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The Impacts of Imposing Carbon Taxes on Total Greenhouse Gas Emissions

Xinyuan Zhang[1,a,*]

[1]*Ulink College of Shanghai, Shanghai, 201615, China*
a. lynxinyuanzhang@gmail.com
**corresponding author*

Abstract: Carbon taxes are widely known as an effective way of reducing greenhouse gas emissions. This tax has been imposed in many countries and made huge progress. This paper focuses on the impacts of carbon taxes on total greenhouse gas emissions and figures out how those impacts are able to benefit the environment, economy, and society. In addition, this paper discusses the solutions to improve the total effect of these carbon taxes. Besides, this paper addresses the viable ways to achieve carbon taxes properly with reasonable approaches. The conclusion drawn from the work is that carbon taxes can potentially reduce total pollution in the future, but it still has some flaws, such as the competitiveness of industries. This paper points out what traits carbon taxes have in both positive and negative aspects. This paper also gives improvement methods for this policy and calls for attention to environmental issues.

Keywords: Carbon taxes, economy, industrial emissions

1. Introduction

Implementing carbon taxes, in light of technological advancements and industrial growth, represents a viable approach to address and reduce greenhouse gas emissions. This approach demonstrates significant potential in generating heightened social and economic value while concurrently mitigating the emission of greenhouse gases. Despite this, the implementation of carbon taxes continues to be observed. Therefore, it is imperative to implement these measures more comprehensively across nations and jurisdictions as a pivotal step towards effectively mitigating the severe impacts of climate change.

2. Background on carbon taxes

Greenhouse gases, including carbon dioxide, methane, nitrous oxide, and F-gases [1], cause changes in global temperatures and burdens on the economy, humans and the whole of nature. A carbon tax is a tax levied on the carbon emissions required to produce goods and services. Carbon taxes impose a financial burden on fossil fuels commensurate with their carbon content, thereby establishing a monetary value for carbon. The more carbon dioxide released when the fuel is burned, the higher the tax. They provide a financial incentive for individuals and businesses to shift away from carbon-intensive fuels and reduce their CO2 emissions. The increased cost drives demand down. The emitters can either pay their carbon prices or lower their emissions.

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3. Evidence that carbon taxes reduce emissions

Carbon taxes have been implemented in numerous countries and jurisdictions globally, including Canada, Europe, and certain regions of the United States. They are garnering support as a solution based on market principles. Up until now, there are 27 countries with significant carbon tax [2]. Carbon taxes have the potential to effectively mitigate emissions. British Columbia introduced a carbon tax policy in 2008. Figure 1 shows the change in total refined petroleum product use in British Columbia and the Rest of Canada from 1995 to 2014. The policy imposes supplementary taxes on fossil fuels consumed for electricity generation, household consumption, and transportation. Meanwhile, it aims to decrease both personal income taxes and corporate taxes. After five years, specifically in 2013, this policy demonstrated significant success. Fossil fuel consumption had dropped 17.4% per capita. By 2015, emissions had declined by 12.9%, while the province's GDP grew by 17.4%. Compared to the Rest of Canada at the same time, British Columbia had less total refined petroleum product use.

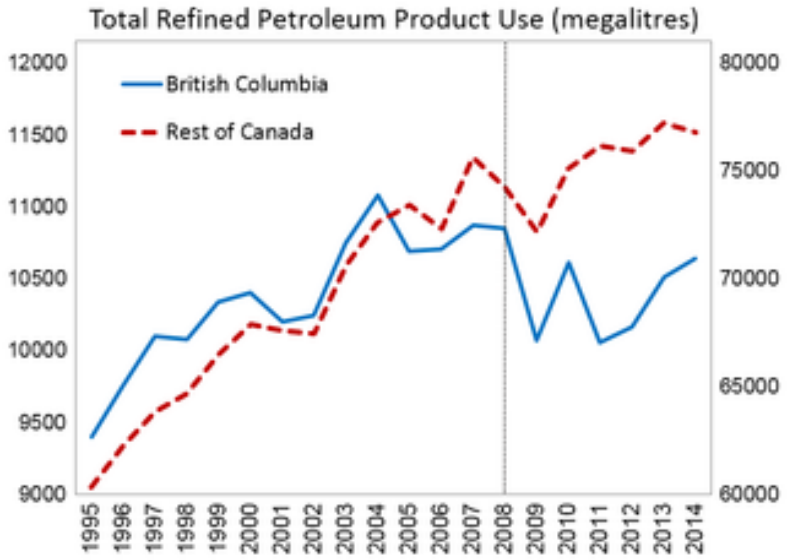

Figure 1: British Columbia's total refined petroleum product use from 1995 to 2014.

