6 to 9% may be a broad range in which the export price of petrochemical products of Saudi Arabia would rise after the subsidy in natural gas is eliminated.

Figure 4.1: Price of Natural Gas and Export Price of LLDPE (cross country comparison)



To assess the effect of price hike on exports of petrochemicals from Saudi Arabia, the price elasticity of demand is needed. No estimate of export price elasticity is readily available. It has been assumed therefore that the price elasticity may lie in the range of 1.5 to 2.0. Thus, the decline in export that may take place due to elimination of natural gas subsidy in Saudi Arabia is in the range of 9% to 18%. Saudi Arabia has a share of about 5% in global exports of petrochemicals.[68] India's share is on the other hand about 0.8%. If it is assumed that the fall in exports of Saudi Arabia will be proportionately

[68] Based on international trade data for 2005.

shared by other exporting countries, then India's exports should go up by 0.5% to 0.9%. The share of Saudi Arabia in India's imports of petrochemicals is about 20%.[69] As the exports of Saudi Arabia fall, there will be a decline in India's imports of petrochemicals from Saudi Arabia. Assuming that the imports from other countries do not change, the decline to total imports of petrochemicals by India would be in the range of 2 to 4%.

Total production of polymers in India in 2005-06 was 4965 thousand tonnes, while exports and imports were 746 and 412 thousand tonnes respectively. Going by the estimates of changes in exports and imports given above, the elimination of natural gas subsidy in Saudi Arabia would have led to an increase in the total domestic production of polymers in India by about 0.2% to 0.5%.

One may make a more optimistic assumption that Saudi Arabia will lose half of its export market due to hike in its cost of production of petrochemicals emanating from the elimination of subsidy in pricing of natural gas. Under those circumstances, making calculation in a manner similar to the above, it seems that India's production of petrochemical products will go up by about 1.3%. Evidently the effect on India's petrochemical industry is not large.

Besides Saudi Arabia, low gas prices exist in several other countries such as Oman, Qatar, Russia and UAE (United Arab Emirates). These five countries together account for about 6.5% of world exports of petrochemicals and their share in India's imports of petrochemicals is about 40%. If the gas subsidy is eliminated in all these five countries and exports of petrochemicals by these countries fall by 50% due to enhanced cost of petrochemicals production, the domestic production of petrochemicals is expected to increase in India by about 2.2% (Table 4.3). Again, the impact is not very large.

[69] Based on India's import data for 2006-07.

Table 4.3: Impact of Elimination of Natural Gas Subsidy in Oman, Qatar, Russia Saudi Arabia and UAE on Indian Petrochemicals Industry

Item	Amount/ percent
Share of the five countries in world exports of petrochemicals	6.5%
50% cut in their export will reduce it to	3.25%
Gain to Indian exports if all other exporters gain proportionately	3.25%
Share of the five countries in India's imports of petrochemicals	40%
50% cut in their export will reduce their share to	20%
Reduction in India's imports assumed to be made up by increased domestic production	20%
Increase in production due to increase in increase in exports (exports of polymers in 2005-06 were 746 tonnes)	3.5% of 746 thousand tonnes = 26,000 MT
Increase in production due to fall in imports (imports of polymers in 2005-06were 412 thousand tonnes)	20% of 412 thousand tonnes = 82,000 MT
Percentage increase in Domestic Production (production of polymers in 2005-06 was 4965 thousand tonnes)	(26+82)/4965 = 2.2%

4.2 Natural Gas Pricing in Oman – Effects on India's Urea Industry

As may be noted in Table 4.1 above, the price of natural gas in Oman is about US$0.8/MMBTU close to the price in Saudi Arabia and much lower than the price generally prevailing in other countries. Oman has recently been a major source of urea imports in India. In 2005-06, India imported 1917 thousand tonnes of urea of which 1075 thousand tonnes were from Oman. In 2006-07, India imported 4050 tonnes of urea of which 1463 thousand tonnes were from Oman.

