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Increasing Emissions Certainty under a Carbon Tax

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Introduction

Some groups have recently proposed that the United States consider use of a carbon tax as the primary federal policy to reduce greenhouse gas emissions. A carbon tax establishes a fixed fee per unit of emissions and thereby provides a certain price incentive to cut emissions.[1] However, one possible concern regarding a carbon tax is that it does not ensure that the nation will achieve a specific emissions goal because uncertainty exists about the economy's response to such a tax. This concern mirrors the reciprocal apprehension over allowance-price uncertainty (and ultimately cost uncertainty) under a cap-and-trade program, which does provide for a certain emissions outcome. Moreover, just as policy mechanisms can increase price certainty under a cap-and-trade program, so too can policy mechanisms increase emissions certainty under a carbon tax.

Ultimately, there is an underlying tradeoff between certainty about emissions and certainty about prices and costs. To reduce uncertainty about whether a tax will achieve specific emissions goals, additional mitigation measures could be called upon if emissions exceed those goals by a given amount. However, such additional measures introduce uncertainty about costs. At the extreme, a commitment to achieve emissions targets at all costs would imply that costs could be quite high. Discussions of policy mechanisms to increase price and cost certainty under several current cap-and-trade programs confronted this same dilemma: how much uncertainty about emissions outcomes is acceptable given reciprocal uncertainty about costs?

Viewed through a slightly different lens, mechanisms that balance emissions and cost uncertainty can be viewed as a way to structure a more careful compromise between economic and environmental interests. Under a cap-and-trade program, a price ceiling or allowance reserve may allow economic interests to agree to what may be viewed as an economically risky cap with the assurance that further steps will be taken should prices become too high. Similarly, under a carbon tax, mechanisms that can increase mitigation action may allow environmental interests to agree to what they may view as an environmentally risky tax with the assurance that further steps will be taken should emissions become too high.

This policy brief discusses mechanisms that could increase emissions certainty under a carbon tax. It draws from recent discussions between the authors and other policy experts, and its goal is to introduce ideas for further exploration. It begins with a discussion of how to measure emissions performance, or what it means to be achieving or not achieving an emissions goal. This performance would presumably provide the basis for pursuing remedial mechanisms. Next, the brief turns to a taxonomy of such mechanisms and the challenges and opportunities of each. It discusses ideas for initiating these mechanisms, either through some automated or discretionary procedure. The brief concludes with areas for additional research.

[1] This policy brief uses the term *carbon tax* to denote a tax on greenhouse gas emissions without taking a particular stand on which gases the tax would cover.

Measuring Emissions Performance

What does it mean to decide whether the country is achieving an emissions goal after some period of time? Many emissions goals are expressed as targets in a particular year. For example, the goal of the United States in the Paris Agreement is to achieve an emissions reduction of 26–28% below 2005 levels by 2025. The most obvious definition of achieving or not achieving the target would be whether emissions exceed this range in 2025. This raises two issues: (1) whether emissions in a single year is the best indicator of achievement, and (2) how projections of future emissions might affect interim assessment of achievement.

Although the Paris target is specific to a single year, presumably a long-term carbon tax policy for the U.S. could specify multi-year periods of performance moving forward. Emissions in a particular year might not be the best measure of performance. Emissions can be high or low in any single year for a variety of reasons, including weather, economic cycles, major events, or accidents. Defining success or failure on the basis of performance in a single year could create unnecessary volatility in the adjustment mechanism if temporary changes in emissions lead too quickly to an intervention. That is, any short-term emissions volatility will tend to average out over a number of years without requiring any (or as frequent) interventions.

Recognizing that cumulative, or multi-year, averages are what matter for the environment, many programs include multi-year targets. For example, the Kyoto Protocol set a goal that measured performance on the basis of average emissions over five years (2008–2012). Further, even with annual targets, programs often define compliance over a longer window. The 2009 Waxman Markey Bill used a two-year window and allowed costless borrowing of next-year's emissions allowances. The European Union Emissions Trading System similarly allows the circulation of future vintage allowances for compliance, so long as they are from the same five- to eight-year trading period. Similarly, the Regional Greenhouse Gas Initiative has three-year compliance periods. Therefore, it likely makes sense to think about measuring emissions performance as an average over multiple years.

