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Обзор инструментов политики для снижения рисков изменения климата

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Эта статья призвана помочь лицам, принимающим решения, с выбором политики в области изменения климата, исследуя ключевые характеристики, различия, и сходства между существующими для этого инструментами.

Ключевые слова: изменение климата, климатическая политика, сокращение выбросов парниковых газов, анализ политики с использованием критериев множественных атрибутов

An Overview of Policy Instruments for Climate Change Mitigation

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This paper attempts to help decision-makers with climate policy choice by examining the key design characteristics and trade-offs between different policy instruments.

Keywords: climate change, climate policy, greenhouse gas emission reductions, multi-attribute policy analysis

Scientists have warned that urgent climate policy responses are required to lower climate change risks. However, most governments have been failing to significantly reduce emissions, accelerating the rate of future extreme climate change events. Most non-compulsory instruments appear to have higher costs and lower emission reduction potential than carbon taxes, regulations, and cap-and-trade. Although carbon taxes are economically efficient and environmentally effective, they are lacking political acceptance and therefore less likely to be implemented. Cap-and-trade systems are administratively complex and can have many design loopholes lowering their effectiveness. In contrast, regulatory instruments are highly acceptable, easy to administer, and can be designed to achieve substantial emission reductions at moderate costs. Therefore, policy-makers can be advised to implement climate regulations to address the urgent need for climate change mitigation.

1. Introduction

The recent 2013 report of the Intergovernmental Panel on Climate Change (IPCC) concludes that human activities, such as combustion of fossil fuels and land use changes, are increasing greenhouse gas (GHG) emission concentrations at an unprecedented rate, resulting in dangerous climate change. Some of the observed impacts of climate change include intense heat waves and associated human deaths in Europe in 2003 and Eastern Russia in 2010; increased occurrence and intensity of storms and floods, such as hurricane Sandy in Eastern North America in 2012 and a recent typhoon Haiyan in Philippines; draughts in India and sub-Saharan Africa; melting glaciers and rising sea level; loss of biodiversity and destruction of ecosystems (McMichael et al., 2006; The Guardian, 2012; Munich Climate-Insurance Initiative, 2013). All of these impacts impose significant costs on economies of both developed and developing countries where the latter suffer the most.

Although the majority of countries recognize the importance of mitigating climate change, most governments have been unsuccessful in implementing climate policies that significantly reduce GHG emissions. This paper attempts to review the key challenges most policy-makers face when choosing among different policy instruments. Specifically, the study's objectives are the following:

1. Review the key types of climate policies, including voluntary programs, direct government actions, subsidies, carbon taxes, regulations, and cap-and-trade.
2. Assess these policies against the traditional multi-attribute criteria of environmental effectiveness, economic efficiency, administrative feasibility, and political acceptance.

The rest of this paper is organized as follows. Section 2 describes they key design characteristics of the six aforementioned policy types. Section 3 defines the multi-attribute policy evaluation criteria and assesses all six policies against the criteria. Based on this analysis, Section 4 summarizes the key trade-offs between different types of climate policies and provides policy recommendations in light of the urgent need for climate change mitigation.

2. Climate Policy Types: Design Characteristics

Most climate policies can be divided into two broad categories - incentive-based instruments and regulatory instruments (Goulder and Parry, 2008). Incentive-based instruments are designed to offer an incentive to individuals and businesses to decrease their emissions by minimizing fuel consumption, improving fuel efficiency, and switching to lower emission technologies. These policies typically include voluntary programs, subsidies, carbon taxes, and cap-and-trade systems. Regulatory instruments impose specific requirements on technologies or limits on emissions, with non-compliance resulting in substantial fines. Direct government actions represent a separate type of policies that include government investments in GHG-reducing activities. Another way to categorize climate policies is by the degree of their 'compulsoriness' or ability to impose a real price on

emissions that results in higher GHG reductions over time. As such, voluntary programs, direct government actions, and subsidies are generally less compulsory than carbon taxes, cap-and-trade, and conventional regulations.

2.1 Voluntary programs

Voluntary programs intend to encourage individuals and companies to voluntary change their behaviour and/or technologies to reduce emissions. Voluntary programs include information programs and moral suasion programs. Information programs describe how households and businesses can benefit from adopting environmentally friendly behaviors or purchasing low emission technologies. For example, energy efficiency labels attached to most of the new kitchen appliances inform potential buyers about environmental 'friendliness' of technologies. Public information on government websites, TV, or newspapers, that emphasizes GHG reductions and cost savings from electricity conservation, attempts to influence people to make behavioural changes, such as taking shorter showers and setting thermostats to lower temperatures in the winter, or technological changes, such as purchasing efficient light bulbs and installing heat pumps.

The second type of voluntary programs is moral suasion programs that try to convince polluters to pay extra money by making them feel responsible for their emissions. One example is asking companies to produce corporate social responsibility reports explaining how GHG emissions are reduced each year. Another example is promoting green consumerism to encourage purchasing recyclable goods and organic foods.

