EMPIRICAL ESTIMATES OF INVERTED DUTY STRUCTURE AND EFFECTIVE RATE OF PROTECTION
- The case of India

Kanika Pathania[1]

Abstract

In this study, we analyse three rates of tariffs viz. nominal tariff, input-tariffs and effective tariffs being imposed by the government of India on its imports of merchandise goods during the period 2000-2014. Effective tariffs have been computed using the World Input-Output Database using both the Corden's and Balassa's methodology. In addition, we also investigate whether any of the selected merchandise industries in the country is characterised by the presence of inverted duty structure. Our estimates suggest that the higher the extent of positive protection, the lesser is the chance of IDS. In particular, as per the value-added statistics, IDS exists in paper and paper products, chemical and chemical products, pharmaceuticals, computer, electronics and optical products, machinery and equipment, other transport equipment for the majority of the years under consideration.

JEL Classification: F14

Key Words: Nominal tariffs, effective rate of protection, inverted duty structure, imports, India

1. INTRODUCTION:

One of the major concerns with regard to the growth and development of the domestic industries is to analyse their tariff structure. In 1991, India's foreign exchange reserves had plummeted to a level that would finance only a fortnight imports and fiscal deficit was above 8%. This imposed huge pressure on its balance of payments. It was then when the budget, for the first time, recognised the significance of trade-policy reform as a part of overall reform stating that - 'The policies for industrial development are intimately related to policies of trade'.

The 1991 tariff reforms led to a reduction in the peak tariff rates applied to non-agricultural goods, mainly on industrial products (Singh 2017). In fact, as shown in table 1.1, on an average, the peak tariff rates imposed on imports of these products have experienced a decline since the year 1991-92. However, the country's tariffs on capital goods, chemicals, electronics, textiles and tyres etc. have remained high, mainly due to significantly high tariff peaks on manufactured goods other than consumer goods (Rasheed 2012, Singh 2017).

Table 1.1: India's peak tariff rates announced in the Budget speech since 1991

Year	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Peak rate (%)	150	110	85	65	50	52	45	45	40	38.5	35	30	25	20	15	12.5	10

Note: No observed change in peak rate since 2007. However, several individual tariff rates were reduced and, in some cases, even increased every year.

Source: Singh (2017).

[1] Ph.D. Scholar, Department of Economics, Delhi School of Economics, Delhi-110007, IN. Email: kanika@econdse.org.

Table 1.2: India Simple average tariff by Stage of processing in Manufacturing 1990-91 to 2014-15

	1990-91	1993-94	1995-96	1996-97	1997-98	2010-11	2014-15
Unprocessed	107	50	27	25	25	22.5	23.5
Semi-processed	122	75	44	38	35	8.6	9
Processed	130	73	43	42	37	12.2	13.6

Source: Trade Policy Reviews of India, Secretariat Reports (various years), WTO

The 2002-03 Budget also expressed a vision that 'by the year 2004-05, there would be only two basic rates of custom duties - 10 percent covering generally raw materials, intermediates and components and 20 percent covering generally final products' (Singh 2017). Initially, it was expected that this tariff wall would give protection to final goods sector, and, in turn, would improve the efficiency of the domestic supply chain by offering inputs at a lower tariff rate. However, with a rise in the number of India's regional trade engagements in the recent past, overall Most Favoured Nation (MFN) as well as the FTA tariff rates,[2] have come down drastically across the sectors, which lead to the apprehension that large number of final goods would enter the country due to the significant tariff cuts under FTAs, as the duties on intermediate and capital goods remain relatively higher.

Table 1.2 provide one such evidence – It shows the fall in tariff rates imposed on imports of processed, semi-processed and unprocessed goods during the years 1990-91 to 2014-15. If such a scenario remains, then it would negatively impact the final goods producers as they need to compete with cheaper foreign commodities especially from the East and South-East Asia. The technical term that describes this situation is referred to as the Inverted Duty Structure (IDS): that is, when the tariff on import of intermediate inputs is more than tariff imposed on import of final output of goods produced with those inputs. On the contrary, tariff escalation refers to the case when import duties on semi-processed products are higher than on raw materials, and higher still on finished products. This practice protects domestic processing industries and discourages the \development of processing activity in the countries where raw materials originate.[3]

This issue of IDS has also been recognized by the Indian policy makers. In an interaction with the members of *Economic Times*, Finance Minister Arun Jaitley said:

[2] FTAs are arrangements between two or more countries or trading blocs that primarily agree to reduce or eliminate customs tariff and non-tariff barriers on substantial trade between them. FTAs, normally cover trade in goods or trade in services. Source: Indian Trade Portal.

[3] https://www.wto.org/english/thewto_e/glossary_e/tariff_escalation_e.htm

> ...I propose to reduce the rates of basic customs duty on certain inputs, raw materials, intermediates and components (in all 22 items) so as to minimize the impact of duty inversion and reduce the manufacturing cost in several sectors.
>
> (Seth, 2015)

This is indeed required to incentivize domestic manufacturing, which is being promoted by the government as a part of its 'Make In India' campaign. In fact, in the past two years, various steps have been undertaken to rectify this problem in major sectors of the Indian economy, however, till now, no concrete study has been done to verify the existence of IDS in manufacturing production. Of crucial importance is another concern regarding the existence of negative protection in India's merchandise industries. This is because if ERP is positive in the presence of IDS, then the latter may not affect the domestic industries as the structure of tariff is still giving them protection. But if the opposite holds true, then the tariff structure may severely impact the domestic as well as international position of the country's manufacturing industries, which are characterised by less than potential growth rate since the past two decades. Hence, there is an emergent need to relook at the country's tariff structure and calculate the rate of effective protection accorded by India. Moreover, it is important to note that we would be using the concept of effective protection only to evaluate the possible impact of the duty structure (particularly, IDS) on value added, and not as an indicator of resource allocation, which was demolished by Ramaswami and Srinivasan in their 1971 study.

This motivates us to undertake an empirical investigation of the tariff structures characterising various Indian industries. We are particularly interested in analysing three rates of tariffs viz. nominal tariff i.e. the duty imposed on imports of final goods, input-tariffs i.e. the duty imposed on imports of intermediate goods, and effective tariffs – which are calculated on the basis of input and output tariffs and indicate the level of actual protection being accorded to firms in a particular industry.

The rest of the study is structured as follows. Section 2 discusses the existing empirical literature on estimation of ERP for the Indian goods industries (manufacturing and a few others). Section 3 outlines the empirical methodology, followed by section 4 explaining the data that we have utilized to compute different rates of protection. Section 5 discusses the empirical estimates of ERP, followed by a small section discussing the economic and statistical reasons that explain the existence of negative value added under free trade in some of the Indian industries. The last section summarises the study.

2. STUDIES OF ERP FOR INDIAN INDUSTRIES

The present scenario of the Indian manufacturing sector, with the advent in the number of RTAs,[4] that the country has negotiated in the recent past, has made it imperative to revisit the protection mechanism accorded to its merchandise sector in the past, and compare it with the recent trends, so as to cull out the important factors that are hindering the sector's growth. The present subsection reviews and evaluates finding of previous studies that derived ERP and IDS on the basis of tariff and non-tariff barriers faced by the Indian Industries.

ERP is defined as the percentage excess of the domestic value added due to the imposition of tariffs and other protective measures on the product and its inputs, over foreign market value added. We can define ERP as follows:

ERP = (Value added under restricted trade – Value added under free trade) / Value added under free trade

The study by Corden (1971) has been one of the pioneers that broadly explains the conceptual framework for ERP. It details the relation between the nominal tariff rate on a product, the nominal tariff rates on its inputs, and the share of inputs in the cost of the product at free trade prices both graphically and algebraically. The author has derived the concept of ERP by considering a set of assumptions like the small country assumption, competitive domestic markets, domestic prices being equal to the world prices plus tariffs, etc. Algebraically Corden has defined the measure of ERP as follows:

$$ERP_j = \frac{t_j - \sum_i a_{ij} t_i}{1 - \sum_i a_{ij} t_i}$$

where ERP_j is the effective rate of protection on output j, a_{ij} is the share of i in the cost of j at free trade prices, t_j is the nominal rate of tariff on j and t_i the nominal rate of tariff on i.

Most of the methodologies that have been adopted to estimate the measure of ERP can be broadly classified into three categories – price comparison based, tariff based and duty collection based. In price comparison method, the price of the domestic good (after restrictions) is compared to its foreign equivalent to evaluate the value addition in that good in home country due to tariff and non-tariff barriers. These estimates of ERP have an advantage of capturing the effect of both tariffs and non-tariff barriers. However, there are immense difficulties in getting comparable international and domestic prices since there are no similar foreign counterparts. In the second measure based on tariffs, authors try to compute the simple average tariff rate and import weighted tariff rate to find out the measure of ERP by using Corden's methodology.

[4] RTAs are trading arrangements that two or more countries agree to enter into, whereby they offer tariff as well non-tariff concessions on each other's imports.

While in the collection based approach, a tariff rate is imputed by dividing the total customs revenue earned from import of a particular product by the import value of that product. If there are QRs and several exemptions, then collection rate becomes a better measure to estimate ERP. (Nouroz, 2001)

Bhagwati and Desai (1970) estimated ERP for 18 organized industries in India covering consumer goods, raw materials and intermediate and capital goods for the years 1961 and 1962. They took into account the changes in the premium of quantitative restrictions (QRs) which significantly change over time. They have defined ERP as the ratio of incremental value added (i.e. difference between the value added at restricted trade and value added at free trade) to value added at domestic prices. As per conventional method, ERP is defined as the percentage excess of domestic value added due to imposition of tariff and non-tariff barriers over free trade value added at international prices. They estimated ERP, using domestic value added data from the industrial census and deflated this with import premium, tariffs, etc to arrive at c.i.f. values,[5] and hence international prices. Their empirical estimates showed that in the early 1960s, the level of effective protection was high in Indian industries. In fact, for a number of industries, they found that the value added at world price was negative. Taking the weighted average of 18 industries, the ERP due to tariff was 208 percent, while that due to QRs ranged from 60 to 80 percent, respectively. The average ERP taking into account both tariffs and QRs ranged between 80 to 100 percent.

In Bhagwati and Srinivasan (1975), Panchmukhi also estimated the rate of effective protection by using implicit tariffs for 76 major industries for the years 1968-69. For some sectors, direct comparisons have been made whereas, for others, data on premium rates on import licences and nominal tariff rates have been used to derive implicit tariff. They showed that the ERP for primary consumer goods was the lowest and those for the non-food consumer goods are amongst the highest. Moreover, it was found out that the agro-based intermediate goods of semi–finished/ finished type received much higher protection than the other intermediate goods. And, the capital goods receive much lower effective protection in comparison to the intermediate goods.

[5] c.i.f. is Cost Insurance and freight. In CIF agreements, insurance and other costs are assumed by the seller, with liability and costs associated with successful transit paid by the seller up until the goods are received by the buyer.

In yet another study, Nambiar (1983) used price comparisons, namely, wholesale price quotations for domestic prices and unit values of similar products exported to India to estimate the rate of effective protection. He estimated the ERP for 44 sectors for the years 1961 and 1968. The results indicate that the ERP estimates based on tariff significantly overstate the extent of protection enjoyed by the Indian industries. While the average ERP for manufactured goods was found to be 140 per cent when the estimate is based on tariff, it turned out to be only 41% when the estimates were based on the comparison of domestic and international prices. ICICI (1985) also estimated the ERP for 51 exporting firms for the year 1980-81. They found that Indian exports face negative ERP, even while taking into account all the incentives given to offset cost disadvantage of firms operating in the domestic economy.

Further, the World Bank (1989) estimated the nominal and effective rates of protection for 56 major Indian manufacturing industries for the years' 1986-87 to study the level and structure of protection. Their estimates were based on price comparison and indicate that the protection is bi modal. In terms of shares of gross value added, ERP was found to be high (above 70 percent) for 39 percent of the manufacturing, moderate (30 percent to 70 percent) for only about 6 percent of the manufacturing and low (less than 30 percent) for about 55 percent of the sector. The weighted average rate of nominal protection of 56 industries was estimated to be 50 percent and using value-added at world prices as weights, it was estimated to be 40 percent. Thus, their study showed high levels of protection and inability to undertake process and product innovation.

Aksoy (1991) quantified the structure of import licensing regime for the year 1987-88 and has analysed the structure of tariffs. The author calculated nominal tariff and argued about the existence of higher absolute level of tariffs in the Indian industries, specifically focussing on higher tariff walls characterising the imports of capital goods. Furthermore, Aksoy and Ettori (1992) estimated the ERP for 210 commodities to estimate the structure of incentives and protection from various sources that were grouped into 16 different categories. They found out that the levels of effective protection were generally high and provides ample room for profits and/or inefficiency. The ERP estimates were high for edible oils, heavy chemicals, iron and steel products and particularly synthetic fibres/ resins and synthetic textiles. Their ERP estimates were based on the comparison of value added in domestic and international prices, and effectively assume that capital costs are same in all countries. Since, most of the countries did not levy high taxes or quantitative restriction on capital goods unlike India, this assumption was reasonable approximation. However, India imposes high taxes and tariffs on capital goods, thus, higher prices for capital goods (domestic or imported) paid by Indian firms imply that

their value added should include a larger return to capital. As explained by the authors, this results in domestic value added exceeding the international value added and hence to positive ERP. They argued that the Indian firms which may be as efficient as the foreign firms, would show higher prices and ERPs. In order to check for this issue, the authors re-estimated ERP after separating out the effect of capital costs. From their analysis, they concluded that, on an average, the protective system does not give very high protection in the industrial sector. However, this has created unplanned variance in net ERP, where half the industry receives high positive ERP, while the other half receives negative ERP.

Goldar and Saleem (1992) have also estimated ERP for the manufacturing sector for the years 1980-81, 1983-84 and 1989-90 using Corden's approach. The average ERP for the Indian industries was estimated as 94 percent in the year 1980-81, 119 percent in 1983-84 and 127 percent in 1989-90. For the year 1989-90, three sets of ERPs were estimated where in first estimate was based on simple average of tariff rates, second estimated was based on import weighted average of tariff rates and the third set of estimates was based on tariff collection rate. The simple average ERP was 127%, the import weighted average was 117% and that based on collection rate was 86%. Their study showed an increase in protection across Input Output sectors, input based sectors and trade based sectors across the years.

On the contrary, Mehta (1997) computed the NRP, ERP and frequency ratio,[6] for the years 1989-90, 1993-94 and 1995-96 for 53 sectors of the country using Corden technique and showed that the liberalization process has resulted in a significant decline in protection of Indian industries.

Gang and Pandey (1998) examined the structure of protection by finding the measure of NRP and ERP based on both Balassa and Corden Methods in India for the four years viz.1979-80, 1984-85, 1991-92 and 1995-96. They created 53 comparable sectors from the input output tables of the sixth, seventh and eighth five-year plans. They have used nominal tariffs and collection rates to estimate ERP and have shown that the level of protection varies according to the tariff used. ERP levels indicate positive protection for 32 manufacturing sectors.

Studies such as those by Pandey (1999), Mehta (1999), etc. have also been undertaken to assess the role of non-tariff barriers (or NTBs). While the former computed tariff equivalence of NTB

[6] A frequency ratio is the proportion of national tariff lines that are affected by a particular non- tariff barrier or by a specified group of non-tariff barriers, irrespective of whether the products affected are actually imported. (Source: The OECD Economic Outlook: Sources and Methods)

and showed a decline in its incidence over the three years' period – 1994-95, 1996-97 and 1997-98, the latter showed a significant decline in the average tariff rates and frequency ratio during the period – 1993-94 to 1998-99. Further, his study showed that only 28% of product lines subject to NTB by 98-99. Hasheem (2001), on the other hand, examined the structure of tariffs and NTB's for four years 1987-88, 1992-93, 1994-95 and 1997-98 by calculating NRP and ERP. He showed a steady decline in both ERP and NRP level and the pattern of protection is dependent on choice of tariff rates.

In another study, Das (2003) has estimated trade barriers at the level of disaggregate industry groups for Indian manufacturing for the year 1980-2000 to examine whether the sector's protection has indeed declined over twenty years. The author has estimated trade barriers (both the tariff and non-tariff barriers) for 72 industries belonging to intermediate, capital and consumer goods sectors for period under analysis and the phases of trade reforms therein. The study has shown that while the levels of effective rate of protection and percentage of imports subject to licencing has declined during the 90s, the import penetration rates have shown a rise only in the second half of the 90s. This, in turn, means that there have been considerable lags between reduction of tariffs and non-tariff barriers, and measurable impact on imports and on the economy for the period under consideration. In his 2015 study, the same author examined the organised manufacturing sector and use based sectors of organized manufacturing for the periods 1990-91 to 2009-10. His study shows that trade protection measured by nominal import tariff as well as effective rate of protection were brought down substantially in the 1990s. Capital goods saw faster reduction in ERP during 1990s compared to intermediate and consumer goods. He then compared the period of 1990s versus 2000s in order to understand the manner of lowering of tariff as well as non-tariff barriers. He then confirmed that there was a sharper decline in tariff levels as well as quantitative restrictions in the 1990s as compared to the 2000s. This is because the periods of 2000s were more aimed at simplifying the trade procedures as well as boosting exports.

3. METHODOLOGY

In this section, our objective is to calculate the rates of effective protection for different Indian manufacturing industries for the years 2000-2014 and to identify industries that also have inverted duty structure (IDS).

Corden (1971) derived the concept of ERP algebraically by considering the following set of assumptions:

1. **Fixed input-output coefficients:** This implies that there is a fixed physical input-output coefficient in domestic production of a particular product, and this remains same for all the domestic firms. Additionally, it implies that price distortions do not affect the technology so used in the firms under consideration. The elasticity of substitution among inputs is zero.
2. **Small country assumption:** foreign supply elasticity of imports is infinite.
3. Production takes place under **Constant Returns to Scale**.
4. Domestic markets are **competitive**.
5. There is **international immobility** of factors of production.
6. Trade continues even after **tariffs** are imposed.
7. **No quantitative restrictions** are imposed on imports of goods.

On the basis of the afore-mentioned assumptions, we can also say that domestic prices are equal to the **world prices plus tariffs** (as can be derived from assumptions 2, 3, 4, 6 and 7).

Based on these assumptions, the rate of effective rate of protection is computed as follows:

Let P_v be the value added per unit in activity j in the absence of tariffs, g be the effective rate of protection, P_j the nominal price of a unit of j in free trade, a_{ij} be the share of i in the cost of j at free trade prices, t_j be the nominal rate of tariff on j and t_i the nominal rate of tariff on i. Then,

$$P_v = P_j (1- \sum_i a_{ij}) \quad (1)$$

Here, $\sum a_{ij}$ includes all the tradable inputs per unit of output j in the absence of tariffs. Incorporating the tariff rate in the above identity, equation (1) becomes

$$P_v' = P_j((1+t_j) - \sum_i a_{ij}(1+t_i)) \quad (2)$$

The first term on the right-hand side shows the enhanced value of output due to tariffs on output and the second term is enhanced value of tradable inputs due to tariff on inputs. The implication of this equation is that the rate of protection on value added in a production process can differ widely from the tariff rate applicable to the commodity produced in that process. So, the ERP can be defined as follows:

$$g_j = (P_v' - P_v)/ P_v \quad (3)$$

where g_j is the percentage increase in value added per unit of j made possible by the tariff structure. Substituting equation (1) and (2) in equation (3), we get:

$$g_j = \frac{t_j - \sum_i a_{ij} t_i}{1 - \sum_i a_{ij} t_i} \quad (4)$$

Equation (4) tells us that g_j depends on the nominal tariff on output, the nominal tariff of input and their input shares. Based on this, the author defined seven different implications:

I. If $t_i = t_j$, then $g_j = t_i = t_j$ for all i

i.e. if the tariff rate on the output of the process is the same as the tariff rate on the input, then the effective rate of protection to the process will be the same as the input and the output tariff. In other words, there is no divergence between the nominal and effective rate.

II. If $t_i > t_j > 0$, then $g_j < t_j < t_i$ for all i.

i.e. if the tariff rate on input is larger than that on output, then the effective rate of protection of the process will be less than the tariff rate on output.

III. Similarly, if $0 < t_i < t_j$, then $g_j > t_j > t_i$

IV. If $t_j < \Sigma_i a_{ij} t_i$, then $g_j < 0$

This case calls for negative ERP. Note that the effective rate can be negative even though the nominal rate is positive. It also shows that if $t_j = \Sigma_i a_{ij} t_i$, the effective rate will be zero.

V. If $t_i > t_j = 0$, then $g_j = - (\Sigma_i a_{ij} t_i)/(1- \Sigma_i a_{ij}) < 0$

i.e. if the tariff rate on output is zero, the effective rate of protection to the process is a function of input share and tariff rate of input. If the input rate is positive, the effective rate of protection is negative.

VI. If $t_i = 0$, then $g_j = t_j/(1- \Sigma_i a_{ij})$

i.e. if the tariff rate on input is zero, then the effective rate of protection to the process is a function of the tariff rate on output and the cost share.

VII. If $1 < \Sigma_i a_{ij} t_i$ then with $t_j > \Sigma_i a_{ij} t_i$ we still have negative effective rate of protection. This is a case where value added under free trade is negative leading to negative effective rate of protection.

