Short-Term Economic and Environmental Implications of a Domestic Carbon Pricing Mechanism in India as a Response to EU-CBAM

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Abstract

Since, CBAM in its transitional phase has already been implemented by the EU, with no effective carbon pricing policy in India. This study aims at estimating the tariff equivalence of CBAM on Indian exports and a short-term assessment of the potential impacts of a domestic carbon pricing policy as a response to EU-CBAM. The results show that almost a quarter of India's total exports of Iron and Steel and Aluminium are directed to the EU and finds CBAM equivalent tariff on these goods to be significant. The short-term impacts of a domestic carbon tax are estimated using the ESAM for India. Across all three scenarios, there has been minimal adverse impact on households' welfare and the economy. The environment however benefits as carbon tax results in absolute reduction in CO2e. Carbon tax also generates significant revenues, which can support India's climate financing requirements.

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1. Introduction

Curbing the rising emissions and addressing climate change is gaining widespread support globally. As a response, many nations are increasingly committing to achieving "net zero" carbon emissions, leading to the introduction and implementation of various carbon pricing initiatives to counter the rising greenhouse gas (GHG) emissions. These national carbon pricing policies are believed to have promoted carbon leakage, and to fight against the same, the European Union (EU) in 2023, has already implemented the Carbon Border Adjustment Mechanism (CBAM), to curb emissions and safeguard against the risk of carbon leakage (Union, 2023).

There exist many studies in the literature which discuss that CBAM might impact developing countries more adversely. Lowe (2021) found that if CBAM were to apply to the import of all goods covered under the EU ETS, exports of developing countries to the EU might face an additional cost of up to $16 billion. Simola (2021) estimated the potential cost effects of CBAM on some of the EU major import sources i.e. China, India, Russia, Turkey and Ukraine and found that due to CBAM additional cost of importing from selected countries would be limited but not insignificant as it would vary from 0.1% of the value of imports from China to the EU to 4% in case of Ukraine. UNCTAD (2021) using GTAP-E found that due to CBAM global CO_2 emissions declined marginally, whereas international trade patterns changed more in favour of developed countries.

Considering the potential adverse impacts of CBAM especially on developing countries, and India being the third largest carbon emitting and net-exporting country with no carbon pricing mechanism at place, it becomes important to understand how CBAM may impact India’s exports to the EU. A significant share of India's exports of Iron and Steel and Aluminium heads to the EU, highlighting the potential for significant adverse impact of CBAM on India’s exports to the EU. CBAM may cause an additional burden on imports in the form of a CBAM equivalent tariff. Against this backdrop, this study aims at estimating the carbon price and the resultant CBAM equivalent tariff, Indian exports are subject to be charged in the absence of domestic carbon pricing policy within India.

As per Union (2023), carbon price already paid domestically during the production of imported goods will be deducted when determining the carbon price payable on EU’s imports. India, however, do not have any carbon pricing policy in place yet, hence, this study also aims at assessing potential short-term impacts of a hypothetical carbon pricing policy if implemented as a response to the EU-CBAM. Within the literature most commonly used approaches to estimate potential implications of such policies include Input-Output (I-O), Social Accounting Matrix (SAM) and Computable General Equilibrium Models. Hamilton & Cameron, (1994) utilized a combination of tools including I-O model to analyse short-run distributional impacts of a carbon tax in Canada and found the incidence on households to be regressive. The incidence of carbon tax on households while utilizing the I-O and Hybrid Input-Output approach was also found regressive in

case of Mexico (Renner, 2018) and Brazil (Moz-Christofoletti & Pereda, 2021) respectively. Gemechu et al. (2014) found a trade-off between households' welfare, environment and the economy when a new carbon tax was introduced in Spain. They further found that these adverse impacts on welfare may be counterbalanced by utilizing the revenues collected from such taxes to compensate the households impacted adversely. Similar results on the undesirable trade-off between emission reduction, equity and efficiency were found by Ojha et al. (2020) who used CGE modelling to analyse the potential impacts of a carbon tax and various revenue recycling policies on the Indian economy.