2.2 Direct Government Actions

Direct government actions are government investments in public assets to reduce GHG emissions through technological or behavioural changes. These assets include public buildings, equipment, and other infrastructure, as well as government employees. Direct government actions in sustainable development are popular in the European Union and Canada.

2.3 Subsidies

Subsidies represent financial rewards that promote adoption of low emission technologies through the provision of grants, tax incentives, and loans. Some examples of subsidies include rebates for purchasing highly efficient or zero emission vehicles (e.g., electric or hybrid vehicles) and loans with low interest rates for home renovations, such as insulation of walls and windows.

2.4 Carbon taxes

Carbon tax is a tax paid on the amount of GHG emissions released from fossil fuel combustion or other emitting activates, such as land use changes and livestock. Carbon taxes increase private costs of polluting activities so that they equal social costs. By raising the cost of production, carbon taxes drive the production of polluting goods and services down and reduce GHG emis-

sions. Firms and households have two choices: (1) to reduce emissions when the cost of emission reductions is less than paying the tax, or (2) to pay the tax when the cost of emission reductions is higher than the tax rate.

2.5 Conventional regulations

Conventional regulations are requirements to meet specific performance levels or adopt specific technologies or fuels, with non-compliance leading to rigid penalties. Those regulations that set specific limits on the amount of GHG emissions released into the atmosphere are known as emission performance standards. These standards are usually expressed in rates of emission discharge per unit of time or per energy produced from certain equipment or activities. Governments can also implement technology or fuel standard that set specific rules on technologies, processes, or fuels. For example, most countries require capturing sulphur dioxide from coal power generation.

2.6 Cap-and-trade systems

Cap-and-trade systems combine the use of standards with the creation of a market for trading rights to emit GHGs. Government sets an overall pollution limit known as cap and creates permits equivalent in quantity to the as a cap. These permits are allocated to emitters through grandfathering (i.e., based on past emissions) or auction. Once permits are distributed, emitters can buy and sell permits from/to each other, therefore establishing a pollution market. Similar to carbon taxes, cap-and-trade systems provide two choices: (1) to reduce emissions if the cost of abatement is less than paying the permit price, and then sell the surplus permits to firms with higher abatement costs, or (2) to buy permits from others when abatement costs are higher than the permit price.

3. Multi-Attribute Policy Analysis

To compare the six listed climate policies, the traditional multi-attribute policy criteria were applied. Specifically, the criteria included environmental effectiveness, economic efficiency, administrative feasibility, and political acceptance (Harris and Roach, 2013). The criterion of environmental effectiveness implies the amount of annual GHG reductions that will likely be achieved from each climate policy over time. Economic efficiency is the marginal cost of GHG emission reductions due to each policy. Administrative feasibility represents the administrative complexity and costs associated with implementation and operation of each policy. Finally, the criterion of political acceptance relates to the extent to which a policy does not provoke resistance from the general public and interest groups, and thus is easy to implement. Due to the theoretical nature of the analysis, each criterion is measured on a qualitative scale ranging from "low" to "medium" and "high".

3.1 Environmental Effectiveness

All non-compulsory policies, including voluntary programs, direct government actions, and subsidies, score "low" on environmental effectiveness due to their inability to impose a real price on GHG emissions and enforce economy-wide compliance (Jaccard, 2006). They often give a false sense that some actions to reduce climate change are taken but, in fact, delay other more effective policies. Voluntary programs do not guarantee any GHG reductions because they lack enforcement. Direct government actions are limited in their effectiveness because governments control only certain parts of the economy and are characterized by inflexible bureaucratic processes. The environmental effectiveness of subsidies is suppressed by free-ridership, which occurs when a person or company receives a subsidy for actions that he/she was going to undertake anyway, without any payments. As a result, subsidies do not elicit many additional GHG reductions.

Carbon taxes, if set at a high enough rate and applied widely to all polluters and GHG emissions, can result in significant emission reductions because they provide a price incentive to reduce emissions. As long as emission reductions are cheaper than paying the tax, individuals and businesses will be decreasing their fuel consumption, improving fuel efficiency, or purchasing low emission technologies. However, if the tax is too low or has lots of exemptions, its effectiveness will be reduced. Also, by setting an emissions price, carbon taxes do not provide much certainty about the amount of potential emissions reductions. In contrast, conventional regulations provide more certainty about the amount of GHG reductions by setting specific emission limits or technology requirements. However, regulations do not provide any incentive to reduce emissions beyond the required amount. Cap-and-trade systems combining elements of carbon taxation and regulation can be effective if the cap is set high enough to match an emissions target, which provides certainty about emission reductions, and if the policy is designed to eliminate possible speculations in the permit trading market and other loopholes. Overall, carbon taxes, regulations, and cap-and-trade are significantly more effective than non-compulsory policies but could be limited in effectiveness by design. For these reasons, they score "medium - high" on environmental effectiveness.