For the present study, we would be using data on value added from World Input-Output tables (WIOT), which is an initiative on the part of the European Commission and details information on both domestic and foreign value added for a set of 43 countries, including India. The advantage of using this data base entails from its time series availability for the period 2000-2014. Unlike WIOT, data on national input-output tables is available for limited and disconnected time periods and hence, cannot be directly used to compute ERP values for the years other than their reported years.[7]

[7] The construction of WIOT tables is detailed in Appendix 1.

Based on the availability of data as discussed above, we can modify Corden's measure to some extent as follows:

We can represent ERP in sector j as,

$$ERP_j = \frac{VA_{Tj} - VA_{FTj}}{VA_{FTj}} \text{ X } 100 \quad (5)$$

where VA_{Tj} refers to value added under restricted trade at basic prices,[8] and VA_{FTj} refers to value added under free trade at basic prices. Value added at basic price is defined as value of output at basic prices minus intermediate consumption at purchasers' price (Source: Eurostat). Thus, the former can be algebraically represented as follows (on similar lines of Corden and data availability):

$$VA_{Tj} = VO_j - \Sigma_i(IC_{ij}) \quad (6)$$

where,

VO_j refers to value of output of sector j at basic prices.

IC_{ij} refers to intermediate consumption of good i in production of output j at purchaser' price.[9]

Since, we would be referring to each year's input output table, whose values have been computed taking into account the import tariffs imposed on the import of the final output and intermediate input, therefore, in order to find the counterfactual (i.e. value added under free trade), we will normalize the ex-post value of output by the amount of tariffs charged on each product i.e. $(1+t_j)$ and ex-post intermediate consumption by $(1+t_i)$. We can write the value of VA_{FTj} as follows:

[8] The basic price is the amount receivable by a producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer. (Source: OECD). On the contrary, purchaser's price refers to the price paid by the consumers to the suppliers of the good. In other words, basic prices imply that all the costs are borne by the producers and purchaser's price is the price at which the buyers purchase goods from the producer.

[9] Since the available data gives the value of Intermediate consumption at basic price, we have to calculate the value for the same at purchasers' price. The difference between the basic prices and purchaser prices arise because of the two cost components viz. international transport margin (or ITM) and net indirect taxes (or NIT). Therefore, to calculate value added at purchaser prices, intermediate consumption (which is at basic prices), NIT and ITM are added from value of output at purchasers' price. (or NIT and IT will be added to IC at basic prices to compute IC at purchasers' price). Algebraically,

$$IC \text{ (purchasers' price)} = IC \text{ (basic price)} + NIT_i + ITM_i$$

where,

NIT_i refers to net taxes on product i, which, in turn, is equal to taxes minus subsidies and ITM_i refers to lump sum international transport margins where it includes all automotive trade, wholesale trade, retail trade and transport margins.

$$VA_{FTj} = \frac{VO_j}{(1+t_j)} - \sum_i \frac{IC_{ij}}{(1+t_i)} \quad (7)$$

Here, t_j refers to ad valorem tariff on import of final output j and t_i refers to ad valorem tariff on imports of intermediate consumption.

Rewriting the value of ERP in terms of equation (6) and (7), we find

$$ERPj = \frac{Eq(6) - Eq(7)}{Eq(7)} \text{ X } 100$$

$$ERP_j = \frac{(VO_j - \sum(IC_{ij})) - (\frac{VO_j}{(1+t_j)} - \sum_i \frac{IC_{ij}}{(1+t_i)})}{\frac{VO_j}{(1+t_j)} - \sum_i \frac{IC_{ij}}{(1+t_i)}} \text{ X } 100 \quad (8)$$

Solving eq (8) will give us the following method for finding ERP:

$$ERPj = \frac{\frac{t_j VO_j}{(1+t_j)} - \sum_i \frac{t_i IC_{ij}}{(1+t_i)}}{\frac{VO_j}{(1+t_j)} - \sum_i \frac{IC_{ij}}{(1+t_i)}} \text{ X } 100 \quad (9)$$

Equation (9), therefore, becomes our final equation of interest and we would next try to empirically estimate this equation. This eq (9) is just a reformulation of Corden's measure based on the availability of data. It is crucial to note that since one product may employ more than one input in its production, we'll first find out the import weighted average tariff on intermediate imports (Avt_i) and then utilise it to compute ERP estimates.

Moreover, it is worth noting here that a negative value of ERP may arise because of the following three possibilities:

1. If both value added under free trade and restricted trade are positive: In this case, ERP < 0 when the latter falls short of the former. As per the Corden formula, this will happen if $t_j < \Sigma_i a_{ij} t_i$ (as discussed in section 3). Note that the effective rate can be negative even though the nominal rate is positive. Moreover if $t_i > t_j = 0$, then $g_j = -(\Sigma_i a_{ij} t_i)/(1- \Sigma_i a_{ij}) < 0$ i.e. if the tariff rate on output is zero, the effective rate of protection to the process is a function of input share and tariff rate of input. In this case, if the input rate is positive, then the effective rate of protection is negative.
2. If value added under free trade is negative and that under restricted trade is positive: Corden has explained this condition that if $1 < \Sigma_i a_{ij} t_i$ then with $t_j > \Sigma_i a_{ij} t_i$ we still have negative effective rate of protection. This is a case where value added under free trade is negative leading to negative effective rate of protection. As per our formulation, this is possible if value of output

under restricted trade < intermediate consumption under restricted trade. Intermediate consumption can be higher if either the tariffs imposed are very high or given the rate of tariff, we are importing large amount of intermediate inputs. This could be due to the possibility of tariff escalation. As per our calculations, as tariff on output keeps on exceeding tariff on inputs, a point may come when the free trade value of output falls short of value of intermediate consumption, thus leading to negative value added under free trade. This is one possibility. The other possibility is when value added under free trade is very high, which is possible when cost of intermediate consumption is very low.

3. If value added under restricted trade is negative while that under free trade is positive and the magnitude of the former is more than that of the latter: Given that the producers are profit maximisers, this situation is unlikely to occur except temporarily.

How will the ERP change if any of the two tariff rates or value of output rise? – To assess this impact, we partially differentiate equation (8) w.r.t. t_j, t_i and VO, respectively. The derivations are detailed in Appendix 1. The results imply that: Now, to look how tariff on final output, tariff on intermediate input and value of output affect effective rate of protection, we have tried to derive the implication whose results are as follows:

1. $\frac{\partial ERP}{\partial t_j} > 0$

   This means that as per our formulation of ERP, an increase in tariff on output leads to an increase in the rate of effective protection

2. $\frac{\partial ERP}{\partial t_i} < 0$

   This implies that ERP is negatively associated with rate of tariff imposed on imports of an intermediate input.

3. $\frac{\partial ERP}{\partial VO} > 0$ if $\frac{\sum IC}{\sum(\frac{IC}{1+t_i})} > 1 + t_j$

   This implies that with an increase in the value of output, the extent of protection also rises if the ratio of intermediate cost at restricted trade to intermediate cost at free trade is greater than 1 plus the tariff rate on output. In a special case, where import tariffs on all the intermediate inputs are same, a rise in VO will lead to an increase in ERP if import tariff on input is greater than the import tariff on output.[10]

[10] According to the conventional literature on ERP, under the small country assumption, domestic prices are fully determined by world prices plus the rate of tariff, and thus, any change in VO or IC can only be due to change in volumes. Moreover, assumption of fixed input-output coefficients requires that any change in VO requires a fixed amount of change in intermediate input and hence, the measure of ERP remains scale neutral. In the present case, however, this is not the case – in fact, ERP is positively associated with an increase in VO and this is precisely because our data/methodology is not constrained by the assumption of fixed input-output coefficients. This is

The existing literature suggests two different possibilities about the treatment of non-traded inputs,[11] while calculating the measure of ERP - either to treat the non-traded inputs as part of value added (i.e. as primary factors) or to treat them as traded inputs with zero tariff. Balassa (1965) argued that non-traded inputs could be treated as if they were traded input in infinitely elastic supply. In such circumstances their price would be insensitive to protection and tariff on input will be zero.[12] In contrast, Corden (1966) argued that value added in non-traded inputs should be aggregated with all other value added. In effect then, non-traded inputs enjoy the same level of protection as primary factors. As has been posited by Bhagwati and Desai (1970), Corden (1966) argues on the basis of the argument that Balassa estimates would bias the measures away from the correct resource allocation predictions. On the other hand, in Corden's model, the non-traded input is just a proxy for a primary factor which is not traded itself; hence the analysis does not really come to grips with the problem in any essential way. As a consequence, there is no relevant theoretical guideline for anyone who measure effective rate of protection, relating to the treatment of non- traded goods. We have proceeded to compute effective rates for Indian industries using both the assumptions, treating the procedure as amounting to some form of sensitivity analysis. Thus, one can say that true value of ERP lies within the bounds of these two assumptions defined by Corden and Balassa.

Depending upon the treatment of non-traded inputs and our methodology for computing ERP, we can infer the following:

1. In cases when Balassa's technique is used, average input tariffs will always be relatively less vis-à-vis that of the tariffs determined using the Corden's measure. This is because we are referring to import weighted tariffs and while Balassa considers non-traded input as equivalent to traded inputs with zero tariffs, Corden assumes that non-traded inputs constitute a part of value added only and hence, he doesn't deduct them from the value of output while computing value added.

more realistic in our study, which covers years over a period when these coefficients could not be assumed to remain fixed.

[11] Non traded: These are goods (and above all, services) where no significant part of domestic consumption is imported or of production is exported so that they do not have their prices set in the world market. They may be conceivably or physically tradeable, but because of transport costs or for other reasons are not actually traded. Corden (1971).

[12] However, in such a case, even the value of non-traded inputs will get affected by exchange rate fluctuations. On the contrary, in case of Corden methodology, any change in exchange rate will not impact the value of non-traded inputs. It is important to note that in the analyses that follows, we have not considered the effect of exchange rate fluctuations in impacting the rate of effective protection.

2. The measure of value added under free trade using Corden's treatment of non-traded goods will always be higher than when Balassa's technique is employed.

3. Following 1 and 2, the measure of ERP defined using Corden's technique should always be less than ERP determined using Balassa's technique, provided that both value added under free trade and under restricted trade are positive.

After computing these two estimates, we shall also check if IDS exist in any of our industries under consideration for these two assumptions on the treatment of non-traded goods. If $Avt_i > t_j$, then it becomes the case of IDS.

4. COLLECTION AND PROCESSING OF DATA:

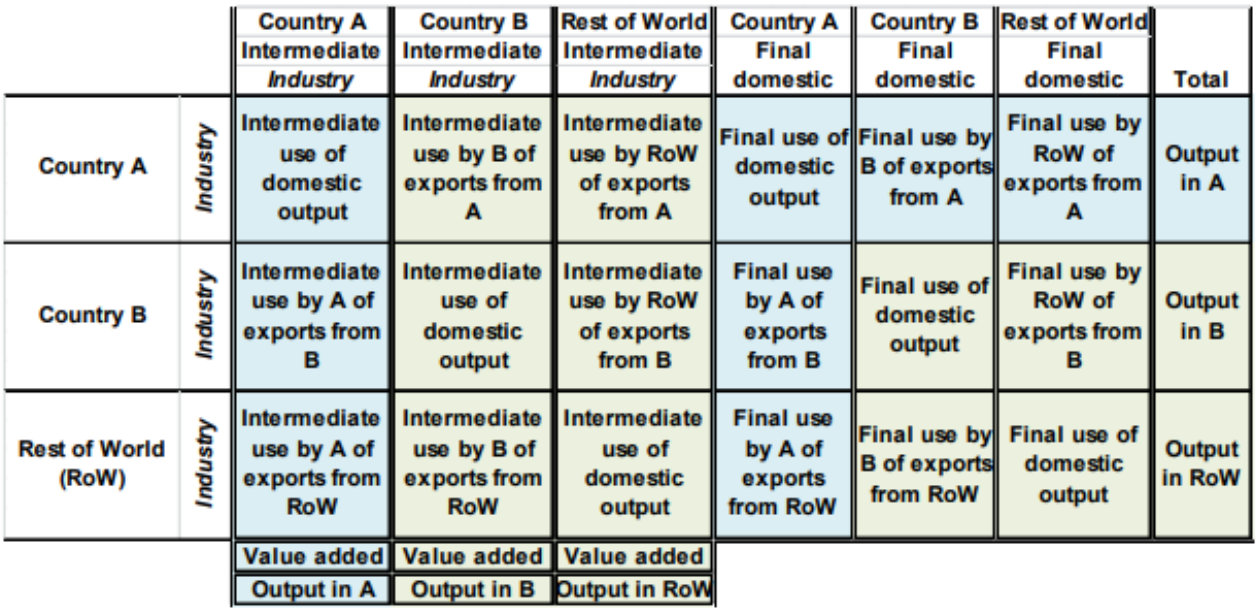
Unlike the existing studies on calculation of ERP for Indian manufacturing industries (for e.g., Chand and Sen 2002, Das 2003, Nouroz 2010, Das 2012 among others), which use the National Input-Output tables (IOT) for computing value added data, we propose to utilize the World Input-Output Database (WIOD) to compute time-series data on value of output, intermediate consumption, net taxes and international transport margin. Even though both are based on the Supply-Use tables (SUTs) of the Indian economy,[13] the problem with the former is that it is last available for the year 2007 and has not been formulated again afterwards. Given that the Indian economy is globalizing at a rapid rate, its structure of production has also changed in the past one decade and a half. Taking this issue into account and the substitution possibilities between different factors of production, the existing studies (mentioned above) have tried to derive the ERP statistics for the country by modifying the base 2007 table only. The advantage of the World Input Output Database is that it consists of a time series data and covers 28 EU countries and 15 other major countries (total of 43 countries), including India, for the period 1995-2014. More so, the data also covers 56 industries, that are classified according to the International Industrial Classification Revision 4 (ISIC Rev. 4).

The second difference with the national tables is that the use of products is also broken down according to their origin. Each product can be produced either by a domestic industry or by a foreign industry. In contrast to the national IOT, this information is made explicit in the WIOD. For a country A, flows of products both for intermediate and final use are split into domestically produced or imported. In addition, the WIOT shows in which foreign industry, the product was produced. This enables us to apply origin specific tariffs, which may diverge from MFN tariffs due to trade agreements. All the other assumptions remain the same viz. the data implicitly

[13] A supply table provides information on products produced by each domestic industry and a use table indicates the use of each product by an industry or final user.

assumes that equilibrium is attained in the world market and hence, total demand is always equal to total supply for both the final and intermediate goods. An illustration of how exactly the table is structured, is provided in figure 1.

Figure 1: Schematic outline of World Input-Output Table (WIOT), three regions



		Country A Intermediate *Industry*	Country B Intermediate *Industry*	Rest of World Intermediate *Industry*	Country A Final domestic	Country B Final domestic	Rest of World Final domestic	Total
Country A	*Industry*	Intermediate use of domestic output	Intermediate use by B of exports from A	Intermediate use by RoW of exports from A	Final use of domestic output	Final use by B of exports from A	Final use by RoW of exports from A	Output in A
Country B	*Industry*	Intermediate use by A of exports from B	Intermediate use of domestic output	Intermediate use by RoW of exports from B	Final use by A of exports from B	Final use of domestic output	Final use by RoW of exports from B	Output in B
Rest of World (RoW)	*Industry*	Intermediate use by A of exports from RoW	Intermediate use by B of exports from RoW	Intermediate use of domestic output	Final use by A of exports from RoW	Final use by B of exports from RoW	Final use of domestic output	Output in RoW
		Value added	Value added	Value added				
		Output in A	Output in B	Output in RoW				

Source: http://www.wiod.org/database/index.htm

Figure 1 illustrates a simple case of three regions: countries A and B, and the rest of the world. The WIOD distinguishes 40 different countries for which the data is available and the rest of the World, but the basic outline remains the same. For each country, the use rows are split into two separate rows, one for domestic origin and one for foreign origin. In contrast to the national IOT for country A, it is now clear from which foreign industry the imports originate, and how the exports of country A are being used by the rest of the world, that is, by which industry or final end user. The method of construction of WIOT is detailed in Appendix 2.

Other than the data on value of output, we also require information on import tariffs. World Integrated Trade Solution, or what is commonly referred to as WITS, is a World Bank database, that provides commodity-wise data on import tariffs for all the economies around the globe. The advantage is that the data is also available in terms of ISIC rev. 3, which can be concorded with ISIC rev. 4. The source provides data on three different tariff rates viz. effectively applied rates,[14] most favoured nation (MFN) tariff rate and bound rates in terms of both simple average

[14] WITS uses the concept of effectively applied tariff, which is defined as the lowest available tariff on imports from each country. If a preferential tariff exists, it will be used as the effectively applied tariff. Otherwise, the MFN applied tariff will be used.

and import weighted average tariff. For our analysis, we would be referring to effectively applied tariff rates to calculate the import weighted tariff.[15] We would refer to country-wise tariff lines to calculate ERP in any industry j. For e.g., if industry 'j' in India is importing intermediate input 'i' from countries X and Z and if India is imposing different tariff rates on imports from both these countries, then we would be referring to both these rates corresponding to quantities imported from each of these countries.[16] While calculating the component (t_j) in equation (9), we will take the country's import weighted tariffs.[17] In total, our analysis is based on 24 industries including agriculture and allied activities, mining, electricity, gas and water supply. The industries are listed in Appendix 3, and the countries for which tariff data is available, are as tabulated in Appendix 4. Since WITS gives us the tariffs imposed by India on world (average tariffs from all the countries), therefore, we have taken tariffs of rest of the world as world tariffs. The concordance between ISIC Rev 3 and ISIC Rev 4 is reported in Appendix 5.

5. SECTOR WISE STATISTICAL RESULTS AND ANALYSIS:

This section will discuss the results from our statistical analysis for each of the merchandise industries for which we have estimated effective rates of production.

5.1. Crop and animal production, hunting and related service activities.

This industry includes two basic activities, namely, the production of crop products and production of animal products. It also covers various forms of organic agriculture such as the growing of genetically modified crops and the raising of genetically modified animals. In addition, the sector also includes service activities that are incidental to agriculture, as well as hunting, trapping and other related activities.

Agriculture has a long-drawn history in the context of the Indian economy, contributing about 17% of its GDP though the share has been declining since 1991. Even today, the majority of the rural India relies on agriculture and other allied activities for their livelihood. Due to the sensitive nature of the sector and in order to protect its farmers, the government of the country has always imposed higher rates of tariffs on its agricultural imports. In fact, many of India's

[15] In simple average tariff, all items get equal weightage irrespective of their importance. Therefore, this method of computing NRP gives undue weightage to some small item. To overcome this, we have used import weighted averages.

[16] This is possible when trade with one (or both) the exporters is via an RTA route.

[17] $\boldsymbol{t_j} = \sum_k \boldsymbol{m_k} * \boldsymbol{t_{kj}}$, where k refers to countries, m_k refers to import weight of country k and is calculated as $m_k = \frac{import\ from\ country\ k}{total\ imports\ by\ India}$, and, t_{kj} refers to tariffs imposed on country k by India on its import of final output j

bound tariff rates on agricultural products are amongst the highest in the world.[18] Even in the regional trade agreements that the country has signed so far, most of the agricultural commodities are excluded from the positive list. Moreover, several agricultural commodities, mainly food, are subject to stringent export and import controls. In fact, because of the deep-rooted problems of food insecurity and poverty, and the historic mind-set of the policymakers, this sector has always has been restricted.

Before analysing the rates of tariffs, it is important to recall that there are two rates of effective protection – one, as defined by Corden and the other as defined by Balassa. As the literature suggests, the actual measure should lie between the two. Accordingly, we will have two rates of intermediate inputs for each of the final item under consideration.

As is evident from figure 5.1 and for the partners under consideration (see Appendix 4), the tariff on imports of this sector has increased steadily over time ranging from 11.53% in the year 2000 to reach as high as 30.90% in 2014, with an average tariff rate of about 30.25%.

The consequences of higher import tariffs are clearly reflected in the rates of effective protection - it has been positive throughout the 15 years long time period.[19] This is true for both the Corden's and Balassa's measures. In fact, the extent of positive effective protection has increased from about 15.98% in the year 2000 to reach as high as 45.84% by the year 2014, only to experience a fall to about 24% in the year 2008.Not only this, NRP has also fallen during the latter period, due mainly to a reduction in tariffs on edible vegetable oils from an average of almost 75 per cent to 7.5 per cent (Cagliarini and Rush 2011). The estimates also suggest that the two rates of ERP almost coincide for the period under consideration, which may imply that this industry is characterized by very low amount of imports of non-traded intermediate inputs.