In this study, we opt for the SAM to simulate the potential impacts of a domestic carbon pricing policy in India as a response to CBAM. This is because I-O and SAM approaches are capable of capturing the potential impacts of exogenous shocks on the relative prices, output, etc. in a systematic and granular manner. Unlike CGE, these models also help in analysing the short-term effects (Zhong & Pei, 2022). The objective of this study is to (a) estimate additional cost (CBAM equivalent tariff) on EU's imports of CBAM sectors from India in absence of any domestic carbon pricing policy, and (b) assess possible short-term impacts on Indian economy if as a response to CBAM, it implements a domestic carbon pricing policy. While the potential impacts of CBAM or domestic carbon pricing policy have been extensively discussed in the literature, studies focusing on India are very limited. Moreover, to the authors' best of knowledge, there is no study in the literature, that assesses the potential impacts of a Carbon tax coupled with a reduction in existing taxes imposed by the government on targeted sectors. Such an approach aims to offer relief to producers and consumers of these sectors, from the potential adverse impacts of introducing a new carbon tax. This study endeavours to fill this gap in the existing literature by analysing the effects of these combined policy measures and their implications for the Indian economy.

The rest of the paper is organised as follows: Section 2 discusses the data and methods used to calculate the CBAM equivalent tariff rate and the potential impacts of domestic carbon pricing policy on the Indian economy. Section 3 presents the different scenarios, Section 4 discusses and analyses the results of this study, with Conclusions and Recommendations offered in Section 5.

2. Data and Methods

2.1 CBAM equivalent tariff

This study uses various databases to estimate the CBAM equivalent tariff. Data on India's exports of CBAM products (both in value and volume) is sourced from Trade Statistics by the Department of Commerce, India. Since, product-specific emission intensity is not available for all the targeted products, same has been sourced from country wise emission intensities published by Vidovic et al. (2023). However, wherever actual product-specific

emission intensity is available[2] and reported by the Indian government agencies (as in case of Fertilisers and Iron and Steel), the same are used.

The emissions embedded in India's exports to the EU have been estimated using the estimation method discussed in EU-CBAM regulation, which along with average EU-ETS price and India's exports data has been used to estimate the CBAM equivalent tariff on India's exports to the EU. The detailed method used to calculate CBAM equivalent tariff is as follows:

$$CBAM\ equivalent\ tariff_i = \frac{Carbon\ Price\ payable\ on\ Imports_i}{Value\ of\ Imports_i} \quad (1)$$

$$Carbon\ Price\ payable\ on\ imports_i = Embedded\ Emissions_i * CBAM\ Certificate\ Price \quad (2)$$

$$Embedded\ Emissions_i = Volume\ of\ Imports_i * Emission\ Intensity_i \quad (3)$$

2.2 Potential Impacts of a domestic carbon tax on the Indian economy

To estimate the potential impacts of a domestic carbon tax on the Indian economy, the data is sourced from the Social Accounting Matrix for India generated by NCAER (Chaudhuri et al., 2024), which is based on the year 2021-2022. To simulate the environmental impact of a domestic carbon tax, the SAM has been extended by including the environmental accounts (CO_2e emissions data) for India, which has been sourced from India Climate and Energy Dashboard by NITI Aayog. Since, latest CO_2e data for India is available for year 2019-20, same has been extrapolated for year 2021-22. The imposition of carbon prices by creating an additional burden on producers will result in increasing cost of production not just of the targeted sectors, but of all the sectors dependent on them for their inputs, which in turn will create a multiplier effect. This cost-push system due to carbon price may lead to a change in relative prices of all the 23 sectors in the economy which has been estimated using the Leontief Price Model (Miller & Blair, 2009; Choi et al., 2010; Gemechu et al., 2014) as in equations 4 and 5.

$$P_{23*1} = (I - A^T)^{-1}_{23*23} \times v_{23*1} \quad (4)$$

$$\Delta P_{23*1} = (I - A^T)^{-1}_{23*23} \times \Delta v_{23*1} \quad (5)$$

The change in relative prices of these 23 sectors will also bring a change in the price index of goods and services consumed by households, which has been estimated as in equation 6 below:

[2] Except for fertilisers and certain products of Iron and Steel for which nation-specific emission intensity is not reported by the EU. Direct emissions for these products are estimated on the basis of emissions reported by the Indian industries and/or the Government of India, and indirect emissions are estimated on the basis of electricity consumed by them as reported by the Central Electricity Authority and the emission factor of electricity production.

