

Moving to Goods and Services Tax in India: Impact on India's Growth and International Trade

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Foreword

Tax policies play an important role on the economy through their impact on both efficiency and equity. A good tax system should keep in view issues of income distribution and, at the same time, also endeavour to generate tax revenues to support government expenditure on public services and infrastructure development. Cascading tax revenues have differential impacts on firms in the economy with relatively high burden on those not getting full offsets. This argument may be extended to international competitiveness of the adversely affected sectors of production in the economy. Such domestic and international factors lead to inefficient allocation of productive resources in the economy. This results in loss of income and welfare of the affected economy.

Value added tax was first introduced by Maurice Laure, a French economist, in 1954. The tax was designed such that the burden is borne by the final consumer. Since VAT can be applied on goods as well as services it has also been termed as goods and services tax (GST). Over the past four decades, VAT has been an important instrument of indirect taxation with 130 countries having adopted this, resulting in one-fifth of the world's tax revenue. Tax reform in many of the developing countries has focused on moving to VAT. Most of these countries have gained from it, and hence the suggestions that others stand to gain from its adoption.

For a developing economy like India it is desirable to become more competitive and efficient in its resource usage. Apart from various other policy instruments, India should pursue taxation policies that would maximise its economic efficiency and minimise distortions and impediments to efficient allocation of resources, specialisation, capital formation and international trade. With regard to the issue of equity it is desirable to rely on horizontal equity rather than vertical equity. While vertical equity is based on high marginal rates of taxation, both in direct and indirect taxes, horizontal equity relies on simple and transparent broad-based taxes with low variance across the tax rates.

Traditionally India's tax regime relied heavily on indirect taxes including customs and excise. Revenue from indirect taxes was the major source of tax revenue till tax reforms were undertaken during nineties. The major argument put forth for heavy reliance on indirect taxes was that the India's majority of population was poor and thus widening base of direct taxes had inherent limitations. Another argument for reliance on indirect taxes was that agricultural income was not subjected to central income tax and there were administrative difficulties involved in collecting taxes.

The broad objectives of our study refer to analysing the impact of introducing comprehensive goods and services tax (GST) on economic growth and international trade; changes in rewards to the factors of production; and output, prices, capital, employment, efficiency and international trade at the sectoral level.

Analysis in this study indicates that implementation of a comprehensive GST in India is expected to lead to efficient allocation of factors of production thus leading to gains in GDP and exports. This would translate into enhanced economic welfare and returns to the factors of production, viz. land, labour and capital.

Suman Bery
Director General

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ABSTRACT

The differential multiple tax regime across sectors of production leads to distortions in allocation of resources thus introducing inefficiencies in the sectors of domestic production. With regard to India's exports, this leads to lack of international competitiveness of the sectors which would have been relatively efficient under distortion-free indirect tax regime. Further, there is lack of full offsets of taxes loaded on to the fob export prices. Efficient allocation of productive resources and providing full tax offsets is expected to result in gains for GDP, returns to the factors of production and exports of the economy. Implementation of a comprehensive goods and services tax (GST) is expected, *ceteris paribus*, to provide gains in India's GDP somewhere within a range of 0.9 to 1.7 per cent. It is expected that the real returns to the factors of production would go up. Our results show gains in returns to land ranging between 0.42 and 0.82 per cent. Wage rate gains vary between 0.68 and 1.33 per cent. Returns to capital would gain somewhere between 0.37 and 0.74 per cent. In sum, implementation of a comprehensive GST in India is expected to lead to efficient allocation of factors of production thus leading to gains in GDP and exports. This would translate into enhanced economic welfare and higher returns to the factors of production, viz. land, labour and capital.

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Executive Summary

The broad objectives of this study refer to analysing the impact of introducing comprehensive goods and services tax (GST) on economic growth and international trade; changes in rewards to the factors of production; and output, prices, capital, employment, efficiency and international trade at the sectoral level. The results and conclusions of this study are comparative static in nature and may not be interpreted as forecasts of the variables under analysis.

The differential multiple tax regime across sectors of production leads to distortions in allocation of resources thus introducing inefficiencies in the sectors of domestic production. With regard to India's exports, this leads to lack of international competitiveness of the sectors which would have been relatively efficient under distortion-free indirect tax regime. Add to this, the lack of full offsets of taxes loaded on to the fob export prices. The export competitiveness gets negatively impacted even further. Efficient allocation of productive resources and providing full tax offsets is expected to result in gains for GDP, returns to the factors of production and exports of the economy.

While indirect taxes paid by the producing firms get offsets under state VAT and CENVAT, the producers do not receive full offsets particularly at the state level. The multiplicity of taxes further adds the difficulty in getting full offsets.

The Joint Working Group of the Empowered Committee of the State Finance Ministers submitted its report on the proposed Goods and Services Tax (GST) to the Finance Minister in November 2007. A dual GST, one for the Centre and other for the states, would be implemented by 1 April 2010. The new system would replace the state VAT and the CENVAT.

Implementation of a comprehensive GST across goods and services is expected, *ceteris paribus*, to provide gains to India's GDP somewhere within a range of 0.9 to 1.7 per cent. The corresponding change in absolute values of GDP over 2008-09 is expected to be between Rs 42,789 crore and Rs 83,899 crore, respectively.

The additional gain in GDP, originating from the GST reform, would be earned during all years in future over and above the growth in GDP which would have been achieved otherwise. The present value of the GST-reform induced gains in GDP may be computed as the present value of additional income stream based on some discount rate. We assume a discount rate as the long-term real rate of interest at about 3 per cent. The present value of

total gain in GDP has been computed as between Rs 1,469 thousand crore and 2,881 thousand crore. The corresponding Dollar values are \$325 billion and \$637 billion.

In alternate scenario we assume a discount rate as the long-term real rate of interest at 5 per cent. The present value of total gain in GDP turns out to be somewhere between Rs 856 thousand crore and 1,678 thousand crore. The corresponding Dollar values are \$189 billion and \$371 billion.

The sectors of manufacturing would benefit from economies of scale. Output of sectors including textiles and readymade garments; minerals other than coal, petroleum, gas and iron ore; organic heavy chemicals; industrial machinery for food and textiles; beverages; and miscellaneous manufacturing is expected to increase. The sectors in which output is expected to decline include natural gas and crude petroleum; iron ore; coal tar products; and non-ferrous metal industries. There are minor gains and losses in output of other sectors. Intersectoral movements of labour and capital would be in line with changes in output with these factors of production moving into sectors with increased output and away from others.

Gains in exports are expected to vary between 3.2 and 6.3 per cent with corresponding absolute value range as Rs 24,669 crore and Rs 48,661 crore. Imports are expected to gain somewhere between 2.4 and 4.7 per cent with corresponding absolute values ranging between Rs 31,173 crore and Rs 61,501 crore.

The sectors with relatively high proportional increase in exports include textiles and readymade garments; beverages; industrial machinery for food and textiles; transport equipment other than railway equipment; electrical and electronic machinery; and chemical products: organic and inorganic. The moderate gainers are agricultural machinery; metal products; other machinery; and railway transport equipment. Exports are expected to decline in agricultural sectors; iron and steel; wood and wood products except furniture; and cement. There are minor gains and losses in exports of other sectors.

The major import gaining sectors include leather and leather products; furniture and fixtures; agricultural sectors; coal and lignite; agricultural machinery; industrial machinery; other machinery; iron and steel; railway transport equipment; printing and publishing; and tobacco products. The moderate gainers include metal products; non-ferrous metals; and transport equipment other than railways. Imports are expected to decline in textiles and readymade garments; minerals other than coal, crude petroleum, gas and iron ore; and beverages.

Prices of agricultural commodities and services are expected to rise. Most of the manufactured goods would be available at relatively low prices especially textiles and readymade garments. Consequently, the terms-of-trade move in favour of agriculture vis-à-vis manufactured goods within a range of 1.8 to 3.8 per cent.

GST would lead to efficient allocation of factors of production. The overall price level would go down. It is expected that the real returns to the factors of production would go up. Our results show gains in real returns to land ranging between 0.42 and 0.82 per cent. Wage rate gains vary between 0.68 and 1.33 per cent. The real returns to capital would gain somewhere between 0.37 and 0.74 per cent.

The efficiency of energy resource use improves in the new equilibrium. The introduction of GST would thus be environment friendly.

Based on our computations, the revenue neutral GST rate across goods and services is expected to be positioned somewhere in the range of 6.2 per cent and 9.4 per cent, depending on various scenarios of sectoral exemptions.

In sum, implementation of a comprehensive GST in India is expected to lead to efficient allocation of factors of production thus leading to gains in GDP and exports. This would translate into enhanced economic welfare and returns to the factors of production, viz. land, labour and capital.

As with any other modelling exercise, the results of our exercise are subject to certain limitations. The general equilibrium model that we have used is comparative static in nature. Aggregate supplies of labour, capital, and agricultural land are assumed to remain fixed so as to abstract from macroeconomic considerations. Given these limitations the results must not be read as *forecasts* of variables but only as indicative directional changes.

Moving to Goods and Services Tax in India: Impact on India's International Trade

I. Backdrop

India has posted high rates of growth since the early 1990s. It has become increasingly integrated with the global economy. Exports have become an important engine of India's economic growth (Krueger, 2008). The share of exports (goods and services) in GDP has increased from 8 per cent in 1990-91 to 14.7 per cent in 2000-01 and further up to 25.6 per cent in 2008-09. The competitiveness of India's exports has increased over time but gets partially impeded due to certain domestic constraints, one of them being an inefficient indirect tax regime.

Even though the country has moved on the path of tax reforms since the mid-1980s yet there are various issues which need to be restructured so as to boost productivity and international competitiveness of the Indian exporters. Sales of services to the consumers are not appropriately taxed with many types of services escaping the tax net. Intermediate purchases of inputs by the business firms do not get full offset and part of non-offset taxes may get added up in prices quoted for exports thus making exporters less competitive in world markets (Poddar and Ahmad, 2009). Even though we do not have precise numbers on the non-offset indirect tax components for various sectors of production it may still be somewhere close to 20 to 30 per cent of the total tax revenue.

The ongoing tax reforms on moving to a goods and services tax would impact the national economy, international trade, firms and the consumers. A rich set of reports, papers and books is available on issues relating to strengths and weaknesses of the India's existing tax regime. However, there has not been much work on the impact of tax reforms on India's international trade in a general equilibrium framework. The present study makes an attempt to fill this gap albeit in a modest way. Analysis in this study is conducted using a computable general equilibrium (CGE) model of the Indian economy (Chadha *et al.*, 1998).

The broad objectives of our study refer to analysing the impact of introducing comprehensive goods and services tax (GST) on economic growth and international trade; changes in rewards to the factors of production; and output, prices, capital, employment, efficiency and international trade at the sectoral level. The results and conclusions of this study are comparative static in nature and may not be interpreted as forecasts of the variables under analysis.

II. India's Tax Regime

Tax policies play an important role on the economy through their impact on both efficiency and equity. A good tax system should keep in view issues of income distribution and, at the same time, also endeavour to generate tax revenues to support government expenditure on public services and infrastructure development. Cascading tax revenues have differential impacts on firms in the economy with relatively high burden on those not getting full offsets. This analysis can be extended to international competitiveness of the adversely affected sectors of production in the economy. Such domestic and international factors lead to inefficient allocation of productive resources in the economy. This results in loss of income and welfare of the affected economy.

For a developing economy like India it is desirable to become more competitive and efficient in its resource usage. Apart from various other policy instruments, India must pursue taxation policies that would maximise its economic efficiency and minimise distortions and impediments to efficient allocation of resources, specialisation, capital formation and international trade. With regard to the issue of equity it is desirable to rely on horizontal equity rather than vertical equity. While vertical equity is based on high marginal rates of taxation, both in direct and indirect taxes, horizontal equity relies on simple and transparent broad-based taxes with low variance across the tax rates.

Traditionally India's tax regime relied heavily on indirect taxes including customs and excise. Revenue from indirect taxes was the major source of tax revenue till tax reforms were undertaken during nineties. The major argument put forth for heavy reliance on indirect taxes was that the India's majority of population was poor and thus widening base of direct taxes had inherent limitations. Another argument for reliance on indirect taxes was that agricultural income was not subjected to central income tax and there were administrative difficulties involved in collecting taxes.

The ratio of indirect taxes to GDP in India increased from 3.99 per cent in 1950-51 to 13.32 per cent in 1985-86. It then decline to 10.95 per cent in 1999-2000 and increased thereafter to 12.7 per cent in 2008-09 (Figure-1).

A comparison of indirect tax to GDP ratio for some select countries for the year 2007 is depicted in Figure-2. It may be observed that the ratio for India is relatively high with only Russian Federation posting a higher rate within this select group of countries.

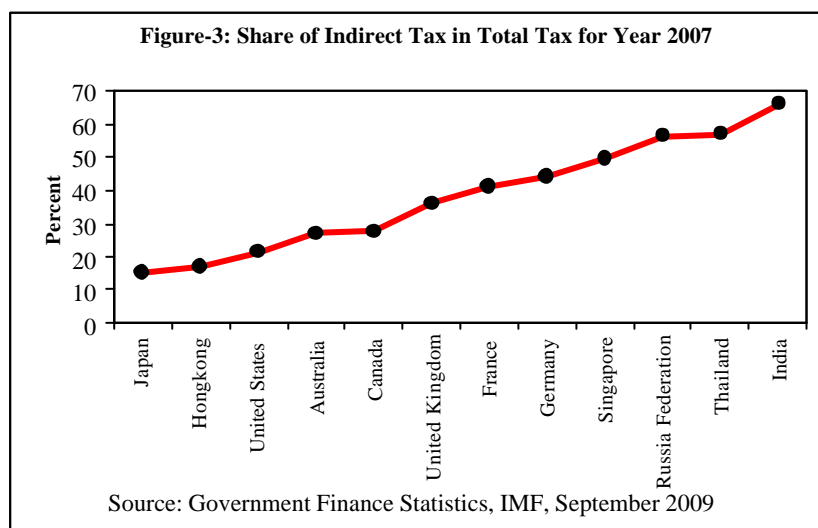
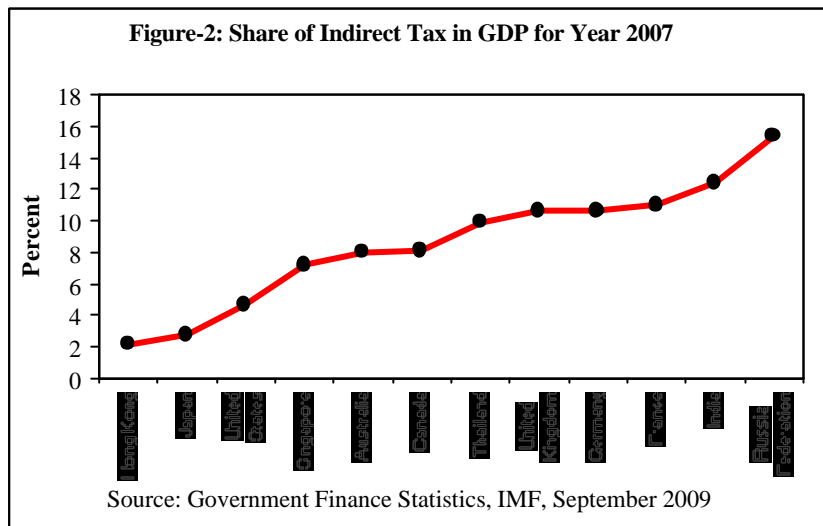
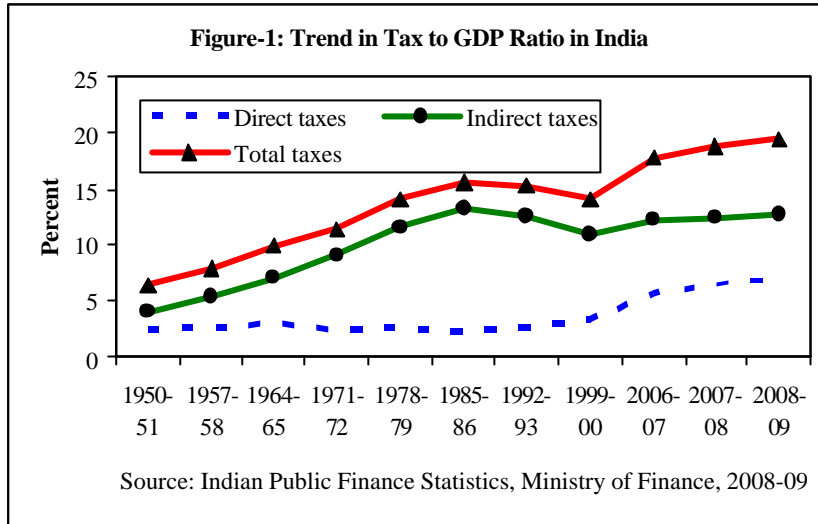
The share of indirect tax in total tax for the year 2007 is portrayed for the same select group of countries in Figure-3. India has the highest share among this select group of countries.

In order to simplify and rationalise indirect tax structures, Government of India attempted various tax policy reforms at different points of time. Through 1950s to 1970s, base of the indirect taxes particularly excise duties was widened. In case of excise duty, attempts were made to curb the consumption of luxury and semi luxury items, mopping excess profits in the case of commodities in short supply and for encouraging exports. In 1975-76, a general levy of one per cent *ad valorem* covering all goods produced for sale or other commercial purposes not specified in the central excise tariff was imposed with exemptions for a few items.

Around the same time, it became evident that indirect taxes lead to undesirable effects on prices and allocation of resources. The Government of India constituted the Indirect Taxation Enquiry Committee in 1976 headed by Shri L. K. Jha to study the structure of indirect taxes, central, state and local level taxes and suggest policy reforms. It submitted its report in 1978. The committee found a major problem with indirect tax regime as it had caused unintended distortion in the allocation of resources and cascading effects. The committee recommended that indirect taxation should move towards taxation of final products and introduce modified form of value added tax.

However, a major obstacle in rationalisation of indirect tax system was the levy of tax on commodities by government at different levels viz., centre, state and local authorities. This multiple taxation provides incentives for tax evasion and undermines efficiency. Further, there is lack of uniformity in the pattern of commodity taxation resulting in harassment to the public by multiple tax authorities. Heavy reliance on indirect taxes for raising revenue was also found to increase cost and fuel inflation.

The government introduced the Long Term Fiscal Policy (LTFP) on 19 December 1985 for prudent fiscal management. LTFP was expected to provide a definite direction and coherence to annual budgets and to bring about a greater predictability and stability in the economic system. It would provide rule based fiscal and financial policies rather than discretionary approach. Further, it would also facilitate effective coordination of different



dimensions of economic policies. Major reforms in excise and customs taxation were proposed under LTFP. These reforms were considered for progressively moving from discretionary, quantitative restrictions and physical controls to non-discretionary fiscal methods. The major reforms announced under Union excise taxation aimed at reducing the number of effective rates after harmonisation of the tariff classification with the custom nomenclature and implementing a modified system of value added taxation, i.e., MODVAT. Excise duty is collected as CENVAT introduced in 2000 through re-naming of MODVAT of 1986.

However, fillip to tax policy reforms came in with the introduction of economic reforms in 1990s. It was realised that a complex tax structure involving both the centre and the states taxing production and sales of commodities was not fostering efficiency in the economic activities. The presence of central sales tax acted as constraint to inter-state trade movement and contradicted the idea of India being a common market.