For Sweden, it instituted a carbon tax in 1991. Sweden had the highest carbon tax rate in the whole world. Figure 2 shows the decline in greenhouse gas emissions in Sweden from 1990 to 2015. As a result, national carbon emissions have been declining. Between 1990 and 2019, Sweden's GDP per capita increased by more than 50 percent, while the total greenhouse gas emissions decreased by about 27 percent [3].

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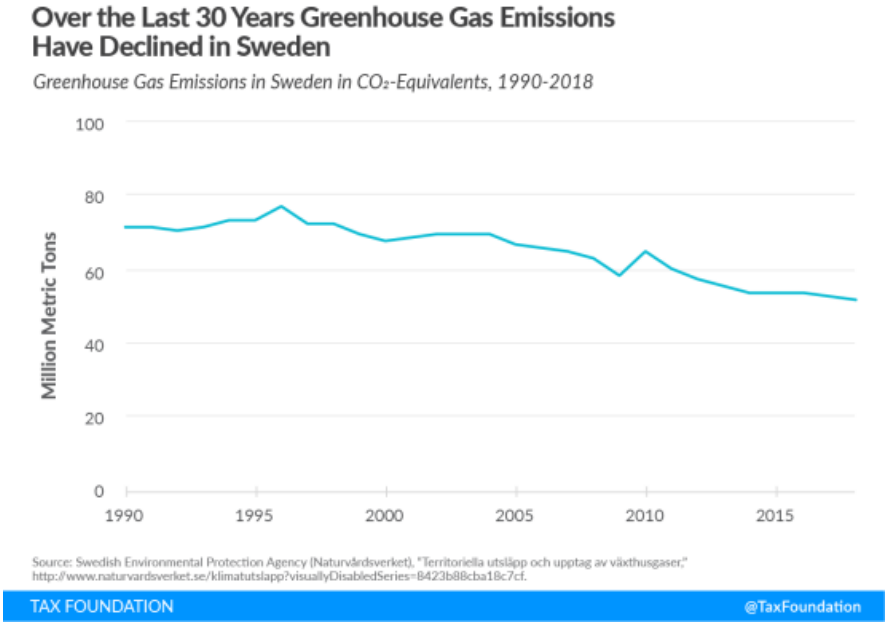

Figure 2: Greenhouse gas emissions in Sweden from 1990 to 2015.

The Regional Greenhouse Gas Initiative, a cap-and-trade program in the northeast U.S., since the start of this program in 2009, achieved a reduction of over 40% carbon emissions in the power sector. The state with this program had a growth in economies of 21.2% [4].

4. Benefits of Carbon Taxes

Carbon taxes have many benefits. To commence, the revenue derived from carbon taxes has the potential to be redistributed to taxpayers in a manner that ensures revenue neutrality. The majority of nations have integrated the money generated by carbon taxes into their overall budgets and then allocated them as rebates, with the aim of preserving the fiscal neutrality of the carbon tax.

The United Kingdom utilizes three strategies to accomplish tax reimbursement. Firstly, it reduces the national insurance payments made by businesses on behalf of their employees. Secondly, it enhances investment subsidies for energy-efficient and eco-friendly technology. Lastly, it establishes a carbon fund.

Funds can also be allocated to support initiatives such as renewable energy, public transit, and environmental restoration. Based on one research conducted, providing these services without any cost has resulted in a reduction in residential energy emissions by 13.4 percent and vehicle fuel emissions by 23.8 percent [5]. Implementing a carbon price holds the potential to alleviate the detrimental impacts of climate change on the environment. Using funds generated from carbon taxes could potentially support the implementation of eco-friendly energy sources and the developing of complementary public transportation systems. This, in turn, could result in a significant reduction in greenhouse gas emissions originating from residential areas.