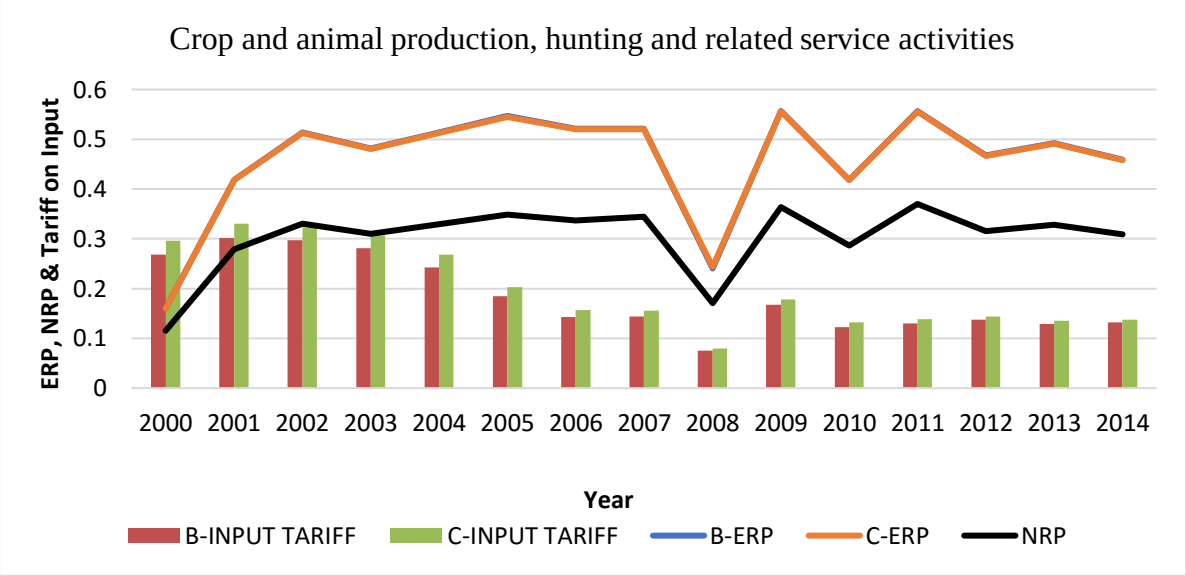
The majority of the rise in the ERP has happened in the years 2000-2002, which also coincided with the rise in both the nominal rate of protection and tariffs on intermediate inputs. This could be because the proportionate rise in the NRP on final goods exceeded the proportionate rise in the input tariffs. In fact, the initial two years also evidence the existence of IDS in the industry. How can we explain this? - it may imply that we are importing less of agricultural inputs, so that the higher value of tariffs imposed on their imports of intermediate goods is not able to

[18] https://www.export.gov/article?id=India-Import-Tariffs

[19] The computed measure of ERP is based only on the rates of tariff, however, imports of agriculture commodities are still restricted by high levels of non-tariff barriers. Taking this into consideration, we may conclude that the estimated measure of ERP is not a true representation of the actual level of protection accorded to domestic firms in this industry.

affect the positive sign of ERP in the presence of IDS. Thereafter, all the three rates have remained relatively stable, except in the year 2008.

Fig 5.1: Corden and Balassa ERP estimates of Crop and animal production, hunting and related service activities



Moreover, it is important to note that for all the years under consideration, NRP falls short of ERP, which seems contradictory to what we have detailed in the review of the literature on the evolution of the concept of effective rate of protection. If imposing tariffs on imports of intermediate inputs reduces protection for final output producers, then in that case, for the industry as a whole, ERP should be less than NRP. However, the existence of an opposite result demonstrates that effective tariff is not only guided by the two rates of tariffs on output and input, but by other variables too viz. the value of output and imports of intermediate input, which, in turn, depend on a lot of demand and supply side factors.

5.2 Forestry and logging.

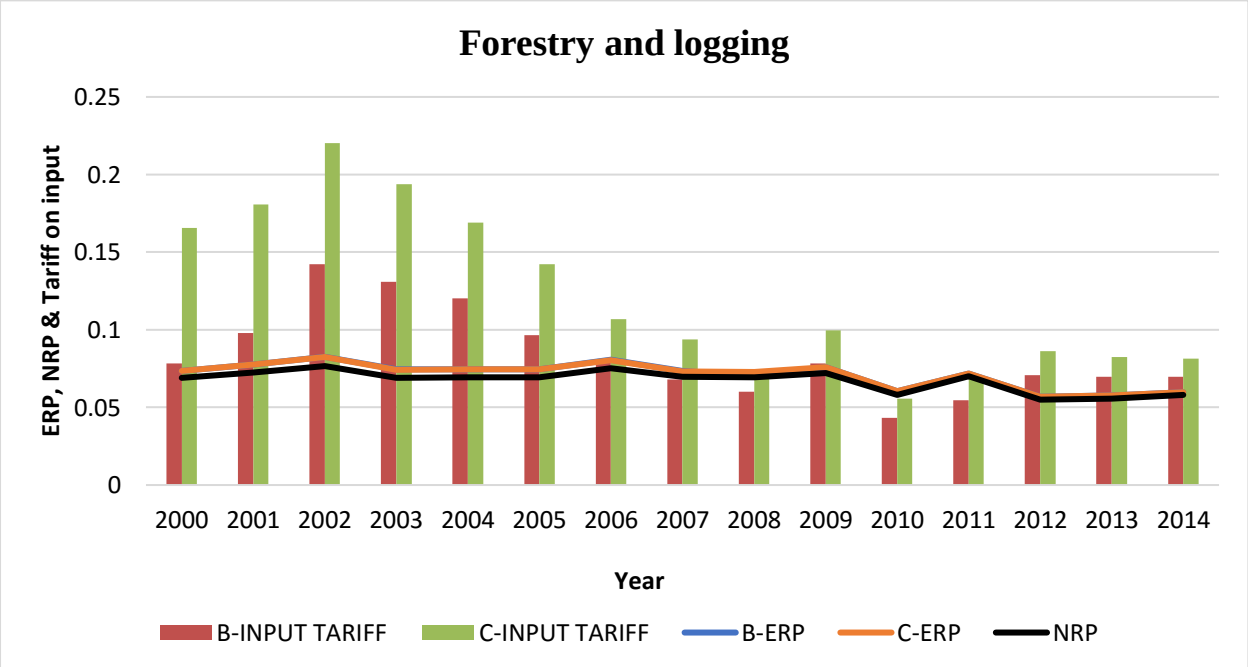
This industry includes the production of round wood for the forest-based manufacturing industries as well as the extraction and gathering of wild growing non-wood forest products. Besides the production of timber, forestry activities result in products that undergo little processing, such as fire wood, charcoal, wood chips and round wood used in an unprocessed form (e.g. pit-props, pulpwood etc.). These activities can be carried out in natural or planted forests.

India has a large forest cover and as of 2010, the Food and Agriculture Organisation of the United Nations estimates India's forest cover to be about 68 million hectares, or 22% of the

country's area. As per report of FAO 2002,[20] forestry industry contributed to 1.7% to India's GDP. However, in 2010, the contribution to GDP falls to 0.9%, largely because of rapid growth of the economy in other sectors and the government's decision to reform and reduce import tariffs to let imports satisfy the growing Indian demand for wood products.

The import tariff on this industry has remained relatively stable with an average tariff of 6.73% except with a maximum tariff of 7.66% in 2002, while the minimum tariff accorded in this sector is 5.55%.

Fig 5.2: Corden and Balassa ERP estimates of Forestry and logging



As is evident from the above figure 5.2, Balassa and Corden measure have coincided with each other, with maximum protection of 8.2% and minimum protection of 5.6% and an average protection of approximately 7.1%. Also, the analysis demonstrates two points about the co-movement of the three rates of tariffs: 1. Both ERP and NRP have remained relatively stable throughout the period 2000-2014, while the rate of import tariffs on intermediate input initially

[20] *"Forests and the forestry sector: India". Food and Agriculture Organisation of the United Nations. 2002*

increased and then started declining from the year 2003 onwards. This implies that in the case of this sector, tariffs imposed on import of inputs are quite high which lead to the lesser usage of foreign tradable input into its production. This is what commonly known as 'Water in tariff'. Moreover, as mentioned in footnote 18, it could be also being because of quantitative restrictions imposed import of primary products, which have not been taken into account in while estimating the measure of ERP. And, 2. Over the 14 years' period, with the fall in the rate of input tariff, ERP has also converged with the rate of nominal protection.

In addition, similar to the case of Crop and animal production, hunting and related activities, here also the estimates suggest that there exists IDS in this industry despite positive ERP for most of the years under consideration as per the Corden's measure and for relatively fewer years as per the Balassa's definition.

5.3. Fishing and aquaculture.

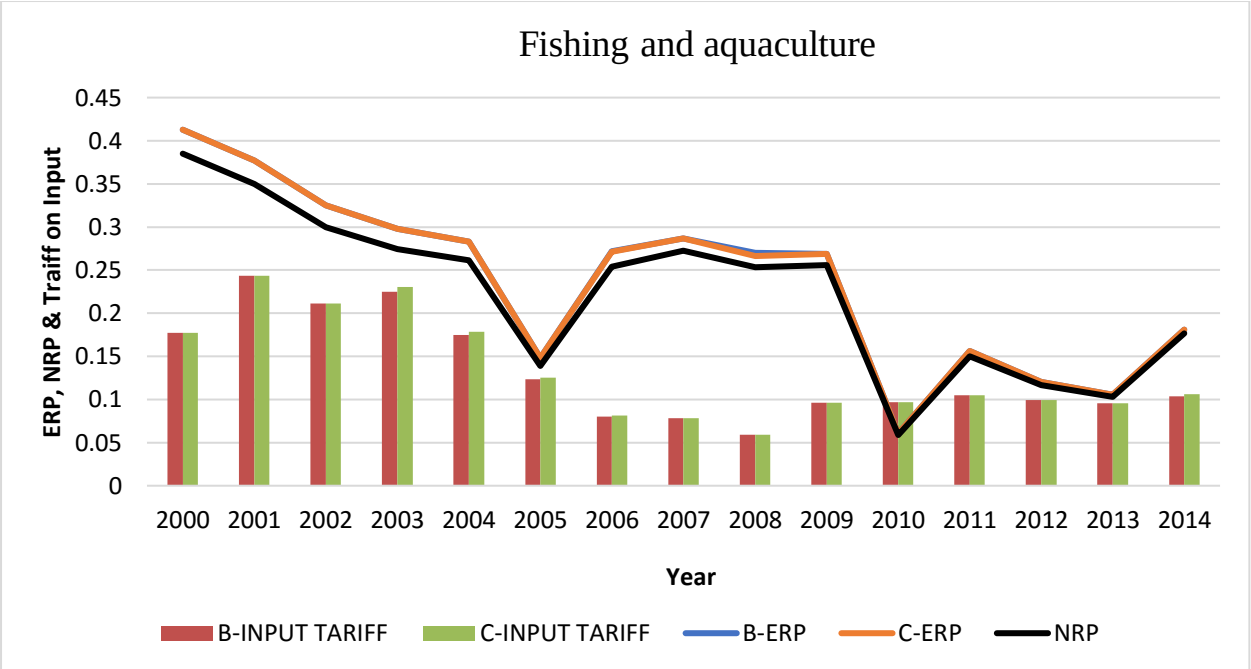
This industry includes fishery and aquaculture, covering the use of fishery resources from marine, brackish or freshwater environments, with the goal of capturing or gathering fish, crustaceans, molluscs and other marine organisms and products (e.g. aquatic plants, pearls, sponges etc.). Also included are activities that are normally integrated in the process of production for own account (e.g. seeding oysters for pearl production).

Fishing and aquaculture in India is a major activity in its coastal states, employing over 14 million people. In 2014-15, the country exported over 10,50,000 metric tonnes of fish to 75 countries, earning over $5.51 billion.[21] According to the Food and Agriculture Organization (FAO) of the United Nations, fish production has increased more than tenfold since 1947 and doubled between 1990 and 2010.[22]

As is evident from figure 5.3, the tariff on import of fishing and aquaculture has decreased from 38.5% in 2000 to 17.6% in 2014. The year 2010, experienced a steep decline to 5.88% in between, however, it was not so for the case of tariff on intermediate inputs in the industry.

Fig 5.3: Corden and Balassa ERP estimates of Fishing and aquaculture.

[21] Market, Capital (2015-07-03). MPEDA expects marine products exports at US$ 6.6 billion in 2015-16 against US$ 5.5 billion in 2014-15". *Business Standard India*. Retrieved 2017-12-29.
[22] "Fishery and Aquaculture Country Profiles: India". Food and Agriculture Organization of the United Nations. 2011



What about the trend in ERP – has it increased or decreased over the years? – Overall the industry has experienced a fall in the rate of effective protection from about 41% in the year 2000 to approximately 17% by 2014. In fact, the rate has follow the trend of NRP over the 15 years' period. And this has happened despite the initial fluctuation in the rate of import tariffs on intermediate inputs and existence of IDS in the year 2010. This implies that, in this specific case, the industry's imports of intermediate inputs are enough to sufficiently trigger the movement of ERP. As was true for Crop and animal production, hunting and related activities, here also the value of NRP falls short of ERP for most of the years under consideration.

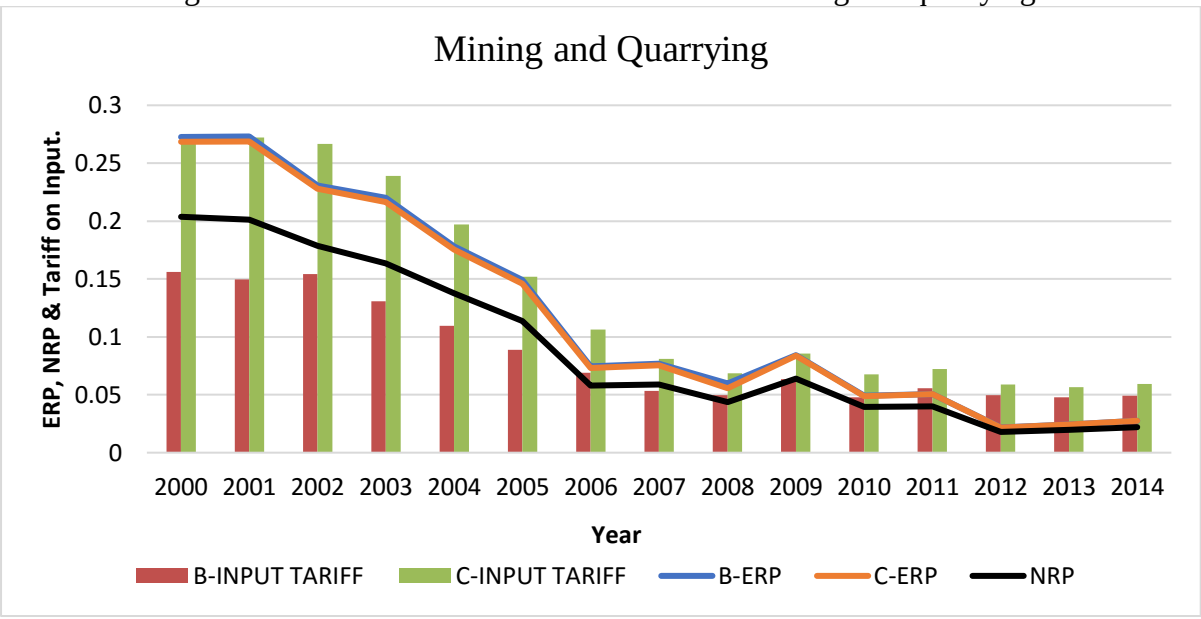
5.4. Mining and quarrying.

This industry includes the extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved by different methods such as underground or surface mining, well operation, seabed mining etc. This sector also includes supplementary activities aimed at preparing the crude materials for marketing, for example, crushing, grinding, cleaning, drying, sorting, concentrating ores, liquefaction of natural gas and agglomeration of solid fuels. These operations are often carried out by the units that extracted the resource and/or others located nearby.

The Mining industry in India is amongst of the major economic activities, which contributes significantly to the economy of India. The GDP contribution of the mining industry varies from 2.2% to 2.5% only, however, if we consider the GDP of the entire industrial sector, then it accounts for about 10-11%.

As is evident from the data, the tariff on import of mining and quarrying has decreased steadily from 20.37% in 2000 to 2.20% in 2014 and it reached as low as 1.7% in 2012.[23]

Fig 5.4: Corden and Balassa ERP estimates of Mining and quarrying.



The consequence of lower import tariffs is clearly reflected in the rates of effective protection - though it has been positive throughout the time period under consideration but the extent of protection has been falling. This is true for both the Corden's and Balassa's measures. In fact, the extent of positive effective protection has decreased from about 27% in the year 2000 to reach 2.7 by the year 2014 and so is the case for tariff on imports of intermediate inputs. Thus, the co-movement of the three rates of tariffs (nominal tariff on final output, intermediate input and ERP) in addition to existence of IDS (as per Corden's measure) during all the 15 years, clearly signify that the movements in ERP are guided more by the value of output and tariff on final output than by tariff on intermediate input. As regards, the Balassa's measure, duty inversion is evident for most of the years starting from 2006 onwards.

5.5. Manufacture of food products, beverages and tobacco products

This industry includes the processing of products of agriculture, forestry and fishing into food for humans or animals, and includes the production of various intermediate products that are not directly food products. The activity often generates associated products of greater or lesser value (for example, hides from slaughtering, or oilcake from oil production). This industry is organized by activities dealing with different kinds of products: meat, fish, fruit and vegetables, fats and oils, milk products, grain mill products, animal feeds and other food products.

[23] In an attempt to promote external liberalisation, in almost every budget speech starting from the year 2002 onwards, the Indian government has proposed to reduce the rates of import tariff on all the non-agriculture and non-dairy products. This is also evident from our discussion on trends in import tariffs imposed on non-agricultural commodities.

Production can be carried out for own account, as well as for third parties, as in custom slaughtering. Some activities are considered manufacturing (for example, those performed in bakeries, pastry shops, and prepared meat shops etc. which sell their own production) even though there is retail sale of the products in the producers' own shop. However, where the processing is minimal and does not lead to a real transformation, the unit is classified to Wholesale and retail trade.

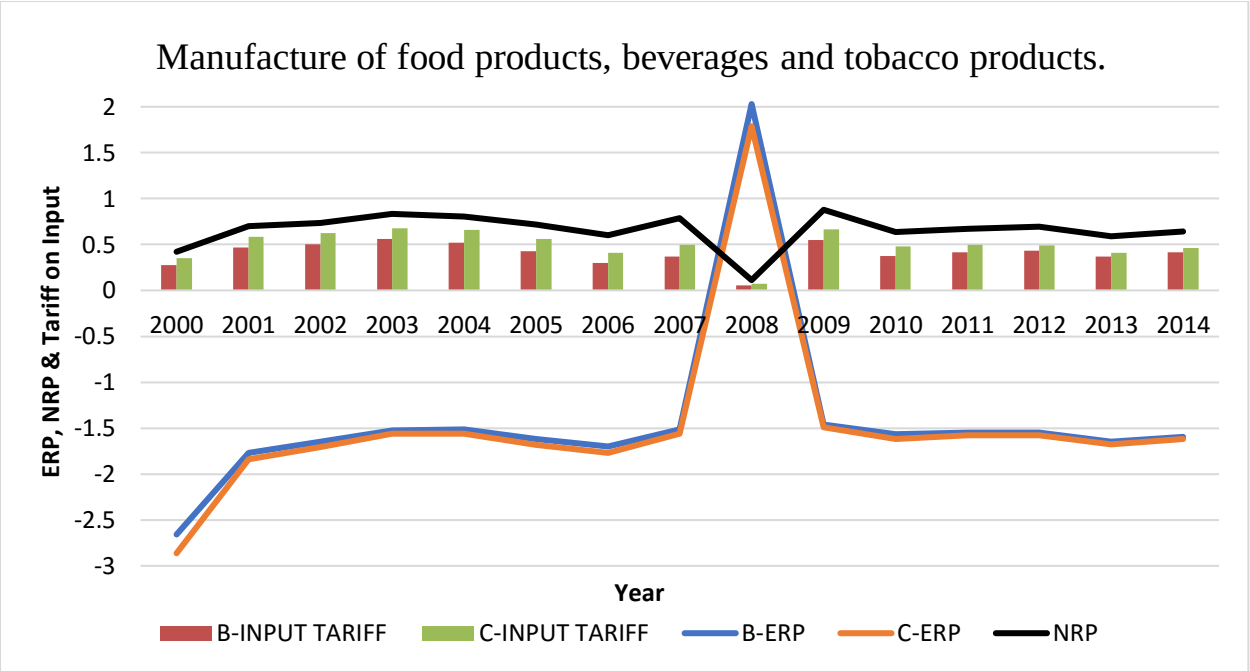
The industry also includes the manufacture of beverages, such as non-alcoholic beverages and mineral water, manufacture of alcoholic beverages mainly through fermentation, beer and wine, and the manufacture of distilled alcoholic beverages. But this sector excludes the production of fruit and vegetable juices, the manufacture of milk-based drinks and the manufacture of coffee, tea and maté products.

This industry further includes the processing of an agricultural product, tobacco, into a form suitable for final consumption.

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year. In India, the food sector has emerged as a high-growth and high-profit sector due to its immense potential for value addition, particularly within the food processing industry.

The tariff rate on import of manufacture of this industry has increased overtime from about 42.1% in 2000 to 63.97% in 2014, except for a sharp fall to about 11.22% in 2008. The average tariff rate has remained around 65.41% with maximum value of 87.82% in the year 2009. Similarly, the rate of tariff on imports of intermediate input has also risen during the period. However, unlike previously discussed industries, food, beverages and tobacco, has experienced negative ERP for all the years under consideration, except for the year 2008.

Fig 5.5: Corden and Balassa ERP estimates of Manufacture of food products, beverages and tobacco products.



Amongst the three reasons detailed in section 3 for existence of negative ERP, in the present case, it occurs because of the second reason, viz. existence of negative value added under free trade and tariff escalation. Possible explanations for this are discussed in Section 6 below.

5.6 Manufacture of textiles, wearing apparel and leather products

This industry includes preparation and spinning of textile fibres as well as textile weaving, finishing of textiles and wearing apparel, manufacture of made-up textile articles, except apparel (e.g. household linen, blankets, rugs, cordage etc.). In addition, it also includes all tailoring (ready-to-wear or made-to-measure), in all materials (e.g. leather, fabric, knitted and crocheted fabrics etc.), of all items of clothing (e.g. outerwear, underwear for men, women or children; work, city or casual clothing etc.) and accessories. There is no distinction made between clothing for adults and clothing for children, or between modern and traditional clothing. It also includes the fur industry (fur skins and wearing apparel).