$$Price\ Index\ of\ goods\ and\ services\ consumed\ by\ HHs = \frac{Value\ of\ goods\ and\ services\ consumed\ by\ HHs\ at\ new\ relative\ prices}{Value\ of\ goods\ and\ services\ consumed\ by\ HHs\ at\ initial\ relative\ prices} \quad (6)$$

where,

$$Value\ of\ all\ goods\ and\ services\ consumed\ by\ HHs = \sum_{j=1}^{23} w_j P_j \quad (7)$$

w_j is the weight associated with consumption of sector j, which is determined on the basis of share of budget spent by all HHs in the economy on sector j, and P_j is the relative price of sector j.

This change in relative prices, estimated using equation 5 will also lead to a change in the final consumption expenditure of each household category which depends on the new relative prices, and respective household's spending on the 23 production sectors. Since in the short run, households' expenditure share on various products is expected to remain constant, expenditure incurred by i_{th} household has been estimated using Equation 8. The impact of carbon tax on households' welfare has been estimated using one of the most commonly used measures of change in welfare- Compensating Variation. Equation 9 measures change in household's consumption expenditure due to an increase in relative prices, while assuming households consuming goods and services in the same proportion as before in order to keep their utility constant. An increase in HH's expenditure post-imposition of tax reflects a decline in their welfare. Considering the prevailing inequality in the economy and a potential decline in households' welfare, it also becomes important to understand if this carbon tax would impact different households differently, and if incidence of tax is progressive or regressive. The incidence of carbon tax in this study has been assessed by analysing the change in HHs' expenditure as a share of their initial expenditure across different quintiles (equation 10). If it increases as HHs move to higher quintiles, the incidence of tax is said to be progressive, and if it decreases then regressive.

$$E_i = HH\ exp_i = \sum_j^{23} (P_j * \alpha_{ij}) * Exp_{ij} \quad (8)$$

$$\Delta HH\ exp_i = E_i^1 - E_i^0 \quad (9)$$

where, α_{ij} is expenditure incurred by HH_i on product j as a share of his/her total consumption expenditure.

Incidence of Tax on HH_i is determined by $\frac{\Delta HH\ exp_i}{Initial\ Exp_i}$ (10)

The Change in relative prices will also bring a change in final demand in the short term which as in equation 11 has been estimated using the price elasticity of demand[3] and the resultant changes in the relative prices.

$$y_1 = y_0 + \widehat{\Delta P} * \widehat{e_d} * y_0 \quad (11)$$

where, y_1: new final demand (post imposition of carbon tax), y_0: initial final demand (before carbon tax), $\widehat{\Delta P}$ and $\widehat{e_d}$ are the diagonal matrices of change in relative prices and price elasticity of demand, respectively. Further, the change in each sector's total output due to change in final demand has been estimated using the Leontief Quantity Model as in equation (12) below:

$$X_1 = (I - A)^{-1} * y_1 \quad (12)$$

Further, the impact of changes in output due to the imposition of a domestic carbon tax on the CO_2e emissions may be computed using equation 13 below:

$$C_1 = Em \times X_{1'} \quad (13)$$

where, C_1: CO_2e emissions post imposition of tax,

Em: Initial emissions coefficient defined as initial emissions/initial output of each sector,

X_1': New sector-wise output at constant prices

This entire process has been captured in Figure 1 below, which shows how the imposition of a carbon tax affects the domestic economy.

Figure 1: Impact of a Carbon Tax on Domestic Economy



Source: Authors' observations

[3] Price elasticity of demand in the short term is assumed to remain constant. For this study, the Price elasticity of demand of various sectors has been taken from the literature. Sectors for which elasticity is not available in the literature has been either estimated or assumed. Details are given in Table A1, Appendix A.

3. Carbon Pricing Mechanism and Scenarios

One of the objectives of this study is to assess the potential consequences of a hypothetical carbon pricing mechanism in India. Imposition of carbon tax first requires a close examination of scope of the policy, as in what sectors and gases to cover. In order to examine the coverage of sectors, we will be assessing which sectors are more prone to get impacted due to CBAM. This is done by calculating India's exports of CBAM sectors to the EU as a share of their total exports to the world. Table 1 below shows the significant share of India's exports of Aluminium and Iron and Steel to the EU, almost negligible export share of Cement and Fertilisers to the EU, with no exports of Electricity and Hydrogen.