Imports of urea from Oman India Fertilizer Company (OMIFCO) were done at a low price.[70] The balance was imported from the open market from higher prices. In

[70] Oman India Fertilizer Company (OMIFCO), a joint venture company of IFFCO and KRIBHCO and Oman Oil Company has been set up in Sur, Oman to produce 16.52 lakh MT granular urea and 2.48 lakh MT of surplus ammonia per annum (1 lakh=100,000). Government of India has entered into a long term Urea Off-take Agreement (UOTA) to lift the entire production of granular Urea produced by the company during the first 15 years at the pre-determined FOB price fixed under UOTA. The project has enabled Govt. of India to further supplement the indigenous urea production and meet the growing demand. It has also

2006-07, the average unit value of imports from Oman was US$188 per tonne, while imports from other countries were done at about US$ 270 to 280 per tonne (see Table 4.4).

Table 4.4: India's Urea Imports, 2004-05 to 2006-07

Country	Quantity (000 tonne)			Unit Value (US$/ tonne)		
	2004-05	2005-06	2006-07	2004-05	2005-06	2006-07
BAHARAIN IS			46			273
BANGLADESH PR	35		118	218		271
BELARUS			3			265
CHINA P RP			155			273
EGYPT A RP			100			275
IRAN	11			226		
KUWAIT		16	72		278	264
LIBERIA			26			272
LIBYA			130			274
MALAYSIA			69			278
OMAN		1075	1463		155	188
POLAND	21			261		
QATAR	171	74	184	240	262	280
ROMANIA			44			278
RUSSIA	33	67	118	289	284	276
SAUDI ARAB	72	121	100	209	264	277
U ARAB EMTS	123	104	226	222	269	275
UKRAINE	153	433	1197	259	265	277
UNSPECIFIED	26	27		179	151	
Total	645	1917	4050	237	203	244

The energy cost of urea imported from Oman is about US$ 18.5 per tonne (based on the energy consumption rate of 24 thousand BTU per tonne of urea, and the price of natural gas at US$0.77 per MMBTU). If the subsidy in the price of natural gas is eliminated and natural gas is supplied at the price of say US$ 3 per MMBTU, the energy cost of urea production in Oman will rise by about US$54 per tonne. This would have little effect on the domestic production of urea in India since the domestic firms are

helped in major savings in subsidy due to its competitive prices. Source: A Brief on Fertilizer Sector for Economic Editors' Conference held November 2007.

operating under a regulated regime. But, the hike in the cost of production of urea in Oman would have an impact on the fertilizer subsidy paid by the government. It would raise the subsidy outgo on urea by about 2.2 per cent (increase in subsidy by Rs 3.3 billion as against actual subsidy paid of Rs 153 billion in 2006-07).

A substantial part of the world exports of urea are from countries that have subsidized natural gas availability. These include Russia, Saudi Arabia and Qatar. These three countries together accounted for 7.6 million tonnes of urea exports in 2000 out of a total export of urea of 26.2 million tonnes.[71] If the subsidy in natural gas is eliminated, the cost of production of urea will increase significantly in those countries and this is likely to push up the open market price of urea in the global market. In Russia, for instance, the price of natural gas is about US$1.5 per MMBTU. If this increases to US$3 per MMBTU, the cost of production of urea will go up by about US$36 per tonne of urea. It is difficult to ascertain the extent of increase in the open market price of urea that will take place once the subsidies in natural gas are eliminated. But, it seems reasonable to assume that the figure is about US$ 20 per tonne of urea. The implication is that the elimination of natural gas subsidies will raise the cost of urea imported by India from Oman by about US$ 54 per tonne and the cost of urea imported from other countries by about US$ 20 per tonne. Thus, the overall increase in urea subsidy will be about 3.6% (Rs 5.5 billion additional subsidy).

In case, natural gas subsidy gets eliminated in Russia, Saudi Arabia, Oman, Qatar and other such countries, this would happen also in India. The gas based urea plants will have to pay a much higher price for natural gas and this will translate into a much higher subsidy outgo from the government if the issue price of urea for the farmer has to be kept at the present level. The increase in gas price may be about US$ 2 per MMBTU, which will raise the urea production cost of gas-based plants by about US$ 48 per tonne. The overall increase in urea subsidy will be about Rs 30 billion (due to increased cost of

[71] K.G. Soh, "Gas Supply and Demand for Urea," Presented at Mitco Marketing and Trading Forum, 2001, Bangi, Malaysia, on 27 August 2001.

imported urea and increased cost of gas based production of domestic urea), which implies approximately a 20% increase in urea subsidy.