Dressing and dyeing of fur and the transformation of hides into leather by tanning or curing and fabricating the leather into products for final consumption are also included in this industry. It also includes the manufacture of similar products from other materials (imitation leathers or leather substitutes), such as rubber footwear, textile luggage etc. The products made from leather substitutes are included here, since they are made in ways similar to those in which leather products are made (e.g. luggage) and are often produced in the same unit.

The textile industry in India, traditionally, after agriculture, is the only industry that has generated huge employment for both skilled and unskilled labour in textiles. The textile

industry continues to be the second-largest employment generating sector in India. It offers direct employment to over 35 million in the country.

As is evident from the data, the tariff on import of manufacture of textile, wearing apparel and leather products has decreased steadily from 30.51% in 2000 to 9.85% in 2014 with a minimum tariff of 9% in 2011. The average tariff remained at 16.73%.

Fig 5.6: Corden and Balassa ERP estimates of Manufacture of textiles, wearing apparel and leather product

Unlike other cases discussed so far, not only Corden's and Balassa's ERP estimates are different, but also the two rates of input tariffs. In fact, higher the difference between the rates of input tariffs, higher is the difference between the corresponding ERP estimates, thus, highlighting the role of the former in defining the extent of protection in this industry. Also, overtime, with the decline in the gap between the two measures of input tariffs, the gap between the two measures of ERP has also fallen,[24] thereby signifying the role of input tariffs in defining the extent of protection in this specific industry. And, what explains the decline in the two rates of input tariffs, is nothing but the fall in the volume of non-traded (imports of service-inputs, in our case). One of the reasons characterising such fall could be the rise in FDI in India, majority of which has happened in the services sector. This is possible when FDI and imports

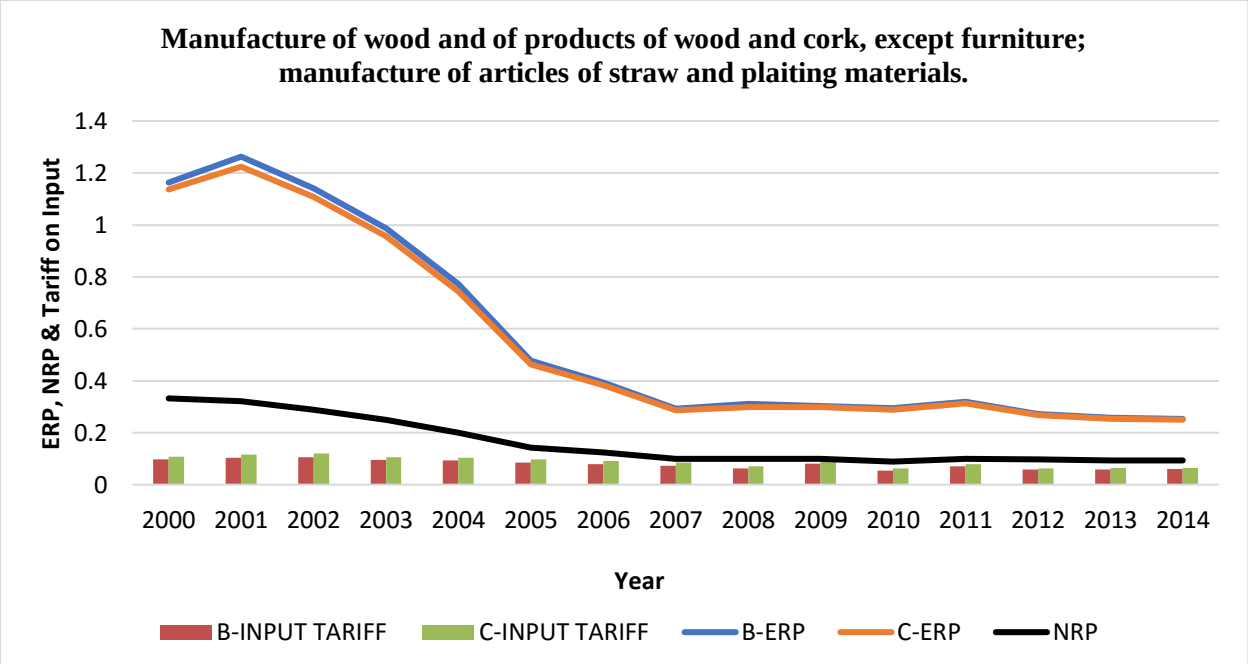
[24] As can be observed from the figure 5.6, there has been a steep decline in the two rates of effective protection during the first half of the last decade (2000-2005) despite the fact that the relative difference between tariff rates on the imports of output and input have not fallen by such a high proportion –while latter has changed by about 58.91% during this period, the change in ERP approximates 72%. In fact, this trend in ERP has also been observed for a few other manufacturing industries.

act as substitutes for each other. On the whole, the extent of protection has remained positive throughout the period under consideration. Further, as is evident from figure 5.6, there exists a huge difference between ERP and NRP during the initial years under consideration and the gap has fallen over time. This is precisely because over time, the industry's value of output has risen while the import tariffs have fallen, thereby reducing the gap between value added under restricted trade and value under free trade and hence, the gap between ERP and NRP. In fact, this hold true for various other industries of the economy as well.

5.7 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.

This industry includes the manufacture of wood products, such as lumber, plywood, veneers, wood containers, wood flooring, wood trusses, and prefabricated wood buildings. The production processes include sawing, planning, shaping, laminating, and assembling of wood products starting from logs that are cut into bolts, or lumber that may then be cut further, or shaped by lathes or other shaping tools. The lumber or other transformed wood shapes may also be subsequently planed or smoothed, and assembled into finished products, such as wood containers.

Fig 5.7: Corden and Balassa ERP estimates of Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.

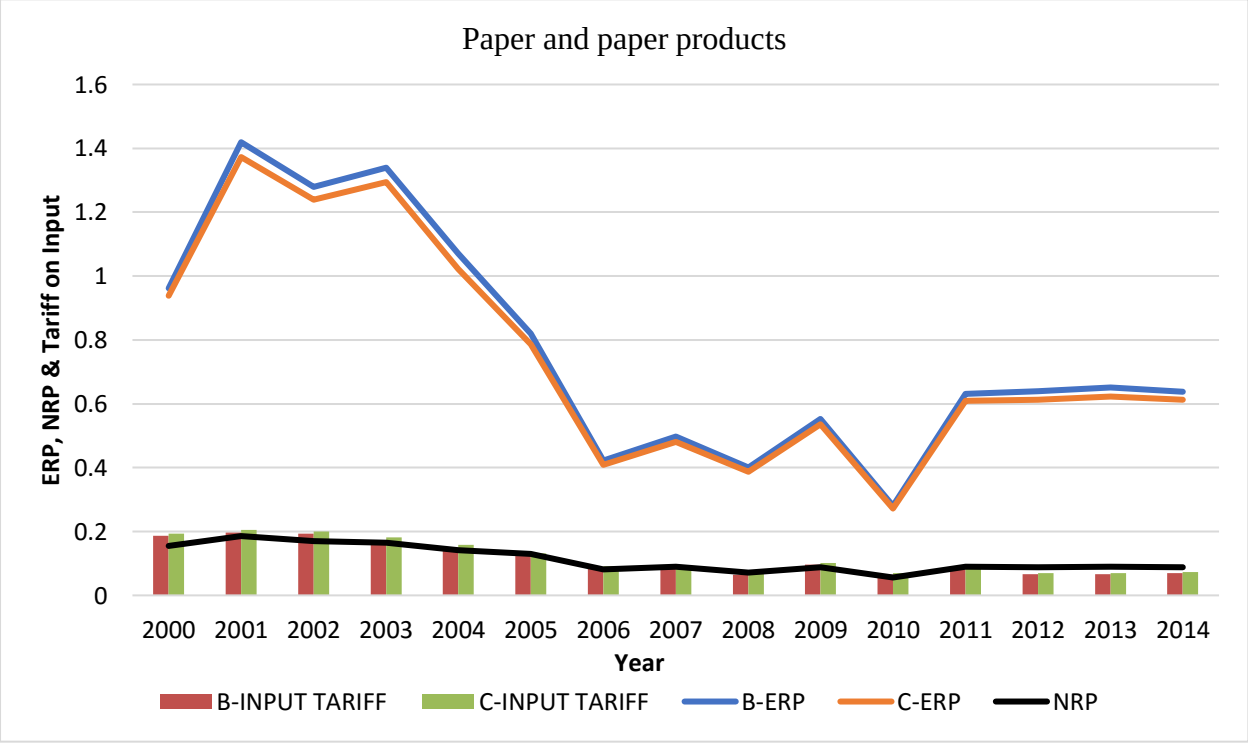


As was true in case of item 6, here also the consequence of the gap between the two measures of input tariffs is getting reflected in the gap between the corresponding measures of ERP. On the whole, as is evident from the figure 5.7, both final and input tariff rates have fallen during 2000-2015 and so does the rate of effective protection.

5.8 Manufacture of paper and paper products

This industry includes the manufacture of pulp, paper and converted paper products. The manufacture of these products is grouped together because they constitute a series of vertically connected processes. More than one activity is often carried out in a single unit. There are essentially three activities: The manufacture of pulp involves separating the cellulose fibres from other impurities in wood or used paper. The manufacture of paper involves matting these fibres into a sheet. Converted paper products are made from paper and other materials by various cutting and shaping techniques, including coating and laminating activities. The paper articles may be printed (e.g. wallpaper, gift wrap etc.), as long as the printing of information is not the main purpose.

Fig 5.8: Corden and Balassa ERP estimate of Paper and paper products



The tariff on manufacture of paper and paper products has decreased over time from 15.47% in 2000 to 8.82% in 2014. Similar is the case with input tariffs and rate of effective protection. In fact, as is evident from the figure, ERP seems to follow the movement of both NRP and input tariffs, but the response is more than 1:1 for most of the years, meaning thereby if say, output tariff and input tariff are declining by 1%, then ERP is declining by more than 1%. Another observation is that during the period 2000-2011, the industry is characterised by existence of duty inversion, post which the rates of ERP have remained relatively stable.

5.9 Printing and reproduction of recorded media.

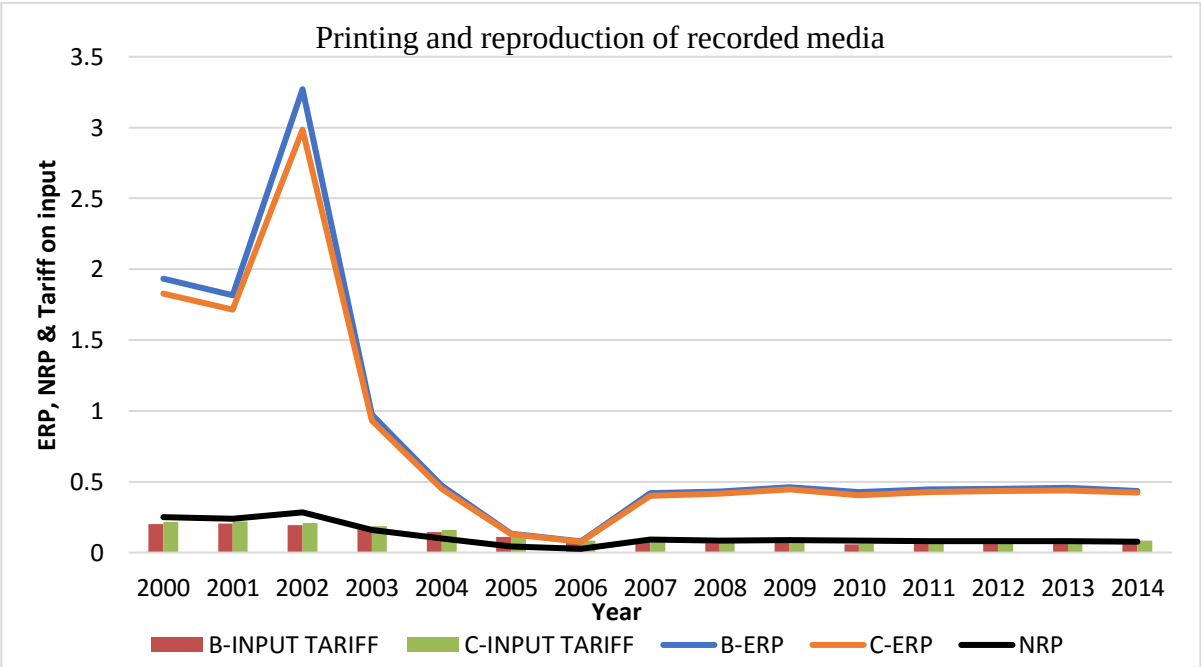
This sector includes printing of products, such as newspapers, books, periodicals, business forms, greeting cards, and other materials, and associated support activities, such as bookbinding, plate-making services, and data imaging. The support activities included here are an integral part of the printing industry, and a product (a printing plate, a bound book, or a computer disk or file) that is an integral part of the printing industry is almost always provided by these operations.

Processes used in printing include a variety of methods for transferring an image from a plate, screen, or computer file to a medium, such as paper, plastics, metal, textile articles, or wood. The most prominent of these methods entails the transfer of the image from a plate or screen to the medium through lithographic, gravure, screen or flexographic printing. Often a computer file is used to directly "drive" the printing mechanism to create the image or electrostatic and other types of equipment (digital or non-impact printing).

Though printing and publishing can be carried out by the same unit (a newspaper, for example), it is less and less the case that these distinct activities are carried out in the same physical location.

This division also includes the reproduction of recorded media, such as compact discs, video recordings, software on discs or tapes, records etc. But it excludes publishing activities.

Fig 5.9: Corden and Balassa ERP estimates of Printing and reproduction of recorded media



Overall, comparing the two extreme time periods, all the three tariff rates have fallen – nominal tariff, two measures of input tariffs and the two measures of effective tariffs. However, ERP

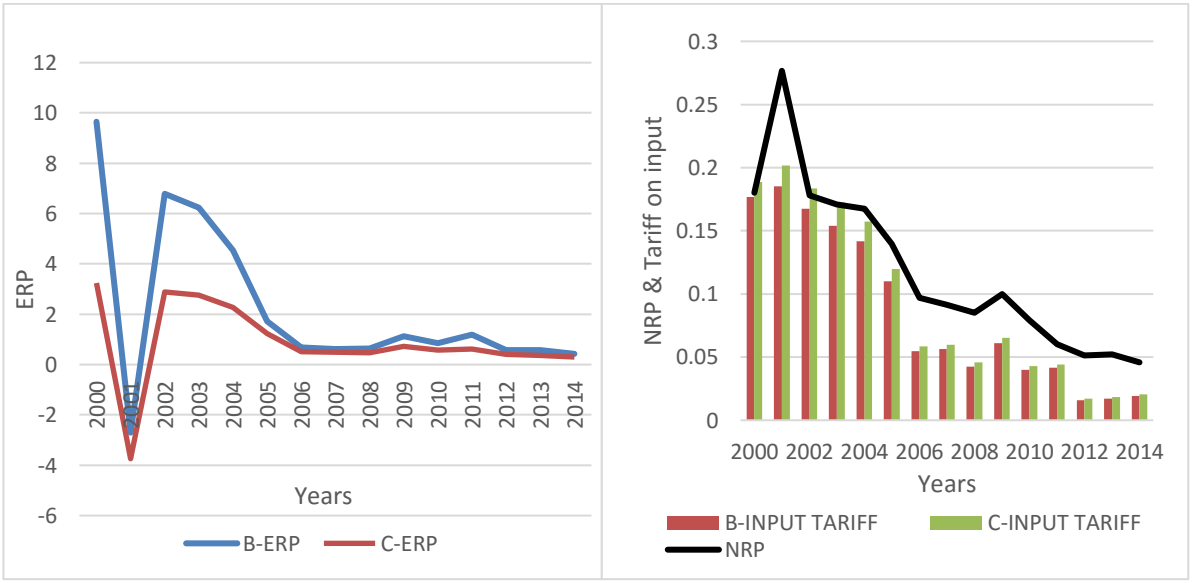
seems to be dependent upon the trend of nominal tariff more than that of input-tariffs – every fall in the latter rate is accompanied with a fall in the former rate, and so does every rise. The response of ERP, however, is more than proportionate to the change in rate of nominal protection. This is more evident during the years 2005-06 when the gap between ERP and NRP reduced to the minimum and this is because, in these two years, even though value of industrial output increased and the rate of import tariff fell. However, the proportionate rise in the former is much less than the proportionate fall in the latter, thus leading to a fall in the rate of effective protection.

5.10 Manufacture of coke and refined petroleum products.

This industry includes the transformation of crude petroleum and coal into usable products. The dominant process is petroleum refining, which involves the separation of crude petroleum into component products through such techniques as cracking and distillation. This division also includes the manufacture for own account of characteristic products (e.g. coke, butane, propane, petrol, kerosene, fuel oil etc.) as well as processing services (e.g. custom refining).

This industry includes the manufacture of gases such as ethane, propane and butane as products of petroleum refineries.

Fig 5.10: Corden and Balassa ERP estimates of Manufacture of coke and refined petroleum products



The possibility of lower input tariffs vis-à-vis that of the output-tariffs evidence a case of positive ERP in this case. However, as can be noted from the figure 5.10, a high level of tariff escalation is accompanied by negative ERP in the year 2001, which, in turn, is characterised by negative value added under free trade. Thus, this strengthens our previous assertion that

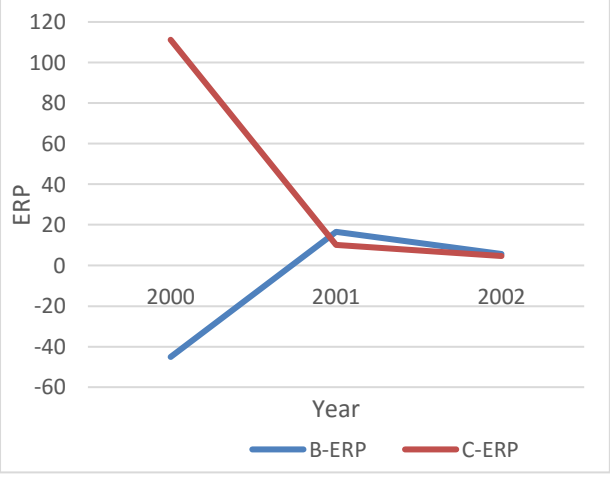
higher the gap between output and input tariffs, higher is the possibility of negative free trade value added, which implies negative effective protection. However, this is a purely statistical reason and is driven by the absence of an adequate data on free trade and methodology of estimating ERP. Moreover, the year 2001 is characterised by an 18 percent rise in value added under restricted trade, while the rate on tariff on final output rose by about 53 percent during the same time thus leading to negative value added under free trade and negative rate of effective protection.

On the whole, however, the industry is characterised by falling nominal and input tariff and relatively stable rate of effective protection post the year 2005.

5.11 Manufacture of chemical and chemical products

This sector includes the transformation of organic and inorganic raw materials by a chemical process and the formation of products. It distinguishes the production of basic chemicals that constitute the first industry group from the production of intermediate and end products produced by further processing of basic chemicals that make up the remaining industry classes.

Fig 5.11.a : Corden and Balassa ERP estimates of Manufacture of chemicals and chemical products for years 2000-2002.



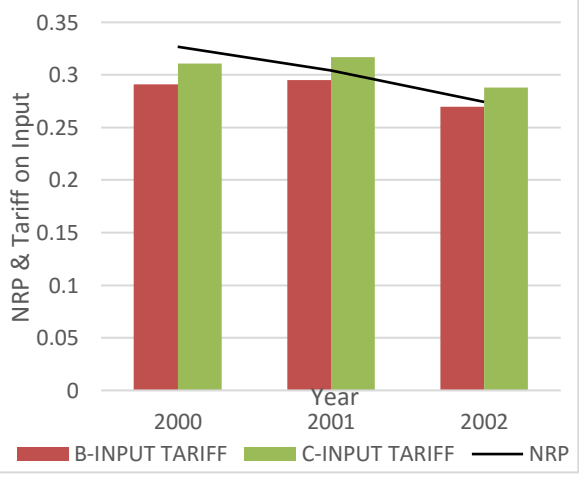
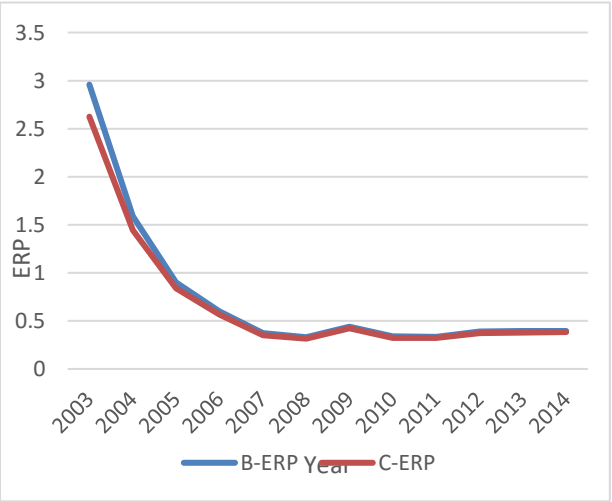


Fig 5.11.b : Corden and Balassa ERP estimates of Manufacture of chemicals and chemical products for years 2003-2014.



