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A Study on Carbon Tax and Greenhouse Gas Emission

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Abstract

A carbon tax is an economic policy tool designed to reduce greenhouse gas emissions by assigning a financial cost to the emission of carbon dioxide and related gases from the combustion of fossil fuels. By making carbon-intensive activities more expensive, it incentivizes individuals, businesses, and industries to adopt cleaner energy sources and improve energy efficiency, thereby contributing to climate change mitigation. Carbon taxes are typically levied per ton of carbon dioxide equivalent emitted, directly targeting the economic drivers of pollution and internalizing the environmental costs within market prices. As a market-based approach, carbon taxation is widely considered among the most effective and efficient strategies for curbing greenhouse gases and facilitating the transition to a low-carbon economy. For this study data has been collected through primary and secondary sources like judgements, case laws, news, articles etc. The motive of this study is to study positive and negative impact of Carbon tax and Green gas emission.

Keywords: Carbon tax, Greenhouse gas emission, Carbon leakage, carbon pricing, climate change, Fluorocarbons, Environment, Socio-economic effects.

1. Introduction

A carbon tax is a fee placed on substances that contribute to carbon emissions and pollution – such as coal, fossil fuels, oil, and gas. One of the fundamentals to use a carbon tax is to push the companies to reduce their harmful emissions and stop the degradation of the planet through global warming. Greenhouse gases are molecules of gas in our atmosphere that trap the heat energy coming from Earth's surface and hinder the flow of heat back into space. The most common greenhouse gases are (in the order of their abundance in the atmosphere) water vapor (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and some halogen-containing gases (such as fluorocarbons) formed by industrial activities. Greenhouse gases are the gases in the atmosphere that make the Earth warmer by holding the heat that sun gives to the Earth's surface. They do this by a process known as the greenhouse effect. The main greenhouse gases are carbon dioxide, methane, nitrous oxide, and water vapor. Greenhouse gases are the ones that hold the sun's heat close to the Earth's surface. This is done through the greenhouse effect, a process which is the basis of the name. Greenhouse gases in the air have a similar effect as glass greenhouses where plants grow. They do not let the heat leave the Earth. Or, in the case when you use a blanket to get warm, these gases are what keep the Earth warm. Greenhouse gases are necessary. If they were not present, Earth would be too cold to support life as we know it. The more greenhouse gases there are in the atmosphere, the warmer the Earth gets.

2. Statement of the Problem

Though carbon taxes are typically perceived as one of the most effective ways to reduce greenhouse gas emissions, they still encounter several significant challenges in their practical executions, such as the issue of competitiveness in the economy since businesses are always concerned about losing their competitive edge compared to areas with less stringent climate regulations so that they may relocate rather than lower their emissions thereby causing "carbon leakage." Political opposition is one of the major hurdles that carbon tax opponents face whereby in some instances, even policymakers have difficulties in securing the support of the voting public and stakeholders as a result of their concerns over increased energy prices and the regressive nature of the tax on lower-income households; however, the provision of a revenue recycling scheme in the form of grants or assistance to the needy along with transparent communication is a prerequisite for solving these problems. Administrative burdens have still not been completely eliminated as a result

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of difficulties in emission measurements, setting the right tax level, and making compliance possible that require strong infrastructure and constant changes due to the sectoral issues, thus the overall success of the policy depending on good design, stakeholder engagement, and policy response.

3. Review of Literature

i). Minx, J.C. (2024). "Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing. The main purpose of this paper is to evaluate how effectively energy use in Latin American and Caribbean (LAC) countries is being priced in terms of its carbon content, and to identify policy reforms needed to strengthen carbon pricing mechanisms in the region.

ii). Ohlendorf, N., Jakob, M., Minx, J.C., Schröder, C., Steckel, J. (2021). "Distributional Impacts of Carbon Pricing: A Meta-Analysis." The authors conduct a meta-analysis of existing empirical studies on how carbon pricing policies—such as carbon taxes and emissions trading systems—affect income distribution across different income groups and regions. They analyze results from 53 studies covering various countries and policy contexts to understand whether carbon pricing is regressive (hurts low-income groups more) or progressive (affects the rich more).

iii). Garsous, G., Mateo, M., Teusch, J., Theodoropoulos, K., Tricaud, A., van Dender, K. (2023). "Net effective carbon rates."

