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# Can Carbon Taxes be Good for China and the United States?

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## About the Author

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This essay is adapted from a working paper of the University of California, San Diego.

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## Introduction

The US Environmental Protection Agency (EPA) recently announced a plan to reduce carbon emissions from power plants by 30 percent by 2030. These regulations engendered immediate controversy, and some promptly denounced them as an indirect tax on energy that would be destructive to the US economy. Underlying the debates regarding the regulation of carbon through taxes, permits, or regulations is premised on a widespread assumption that controlling carbon will be bad for economic growth.

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The typical argument that carbon taxes will hurt the economy goes something like this: controlling carbon will raise the price of energy. Increases in energy prices will hurt the energy sector, costing the country jobs and raising prices throughout the economy. Energy price hikes will hurt businesses and consumers alike. In China, some deem that the economic cost will in fact be higher than the cost in the United States, since China relies more on heavy industry and has a much more carbon-intensive energy mix.

Indeed, research by public finance economists and environmental economists alike have confirmed the basic result that carbon taxes are bad for the economy. For decades, the academic literature has supported the popular consensus that carbon taxes will be bad for economic welfare, even when the revenue from these taxes is recycled back into the economy through concomitant tax cuts in other areas.[2]

This paper, however, presents evidence for the opposite conclusion. The key finding is that carbon taxes, provided that the revenue is recycled to cut taxes in other areas,[3] can be good for economic welfare and boost economic growth. The basic reason for this potentially provocative result is that carbon taxes are more efficient than other forms of taxation and can offset inefficiencies in the existing tax structure.

And that raises an important question about China, which is, after all, the world's largest emitter of greenhouse gases (GHGs) and has considered various plans to contain its carbon emissions. Shortly after the US EPA

announced its plan, He Jiankun, the Chairman of China's Advisory Committee on Climate Change, said that China would impose a cap on its carbon emissions starting from 2016.[1] Professor He later clarified in interviews that his comments were made as a private citizen rather than in his capacity as an advisor to the Chinese government, raising questions about the scope and depth of any such commitment. Yet many analysts nevertheless believe that China will act to meaningfully control its emissions.

One way that China may do that is through the recent idea of a national carbon permit trading system, building on its carbon permit pilot programs. In China's case, the internal debate about promulgating these actions centers on the implicit question of whether the cost to the economy of pricing carbon is worth the benefit of mitigating the impacts of climate change.

But since China's system, in particular, is less efficient than that of the United States, this paper argues that China has potentially the most to gain from a shift toward carbon taxes relative to, say, an advanced economy like the United States.

The paper begins by summarizing how differences between carbon taxes and other taxes can change the policy calculus. The first section summarizes the advantages that carbon taxes have over other kinds of taxes. Three reasons are offered here. First, carbon taxes are harder to evade than other taxes, and shifting the tax base towards carbon taxes can reduce tax evasion. Second, carbon taxes fall on sources of energy and distort market behavior less than other taxes. Third, carbon taxes can play a role in minimizing the informal sector.

The second section uses simple simulations to show that these three factors are quantitatively significant, and how they can act in concert to challenge the conventional belief that restricting carbon emissions will necessarily lead to negative ramifications for the economy. The last section concludes by discussing the implications for Chinese policy of this initial analytical finding.

## Why Are Carbon Taxes More Efficient Than Other Forms of Taxation?

Environmental economists have long studied a "double dividend" style of tax reform, where a carbon tax is imposed, and the revenue from this tax is used to cut preexisting taxes. Early research was motivated by the possibility of two forms of benefits: environmental benefits from the carbon tax and economic benefits by cutting a preexisting tax such as a labor tax.

Unfortunately, the possibility of a double dividend seemed out of reach when the issue was examined more carefully. One review of environmental tax research stated: "The general finding in the theoretical literature is that—with some qualifications—the net impact from shifting taxes off income and onto emissions is to increase the costs of preexisting taxes."[4]

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But recent research has resurrected the possibility of economic benefits from carbon taxes by pointing out that such taxes can be more efficient than other forms of taxation. The recent literature has pointed out three areas where carbon taxes may display such comparative efficiencies: their tax evasion properties, their ability to raise revenue without significantly distorting the behavior of market participants, and their impact on the informal economy.