The Government of India constituted Tax Reforms Committee under the Chairmanship of Dr. Raja J. Chelliah in August 1991 so as to bring comprehensive reforms in the Indian tax system. The Committee suggested policy reform measures to restructure both direct and indirect tax systems. For indirect tax, the Committee recommended reduction in the general level of import tariffs comparable with similar developing countries, reduction in dispersion of tariff rates and abolition of end use exemptions. The excise duty was to be progressively converted from MODVAT to VAT. Some specific recommendations of the Tax Reforms Committee included higher import tariffs on finished goods than basic raw materials and moderate rates for components and machinery. Central excise duties were to be restructured into three-rate MODVAT regime at the manufacturing level at 10, 15 and 20 per cent and selective excise on nonessential commodities at 30, 40 and 50 per cent.

The 1990s tax reforms brought structural changes in the tax system. These reforms aimed at correcting imbalances in the sources of revenues through increasing the share of direct taxes. In July 2002, Government of India constituted a Task Force under the Chairmanship of Dr. Vijay Kelkar to suggest measures for simplification and rationalisation of indirect taxes. The Task Force recommended various measures including trust based customs clearance, automation and modification of CENVAT rules to remove the distinction between capital goods and inputs. On central excise, all duties should be replaced by only one levy, the CENVAT. Scope of service tax should be expanded.

A system of VAT on services at the central government level was introduced in 2002. The states collect taxes through state sales tax VAT, introduced in 2005, levied on intrastate trade and the CST on interstate trade.

The Government of India constituted a Task Force on implementation of Fiscal Responsibility and Budget Management Act, 2003 to chalk out a framework for fiscal policies to achieve FRBM targets. Task Force headed by Dr. Vijay L. Kelkar made a number of recommendations. Among others, it suggested an All India goods and services tax (GST) which would help achieve a common market and widen the tax base. It recommended that the multiplicity of tariffs should be reduced to three components viz., basic customs duty, additional duty and anti-dumping duties. All exemptions should be removed barring life saving drugs, security items, goods for relief and charitable purposes and international obligations.

Despite all the various changes the overall taxation system continues to be complex and has various exemptions. The Report of the Task Force on implementation of the FRBMA, chaired by Dr. Vijay Kelkar, submitted its Report in July 2004. It has recommended introduction of a national VAT on goods and services (GST) which would help improve the revenue productivity of domestic indirect taxes and enhance welfare through efficient resource allocation.

The Joint Working Group of the Empowered Committee of the State Finance Ministers submitted its report on the proposed Goods and Services Tax (GST) to the Finance Minister in November 2007. A dual GST, one for the Centre and other for the states, would be implemented by 1 April 2010. The new system would replace the state VAT and the CENVAT.

Most of the indirect taxes would be subsumed under GST except for stamp duty, toll tax, passenger tax and road tax. All goods and services would be taxed with some exceptions. There is a debate on the specific rate of the GST within a band varying from 12 to 20 per cent. Nevertheless the move to GST would be one of the most important indirect tax reforms in India.

An “Empowered Committee of the State Finance Ministers” (EC), constituted by the Government of India in July 2000, submitted a White Paper on State-Level Value Added Tax in January 2005. It suggested state VAT to have two basic rates of 4 per cent and 12.5 per cent. There is an exempt category and a special rate of 1 per cent for a few selected items.

The items of basic necessities and goods of local importance are put under the exempted category. Special rate of 1 per cent is applicable for Gold, silver and precious stones. The 4 per cent rate applies to other essential items and industrial inputs. The 12.5 per cent rate is residual rate of VAT applicable to commodities not covered by other schedules. There is also a category with 20 per cent floor rate of tax, but the commodities listed in this schedule will not be subjected to VAT. This category covers items like motor spirit (petrol, diesel and aviation turbine fuel), liquor, etc.

VAT system makes provision for eliminating the multiplicity of taxes. Several State taxes on purchase or sale of goods have been subsumed in VAT. It also permits input tax credit. Since VAT is implemented intra-state and does not cover inter-State sale transactions. Input credit is not available for inter-state purchases. Further, exports will be zero-rated, and at the same time, credit will be given for all taxes on inputs purchases related to such exports.

“A well designed destination-based GST on all goods and services is the most elegant method of eliminating distortions and taxing consumption. Under this structure, all different stages of production and distribution can be interpreted as mere tax pass-through, and the tax essentially ‘sticks’ on final consumption within the taxing jurisdiction.” (Kelkar, 2009a).

“What would be the design of the GST? The broad framework of GST is now clear. This is on the lines of the model approved by the Empowered Committee of the State Finance Ministers. The GST would be a dual tax with both central and the State GST component levied on the same base. Thus all goods and services barring a few exceptions will be brought into the GST base. Importantly, there would be no distinction between goods and services for the purpose tax with a common legislation applicable to both.” (Kelkar, 2009b).

III. Literature Survey

Value added tax was first introduced by Maurice Laure, a French economist, in 1954. The tax was designed such that the burden is borne by the final consumer. Since VAT can be applied on goods as well as services it has also been termed as goods and services tax (GST). During the last four decades VAT has become an important instrument of indirect taxation with 130 countries having adopted this resulting in one-fifth of the world’s tax revenue. Tax reform in many of the developing countries has focused on moving to VAT. Most of these countries have

gained thus indicating that other countries would gain from its adoption (Keen and Lockwood, 2007).¹

McLure (2003) outlines characteristics of a well designed indirect tax regime in the context of Canada. While consumers should be taxed at single rate sales of inputs to business should not carry any tax liability. With regard to exports the tax should be levied under the destination principle, i.e. exports should be tax-free and imports should be taxed at the same rate as domestic products.

McLure points out some adverse outcomes emanating from inefficient indirect taxation:

- Differential tax regime on taxation of consumers on goods and services has adverse implications for economic neutrality as well as equity. Consumers with relatively strong preference for taxed goods are at disadvantage vis-à-vis consumers with the same income level but preferring consumption of non-taxed / less taxed services. The equity aspect refers to the fact that the higher income household allocate relatively proportion of their incomes on purchase of services.
- Failure to provide full tax offsets to the business firms leads to distortions of choice of methods of production based on the types of differentially taxed inputs and also impacts household consumption patterns.
- Taxation of capital goods without apt offsets to business is perhaps the most serious consequence of inefficient taxation system. This discourages savings and investment and decelerates growth of productivity.²
- Domestic producers face competitive disadvantage in the absence of destination based taxation principle both between India and rest-of-world as well as across states.
- Some states may have more complex tax regime as compared with some other states. Lack of proper coordination between the central and the state-level tax administration creates complexities and cost inefficiency.

¹ GST is VAT applied to goods and services. We would refer to GST though VAT may also be used as an alternative for the same.

² “Perhaps the most celebrated example of tax-induced migration of industry is that of Intel, which built a new factory in New Mexico, rather than pay California sales tax on its construction costs. Although Intel is one of the quintessential corporations of the digital age, this episode could have occurred in any industry that was footloose.”, McLure (1998).

Imports which are currently implicitly subsidised (since much of these do not have to pay intermediate taxes but only taxes at the final sale to the consumer) would be taxed under the GST regime. While tariffs have protective effect, GST, through eliminating implicit subsidy on imports, creates a level playing field. Thus GST does not distort domestic production. Further, GST is superior to import tariffs since consumption provides a wider tax base than imports so that tax on consumption has a smaller deadweight loss per rupee of revenue collected (Bird and Gendron, 2007). Apart from improving export competitiveness, GST also creates level playing field between imports and domestic production since it does away with flawed structure of domestic indirect taxes.

One of the areas of interest has been to analyse the impact of moving to GST on resource allocation and efficiency of sectors of production and on economy as a whole. Apart from other analysis, Computable general equilibrium (CGE) models have also been used to assess the impact of GST on an economy though there has not been much work on assessing the impact of GST specific to international trade of an economy for all the sectors of an economy.

Devarajan *et al* (1991) analyse the impact of introducing 10 per cent VAT in Thailand using a general equilibrium model to identify gainers and losers and the effect on output, prices and incomes. Though the paper provides an overall view of the changes in aggregate exports and imports it does not bring out sectoral changes therein. It does not provide reference to the type of the model used.

Wittwer and Kym (2002) use a computable general equilibrium model (CGE) to analyse the impact of the GST and wine tax reform on Australia's wine industry introduced in 2000. It is concluded that export-oriented premium segment would gain at the expense of non-premium segment of wine industry. The implicit message is that such gains would originate from increased prospects of exports of the premium wine segment.

Meagher and Parmenter (1993) analyse short-run implications of Australia's tax reforms of 1992 proposed as *Fightback (Liberal and national Parties, 1992)*. *Fightback* was a radical economic reform package and incorporated move to 15 per cent GST. They use a general equilibrium model for their analysis. The conclusion states that: "The GST does not discriminate between imports and domestic commodities and affects exports only in a minor indirect way. Hence, its impact on cost-sensitive industries exposed to international competition is smaller than the impacts of other taxes. Hence the implications of the GST for

output and employment are relatively small". However, the paper does not lay out changes in the composition of Australia's foreign trade.

Dixon and Rimmer (1999) use a general equilibrium model to analyse the impact of Australia's tax reforms contained in Treasury Paper (*ANTS*) of 1998. *ANTS* programme proposed tax reforms including move to 10 per cent GST. The paper concludes that the long-run resource allocation gains flowing from the proposed tax changes will be negligible. Terms-of-trade effect would be negative. Composition of exports would change away from services and in favour of goods. For example, the package would harm tourism and benefit traditional exporters like iron ore.

A desirable tax system should be able to enhance economy's competitiveness through enabling efficient allocation of productive resources thus resulting in increase in growth and increase in real income of consumers in a country. Most of the static models focus on productive services of primary factors of production. Such analysis does not incorporate the additional impact of capital coefficients which, in turn, would enhance efficiency and result in higher returns to the factors of production. Hamilton *et al* (1991) use a general equilibrium model to analyse the impact of GST on economic growth in Canada. The federal sales tax (FST) in Canada, as in 1989, created several distortions. One of the important distortions refers to tax applied on capital goods used in production process. It was about 4 per cent on capital goods. The removal of taxes from capital goods would, over time, lower the cost of capital to domestic producers. This would lead to increases in investments, productivity and domestic real output. The GST reforms would have substantial impacts on real output, particularly for sectors which rely heavily on taxed inputs and those which compete in the international markets – either exports or import-competing domestic products. The GST reform would increase the real output of the Canadian economy by approximately 1.4 per cent, i.e. about \$9 billion over 1989.

GST is destination based. It implies export prices do not include any taxes while imports are taxed at the same rates as domestically produced goods. It is generally believed that GST encourages exports may be at the cost of imports or / and domestic consumption. But this may not hold true according to the theory of international trade.³ The economic theory suggests that the destination-based feature of GST does not affect exports and imports. Exchange rates adjust to nullify the effects on imports and exports of moving to GST. However, the evidence from 136 countries in 2000 brings out contradiction between commonly believed view that GST

³ "In theory, the destination-based nature of a VAT should have no effect whatsoever on exports and imports. The reason is that exchange rates adjust to undo the effects of VATs on

encourages exports versus GST has no effect on trade pattern of a country. While the evidence based on data for 1950-2000 showed negative relationship between GST and international trade of a country a well-designed and properly-administered GST is expected to international trade of countries adopting such reformed tax structure in future.

The evidence that the GST implementation by a country impedes international trade is based on two undesirable reasons: a) GSTs were generally imposed heavily on traded sectors; and b) governments often failed to provide adequate GST rebates for exports. However, there has not been much work on empirical relationship between VAT usage and export and import performance (Desai and Hines, 2002).

It is thus clear that it was lack of implementation of GST in letter and spirit that resulted in distorted consequences. The GST must be applied on all sectors both tradable and non-tradable. Thus all services must fall under the preview GST and that the export should be fully tax rebated. The countries now introducing GST without weaknesses of the past would get benefits of expansion of their international trade with special affect on exports.

While economic theory needs a careful review, there is case for implementing the GST in full earnest. It should be applied across the board on all goods and services. Further the basic purpose of analysing the effect of GST on international trade gets defeated if exporters do not receive full tax offsets.

IV. Scheme of Analysis

4.1 Sources of Data

India's international trade has increased rapidly during the last two decades. Differential indirect tax rates in the economy without apt setoffs have lead to tax cascading which distort production efficiency as well consumption pattern basket. Such taxes are likely to impact comparative advantage of exports in sectors in which taxes paid on various inputs have not been fully set off. This results in implicit taxation of such exports. Further, in the absence of efficient input tax setoffs, productive resources would move towards less taxed sectors and away from high taxed sectors

We assume that the non-offset component of exports acts as export tax equivalent (ETE). Once GST gets introduced, exporters would be able to take full credit of non-offset components of the net indirect taxes (NIT) paid by them. This would make exports 'zero-rated', i.e. subject to zero tax rates. GST would thus provide competitive advantage to India.

While much of the taxes paid on intermediate purchases by the business firms get rebates there still exist components which do not get this benefit. While the Central indirect taxes including customs and excise duties get nearly fully reimbursed, the state-level taxes do not get full offsets. Some such state-level taxes include central sales tax (CST), electricity duty, sales tax on petroleum products, mandi tax, entry taxes, octroi and municipal taxes. The cumulative impact of such un-rebated taxes has been estimated as between 3 per cent to 12 per cent of the fob export value depending on the product and its state of origin (Ministry of Commerce and Industry, Government of India, 2009). These figures include 1 per cent to 9 per cent as electricity duty, CST and sales tax on petroleum products and the remainder on account of mandi tax, entry tax, octroi, municipal taxes and cesses (NCAER 2005). Since all taxes, central as well as state, would be subsumed in GST exports are expected to become tax-free thus enhancing competitiveness of Indian exporters. In fact, all local duties and cesses should also get full offset through the instrument of GST.

The objective of this study is to estimate the impact of moving to a national GST, i.e. VAT on both goods and services, on India's foreign trade vis-à-vis the rest-of-world. It is expected that non-rebated indirect tax-induced resource allocation distortions would be done away with through state-level and centre-level GST and hence productivity of the economy would increase thus leading to enhanced welfare. The changes in comparative advantage in different sectors of production would alter composition of imports and exports – both of goods and services.

The Input-Output Transactions Tables (IOTT) for 2003-04 along with data obtained from the Annual Survey of Industries (2004-05) and the National Accounts Statistics (2008) provide background information for our analysis.⁴ The base year thus predates the introduction of state-level sales tax VAT though CENVAT was already in vogue. There are 130 sectors of production – 37 primary, 68 manufacturing and 25 tertiary (discussion in the following paragraphs of this section has been extracted from the background note on IOTT).

⁴ *Input-Output Transactions Table - 2003-04*, (2008): Central Statistical Organisation (CSO), Ministry of Statistics and Programme Implementation (MOSPI), Government of India.

National Accounts Statistics (2008): Central Statistical Organisation (CSO), Ministry of Statistics and Programme Implementation (MOSPI), Government of India.

Annual survey of Industries (2004-05): Central Statistical Organisation (CSO), Industrial Statistics Wing, Ministry of Statistics and Programme Implementation (MOSPI), Government of India.

We have mapped 130 IOTT sectors (Appendix 5 of IOTT 2003-04) into 60 IOTT sectors (Appendix 4 of IOTT 2003-04). In present study we work with these 60 sectors of production. In our analysis, the Commodity x Commodity (C x C) matrix has been prepared by following the standard methodology of the CSO. The 60 sectors include 7 agriculture and allied sectors; 4 mining sectors; 33 manufacturing sectors; and 16 services sectors (Refer to Table-1 for sectoral classification).

All the entries in the IOTT are at factor cost. These exclude trade and transport margins and net indirect taxes (NITs). In fact, the IOTT is first prepared at original purchasers' prices, i.e. prices at which actual transactions take place. The entries at factor cost are derived thereafter by removing the components of trade and transport margins and NITs. The NITs are shown in a separate row in IOTT and depict indirect taxes paid by the industries on intermediate inputs used in the process of production of industries' outputs.

Much of the information on industries and capital coefficients has been sourced from the Annual Survey of Industries and the National Accounts Statistics provides background information for primary service sectors

NIT is the difference between indirect tax paid and subsidy received by a sector of production. Indirect taxes are distinguished as commodity taxes and other indirect taxes. Commodity taxes include union & state excise duties, sales tax, custom duties (on imports & exports) and various other duties and cesses. Other indirect taxes include levies like electricity duty, motor vehicle tax, entertainment tax, and stamp duty, etc. The types of indirect taxes by commodities and services on which they are levied have, therefore, been ascertained and each particular tax has been apportioned in proportion to the value of flow of commodities going to different industry sectors and final uses. The source material used for different components of net indirect taxes on various commodity groups is described as follows (IOTT, 2003-04, CSO):

1. Commodity-wise union excise duties for the year 2003-04 have been taken from the Receipts budget 2005-06 of Central Government whereas data on state excise duties from respective State budget documents for the year 2005-06.
2. The budget documents of State Governments give only the state-wise break-up of the total sales tax levied and do not furnish their commodity-wise data. There is very little uniformity in the rates and exemptions of sales tax levied in different States & Union Territories. For allocating the total sales tax amongst different commodity sectors, the commodities on which sales tax are levied are identified, to the extent possible, and are

allocated to the respective sectors. The remaining amount of sales tax is allocated to the different commodity sectors in proportion to the norms arrived on the basis of the industry-wise data on sales tax from the ASI- 2003-04.

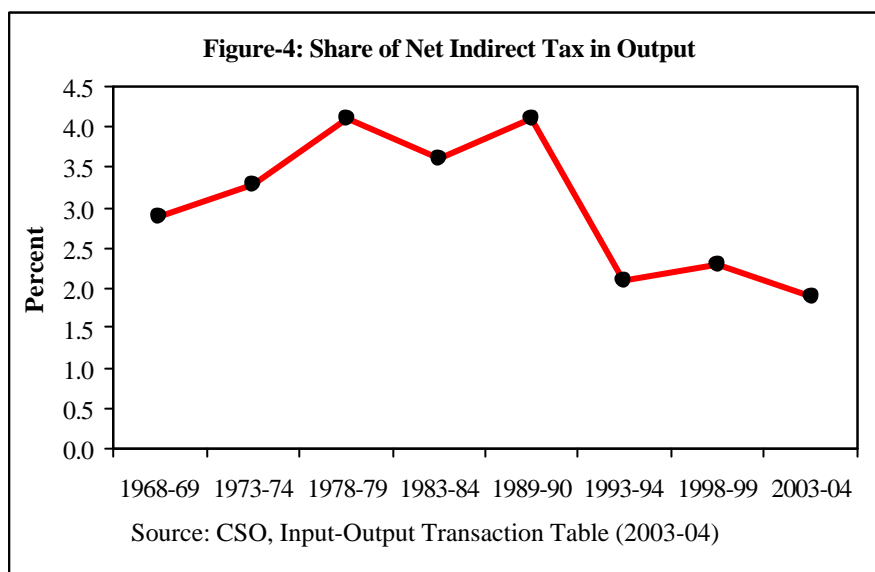
3. Imports are reported at c.i.f. values and are exclusive of import duties and domestic taxes. The commodity-wise custom duties (both on imports and exports) are available from the Ministry of Finance. Data on import duties have been used to build up commodity sector-wise import duties (130 sectors). Adjustments have been made for refunds & withdrawals to arrive at net import duties. Similarly, using the same source, commodity-wise export duties/cesses have been prepared.
4. Source material used for “other indirect taxes” is the budget documents of state governments and Finance Accounts of the Union and State Governments. These taxes have been identified and allocated to the respective sectors of the IOTT.
5. The commodity-wise subsidies have been compiled from the budgets of Central and State governments. These are identified to the relevant commodity sectors and allocated to different consuming industry sectors and final uses in proportion to the domestic flow. Some of the subsidies meant for specific purpose like subsidy provided for electricity and subsidy on the construction of wells for agriculture purposes have been allocated to the respective cells of the domestic flow matrix. Requisite details are, however, not available for many items like subsidies to agriculture, industry, irrigation, Food Corporation of India (FCI), National Small Industries Corporation, Small and Marginal Farmers Development Agencies, industrial corporations and subsidies for product promotion etc. Subsidies paid to FCI have been allocated to items such as wheat, rice and other crops on the basis of detailed data available from the Annual Report and Accounts of FCI, 2003-04. Similar subsidies given to Khadi and Village Industries Commission (KVIC) have been allocated on the basis of details available in the report of KVIC. Irrigation subsidy has been allocated to various crops in proportion to irrigated crop area.