Table 1: India's exports of CBAM targeted sectors to the EU

	Exports to EU (in tonnes)		**Exports to EU as a share of total exports (%)**	
Sector	**Apr-Mar 2023**	**Apr-Mar 2022**	**Apr-Mar 2023**	**Apr-Mar 2022**
Cement	51.08	1.78	0.25%	0.00%
Electricity	0.00	0.00	0.00	0.00
Fertilisers	315.03	212.57	0.21%	0.14%
Iron and Steel	**3811782.41**	**5211882.37**	**26.54%**	**20.15%**
Aluminium	**741423.00**	**685236.95**	**26.14%**	**20.05%**
Hydrogen	0.00	0.00	0.00	0.00

Source: Authors' computations on the basis of data retrieved from Trade Statistics, Department of Commerce.

These results suggest that as a response to CBAM, India may impose a carbon tax on CO_2e emissions from the production processes of Aluminium and Iron and Steel. The assumed carbon tax rate for this study is \$60/t CO_2e, approximating the average EU-ETS price in February 2024.

For this study three different scenarios are considered:

Scenario 1: A carbon tax @ \$60/t CO_2e on Iron and Steel and Aluminium

Scenario 2: A carbon tax @ \$30/t CO_2e on Iron and Steel and Aluminium

Scenario 3: A carbon tax @ \$60/t CO_2e on Iron and Steel and Aluminium with a simultaneous decline in existing Goods and Services Tax (GST) on Aluminium and Iron and Steel by 10 and 5 percentage points respectively.

In Scenario 1 carbon tax rate levied on targeted sectors has been set equivalent to average EU-ETS price considered in this study, whereas in Scenario 2 the carbon tax rate has been reduced to half to factor in the idea of differential carbon price for developed and developing countries. In Scenario 3, along with the imposition of a carbon tax as a response to the EU CBAM, existing taxes paid by these targeted sectors have been reduced[4] to compensate the domestic producers for additional cost to be borne in the form of a carbon tax.

4. Results and Discussion

4.1 CBAM equivalent tariff

The embedded emissions in India's exports and the corresponding CBAM tariff equivalent of these exports have been estimated and results are presented in Table 2 below. The results show that India's export of Cement to the EU is highly carbon intensive and will experience a CBAM equivalent tariff of around 15% (both direct and indirect emissions are to be priced in case of Cement and Fertilisers), whereas in case of Fertilisers, equivalent tariff would be around 1.44%. However, since India's exports of Cement and Fertilisers to the EU are negligible as far as its total exports of these products to the world are concerned, thereby a carbon tax on these products might not be of huge concern as the export of these products may be diverted to other nations. In case of Aluminium and Iron and Steel, the export of which to the EU accounts for around 25% of India's total exports, might get adversely impacted due to carbon price, as the CBAM equivalent tariff on these products is around 3.3% and 10% respectively as far as direct emissions are considered, which increases to around 22% and 12% when both direct and indirect emissions are accounted for. These results show that with CBAM into force, India's exports of Aluminium and Iron and Steel to the EU will get hit harder, which calls for the implementation of a domestic carbon pricing mechanism.

Table 2: Direct, Indirect emissions and CBAM equivalent Tax rate on India's exports to the EU

	Apr-Mar 2023	**As per EU-JRC-2023 (in tCO_2e/t)**	**Embedded Emissions (tCO_2e)**	**Carbon price to be paid on exports to EU (when EU ETS average price is USD 60)**	**CBAM Equivalent Tax Rate (%)**

[4] The reduction in GST has been done in order to compensate the producers of Aluminium and Iron and Steel sectors for the additional cost to be borne by them (in form of CBAM equivalent tax) by almost half. Thus, Scenario 2 and 3 both in some sense try to lower this additional burden by half.