First, carbon taxes are difficult to evade.[5] Such taxes fall most heavily on energy, in particular crude oil, electricity, and gasoline. These energy sources must flow through centralized points of infrastructure such as pipelines or the electrical grid. At these points of infrastructure, prices are easy to monitor and taxes are easy to collect. In addition, the centralized nature of these infrastructure points mean that quantities bought and sold are known with a high level of precision—virtually all government agencies already track very closely how much energy is produced and consumed. For these reasons, tax evasion on energy is quite difficult, even in industrializing countries like China.

Empirical evidence supports the idea that tax evasion on environmental taxes is much lower than evasion on other forms of tax. Sweden has for decades deployed carbon taxes and environmental taxes alongside other taxes. For each type of tax, Sweden has measured its "tax gap," the difference between the revenue that is actually collected and the revenue that should be paid if all taxes were paid honestly.

It has found that the tax gap for carbon taxes and environmental taxes is less than 1 percent, a rate far lower than

**Table 1. Tax Gap and Evasion Rates for Various Tax Types**

| Tax Type | Tax Gap | Taxes Collected | Tax Evasion |
|---|---|---|---|
| **Income tax on employment** | 20.4 | 405.0 | 4.8% |
| **Tax on capital** | 10.9 | 22.7 | 32.4% |
| **Income tax on Business income** | 31.9 | 92.0 | 25.7% |
| **Social security** | 30.2 | 425.0 | 6.6% |
| **VAT** | 35.3 | 253.0 | 12.2% |
| **Alcohol and tobacco** | 3.3 | 11.0 | 23.0% |
| **Energy and environment** | 0.5 | 66.7 | 0.7% |

Notes: Tax figures are in billions of kronor; all amounts are for 2005.
Source: Liu (2013)

taxes such as the sales tax or personal income tax (see Table 1). Even the value-added tax, a revenue stream purported to have a low rate of evasion, has an evasion rate of 12 percent.

As a result, a tax system that leans more heavily on carbon taxes and less on other kinds of tax revenue will yield less overall tax evasion. Since tax evasion generates real costs—such as lawyers and accountants who are hired to find loopholes—a system with lower tax evasion will be more efficient than one with higher tax evasion.

Second, carbon taxes raise revenue with less distortion than other types of taxes.[6] Consider the types of taxes that are currently the main drivers of revenue in both the United States and China. In the United States, the personal income tax, the social security tax, and the sales tax are most important to the revenue base. For each of these, higher tax rates lead to tradeoffs in terms of lower incentives to work and less consumer spending. These "tax distortions" are deemed a necessary evil to raising government revenues. In China, by contrast, the main sources of taxation—the value added tax (VAT), the personal income tax, and the corporate income tax—can act as similar disincentives to work and spend.

Now consider the carbon tax. A large portion of the carbon tax falls on energy, which in turn is imposed on producers of energy at oil wells and natural gas fields. Many of these producers earn profit by licensing and pumping these natural resources. A carbon tax would reduce these profits, but it would have considerably less impact on the decision to produce or not produce than comparable taxes on labor, sales, or profits.

As a result, an economy that leans more heavily on carbon taxes will have lower amounts of production

decision distortion than an economy that excludes them. Minimizing these distortions improves welfare and benefits the economy.

Third, carbon taxes can work to reduce the scope and impact of the informal economy.[7] The informal economy is defined as the portion of the economy that escapes taxes and regulations, and it plays a major role in every country. The United States has one of the smallest informal sectors in the world, representing just 8 percent of GDP; in China, the informal economy is estimated at 16 percent of GDP.[8]

*Carbon taxes can potentially be more effective in China than in the United States because the former's existing tax system is relatively less efficient across these important dimensions.*

To understand how carbon taxes can affect the informal economy, first consider the composition of the informal economy. In the United States, services such as home care and domestic help constitute a large portion of the informal sector; so do informal finance and informal construction. In China, these services also play a large role, joined by elements such as informal retail and light manufacturing. Each of the constituent parts of the informal sector is comparatively labor intensive and does not require much energy.