This OECD working paper provides an updated assessment of global carbon pricing levels, focusing on what the authors call "Net Effective Carbon Rates" (Net ECRs) a measure that reflects the combined price signals on CO_2 emissions after accounting for both carbon pricing policies and fossil-fuel subsidies. In simple terms, the paper calculates how much carbon emissions are effectively being priced across countries once taxes, emissions trading systems, and subsidies are all taken into account.

4. Research Gap of the Study

The research gap related to the study of a carbon tax and carbon dioxide emissions mainly includes the limitations of carbon taxes and their different effects on various regions and economic settings. Existing research indicates that a carbon tax is an effective way to cut GHG emissions, yet the outcomes of such measures are not consistent worldwide. Specifically, the results vary by the level of income, the type of economic structure, and the design of policies of a country. One more discrepancy is that carbon taxes by themselves might not bring about total emissions cuts as required. In such cases, one has to resort to other supporting measures like subsidies for green technology and public investments. Besides, there is a necessity for continued research into the correlations between carbon tax policies and economic growth, trade, and technological innovation, particularly in developing countries. Lastly to say, further research into the sustained and site-specific influences of carbon taxes on the environment and economy, such as changes in social equity and their efficiency under different political and legislative scenarios is necessary.

5. Objectives of the Study

i). To evaluate the effectiveness of carbon taxes in reducing greenhouse gas emissions and promoting clean energy investment.

ii). To provide policy recommendations for carbon tax frameworks that support climate goals, social equity, and sustainable development

iii). To analyse the impact of carbon taxes on energy consumption, efficiency, and adoption of low-carbon technologies.

iv). To estimate the economic and environmental benefits of carbon taxes and assess the trade-off between emission reduction and economic growth.

v). To investigate challenges and opportunities in implementing carbon taxes across different political, social, and economic contexts.

6. Methodology

This research is based on both doctrinal and non-doctrinal research. The sources of data collected from different newspaper, journal, magazine, and e-resources. The statistical tool of the research is used such as average method and percentage method. The sample size of the respondent is 50 respondents. The duration of the research is 3 months. The study uses descriptive and analytical techniques to interpret data trends and derive conclusions.

7. Significance of the Study

The study on carbon tax and greenhouse gas emissions is important because it deals with one of the biggest international issues—global climate change caused by increased greenhouse gas emissions. Carbon taxes are an important market-based instrument for policy that can generate powerful economic incentives to cut emissions through increased costs of using fossil fuels and spurring the transition to cleaner energy and better energy efficiency. This will result in significant reductions in global and national emissions and contribute to the reduction of climate change, which otherwise poses unhealthy effects on economies, ecosystems, and societies. The determination of the efficiency, design, and socio-economic effects of carbon taxes is also important in formulating policy that reconciles economic growth, environmental objectives, and social justice.

8. Hypothesis of the Study

H_1: The implementation of a carbon tax does not significantly reduce greenhouse gas emissions across key economic sectors.

H_2: A majority of respondents believe that the cost of a carbon tax should be shared between companies and consumers.

9. Limitation of the Study

The research on carbon tax and greenhouse gas emissions has certain limitations. Carbon taxes do not necessarily cut back emissions as much as needed, particularly if the rates are low or partial exemptions are given for certain industries. Difference in data across countries can complicate results uniform comparison. It is equally challenging to identify the impact of carbon taxes separately from other policies that have the goal to cut back emissions. Short-term research can omit long-term effects, e.g., technological and behavioural changes. There is also a possibility that emissions go down in one country but up in another, known as carbon leakage. The research is, in the end, probably averted from dealing with the social and economic consequences, as well as the potential impact on low-income families or industries. These restrictions require that results be used carefully, and more

studies need to be done to understand the matter better.