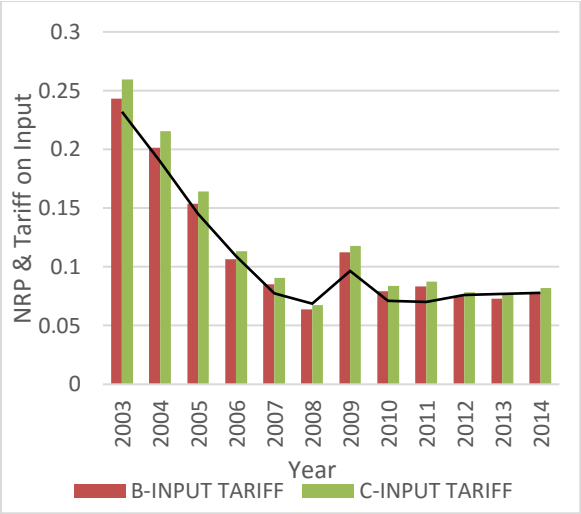


Figure 5.11.a and Figure 5.11.b represent the trends in the ERP, NRP and input tariffs where the former represents the trends in these rates from 2000 to 2002 and the latter represents the time period 2003-2014. This has been done because there exists a huge difference between the magnitude of these rates during the aforementioned time periods.

Unlike other items, this particular industry is characterised by positive ERP as per the Corden's measure with negative ERP as per the other measure. What is deriving this result? – While computing the value added under free trade, as per our methodology, we deduct intermediate consumption deflated by one plus the rate of input tariff, net indirect taxes and international transport margin from value of output (deflated by the rate of output tariff). Even though the difference of the effective value of output and intermediate consumption is zero for each of the two measures of ERP, however, further deduction of NIT and ITM makes free trade value added negative when defined as per the Balassa's measure. This is because, as discussed before, due to treatment of non-traded input as equivalent traded with zero tariffs, value added under free trade in case of Balassa is less than that of the Corden's derived free trade value added.

For years other than 2000-2002, however, both Balassa's and Corden's ERP coincide with each other. The rate of input and output tariff, on the other hand, have fallen from by about 4 times in the 15 years' period under consideration. As per the Corden's measure, this industry is also characterised by existence of inverted duty structure for majority of the years.

5.12 Manufacture of basic pharmaceutical products and pharmaceutical preparations.

This sector includes the manufacture of basic pharmaceutical products and pharmaceutical preparations. This includes also the manufacture of medicinal chemical and botanical products.

Fig 5.12.a: Corden and Balassa ERP estimates of Manufacture of basic pharmaceutical products and pharmaceutical preparation for 2000-2002.

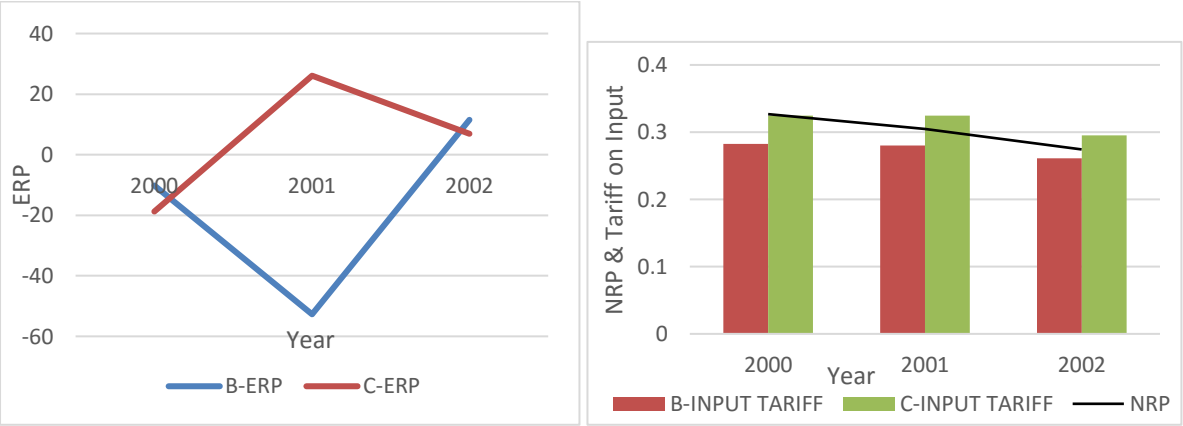
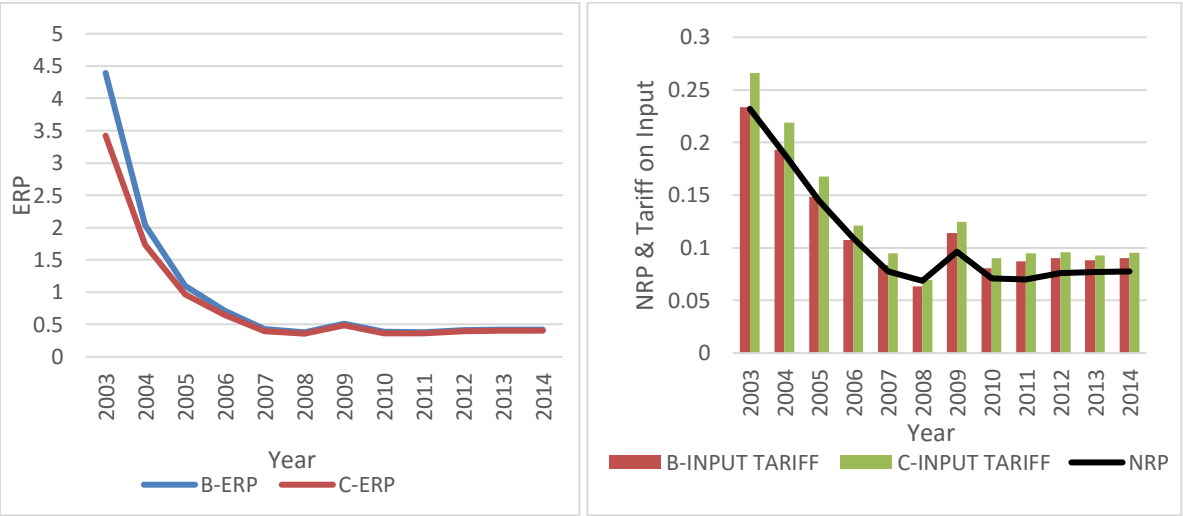


Fig 5.12.b: Corden and Balassa ERP estimates of Manufacture of basic pharmaceutical products and pharmaceutical preparation for 2003-2014.



This industry is also characterised by negative ERP as per Balassa's technique and positive ERP as per Corden's technique for the year 2001 because of the deduction of ITM and NIT from value of output under free trade. The industry seems to have experienced relaxations in terms of the reduction in both input and output tariff, except for a rise in both in the year 2009, which is accompanied by a fall in the industry's ERP. This could be because of the higher proportionate increase in the input tariff vis-à-vis that of the rise in output tariff in the same year.

5.13 Manufacture of rubber and plastic products

This sector includes the manufacture of rubber and plastics products. This division is characterized by the raw materials used in the manufacturing process.

In this case, the industry is characterised by negative effective protection during the initial 4 years under consideration viz. 2000-2003 due to existence of negative value added under free trade. For all the other years, ERP has remained positive though the rate has declined by about 5 times from 2004 to 2014. As regards the input and output tariffs, on an average, both have fallen over the 15 years' period, with existence of inverted duty structure during the years 2005 and 2008 when measured using Corden's technique of computing import weighted input-tariffs.

Fig 513.a : Corden and Balassa ERP estimates of rubber and plastic products for year 2000-2003

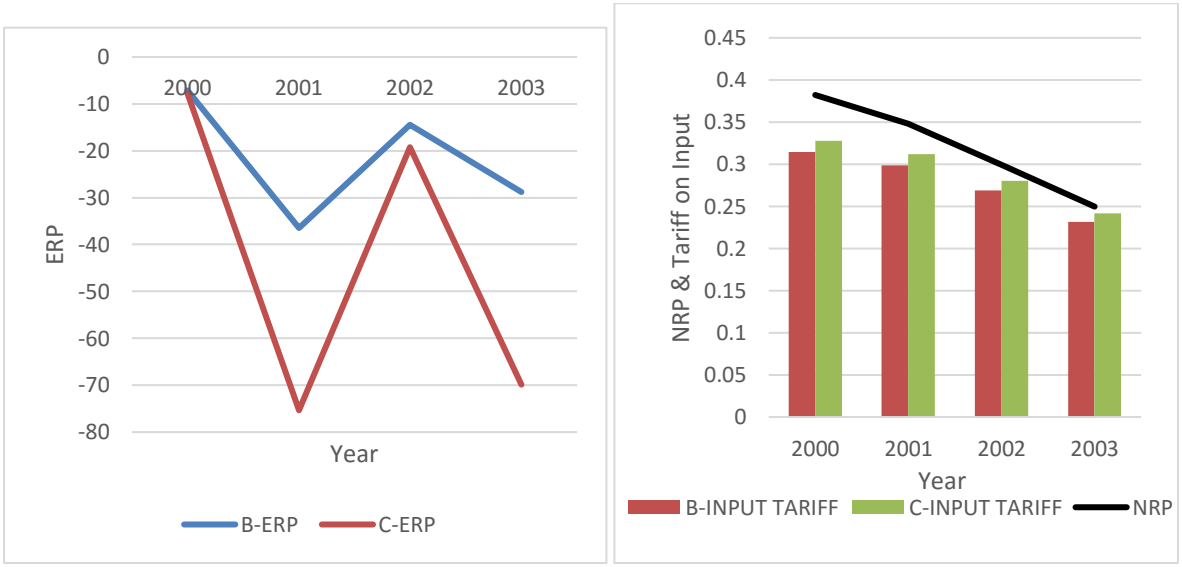
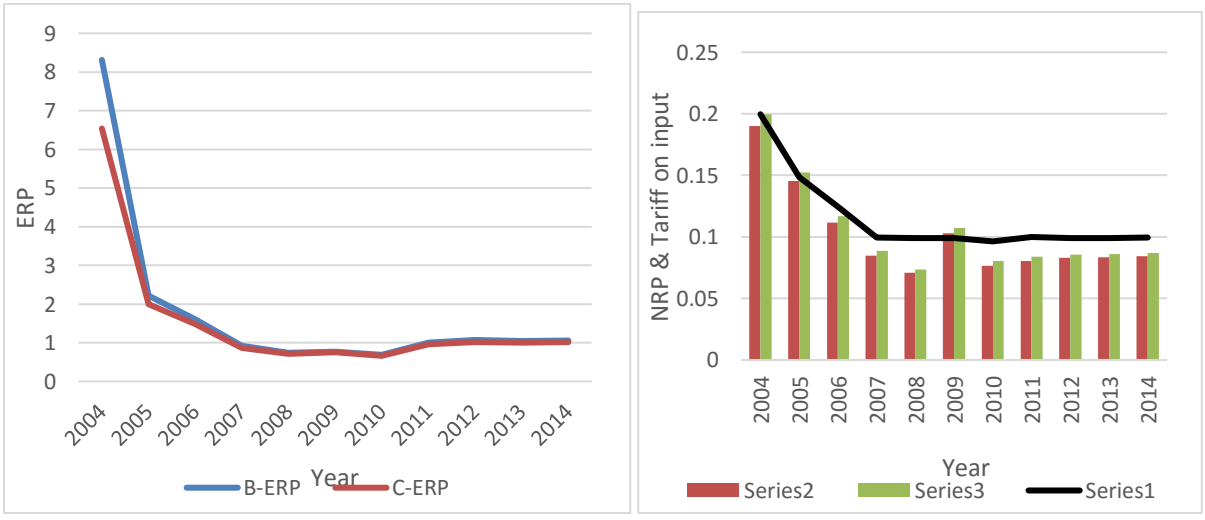


Fig 5.13.b : Corden and Balassa ERP estimates of rubber and plastic products for year 2004-2014



5.14 Manufacture of other non-metallic mineral products

This industry includes manufacturing activities related to a single substance of mineral origin. The division includes the manufacture of glass and glass products (e.g. flat glass, hollow glass, fibres, technical glassware etc.), ceramic products, tiles and baked clay products, and cement and plaster, from raw materials to finished articles. The manufacture of shaped and finished stone and other mineral products is also included in this division.

The industry is characterised by a fall in the rate of nominal tariff from about 35% in the year 2000 to 8.9% by the year 2014. The rate of import weighted input tariffs (measured according to Balassa's and Corden's technique) have also experienced a fall from an average of about 21.5% in 2000 to 3.3% in 2014 and so does the rate of effective protection. The latter fall at a higher rate during the first half of the last decade, and then start rising gradually to reach 34.07% by the year 2014. In this case also, ERP is greater than NRP for all the years, thus signifying the role of factors other than tariffs in determining the former.

5.15 Manufacture of basic metals

This industry includes the activities of smelting and/or refining ferrous and non-ferrous metals from ore, pig or scrap, using electro metallurgic and other process metallurgic techniques. This division also includes the manufacture of metal alloys and super-alloys by introducing other chemical elements to pure metals. The output of smelting and refining, usually is in ingot form, is used in rolling, drawing and extruding operations to make products such as plate, sheet, strip,

bars, rods, wire, tubes, pipes and hollow profiles, and in molten form to make castings and other basic metal products.

Fig 5.15.a: Corden and Balassa ERP estimates of Manufacture of basic metals for 2000-2002.

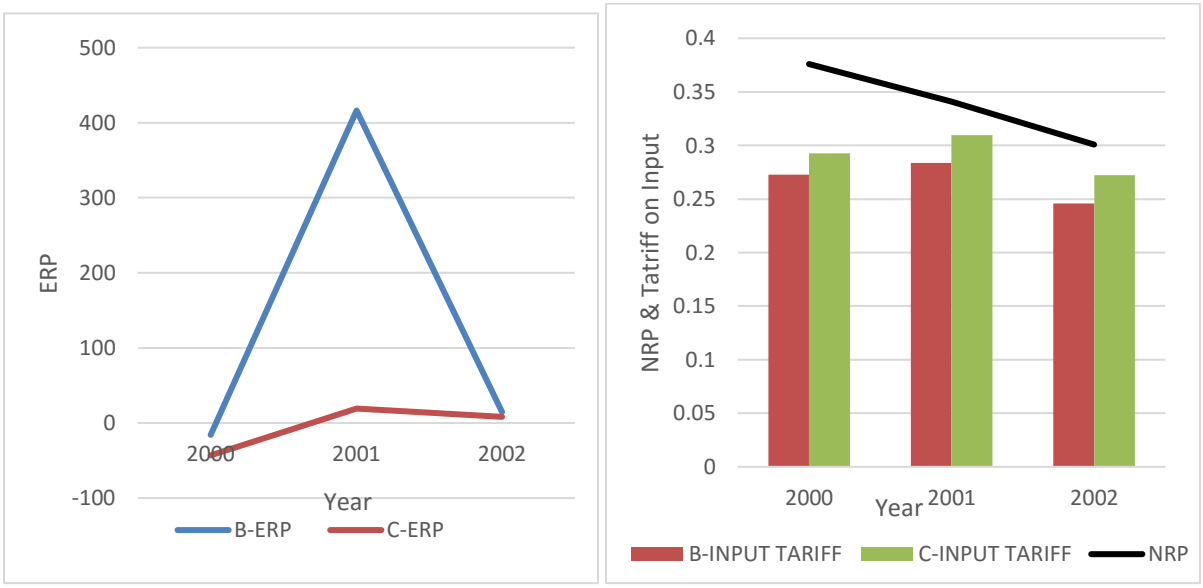
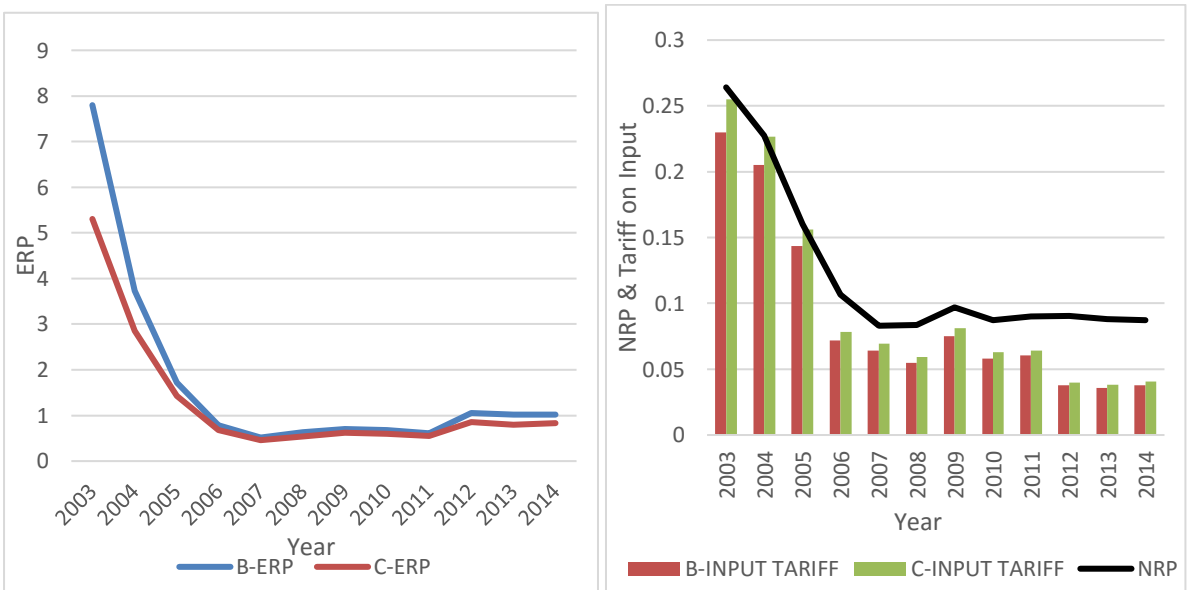


Fig 5.15.b: Corden and Balassa ERP estimates of Manufacture of basic metals for 2003-2014.



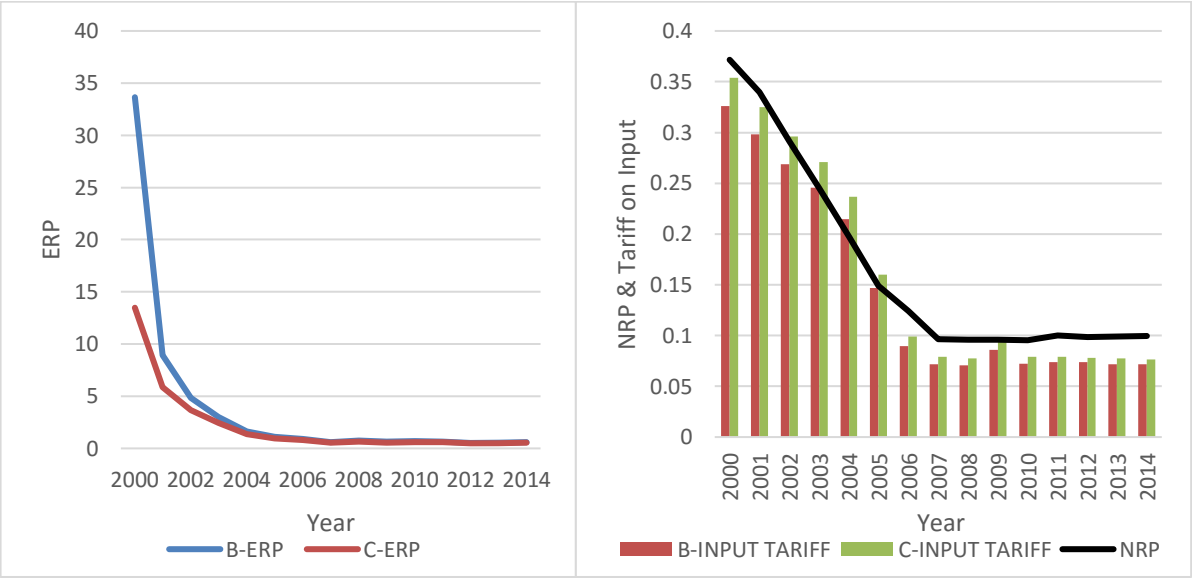
Again, due to higher value of ITM and NIT, there exists a huge gap between Balassa's and Corden's measure of ERP, while one is negative, the other is positive for the year 2001. In the previous year, however, both the rates are negative. This is because of existence of negative value added under free trade, which has happened despite a fall observed in both NRP and input tariffs. For all the years, NRP exceeds the value of both the measures of input tariffs, and thus, there is no possibility of IDS in this industry.

5.16 Manufacture of fabricated metal products, except machinery and equipment

This industry includes the manufacture of "pure" metal products (such as parts, containers and structures), usually with a static, immovable function, as opposed to the divisions, which cover the manufacture of combinations or assemblies of such metal products (sometimes with other materials) into more complex units that, unless they are purely electrical, electronic or optical, work with moving parts.

The manufacture of weapons and ammunition is also included in this division. However, this division excludes specialized repair and maintenance activities and the specialized installation of manufactured goods produced in this division in buildings, such as central heating boilers.