A carbon tax, when coupled with concomitant cuts on other forms of taxation, will shift the tax burden off of these labor-intensive goods and onto energy-intensive ones. The most energy-intensive goods, such as cars, heavy manufacturing, and power, are almost impossible to produce in the informal economy. So a carbon tax increase has little effect on the informal sector.

By contrast, a tax cut on services creates a new incentive for participants in the informal economy to re-join the formal sector. Some firms operating at the fringes of the formal and informal economies may join the formal sector, boosting the overall tax base of the economy.[9]

Shrinking the informal sector can also have salutary effects on the wider economy. For example, a tax cut on a labor tax like the social security tax in the United States would reduce the cost of operating in the formal sector for painters, nannies, and gardeners. Some small businesses in these groups may decide that the disadvantages of remaining in the informal sector—such as being unable to scale activity while remaining invisible—are now too great; they may register as businesses and pay taxes. If some of these choose to join the formal economy for the first time, the burden on other taxpayers will decrease, boosting the economy overall.

Revenue from a carbon tax in China might be directed to cut taxes like the business tax, which functions as a tax on sales that is targeted at the services sector. China, with its larger informal

economy, has even more potential for growth from streamlining its tax system. Some operators in the Chinese informal sector—financial services, construction, and other informal services—might respond to this incentive to enter the formal sector, representing an enormous source of potential growth in the economy.

In summary, this section has illustrated how a carbon tax has unique characteristics that distinguish it from other types of taxation. When an economy relies more heavily on a carbon tax, it could well result in less tax evasion, less tax distortion, and a smaller informal economy.

But one important conclusion is that each of these factors tends to be more important in China than in the United States. That is because China has a higher rate of tax evasion, depends more heavily on energy production, and has a much larger informal sector. As a result, carbon taxes can potentially be more effective in China than in the United States because the former's existing tax system is relatively less efficient across these important dimensions.

## Can Carbon Taxes Be Good for the Chinese and US Economies?

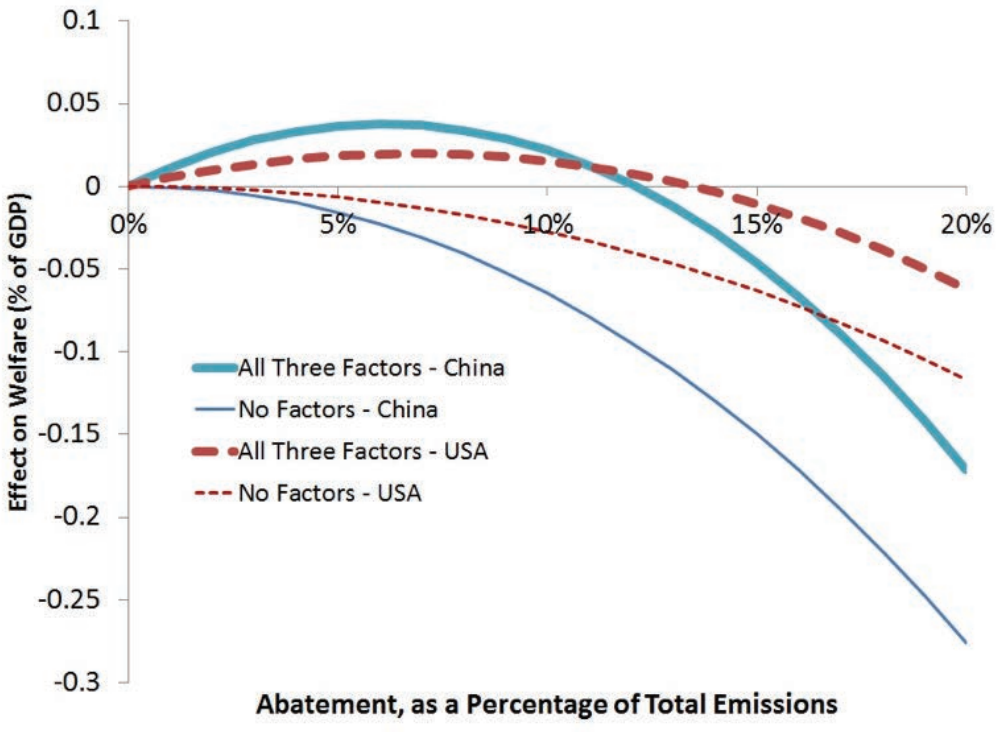
Merely highlighting that carbon taxes have some beneficial properties is useful but does not prove that carbon taxes can be good for the economy. Each factor separately reduces the economic cost of carbon taxes, but how do they cumulatively affect the economy?