This may, however, be noted that requisite details of indirect taxes and subsidies by products are generally not available, particularly in respect of VAT type taxes collected by different states, as well as in respect of the indirect taxes collected by local bodies.

4.2 Indirect Tax - Matrix Structure

A matrix of net indirect taxes is available from CSO. It provides the aggregate value of indirect taxes (130 x 130) paid during the IO transactions. Let NIT (i,j) denote net indirect tax paid by sector-j for purchases of inputs from sector-i.

Summation NIT (i,j), i varying from 1-130, indicates the total of net indirect taxes paid by sector-j for purchases of various inputs i (1-130) in its production process. This is the vertical summation of all the net indirect taxes paid by the jth sector on purchases of various inputs from 130 sectors



Summation NIT (i,j), j varying from 1-130 is the sum of net indirect taxes paid by 130 sectors of production while buying inputs from sector-i. This thus indicates total net indirect taxes paid on sales of sector-i to various sectors which purchase the output of sector-i as their inputs. This is the horizontal summation of all the net indirect taxes paid by 130 sectors on purchase of output of a particular sector as input in their respective production processes.

The ratios of total NIT to total output have large variations across sectors of production (Table 1). The manufacturing sectors as a whole are subjected to 5.7 per cent NIT. The corresponding ratio is 6.3 per cent in the case of capital goods and 5.3 per cent in buildings and construction.⁵ Thus net indirect tax rates are relatively high in capital goods as well as construction vis-à-vis overall rate of 1.9 per cent for the economy as a whole. The overall NIT of the seven capital goods sectors is higher than NIT of all the 33 manufacturing sectors taken

⁵ Capital goods sectors include Sectoral Classification Codes 37-43. Construction refers to Sector Code 45 (Table-1)

together. Relatively high taxes on capital goods affect investment through higher cost of capital (Bird *et al*).

The share of net indirect tax to output for India had increased from 2.9 per cent in 1968-69 to 4.1 per cent in 1978-79 and remained nearly the same till 1989-90 (Figure-4). It has declined thereafter to 1.9 per cent in 2003-04.

4.3 Analytical Framework

The objective of this study is to analyse the impact of GST introduction on India's foreign trade. Net indirect taxes lead to distortions in domestic resource allocation. Sectors of production which pay relatively high net indirect taxes without getting setoffs thereof might lose out on allocation of new resources in favour of sectors which pay relatively low net indirect taxes or receive full setoffs. Net indirect taxes may be viewed as implicit export tax equivalents (ETE). In fact, exports of all the products which do not get tax offsets suffer comparative disadvantage with high taxed sectors suffering relatively more vis-à-vis others.

The values of exports and imports during 2003-04 may be considered to be the base values. The NCAER / Michigan stand-alone CGE model has been used for our analysis in this study.

The structural input coefficients, a_{ij} in the $C \times C$ matrix (Matrix-A) do not reflect capital requirements of the economy. These represent flows from sector "i" to sector "j" of inputs required to produce one rupee's worth of output in the current year and are not representative of the capital coefficients in each of the 60 sectors of the economy.

In the standard input-output flow matrix (IO), sector-wise inputs required for capital formation are included in the final demand vector. In order to make the original input coefficients representative of the capital requirements we formulate an additional matrix called the "Capital Matrix - B". The detailed methodology for computing of the B-matrix is presented in the following discussion.

4.4 Leontief Dynamic Theory

Net indirect taxes on capital goods can have long-lasting effects on the economy if the same do not get full offsets. This limits the growth of capital stock and reduce productivity and employment over time (Smart and Bird, 2006).

The static input-output scheme used in earlier versions of our CGE model explains mutual interdependence of some distinct sectors of the national economy in terms of a given set of structural coefficients, a_{ij} ($i = n; j = n$). Each such coefficient represents the amount of the i^{th}

sector's output which is absorbed by per unit output of the j^{th} sector. A complete set of such coefficients for the j^{th} sector determines the flows of raw materials, fuel, labour and replacement parts from "n" supplying sectors in order to produce one unit of output. Given the vector of final demand for output of "n" sectors the Leontief Input-Output Model determines the total output of various sectors of the economy: $X = (I - A)^{-1} F$.

The input coefficients a_{ij} do not reflect the stock requirements of the economy (Leontief, 1953). These do not explain the magnitude of those input flows which serve directly to satisfy the capital needs of sectors of the economy, either as additions to fixed investment in buildings or in plant & equipment. In the open static system, such as described above, the capital inputs are not assigned to the sectors which absorb these but are shown as components of their final demand. This implies that whereas the effects of investment demand on outputs of all the sectors of production are explained the observed magnitude of the demand for capital goods is not explained.

Such explanation becomes possible as soon as the stock requirements of all the individual sectors of the economy are included in the structural map of the system along with the intermediate A_{ij} flows.

We have assumed that fixed assets created in a specific sector of production impact the output of this sector during the following year, i.e. assumption of one year lag. The reasons to assume one-year lag between capital formation and consequent increase in output have been discussed in Douette (1973).

Matrices A and B

- Structural input coefficients a_{ij} do not reflect capital requirements of an economy
- These represent flows from sector "i" to sector "j" of inputs required to produce one rupee's worth of output in the current year
- In standard input-output flow matrix inputs required for capital formation are included in the final demand vector
- B matrix (b_{ij}) represents capital requirements of 60 sectors of the economy

Structural Balance

$$X = AX + F$$

$$X = AX + B \Delta X + F$$

$$i = 1, 60; j = 1, 60$$

$$X_i = \sum a_{ij} X_j + \sum b_{ij} \Delta X_j + F_j$$

Need for Additional Investment

$$X_1 = a_{11}X_1 + a_{12}X_2 + b_{11} \Delta X_1 + b_{12} \Delta X_2 + F_1$$

$$X_2 = a_{21}X_1 + a_{22}X_2 + b_{21} \Delta X_1 + b_{22} \Delta X_2 + F_2$$

$$X_1 = (a_{11}+b_{11}) X_1 + (a_{12}+b_{12}) X_2 - (b_{11}X_1^0 + b_{12}X_2^0) + F_1$$

$$X_2 = (a_{21}+b_{21}) X_1 + (a_{22}+b_{22}) X_2 - (b_{21}X_1^0 + b_{22}X_2^0) + F_2$$

Where

$$\Delta X_i = X_i - X_i^0$$

$b_{ij} \Delta X_j = \Delta K_{ij}$ is the additional capital requirement of the j^{th} sector for capital good coming from the i^{th} sector

Details of computing Capital Matrix (B) are provided in Annex-1.

V. Modelling GST

5.1 General Equilibrium Model

We use a general equilibrium model to analyse the impact of India moving towards a comprehensive GST on goods and services along with ensuring full tax rebates on exports.

The CGE model that we have developed is distinctly different from existing models of the Indian economy (Brown *et al* 1996 and Chadha *et al*, 1998). Our India Model is a single-country, multi-sectoral CGE model. The present model incorporates some of the features of the new trade theory, viz. increasing returns to scale, monopolistic competition and product heterogeneity. India is modelled to produce, consume and 60 goods.

The market structure in 33 manufacturing sectors is modelled as monopolistically competitive. Perfect competition is assumed in agriculture, mining and service sectors

The final demand equations for various sectors are obtained assuming a single representative consumer who maximises utility subject to a budget constraint. It is assumed that the revenue from tariffs and indirect taxes gets re-distributed to consumers and then spent. Intermediate demands are derived from the profit-maximising decisions of the representative firms in each sector. Products in all the tradable sectors are characterised by some degree of product differentiation. In the nine sectors where markets are taken to be perfectly competitive, products are differentiated by country of origin, i.e., whether from India or rest-of-world (ROW). In the monopolistically competitive industries, products are differentiated by firm. India is assumed to be a small country such that world prices of various tradable goods are exogenous.

Consumers and producers are assumed to use a two-stage procedure to allocate expenditure across differentiated products. At the first stage, expenditure is allocated across goods without regard to the country of origin (whether India or ROW) or the producing firm. At this stage, the utility function is taken to be Cobb-Douglas and the production function requires intermediate inputs in fixed proportion. In the second stage, expenditure on monopolistically competitive goods is allocated across competing firms in India and ROW. However, in the case of perfectly competitive goods, since individual firm supply is indeterminate, expenditure on each good is allocated over the industry as a whole. The aggregation function in the second stage is a Constant Elasticity of Substitution (CES) function. We assume that aggregate expenditure varies endogenously to hold aggregate employment constant. Such a closure may be thought of as analogous to the Johansen closure rule.

With respect to factor markets, the variable input requirements are taken to be the same for the three market structures. Primary and intermediate input aggregates are required in fixed proportion to output.⁶ Expenditures on primary inputs are allocated between capital and labour, assuming that a CES function is used to form the aggregate of these primary inputs. In the case of the four agricultural sectors, land (along with capital and labour) is also assumed to be one of the primary factors of production. The primary inputs aggregate in these cases is a CES function of labour and a CES composite of land and capital. In the monopolistically competitive sectors as well as in the state monopoly sectors, additional fixed inputs of capital and labour are required. It is assumed that fixed capital and fixed labour are used in the same proportion as variable capital and variable labour so that production functions are homothetic. Capital and labour are assumed to be perfectly mobile across sectors. However, we keep the option of

⁶ Intermediate inputs include both domestic and imported varieties.

specifying sector-specific capital for some purposes, especially for short-term analysis. Land usage in agriculture is assumed to be substitutable across the four agricultural sectors. Returns to land, capital and labour are determined to equate factor demand to an exogenous supply of each factor. The aggregate supplies of labour, capital, and agricultural land are assumed to remain fixed so as to abstract from macroeconomic considerations involving, for example, determination of investment, since our focus is on the intersectoral allocation of resources. We introduce an element of capital coefficients during the base period though its effect on additional output gets reflected only in the post-simulation new equilibrium values. However, this does not imply that we increase the base year capital stock in any direct way. In fact, we estimate the impact of capital coefficients in addition to the input-output structural coefficients.

Perfectly competitive firms are assumed to set price equal to marginal cost, while monopolistically competitive firms maximise profits by setting price as an optimal mark-up over marginal cost. The numbers of firms in sectors under monopolistic competition are determined by the condition that there are zero profits. The price changes are relative to the domestic *numeraire* price of the sector “iron and steel”. This price is held constant while solving the model.

It is assumed that trade remains balanced, i.e. the initial trade imbalance remains constant as trade barriers are changed. This assumption reflects flexible exchange rate. Moreover, this is an appropriate way of abstracting from the macroeconomic forces and policies that are the main determinants of trade imbalance.

This model is solved using GEMPACK (Harrison and Pearson, 1996). The solution of simulation yields percentage changes in sectoral employment and certain other variables of interest for India. Multiplying the percentage changes by actual levels given in the data base yields the absolute changes, positive or negative, that might result from India’s unilateral trade and domestic policy reforms.

In addition to the sectoral effects that are the primary focus of our analysis, the model also yields results for changes in exports, imports, the overall level of welfare (measured through GDP) in the economy, and the economy-wide changes in real wages and returns to land and capital. Because both labour and capital are assumed to be homogeneous and mobile across sectors in these scenarios, we cannot distinguish effects on factor prices by sector. Nor can we distinguish effects on different skill groups or other categories of labour. Though we would like to know more about the distributional issues associated with the reforms, the model in its present form is

not set up to accomplish this. Our model also does not account for changes in foreign direct investment, and it does not make any allowance for dynamic efficiency changes and economic growth.

5.2 Simulations Design

The Net Indirect Taxes (NIT) paid by exporters on intermediate purchases (if they are producer exporters) or NIT passed on to them by producers from whom they purchase the exportable commodities are supposed to be fully offset. However, the same is not true in practice. We consider non-offset net indirect taxes as being exported and hence act like “export tax equivalent” (ETE).

While most of the Central taxes are offset the same is not true at the state-level. In order to facilitate our analysis we assume non-rebated tax proportions to vary between 25 per cent and 50 per cent (Box-1).

For the present study, we design two sets of simulations, Set-1 and Set-2. While Set-1 refers to experiments in which export tax equivalents (ETE) are brought down to zero by the full knocking off the ETE in all the sectors except primary sectors (codes 1-11). The methodology used is based on standard IOTT “A” matrix. We do not incorporate the additional impact of capital coefficients in our experiments.

Set-2 refers to the same experiments as in Set-1 but assuming the additional impact of capital coefficients in our experiments. We use both the “A” and the “B” matrices in S2.1 and S2.2.

The experiments under Set-1 refer to the simulations on providing full tax offsets for the non-offset component which gets exported through higher export fob price. We assume two different scenarios as mentioned in Box-1.

The Set-2 of simulations corresponds to those of Set-1 except that these are conducted under the additional impact of capital coefficients on output of the economy. These parallel simulations are labelled as S2.1 and S2.2.

As discussed above, our simulations have been designed to study the effect of offsets experimenting with various scenarios. Under the hypothetical offset of 75 per cent, the remaining 25 per cent of the ETE is completely eliminated in S1.1 and S2.1. In simulation S1.2 and S2.2 we assume that there are 50 per cent offsets and that the entire amount of remaining NIT needs to be eliminated. Our results are presented in Table 2-10.

Box-1: Simulations Design

SET 1	
S1.1	Export tax equivalents are estimated at 25 per cent of NIT without the effect of capital-coefficients
S1.2	Export tax equivalents are estimated at 50 per cent of NIT without the effect of capital-coefficients
SET 2	
S2.1	Export tax equivalents are estimated at 25 per cent of NIT with the additional impact of capital-coefficients
S2.2	Export tax equivalents are estimated at 50 per cent of NIT with the additional impact of capital-coefficients

VI. Results

6.1 Macro Variables: Simulations

In the absence of the additional impact of capital coefficients in the model, the reduction in ETE of the NIT leads to an improvement in productivity of the economy. The improvement increases for Simulations under Set 2 as compared with Simulations under Set 1.

Gain in GDP under S1.1 is 0.04 per cent which increases to 0.09 per cent in S1.2 (Table 2). However, a substantial improvement may be observed when we consider the additional impact of capital coefficients (Set-2). Here, the gain in GDP increases from 0.87 per cent to 1.7 per cent between S2.1 and S2.2. The gain in growth of GDP is one-time though the additional absolute return would be perpetual.

The efficiency of energy resource use improves in the new equilibrium. The domestic consumption of coal, petroleum products and electricity as ratio to GDP goes down from 14.3 per cent to 13.9 per cent. While the GDP grows by 1.7 per cent under scenario S2.2 the usage of coal & lignite and electricity grows only by 1 per cent each. The usage of petroleum products declines by 4.5 per cent. The introduction of GST would thus be environment friendly.

Under Set-1, gain in exports increases from 1.55 per cent to 3.07 per cent between S1.1 and S1.2. The comparable gains under the additional impact of capital coefficients (Set-2) are 3.22 per cent and 6.34 per cent, respectively.

Gains in imports increase from 1.09 per cent in S1.1 to 2.16 per cent in S1.2. Under Set-2 the corresponding increase is 2.39 per cent to 4.71 per cent, respectively.

Gain in net exports of the economy expands from 0.46 per cent to 0.91 per cent in S1.1 and S1.2, respectively. Their comparable values in Set-2 are 0.83 per cent to 1.63 per cent.

The economy-wide gain in output expands by 0.21 per cent in S1.1 and by 0.42 per cent in S1.2. Comparable expansions for Set-2 simulations are 0.32 per cent and 0.64 per cent, respectively.

Real returns to labour and capital show improvements between the Simulation-1 and Simulation-2 under both the sets, Set-1 and Set-2. The returns to these factors of production show substantial improvements with the inclusion of capital coefficients in the model.

Real returns to land deteriorate for both the simulations conducted under Set-1. However, we get indications of positive real returns to land under simulations of Set-2. This clearly highlights that land becomes more efficiently allocated in the latter set of experiments.

Using the results, changes in GDP and trade (imports and exports) in absolute values, over the corresponding values of 2008-09, are provided in Table 3.

6.2 Macro Variable: Comparisons across S1.1, S1.2, S2.1 and S2.2

Gain in absolute value of GDP is Rs 2,169 crore under S1.1 which increases to Rs 4,427 crore under S1.2. The corresponding changes in Dollar values are \$480 million and \$979 million, respectively. The results exhibit significant increases under S2.1 and S2.2. Gain in GDP is Rs 42,789 crore under S2.1 which increases to Rs 83,899 crore under S2.2. The corresponding changes in Dollar values are \$9,461 million and \$18,550 million, respectively.

The additional gain in GDP, originating from the GST reform, would be earned during all years in future over and above the growth in GDP which would have been achieved otherwise. The present value of the GST-reform induced gains in GDP may be computed as the present value of additional income stream based on some discount rate. We assume a discount rate as the long-term real rate of interest at about 3 per cent. The present value of total gain in GDP has been computed as between Rs 1,469 thousand crore and 2,881 thousand crore. The corresponding Dollar values are \$325 billion and \$637 billion.

In alternate scenario we assume a discount rate as the long-term real rate of interest at 5 per cent. The present value of total gain in GDP turns out to be somewhere between Rs 856

thousand crore and 1,678 thousand crore. The corresponding Dollar values are \$189 billion and \$371 billion.

Gains in exports are expected to vary between 3.2 and 6.3 per cent with corresponding absolute value range as Rs 24,669 crore and Rs 48,661 crore. The comparable Dollar value increment is estimated to be between \$5,427 million and \$10,704 million, respectively. Imports are expected to gain somewhere between 2.4 and 4.7 per cent with corresponding absolute values ranging between Rs 31,173 crore and Rs 61,501 crore. The comparable Dollar value increment is estimated to be between \$6,871 million and \$13,556 million, respectively.

6.3 Sectoral Results

We discuss our observations on sectoral output and scale effects for simulation S2.1 and 2.2 (Tables 4 and 5). Results for other simulations have also been presented in these Tables. It may be observed that output of agricultural sectors shows gains under simulation S2.1 as compared with S1.1 in which output of agricultural sectors shows expected decline. Further the gains under S2.2 are higher than those observed under S2.1. The largest increases in output occur in textiles and readymade garments; minerals other than coal, petroleum, gas and iron ore; organic heavy chemicals; industrial machinery for food and textiles; beverages; and miscellaneous manufacturing (Table 4). The sectors in which output is expected to decline include natural gas and crude petroleum; iron ore; coal tar products; and non-ferrous metal industries. There are minor gains and losses in output of other sectors

The scale effect (Table 5), which indicates the per cent change in output per firm, is positive and relatively high for sectors including beverages; textiles and readymade garments; coal tar products; chemical products; fertilisers; sugar; paints; pesticides; and cement. Scale effects are positive for all other sectors of manufacturing. Increased output per firm (scale effect) in the imperfectly competitive manufacturing sectors is an indicator of efficiency gains. The sectors, in which output grows, the proportional change in output is greater than proportional increase in number of firms. On the other hand, the sectors, in which output declines, the proportional decline in output is less than proportional decline in number of firms.