Table 4.5: Impact of natural gas subsidy elimination on urea subsidy in India, 2006-07

Item	Amount (000 MT)	Increase in cost due to hike in the price of natural gas (US$/MT)	Cost hike/ additional subsidy US$ mn or Rs mn
Imports of urea from Oman	1463	54	79.0 US$ mn
Imports of urea from other countries	2587	20	51.7 US$ mn
Urea production in India	20308		
- based on gas (taken as 60%)	12185	48	584.9 US$ mn
- based on other feedstock	8123	0	0 US$ mn
Total increase in subsidy in US$ mn			716.6 US$ mn
Total increase in subsidy in Rs mn (exchange rate Rs 42.25= US$1)			30235 Rs mn
Actual urea subsidy during 2006-07 (Rs mn)			153540 Rs mn
Percentage increase in subsidy in the event of elimination of natural gas subsidy in India and elsewhere			30235/153540 = 19.9%

Attention may be drawn here to the significant cost difference that exists among urea producing plants in India based on alternate feedstock. The cost of production of urea in gas based plants is about Rs 7000 to 8000 per tonne (on average) which comes to about US$ 170 to 190 per tonne (exchange rate Rs 42 per US$), while the cost in naphtha based plants is about Rs 14,000 to 15,000 per tonne (on average), which comes to about US$ 330 to 360 per tonne.[72] The cost of urea in units based on Fuel oil/LSHS is about US$360 per tonne on average.[73] About 60 per cent of the domestic urea production is gas

[72] Ambarish Mukherjee, Gas Based Units Feel Sqeezed, Business Line, May 20, 2007.
[73] "The practical insight to gas pricing in India," Hydrocarbon Asia, September/October 2007.

based. Average price paid for imported urea during 2006-07 was about US$280 per tonne barring the import from Oman, which was obtained at US$ 188 per tonne. The average subsidy per tonne is higher for imported urea than for domestically manufactured urea.[74] It seems, however, that the cost of production of urea in some of the large exporters such as Russia, Saudi Arabia and Qatar is around US$ 200 per tonne and in a more competitive market conditions, urea will be supplied to India at that price. In the present system of regulation in the domestic urea market (units getting group wise retention prices), domestic urea plants do not face competition from imports (or from one another). If the urea industry is deregulated (say, the system is changed to one existing for DAP), units based on naphtha and FO/LSHS will mostly be competed out. This will mean a much higher dependence on imports (say, 40 to 50%, up from about 16% in 2006-07), but a substantial reduction in urea subsidy. Elimination of natural gas subsidy in countries that are currently providing such subsidy will improve the competitiveness of urea plant based on naphtha and FO/LSHS in India and thus help in containing the adverse effect on domestic urea manufacturing that may arise from deregulation of the industry. This will, however, come at the cost of a substantial hike in urea subsidy.

[74] Ambarish Mukerjee, ibid.

5. Assessment of India's Interest

The analysis presented above has brought out that two prominent natural resource subsidies being given in India at present are the subsidy in natural gas and that in coal. The former is an explicit subsidy being given through the administrative price mechanism. The latter is an implicit subsidy being given by the public sector agencies engaged in coal production and supply. The main beneficiaries of these two subsidies are power and fertilizer industries.