What follows are simple simulations that quantitatively estimate how the size of the cumulative effect of these three factors on the economy.[10] These first simulate the United States, then China. The key result is presented in the graph below (see Figure 1).

Each point on the x-axis of this graph is a separate simulation, and each point on this graph is the percentage by which carbon emissions are reduced. The y-axis is the impact of the policy change in welfare, expressed as a percentage of the country's GDP. This change in welfare is certainly a low estimate, since it does not include improvements to the environment from emissions reductions.

Let us focus first on the thin dashed red line and the thin blue line. These are the results of the simulations when none of the three factors from the previous

**Figure 1. Effect of All Factors Combined on the Cost of Carbon Emissions Cuts**




Source: Carson et al. (2014)

section is considered. The lines confirm the prior contention in three ways.

First, every point on these lines is below the x-axis, so that every cut in carbon emissions through a carbon tax is harmful to the economy. Second, the lines sweep exponentially downward, suggesting that the cost of large cuts in emissions is exponentially larger than the cost of small cuts. Third, the thin blue line is below the thin dash red line, showing that carbon cuts in China are more expensive than those in the United States.

Now consider the other pair of thick dashed red lines and the thick solid blue line. These are the same simulations, except that three factors outlined in the section above are included. The incorporation of the three factors markedly shifts the result.

In fact, the central finding of this paper is that for emission cuts below 13 percent, both lines lie above the x-axis. It indicates that the three factors discussed above can actually act as a corrective presence in the economy, reducing the inefficiencies caused by tax evasion, distortionary behavior, and the informal sector. The economy will see improvements by shifting the tax base toward a carbon tax.

The second major result is that the thick solid blue line is above the thick red line for emission cuts below 12 percent. This suggests that the welfare gain in China, up to a point, will be even greater than similar gains in the United States for policy relevant cuts in carbon emissions. As explained above, because China has higher levels of all three factors—tax evasion, reliance on non-distortionary energy sources, and informal sector size—a carbon tax could improve the Chinese economy more significantly than the American one.

In summary, simple simulations of the impact of the three key factors show that they are quantitatively significant. They appear large enough to offset the entire cost of a carbon tax for carbon emission cuts below 12 percent. Moreover, the results offer evidence contradicting the prevailing view of the economic cost of a carbon tax, particularly for China since it stands to gain more from taxing carbon than the United States would at this point.

For large emissions reductions, the costs of a carbon tax are still large and positive. Despite the three factors presented here, the tradeoff between economic efficiency and environmental quality remains significant when contemplating the very large reductions in carbon emissions called for in many international forums.

## Conclusions and Areas for Future Research

The possibility that imposing a carbon tax could simultaneously reduce emissions and enhance economic growth could dramatically alter the dynamics of what is both optimal and possible in terms of a global climate agreement. While most analysts think that the best way to decrease GHG emissions is carefully coordinated country-by-country unilateral action, these results, albeit preliminary, suggest that countries might benefit economically even if they made unilateral cuts in their carbon emissions through revenue-neutral carbon taxes.

These results come with some important caveats, however. Implementation of a carbon tax matters enormously, and each country's tax code incorporates unique complexities that could influence this result. More fine-tuned and detailed models are necessary to study these issues further. Prior studies that have reproduced these factors in full economic models have generally affirmed their quantitative importance.

