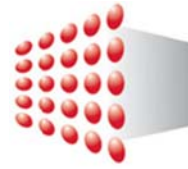


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## REVIEW ARTICLE

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## Taxing Questions on the Carbon Challenge

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## **ABSTRACT**

*Any regime to control greenhouse gases will require a price to be placed on emissions. This will create the economic signals necessary to change consumer behaviour and ultimately to favour products with smaller carbon footprints. There are two main ways to price carbon emissions: carbon tax and cap-and-trade. Costs will rise in both cases. World leaders will meet in Copenhagen next week to determine a successor framework to the Kyoto Protocol. When implemented properly, a carbon tax or a cap-and-trade system - or a combination of both - will work. But whatever approach policymakers adopt, it will turn out to be either overly lax or overly stringent, depending on the developing science of climate change and what we learn about global warming. Whatever regime we adopt, it will have to be tweaked as more information becomes available.*

## **KEY WORDS**

*Carbon Tax, Cap and Trade, Price on Carbon Emissions*

1. The global effort to reach a consensus on climate change is fraught with uncertainty. In its 2007 Climate Change synthesis report, the Intergovernmental Panel on Climate Change asserted that humans had caused carbon to accumulate in the atmosphere and that there was an urgent need to cut greenhouse gas emissions to avoid global warming. But there are still sceptical scientists who question if climate change is anthropogenic. Adding to the confusion are the effect of economic growth and population growth rates on carbon emissions and the viability of technologies to cut greenhouse gas emissions, to list just a few.
2. Any regime to control greenhouse gases will require a price to be placed on emissions. This will create the economic signals necessary to change consumer behaviour and ultimately to favour products with smaller carbon footprints. Unfortunately, this will also push up costs.
3. There are two main ways to price carbon emissions. One, the carbon tax regime, requires the government to set the price of carbon emissions but relies on the market to determine the level of emissions. The other, the cap-and-trade mechanism, requires the government to decide the level of carbon emissions but allows the market to settle on the price of the carbon to be emitted. Costs will rise in both cases.
4. Carbon taxes are already levied in various forms around the world – including in Finland, Sweden and Britain. Boulder in the United States has a tax on carbon emissions from electricity generation, while Quebec in Canada has a tax on hydrocarbons. France recently announced plans for a new carbon tax next year.
5. The uncoordinated implementation of carbon taxes could lead to a situation where companies simply move their operations to countries that allow more carbon to be

- emitted. To prevent this, the carbon penalty has to be imposed equally in all countries and across all economic sectors.
6. It is necessary to distinguish between an energy tax and a carbon tax. Many countries already have a tax on fuels such as petrol and diesel. Energy taxes are commonly used to generate tax revenue, without regard to how much carbon is produced. A carbon tax would be applied specifically to make products with a high carbon footprint less attractive than those with a smaller one. Such a tax will use the carbon content of a good or service as the basis for determining the levy.
  7. How would carbon pricing affect cost if it is implemented here? If the price is set at US\$30 per ton of carbon emissions, Singaporeans can expect to pay a carbon tax of S\$0.0205 per kilowatt-hour (kWh) of electricity generated by natural gas, whereas electricity produced using fuel oil (which has a higher carbon content) would be taxed at S\$0.0297 per kWh. In this example, a carbon tax would increase the price of electricity by 9-13 per cent, depending on the fuel type.
  8. One argument in favour of such a tax is that it would help mitigate the costs of developing alternative energy sources such as solar. However, going by the International Energy Agency's Projected Costs of Generating Electricity study, such a tax will not make solar energy cost-competitive any time soon, given the current state of the technology.
  9. The other main method of pricing carbon is the cap-and-trade mechanism. The Kyoto Protocol, which came into force in 2005, committed most developed nations to a cap-and-trade system for the six major greenhouse gases.

10. At present, the European Union Emissions Trading Scheme is the largest multi-national trading platform, with 25 members of the European Union participating. Other countries, such as the United States, Australia and New Zealand, are in various stages of preparing their own cap-and-trade mechanisms.
11. Under such a system, governments avoid the onerous task of directly setting a carbon price though they will have to determine caps or limits for carbon emissions, which will in turn affect the carbon price. The mechanism will require companies to bid for permits to emit carbon. Companies can then trade their permits. In keeping with the forces of supply and demand, a low carbon cap will mean a higher carbon price.
12. Just as key domestic industries lobby for tax exemptions for themselves, the same may happen in a cap-and-trade system. Indeed, to mitigate the impact of cap-and-trade on economic competitiveness, governments have resorted to various measures, including exempting vulnerable sectors from having to auction for permits. Is one mechanism better than the other? One major criticism of carbon taxes is that they are unable to direct the world towards a specific carbon emissions target. A cap-and-trade system appears to offer the certainty of capping carbon emissions.
13. World leaders will meet in Copenhagen next week to determine a successor framework to the Kyoto Protocol. When implemented properly, a carbon tax or a cap-and-trade system – or a combination of both – will work. But whatever approach policy-makers adopt, it will turn out to be either overly lax or overly stringent, depending on the developing science of climate change and what we learn about global warming. Whatever regime we adopt, it will have to be tweaked as more information becomes available.

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Dr Chang teaches Energy Security to graduate students and Energy Economics to undergraduate students at NTU. Prior to this, he taught Resource and Energy Economics, Environmental Economics, Macroeconomics, Principles of Economics, and Economics of the Environment from 1999 to 2007 at the National University of Singapore. He has conducted courses for government officials from the region and the world at the Singapore Environment Institute (SEI), the Ministry of the Environment and Water Resources (MEWR) and has been invited to speak at numerous energy workshops, conferences and seminars, including the 7<sup>th</sup> East Asia Summit Energy Cooperation Task Force Meeting in Seoul in June 2008.

Dr Chang specialises in the economics of climate change, the economics of renewable resources, energy and security, oil and economy, and electricity market deregulation. His current research interests are oil price fluctuations and macroeconomic performances, the economics of energy security, the transition of resource use in an economy, the economics of sustainability, energy use and climate change, and the effectiveness of new market structures in deregulated electricity markets. He has published research papers in academic journals such as *Econometric Theory*, *Economics Letters*, *Energy Policy*, *International Journal of Global Energy Issues*, and *International Journal of Electronic Business Management*. He has also carried out consultation projects for the public and private sector including “Analysis of the Effectiveness of New Market Structure in

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