Next, a carbon tax can encourage emissions reductions across the entire economy. The carbon tax is an economic policy tool to address environmental concerns by reducing glasshouse gas emissions [6]. The primary objective of this initiative is to internalize the costs related to environmental damage, thereby influencing decisions regarding pricing. The carbon tax mechanism does not limit the overall quantity of emissions. The implementation of price intervention facilitates economic actors in optimizing their production and operational practices, aiming to reduce carbon emissions. The

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implementation of a carbon price has the potential to significantly mitigate emissions by altering a range of industrial-technological initiatives.

Carbon taxes are simple and cost-effective to implement compared to cap-and-trade or regulations. Implementing a carbon tax involves directly taxing glasshouse gas emissions, wherein enterprises must remit a fee of $1 per metric ton of carbon dioxide released. A cap-and-trade system allocates a certain quantity of "allowances" annually [7]. Implementing carbon taxes is made easier by their compatibility with existing tax systems, eliminating the necessity of creating new infrastructure to support permit trading. This implies that within the broader economic context, the implementation of a carbon tax has the potential to provide greater reductions in glasshouse gas emissions compared to other climate initiatives while maintaining a comparable cost [8].

Additionally, carbon taxes provide market certainty and incentives for investments in clean technology. Carbon prices are also vital for hastening the adoption and spread of new, greener technology. Existing fossil fuel firms and the sectors that rely on their products will fight change if oil, gas, and coal prices stay artificially low. Companies may not embrace new technology if costly, even if it considerably lowers pollution. A carbon tax might solve this issue in part by boosting the price of polluting energy sources and increasing private profits from energy efficiency and low-carbon energy development.

5. Design Considerations for Carbon Taxes

Despite all those benefits, carbon taxes require cautious implementation. Still, many considerations about carbon taxes should be taken into account. A policy should be as reasonable as possible.

Firstly, it is necessary for carbon taxes to start low and increase gradually over time. A progressive increase in carbon taxes will effectively reduce the demand for emissions over time. Producers may choose to use renewable energy or just cut the emissions accordingly to reduce costs in order to maintain profitability. However, overall costs could increase and cause producers to raise their prices in order to earn more profit. If the costs outweigh the environmental benefits, emissions reductions could not be achieved.

Next, it is important to use the tax revenue to help offset impacts on low-income households. According to the data from WHO released by 2021, more than 7.3 billion people are affected by unsafe air pollution. About 80 percent live in low-income and middle-income households [9]. On the other hand, people from low-income areas lack access to clean or less-pollution energy. People are not equally affected by air pollution, and some are more vulnerable. They even could get asthma due to the strong health risks of air pollution [10].

Furthermore, fostering collaboration across diverse jurisdictions would promote the implementation of the carbon tax. In order to effectively implement a comprehensive policy, it requires coordination across various states. By promoting coordination among these jurisdictions, the efficacy of carbon taxation could be achieved.

6. Addressing Counter-Arguments

Every coin has two sides. The disadvantages of carbon taxes need to be taken into account. Carbon taxes may hurt competitiveness. One perspective posited that introducing a carbon tax may result in carbon leakage and issues related to competitiveness. This refers to the phenomenon wherein enterprises with high carbon emissions relocate their production activities to other countries or regions or where domestic products experience a decline in competitiveness [11].

Consequently, this could potentially undermine the economic interests of the nation. However, these problems can be resolved. Consideration should be given to adopting policies coordinated with those of other countries. This is important in order to avoid issues related to carbon displacement and

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competitiveness. One possible solution is to establish a carbon tax trade agreement [12]. This agreement would ensure that businesses in all countries are subject to the same carbon tariffs, thus reducing trade distortions caused by competitiveness. On the other hand, enterprises can enhance their competitiveness by adopting low-carbon technology and implementing stronger environmental protection measures. This will help reduce their dependence on carbon taxes.

Secondly, it is possible that revenue-neutral design offsets economic impacts. Despite generating controversy, carbon tax offsets seem to have a discernible influence on the overall carbon footprint of both people and corporations. These carbon offsets are acquired through non-profit entities that allocate the proceeds towards mitigating or eliminating certain quantities of greenhouse gases from the Earth's atmosphere. Carbon taxes have the potential to generate substantial government funds, which may be used to mitigate the adverse economic consequences resulting from increased gasoline costs [13]. One potential approach governments may use is using the monies generated by carbon taxes to alleviate the tax burden on individuals.