Sector	India's exports to EU (in Tonnes)	India's exports to EU (in USD million)	Direct emission intensity	Indirect emission intensity	Direct	Indirect	Carbon price- Direct emissions (USD mn /tCO_2e)	Carbon price- Indirect emissions (USD mn /tCO_2e)	Total Carbon Price- direct + indirect (USD mn /tCO_2e)	Direct emission intensity	Indirect emission intensity	Direct and Indirect emissions
Cement	51	0.04	1.82	0.17	93.08	8.57	0.01	0.00	0.01	**13.96%**	**1.29%**	**15.25%**
Electricity	0.00	0.00			0.00	0.00	0.00	0.00	0.00			
Fertilisers	315	1.06	0.72	0.09	226.44	28.00	0.01	0.00	0.02	**1.28%**	**0.16%**	**1.44%**
Iron and Steel	38,06,024	6,381	2.71	0.52	1,03,10,762	19,86,674	618.65	119.20	737.85	**9.69%**	**1.87%**	**11.56%**
Aluminium	7,41,423	2,655	1.98	11.07	14,70,795	82,06,047	88.25	492.36	580.61	**3.32%**	**18.55%**	**21.87%**
Chemicals	0.00	0.00			0.00	0.00	0.00	0.00	0.00			

Source: Authors' Computations

4.2 Domestic Carbon Pricing Mechanism as a response to CBAM- Impact on Indian Economy

4.2.1 Impact on Relative Prices

The impact of carbon tax on relative prices of all production sectors has been assessed using the Leontief Price Model. Table 3 below shows that a carbon tax on Aluminium and Iron and Steel will have a substantial impact on their relative prices. Of the three tax scenarios, the increase in relative prices of all sectors (except Aluminium and Iron and Steel) is highest in Scenario 1 followed by Scenario 2 and Scenario 3. For Scenario 1 and Scenario 2 such impacts are clear fold, the imposed carbon tax rate in Scenario 2 is half than what has been imposed in Scenario 1. The relatively lesser rise in relative prices of all sectors except Aluminium and Iron and Steel in Scenario 3 as compared to Scenario 2 can be explained through the simultaneous decline in GST in Scenario 3. GST is a consumption tax, the reduction in which has benefitted the sectors consuming Aluminium and Iron and Steel more than these two sectors themselves. This is because when the existing GST rates have been reduced in Scenario 3, the tax payments made by users of these two products have declined, benefitting the consumers, whereas the benefit of reduction in existing taxes on these products are not getting translated much to the producers[5]. It highlights that an effort to compensate the producers for additional burden due to carbon tax by reducing the existing indirect taxes i.e. GST is not benefitting them, and thus might not help correct the terms of trade of the two sectors. However, the benefits of a reduction in GST are getting translated to its consumers.

Table 3: Impact of Carbon Tax on Relative Prices

	%age Change in Relative Prices		
Sector	**S1**	**S2**	**S3**
Agriculture and Forestry	0.35%	0.18%	0.05%

[5] Iron and Steel and Aluminium too have experienced a slight decrease in their relative prices due to a reduction in GST in S3 as compared to S1, because they also consume some Iron and Steel and Aluminium as inputs.

Fisheries	0.33%	0.17%	0.05%
Livestock	0.32%	0.17%	0.05%
Biomass	0.35%	0.18%	0.05%
Coal	0.59%	0.31%	0.10%
Oil and Natural Gas	0.76%	0.40%	0.11%
Mining and Quarrying	0.47%	0.25%	0.07%
Textiles and Leather	0.47%	0.25%	0.07%
Paper products	0.60%	0.31%	0.10%
Petroleum Products	0.67%	0.35%	0.10%
Cement	0.55%	0.29%	0.08%
Iron and Steel	**7.19%**	**3.70%**	**5.15%**
Aluminium	**21.39%**	**11.90%**	**20.62%**
Other Non-Ferrous Metals	1.40%	0.76%	0.48%
Fertilizer	0.51%	0.27%	0.08%
Chemicals	0.54%	0.28%	0.09%
Other manufacturing	0.94%	0.50%	0.15%
Electricity	0.72%	0.38%	0.08%
Railway Transport	0.40%	0.21%	0.05%
Land Transport	0.46%	0.24%	0.06%
Water transport	0.61%	0.32%	0.09%
Air transport	0.57%	0.30%	0.09%
Services	0.60%	0.32%	0.07%