Fig 5.16: Corden and Balassa ERP estimates of Manufacture of fabricated metal products, except machinery and equipment



The industry has experienced a steep fall in both output and input tariffs from 2000 until the year 2007, post which the rates remained relatively stable. While output tariffs fell from 37.16% to 9.62%, average input tariffs reached 7.25% by the year 2007. In the intermediary stages, the industry has also experienced existence of inverted duty structure for the years 2002-2005 if we refer to Corden's technique but only for the year 2004 as per the Balassa's method of import-weighted input tariffs. If we look at panel 1 of figure 5.16, however, we can see that ERP has also experienced a steep fall during the first 8 years, post which it has remained relatively stable. In fact, two observations are worth noting for the values of ERP during initial two periods under consideration: a. in both the years, Balassa's and Corden's measure of ERP are different, unlike the years post 2005, when both of them almost coincide, and b. There is a steep fall in both the rates from 2000 to 2001, with B's ERP falling by a higher amount vis-à-vis that of the C's ERP. And this has occurred despite the fact the rate of change in both the

input tariffs is almost same. With common output tariffs and value of output too, this strongly implies the role of intermediate consumption (imports of non-traded/services) in triggering the fall in the value of ERP in this sector.

In addition, in this industry also, nominal protection is less than the effective rate of protection for all the years under consideration.

5.17 Manufacture of computer, electronic and optical products

This division includes the manufacture of computers, computer peripherals, communications equipment, and similar electronic products, as well as the manufacture of components for such products. Production processes of this division are characterized by the design and use of integrated circuits and the application of highly specialized miniaturization technologies.

The division also contains the manufacture of consumer electronics, measuring, testing, navigating, and control equipment, irradiation, electro-medical and electrotherapeutic equipment, optical instruments and equipment, and the manufacture of magnetic and optical media.

Fig 5.17.a: Corden and Balassa ERP estimates of Manufacture of computer, electronic and optical products from 2000-2004

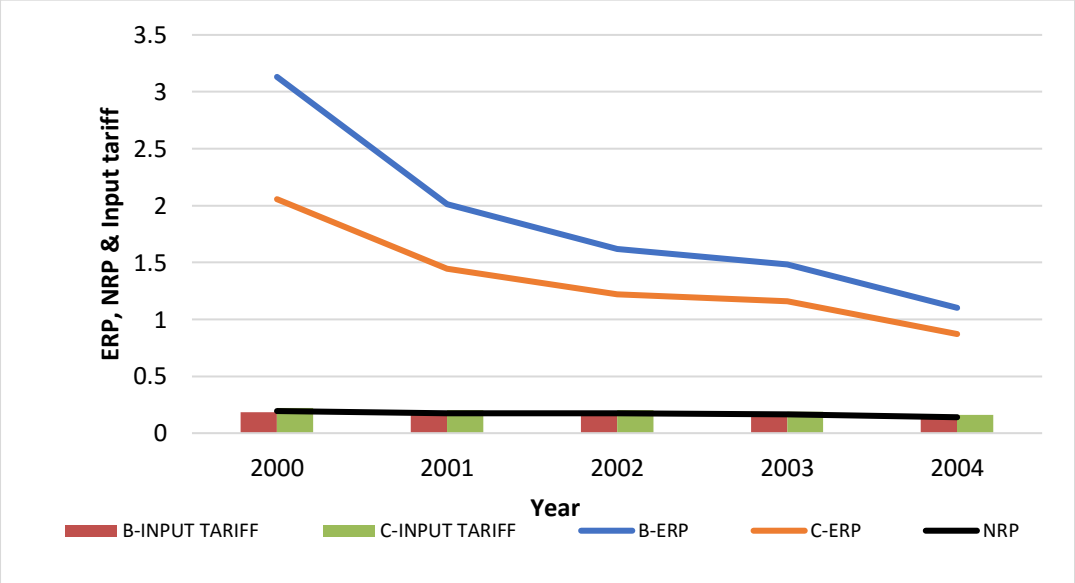
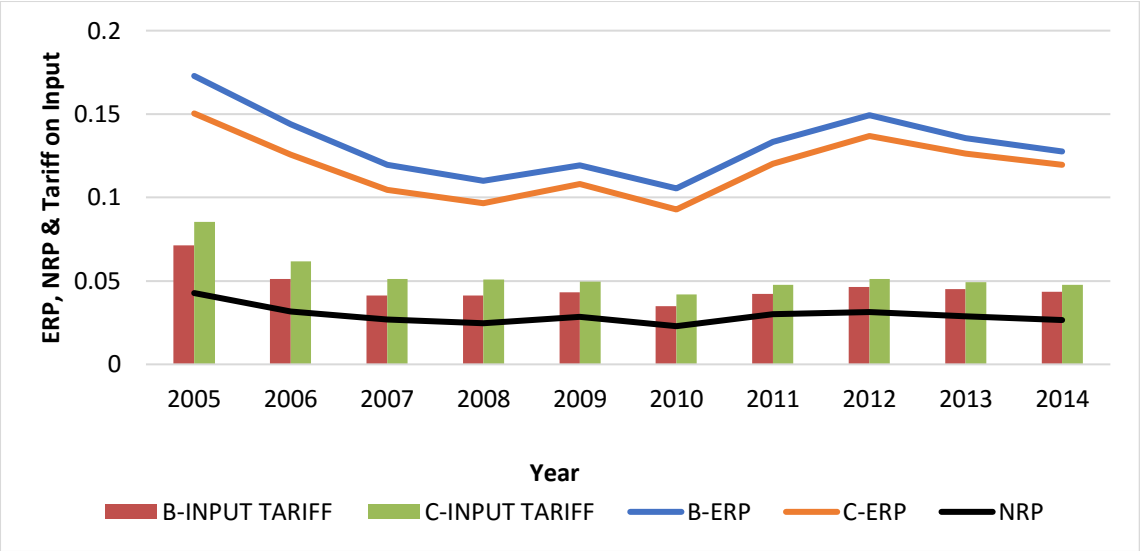


Fig 5.17.b: Corden and Balassa ERP estimates of Manufacture of computer, electronic and optical products from 2005-2014



Here also, all the three rates of tariffs viz. nominal, import-weighted input tariffs and effective tariffs have fallen during the 15 years' period. Effective tariff is always greater than the rate of nominal tariffs and so are Corden's input-tariff estimates thereby implying the existence of IDS in the computer, electronics and optical industry. During the initial 5 years, when both input and output tariffs were relatively higher in comparison to their rates in the last 10 years of the 15 years long period, ERP was high and its responsiveness to the decline in input-output tariffs was also more. What does this imply? It seems reasonable to conclude here that the elasticity of ERP w.r.t. input and output tariffs is not constant and it depends on a lot of demand and supply side factors. The response of value of output/ intermediate consumption to a change in rate of tariff, be it input or output also play a crucial role in determining the rates of effective tariff.

From 2005 onwards, however, the industry has experienced relatively stable and lower rates of all the three tariff rates, hence, indicating the lower level of protection being accorded to its firms.

5.18 Manufacture of electrical equipment

This industry includes the manufacture of products that generate, distribute and use electrical power. Also included is the manufacture of electrical lighting, signalling equipment and electric household appliances. It, however, excludes the manufacture of electronic products.

Fig 5.18.a: Corden and Balassa ERP estimates of Manufacture of electrical equipment from 2000-2004

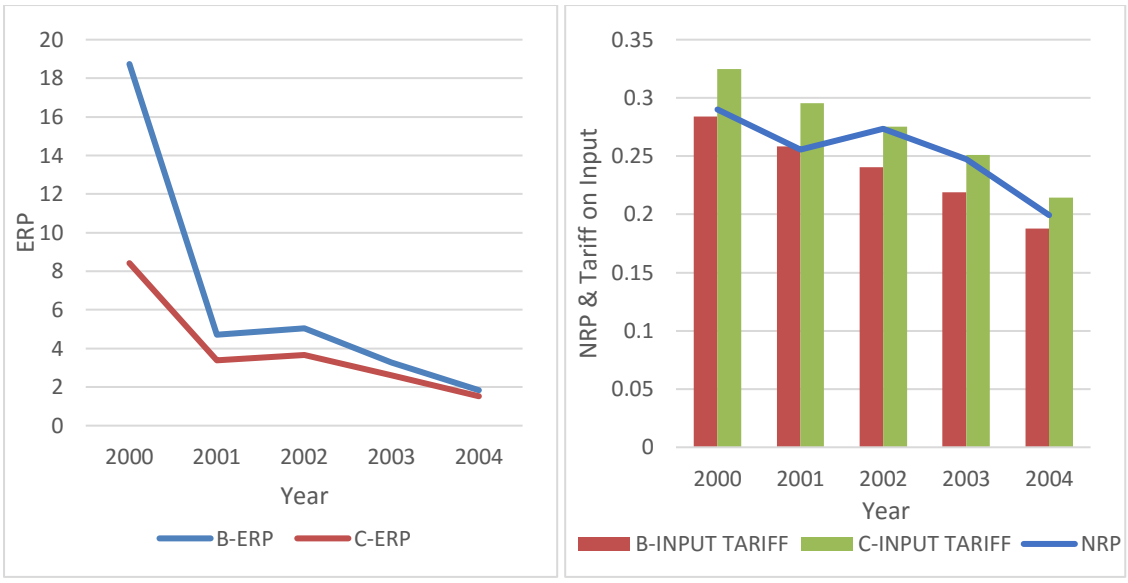
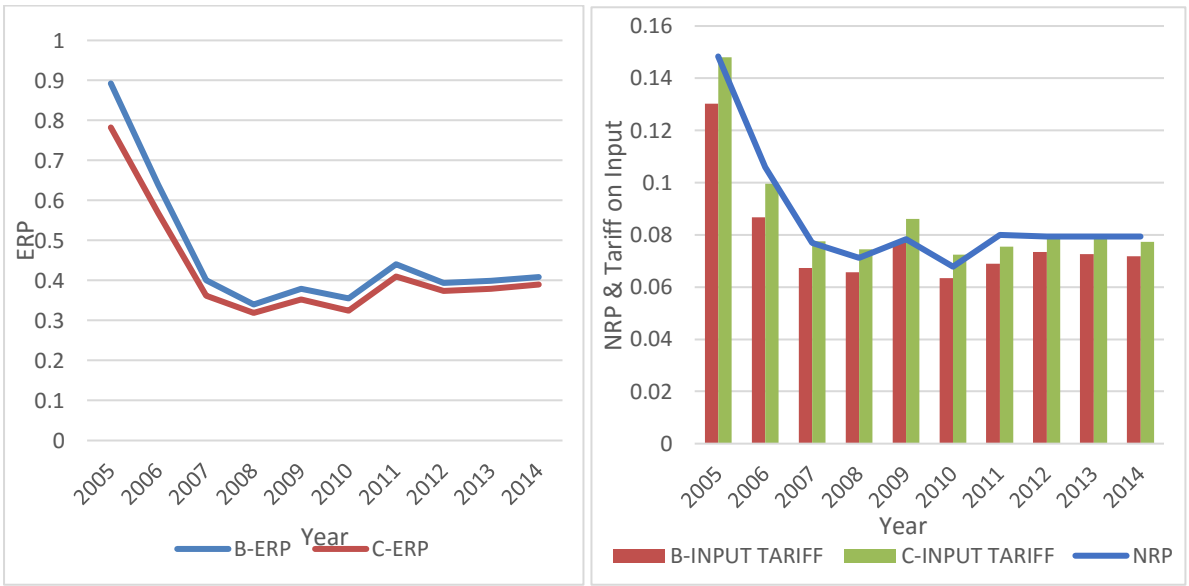


Fig 5.18.b: Corden and Balassa ERP estimates of Manufacture of electrical equipment from 2005-2014

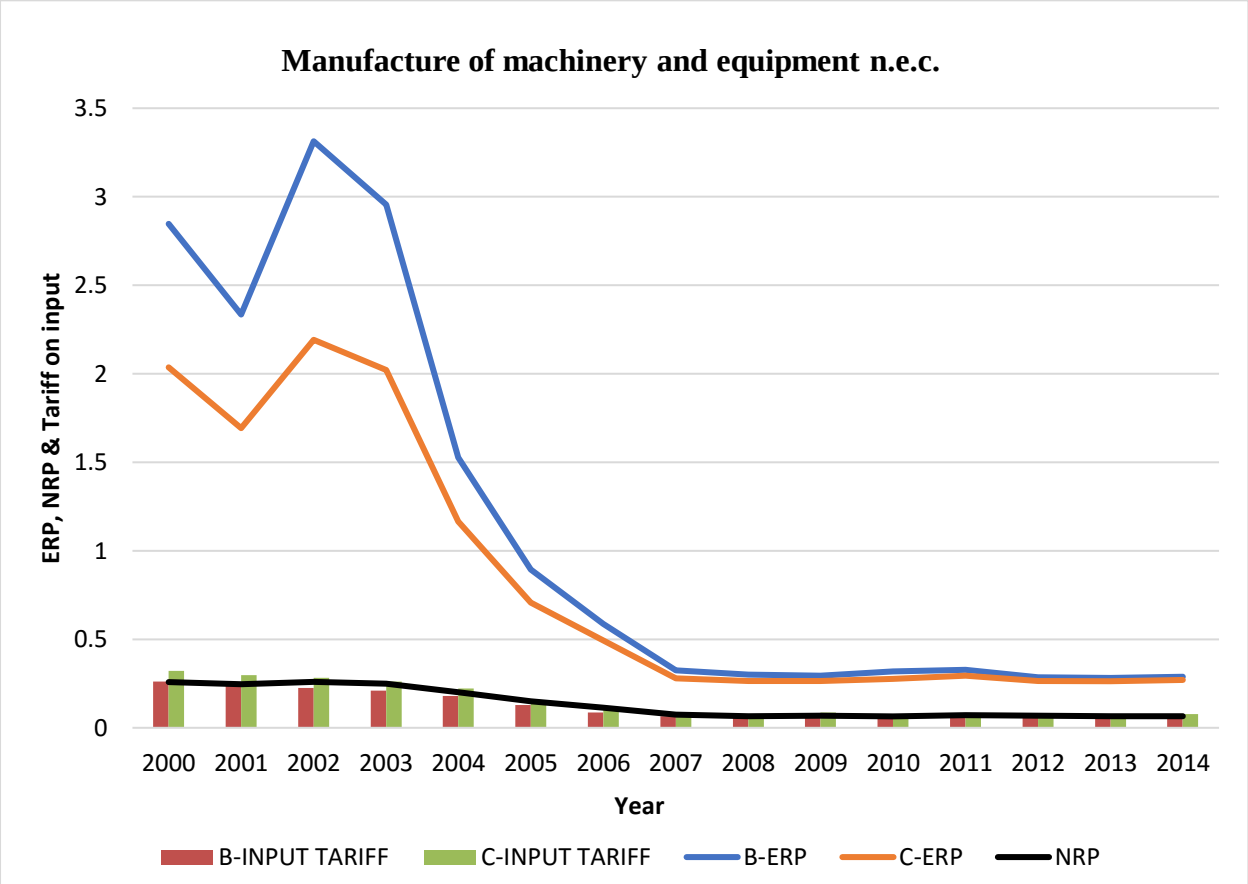


All the three tariff rates have experienced a fall during the period under consideration, with the first 6 years accounting for the majority of this decline, as was true in other manufacturing industries discussed so far. Post 2006, the rates have been relatively stable and both the measures of ERP almost coincide with each other. IDS exists only as per the Corden's estimates of import-weighted input tariffs during all the years except 2006, 2011-2014.

5.19 Manufacture of machinery and equipment n.e.c.

This industry includes the manufacture of motor vehicles for transporting passengers or freight. The manufacture of various parts and accessories, as well as the manufacture of trailers and semi-trailers, is included here.

Fig 5.19: Corden and Balassa ERP estimates of Manufacture of machinery and equipment n.e.c.

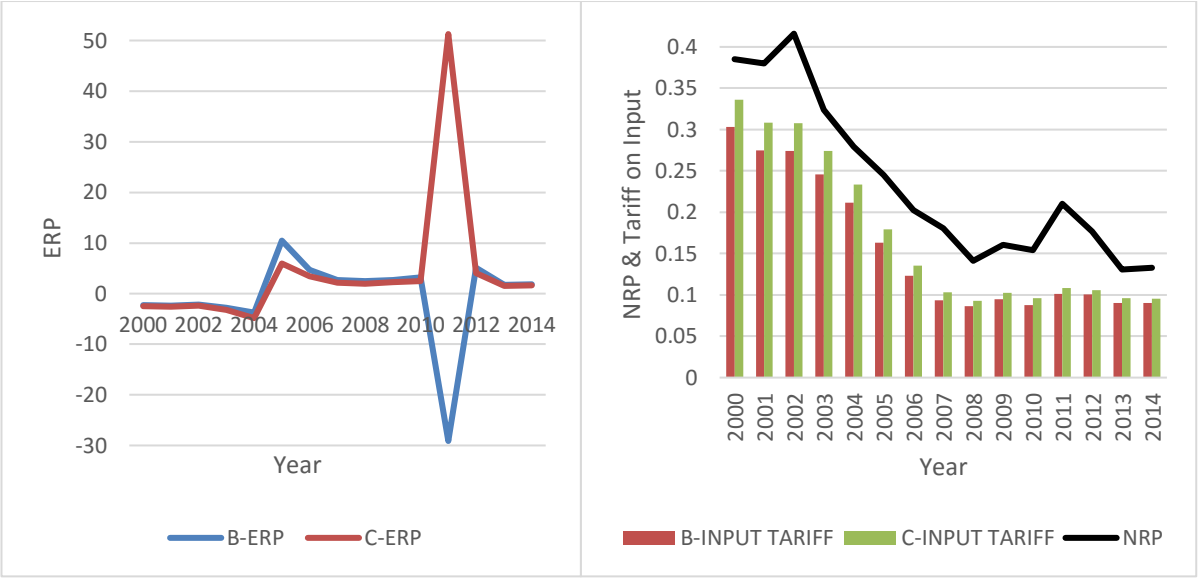


As is evident from the figure 5.17, the industry has experienced a decline in the rate of nominal, import-weighted input and effective tariff over the 15 years' period, even though the last two experienced a rise during 2002. This is accompanied with a decline in input tariffs, which may have further inflated the values of ERP for that year. Post 2002, all the three rates start declining and became relatively stable from 2006 onwards. In fact, during the last few years, both B's and C's based ERP estimates almost coincide, and so do the corresponding input-tariff rates.

5.20 Manufacture of motor vehicles, trailers and semi-trailers

This division includes the manufacture of motor vehicles for transporting passengers or freight. The manufacture of various parts and accessories, as well as the manufacture of trailers and semi-trailers, is included here.

Fig 5.20: Corden and Balassa ERP estimates of Manufacture of motor vehicles, trailers and semi-trailers

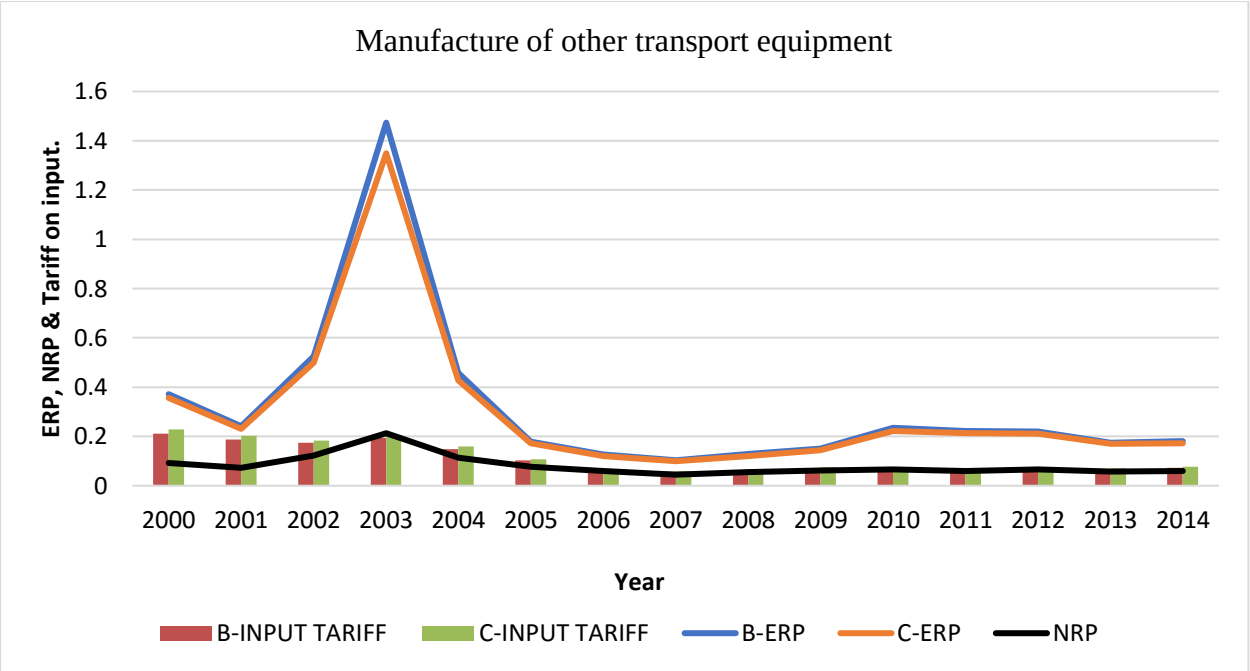


Even though the industry is characterised by positive input and output-tariffs (with former lesser than the latter during each year), yet it suffered from negative effective protection during the years 2000-2004 and 2011. In this case also, even though value added under restricted trade was positive but free trade value added was negative, which guided the sign of ERP. For the year 2011, only Balassa's estimate is negative while the other ERP is positive. This is because of the negative value under free trade for Balassa's estimate. As per our definition, VA under free trade = Value of Output (deflated by $(1+t_i)$) minus intermediate consumption (deflated by $(1+t_j)$) minus international transport margin minus net indirect taxes. Our calculations suggest that even though the sum of the first two components (Value of Output (deflated by $(1+t_i)$) minus intermediate consumption (deflated by $(1+t_j)$) is positive in case of both Balassa and Corden, however, the deduction of NIT and ITM makes the estimate of free trade VA negative for the former.