The available data are hard to support that carbon taxes significantly impact GDP growth. The relationship between carbon emission reduction and GDP growth has always been the subject of divergent opinions, as well as concerns and anxieties that drastic emission reductions will harm economic development. There are two aspects to the effect of carbon tax on economic development. A carbon tax will, on the one hand, diminish the incentive for private investment and inhibit economic expansion [14]. On the other hand, carbon taxation can augment government revenue, broaden the scope of government investment, and stimulate economic expansion [15]. When viewed from a temporal perspective, the carbon tax will have an immediate impact on the prices of related products, thereby reducing consumer demand and consequently impeding economic growth. However, the carbon tax will foster the development of related alternative products, lower environmental management expenses, and foster the growth of a healthy economy over the medium and long term [16].

Transitioning workers from carbon-intensive industries to other sectors is even more challenging. The shift from a high-carbon economy to a low-carbon industry can be tackled through subsequent measures and recommendations. Firstly, it is imperative for the government to adopt various measures, including the implementation of restrictions and effluent fees on high-carbon industries, as well as the introduction of suitable economic support policies. These actions are necessary to incentivize businesses and individuals to shift towards low-carbon industries. Additionally, it is imperative to incentivize businesses to enhance their investments in new energy vehicles and renewable energy sources. This approach will facilitate the development and widespread implementation of related technologies. Thirdly, it is imperative to promote the active involvement of financial institutions in investment and financing endeavors within low-carbon industries while concurrently establishing a robust and reliable low-carbon financial system. By implementing green credit, green bonds, and other financial instruments, enterprises transitioning towards low-carbon industries will be provided financial support.

7. Call for Wider Adoption of Carbon Taxes

Carbon taxes have been shown to effectively reduce emissions, as evidenced by numerous studies and real-world examples. Research suggests that implementing such taxes serves as a motivating factor for businesses and individuals to actively mitigate their carbon footprint, as it imposes a financial burden on emissions. Countries such as Sweden and Canada have observed substantial reductions in emissions following the implementation of carbon taxes, thereby supporting the efficacy of such measures.

The imperative to enhance the implementation of carbon pricing mechanisms is of utmost importance in pursuing our climate objectives. Failing to achieve significant reductions in greenhouse

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gas emissions exposes society to the severe and potentially irreversible consequences of catastrophic climate change. The implementation of carbon pricing plays a crucial role in addressing the crisis by providing a market-driven approach that incorporates the actual costs of emissions. This approach serves as a potent catalyst for driving change, encouraging the adoption of cleaner technologies and the incorporation of sustainable practices across various industries. By implementing a financial mechanism that assigns a monetary value to emissions, carbon pricing incentivizes businesses and individuals to reassess their carbon footprint and adopt environmentally conscious behaviors. Engaging in such actions, not only serves to alleviate the negative consequences of climate change but also drives us toward a future that is environmentally sustainable.

Coordination among jurisdictions plays a pivotal role in ensuring the effectiveness of carbon taxes. A coordinated approach is essential to prevent businesses and individuals from easily transferring their emissions to regions with less stringent regulations. When multiple regions or countries adopt carbon pricing mechanisms, it facilitates equitable treatment, mitigates carbon leakage, and cultivates a fair, competitive environment for businesses, thereby stimulating enhanced global reductions in emissions. Taking immediate action is crucial in order to prevent the long-term entrenchment of high levels of emissions. Delaying the implementation of carbon taxes may result in allocating resources towards developing carbon-intensive infrastructure and technologies, which could pose challenges regarding future reversibility. By taking proactive measures, we can circumvent the lock-in effect, facilitate a seamless shift towards cleaner alternatives, and substantially mitigate the enduring environmental and economic ramifications linked to climate change.

8. Conclusion

All things considered, carbon taxes are highly effective and efficient in mitigating emissions and promoting the adoption of cleaner energy resources. According to various reports, the implementation of carbon taxes has the potential to effectively mitigate pollution levels and stimulate the advancement of cleaner energy sources. Based on the current circumstances, there is evidence to suggest that global warming is likely to worsen. There is an urgent imperative to implement carbon taxes more extensively in order to attain climate objectives and mitigate greenhouse gas emissions.

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