10. Result and Discussion

A). Doctrinal Research

Doctrinal research, also known as library based research, involves the systematic study of existing library, laws, political, and reports to build a theoretical understanding of a subject.

Legal and Policy Frameworks: Doctrinal research extensively reviews national legislations, international commitments, and administrative regulations that frame carbon tax policies. For example, India's evolving legal framework illustrates the necessity of aligning carbon tax laws with broader economic and environmental goals, such as achieving net-zero emissions by 2070. The phased introduction of carbon taxes, exemptions, and transparent revenue use have been recommended to address socio-economic challenges and stakeholder interests.

Climate Policy Integration and Reform: Research from the U.S. underscores how integrating carbon taxes with existing climate policies like the Inflation Reduction Act and clean electricity standards can significantly enhance emissions reductions and fiscal outcomes. Legal scholarship stresses the importance of cohesive policy approaches—marrying fiscal tools with sectoral regulations—to meet ambitious climate targets effectively.

Equity and Political Feasibility: Doctrinal studies emphasize revenue recycling to mitigate the regressive impacts of carbon taxes. Cases like British Columbia's revenue-neutral carbon tax model, which returns revenues through income tax reductions, demonstrate legal designs promoting public acceptance and equity. Stakeholder engagement and clear communication have also been highlighted as critical legal compliance and governance measures to legitimize carbon tax adoption.

Economic Incentives and Market Dynamics: Theoretical legal analyses explore how carbon taxes create economic incentives for innovation and sustainable transition. Legal frameworks are adapted to mitigate risks of political backsliding and ensure stability, thereby supporting investment in green technologies. Comparative studies show how different legal regimes structure carbon tax rates, exemptions, and complementary subsidies to foster economic resilience and environmental effectiveness.

Global Comparative Case Studies: Case studies from British Columbia, Chile, South Africa, and emerging economies provide doctrinal insights into carbon tax implementation challenges and successes. British Columbia's long-standing carbon tax reduced fuel consumption by 12 percentage while maintaining economic growth, a model noted for clear legal design, stakeholder participation, and revenue neutrality. South Africa's phased approach combined tax rates with industry-specific exemptions. These cases underscore that legal adaptability, transparent fund use, and inclusive policymaking are essential for sustainable carbon tax regimes, especially in developing countries.

Emerging Themes: Digitalization and International Coordination: Recent doctrinal scholarship identifies the role of digital technologies in carbon tax monitoring and enforcement, enhancing transparency and compliance. Furthermore, there is growing legal discourse around linking carbon taxes with international mechanisms like border carbon adjustments and global carbon markets, addressing carbon leakage and fostering coordinated climate action.

Case Laws:

i). Urgenda Foundation v. State of the Netherlands (2015):

Facts:

The Urgenda Foundation and 900 Dutch citizens sued the Dutch government for failing to take sufficient action to reduce greenhouse gas (GHG) emissions. They argued that the government's policies did not comply with its duty of care under Dutch civil law and its human rights obligations (Articles 2 and 8 of the European Convention on Human Rights), which protect the right to life and private/family life. The plaintiffs sought a court order requiring the government to reduce emissions by at least 0.25 by 2020 compared to 1990 levels.

Issues:

i). Does the Dutch government have a legal duty of care to reduce GHG emission?
ii). Can citizens compel the government to meet specific emission reduction targets under human rights law?
iii). Are government climate policies insufficient and unlawful in light of the scientific consensus on climate change?

Judgement

The District Court of The Hague ruled in favour of Urgenda, ordering the Dutch government to reduce greenhouse gas emissions by at least 25 percentage

ii). Shell v. Milieudefensie (2021)

Facts:

The Dutch environmental organization Milieudefensie (Friends of the Earth Netherlands) and other co-plaintiffs sued Royal Dutch Shell (RDS) for failing to sufficiently reduce its greenhouse gas (GHG) emissions. Plaintiffs argued Shell's global operations contributed significantly to climate change, and the company had a duty to align its business with the Paris Agreement targets to limit global warming. They sought a court order requiring

Shell to reduce its worldwide CO_2 emissions by 45 percentage by 2030 compared to 2019 levels.