The intersectoral movements of labour and capital are recorded in Tables 6 and 7. Generally, labour and capital move into the sectors in which output is expected to increase.

The results of our study are based on using capital coefficients computed in B-matrix (Annex-1). These refer to the registered / organised sectors of the economy. Our analysis in

this study is thus based on the assumption that the capital coefficients computed for the registered sectors are also applicable to the unregistered sectors. However, it is worthwhile to compute capital coefficients for unregistered manufacturing sectors also and incorporate the same in the overall capital matrix. We have not been able to do so due to data limitations. Using information from the “Unorganised Manufacturing Sector in India: Employment, Assets and Borrowings”, NSSO (2005-06) we have computed some crude estimates of sectoral as well as overall capital coefficients in the unregistered sector. The aggregate incremental capital-output ratio turns out to be 1.46 for the unregistered manufacturing compared with 1.36 for the registered manufacturing sector. Capital coefficients are significantly high in certain unregistered sectors, viz. food products, textiles, garments, chemicals and some other manufacturing sectors. It may thus be observed that capital-output ratios are higher in some of the unregistered sectors than in the registered sectors. The GST reform would benefit the small-scale and other manufacturing units in unregistered sectors, relatively more than the corresponding registered sectors, through making capital cheaper than before through providing the benefits of full tax offsets. The unorganised sector would thus benefit more than the organised sector as a whole. The same may be true of some of the sectors within the unorganised sector thus making these more competitive in international markets than the scenario before the GST reform. The sectors mentioned in this paragraph are export intensive and hence would add to the exports from India.

6.4 Returns to the Factors of Production

GST would lead to efficient allocation of factors of production. It is expected that the real returns to the factors of production would go up under the scenarios of Set-2 as compared with Set-1. Our results for Set-2 show gains in real returns to land ranging between 0.42 and 0.82 per cent. Wage rate gains vary between 0.68 and 1.33 per cent. The real returns to capital would gain somewhere between 0.37 and 0.74 per cent.

6.5 Exports and Imports

The details of gains in merchandise exports and imports under different scenarios are given in Tables 8 and 9. Under simulation S2.2 the sectors with the largest proportional change in exports increases include textiles and readymade garments; beverages; industrial machinery for food and textiles; transport equipment other than railway equipment; electrical and electronic machinery; and chemical products: organic and inorganic. The moderate gainers are agricultural machinery; metal products; other machinery; and railway transport

equipment. Exports are expected to decline in agricultural sectors; iron and steel; wood and wood products except furniture; and cement. There are minor gains and losses in exports of other sectors (Table 8).

The major import gaining sectors include leather and leather products; furniture and fixtures; agricultural sectors; coal and lignite; agricultural machinery; industrial machinery; other machinery; iron and steel; railway transport equipment; printing and publishing; and tobacco products. The moderate gainers include metal products; non-ferrous metals; and transport equipment other than railways. Imports are expected to decline in textiles and readymade garments; minerals other than coal, crude petroleum, gas and iron ore; and beverages (Table 9).

6.6 Changes in Prices

There are two opposing forces which determine the changes in price levels. First, increased payments to the primary factors of production, viz. land, labour and capital, increase the cost of production and hence tend to have upward pull on prices. Second, sectors under imperfect competition (manufacturing sectors) get benefits of cost reduction through increasing returns to scale which are not reaped by sectors assumed to be in perfect competition. The relative impact of the force determines the overall price change. It may also be noted that the share of primary inputs (land, labour and capital) in total output is relatively high in agricultural and services sectors

Another factor that impacts the price levels refers to the quantum of intermediate input purchases from sectors under perfect competition versus imperfect competition. Relatively low proportions of intermediate inputs purchased by agriculture and service sectors (i.e. sectors under perfect competition) are sourced from manufacturing sectors and hence these sectors do not reap the benefit of relatively low cost inputs from manufacturing sectors

Terms of trade would improve in favour of agriculture vis-à-vis manufactured goods. The overall prices of agricultural goods (Sectors 1 - 7) go up by 0.57 per cent under S-2.1 and by 1.12 per cent under S-2.2. The overall prices of all the manufacturing sectors (sectors 12 - 44) decline by 1.22 per cent under S-2.1 and by 2.53 per cent under S-2.2. Consequently, the terms-of-trade move in favour of agriculture vis-à-vis manufactured goods within a range of 1.8 to 3.8 per cent.

The increase in agricultural prices would benefit millions of farmers in India. With regard to the food crops the poor would continue to remain secured through the public distribution

system. The prices of many other consumer goods are expected to decline. These include sugar; beverages; cotton textiles; wool, silk and synthetic fibre textiles; and textile products and wearing apparel.

N.C.: Not Computed; Sectors 45, 46, 47, 50, 56, 57, 58 and 60 are not internationally traded (IO 2003-04) and hence the changes in their prices could not be computed.

6.7 Net Indirect Tax and Gains in Exports

We have computed regression equation with percentage change in exports as dependent variable and “net indirect tax to output ratio (NIT-to-Q ratio)” as independent variable. Results show positive and significant relationship between percentage changes in exports to NIT-to-Q ratio. This is indicative of the fact that full tax offsets in relatively high taxed sectors would lead to higher gains in exports compared to less taxed sectors

VII. Revenue Neutral GST Rate

Based on the results of our simulations, we have attempted to determine a uniform revenue-neutral GST rate. This implies computation of GST rate which results in the same net indirect revenue as collected in 2003-04, i.e. the IOTT used in this study. The total NIT was 2,16,073 crore. The revenue neutrality exercise has been undertaken for the simulations S2.1 and S2.2. The model does not have details on government budget. It abstracts from macroeconomic variables

The output tax rates (row-wise) are given in Table 11.⁷ However, given the sensitivity of the subsidized sectors, i.e. sectors with negative NIT values, our computations have excluded such sectors from the ambit of computing the revenue neutral GST rate. We have conducted two alternative exercises:

1. Applying GST to all the sectors of goods and services excluding sectors: food crops (01); cash crops (02); plantation crops (03); other crops (04); and fertilizers (30).
2. Applying GST to all the goods and services sectors excluding sectors: fishing (07); electricity (46); railway transport services (48); and communication (51) over and above those mentioned in Scenario-1.
3. Applying GST to all goods and services sectors excluding food crops (01), education and research (57) and medical and health (58). Under the assumption that the petroleum

⁷ We do not assume any exemptions on indirect taxes paid on final consumption in our computations. The GST rate would be higher than what we have computed if there are some exemptions for taxing consumption of certain goods and services.

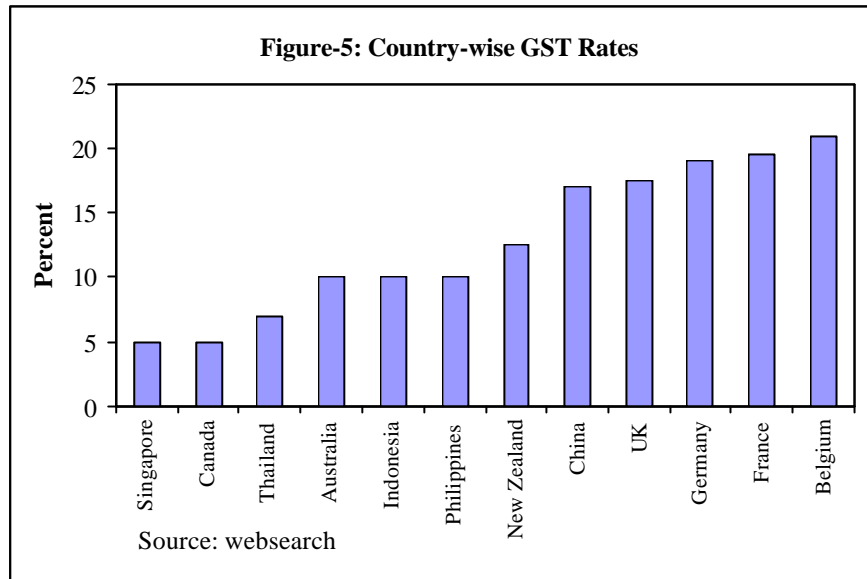
tax would not be subsumed in GST, the base tax value has been adjusted through subtracting the NIT on output of petroleum products from total NIT. The total NIT is Rs2,16,073 crore. The NIT on output of petroleum products (IO sector 26) is Rs39,184 crore. Thus, the revised base tax after excluding NIT for the petroleum products is Rs1,76,889 crore.

4. Applying GST on all goods and services (no exemptions) with initial tax base being same as in Scenario-3.

The computation of revenue neutrality is based on taxing all the goods and services going to final consumption, i.e. “final demand net of change in stocks *minus* exports *plus* imports (excluding imports going for intermediate usage)”. We have attempted two different variants.

The results of these four cases are tabulated in Box-2. Based on our computations, the revenue neutral GST rate across goods and services is expected to be positioned somewhere in the range of 6.2 per cent and 9.4 per cent, depending on various scenarios of sectoral exemptions. GST rates of some other countries are shown in Figure-5.

Box 2: Revenue Neutral GST Rates			
Group	Excluded IO sectors	Revenue Neutral GST Rate (%)	
		S2.1	S2.2
1	Food crops (01), Cash crops (02), Plantation crops (03), Other crops (04), Fertilizers (30)	9.04	9.01
2	Food crops (01), Cash crops (02), Plantation crops (03), Other crops (04), Fishing (07), Fertilizers (30), Electricity (46), Railway transport services (48), Communication (51)	9.42	9.40
3*	Food crops (01), Education and research (57), Medical and health (58)	7.25	7.22
4*	None	6.22	6.20
<p>* In scenario 3 and 4, the revised base tax has been computed after excluding NIT on output of petroleum products (IO 26) from total NIT.</p> <p>S2.1: Export tax equivalents are reduced by 25 per cent with additional impact of capital-coefficients.</p> <p>S2.2 Export tax equivalents are reduced by 50 per cent with additional impact of capital-coefficients.</p> <p>Source: NCAER computations</p>			



VIII. Concluding Remarks

Implementation of a comprehensive GST across goods and services is expected, *ceteris paribus*, to increase India's GDP somewhere within a range of 0.9 per cent to 1.7 per cent. The corresponding changes in absolute values of GDP over 2008-09 is expected to be between Rs 42,789 crore and Rs 83,899 crore, respectively. The comparable Dollar value increment is estimated to be between \$9,461 million and \$18,550 million, respectively.

The additional gain in GDP, originating from the GST reform, would be earned during all years in future over and above the growth in GDP which would have been achieved otherwise. The present value of the GST-reform induced gains in GDP may be computed as the present value of additional income stream based on some discount rate. We assume a discount rate as the long-term real rate of interest at about 3 per cent. The present value of total gain in GDP has been computed as between Rs 1,469 thousand crore and 2,881 thousand crore. The corresponding Dollar values are \$325 billion and \$637 billion.

Gains in exports are expected to vary between 3.2 and 6.3 per cent with corresponding absolute value range as Rs 24,669 crore and Rs 48,661 crore. The comparable Dollar value increment is estimated to be between \$5,427 million and \$10,704 million, respectively. Imports are expected to gain somewhere between 2.4 and 4.7 per cent with corresponding absolute values ranging between Rs 31,173 crore and Rs 61,501 crore. The comparable Dollar value increment is estimated to be between \$6,871 million and \$13,556 million, respectively.

GST would lead to efficient allocation of factors of production. The overall price level would go down. It is expected that the real returns to the factors of production would go up. Our results show gains in real returns to land ranging between 0.42 and 0.82 per cent. Wage rate gains vary between 0.68 and 1.33 per cent. The real returns to capital would gain somewhere between 0.37 and 0.74 per cent.

The efficiency of energy resource use improves in the new equilibrium. The introduction of GST would thus be environment friendly.

Based on our computations, the revenue neutral GST rate across goods and services is expected to be positioned somewhere in the range of 6.2 per cent and 9.4 per cent, depending on various scenarios of sectoral exemptions.

In sum, implementation of a comprehensive GST in India is expected to lead to efficient allocation of factors of production thus leading to gains in GDP and exports. This would translate into enhanced economic welfare and returns to the factors of production, viz. land, labour and capital.

As with any other modelling exercise, the results of our exercise are subject to certain limitations. The general equilibrium model that we have used is comparative static in nature. Aggregate supplies of labour, capital, and agricultural land are assumed to remain fixed so as to abstract from macroeconomic considerations. Given these limitations the results must not be read as *forecasts* of variables but only as indicative directional changes.

Table 1: Distribution of Net Indirect Tax (NIT) across Sectors: Column-wise (Rs Lakh)

IO Code	Description	NIT	Output	NIT/Q (%)	Non-Offset Component of NIT/Q*	
					25% for all sectors	50% for all sectors
01	Food crops	-2459549	24018772	-10.24	-	-
02	Cash crops	-799381	8415368	-9.50	-	-
03	Plantation crops	-21715	6158859	-0.35	-	-
04	Other crops	-1319582	14717186	-8.97	-	-
05	Animal husbandry	58446	18281531	0.32	0.08	0.16
06	Forestry & logging	10162	2486237	0.41	0.10	0.20
07	Fishing	5148	3171641	0.16	0.04	0.08
08	Coal and lignite	63565	3504984	1.81	0.45	0.91
09	Natural gas & Crude Petroleum	70976	3417653	2.08	0.52	1.04
10	Iron ore	8916	466676	1.91	0.48	0.96
11	Other minerals	18619	1362604	1.37	0.34	0.68
12	Sugar	36082	3347510	1.08	0.27	0.54
13	Food products excluding sugar	310823	18862942	1.65	0.41	0.82
14	Beverages	125281	2578789	4.86	1.21	2.43
15	Tobacco products	75711	1146560	6.60	1.65	3.30
16	Cotton textiles	127337	5775566	2.20	0.55	1.10
17	Wool, silk & synthetic fibre textiles	167616	3779899	4.43	1.11	2.22
18	Jute, hemp and mesta textiles	6292	448282	1.40	0.35	0.70
19	Textiles products including wearing apparel	249570	8352802	2.99	0.75	1.49
20	Wood and wood products except furniture	15137	848314	1.78	0.45	0.89
21	Furniture and fixture	31336	817397	3.83	0.96	1.92
22	Paper and paper products	157595	2413073	6.53	1.63	3.27
23	Printing, publishing and allied activities	134929	2093160	6.45	1.61	3.22
24	Leather and leather products	72760	1633695	4.45	1.11	2.23
25	Plastic and rubber products	367018	6013,370	6.10	1.53	3.05
26	Petroleum products	1648626	17375676	9.49	2.37	4.74
27	Coal tar products	45531	829162	5.49	1.37	2.75
28	Inorganic heavy chemicals	198546	2926687	6.78	1.70	3.39
29	Organic heavy chemicals	182309	2495675	7.30	1.83	3.65
30	Fertilizers	170890	3200493	5.34	1.33	2.67
31	Paints, varnishes and lacquers	132469	1762397	7.52	1.88	3.76
32	Pesticides, drugs and other chemicals	1025062	14640229	7.00	1.75	3.50
33	Cement	52996	1897034	2.79	0.70	1.40
34	Non metallic mineral products	199323	4045898	4.93	1.23	2.46
35	Iron & steel industries and	748355	13749377	5.44	1.36	2.72

IO Code	Description	NIT	Output	NIT/Q (%)	Non-Offset Component of NIT/Q*	
					25% for all sectors	50% for all sectors
	foundries					
36	Other basic metal industry	154267	2979788	5.18	1.29	2.59
37	Metal products except mach & transport Equipment	371203	5798872	6.40	1.60	3.20
38	Agricultural machinery	79857	1048495	7.62	1.90	3.81
39	Industrial machinery for food and textiles	66534	823870	8.08	2.02	4.04
40	Other machinery	559456	7662699	7.30	1.83	3.65
41	Electrical, electronic machinery & appliances	1317141	16443198	8.01	2.00	4.01
42	Railway transport equipment	55629	865713	6.43	1.61	3.21
43	Other transport equipment	638423	9216468	6.93	1.73	3.46
44	Miscellaneous manufacturing industries	336979	7100046	4.75	1.19	2.37
45	Construction	2339910	44152788	5.30	1.32	2.65
46	Electricity	-948373	14790883	-6.41	-	-
47	Water supply	4121	786315	0.52	0.13	0.26
48	Railway transport services	-158825	5513456	-2.88	-	-
49	Other transport services	2178276	36359410	5.99	1.50	3.00
50	Storage and warehousing	3952	308332	1.28	0.32	0.64
51	Communication	-102072	5728231	-1.78	-	-
52	Trade	278957	45422021	0.61	0.15	0.31
53	Hotels and restaurants	198573	10292468	1.93	0.48	0.96
54	Banking	67202	16842287	0.40	0.10	0.20
55	Insurance	52977	4239538	1.25	0.31	0.62
56	Ownership of dwellings	14181	13931500	0.10	0.03	0.05
57	Education and research	27015	10887331	0.25	0.06	0.12
58	Medical and health	261743	7301778	3.58	0.90	1.79
59	Other services	176794	21413849	0.83	0.21	0.41
60	Public administration and defence	0	15615700	0.00	0.00	0.00
	Total	9891117	512560534	1.91	0.00	0.00

* Non-Offset Component of NIT at 25% implies that the total NIT paid has been offset to the extent of 75%. Similarly, Non-Offset Component of NIT at 50% implies that the total NIT paid has been offset to the extent of 50%.

Source: NCAER computation based on IO 2003-04. Sectors with subsidy (negative NIT/Output ratio) are not considered in computations in this Table.