Substantial subsidy is being given for natural gas in Russia and some countries of the middle-east such as Saudi Arabia, Oman, UAE and Qatar. It is believed that these subsidies have provided significant cost advantage to these countries in respect of production of petrochemicals. An analysis of how Indian petrochemicals industry is impacted by these subsidies indicated that if the current subsidies in natural gas in Saudi Arabia, other countries of the middle-east and Russia are eliminated, then India's production of petrochemicals will go up by about 2.2%. A similar analysis done for urea showed that the elimination of gas subsidies in Russia, Oman and other countries of the middle east will have little effect on India's production of urea, but the urea subsidies may go up by about 20% if gas subsidies in India is eliminated along with elimination of gas subsidies in Russia, Oman and other countries of the middle east. Such studies need to be done for a number of natural resources for a proper evaluation of the benefits and costs of elimination of natural resource subsidies. It seems, however, from the analysis done that the benefits to India from elimination of natural resource subsidies in other countries will not be as large as the costs that India may have to suffer if she has to eliminate the subsidies on natural gas and coal in India. In this context, it should be pointed out that the present natural resource subsidies in India are contributing significantly in keeping the power rates low. There is a view that Indian industry is not able to compete well with industries of other countries because the cost of power is relatively higher in India. Because of large subsidies in power given to farmers and domestic consumers, the power rates for industries have to be kept high. If the price of gas and coal has to increase because of elimination of subsidies on coal and gas, the power rate will rise significantly, reducing the cost competitiveness of Indian industry. Thus, the elimination of gas and coal subsidies would adversely affect the competitiveness of Indian industries.

While elimination of gas and coal subsidies do not seem to be in India's interest, elimination of crude oil subsidies seem to be in India's interest. India is poised to become a major center of crude oil refining in the coming years. This will be based on imported crude oil. Indeed, a large increase in crude oil imports in likely to take place in future if one goes by the plans being made for addition to refining capacity. Indian refiner expect to add 112 million metric tonnes per annum (MMTPA) capacity in their existing 149 MMTPA refining capacity by 2012.[75] Evidently, for India to be a refining hub of the world, it is important that other countries do not get an unfair advantage through access to subsidized crude oil. This is an issue that needs further study.

[75] Rajeev Jayaswal, Refining Crude – Success Story, Economic Times, 10 January 2008.

Annexes

Annex 2.1: Augmented Dickey-Fuller (ADF) Test

Product	Demand			Relative Price			Activity Variable			
	Level	First Difference	Inference	Level	First Difference	Inference	Variable	Level	First Difference	Inference
Aluminium	-3.280**	-5.841*	I(0)	-2.084	-6.407*	I(1)	GDP	0.651	-3.824*	I(1)
Bauxite	-0.529	-5.502*	I(1)	-0.535	-3.617*	I(1)	GDP	0.651	-3.824*	I(1)
Steel	1.350	-5.253*	I(1)	-1.810	-4.932*	I(1)	GDP	0.651	-3.824*	I(1)
Iron Ore	-0.271	-8.189*	I(1)	-1.655	-2.870#	I(1)	PR_ steel	0.761	-6.002*	I(1)
Copper	-0.066	-10.249*	I(1)	-2.019	-3.880*	I(1)	GDP	0.651	-3.824*	I(1)
Copper Ore	-1.231	-4.348*	I(1)	-2.019	-3.880*	I(1)	PR_ cu	-0.384	-4.272*	I(1)
Urea	-2.020	-7.001*	I(1)	-1.552	-4.495*	I(1)	GDPA	-0.793	-8.616*	I(1)
DAP	-1.488	-4.305*	I(1)	-2.051	-3.367@	I(1)	GDPA	-0.793	-8.616*	I(1)
Coal	-2.508	-3.678@	I(1)	0.929	-3.703*	I(1)	GDP	0.651	-3.824*	I(1)
Electricity	-3.825*	-1.548	I(0)	-0.619	-4.034*	I(1)	GDP	0.651	-3.824*	I(1)
Crude Oil	-1.025	-5.482*	I(1)	-2.020	-5.482*	I(1)	GDP	0.651	-3.824*	I(1)
Naphtha	0.455	-4.228*	I(1)	-0.187	-1.647		GDP	0.651	-3.824*	I(1)
HSD	-2.142	-3.861*	I(1)	0.635	-4.186*	I(1)	GDP	0.651	-3.824*	I(1)
FO	0.301	-4.098*	I(1)	-2.119	-2.745#	I(1)	GDP	0.651	-3.824*	I(1)
Kerosene	-1.674	0.239		-1.255	-4.045*	I(1)	GDP	0.651	-3.824*	I(1)
Acetic Acid	-0.720	-3.605@	I(1)	-2.030	-4.816*	I(1)	GDP	0.651	-3.824*	I(1)
Ethylene Glycol	-2.250	-6.480*	I(1)	-1.308	-3.685*	I(1)	GDP	0.651	-3.824*	I(1)
Methanol	-0.477	-5.064*	I(1)	-1.863	-4.059*	I(1)	GDP	0.651	-3.824*	I(1)

Notes:

1. *, @, # indicate statistically significant at 1%, 5% and 10% respectively.
2. All the variables are taken in natural logarithm.
3. ADF Tests have been done including constant term only.
4. I(1) means the series contains unit root and integrated of order 1.
5. I(0) means series integrated of order 0.