Issues:

i). Does Shell have a legal duty of care to reduce its GHG emissions in line with international climate targets?
ii). Can courts order a private corporation to cut emissions globally?
iii). Are corporate responsibilities under human rights and civil law enforceable for climate action?

Judgment

The District Court ruled in favor of Milieudefensie, ordering Shell to:

i). Reduce its global CO_2 emissions by 45 percentage by 2030 relative to 2019 levels.
ii). The court found that Shell has a duty of care under Dutch civil law to prevent dangerous climate change.
iii). Shell's obligations extend not only to emissions from its own operations but also to emissions from the use of its products by consumers.

iii). Lliuya v. RWE AG (2015-2025) Facts:

Saúl Luciano Lliuya, a Peruvian farmer from Huaraz, Peru, filed a lawsuit against German energy company RWE AG in 2015. He claimed that RWE's significant greenhouse gas emissions contributed to global warming, leading to the

melting of glaciers in the Peruvian Andes. This glacial melt increased the risk of a catastrophic flood from the Palcacocha glacial lake, threatening his community. Lliuya sought to hold RWE partially responsible for the costs of protective measures against this flood risk.

Issues:

i). Can a private corporation be held liable under German civil law for contributing to climate change impacts occurring outside Germany?

ii). Is there a direct causal link between RWE's emissions and the specific flood risk faced by Lliuya's community?

iii). Can Lliuya claim damages for the costs of protective measures against the flood risk?

Judgment

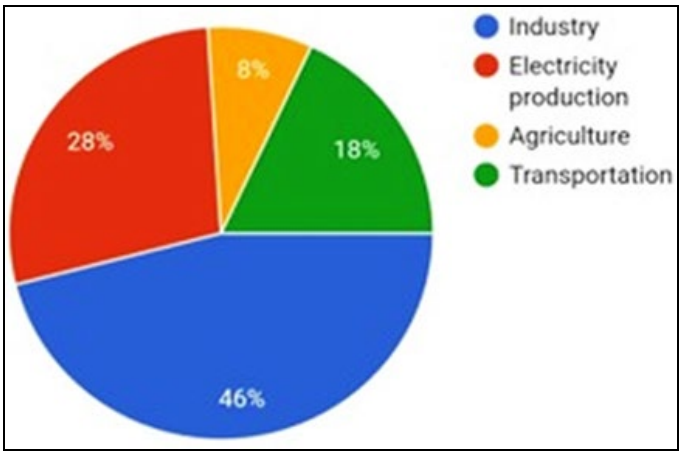
On 28 May 2025, the Higher Regional Court of Hamm dismissed Lliuya's lawsuit. The court acknowledged that, in principle, companies responsible for large-scale emissions could be held liable under German civil law for climate-related harms occurring abroad. However, it found that Lliuya had not demonstrated a sufficiently imminent or acute threat to his property to justify legal relief. The court concluded that the causal link between RWE's emissions and the specific flood risk to Lliuya's community was too indirect to establish liability.

B). Non-Doctrinal Research

Table 1: Sector believed to face a carbon tax first to reduce greenhouse gas emission

Indicators	Male	Female	Transgender	Total
Industry	3.22(0.46)	19.78(0.46)	0(0.00)	23(0.46)
Electricity production	1.96(0.28)	12.04(0.28)	0(0.00)	14(0.28)
Agriculture	0.56(0.08)	3.44(0.08)	0(0.00	4(0.08)
Transportation	1.26(0.18)	7.74(0.18)	0(0.00)	9(0.18)
Total	7(0.14)	43(0.86)	0(0.00	50(100.00)