Table 2: Percentage Change in Macro Variables

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1	S 1.2	S 2.1	S 2.2
	Non Offset NIT Rate	(25%)	(50%)	(25%)	(50%)
1	GDP	0.04	0.09	0.87	1.70
2	Export	1.55	3.07	3.22	6.34
3	Import	1.09	2.16	2.39	4.71
4	Net Export	0.46	0.91	0.83	1.63
5	Output	0.21	0.42	0.32	0.64
6	Real Returns to Land	-0.06	-0.11	0.42	0.82
7	Real Returns to Labour	0.12	0.24	0.68	1.33
8	Real Returns to Capital	0.34	0.68	0.37	0.74

Source: NCAER Simulations

Table 3: Absolute Changes in Macro Variables over 2008-09 Values

S. No.	Sector Description	Values: 2008-09	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
			S 1.1	S 1.2	S 2.1	S 2.2
			(25%)	(50%)	(25%)	(50%)
Rs Crore						
1	GDP	49,33,183	2,169	4,427	42,789	83,899
2	Export	7,66,935	11,859	23,547	24,669	48,661
3	Import	13,05,503	14,165	28,158	31,173	61,501
4	Net Export	-5,38,568	-2,484	-4,919	-4,464	-8,800
US\$ Million						
1	GDP	1,090,734	480	979	9,461	18,550
2	Export	168,704	2,609	5,180	5,427	10,704
3	Import	287,759	3,122	6,207	6,871	13,556
4	Net Export	-119,055	-549	-1,087	-987	-1,945

Source: NCAER Simulations

Table 4: Percentage Change in Output

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
1	Food crops	-0.09	-0.17	0.19	0.36
2	Cash crops	-0.09	-0.17	1.25	2.46
3	Plantation crops	-0.14	-0.28	0.03	0.04
4	Other crops	-0.04	-0.08	0.06	0.11
5	Animal husbandry	-0.04	-0.09	0.40	0.78
6	Forestry & logging	-0.19	-0.38	-1.18	-2.31
7	Fishing	-0.46	-0.91	0.54	1.04
8	Coal and lignite	0.01	0.01	-0.43	-0.85
9	Natural gas & Crude Petroleum	-1.43	-2.86	-3.63	-7.17
10	Iron ore	-1.15	-2.29	-2.89	-5.69
11	Other minerals	2.82	5.61	9.21	18.13
12	Sugar	-0.14	-0.27	1.47	2.88
13	Food products excluding sugar	-0.34	-0.66	0.62	1.20
14	Beverages	-0.10	-0.20	3.06	6.00
15	Tobacco products	-0.09	-0.18	0.54	1.05
16	Cotton textiles	-0.52	-0.94	6.22	12.26
17	Wool, silk & synthetic fibre textiles	1.29	2.63	11.06	21.78
18	Jute, hemp and mesta textiles	-0.32	-0.63	0.81	1.58
19	Textiles products including wearing apparel	-0.10	0.03	16.71	32.99
20	Wood and wood products except furniture	-0.08	-0.17	-1.00	-1.96
21	Furniture and fixture	0.13	0.25	0.53	1.03
22	Paper and paper products	-0.01	-0.03	1.03	2.01
23	Printing, publishing and allied activities	-0.11	-0.22	0.70	1.37
24	Leather and leather products	0.68	1.34	0.12	0.25
25	Plastic and rubber products	0.63	1.25	1.88	3.68
26	Petroleum products	0.54	1.06	1.31	2.55
27	Coal tar products	-0.27	-0.55	-2.13	-4.18
28	Inorganic heavy chemicals	0.65	1.27	2.12	4.14
29	Organic heavy chemicals	4.26	8.33	5.65	11.03
30	Fertilizers	0.12	0.23	1.27	2.49
31	Paints, varnishes and lacquers	0.75	1.46	1.06	2.08
32	Pesticides, drugs and other chemicals	0.75	1.46	1.93	3.78
33	Cement	0.13	0.26	-0.63	-1.23
34	Non metallic mineral products	0.19	0.36	-0.25	-0.49
35	Iron & steel industries and foundries	0.90	1.76	-0.23	-0.46
36	Other basic metal industry	2.09	4.05	-2.30	-4.55
37	Metal products except mach & transport Equipment	0.63	1.23	0.70	1.36
38	Agricultural machinery	0.34	0.67	0.33	0.65
39	Industrial machinery for food and textiles	0.29	0.59	3.99	7.84
40	Other machinery	0.63	1.21	-0.23	-0.47

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1	S 1.2	S 2.1	S 2.2
Non Offset NIT Rate		(25%)	(50%)	(25%)	(50%)
41	Electrical, electronic machinery & appliances	0.59	1.14	0.61	1.19
42	Railway transport equipment	0.19	0.38	0.43	0.84
43	Other transport equipment	0.49	0.96	1.21	2.37
44	Miscellaneous manufacturing industries	9.09	17.94	3.00	6.00
45	Construction	0.11	0.21	-3.52	-6.88
46	Electricity	0.17	0.34	0.68	1.33
47	Water supply	-0.02	-0.05	0.01	0.02
48	Railway transport services	0.21	0.41	-0.19	-0.37
49	Other transport services	-0.02	-0.04	0.82	1.60
50	Storage and warehousing	-0.11	-0.21	0.02	0.03
51	Communication	0.14	0.27	0.61	1.19
52	Trade	-0.19	-0.37	0.31	0.61
53	Hotels and restaurants	-0.30	-0.60	0.07	0.13
54	Banking	0.06	0.12	0.37	0.73
55	Insurance	-0.10	-0.20	0.41	0.81
56	Ownership of dwellings	-0.16	-0.32	-6.10	-11.92
57	Education and research	-0.11	-0.21	0.42	0.82
58	Medical and health	0.02	0.05	-2.22	-4.35
59	Other services	-0.78	-1.56	-1.84	-3.63
60	Public administration and defence	-0.01	-0.03	0.22	0.43
	Total	0.21	0.42	0.32	0.64

Note: Increase and decrease in output results from full employment and resource use in the economy. Results are based on resource re-allocation across sectors

Source: NCAER Simulations

Table 5: Percentage Change in Output per Firm: Scale Effects

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
1	Food crops	-	-	-	-
2	Cash crops	-	-	-	-
3	Plantation crops	-	-	-	-
4	Other crops	-	-	-	-
5	Animal husbandry	-	-	-	-
6	Forestry & logging	-	-	-	-
7	Fishing	-	-	-	-
8	Coal and lignite	-	-	-	-
9	Natural gas & Crude Petroleum	-	-	-	-
10	Iron ore	-	-	-	-
11	Other minerals	-	-	-	-
12	Sugar	0.05	0.10	1.22	2.40
13	Food products excluding sugar	0.04	0.07	0.68	1.34
14	Beverages	0.06	0.12	2.90	5.68
15	Tobacco products	0.04	0.08	0.11	0.21
16	Cotton textiles	0.04	0.08	1.69	3.32
17	Wool, silk & synthetic fibre textiles	0.38	0.77	2.73	5.37
18	Jute, hemp and mesta textiles	0.06	0.13	0.90	1.76
19	Textiles products including wearing apparel	0.10	0.23	2.86	5.62
20	Wood and wood products except furniture	0.20	0.40	0.27	0.54
21	Furniture and fixture	0.26	0.51	0.45	0.88
22	Paper and paper products	0.18	0.35	0.93	1.83
23	Printing, publishing and allied activities	0.21	0.41	0.85	1.67
24	Leather and leather products	0.18	0.35	0.46	0.90
25	Plastic and rubber products	0.41	0.81	1.36	2.67
26	Petroleum products	0.57	1.13	1.14	2.24
27	Coal tar products	0.32	0.63	1.30	2.54
28	Inorganic heavy chemicals	0.49	0.97	1.56	3.06
29	Organic heavy chemicals	0.52	1.02	1.59	3.13
30	Fertilizers	0.48	0.94	1.65	3.23
31	Paints, varnishes and lacquers	0.47	0.92	1.30	2.55
32	Pesticides, drugs and other chemicals	0.48	0.94	1.24	2.43
33	Cement	0.26	0.51	1.06	2.09
34	Non metallic mineral products	0.26	0.51	1.12	2.20
35	Iron & steel industries and foundries	0.35	0.68	0.51	1.01
36	Other basic metal industry	0.48	0.96	0.88	1.73
37	Metal products except mach & transport Equipment	0.41	0.81	0.57	1.12
38	Agricultural machinery	0.37	0.72	0.63	1.24
39	Industrial machinery for food and textiles	0.41	0.81	0.64	1.26
40	Other machinery	0.39	0.76	0.53	1.04

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
41	Electrical, electronic machinery & appliances	0.47	0.93	0.74	1.45
42	Railway transport equipment	0.32	0.63	0.48	0.94
43	Other transport equipment	0.34	0.66	0.54	1.07
44	Miscellaneous manufacturing industries	0.93	1.84	1.09	2.15
45	Construction	-	-	-	-
46	Electricity	-	-	-	-
47	Water supply	-	-	-	-
48	Railway transport services	-	-	-	-
49	Other transport services	-	-	-	-
50	Storage and warehousing	-	-	-	-
51	Communication	-	-	-	-
52	Trade	-	-	-	-
53	Hotels and restaurants	-	-	-	-
54	Banking	-	-	-	-
55	Insurance	-	-	-	-
56	Ownership of dwellings	-	-	-	-
57	Education and research	-	-	-	-
58	Medical and health	-	-	-	-
59	Other services	-	-	-	-
60	Public administration and defence	-	-	-	-

Source: NCAER Simulations

Table 6: Percentage Change in Employment

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
1	Food crops	-0.10	-0.21	0.05	0.09
2	Cash crops	-0.13	-0.24	1.13	2.21
3	Plantation crops	-0.17	-0.34	-0.10	-0.21
4	Other crops	-0.08	-0.16	-0.07	-0.14
5	Animal husbandry	-0.07	-0.15	0.27	0.53
6	Forestry & logging	-0.22	-0.44	-1.30	-2.56
7	Fishing	-0.29	-0.57	0.30	0.57
8	Coal and lignite	0.21	0.40	-0.69	-1.37
9	Natural gas & Crude Petroleum	-1.24	-2.48	-3.90	-7.69
10	Iron ore	-0.95	-1.90	-3.15	-6.21
11	Other minerals	3.02	6.00	8.94	17.61
12	Sugar	-0.08	-0.15	1.20	2.35
13	Food products excluding sugar	-0.27	-0.54	0.42	0.82
14	Beverages	-0.03	-0.05	2.51	4.92
15	Tobacco products	-0.01	-0.03	0.40	0.77
16	Cotton textiles	-0.46	-0.82	5.87	11.58
17	Wool, silk & synthetic fibre textiles	1.34	2.72	10.50	20.69
18	Jute, hemp and mesta textiles	-0.25	-0.49	0.56	1.11
19	Textiles products including wearing apparel	0.01	0.25	16.11	31.80
20	Wood and wood products except furniture	-0.11	-0.22	-1.28	-2.51
21	Furniture and fixture	0.09	0.17	0.17	0.33
22	Paper and paper products	0.21	0.41	0.55	1.07
23	Printing, publishing and allied activities	-0.02	-0.04	0.17	0.31
24	Leather and leather products	0.74	1.46	-0.18	-0.35
25	Plastic and rubber products	0.72	1.41	1.48	2.89
26	Petroleum products	0.59	1.16	0.95	1.85
27	Coal tar products	-0.23	-0.47	-2.44	-4.79
28	Inorganic heavy chemicals	0.73	1.43	1.67	3.27
29	Organic heavy chemicals	4.34	8.49	5.19	10.15
30	Fertilizers	0.23	0.44	0.78	1.52
31	Paints, varnishes and lacquers	0.83	1.63	0.65	1.28
32	Pesticides, drugs and other chemicals	0.83	1.63	1.53	2.99
33	Cement	0.25	0.49	-1.01	-1.96
34	Non metallic mineral products	0.30	0.59	-0.63	-1.24
35	Iron & steel industries and foundries	0.97	1.91	-0.48	-0.95
36	Other basic metal industry	2.11	4.08	-2.55	-5.04
37	Metal products except mach & transport Equipment	0.67	1.31	0.47	0.92
38	Agricultural machinery	0.49	0.96	-0.04	-0.08
39	Industrial machinery for food and textiles	0.43	0.87	3.62	7.11
40	Other machinery	0.76	1.47	-0.61	-1.21

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
41	Electrical, electronic machinery & appliances	0.86	1.68	0.03	0.05
42	Railway transport equipment	0.30	0.58	0.15	0.30
43	Other transport equipment	0.62	1.20	0.89	1.75
44	Miscellaneous manufacturing industries	9.27	18.27	2.41	4.85
45	Construction	0.18	0.36	-3.63	-7.09
46	Electricity	0.26	0.51	0.56	1.10
47	Water supply	0.06	0.12	-0.11	-0.21
48	Railway transport services	0.29	0.56	-0.29	-0.57
49	Other transport services	0.17	0.32	0.56	1.10
50	Storage and warehousing	0.04	0.07	-0.18	-0.34
51	Communication	0.29	0.56	0.40	0.79
52	Trade	0.04	0.08	0.00	0.01
53	Hotels and restaurants	-0.09	-0.17	-0.22	-0.45
54	Banking	0.24	0.47	0.13	0.25
55	Insurance	0.08	0.15	0.17	0.33
56	Ownership of dwellings	0.03	0.06	-6.37	-12.44
57	Education and research	0.02	0.05	0.24	0.47
58	Medical and health	0.16	0.31	-2.41	-4.70
59	Other services	-0.65	-1.30	-2.03	-3.99
60	Public administration and defence	-0.01	-0.03	0.22	0.43

Source: NCAER Simulations

Table 7: Percentage Change in Capital

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
1	Food crops	-0.28	-0.55	0.29	0.55
2	Cash crops	-0.30	-0.58	1.36	2.68
3	Plantation crops	-0.34	-0.68	0.14	0.26
4	Other crops	-0.26	-0.50	0.17	0.32
5	Animal husbandry	-0.25	-0.49	0.51	0.99
6	Forestry & logging	-0.39	-0.78	-1.07	-2.10
7	Fishing	-0.51	-1.00	0.60	1.17
8	Coal and lignite	-0.12	-0.24	-0.25	-0.50
9	Natural gas & Crude Petroleum	-1.56	-3.12	-3.45	-6.82
10	Iron ore	-1.28	-2.54	-2.71	-5.34
11	Other minerals	2.69	5.36	9.39	18.48
12	Sugar	-0.19	-0.37	1.35	2.64
13	Food products excluding sugar	-0.39	-0.76	0.58	1.12
14	Beverages	-0.14	-0.27	2.67	5.22
15	Tobacco products	-0.13	-0.25	0.55	1.06
16	Cotton textiles	-0.61	-1.12	6.07	11.98
17	Wool, silk & synthetic fibre textiles	1.19	2.43	10.71	21.09
18	Jute, hemp and mesta textiles	-0.40	-0.79	0.77	1.51
19	Textiles products including wearing apparel	-0.24	-0.24	16.45	32.47
20	Wood and wood products except furniture	-0.27	-0.54	-1.05	-2.07
21	Furniture and fixture	-0.08	-0.15	0.40	0.77
22	Paper and paper products	-0.20	-0.40	1.11	2.16
23	Printing, publishing and allied activities	-0.28	-0.55	0.52	1.01
24	Leather and leather products	0.52	1.02	0.13	0.25
25	Plastic and rubber products	0.51	1.00	1.77	3.46
26	Petroleum products	0.45	0.88	1.14	2.23
27	Coal tar products	-0.38	-0.75	-2.25	-4.41
28	Inorganic heavy chemicals	0.53	1.03	1.95	3.80
29	Organic heavy chemicals	4.14	8.09	5.47	10.68
30	Fertilizers	-0.01	-0.02	1.10	2.14
31	Paints, varnishes and lacquers	0.63	1.23	0.93	1.81
32	Pesticides, drugs and other chemicals	0.63	1.23	1.80	3.53
33	Cement	0.02	0.05	-0.70	-1.36
34	Non metallic mineral products	0.08	0.15	-0.32	-0.63
35	Iron & steel industries and foundries	0.81	1.58	-0.25	-0.50
36	Other basic metal industry	2.00	3.86	-2.39	-4.75
37	Metal products except mach & transport Equipment	0.50	0.97	0.71	1.38
38	Agricultural machinery	0.15	0.29	0.43	0.84
39	Industrial machinery for food and textiles	0.09	0.19	4.09	8.03

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
40	Other machinery	0.42	0.80	-0.14	-0.30
41	Electrical, electronic machinery & appliances	0.36	0.69	0.72	1.40
42	Railway transport equipment	0.05	0.09	0.49	0.96
43	Other transport equipment	0.37	0.71	1.23	2.41
44	Miscellaneous manufacturing industries	8.76	17.28	3.11	6.20
45	Construction	-0.19	-0.37	-3.12	-6.10
46	Electricity	-0.07	-0.13	1.00	1.96
47	Water supply	-0.26	-0.52	0.34	0.66
48	Railway transport services	0.02	0.04	0.08	0.14
49	Other transport services	-0.10	-0.20	0.93	1.81
50	Storage and warehousing	-0.23	-0.46	0.19	0.37
51	Communication	0.02	0.04	0.77	1.50
52	Trade	-0.23	-0.45	0.37	0.72
53	Hotels and restaurants	-0.35	-0.70	0.14	0.26
54	Banking	-0.03	-0.06	0.49	0.96
55	Insurance	-0.19	-0.38	0.54	1.04
56	Ownership of dwellings	-0.23	-0.46	-6.00	-11.72
57	Education and research	-0.24	-0.48	0.61	1.18
58	Medical and health	-0.11	-0.22	-2.04	-3.99
59	Other services	-0.92	-1.82	-1.66	-3.28
60	Public administration and defence	-0.28	-0.55	0.59	1.15

Source: NCAER Simulations

Table 8: Percentage Change in Export

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1	S 1.2	S 2.1	S 2.2
	Non Offset NIT Rate	(25%)	(50%)	(25%)	(50%)
1	Food crops	-1.99	-3.96	-5.52	-10.86
2	Cash crops	-1.96	-3.89	-5.69	-11.20
3	Plantation crops	-1.87	-3.71	-5.94	-11.68
4	Other crops	-1.93	-3.84	-6.05	-11.90
5	Animal husbandry	-2.03	-4.02	-5.43	-10.68
6	Forestry & logging	-1.69	-3.37	-6.39	-12.55
7	Fishing	-2.48	-4.91	-3.27	-6.46
8	Coal and lignite	-1.92	-3.81	-4.68	-9.21
9	Natural gas & Crude Petroleum	-0.61	-1.21	-1.49	-2.94
10	Iron ore	-1.88	-3.72	-4.48	-8.82
11	Other minerals	0.63	1.25	1.42	2.80
12	Sugar	-1.81	-3.57	-0.70	-1.39
13	Food products excluding sugar	-1.52	-3.00	-2.14	-4.20
14	Beverages	0.94	1.85	7.13	13.98
15	Tobacco products	2.19	4.27	0.49	0.92
16	Cotton textiles	-3.13	-5.87	17.63	34.86
17	Wool, silk & synthetic fibre textiles	7.55	15.21	39.16	77.14
18	Jute, hemp and mesta textiles	-3.85	-7.58	-4.38	-8.59
19	Textiles products including wearing apparel	-0.13	0.22	33.98	67.12
20	Wood and wood products except furniture	-0.47	-0.93	-3.68	-7.21
21	Furniture and fixture	1.08	2.13	-1.32	-2.57
22	Paper and paper products	2.96	5.79	2.68	5.24
23	Printing, publishing and allied activities	2.76	5.40	1.88	3.67
24	Leather and leather products	1.90	3.75	-0.81	-1.57
25	Plastic and rubber products	3.57	7.01	3.94	7.71
26	Petroleum products	6.01	11.71	5.46	10.62
27	Coal tar products	2.51	4.93	0.74	1.47
28	Inorganic heavy chemicals	4.26	8.34	5.12	10.01
29	Organic heavy chemicals	7.62	14.92	8.07	15.79
30	Fertilizers	2.35	4.61	3.02	5.90
31	Paints, varnishes and lacquers	4.81	9.40	3.86	7.53
32	Pesticides, drugs and other chemicals	4.45	8.71	4.59	8.97
33	Cement	0.12	0.24	-2.73	-5.34
34	Non metallic mineral products	1.84	3.63	-0.34	-0.65
35	Iron & steel industries and foundries	7.21	14.13	-1.27	-2.51
36	Other basic metal industry	9.62	18.90	2.82	5.55
37	Metal products except mach & transport Equipment	3.83	7.50	1.23	2.39
38	Agricultural machinery	4.22	8.23	1.75	3.40
39	Industrial machinery for food and textiles	5.04	9.86	5.19	10.15