In addition to thinking about a multi-year average to establish emissions performance, it will be valuable to consider knowledge about likely future emissions. Learning as much as possible about future emissions can help policy makers tailor any adjustment. For example, suppose emissions were 2% above the stated emissions goal for several years. This overage might typically demand an adjustment. But whether and how much to make an adjustment would likely be different if this deviation were projected to grow, shrink, or stay the same given emerging technological and market conditions. For instance, the response might different if new nuclear power facilities were slated to soon come on line that would replace a large number of coal units, versus a situation where such activity is not anticipated.

Further, policy makers will need to decide on which emissions data they rely on to measure current performance as well as which models, if any, should be used for projecting future emissions. One source for historic emissions may be the national greenhouse gas inventory, and one source for projections may be government forecasts, such as those produced by the U.S. Energy Information Administration (EIA). It will be important to ensure that these tools and others are up to the task. For instance, the timing of any performance measures used to make policy adjustments will depend on the timing of the release of nationally aggregated emissions data and of emissions projections.

Mechanisms to Increase the Emissions Certainty of a Carbon Tax

If emissions outcomes under a carbon tax are above or below a given goal, policy makers have several policy mechanisms they could use to guide the emissions level toward the goal. These mechanisms include changing the tax rate or schedule, using traditional regulatory tools, using revenue spending, or applying hybrid approaches that combine elements of all three.

Tax Adjustments

One approach to increase emissions certainty with a carbon tax would be to adjust the tax rate to reflect updated information about greenhouse gas emissions performance. This adjustment could occur on the basis of a predetermined formula or on a more ad hoc basis. With a predetermined formula, legislators would decide up front how the tax would change over time and in response to established performance metrics. With an ad hoc adjustment, Congress would first establish the emissions performance goals and an initial trajectory for the tax rate over time. Then, either Congress or an executive agency would review emissions performance and determine the necessary adjustments to achieve the stated performance goals in the future. An adjustment using a predetermined formula is discussed here; the idea of a more discretionary approach is discussed below in the context of triggering mechanisms.

A predetermined formula would need to specify the exact timing and method of a tax rate adjustment as well as the performance metrics used to determine the adjustment. The adjustment could be relatively simple. For example, the tax schedule might include pre-determined low and high paths for the tax rate, along with conditions under which the actual tax rate path would switch from one to the other. The tax might start on the low path, but if emissions were deemed "too high" relative to the established goal, the rate would switch from the low to the high path. In economic policy, there is a long history of such operational models in which an initial default path is maintained until a threshold that justifies a suitable, discrete adjustment is reached. This type of adjustment—one in which the tax rate discretely switches between predetermined paths—is optimal when there are adjustment costs associated with tax rate changes, which otherwise might be adjusted almost continuously. For a carbon tax, such induced adjustment costs could include those from actions like changing capital investments before the end of their useful life or retraining workers for different tasks.

More complex rules for guiding the adjustments might also exist. Such rules might allow triggering events based on a wider set of performance indicators along with more gradations in the tax rate change. In determining whether simple or more complex rules are optimal, it will be important to consider the objectives of the policy. In addition to increasing emissions certainty, limiting the volatility of the tax rate and thus making changes in the tax rate schedule transparent, predictable, and easy to understand may also be valuable. It will also be important to consider whether adjustments are symmetric: if the tax rate can adjust up when emissions are above the established goal, can it also adjust down when emissions are below it (or cease to be above it)?

In the context of the tradeoff between emissions and cost certainty, there is the question of the degree and type of emissions certainty that is desired. If the objective is to move emissions closer to a goal when they are otherwise too high, it might be sufficient to have simply a low and high path for the emissions tax. However, a low and high path may be insufficient if the goal is to ensure with a high probability that the United States meets an explicitly defined emissions target. In this case, unless there is willingness to allow the high path to be quite high, it might be more appropriate to make sequential adjustments as necessary without raising the tax more than required to achieve the emissions target. Put another way, a system designed for fine-tuning might have to adjust more frequently by smaller amounts on the basis of smaller deviations from the emissions goal. Thinking through these choices—what triggers the adjustment, how large it is, and what constraints should be placed on its frequency—are important policy design questions.