Abbreviations used:

GDP=Gross Domestic Product
PR_ steel= Production of Steel
PR_ cu= Production of Copper
GDPA=Gross Domestic Product in Agriculture

Annex 2.2: Johansen Cointegration Test

Product	Variables Considered	Trace Statistic	Critical Values	Maximum Eigen Statistic	Critical Values
Aluminium					
Bauxite	D Bauxite, GDP, RP	33.992@	29.797	25.396@	21.132
Steel	D Steel, GDP, RP	36.810@	29.797	33.016@	21.132
Iron Ore	D Iron, PR_steel, RP	38.490@	29.797	28.592@	21.132
Copper	D Cu, GDP, RP	31.069@	25.861	21.734@	21.132
Copper Ore	D Cu, PR_cu, RP	44.559*	35.458	32.140*	25.861
Urea	D Urea, GDPA, RP	66.636*	35.458	48.009*	25.861
DAP	D DAP, GDPA, RP	28.928#	27.067	22.505#	18.893
Coal	D Coal, GDP, RP	45.315*	35.458	25.725@	25.861
Electricity					
Crude Oil	D Crude, GDP, RP	41.024*	35.458	33.102*	25.861
Naphtha					
HSD	D HSD, GDP, RP	37.717@	29.797	26.556@	21.132
FO	D FO, GDP, RP	43.187*	35.458	32.265*	25.861
Kerosene					
Acetic Acid	D Acetic, GDP, RP	34.145@	29.797	24.871@	21.132
Ethylene Glycol	D Ethygly, GDP, RP	90.997*	35.458	83.919*	25.861
Methanol	D Methanol, GDP, RP	32.565@	29.797	22.782@	21.132

Notes:
1.*, @, # indicate statistically significant at 1%, 5%, and 10% respectively.
2. All the variables are taken in natural logarithm.

For Aluminium, Electricity, Naphtha and Kerosene, Johansen cointegration test has not been carried out because the series on the demand, price and activity variables are not all I(1).

Abbreviations used: D=Domestic Demand for the Product; RP=Relative Price of the Product GDP=Gross Domestic Product; PR_ steel= Production of Steel; PR_ cu= Production of Copper; GDPA=Gross Domestic Product in Agriculture.

Annex 2.3: Alternate Estimates of the Demand Models

Iron Ore

Table A2.3.1: Factors affecting demand for Iron Ore

Dependent variables	**Log(Iron Ore demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.8586
Durbin-Watson d-statistic	1.75
Explanatory variables	Coef. *(t-value)*
Log (Steel production)	0.76*** *(11.12)*
Log (relative price for Iron Ore)	-0.29* (-1.92)
Constant	-2.90

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Finished Steel

Table A2.3.2: Factors affecting demand for Steel

Dependent variables	**Log(Steel demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.9584
Durbin-Watson d-statistic	1.61
Explanatory variables	Coef. *(t-value)*
Log (GDP)	1.18*** *(17.48)*
Log (relative price for steel)	-0.45 (-1.47)
Constant	-6.25

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Copper Ore/Concentrate

Table A2.3.3: Factors affecting demand for Copper Ore and Concentrate

Dependent variables	**Log (Copper Ore/ concentrate demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.217
Durbin-Watson d-statistic	0.515
Explanatory variables	Coef. *(t-value)*
Log (production of copper)	0.39*** *(2.78)*
Dummy: (Year>98=1)	-0.94*** *(-2.94)*
Constant	11.14

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Note: Test of structural break was done using cumulative sum and cumulative sum of squares test and the results indicated structural break around year 2000. Durbin-Watson d-statistic with 3 explanatory variables and 25 observations lies below the limit of (0.906, 1.409) showing autocorrelation. A dummy variable taking value one for years beyond 1998 is used in the regression to reflect a marked increase in imports of copper ore/concentrate since 1999, thereby taking care of quality improvement.