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1	S 1.2	S 2.1	S 2.2
	Non Offset NIT Rate	(25%)	(50%)	(25%)	(50%)
40	Other machinery	4.49	8.77	1.86	3.61
41	Electrical, electronic machinery & appliances	5.82	11.35	3.42	6.65
42	Railway transport equipment	4.18	8.17	1.05	2.04
43	Other transport equipment	5.25	10.25	3.44	6.71
44	Miscellaneous manufacturing industries	9.35	18.46	5.03	9.98
45	Construction	0.00	0.00	0.00	0.00
46	Electricity	0.00	0.00	0.00	0.00
47	Water supply	0.00	0.00	0.00	0.00
48	Railway transport services	-1.77	-3.52	-5.81	-11.43
49	Other transport services	-1.83	-3.62	-3.06	-6.06
50	Storage and warehousing	0.00	0.00	0.00	0.00
51	Communication	-2.21	-4.40	-4.99	-9.83
52	Trade	-2.49	-4.94	-4.98	-9.83
53	Hotels and restaurants	-2.27	-4.50	-4.61	-9.09
54	Banking	-2.39	-4.74	-5.09	-10.04
55	Insurance	-2.23	-4.42	-4.72	-9.30
56	Ownership of dwellings	0.00	0.00	0.00	0.00
57	Education and research	0.00	0.00	0.00	0.00
58	Medical and health	0.00	0.00	0.00	0.00
59	Other services	-1.97	-3.91	-5.39	-10.61
60	Public administration and defence	0.00	0.00	0.00	0.00
	Total	1.55	3.07	3.22	6.34

Source: NCAER Simulations

Table 9: Percentage Change in Import

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
1	Food crops	1.97	3.90	5.88	11.57
2	Cash crops	1.91	3.81	7.11	13.98
3	Plantation crops	1.86	3.69	6.40	12.59
4	Other crops	1.94	3.85	6.26	12.31
5	Animal husbandry	2.01	3.98	5.89	11.59
6	Forestry & logging	1.81	3.59	6.34	12.45
7	Fishing	2.31	4.58	4.36	8.60
8	Coal and lignite	2.77	5.48	6.28	12.36
9	Natural gas & Crude Petroleum	1.32	2.60	3.11	6.10
10	Iron ore	2.68	5.30	6.05	11.91
11	Other minerals	0.26	0.49	-3.45	-6.76
12	Sugar	2.43	4.81	3.16	6.24
13	Food products excluding sugar	2.52	5.00	4.43	8.73
14	Beverages	2.48	4.91	-0.41	-0.75
15	Tobacco products	2.48	4.92	5.16	10.17
16	Cotton textiles	2.73	5.35	0.52	1.01
17	Wool, silk & synthetic fibre textiles	0.64	1.23	-5.18	-10.18
18	Jute, hemp and mesta textiles	2.64	5.24	4.31	8.49
19	Textiles products including wearing apparel	2.26	4.23	-13.08	-25.85
20	Wood and wood products except furniture	3.29	6.53	8.28	16.32
21	Furniture and fixture	3.02	6.01	7.57	14.93
22	Paper and paper products	2.00	3.98	3.59	7.10
23	Printing, publishing and allied activities	3.31	6.58	5.75	11.38
24	Leather and leather products	2.67	5.30	8.05	15.85
25	Plastic and rubber products	1.38	2.75	2.49	4.94
26	Petroleum products	1.79	3.56	3.73	7.37
27	Coal tar products	2.77	5.50	3.91	7.74
28	Inorganic heavy chemicals	1.40	2.80	2.07	4.11
29	Organic heavy chemicals	-1.11	-2.12	0.25	0.55
30	Fertilizers	1.65	3.28	2.09	4.14
31	Paints, varnishes and lacquers	1.11	2.24	2.39	4.75
32	Pesticides, drugs and other chemicals	1.23	2.47	2.60	5.15
33	Cement	2.04	4.04	3.40	6.71
34	Non metallic mineral products	1.92	3.80	3.23	6.38
35	Iron & steel industries and foundries	1.17	2.34	4.50	8.88
36	Other basic metal industry	0.66	1.34	3.31	6.53
37	Metal products except mach & transport Equipment	1.34	2.68	4.35	8.58
38	Agricultural machinery	2.51	5.01	6.67	13.17
39	Industrial machinery for food and textiles	1.70	3.42	6.48	12.80
40	Other machinery	1.93	3.87	6.77	13.37

S. No.	Sector Description	SET 1: Without Capital Coefficients		SET 2: With Capital Coefficients	
		S 1.1 (25%)	S 1.2 (50%)	S 2.1 (25%)	S 2.2 (50%)
	Non Offset NIT Rate				
41	Electrical, electronic machinery & appliances	1.28	2.56	3.81	7.53
42	Railway transport equipment	1.82	3.62	4.58	9.03
43	Other transport equipment	1.46	2.93	4.16	8.22
44	Miscellaneous manufacturing industries	0.32	0.65	0.89	1.75
45	Construction	0.00	0.00	0.00	0.00
46	Electricity	0.00	0.00	0.00	0.00
47	Water supply	0.00	0.00	0.00	0.00
48	Railway transport services	2.15	4.27	6.10	11.99
49	Other transport services	1.95	3.88	4.20	8.28
50	Storage and warehousing	0.00	0.00	0.00	0.00
51	Communication	2.35	4.67	5.61	11.04
52	Trade	0.00	0.00	0.00	0.00
53	Hotels and restaurants	3.69	7.32	8.26	16.27
54	Banking	2.52	4.99	5.61	11.05
55	Insurance	2.32	4.60	5.57	10.97
56	Ownership of dwellings	0.00	0.00	0.00	0.00
57	Education and research	0.00	0.00	0.00	0.00
58	Medical and health	0.00	0.00	0.00	0.00
59	Other services	3.28	6.51	9.45	18.59
60	Public administration and defence	0.00	0.00	0.00	0.00
	Total	1.09	2.16	2.39	4.71

Source: NCAER Simulations

Table 10: Change in price index of tradable and non tradable goods (%)

S. No.	Sector Description	S 2.1	S 2.2
1	Food crops	0.55	1.07
2	Cash crops	0.61	1.19
3	Plantation crops	0.69	1.35
4	Other crops	0.73	1.42
5	Animal husbandry	0.52	1.01
6	Forestry & logging	0.84	1.64
7	Fishing	-0.2	-0.39
8	Coal and lignite	0.27	0.52
9	Natural gas & Crude Petroleum	-0.79	-1.57
10	Iron ore	0.2	0.39
11	Other minerals	-1.76	-3.48
12	Sugar	-0.79	-1.55
13	Food products excluding sugar	-0.17	-0.33
14	Beverages	-2.47	-4.84
15	Tobacco products	0.17	0.34
16	Cotton textiles	-3.26	-6.44
17	Wool, silk & synthetic fibre textiles	-5.79	-11.4
18	Jute, hemp and mesta textiles	-0.32	-0.62
19	Textiles products including wearing apparel	-8.84	-17.45
20	Wood and wood products except furniture	0.38	0.74
21	Furniture and fixture	0.1	0.19
22	Paper and paper products	-0.58	-1.13
23	Printing, publishing and allied activities	-0.33	-0.65
24	Leather and leather products	0.08	0.16
25	Plastic and rubber products	-1.1	-2.16
26	Petroleum products	-0.79	-1.56
27	Coal tar products	-0.18	-0.36
28	Inorganic heavy chemicals	-1.33	-2.6
29	Organic heavy chemicals	-2.19	-4.29
30	Fertilizers	-0.98	-1.92
31	Paints, varnishes and lacquers	-0.73	-1.44
32	Pesticides, drugs and other chemicals	-1.1	-2.15
33	Cement	0.31	0.61
34	Non metallic mineral products	0.04	0.07
35	Iron & steel industries and foundries	0.25	0.49
36	Other basic metal industry	-0.42	-0.82
37	Metal products except mach & transport Equipment	-0.12	-0.24
38	Agricultural machinery	-0.01	-0.01
39	Industrial machinery for food and textiles	-1.04	-2.05
40	Other machinery	-0.12	-0.23
41	Electrical, electronic machinery & appliances	-0.32	-0.63
42	Railway transport equipment	0.03	0.06
43	Other transport equipment	-0.44	-0.87
44	Miscellaneous manufacturing industries	-1.34	-2.66

S. No.	Sector Description	S 2.1	S 2.2
45	Construction	N.C.	N.C.
46	Electricity	N.C.	N.C.
47	Water supply	N.C.	N.C.
48	Railway transport services	0.65	1.26
49	Other transport services	-0.27	-0.53
50	Storage and warehousing	N.C.	N.C.
51	Communication	0.37	0.73
52	Trade	0.37	0.73
53	Hotels and restaurants	0.25	0.48
54	Banking	0.41	0.8
55	Insurance	0.28	0.55
56	Ownership of dwellings	N.C.	N.C.
57	Education and research	N.C.	N.C.
58	Medical and health	N.C.	N.C.
59	Other services	0.51	0.99
60	Public administration and defence	N.C.	N.C.

N.C.: Not Computed; Sectors 45, 46, 47, 50, 56, 57, 58 and 60 are not internationally traded and hence the changes in their prices could not be computed.

Source: NCAER Simulations

Table 11: Distribution of NIT on Output Across Sectors : Row-wise (Rs Lakh)

IO Code	Description	NIT	Output	NIT/Q (per cent)
01	Food crops	-2086575	24018772	-8.69
02	Cash crops	-682985	8415368	-8.12
03	Plantation crops	24232	6158859	0.39
04	Other crops	-727627	14717186	-4.94
05	Animal husbandry	98468	18281531	0.54
06	Forestry & logging	12586	2486237	0.51
07	Fishing	-24193	3171641	-0.76
08	Coal and lignite	37849	3504984	1.08
09	Natural gas & Crude Petroleum	1572581	3417653	46.01
10	Iron ore	1182	466676	0.25
11	Other minerals	110803	1362604	8.13
12	Sugar	31884	3347510	0.95
13	Food products excluding sugar	833178	18862942	4.42
14	Beverages	714053	2578789	27.69
15	Tobacco products	737087	1146560	64.29
16	Cotton textiles	375788	5775566	6.51
17	Wool, silk & synthetic fibre textiles	120459	3779899	3.19
18	Jute, hemp and mesta textiles	53213	448282	11.87
19	Textiles products including wearing apparel	281182	8352802	3.37
20	Wood and wood products except furniture	70861	848314	8.35
21	Furniture and fixture	35251	817397	4.31
22	Paper and paper products	518687	2413073	21.49
23	Printing, publishing and allied activities	54543	2093160	2.61
24	Leather and leather products	138497	1633695	8.48
25	Plastic and rubber products	995325	6013370	16.55
26	Petroleum products	3918424	17375676	22.55
27	Coal tar products	99261	829162	11.97
28	Inorganic heavy chemicals	488915	2926687	16.71
29	Organic heavy chemicals	766579	2495675	30.72
30	Fertilizers	-1048480	3200493	-32.76
31	Paints, varnishes and lacquers	305084	1762397	17.31
32	Pesticides, drugs and other chemicals	1451577	14640229	9.91
33	Cement	495235	1897034	26.11
34	Non metallic mineral products	652155	4045898	16.12
35	Iron & steel industries and foundries	2313552	13749377	16.83
36	Other basic metal industry	914284	2979788	30.68
37	Metal products except mach & transport Equipment	789777	5798872	13.62
38	Agricultural machinery	51117	1048495	4.88
39	Industrial machinery for food and textiles	100150	823870	12.16
40	Other machinery	1467790	7662699	19.16
41	Electrical, electronic machinery & appliances	2378747	16443198	14.47
42	Railway transport equipment	68935	865713	7.96
43	Other transport equipment	1218135	9216468	13.22

IO Code	Description	NIT	Output	NIT/Q (per cent)
44	Miscellaneous manufacturing industries	1657502	7100046	23.34
45	Construction	870099	44152788	1.97
46	Electricity	-1380044	14790883	-9.33
47	Water supply	2846	786315	0.36
48	Railway transport services	-251404	5513456	-4.56
49	Other transport services	19809	36359410	0.05
50	Storage and warehousing	936	308332	0.30
51	Communication	-123309	5728231	-2.15
52	Trade	0	45422021	0.00
53	Hotels and restaurants	31226	10292468	0.30
54	Banking	50319	16842287	0.30
55	Insurance	12873	4239538	0.30
56	Ownership of dwellings	42300	13931500	0.30
57	Education and research	292959	10887331	2.69
58	Medical and health	223029	7301778	3.05
59	Other services	383179	21413849	1.79
60	Public administration and defence	47414	15615700	0.30
	Total	21607300	512560534	

Source: NCAER computation based on IO 2003-04.

Bibliography

- Bird, Richard M. and Michael Smart (2008): “The Impact on Investment of Replacing a Retail Sales Tax by a Value-Added Tax: Evidence from Canadian Experience”, Working Paper No. 15, the Institute of International Business, University of Toronto.
- Bird, Richard M. and Pierre-Pascal Gendron (2007): *The VAT in Developing and Transition Countries*, Cambridge University Press, Cambridge.
- Bird, Richard M., Jack M. Mintz and Thomas A. Wilson (2006): “Coordinating Federal and Provincial Sales Taxes” Lessons from Canadian Experience”, *National Tax Journal*, (59), 809-25
- Boesters et al: “Economic Effects of VAT Reform in Germany”, Discussion Paper No. 06-030, ZEW, Centre for European Economic Research.
- Brown, Drusilla K., Alan V. Deardorff and Robert M. Stern (1996): “Computational Analysis of the Economic Effects of an East Asian Preferential Trading Bloc”, *Journal of the Japanese and International Economies*, 10: 37-70.
- Brumbaugh (2006): “Taxes and International Competitiveness”, CRS Report for Congress, Order Code RS22445.
- Central Statistical Organisation (2008): “Input-Output Transactions Table 2003-04”, GOI, Ministry of Statistics & Programme Implementation, Central Statistical Organisation, New Delhi.
- Central Statistical Organisation (2008): “National Account Statistics”, GOI, Ministry of Statistics & Programme Implementation, Central Statistical Organisation, New Delhi.
- Central Statistical Organisation (various years): “Annual Survey of Industries”, GOI, Ministry of Statistics & Programme Implementation, Central Statistical Organisation (Industrial Statistics Wing), Kolkata.
- Chadha, Rajesh, Sanjib Pohit, Alan Deardorff and Robert Stern (1998): “The Impact of Trade Policy Reforms: A CGE Modeling Approach”, University of Michigan Press.
- Chen and Mintz (2003): “How Canada’s Tax System Discourages Investment”. No. 68, C.D. Howe Institute.
- Desai, Mihir A. and James R. Hines (2002): “Value-Added Taxes and International Trade: The Evidence”.
- Devarajan *et al* (1991): “A Value-Added Tax (VAT) in Thailand: Who Wins and Who Loses?”, *TDRI Quarterly Review*, 6(1).
- Dixon, Peter B. and Maureen T. Rimmer (1999): “The Government’s Tax Package: Further Analysis based on Monash Model” General Paper No. G-131, CPSIP, Monash University.
- Douette, A. (1973): “The Study of the Capital Coefficient – A Condition of Economic Planning”. *Annals of Public and Cooperative Economics*, 44(4), pp 345-361, Blackwell Publishers
- Dungan et al (2008): “Growth Oriented Sales Tax Reform for Ontario”, C.D. Howe Institute.
- Giesecke and Tran (2009): “Modeling Value Added Tax in the Presence of Multiproduction and Differentiated Exemptions”, General Paper No. G-182, Centre of Policy Studies, Monash University.

- Govinda Rao, Kumar Sen and R. Jena (2008): “Issues Before the Thirteenth Finance Commission”, Working Paper 2008-55, National Institute of Public Finance and Policy.
- Hamilton, Bob and Chun-Yan Kuo (1991): “The Goods and Services Tax: A General Equilibrium Analysis”, *Canadian Tax Journal*, 39(1).
- IMF (2007): “Government Finance Statistics”.
- Keen, Michael and Ben Lockwood (2007): “The value-Added Tax: its Causes and Consequences”, Michael Keen & Ben Lockwood, 2007. "The Value Added Tax: Its Causes and Consequences," Economics Working Papers ECO2007/09, European University Institute.
- Kelkar (2004): “Implementing FRBM Act, 2003”, Economic and Political Weekly.
- Kelkar, Vijay (2009a): “Convocation Address at India Gandhi Institute of Development Research”, IGIDR, Mumbai, 6 February.
- Kelkar, Vijay (2009b): Special Address at 3rd National Conference on “GST for Accelerated Economic growth and Competitiveness”, Special Address, New Delhi, 29 June.
- Kesselman (2004): “Tax Design for Northern Tiger”, Vol. 10, No. 1, Institute for Research on Public Policy.
- Krueger, Anne O. (2008): “The Role of Trade and International Policy in Indian Economic Performance”, *Asian Economic Policy Review*, (3), Japan Center for Economic Research.
- Leontief, Wassily (1953): “Studies in the Structure of the American Economy”, New York - Oxford University Press.
- McLure, Charles E. (1998): “Electronic Commerce and the Tax Assignment Problem: Preserving State Sovereignty in a Digital World”, *State tax Notes*, 14(15), pp 1169-81.
- McLure, Charles E. (2003): “Harmonising the RSTs and GST: Lessons from Canada from Canadian Experience”, Hoover Institution, Stanford University.
- Meagher, G.A. and Brian R. Parmenter (1993): “Some Short-Run Implications of Fight back: A General Equilibrium Analysis”, General Paper No. G-101, CPSIP, Monash University.
- Ministry of Commerce and Industry, Department of Commerce (2008): Office Memorandum: Inputs for 13th Finance Commission, F. No. 19/4/2007 – FT (ST), July 1, 2009.
- Ministry of Finance (2008-09): “Indian Public Finance Statistics”, Department of Economic Affairs, Economic Division, GOI.
- Ministry of Finance and Company Affairs, GOI (2002): “Report of the Task Force on Indirect Taxes”.
- Ministry of Finance, GOI (2004): “Implementation of the Fiscal Responsibility and Budget Management Act, 2003”.
- National Sample Survey Organisation (2008): “Unorganised Manufacturing Sector in India: Input, Output and Value Added – NSS 62nd Round (July 2005 – June 2006)”, Ministry of Statistics & Programme Implementation, GOI, Report No. 526(62/2.2/3).
- National Sample Survey Organisation (2008): “Unorganised Manufacturing Sector in India: Employment, Assets and Borrowings – NSS 62nd Round (July 2005 – June 2006)”, Ministry of Statistics & Programme Implementation, GOI, Report No. 525(62/2.2/2).
- NCAER (2005): “Export Promotion Scheme Replacing DEPB Scheme”.

- Poddar, Satya and Ehtisham Ahmad (2009): “GST Reforms and Intergovernmental Considerations in India”, Ministry of Finance, Government of India.
- Rao, M. Govinda and R. Kavita Rao (2006): “Trends and Issues in Tax Policy and Reform in India”, *India Policy Forum – 2005-06*, NCAER-Brookings Institution.
- Saluja, M. R. (1980): “Component-Wise Capital-Output Ratio in the Indian Economy”, *sankhya: The Indian Journal of Statistics*, 42, Series D.
- Shankar (2005): “Thirty Years of Tax Reform in India”, *Economic and Political Weekly*.
- Smart and Bird (2006): “The GST Cut and Fiscal Imbalance”, ITP Paper 0604, International tax Programme, Institute for International Business, University of Toronto.
- Wytter, Glyn and Kym Anderson (2002): “Impact of the GST and Wine Tax Reform on Australia’s Wine Industry: A CGE Analysis”, *Australian Economic Papers*, Blackwell Publishing Limited.