Source: Authors' Computations

4.2.2 Impact on Households

The change in relative prices due to the imposition of carbon tax will have its bearing on households, as it will lead to a change in their consumption expenditure. Table 4 below shows that effect on households' welfare (in terms of increased expenditure to consume same set of products) is highest in Scenario 1, followed by Scenario 2 and Scenario 3. This is because the change in relative prices of goods and services consumed by them is highest in Scenario 1, followed by Scenario 2 and 3. Despite the huge increase in relative prices of Aluminium and Iron and Steel in Scenario 3 as compared to Scenario 2, the effect on households' welfare is lesser in Scenario 3 than in Scenario 2 because these two directly taxed sectors are not directly consumed by the households. This is to note that, the increase in expenditure for all household categories both in rural and urban regions due to the imposition of carbon tax is not that significant as the increased expenditure as a share of their initial expenditure across all three scenarios is even lesser than 1%. This smaller impact of carbon tax on households is largely because of their consumption pattern which does not include direct consumption of Aluminium and Iron and Steel. Table 4 also shows that the incidence of tax is first regressive as we move from Q1 to Q2 and Q3, however, progressive as we move to further higher quintiles, showing that households belonging to the lowest most quintiles are being impacted disproportionately.

Implementation of any tax results in increasing cost of living and losses in purchasing power of consumers (here households), which can be measured by a general price index

of final consumption goods (Table 5). The impact of carbon tax on price index is rather small, as general price level calculated on basis of HHs' consumption basket has increased by 0.60%, 0.32% and 0.08% across the three scenarios, which is because while calculation of this index, weights are determined in accordance with the households consumption of the 23 production sectors out of which certain products including Aluminium and Iron and Steel are not directly consumed by them, hence no direct impact of carbon tax on them.

Table 4a: Impact of Carbon Tax on Rural HHs

	Impact on Rural HHs- Increase in expenditure as a share of initial expenditure		
HHs	**S1**	**S2**	**S3**
Rural_Q1	0.620%	0.324%	0.092%
Rural_Q2	0.597%	0.313%	0.088%
Rural_Q3	0.560%	0.293%	0.081%
Rural_Q4	0.570%	0.298%	0.081%
Rural_Q5	0.594%	0.310%	0.083%

Source: Authors' Computations

Table 4b: Impact of Carbon Tax on Urban HHs

	Impact on Urban HHs- Increase in expenditure as a share of initial expenditure		
HHs	**S1**	**S2**	**S3**
Urban_Q1	0.605%	0.317%	0.087%
Urban_Q2	0.644%	0.337%	0.094%
Urban_Q3	0.689%	0.361%	0.102%
Urban_Q4	0.603%	0.315%	0.083%
Urban_Q5	0.617%	0.322%	0.082%

Source: Authors' Computations

Table 5: Impact of Carbon tax on Price Index- based on HHs' consumption

	S1	**S2**	**S3**
Price Index (post carbon tax)	1.0060	1.0032	1.0008
%age change	0.60%	0.32%	0.08%

Source: Authors' Computations

4.2.3 Impact on Industries

This change in output (at current prices) has been estimated using the Leontief Quantity Model as discussed in equation (10). Table 6 shows that the implementation of a carbon tax on Aluminium and Iron and Steel has a very small adverse effect on the total industrial output (at current prices), with an overall decline of 0.15% in Scenario 1 which is the highest of all three scenarios. The overall small impact of carbon tax on output (both at current and constant prices) is largely because of the aggregation of total output produced

across all sectors, obscuring variations in sector-specific impacts. Additionally, since this tax has been levied only on two sectors, its ability to substantially affect outputs across the entire economy may be limited.

Table 6: Impact of Carbon Tax on Output produced

	S1	S2	S3
%age change in Total Output (at current prices)	-0.15%	-0.08%	-0.03%
%age change in Total Output (at constant prices)	-0.78%	-0.41%	-0.20%
%age change in Output of Iron and Steel (at constant prices)	-6.99%	-3.72%	-5.02%
%age change in Output of Aluminium (at constant prices)	-17.88%	-10.78%	-17.23%

Source: Authors' Computations

4.2.4 Impact on Government Tax Revenue

Carbon tax like any other tax would generate revenues for the Government of India. In Scenario 3, along with the imposition of a carbon tax, there is a simultaneous reduction in GST which will also impact the tax revenue collected by the Government of India. The revenue so generated from carbon tax on Aluminium and Iron and Steel across all three scenarios has been presented in Table 7, which shows the significant contribution of carbon tax to India's receipts from indirect taxes, thereby stressing the need to develop and implement a domestic carbon pricing mechanism. In order to meet the environmental commitments, the revenue so collected from climate tax may be used to finance the climate requirements.