5.21 Manufacture of other transport equipment

This industry includes the manufacture of transportation equipment such as ship building and boat manufacturing, the manufacture of railroad rolling stock and locomotives, air and spacecraft and the manufacture of parts thereof.

Fig 5.21: Corden and Balassa ERP estimates of manufacture of other transport equipment



The industry is characterised by positive effective protection all throughout the period under consideration. The years 2002-2004, in particular, have experienced higher rates of all the three types of tariff in comparison to rest of the years.

5.22 Manufacture of furniture; other manufacturing

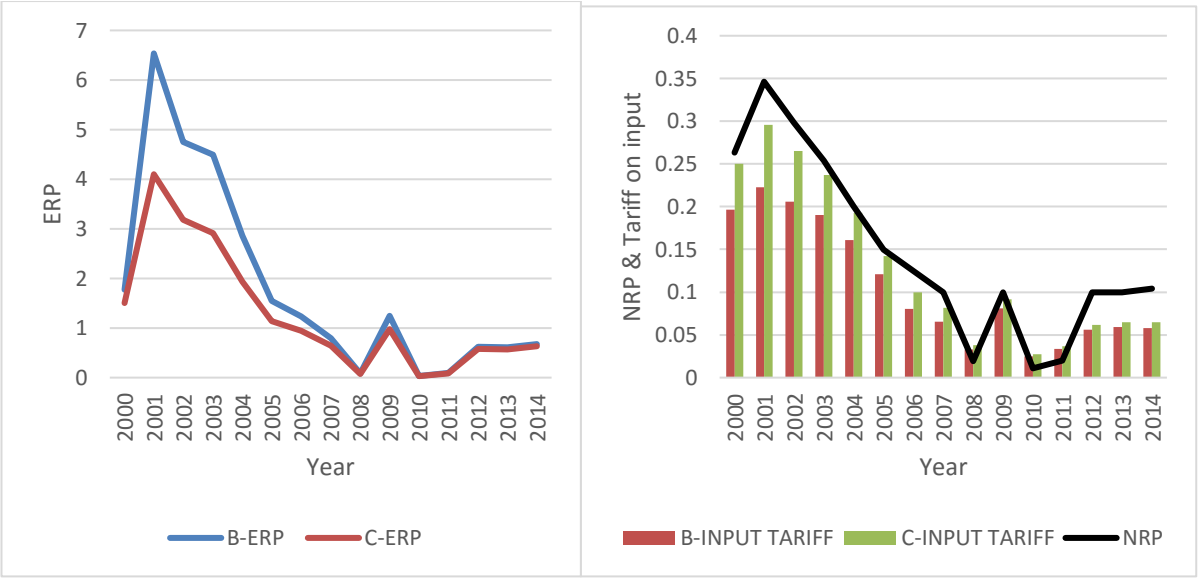
This division includes the manufacture of furniture and related products of any material except stone, concrete and ceramic. The processes used in the manufacture of furniture are standard methods of forming materials and assembling components, including cutting, moulding and laminating. The design of the article, for both aesthetic and functional qualities, is an important aspect of the production process.

Some of the processes used in furniture manufacturing are similar to processes that are used in other segments of manufacturing. For example, cutting and assembly occurs in the production of wood trusses that are classified under manufacture of wood and wood products. However, the multiple processes distinguish wood furniture manufacturing from wood product manufacturing. Similarly, metal furniture manufacturing uses techniques that are also employed in the manufacturing of roll-formed products classified in division 25 (Manufacture of fabricated metal products). The moulding process for plastics furniture is similar to the moulding of other plastics products. However, the manufacture of plastics furniture tends to be a specialized activity.

This division includes the manufacture of a variety of goods not covered in other parts of the classification. Since this is a residual division, production processes, input materials and use of

the produced goods can vary widely and usual criteria for grouping classes into divisions have not been applied here.

Fig 5.22: Corden and Balassa ERP estimates of Manufacture of furniture; other manufacturing



As can be observed from the figure 5.22, the industry's ERP seem to have followed the trend of the input and output tariff imposed on its imports. Started with a higher rate of effective protection of about 151% in the year 2000, the rate shot up further during the year 2001 followed by an 8-years' long period of decline. In the year 2009, ERP again increased, dropped to 2.9% in 2010 and has been increasing since then. However, the responsiveness of ERP to changes in the rate of tariffs differ in each year.

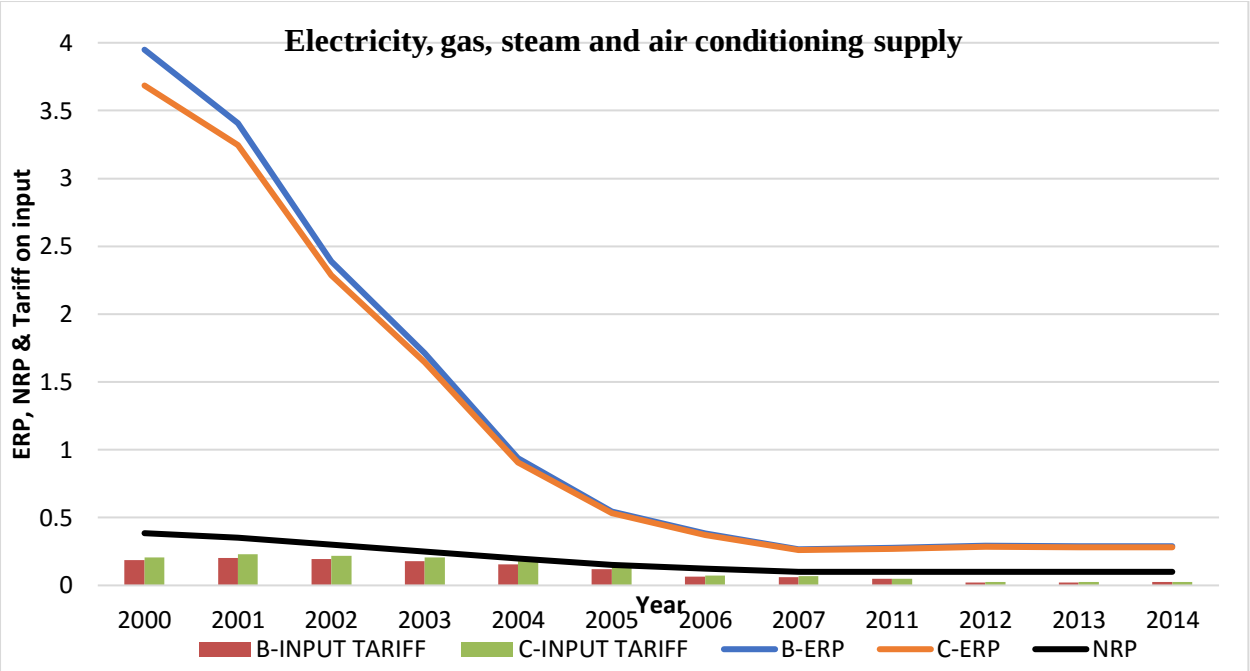
The industry also experienced IDS in the years 2008, 2010 and 2011 and this is true for both the rates of input-tariffs.

5.23 Electricity, gas, steam and air conditioning supply

This section includes the activity of providing electric power, natural gas, steam, hot water and the like through a permanent infrastructure (network) of lines, mains and pipes. The dimension of the network is not decisive; also included are the distribution of electricity, gas, steam, hot water and the like in industrial parks or residential buildings.

This section therefore includes the operation of electric and gas utilities, which generate, control and distribute electric power or gas. Also included is the provision of steam and air-conditioning supply. However, it excludes the operation of water and sewerage utilities**.**

Fig 5.23: Corden and Balassa ERP estimates of Electricity, gas, steam and air conditioning supply

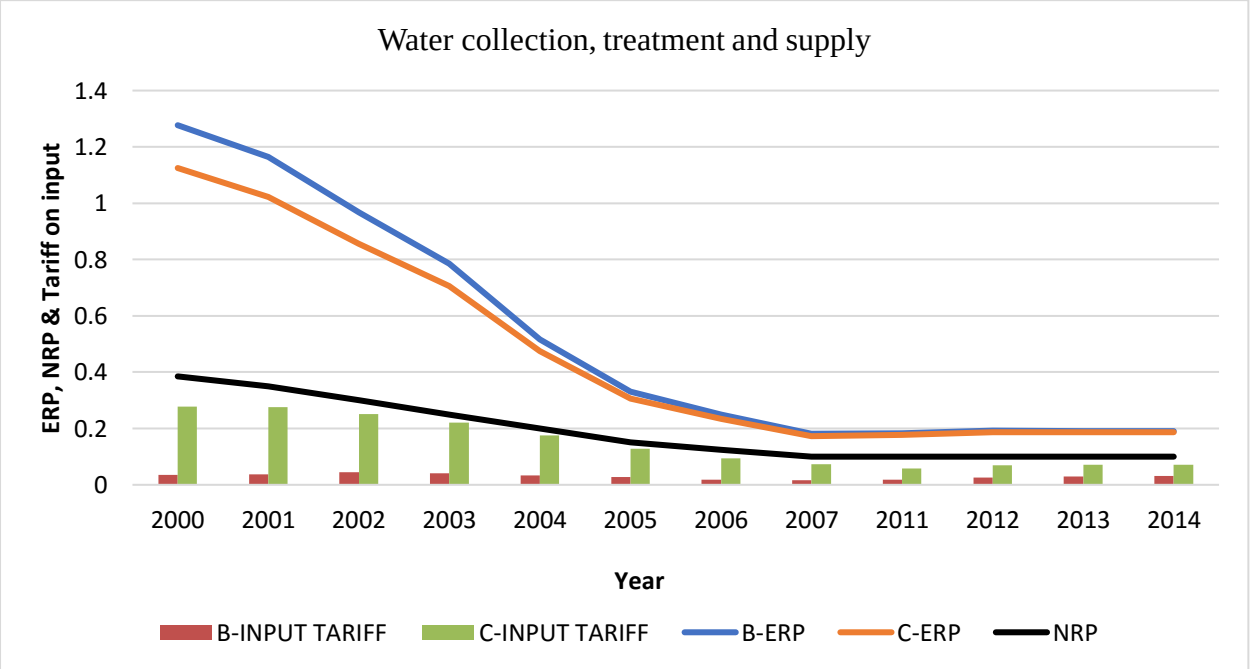


The rate of effective protection has been positive throughout though it experienced a continuous decline till the year 2007, and then remained relatively stable afterwards. Similar is the case with the rate of nominal tariffs.

5.24 Water collection, treatment and supply

This division includes the collection, treatment and distribution of water for domestic and industrial needs. Collection of water from various sources, as well as distribution by various means is included.

Fig 5.24: Corden and Balassa ERP estimates of Water Collection, treatment and supply



All the three tariff rates have declined during the period under consideration. The industry also did not suffer with the existence of inverted duty structure. In fact, as can be observed from the figure 5.24, as the gap between Corden's and Balassa's input tariff decreased, the gap between their corresponding ERPs also fell.

6 REASON FOR NEGATIVE VALUE ADDED UNDER FREE TRADE

As detailed (computed) in section 5, the following table 6.1 shows the tradable sectors that have experienced negative value added under free trade and thus, negative effective protection for a few years under consideration either by using Balassa or Corden method:

Table 6.1: Industries having negative value added under free trade

S.No.	Industry	Year	Basis (Measure).[25]
1.	Manufacture of food products, beverages and tobaccao	2000-2007 & 2009-2014	Corden & Balassa
2.	Manufacture of coke and refined petroleum	2001	Corden & Balassa
3.	Manufacture of chemical and chemical products	2000	Balassa
4.	Manufacture of basic pharmaceutical products and pharmaceutical preparation	2001	Balassa
5.	Manufacture of rubber and plastic products	2000-2003	Balassa & Corden
6.	Manufacture of basic metal	2000	Balassa & Corden
7.	Manufacture of Motor vehicle, trailer and semi-trailer	2000-2004 & 2011	Balassa

These are the cases that can be referred to the implication (VII) in section 3. Corden expressed this condition that whenever $1 < \Sigma_i a_{ij} t_i$ with $t_j > \Sigma_i a_{ij} t_i$,[26] we have negative value added free trade. This is a case where value added under free trade is negative leading to negative effective rate of protection. Corden (op cit.) has also given four possible explanations for negative value added under free trade in home country, which are detailed as follows:

[25] Basis (Measure) here indicates that the particular industry has got negative value added under free trade for the indicated year by using Corden or Balassa method of estimating ERP, as the case may be.

[26] ERP = $\frac{Value\ added\ under\ restricted\ trade - value\ added\ under\ free trade}{Value\ added\ under\ free\ trade} = \frac{t_j - \sum_i a_{ij} t_i}{1 - \sum_i a_{ij} t_i}$

a) Transport cost (which can be regarded as including cost of packaging) expressed as the proportion of the f.o.b. export price in the supplying country, may be much greater than the value of final good.

b) Secondly, the production functions (input coefficients) may differ between countries, the home country being less efficient and wasting materials. In the efficient supplying country only one unit of input may be required to make one unit of the final good. But in the inefficient home country two units of the input may be required.

c) Thirdly, even with same production function and no transportation cost, the value added under free trade can be negative if the input price the users in the supplying country have to pay is lower than the export price of the input. This would be so if there were an export tax on the input (though the effects could be offset by an export tax on the final product), or if the input industry is discriminated against the foreign buyers for the same reason.

d) Fourthly, in the supplying country, there may be a monopolistic producer of both the final product and input, who deliberately prices exports of the input highly so as to discourage processing abroad.

He further added that negative value added under free trade may result from aggregation of industries. This holds relevant in our case also – Since the international input-output tables have been constructed at a fairly aggregated level, we were constrained to use the present definitions of industries.

There are certain economic and statistical reasons given by various economists to explain the existence of negative value added under free trade. Bhagwati and Desai (*op. cit.*) posited that existence of inefficient investment decisions, losses in the short run, existence of quantitative restrictions and restriction of domestic entry which could confer monopoly power of the firms are some of the economic reasons. Other than these, the authors also argued that export subsidisation policies can lead to existence of negative value added under free trade. This is because such policies can lead to processing of inputs, and subsequently exports, which may fall short of the cost of inputs at foreign prices. In addition, the authors also put forward some of the statistical reasons that could be held responsible for such contradictory result. Because of the discretionary features of customs procedure, the duty on inputs could be rated higher than that on output, also under-invoicing and over-invoicing could affect trade valuations, and the use of domestic values that are deflated by the tariffs and premia to provide international values could result in under-estimation of the value-added, if tariffs and premium are not estimated correctly. However, since our entire data set is valued in terms of international prices, we do not need to worry about the second last reason given by the authors.

The issue of negative value added was also resolved by Guisinger (1969) who apart from clarifying the concept, has also shown that the negative value added is neither the result of constancy of production coefficient as contended by some economists, nor that of gross inefficiency in the production system as asserted by others. The author argued that it is not irrational for a country to choose to invest in an industry where value added at world price is initially negative, provided it can be shown that productivity gains will, over time, convert this cost into a net benefit and that the discounted value of the streams of benefits will exceed the original capital cost.

In addition, the author also noted that the existence of negative value added in empirical studies is attributable to the fact that there is no way of getting actual data on production cost under the free trade situation. This is because most of the empirical studies begun with the observed data on the tariff distorted cost structure in various industries and worked their way backwards in computing production cost in the free trade situation. The value added in the absence of tariff is then computed by deducting value of input from the value of outputs at the observed world prices.

The negative value added at world prices simply implies that the commodities in question cannot be produced in the absence of tariff and are being currently produced only under the umbrella of the protective tariff. As suggested by Guisinger, it simply implies that a free trade prices the local supply curve of the import competing industry lies wholly above the world supply curve. However, Guisinger's method is difficult to relateto the recent policies.

We can explain this negative value added from the way in which it has been defined. From equation (7):

$$VA_{FTj} = \frac{VO_j}{(1 + t_j)} - \sum_i \frac{IC_{ij}}{(1 + t_i)}$$

If the difference between tariff on output and tariff on input is positive and large (higher degree of tariff escalation[27]), then, having higher tariff on output or lower tariff on input will lower the normalized value of output more than that of the normalized intermediate consumption. Consequently, the numerical value of value added under free trade may become negative, thus leading to negative ERP in a particular industry. To verify this, we have tried plotting the association between positive and negative ERP separately with tariff escalation using both Corden and Balassa estimates. Figure 6.1 and 6.2 shows the non-linear relationship between estimates of ERP and tariff escalation for Corden and Balassa respectively, where the left side panel reflects on relationship between positive value of ERP and tariff escalation and right side panel focuses on the relation between negative ERP and tariff escalation. As is evident from figures 6.1 & 6.2, not only are positive ERP and tariff escalation positively

[27] Tariff escalation has been computed as the difference between output and average input tariff.

associated (as expected), but so also are negative ERP and TE.[28] This is portrayed through the fitted line in both the left and right panel in each of the two aforementioned figures. Even though there exist a wider range for the values of both Corden and Balassa ERPs, however, in majority of the industry-year observations under consideration, tariff escalation lies within the range [-0.1, 0.1]. Also, worth noting is that negative escalation (IDS) is consistent with positive ERP, but not negative ERP, as theoretically expected.

Figure 6.1: Relationship between Corden ERP and Tariff Escalation

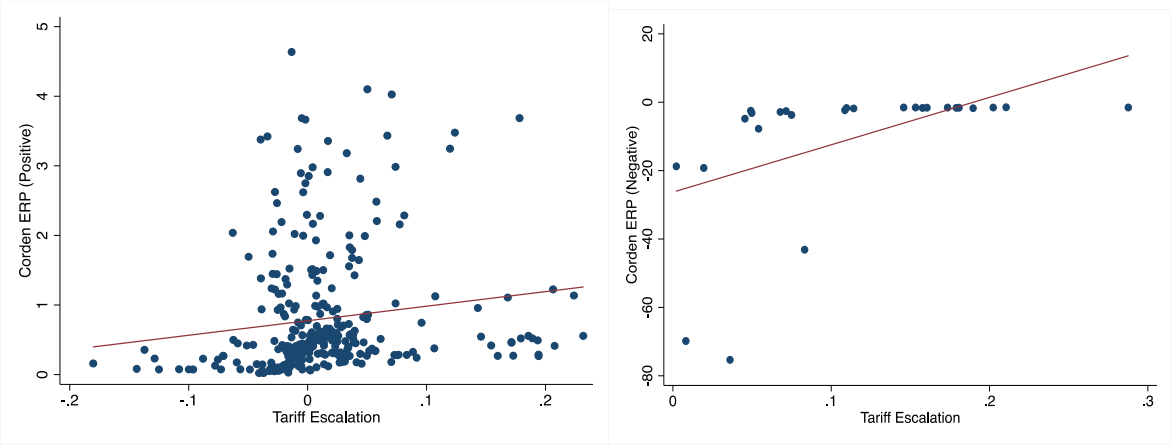
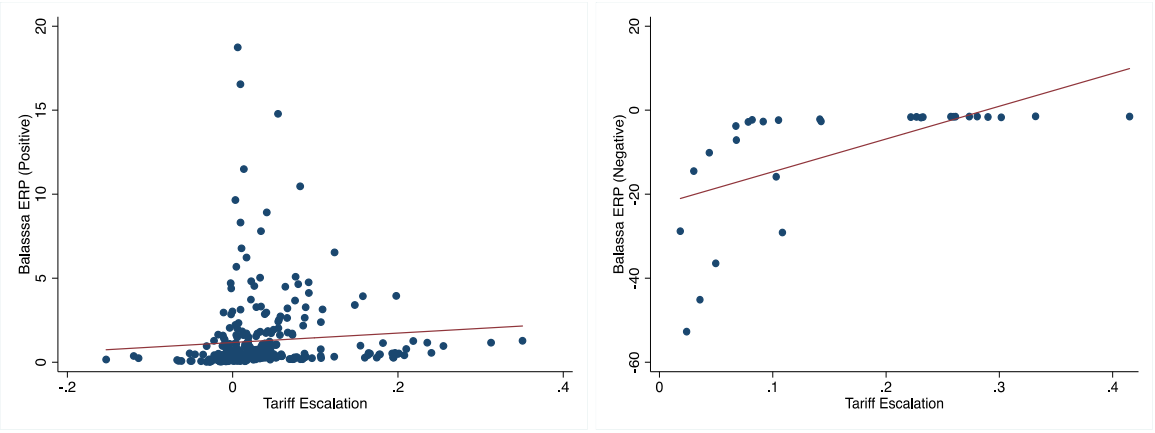


Figure 6.2: Relationship between Balassa ERP and Tariff Escalation



Source: Author's input

Further based on the graphical representations, we have also found out correlations between the negative value added under free trade/negative ERP and tariff escalation. Noting that the relationships appear to be non-linear, we computed Spearman's rank correlation coefficient in addition to Karl Pearson's. Considering all those products that have negative value added under

[28] However, as can be noted from figures 6.1 and 6.2, the relationship in the right panels flattens out near zero ERP for higher levels of escalation, but it lies in the range of [-1,-3]. Moreover, the high ERP corresponding to near-zero values of escalation are mainly in chemical products, pharmaceutical and electrical equipment for the year 2001 . One argument that might explain such trend is the abolishment of quantitative restrictions in 2000-2001. Since, our method is mainly focussing on the treatment of tariffs, it doesn't take it account the impact of QRs.

free trade during the selected 15 years gave us a total of 28 observations. Tables 6.2 and 6.3 report the results from our analysis.