Further, a carbon tax will invariably generate in each country winners who support the tax and losers who oppose it. Since many of the losers are concentrated in a few industries, political opposition to carbon tax reform has tended to be high. This paper contributes to this debate by arguing that the cumulative economic gains from a carbon tax policy will, in fact, outweigh the economic losses.

New evidence is presented here for policymakers weighing the effects of such a tax on the broader economy and how to balance carbon emissions reductions while not sacrificing economic growth. Such a finding is all the more surprising because developing countries, which have historically been most opposed to cutting emissions, stand to gain more from revenue-neutral carbon taxes. This is the case in China.

*Developing countries, which have historically been most opposed to cutting emissions, stand to gain more from revenue-neutral carbon taxes.*

There are many factors that were not directly considered in this analysis that could further enhance the case for carbon taxes. For example, taxes on carbon tend to reduce emissions of other forms of closely-related pollutants, like particulate matter and sulfur dioxide. Reductions in pollution can have broad effects, ranging from reduced property damage to improved worker health and productivity. These "co-benefits" are particularly important in developing countries like China (see Paulson Institute paper on climate and air pollution co-control). Some studies have linked carbon taxes to energy

efficiency, showing how higher prices can induce technological change. Again, analysis suggests that these factors tend to strengthen the benefits of a carbon tax for the economy.

This paper has contributed some additional arguments for the potential imposition of carbon taxes. For instance, policymakers who consider elements such as tax evasion when raising government revenue or revising their tax code should consider a carbon tax because it is difficult to avoid. Meanwhile, even those attempting to minimize the impact of taxes on their economy may also want to consider a carbon tax as a way to gain revenue while limiting other economic distortions. Finally, governments combatting the thorny problem of the informal sector may also consider a carbon tax as a simple way to lighten the burden on those who might otherwise choose to enter the informal economy.

Separately considered, each of these arguments is important. Collectively, however, they suggest that a carbon tax can actually benefit the economies of countries that implement them. And this seems especially to be the case for China.

## Endnotes

[1] Chen, Kathy and Reklev, Stian, "China Plan to Cap Emissions Seen Turning Point in Climate Talks," *Reuters*, June 3, 2014, http://uk.reuters.com/article/2014/06/03/china-climatechange-idUKL3N0OK1VH20140603.

[2] See for example Goulder (1995) and Bovenberg and Goulder (2002).

[3] An equivalent argument is to say that, when revenue must be raised, it should be raised through a carbon tax rather than through another tax.

[4] Parry, I. W., J. Norregaard, and D. Heine, 2012. "Environmental Tax Reform: Principles from Theory and Practice," *Annual Review Resource Economics*, 29(3): S64-S77.

[5] Liu, A. A., 2013. "Tax Evasion and Optimal Environmental Taxes," *Journal of Environmental Economics and Management*, 66(3): 656-670.

[6] Bento, A. and M. Jacobsen. 2007. "Ricardian Rents and Economic Policy: The Double-Dividend Hypothesis," J*ournal of Environmental Economics and Management* 53(1): 17-31.

[7] Bento, A., M. Jacobsen, and A. Liu. 2014. "Environmental Policy in The Presence of An Informal Sector," Working paper, University of California, San Diego.

[8] Schneider, F., 2005. "Shadow Economies of 145 Countries all over the World: What Do We Really Know?" Center for Research in Economies, Management, and the Arts Working Paper No. 2005-13.

[9] Gorodnichenko et al. (2009) show that tax evasion responds sharply to tax rates. Peter (2009) shows that the size of the informal sector responds to the top marginal tax rate.

[10] Carson, R., M. Jacobsen, and A. Liu, 2014. "Comparing the Cost of a Carbon Tax in China and the United States," Working paper, University of California, San Diego.

## About The Paulson Institute

The Paulson Institute, an independent center located at the University of Chicago, is a non-partisan institution that promotes sustainable economic growth and a cleaner environment around the world. Established in 2011 by Henry M. Paulson, Jr., former US Secretary of the Treasury and chairman and chief executive of Goldman Sachs, the Institute is committed to the principle that today's most pressing economic and environmental challenges can be solved only if leading countries work in complementary ways.

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