Table 7: Tax Revenue Generated from Carbon Tax

	S1	S2	S3
Carbon Tax Revenue as a share of NITs received by GoI	5.10%	2.55%	1.16%

Note: Carbon Tax revenue generated in S3 is net of revenue lost due to reduction in GST.
Source: Authors' Computations

4.2.5 Impact on Exports

A change in relative prices of goods and services will also impact the international trade of these goods and services. Overall exports of India experienced a slight decline (Table 8) due to the carbon tax. Again, this slight decline in total exports may be due to the fact that carbon tax has been levied only on two sectors, thus its ability to impact relative prices and overall exports is rather limited.

Table 8: Impact of Carbon Tax on India's Exports

	S1	S2	S3

%age change in Total Exports	-0.97%	-0.52%	-0.27%

Source: Authors' Computations

4.2.6 Impact on Emissions

Due to the imposition of a carbon tax, total CO_2e emitted during the production of all goods and services in the economy has reduced, highlighting the environmental benefits of a carbon tax. Since carbon tax is highest in Scenario 1, so is the reduction in emissions, indicating that a higher carbon tax acts as an incentive to lower down emissions in the economy.

Table 9: Impact of Carbon Tax on Total Emissions

	S1	**S2**	**S3**
%age change in Emissions	-1.38%	-0.75%	-0.65%

Source: Authors' Computations

5. Conclusions and Recommendations

Curbing the rising emissions and addressing climate change is gaining widespread support globally. As a result, many countries have already announced and implemented unilateral carbon mitigation. This paper quantifies the CBAM equivalent tariff on India's exports of targeted products to the EU and also examines the potential impacts on the Indian economy if India imposes a Carbon tax on CO_2e emitted during the production of Aluminium and Iron and Steel. This study finds that implementation of CBAM will have a huge impact on India's exports of targeted products to the EU, resulting in significant carbon payments on Indian exporters to the EU. To avert these payments, when India resorts to a domestic carbon pricing policy it will have its own ramifications. Our simulation results show that the implementation of a carbon tax on Iron and Steel and Aluminium would lead to an increase in relative prices of all the products in the economy, impacting HHs' welfare slightly adversely, benefitting environment and having economic implications. Another important result of this study has been the potential impact on the Indian economy when the imposition of a Carbon tax has been coupled with a reduction in GST, reflecting careful consideration by the government while designing new carbon taxes and compensatory policies to protect the producers and the economy from the potential adverse impacts of such carbon taxes. On the one hand, by imposing a carbon price equivalent to EU CBAM, India will be able generate revenues, which may be used by the GoI for say meeting its climate finance requirements.

Appendix A

Table 1: Price elasticity of demand considered in this study

Sectors	**Price Elasticity of Demand**	**Source**
Agriculture and Forestry	-0.42	Kumar et al. (2011)
Fisheries	-0.33	Average of all available elasticities
Livestock	-0.72	Kumar et al. (2011)
Biomass	-0.33	Average of all available elasticities
Coal	-0.33	
Oil and Natural Gas	-0.43	Dash et al. (2018)
Mining and Quarrying	-0.33	Average of all available elasticities
Textiles and Leather	-0.33	
Paper products	-0.33	
Petroleum Products	-0.19	Shaw (2020)
Cement	-0.33	Average of all available elasticities
Iron and Steel	-0.33	
Aluminium	-0.33	
Other Non-Ferrous Metals	-0.33	
Fertilizer	-0.20	Dholakia & Majumdar (1994)
Chemicals	-0.33	Average of all available elasticities
Other manufacturing	-0.33	
Electricity	-0.21	Tiwari & Menegaki (2019); Tran et al. (2023)
Railway Transport	-0.29	Assuming price elasticity of transport to be same as of services
Land Transport	-0.29	
Water transport	-0.29	
Air transport	-0.29	
Services	-0.29	Kothe (2019)