Table 6.2: Karl Pearson's correlation coefficients between the negative value added under free trade/negative ERP and tariff escalation

KARL PEARSON CORRELATION		
		TARIFF ESCALATION
ERP	Coefficient of correlation	0.5998
	Number of observation	28
	Level of significance	0.0007
Value added under free trade	Coefficient of correlation	-0.7848
	Number of observation	28
	Level of significance	0.0000

Table 6.3: Spearman's Rank Correlation coefficients between the negative value added under free trade/negative ERP and tariff escalation

RANK CORRELATION		
		TARIFF ESCALATION
ERP	Coefficient of correlation	0.9212
	Number of observation	28
	Level of significance	0.0000
Value added under free trade	Coefficient of correlation	-0.8664
	Number of observation	28
	Level of significance	0.0000

Table 6.2 clearly demonstrates the existence of negative and high degree of correlation between VA under free trade and tariff escalation, and high positive correlation between negative ERP and tariff escalation. Even the rank correlation coefficients are negative and significant as reported in Table 6.3. This implies that industries that are characterised by higher negative value added under free trade are also those in which the gap between output and input tariff is large and positive. The positive correlation between negative ERP and tariff escalation shows that as the level of difference between tariff on output and input rises, the ERP also rises.

Summary points or few observations:

- Overall effective protection has declined and so have the rates of nominal tariffs during the 15 years' period, thus highlighting the effect of trade liberalising policies being

implemented by the government of India. These results are in line with the estimates of Deb Kusum Das's (2003 and 2012) studies.

- Tariff rate of agricultural and allied activities have increased overtime while that on non-agricultural commodities have fallen significantly. This is because in the recent years, more number of preferential trade agreements have been signed and more relaxations have been done for non-agricultural than for agricultural commodities, many of which are categorised as sensitive items. Moreover, as recorded in the budget speeches, the peak tariff rates have fallen significantly in the past few years. (Singh 2017)

- The computed measure of ERP is based only on the rates of tariff; however, imports of many agriculture commodities are still restricted by high levels of non-tariff barriers. Taking this into consideration, we may conclude that the estimated measure of ERP is not a true representation of the actual level of protection accorded to domestic firms in this industry.
- In most of the industries under consideration, the rates of effective protection were quite high during the initial 3-4 years and have declined thereafter. This is because initially the rates of tariff were quite high thus leading to a higher value of effective tariff. Over the years, with a fall in the rates of tariff, ERP also experienced a decline.
- The study shows that, as per the value-added statistics, inverted duty structure exists in paper and paper products, chemical and chemical products, pharmaceuticals, computer, electronics and optical products, machinery and equipment, other transport equipment for the majority of the years under consideration. A survey by the Federation of Indian Chambers of Commerce and Industry (2016) also show that capital goods industries such as machinery, electronics suffer from duty inversion.[29] Another study by Hoda and Rai (2014) has also reported existence of inverted duty structures in electronic products such as refrigerators, air conditioners, washing machines, microwave ovens, etc.

- The higher the extent of positive protection, the lesser is the chance of IDS. This is obvious because higher extent of positive protection means more tariff on output.
- A total of 28 (out of 354) industry-year observations show existence of negative value added under free trade. As evidenced with the help of Pearson's and Spearman's correlation coefficient, this seem to be because of the rise in tariff escalation for these

[29] The FICCI survey also reports existence of IDS in other industries such as cement, rubber, minerals and textiles.

industries during some particular years. The existence of negative value added at free trade was also reported by Bhagwati and Desai (1970).

- Overall, we do not have a case of negative ERP which arises in a situation where VA under restricted trade falls short of VA under free. Negative ERP exists only in those industries and for those years when there exists negative VA under free trade. This was also implied by Corden (1971, p. 10, implication point VII).
- Some industries have different values for Corden and Balassa estimates of ERP, but overtime they tend to converge to each other.

APPENDIX 1: Impact of tariff on output, tariff on input and value of output on ERP.

According to our definition (Equation 5),

$$\mathrm{ERP} = \frac{\mathrm{VA_{RT}} - \mathrm{VA_{FT}}}{\mathrm{VA_{FT}}}$$

where VA_{RT} refers to value added under restricted trade and VA_{FT} refers to value added under free trade. And,

$$\mathrm{VA_{RTj}} = \mathrm{VO_j} - \sum_{\mathrm{i}} \mathrm{IC_{ij}}$$

$$\mathrm{VA_{FTj}} = \frac{\mathrm{VO_j}}{(1+\mathrm{t_j})} - \sum_{\mathrm{i}} \frac{\mathrm{IC_{ij}}}{(1+\mathrm{t_i})}$$

where VO_j refers to value of output of industry j at basic price and IC_{ij} refers to intermediate consumption of good i in production of output j at purchaser' price. t_j refers to ad valorem tariff on import of final output j and t_i refers to ad valorem tariff on imports of intermediate consumption.

- **Impact of a change in tariff on output**

Differenting (partially) value added at restricted trade and value added under free trade with respect tariff on output, we get,

$$\frac{\partial\, \mathrm{VA_{RTj}}}{\partial t_j} = 0$$

$$\frac{\partial\, \mathrm{VA_{FTj}}}{\partial t_i} = \frac{-VO}{(1+\ t_j)^2}$$

Therefore, from equation (XX),

$$\frac{\partial ERP_j}{\partial t_j} = \frac{\left(VA_{FTJ} * \frac{\partial VA_{RTj}}{\partial t_j}\right) - \left(VA_{RTJ} * \frac{\partial VA_{FTj}}{\partial t_j}\right)}{(VA_{FT})^2}$$

$$\Rightarrow \frac{\partial ERP_j}{\partial t_j} = \frac{VA_{RTJ} * VO}{(1+\ t_j)^2 * VA_{FT}^2}$$

which is always positive.

- **Impact of a change in tariff on input**

Similarly, differentiating (partially) value added at restricted trade and value added under free trade with respect tariff on input, we get,

$$\frac{\partial \text{ VA}_{\text{RTj}}}{\partial t_i} = 0$$

$$\frac{\partial \text{ VA}_{\text{FTj}}}{\partial t_i} = \frac{IC_i}{(1 + t_i)^2}$$

$$\Rightarrow \frac{\partial ERP_j}{\partial t_i} = \frac{\left(VA_{FTJ} * \frac{\partial VA_{RTj}}{\partial t_i}\right) - \left(VA_{RTJ} * \frac{\partial VA_{FTj}}{\partial t_i}\right)}{(VA_{FT})^2}$$

$$\Rightarrow \frac{\partial ERP_j}{\partial t_i} = -\frac{VA_{RTJ} * (IC_i)^2}{(1+ t_i)^2 * VA_{FT}^2}$$

which is always negative.

- **Impact of change in value of output**

$$\frac{\partial \text{ VA}_{\text{RTj}}}{\partial VO_j} = 1$$

$$\frac{\partial \text{ VA}_{\text{FTj}}}{\partial VO_j} = \frac{1}{(1 + t_j)}$$

Thus,

$$\frac{\partial ERP_j}{\partial VO_j} = \frac{\left(VA_{FTJ} * \frac{\partial VA_{RTj}}{\partial VO_j}\right) - \left(VA_{RTJ} * \frac{\partial VA_{FTj}}{\partial VO_j}\right)}{(VA_{FT})^2}$$

$$\Rightarrow \frac{\partial ERP_j}{\partial VO_j} = \frac{\frac{(\sum IC)}{1+ t_j} - \sum(\frac{IC}{1+ t_i})}{(VA_{FT})^2}$$

$$\Rightarrow \frac{\partial ERP_j}{\partial VO_j} > 0 \text{ if } \frac{\sum IC}{\sum(\frac{IC}{1+t_i})} > (1 + t_j)$$

If same tariffs are imposed on imports of all the inputs, then,

$$\frac{\partial ERP_j}{\partial VO_j} > 0 \text{ if } t_i > t_j$$

APPENDIX 2: World Input Output Table - Construction method (Source: WIOD)

In this appendix, we outline the various steps taken in the construction process of the WIOT. These steps are summarised in Figure 2 that illustrates the basic data sources used and the various transformations applied. Four phases can be distinguished with each different estimation techniques:

A. Raw data collection and harmonization

B. Construction of time-series of SUTs

C. Construction of import use table and breakdown by country of origin.

D. Construction of WIOT.

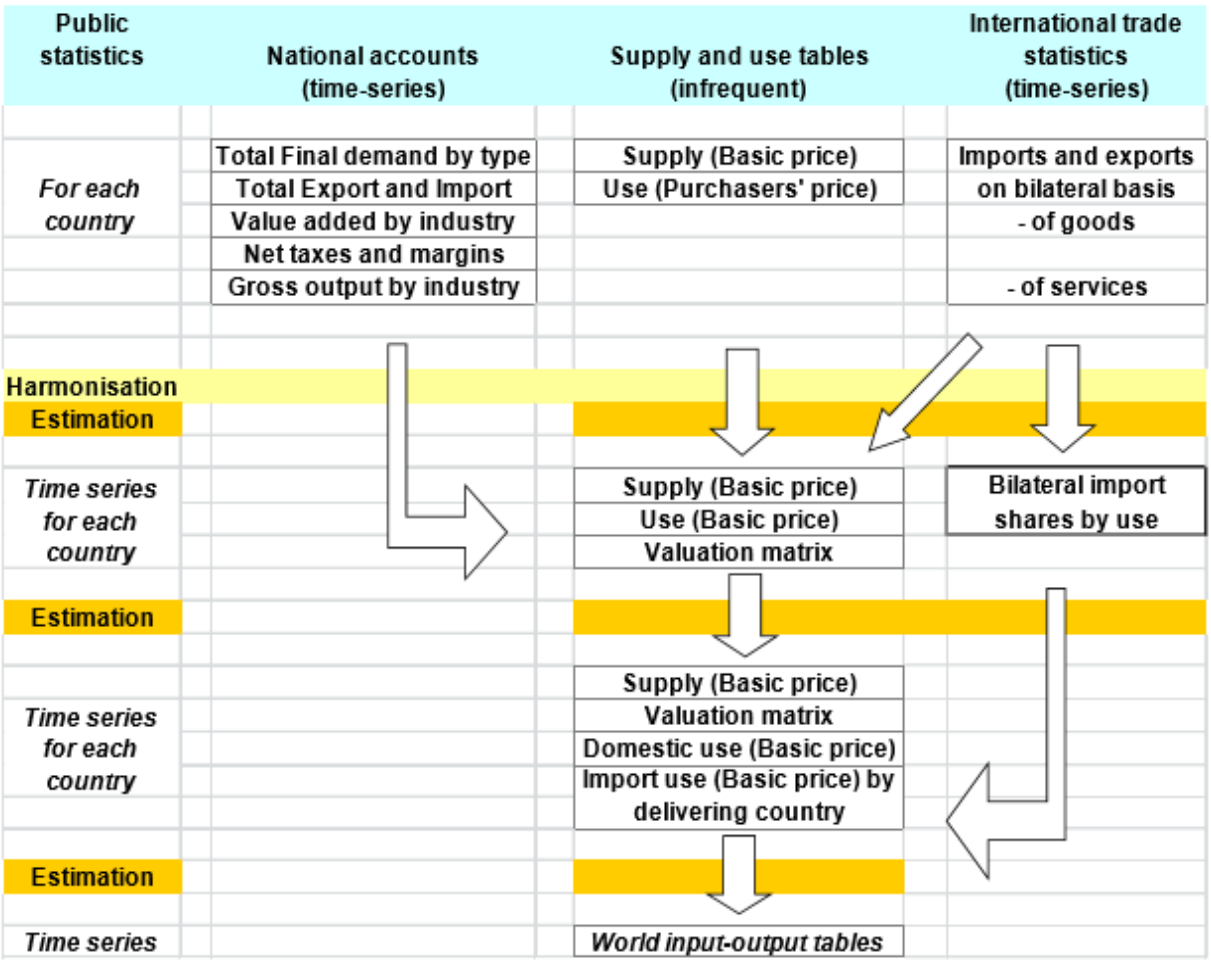
A. RAW DATA COLLECTION AND HARMONIZATION

Three types of data are being used in the process, namely national accounts statistics (NAS), supply-use tables (SUTs) and international trade statistics (ITS). The data is being harmonised in terms of industry- and product-classifications both across time and across countries.

B. CONSTRUCTION OF TIME SERIES OF SUTs

National SUTs are only infrequently available and are often not harmonised over time. Therefore, they are benchmarked on consistent time-series from the NAS in a second step. From the NAS data time series on gross output and value added by industry, total imports and total exports and final use by use category are taken. This data is used to generate time series of SUTs using the so-called SUT-RAS method. This method is akin to the well-known bi-proportional updating method for input- output tables known as the RAS-technique. This technique has been adapted for updating SUTs and has been shown to outperform other methods for generation of time-series of SUTs (Temurshoev and Timmer 2011).

Figure 2: Dataflows and construction steps in WIOT



Timeseries of SUTs are derived for two price concepts: basic prices and purchasers' prices. Basic price tables reflect the costs of all elements inherent in production borne by the producer, whereas purchasers' price tables reflect the amount paid by the purchaser. The difference between the two is the trade and transportation margins and net taxes. Both price concepts have their use for analysis depending on the type of research question. Supply tables are always at basic price and often have additional information on margins and net taxes by product. The use table is typically at a purchasers' price basis and hence needs to be transformed to a basic price table. The difference between the two tables is given in the so-called valuation matrices (Eurostat 2008, Chapter 6). Thus, the difference between the basic prices and purchaser price arise because of the two cost components viz. international transport margin (or ITM) and net indirect taxes (NIT). These rates are first estimated on the basis of supply tables and then used with the use tables to find out the corresponding product-wise and country-wise transport margins and net taxes.

C. BREAKDOWN OF IMPORTS AND DOMESTIC PRODUCTION IN USE TABLE

The basic data is import flows of all countries covered in WIOD from all partners in the world at the HS6- digit product level taken from the UN COMTRADE database. Based on the detailed product description at the HS 6-digit level products are allocated to three use categories: intermediates, final consumption, and resembles the well-known correspondence between the about 5,000 products listed in HS 6 and the Broad Economic Categories (BEC) as made available from the United Nations Statistics Division. These Broad Economic Categories can then be aggregated to the broader use categories mentioned above. For the WIOD this correspondence has been partly revised to better fit the purpose of linking the trade data to the SUTs.

For services trade, no standardised database on bilateral flows exists. These have been collected from various sources (including OECD, Eurostat, IMF and WTO), checked for consistence and integrated into a bilateral service trade database.

D. CONSTRUCTION OF WIOT.

As a final step, international SUTs are transformed into a world input-output table. IO tables are symmetric and can be of the product-by-product type, describing the amount of products needed to produce a particular good or service, or of the industry-by-industry type, describing the flow of goods and services from one industry to another. In case each product is produced by only one industry, the two types of tables will be the same. But the larger the share of secondary production, the larger the difference will be.

An IOT is a construct on the basis of a SUT at basic prices based on additional assumptions concerning technology. We use the so-called "fixed product-sales structure" assumption stating that each product has its own specific sales structure irrespective of the industry where it is produced. Sales structure here refers to the proportions of the output of the product in which it is sold to the respective intermediate and final users. This assumption is most widely used, not only because it is more realistic than its alternatives, but also because it requires a relative simple mechanical procedure. Furthermore, it does not generate any negatives in the IOT that would require manual rebalancing. Application of manual ad-hoc procedures would greatly reduce the tractability of our methods. Millar and Blair (2009) provide a useful and extensive discussion of the transformation of SUTs into IOTs, including a mathematical treatment.

In a first step, the international SUTs for all countries are combined into a world SUT. Basically, the national tables are stacked and reordered to resemble a standard supply-use table. Subsequently, using the fixed product-sales structure, the world SUT is transformed into the WIOT. To ensure consistency between bilateral flows of imports and exports, exports are

defined as mirror flows from imports. More specifically, imports of product *i* of say country A from country B are assumed to be equal to the exports of this product from B to A.

The full WIOT will contain data for forty countries covered in the WIOD. Including the biggest countries in the world, this set covers more than 85 per cent of world GDP. Nevertheless to complete the WIOT and make it suitable for various modelling purposes, a region called the Rest of the World (RoW) has also been added that proxies for all other countries in the world. The RoW needs to be modelled due to a lack of detailed data on input-output structures. Production and consumption in the ROW is modelled based on totals for industry output and final use categories from the UN National Accounts, assuming an input- output structure equal to that of an average developing country. Imports from RoW are given as as share of imports from RoW from trade data applied to the imports in the supply table. Hence, exports from the RoW are simply the imports by our set of countries not originating from the set of WIOD countries. Exports to RoW for each product and country from the set of WIOD countries are defined residually to ensure that exports summed over all destination countries is equal to total exports as given in the national SUTs. This sometimes resulted in negative exports to the rest of the World. In those cases, some additional constraints are added to prevent negativity.

APPENDIX 3: List of sectors for ERP estimates.

1	Crop and animal production, hunting and related service activities
2	Forestry and logging
3	Fishing & Aquaculture
4	Mining and quarrying
5	Manufacture of food products, beverages and tobacco products
6	Manufacture of textiles, wearing apparel and leather products
7	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
8	Manufacture of paper and paper products
9	Printing and reproduction of recorded media
10	Manufacture of coke and refined petroleum products
11	Manufacture of chemicals and chemical products
12	Manufacture of basic pharmaceutical products and pharmaceutical preparations
13	Manufacture of rubber and plastic products
14	Manufacture of other non-metallic mineral products
15	Manufacture of basic metals
16	Manufacture of fabricated metal products, except machinery and equipment
17	Manufacture of computer, electronic and optical products
18	Manufacture of electrical equipment
19	Manufacture of machinery and equipment n.e.c.
20	Manufacture of motor vehicles, trailers and semi-trailers
21	Manufacture of other transport equipment

22	Manufacture of furniture; other manufacturing
22	Repair and installation of machinery and equipment
23	Electricity, gas, steam and air conditioning supply
24	Water collection, treatment & supply

Source: WIOD

APPENDIX 4: List of countries included for estimates of ERP

1	Australia
2	Austria
3	Belgium
4	Brazil
5	Bulgaria
6	Canada
7	China
8	Taiwan, China
9	Croatia
10	Cyprus
11	Czech Republic
12	Denmark
13	Estonia
14	Finland
15	France
16	Germany
17	Greece
18	Hungary
19	Indonesia
20	Ireland
21	Italy
22	Japan
23	Korea, Rep.

24	Latvia
25	Lithuania
26	Luxembourg
27	Malta
28	Mexico
29	Netherlands
30	Norway
31	Poland
32	Portugal
33	Romania
34	Russian Federation
35	Slovak Republic
36	Slovenia
37	Spain
38	Sweden
39	Switzerland
40	Turkey
41	United Kingdom
42	United States
43	Rest of the World

Source: WIOD

APPENDIX 5: Concordance between ISIC Rev 3 and ISIC rev 4:

Industries (ISIC Rev 4)	Industries (ISIC Rev 3)
Crop and animal production, hunting and related service activities	Agriculture, hunting and related service activities
Forestry and logging	Forestry, logging and related service activities
Fishing and aqua culture	Fishing, operation of fish hatchiers and fish farms; service activities incidental to fishing.
Mining and quarrying	1. Mining of coal and lignite; extraction of peat 2. Extraction of crude petroleum and natural gas ; service activities incidental to oil and gas extraction excluding surveying 3. Mining of metal ores 4. Other mining and quarrying
Manufacture of food products, beverages and tobacco products	1. Manufacture of food products and beverages 2. Manufacture of tobacco products.
Manufacture of textiles, wearing apparel and leather products	1. Manufacture of textiles 2. Manufacture of wearing apparel; dressing and dyeing for fur 3. Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear.
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
Manufacture of paper and paper products	Manufacture of paper and paper products
Printing and reproduction of recorded media	Publishing, printing and reproduction of recorded media
Manufacture of coke and refined petroleum products	Manufacture of coke, refined petroleum products and nuclear fuels.
Manufacture of chemicals and chemical products	Manufacture of chemicals and chemical products
Manufacture of basic pharmaceutical products and pharmaceutical preparations	Manufacture of chemicals and chemical products
Manufacture of rubber and plastic products	Manufacture of rubber and plastic products

Manufacture of other non-metallic mineral products	Manufacture of other non metallic mineral products
Manufacture of basic metals	Manufacture of basic metals
Manufacture of fabricated metal products, except machinery and equipment	Manufacture of fabricated metal products, except machinery and equipment
Manufacture of computer, electronic and optical products	1. Manufacture of office, accounting and computing machinery 2. Manufacture of radio, television and communication equipment and apparatus 3. Manufacture of medical, precision and optical instruments, watches and clocks.
Manufacture of electrical equipment	Manufacture of electrical machinery and apparatus n.e.c
Manufacture of machinery and equipment n.e.c.	Manufacture of machinery and equipment n.e.c.
Manufacture of motor vehicles, trailers and semi-trailers	Manufacture of motor vehicles, trailers and semi-trailers
Manufacture of other transport equipment	Manufacture of other transport equipment
Manufacture of furniture; other manufacturing	Manufacture of furniture; other manufacturing
Repair and installation of machinery and equipment	NA
Electricity, gas, steam and air conditioning supply	Electricity, gas and hot water supply
Water collection, treatment and supply	Electricity, gas and hot water supply

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