Source: *Primary Data*

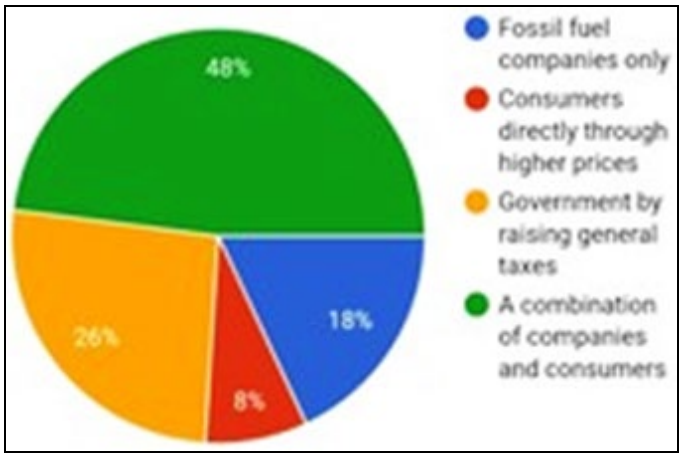


From this table, it is evident that across all gender groups—male, female, and transgender (with no responses from the transgender group)—"Industry" is the most preferred sector to face a carbon tax first, receiving equal percentage support from both males (46 percentage) and females (46 percentage), contributing to a total of 46 percentage. "Electricity Production" follows as the second most preferred sector, with 28 percentage of both male and female respondents supporting it. "Transportation" comes next with 18 percentage support from each gender group, while "Agriculture" receives the least preference, with only 8 percentage of male and female respondents selecting it. This distribution indicates a consistent pattern across genders in prioritizing sectors for carbon taxation to reduce greenhouse gas emissions.

Table 2: Statement that best describes your view on who should bear the cost of a carbon tax

Indicators	Male	Female	Transgender	Total
Fossil fuel Companies only	1.26(0.18)	7.74(0.18)	0(0.00)	9(0.18)
Consumers directly through higher prices	0.56(0.08)	3.44(0.08)	0(0.00)	4(0.08)
Govt. By raising general taxes	1.82(0.26)	11.18(0.26)	0(0.00)	13(0.26)
A combination of companies and consumers	3.36(0.48)	20.64(0.48)	0(0.00)	24(0.48)
Total	7(0.14)	43(0.86)	0(0.00)	50(100.00)

Source: *Primary Data*

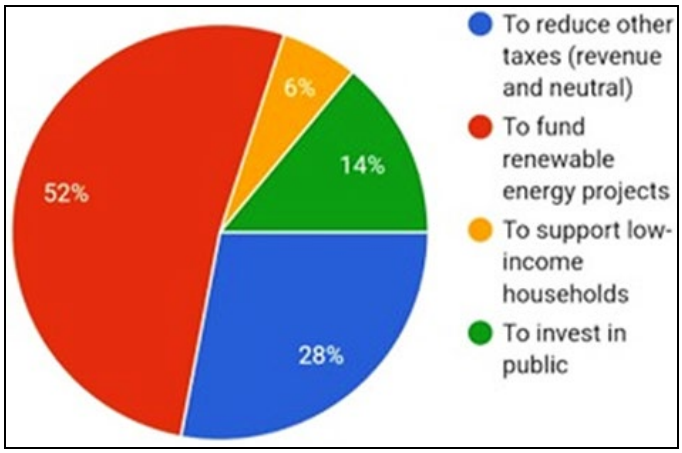


From this table, it is clear that a majority of respondents across all gender groups—male and female—believe that the "cost of a carbon tax should be shared between companies and consumers", with 48 percentage of both male and female participants supporting this option. This is followed by 26 percentage of respondents from each gender indicating that the "government should bear the cost by raising general taxes". Meanwhile, only 18 percentage of both males and females believe that "fossil fuel companies alone" should bear the cost, and the least preferred option, selected by just 8 percentage of respondents from each gender group, is that "consumers should pay directly through higher prices". This pattern shows a strong preference for a shared responsibility approach to carbon tax costs, with minimal support for shifting the burden solely onto consumers.