3.2 Economic Efficiency

The economic efficiency of non-compulsory policies is usually "low." Voluntary programs result in low response and thus considered expensive to society. With direct government actions and subsidies, governments have to choose which technologies or industries to subsidize or invest into. But because governments have complex bureaucratic processes and do not possess perfect information about most efficient investments, the economic costs of direct government actions can be high. Subsidies tend to inefficient due to free-ridership issues, when payments are given to those who would have reduced emissions anyway. Additionally, subsidies require collection of revenues from other sources (usually via additional taxation), which minimizes their economic efficiency.

Carbon taxes are considered highly efficient because, according to the equi-marginal principle, they motivate each agent in the market to reduce emissions up to the point where the marginal costs of reductions for every agent are equal, and therefore total costs of abatement are minimized (Goulder and Parry, 2008). If revenues from a carbon tax are recycled in the economy through other tax cuts, the policy generates additional economic benefits by reducing dampening effects of other taxes on economic growth (known as a double dividend). Cap-and-trade, similar to carbon taxes, meets the equi-marginal principle by motivating polluters to reduce emissions up to the point where it becomes cheaper to pay the permit price. Therefore, cap-and-trade scores "high" on economic efficiency. In contrast, conventional regulations tend to be inefficient because they require identical management and technology choices by all agents, whose costs of compliance can differ significantly due to dissimilar sizes of operations, technologies in-place, and financial situation (Jaccard, 2006). However, regulations can be designed to be less technology specific to increase their efficiency. For example, a requirement to generate zero emission electricity allows companies to choose the least expensive electricity sources and technologies. Hence, regulations are assessed "low-medium" against the criterion of economic efficiency.

3.3 Administrative Feasibility

Most climate policies, except cap-and-trade, score "high" on administrative feasibility. Voluntary programs, direct government actions, subsidies, and regulations are common policy instruments for most societal issues. These policies have been used extensively in the past and do not require additional administrative skills or resources. Carbon taxes are administratively simple because their provisions of collection and remittance usually reflect the provisions applied to fuel taxes existing in most regions of the world. Specifically, governments collect carbon taxes from wholesalers, wholesalers from retailers, and retailer from final consumers. Cap-and-trade scores "low" on administrative feasibility because it involves many complex procedures, such as establishing the cap, issuing and distributing permits, and monitoring permit trading to avoid speculations and market instabilities.

3.4 Political Acceptance

If government expenditures are not significant, voluntary programs, direct government actions, and subsidies policies are highly acceptable by politicians because they do not impose any compulsory actions on individuals and companies. For this reason, these policies have been extremely popular in most countries in the last two decades.

Carbon tax is not favored by politicians due to high levels of public and stakeholder resistance to the policy. High resistance could be attributed to the tax's cost visibility and public bias towards taxation (Caplan, 2007). Thus, the policy scores "low" on political acceptance. In contrast, regulations could be preferred over carbon taxation when urgent actions are required to mitigate climate change (Borick et al., 2010). Costs of regulations are usually hidden and are not easily un-

derstood by the general public (Rhodes and Jaccard, 2013). However, regulations are criticized by some interest groups for their inflexibility and high upfront costs. Therefore, regulations score "medium" on political acceptance. Cap-and-trade systems are usually preferred by businesses because the emissions price is determined by the market, but the policy is criticized for its administrative complexity and potential design loopholes. For these reasons, cap-and-trade is rated "medium" on the criterion of political acceptance.

4. Conclusion

The purpose of this paper was to describe and compare different types of climate policies. Table 1 summaries the assessment of policies.

Table 1. Summary of Policy Assessment

	Environmental effectiveness	Economic efficiency	Administrative feasibility	Political acceptance
Voluntary programs	Low	Low	High	High
Direct gov't actions	Low	Low	High	High
Subsidies	Low	Low	High	High
Carbon tax	Medium-High	High	High	Low
Regulations	Medium-High	Low-Medium	High	Medium
Cap-and-trade	Medium-High	High	Low	Medium

Our analysis shows that policy-makers face multiple trade-offs when choosing among policy options. While non-compulsory policies are simple and acceptable, they are inefficient and ineffective in reducing emissions. Giving the urgent need for GHG reductions, policy-makers could be advised to design and implement effective compulsory policies. Unfortunately, high resistance to carbon taxes may not allow the policy to endure for a long period of time and achieve necessary reductions. As a result, politicians are left with two policy choices - regulations and can-and-trade. Because cap-and-trade takes long time to design and requires stringent monitoring, regulations may be an easier option. If regulations are designed to allow market flexibility (i.e., by not prescribing particular technologies), they may score well against all of the above criteria and be a critical tool in mitigating devastating impacts of climate change.

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