Annex 1: Capital Coefficients Matrix

In this section we discuss the methodology for compiling capital coefficients matrix for the Indian economy. An earlier study had worked out capita-output ratios for the Indian economy for two time periods: 1951-52 to 1961-62 and 1962-63 to 1971-72 (Saluja 1980).

For each of the manufacturing sectors (IO sectors 12 to 44 in our aggregation scheme), capital formation has been computed as the gross value of actual addition to fixed assets (Gross Fixed Capital Formation: GFCF) at current prices. This data is available from the information recorded in Block C on Fixed Assets, of the Annual Survey of Industries (ASI) (refer Table A1). The ASI data has been obtained from the Central Statistical Organisation (CSO) in electronic form. The ASI data is available under the National Industrial Classification scheme (NIC) – 2004 at the 3-digit level. In order to map the NIC codes with the manufacturing sectors in the IO matrix, a concordance scheme has been designed by us (Table A2). This mapping has been used to concord the NIC data with the manufacturing sectors in the IO matrix.

The information on capital formation is available under the following categories:

i) land; ii) building; iii) plant & machinery; iv) transport equipment; v) computer equipment including software; vi) pollution control equipment; vii) others; and viii) capital work in progress; and ix) total. These broad categories have been compressed into three groups referred to as (i) Construction; (ii), Plant & machinery including others (iii + v + vi + vii); and Transport equipment (iv). Further, for each sector, Total GFCF (excluding land) has been defined as the sum of these three broad categories.

For manufacturing sectors where only aggregate information is available from the ASI data, the same have been apportioned based on the output weights within the group in the IO 2003-04. For instance, GFCF reported under the NIC 3-digit category 241, has been apportioned among the IO sectors 28, 29 and 30. Similarly, the GFCF reported under NIC code 242 has been apportioned among the IO sectors 31 and 32; NIC code 273 has been apportioned among the IO sectors 35 and 36; and NIC code 292 has been apportioned among the IO sectors 38, 39 and 40.

Due to lack of GFCF data for jute, hemp and mesta textiles (IO 18), the same has been estimated (from the ASI data for each of the six years) based on its output proportions within the total textile group output (sum of IO sectors 16, 17, 18 and 19) in the IO 2003-04.

Further, the GFCF for the remaining textile sectors (IO sectors 16, 17 and 19) have also been realigned according to their respective shares in the total textile group output of the year 2003-04.

Similarly, GFCF for cement (IO sector 33) has been estimated based on its proportion in the group output of total non-metallic mineral products (sum of IO sectors 33 and 34). The GFCF for non-metallic mineral products (IO sector 34) has also been realigned according to its output-based proportion within in the group.

Thus, we have compiled GFCF (at current prices) in each of the manufacturing sectors of the economy.⁸ A time series has been compiled for the six years 1999-00 through 2004-05.

For agriculture, mining and service sectors, the capital formation data has been compiled from data obtained from the CSO (Table A3). This data is available at current prices. Further, data on capital formation in the agriculture, mining and service sectors is available only under two categories namely, building; and plant & machinery. Due to lack of data, capital formation of transport equipment has been considered zero for the agriculture and service sectors

It may be mentioned that the information on capital formation in the agriculture, mining and service sectors is available for aggregate sectors These have been apportioned (for all the six years 1999-00 to 2004-05) among the relevant sectors of the IO matrix based on their respective proportions in total output during the year 2003-04. Table A4 provides detailed mapping of the non-manufacturing sectors with relevant IO sectors For instance, capital in agriculture during the 1999-00 was apportioned among the IO sectors 01 to 05 according to their respective shares within the group output (of IO sector 01 to 05) in the IO matrix for the year 2003-04. The same proportions were applied to capital formation in all the years and all three types of capital formation.

The GFCF values at current prices have been transformed to corresponding values at constant 1999-2000 prices using the price indices for the respective types of capital computed by using the data from National Accounts Statistics (NAS), 2008 (Table A5).

Thus, based on the earlier discussion we have obtained the sectoral composition of capital formation at 1999-00 prices in all three categories namely, construction; plant & machinery; and transport equipment.

⁸ Capital formation in sugar (IO 12) has been taken as proxy from the capital formation in food products excluding sugar (IO 13).

The values for capital formation thus computed are referred to as ΔK_{ij} , where $i = 1$ to 3 (1: construction, 2: plant & machinery, 3: transport equipment)
 $j = 1$ to 60 (refers to each of the 60 IO sectors)

It may not be apt to compute capital formation values based on one year data due to volatility of observed values of changes in GFCF (and also output). Therefore we have preferred an average over six years to compute GFCF (1999-2000 to 2004-05). Thus, the value for each type of ΔK was averaged for six year period beginning 1999-00 to 2004-05. Further, the sum total of the average values for each capital type has been computed to represent the total capital formation in each IO sector over the reference period.

Similarly, the average change in output (methodology for which is discussed later) has been computed for six years 2000-01 to 2005-06 so as to incorporate one-year lag. It is assumed that the capital formation during a year affects the incremental output in the following year.

Capital –Coefficient Matrix (B)

In order to make a complete capital coefficient matrix, B, it is further required to expand the previously computed ΔK_{ij} 's (of size 3 X 60) to make a capital matrix of size 8 X 60. Since the earlier mentioned three categories of capital, viz. construction, plant & machinery and transport equipment are quite aggregated, we split these further in alignment with the related capital good sectors in the IO structure (Box A).

Box A: Distribution of Capital Formation by Type into IO Capital Good Sector (row-wise expansion of group output)

Capital Formation	Relevant capital good sector in IO
Construction	45
Plant & machinery including others	37, 39, 40, 41
Transport equipment	42, 43

Source: NCAER

It is assumed that capital formation of the type: agriculture machinery (IO 38), originates only in agricultural sectors (IO 01 to 05). Therefore, these five agricultural sectors do not have any other sub-component of capital formation under plant & machinery.

Further, the apportioning of the broad categories (like plant & machinery; and transport equipment) is based on a row-wise expansion of the group output in the 60X60 IO matrix. This is explained in detail below.

The capital under plant & machinery is distributed across four sectors of the IO, viz. metal products except machinery & transport equipment (37); industrial machinery for food and

textiles (39); other machinery (40); and electrical, electronic machinery & appliances (41). The distribution is weighed according to their proportions within the group output in the IO 2003-04 (row-wise expansion of the group output).

Further, we assume that capital formation under industrial machinery for food and textiles (39) originates only in food products (IO 12-14) and textile products (IO 16-19). The values have been apportioned by taking respective share in the output of the corresponding group (column-wise expansion of the group output) (refer Box B).

**Box B: Distribution of Plant & Machinery Capital into IO Sectors
(column-wise expansion of group output)**

Capital origination in IO sector	IO sectors for column-wise expansion
Metal products except machinery & transport equipment (37)	06 to 60
Agriculture machinery (38)	01 to 05
Industrial machinery for food and textiles (39)	12 to 14, 16 to 19
Other machinery (40)	06 to 60
Electrical, electronic machinery & appliances (41)	06 to 60

Source: NCAER

The GFCF in transport equipment is distributed across two sectors, viz. railway transport equipment (IO 42) and other transport equipment (IO 43) with the help of row-wise expansion of the group output in the IO 2003-04.

The construction capital has been mapped into the IO construction sector (IO 45).

The above methodology provided us with a 8 X 60 ΔK matrix.

Capital Formation at factor cost

Based on the available data, the capital formation in the ΔK matrix thus computed has entries valued in market prices in contrast to the IO matrix transactions flows measured at factor cost. It is thus important that before we compute the capital matrix, ΔK should also be at factor cost.

In order to compute the NIT; and trade & transport proportions, we have first transformed the IO transaction matrix at factor cost into IO matrix at market prices by adding the NIT (from the T_2 matrix); and trade & transport margin (from TTM matrix. We then compute a share matrix (of tax; and trade & transport collectively referred to as TTT) with the following formula:

$$TTT_{ij} = \frac{(NIT_{ij} + TTM_{ij})}{A_{ij} + NIT_{ij} + TTM_{ij}}$$

where $i, j = 1$ to 60 (refers to each of the 60 IO sectors)

A_{ij} : ij^{th} flow in the IO transaction table

The capital matrix ΔK , was thus adjusted to factor cost using the shares thus computed

The capital formation refers to 8 capitals good sectors, with positive values residing only in the 8 rows, others being zero. The capital formation matrix B, at factor cost, is obtained by multiplying the capital coefficient matrix (b_{ij}) with the output in IO 2003-04.

Output (Q)

The ASI data on value of output for the manufacturing sectors (sectors 12 to 44 of the IO matrix) has been extracted for six years beginning 1999-00 up to 2005-06. Since the ASI data is available at the NIC 3-digit level, the outputs have been concorded to the IO sectors (IO sectors 12 to 44) (Table A2).

For manufacturing sectors where only aggregate information is available from the ASI data, the same have been apportioned using the same methodology as adopted for capital formation. For instance, NIC code 241 has been apportioned among the IO sectors 28, 29 and 30; NIC code 242 among the IO sectors 31 and 32; NIC code 273 among the IO sectors 35 and 36; and NIC code 292 among the IO sectors 38, 39 and 40.

In absence of data on value of output for jute, hemp and mesta textiles (IO 18), the same has been estimated by apportioning the value of output of the total textile group, as done in the case of estimating the capital formation for the textiles group (refer section on capital formation for details). Also, the output of remaining textile sectors (IO sectors 16, 17 and 19) have been adjusted accordingly.

The same exercise has been done in order to estimate the value of output for cement (IO sector 33) from the group output of total non-metallic mineral products (sum of IO sectors 33 and 34).

Also, it may be observed that value of output for sugar (IO 12) is not available in the ASI data. A time series for the sugar output has been generated by applying annual growth rates of sugarcane output (which have been computed from data in the NAS, 2008) on the sugar output in the IO 2003-04.

The value of output at current prices has been converted into 1999-00 constant prices with the help of price indices computed from the NAS, 2008 (refer Table A6).

The output data (i.e. value of output) for the remaining sectors, i.e. agriculture & allied; mining; and services is sourced from the NAS, 2008 at 1999-00 constant prices. However, for some non-manufacturing sectors, data on value of output was not available. In such cases, we arrived at an approximation by multiplying the sectoral GDP (that was available from NAS at constant prices) with the output-to-GVA ratio of that sector in the IO matrix of the year 2003-04. The underlying assumption here being that the ratio of output to value added remains unchanged over the years. Such IO sectors included electricity (IO 46), water supply (IO 47), other transport services (IO 49), storage and warehousing (IO 50), trade (IO 52), hotels and restaurants (IO 53), banking (IO 54), insurance (IO 55), education and research (IO 57), medical and health (IO 58) and other services (IO 59).

In the case of mining sectors (IO 08, 09, 10 and 11) for which only aggregated data are available, the same have been apportioned based on the output proportions in the corresponding group in the IO 2003-04.

The incremental output in each year was computed as the difference between output (in that year) and that of the preceding year. This is referred to as ΔQ .

Thus we have computed

$$\Delta Q_{ik}, \text{ where } i = 1 \text{ to } 60 \text{ (refers to each of the IO sectors)}$$
$$k = 2000-01 \text{ to } 2005-06$$

An average ΔQ was obtained by averaging over the six year values. It is referred to as ΔQ_i where $i = 1$ to 60.

It may be mentioned that the negative values of ΔQ_i (decline in output) have been ignored for the purpose of taking averages. These included sectors namely food crops (IO 01), sugar (IO 12), tobacco (IO 15) and plastics (IO 25).

Capital to Output ratio (ΔK by ΔQ)

The above mentioned ΔK matrix at factor cost is a 60 x 60 matrix representing the capital formation in a flow form (Table A7). This is converted into coefficients by dividing with the output (i.e. average ΔQ) of respective IO sector. Thus, we arrive at the capital-coefficient

matrix, “ b_{ij} ”. This is essentially a matrix of size 8 X 60, with the coefficients being zero in rows corresponding to the non-capital good sectors (Table A8).⁹

⁹ The capital coefficients computed in this Annex refer to the registered / organized sectors of the economy. However, the IOTT (2003-04) matrix covers the entire economy: registered as well as unregistered. It is worthwhile to compute capital coefficients for unregistered manufacturing sectors as well. The data for aggregate capital formation and aggregate output for unregistered manufacturing are available from National Accounts Statistics (NAS) 2008. However, this document does not provide sectoral details of capital formation. The aggregate incremental capital-output ratio turns out to be 1.36 for the registered manufacturing. The corresponding value is 1.46 for the unregistered manufacturing sector. The data on capital formation for unregistered sector of manufacturing provided by NAS (2008) can not be compared with that of the “Unorganised Manufacturing Sector in India: Employment, Asserts and Borrowings”, NSSO (2005-06). The difference is huge seems to arise due to difference in methods of computing capital formation.

Table A1: Annual Survey of Industries

BLOCK C: FIXED ASSETS

DSL

No./PSL No.....

Sl. No.	Types of Assets	Gross Value (Rs)				Depreciation (Rs)			Net Value (Rs)		
		Opening as on ----	Addition during the year		Deduction & Adjustme nt during the year	Closin g as on ---- (3+4+ 5-6)	Up to year begin ning	Provid- ed during the year	Up to year end (8+9)	Openi ng as on -----	Closing as on -----
			Due to revaluation	Actual Addition							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	Land										
2.	Building										
3.	Plant &Machinery										
4.	Transport equipment										
5.	Computer equipment including software										
6.	Pollution Control Equipment										
7.	Others										
8.	Sub-total (2 to 7)										
9.	Capital work in progress										
10.	Total (1+8+9)										

Source: ASI

Table A2: Concordance between NIC 3-digit (2004) and IO 60 Sectors

S.No.	IO 60 Code	NIC code	Description
1	05	014	Agricultural and animal husbandry service activities, except veterinary activities
2	11	142	Mining and quarrying, n.e.c.
3	11	233	Processing of nuclear fuels
4	13	151	Production, processing and preservation of meat, fish, fruit vegetables, oils and fats
5	13	152	Manufacture of dairy products
6	13	153	Manufacture of grain mill products, starches and starch products, and prepared animal feeds
7	13	154	Manufacture of other food products
8	14	155	Manufacture of beverages
9	15	160	Manufacture of tobacco products
10	16	171	Spinning, weaving and finishing of textiles
11	17	243	Manufacture of man-made fibers
12	19	172	Manufacture of other textiles
13	19	173	Manufacture of knitted and crocheted fabrics and articles
14	19	181	Manufacture of wearing apparel, except fur apparel
15	19	182	Dressing and dyeing of fur; manufacture of articles of fur
16	20	201	Saw milling and planing of wood
17	20	202	Manufacture of products of wood, cork, straw and plaiting materials
18	21	361	Manufacture of furniture
19	22	210	Manufacture of paper and paper product
20	23	221	Publishing
21	23	222	Printing and service activities related to printing
22	24	191	Tanning and dressing of leather, manufacture of luggage, handbags, saddlery and harness
23	24	192	Manufacture of footwear
24	25	251	Manufacture of rubber products
25	25	252	Manufacture of plastic products
26	26	232	Manufacture of refined petroleum products
27	27	231	Manufacture of coke oven products
28	28, 29, 30	241	Manufacture of basic chemicals

S.No.	IO 60 Code	NIC code	Description
29	31, 32	242	Manufacture of other chemical products
30	34	261	Manufacture of glass and glass products
31	34	269	Manufacture of non-metallic mineral products n.e.c.
32	35	271	Manufacture of Basic Iron & Steel
33	35, 36	273	Casting of metals
34	36	272	Manufacture of basic precious and non-ferrous metals
35	37	281	Manufacture of structural metal products, tanks, reservoirs and steam generators
36	37	289	Manufacture of other fabricated metal products; metal working service activities
37	37	293	Manufacture of domestic appliances, n.e.c.
38	38, 39, 40	292	Manufacture of special purpose machinery
39	40	291	Manufacture of general purpose machinery
40	41	300	Manufacture of office, accounting and computing machinery
41	41	311	Manufacture of electric motors, generators and transformers
42	41	313	Manufacture of insulated wire and cable
43	41	314	Manufacture of accumulators, primary cells and primary batteries
44	41	315	Manufacture of electric lamps and lighting equipment
45	41	319	Manufacture of other electrical equipment n.e.c.
46	41	321	Manufacture of electronic valves and tubes and other electronic components
47	41	322	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
48	41	323	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
49	42	352	Manufacture of railway and tramway locomotives and rolling stock
50	43	341	Manufacture of motor vehicles
51	43	342	Manufacture of bodies (coach work) for motor vehicles; manufacture of trailers and semi-trailers
52	43	343	Manufacture of parts and accessories for motor vehicles and their engines
53	43	351	Building and repair of ships & boats
54	43	359	Manufacture of transport equipment n.e.c.
55	44	331	Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes except optical instruments

S.No.	IO 60 Code	NIC code	Description
56	44	332	Manufacture of optical instruments and photographic equipment
57	44	333	Manufacture of watches and clocks
58	44	353	Manufacture of aircraft and spacecraft
59	44	369	Manufacturing n.e.c.
60	44	371	Recycling of metal waste and scrap
61	44	372	Recycling of non-metal waste and scrap
62	46	312	Manufacture of electricity distribution and control apparatus
63	59	223	Reproduction of recorded media

Note: This is a mapping scheme has been used for manufacturing sectors

Source: NCAER

Table A3: GFCF by type of assets at current prices (Rs Crore)

S.N.	Industry	1999-2000			2000-01		
		Construction	Machinery	Total	Construction	Machinery	Total
1	agriculture, forestry & fishing	24921	21454	46375	23189	21605	44793
1.1	agriculture	23950	15773	39724	22172	15913	38085
1.2	forestry & logging	971	53	1024	1017	32	1049
1.3	fishing	-1	5628	5627	-1	5660	5658
2	mining & quarrying	4392	5602	9994	4067	3402	7469
3	manufacturing	45465	99403	144869	49829	96494	146323
3.1	registered	23511	82820	106331	22011	75486	97497
3.2	unregistered	21954	16583	38537	27817	21008	48826
4	elect. gas & water supply	18174	20605	38780	20842	20206	41048
5	construction	1817	7096	8913	1320	7084	8404
6	Trade, hotels & restaurants	4328	7235	11564	5099	7727	12827
6.1	trade	3035	5579	8610	2951	5056	8000
6.2	hotels & restaurants	1292	1657	2954	2148	2671	4827
7	Transport, storage & communication	17041	41406	58448	21833	54147	75980
7.1	railways	3730	1391	5121	3881	1597	5479
7.2	transport by other means	4434	31661	36097	4640	40613	45253
7.3	storage	228	21	248	300	22	322
7.4	communication	8650	8332	16982	13011	11915	24927
8	financing, insurance, real estate & business services	76984	6780	83764	75624	8271	83896
8.1	banking & insurance	2308	4923	7231	1573	5309	6882
8.2	real estate, ownership of dwellings & business services	74676	1857	76533	74051	2962	77014
9	community, social & personal services	42722	10988	53709	44878	12197	57077
9.1	public administration & defence	29416	4999	34415	31069	6010	37079
9.2	other services	13306	5988	19294	13809	6188	19998
10	Total	235844	220569	456416	246681	231135	477818