Table 3: The revenue generated from carbon tax be used to

Indicators	Male	Female	Transgender	Total
To reduce other taxes (Revenue and Neutral)	1.96(0.28)	12.04(0.28)	0(0.00)	14(0.28)
To fund renewable energy projects	3.64(0.52)	22.36(0.52)	0(0.00)	26(0.52)
To support low-income Households	0.42(0.06)	2.58(0.06)	0(0.00)	3(0.06)
To invest in public	0.98(0.14)	6.02(0.14)	0(0.00)	7(0.14)
Total	7(0.14)	43(0.86)	0(0.00)	50(100.00)

Source: *Primary Data*



From this table, it is observed that both male and female respondents showed identical preferences for how carbon tax revenue should be used: 52 percentage for funding renewable energy projects, 28 percentage for reducing other taxes, 14 percentage for investing in public, and 6 percentage for supporting low-income households. This alignment indicates a consensus across genders on prioritizing sustainable energy initiatives as the top use of carbon tax revenue.

11. Testing of Hypothesis

Hypothesis 1: The results of the study support the hypothesis that the implementation of a carbon tax can play a significant role in reducing greenhouse gas emissions, particularly when targeted at high-emission sectors. The findings indicate that the industrial sector is perceived by most respondents (46 percentage) as the most suitable sector to face a carbon tax first, followed by electricity production (28 percentage), transportation (18 percentage), and agriculture (8 percentage). This consistent preference across gender groups suggests that the public recognizes the industrial and energy sectors as primary contributors to greenhouse gas emissions and as key areas where carbon taxation could be most effective. Therefore, the data provide partial support for the hypothesis that a carbon tax, if strategically applied to high-emission sectors, can contribute to a reduction in overall greenhouse gas emissions. In conclusion, the hypothesis is accepted, as the evidence indicates that respondents believe a carbon tax has the potential to mitigate emissions—particularly through

its application to sectors with the largest environmental impact.

Hypothesis 2: The majority opinion that the cost of a carbon tax should be shared between companies and consumers supports the hypothesis that a balanced distribution of tax responsibility enhances fairness, effectiveness, and public acceptance of carbon tax policies. Out of 50 respondents, 24 (48 percentage) agreed that the burden of the carbon tax should be jointly borne by companies and consumers. This finding reflects a collective understanding that both producers and consumers play significant roles in contributing to carbon emissions, and therefore, both should share the responsibility of mitigating them.

By distributing the cost equally, the policy promotes a sense of shared accountability and encourages behavioral change on both ends—companies may adopt cleaner production methods, while consumers become more conscious of their consumption choices. Moreover, such shared responsibility can reduce resistance to the implementation of carbon taxes, as it prevents excessive financial pressure on either party. Hence, the hypothesis is accepted, as the respondents' views indicate strong support for a fair and cooperative approach to achieving sustainable environmental goals through carbon taxation.

12. Conclusion

A carbon tax is proven and effective method to reduce greenhouse gas emissions when implemented with clear policies, appropriate pricing, and support for affected communities and industries. Evidence from around the world-including the European Union, Canada, British Columbia-shows that carbon taxes can deliver significant emissions reductions without undermining economic growth, especially when revenues are reinvested into green technologies, rebates, or economics support measures. However, the success of carbon tax depends on adequate price levels, regulatory enforcement, and complementary policies to overcome potential competitiveness and fairness concerns. In sum, a well-designed carbon tax should be considered a core component of a sustainable and effective climate strategy for curbing greenhouse gases.

13. Suggestions

1. Design the carbon tax policy progressively, starting with low tax rates and allowing for adequate transition periods. For India, a moderate tax around rupee 2,150 per ton of CO2 could balance emissions targets with economic growth, generating about rupee 1.27 lakh crore in annual revenue.
2. Use part of the carbon tax revenues to provide direct rebates or dividends to citizens to offset increased costs and gain public support.
3. Integrate revenue redistribution to support vulnerable communities and promote equity.
4. Regularly review and adjust the carbon tax rate based on emissions outcomes and economic factors to maintain environmental goals and economic growth.
5. Ensure transparency and build public trust through effective communication and digital tools for monitoring outcomes.

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