Prais-Winsten AR(1) regression

Dependent variables	**Log (Copper Ore/ concentrate demand)**
No. of observations	25
Adjusted R^2	0.987
Durbin-Watson d-statistic	1.379
Explanatory variables	Coef. *(t-value)*
Log (production of copper)	0.14 *(1.48)*
Dummy: (Year>98=1)	-0.33** *(-2.26)*
Constant	13.69

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

The coefficient of the activity variable is low in the Prais-Winsten regression. Therefore, for forecasting, the model based on OLS has been used.

Copper

Table A2.3.4: Factors affecting demand for Copper

Dependent variables	**Log(Copper demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.8937
Durbin-Watson d-statistic	1.92
Explanatory variables	Coef. *(t-value)*
Log(gdp)	0.96*** *(13.98)*
Log(relative price for copper)	-0.28*@ *(-1.65)*
constant	-0.96

Note: Test of structural break was done using cumulative sum and cumulative sum of squares test but result shows no structural break.

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively
@ t-value close to the tabulated t-value at 10% level of significance.

Ethyl Glycol

Table A2.3.5: Factors affecting demand for Ethylene Glycol

Dependent variables	**Log(Ethylene Glycol demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.9658
Durbin-Watson d-statistic	1.87
Explanatory variables	Coef. *(t-value)*
Log(GDP)	2.34*** *(6.96)*
Log(relative price for Ethylene Glycol)	-0.64*** (-3.09)
constant	-19.88

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Methanol

Table A2.3.6: Factors affecting demand for Methanol

Dependent variables	**Log(Methanol demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.944
Durbin-Watson d-statistic	1.97
Explanatory variables	Coef. *(t-value)*
Log(GDP)	2.01*** *(11.00)*
Log(relative price for Methanol)	-0.20 (-0.75)
constant	-14.78

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Crude Oil

Table A2.3.7: Factors affecting demand for crude oil

Dependent variables	**Log (crude oil demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.9744
Durbin-Watson d-statistic	1.29
Explanatory variables	Co-ef. *(t-value)*
Log (GDP)	0.92*** *(11.12)*
Log (relative price of coal)	0.59*** *(3.50)*
Log (Generation of Hydro power in Gwh)	-0.29** *(-2.22)*
Constant	1.76

Note: Variables like population of India and time trend were also tried, but these did not work well. Test of structural break was done using cumulative sum and cumulative sum of squares test, but result shows no structural break. Durbin-Watson d-statistic with 4 explanatory variables and 25 observations lies within the limit of (0.831, 1.523) showing DW is in inconclusive range.

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Naphtha

Table A2.3.8: Factors affecting demand for Naphtha

Dependent variables	**Log (Naphtha demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.906
Durbin-Watson d-statistic	1.21
Explanatory variables	Coef. *(t-value)*
Log (GDP)	2.44*** *(10.44)*
Log (natural gas used in fertilizer and pertochemicals production)	-0.45*** *(-5.12)*
Dummy: (Year>92=1)	-0.39** *(-2.88)*
Constant	-20.67

Note: Variables like population of India and time trend were also tried, but these did not working well. Test of structural break was done using cumulative sum and cumulative sum of squares test, but result shows no structural break. Durbin-Watson d-statistic with 4 explanatory variables and 25 observations lies within the limit of (0.831, 1.523) showing that the d-statistic is in inconclusive range.

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively

Urea

Table A2.3.9: Factors affecting demand for Urea

Dependent variables	**Log(Urea demand)**
Statistical method	**OLS**
No. of observations	25
Adjusted R^2	0.933
Durbin-Watson d-statistic	1.66
Explanatory variables	Coef. *(t-value)*
Log(GDPA)	0.91*** *(3.64)*
Log(relative price for urea)	-0.69*** (-3.27)
constant	-1.60

*, **, *** indicate statistically significant at 10%, 5%, and 1% respectively