S.N.	Industry	2001-02			2002-03		
		Construction	Machinery	Total	Construction	Machinery	Total
1	agriculture, forestry & fishing						
1.1	agriculture	30052	29471	59523	27512	31692	59203
1.2	forestry & logging	28851	20966	49817	26559	22832	49391
1.3	fishing	1201	26	1227	952	43	994
2	mining & quarrying	0	8479	8479	0	8817	8818
3	manufacturing	6140	3643	9783	4706	4621	9328
3.1	registered	39597	87367	126963	53806	104360	158167
3.2	unregistered	22197	74216	96413	23076	81154	104231
4	elect. gas & water supply	17399	13151	30550	30730	23206	53937
5	construction	22550	24341	46891	24778	19563	44341
6	Trade, hotels & restaurants	4837	10051	14888	6503	11018	17520
6.1	trade	7597	12356	19955	5306	9436	14742
6.2	hotels & restaurants	5202	9401	14603	3864	7595	11456
7	Transport, storage & communication	2395	2954	5352	1442	1840	3286
7.1	railways	19713	43465	63175	19321	60125	79445
7.2	transport by other means	5167	1684	6851	6364	2717	9081
7.3	storage	3336	29438	32771	5089	46257	51346
7.4	communication	483	46	529	492	42	534
8	financing, insurance, real estate & business services	10727	12298	23024	7375	11110	18484
8.1	banking & insurance	112506	8555	121062	111097	5678	116774
8.2	real estate, ownership of dwellings & business services	2811	5573	8384	1247	2714	3961
9	community, social & personal services	109695	2982	112678	109850	2964	112814
9.1	public administration & defence	59224	16716	75938	67157	18331	85490
9.2	other services	38713	7757	46470	43559	8336	51895
10	Total	20510	8959	29468	23598	9995	33595

S.N.	Industry	2003-04			2004-05		
		Construction	Machinery	Total	Construction	Machinery	Total
1	agriculture, forestry & fishing	29753	28962	58715	35060	33979	69038
1.1	agriculture	28057	20799	48856	34163	24353	58516
1.2	forestry & logging	1696	35	1731	896	121	1016
1.3	fishing	0	8128	8128	0	9505	9505
2	mining & quarrying	11921	3480	15401	12242	15864	28106
3	manufacturing	75476	137403	212879	119924	220816	340741
3.1	registered	29072	102372	131444	47972	166506	214479
3.2	unregistered	46404	35032	81435	71952	54310	126262
4	elect. gas & water supply	24390	32866	57256	27010	30031	57041
5	construction	9797	11124	20922	8961	13896	22856
6	Trade, hotels & restaurants	11049	18921	29972	13568	22819	36387
6.1	trade	8378	15632	24010	9440	17794	27231
6.2	hotels & restaurants	2671	3289	5962	4128	5025	9156
7	Transport, storage & communication	18665	60594	79258	20522	78853	99375
7.1	railways	8012	2688	10700	9764	3211	12975
7.2	transport by other means	5370	51919	57289	6786	64684	71470
7.3	storage	509	24	533	453	25	478
7.4	communication	4774	5962	10736	3519	10932	14452
8	financing, insurance, real estate & business services	111667	9606	121272	109929	11656	121586
8.1	banking & insurance	1811	4328	6139	1831	4064	5895
8.2	real estate, ownership of dwellings & business services	109855	5278	115133	108098	7593	115691
9	community, social & personal services	72515	19700	92215	94360	26491	120850
9.1	public administration & defence	44811	8143	52954	55043	10983	66026
9.2	other services	27704	11557	39261	39317	15508	54824
10	Total	365233	322654	687890	441576	454405	895980

S.N.	Industry	2005-06			2006-07		
		Construction	Machinery	Total	Construction	Machinery	Total
1	agriculture, forestry & fishing						
1.1	agriculture	41289	39770	81058	48601	45974	94575
1.2	forestry & logging	40068	29093	69161	47023	34159	81182
1.3	fishing	1221	69	1290	1578	66	1644
2	mining & quarrying	0	10607	10608	0	11749	11749
3	manufacturing	14302	10419	24721	9176	15033	24208
3.1	registered	146749	289697	436447	188128	365112	553241
3.2	unregistered	69212	231157	300369	88145	289621	377766
4	elect. gas & water supply	77537	58540	136077	99983	75492	175475
5	construction	38013	41395	79409	46393	52262	98654
6	Trade, hotels & restaurants	8210	18350	26561	14766	20308	35074
6.1	trade	13209	22511	35719	17833	30795	48630
6.2	hotels & restaurants	9002	17299	26298	13210	24978	38188
7	Transport, storage & communication	4207	5212	9421	4623	5816	10443
7.1	railways	18848	132238	151085	21605	154329	175934
7.2	transport by other means	9778	5268	15045	12275	5855	18129
7.3	storage	5673	60872	66546	6643	68227	74870
7.4	communication	511	38	548	532	86	618
8	financing, insurance, real estate & business services	2887	66060	68946	2155	80161	82317
8.1	banking & insurance	132958	18542	151499	140145	21409	161554
8.2	real estate, ownership of dwellings & business services	2609	5345	7954	4065	7254	11319
9	community, social & personal services	130348	13197	143545	136080	14156	150235
9.1	public administration & defence	103088	23014	126102	124669	27304	151974
9.2	other services	75436	11604	87040	91290	13460	104750
10	Total	27652	11410	39062	33379	13844	47223

S.N.	Industry	2007-08		
		Construction	Machinery	Total
1	agriculture, forestry & fishing			
1.1	agriculture	58688	50333	109021
1.2	forestry & logging	57018	37711	94729
1.3	fishing	1670	73	1743
2	mining & quarrying	0	12549	12549
3	manufacturing	12167	19849	32017
3.1	registered	214837	431356	646193
3.2	unregistered	104799	348248	453047
4	elect. gas & water supply	110038	83108	193146
5	construction	54224	56856	111080
6	Trade, hotels & restaurants	17040	22853	39893
6.1	trade	15949	27347	43297
6.2	hotels & restaurants	10160	19976	30136
7	Transport, storage & communication	5789	7371	13161
7.1	railways	28493	205451	233945
7.2	transport by other means	16080	7618	23699
7.3	storage	9439	102059	111498
7.4	communication	481	36	517
8	financing, insurance, real estate & business services	2493	95738	98231
8.1	banking & insurance	175442	21629	197070
8.2	real estate, ownership of dwellings & business services	4935	8913	13848
9	community, social & personal services	170507	12715	183223
9.1	public administration & defence	159611	33312	192922
9.2	other services	119094	15693	134787
10	Total	40517	17619	58135

Table A4: Mapping of the Non-Manufacturing Sectors with relevant IO sectors

Industry	IO and ASI Codes
Agriculture, forestry & fishing	
Agriculture	IO: 01 ,02, 03, 04 05 (from ASI: 014)
Forestry & logging	IO: 06
Fishing	IO: 07
Mining & quarrying	IO: 08, 09, 10 11 (from ASI: 142,233)
Services	
Elect. gas & water supply	IO: 46, 47
Construction	IO: 45
Trade, hotels & restaurants	
Trade	IO: 52
Hotels & restaurants	IO: 53
Transport, storage & communication	
Railways	IO: 48

Industry	IO and ASI Codes
Transport by other means	IO: 49
Storage	IO: 50
Communication	IO: 51
Financing, insurance, real estate & business services	
Banking & insurance	IO: 54, 55
Real estate, ownership of dwellings & business services	IO: 56
Education & Research	IO: 57 (from ASI (NIC 731))
Medical and health (IO 58)	same as in ownership of dwellings (56)
Community, social & personal services	
Public administration & defence	IO: 60
Other services	IO: 59

Source: NCAER

Table A5: Price Indices used for Capital Formation

Capital type in NAS	IO Sectors
Construction	Agriculture & allied, mining, manufacturing and services
Transport Equipment	Manufacturing and select agriculture, mining & service sectors*
Other Machinery & Equipment	Only for manufacturing sector
Total Machinery and Equipment	Only for agriculture, mining & service sectors

*: Select sectors refers to IO sectors: 05, 11 46, 59. While these are clearly non-manufacturing sectors, some information on **capital formation** under transport equipment for these sectors has been available in the ASI data.

Source: NAS 2008, Statement No. 74, pp. 182-183.

Table A6: Mapping between NIC and IO sectors for Output at constant prices

NIC Code	IO 60 Code
From sugarcane output, pg147, NAS 2008	12
151 to 154	13
155	14
16	15
171, 172, 173	16, 17, 18
181-18105	19
20	20
361	21
21, 22	22 ,23
182, 19	24
23, 25	25, 26 ,27
24	28, 29, 30, 31, 32
26	33, 34
271 ,272, 2731, 2732	35, 36
28, 29, 30	37, 38, 39, 40
31, 32	41
34, 35	42, 43
33, 369	44

Source: NAS 2008, Statement No. 60, pp. 157,

Table A7: Average Values of Capital Formation and Change in Output (Rs Lakh)

IO Code	Description	1	2	3	4	5	6	7	8	9	10
37	Metal products except mach & transport Equipment	-	-	-	-	-	682	101980	37391	34609	5057
38	Agricultural machinery	608827	217305	159872	441611	2168	-	-	-	-	-
39	Industrial machinery for food and textiles	-	-	-	-	-	-	-	-	-	-
40	Other machinery	-	-	-	-	-	925	147125	51835	50333	6890
41	Electrical, electronic machinery & appliances	-	-	-	-	-	1844	-	106689	108308	15838
42	Railway transport equipment	-	-	-	-	-	-	-	-	-	-
43	Other transport equipment	-	-	-	-	-	-	-	-	-	-
45	Construction	1067962	374170	273858	654381	1995	98365	(24)	290706	283452	38713
	Change in Q	1572500	630900	217680	597640	129487	31850	80633	122895	119833	16363

IO Code	Description	11	12	13	14	15	16	17	18	19	20
37	Metal products except mach & transport Equipment	63	45347	42051	24344	3958	25052	16885	1807	34685	893
38	Agricultural machinery	-	-	-	-	-	-	-	-	-	-
39	Industrial machinery for food and textiles	-	30538	172637	23594	-	51336	34573	3930	77448	-
40	Other machinery	84	56916	59972	34112	5385	32088	22277	2641	47386	1226
41	Electrical, electronic machinery & appliances	196	123960	133287	76975	-	75099	48139	5832	98533	2815
42	Railway transport equipment	9	-	1923	-	-	-	-	50	939	110
43	Other transport equipment	81	18557	16536	6794	1566	5814	4109	487	9126	1001
45	Construction	104	64777	66800	35443	6433	26189	17140	2032	37875	1716
	Change in Q	47777	96554	680728	38631	87901	216861	141928	16832	313576	46750

IO Code	Description	21	22	23	24	25	26	27	28	29	30
37	Metal products except mach & transport Equipment	764	17658	7905	3339	26045	123205	4541	26609	22003	30163
38	Agricultural machinery	-	-	-	-	-	-	-	-	-	-
39	Industrial machinery for food and textiles	-	-	-	-	-	-	-	-	-	-
40	Other machinery	1047	23069	11175	4453	34689	163109	5680	36264	30135	37191
41	Electrical, electronic machinery & appliances	2296	53188	22233	10512	77977	381328	12918	76879	65175	79641
42	Railway transport equipment	64	412	332	285	704	163	69	189	162	206
43	Other transport equipment	619	4017	2875	2775	6883	1590	-	1961	1473	1999
45	Construction	2143	14549	8662	6249	18418	33128	1014	11903	10151	13017
	Change in Q	45474	107257	86740	96409	197507	1460760	10729	109885	93702	120166

IO Code	Description	31	32	33	34	35	36	37	38	39	40
37	Metal products except mach & transport Equipment	5316	43235	13389	27050	90739	19700	12532	2164	1629	15539
38	Agricultural machinery	-	-	-	-	-	-	-	-	-	-
39	Industrial machinery for food and textiles	-	-	-	-	-	-	-	-	-	-
40	Other machinery	6812	54738	17752	37416	126212	26661	17891	2956	2328	21496
41	Electrical, electronic machinery & appliances	15102	121143	38098	83218	280885	60127	38828	6776	4594	46896
42	Railway transport equipment	158	1293	-	611	1304	282	871	130	105	951
43	Other transport equipment	1438	12948	-	5966	12999	2787	8579	1212	1017	9181
45	Construction	7472	62069	10422	22226	60694	13153	14843	2555	2007	18669
	Change in Q	48913	406317	45071	96125	795183	162079	294928	17971	14121	411202

IO Code	Description	41	42	43	44	45	46	47	48	49	50
37	Metal products except mach & transport Equipment	38453	395	55249	8141	133224	320605	16501	27897	523195	401
38	Agricultural machinery	-	-	-	-	-	-	-	-	-	-
39	Industrial machinery for food and textiles	-	-	-	-	-	-	-	-	-	-
40	Other machinery	53174	541	83862	11085	180776	422371	22488	39899	789976	545
41	Electrical, electronic machinery & appliances	114163	1130	177802	23348	418342	858409	47036	88990	1656078	1150
42	Railway transport equipment	659	31	1460	642	-	-	-	-	-	-
43	Other transport equipment	6477	317	13670	5330	-	-	-	-	-	-
45	Construction	27024	597	39486	13587	484535	1895000	100743	523879	427865	35502
	Change in Q	615543	19088	1318153	306150	4219317	517735	20498	270783	2486149	8025

IO Code	Description	51	52	53	54	55	56	57	58	59	60	Total Capital Formation
37	Metal products except mach & transport Equipment	135503	121732	38267	48425	12189		17	51627	126929	-	2527078
38	Agricultural machinery		-							-	-	1429784
39	Industrial machinery for food and textiles		-							-	-	394056
40	Other machinery	183781	188825	52015	65665	16530		23	69996	174628	-	3536455
41	Electrical, electronic machinery & appliances	446053	430273	109906	137143	34591		50	145542	377138	-	7342474
42	Railway transport equipment		-							-	-	14114
43	Other transport equipment	-	-	-	-	-		5	-	-	-	170188
45	Construction	723877	463027	199747	136172	34278	8489442	0	8489456	1955437	-	27715088
	Change in Q	523317	2873509	774164	898978	282239	275817	564332	567876	1740700	-	28110227

Note: **Capital Formation** is averaged over 1999-2000 to 2004-05, Change in Output is averaged for years 2000-01 to 2005-06

Source: NCAER computations

Table A8: Capital Coefficient Matrix

IO 60 Code	Description	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
37	Metal products except mach & Tpt Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0214	1.2647	0.3043	0.2888	0.3091	0.0013	0.4697	0.0618	0.6302	0.0450
38	Agricultural machinery	0.3872	0.3444	0.7344	0.7389	0.0167	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	Industrial machinery for food and textiles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3163	0.2536	0.6107	0.0000
40	Other machinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0290	1.8246	0.4218	0.4200	0.4210	0.0018	0.5895	0.0881	0.8830	0.0613
41	Electrical, electronic machinery & appliances	0.0000	0.0000	0.0000	0.0000	0.0000	0.0579	0.0000	0.8681	0.9038	0.9679	0.0041	1.2838	0.1958	1.9926	0.0000
42	Railway transport equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0028	0.0000	0.0000
43	Other transport equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.1922	0.0243	0.1759	0.0178
45	Miscellaneous manufacturing industries	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Construction	0.6791	0.5931	1.2581	1.0949	0.0154	3.0884	-0.0003	2.3655	2.3654	2.3659	0.0022	0.6709	0.0981	0.9175	0.0732

IO 60 Code	Description	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
37	Metal products except mach & Tpt Equipment	0.1155	0.1190	0.1073	0.1106	0.0191	0.0168	0.1646	0.0911	0.0346	0.1319	0.0843	0.4233	0.2422	0.2348	0.2510
38	Agricultural machinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	Industrial machinery for food and textiles	0.2367	0.2436	0.2335	0.2470	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	Other machinery	0.1480	0.1570	0.1569	0.1511	0.0262	0.0230	0.2151	0.1288	0.0462	0.1756	0.1117	0.5294	0.3300	0.3216	0.3095
41	Electrical, electronic machinery & appliances	0.3463	0.3392	0.3465	0.3142	0.0602	0.0505	0.4959	0.2563	0.1090	0.3948	0.2610	1.2041	0.6996	0.6956	0.6628
42	Railway transport equipment	0.0000	0.0000	0.0030	0.0030	0.0024	0.0014	0.0038	0.0038	0.0030	0.0036	0.0001	0.0065	0.0017	0.0017	0.0017
43	Other transport equipment	0.0268	0.0290	0.0289	0.0291	0.0214	0.0136	0.0375	0.0331	0.0288	0.0348	0.0011	0.0000	0.0178	0.0157	0.0166
44	Miscellaneous manufacturing industries	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
45	Construction	0.1208	0.1208	0.1207	0.1208	0.0367	0.0471	0.1356	0.0999	0.0648	0.0933	0.0227	0.0945	0.1083	0.1083	0.1083

IO 60 Code	Description	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
37	Metal products except mach & Tpt Equipment	0.1087	0.1064	0.2971	0.2814	0.1141	0.1215	0.0425	0.1204	0.1154	0.0378	0.0625	0.0207	0.0419	0.0266	0.0316
38	Agricultural machinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	Industrial machinery for food and textiles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	Other machinery	0.1393	0.1347	0.3939	0.3892	0.1587	0.1645	0.0607	0.1645	0.1648	0.0523	0.0864	0.0283	0.0636	0.0362	0.0428
41	Electrical, electronic machinery & appliances	0.3087	0.2981	0.8453	0.8657	0.3532	0.3710	0.1317	0.3770	0.3253	0.1140	0.1855	0.0592	0.1349	0.0763	0.0991
42	Railway transport equipment	0.0032	0.0032	0.0000	0.0064	0.0016	0.0017	0.0030	0.0072	0.0074	0.0023	0.0011	0.0016	0.0011	0.0021	0.0000
43	Other transport equipment	0.0294	0.0319	0.0000	0.0621	0.0163	0.0172	0.0291	0.0674	0.0720	0.0223	0.0105	0.0166	0.0104	0.0174	0.0000
44	Miscellaneous manufacturing industries	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
45	Construction	0.1528	0.1528	0.2312	0.2312	0.0763	0.0812	0.0503	0.1421	0.1421	0.0454	0.0439	0.0313	0.0300	0.0444	0.1148

IO 60 Code	Description	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
37	Metal products except mach & Tpt Equipment	0.6192	0.8050	0.1030	0.2104	0.0500	0.2589	0.0424	0.0494	0.0539	0.0432	0.0000	0.0000	0.0909	0.0729	-
38	Agricultural machinery	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
39	Industrial machinery for food and textiles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
40	Other machinery	0.8158	1.0971	0.1473	0.3178	0.0679	0.3512	0.0657	0.0672	0.0730	0.0586	0.0000	0.0000	0.1233	0.1003	-
41	Electrical, electronic machinery & appliances	1.6580	2.2947	0.3286	0.6661	0.1433	0.8524	0.1497	0.1420	0.1526	0.1226	0.0000	0.0001	0.2563	0.2167	-
42	Railway transport equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
43	Other transport equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
44	Miscellaneous manufacturing industries	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
45	Construction	3.6602	4.9148	1.9347	0.1721	4.4240	1.3832	0.1611	0.2580	0.1515	0.1215	30.7793	0.0000	14.9495	1.1234	-

Note: This is essentially a matrix of size 8 X 60, with the coefficients being zero in the rows corresponding to the non-capital good sectors

Source: NCAER computations