A number of possible precedents for automatic policy adjustments based on observed outcomes exist. Marginal income tax rates vary based on individuals' income. Borrowing this idea but applying it to the country as a whole, a simple formula for a carbon tax might set the tax rate to rise with aggregate emissions, with a higher tax rate assessed as aggregate emissions grow larger rather than simply with the passage of time. Many income support payments as well as tax brackets and exemptions are automatically adjusted on the basis of inflation indexes. In trade, tariff-rate quotas allow a certain amount of tariff-free imports. If imports exceed the quota, a non-zero tariff is applied. The Taylor Rule provides a formulaic guide for central banks to adjust interest rates in response to specific changes in inflation, unemployment, or gross domestic product, though the formula is not necessarily codified in central bank rules. As noted in the introduction, formulaic adjustments to a carbon tax are analogous to the price collar/allowance reserve approach under a cap-and-trade system, and they thus have precedent in alternative carbon-pricing systems now in operation.

Challenges and Opportunities: The biggest challenge to the formulaic approach is the added complexity of establishing not just the initial path of the tax rate, but the various performance metrics and responses. Given these parameters must be established up front, agreement on their levels might bog down a deliberative process. Additional research could shed light on how different adjustment approaches work when applied to historic or future-simulated data.

The biggest advantages of this approach are its transparency and amenity to tailoring to deliver the desired degree of certainty. These advantages are analogous to those of price collars (floors and ceilings), which are similarly transparent and tailored to such preferences under a cap-and-trade program.

Regulatory Tools

A second potential mechanism to promote emissions certainty is to make use of various regulatory tools as a backup to the carbon tax. This approach would initiate one or more regulatory programs if the United States failed to meet its performance goals. If legislators decide to use such regulatory tools, they could choose from multiple options. This includes use of existing mechanisms under the Clean Air Act or creation of new regulatory authority.

For example, if a carbon tax were implemented in place of regulation under EPA's existing Clean Air Act authority, one approach would be to reinstate that existing authority if emissions fail to meet necessary performance goals. Such an

approach could require each individual state to construct regulatory plans for achieving emissions reductions in different economic sectors as the state also plans implementation of the federal carbon tax. However, the states would only implement the regulatory plans for emissions reductions in the event of a finding that the United States has failed to meet its emissions goals with the carbon tax. This construct already exists in the Clean Power Plan's option for states to use a "state measures" approach, which analogously requires the states to create a parallel federally enforceable plan as a backup in the event that the state-enforced plan does not meet the Clean Power Plan's emissions targets.

A second approach would be to modify the Clean Air Act in a way that provided new regulatory authority if emissions performance goals were not met under the carbon tax. Under this approach, the EPA could have a broad delegation of authority that may include adjustments to the existing state-by-state approach under Section 111 or that could provide the EPA with authority to create an entirely new program, such as a national cap-and-trade system.

Challenges and Opportunities: If one of the goals of a carbon tax is to achieve a particular emissions goal that could be reached using regulations under the Clean Air Act, there is a simple logic to reinstating the suspended regulatory approach should a carbon tax fail to achieve that goal. However, except in rare cases such as the statutory sulfur dioxide cap (8.9 million tons), the Clean Air Act generally does not legislate a particular emissions cap or goal. Thus, the choice of a Clean Air Act-justified emissions goal for carbon dioxide and other greenhouse gases could be contentious if such a cap were put into new carbon tax legislation for the purposes of triggering additional regulation.

Moreover, some stakeholders are looking to a carbon tax as a replacement for either a Clean Air Act-based regulatory program or an economy-wide cap-and-trade program. This motivation may make such regulatory options less appealing. Although the idea of replacing existing regulatory authority with a more flexible alternative might be more appealing, it may be difficult to make changes to the Clean Air Act without opening the whole statute to amendment. Such a possibility may be a concern to some stakeholders, particularly environmental and public health interest groups. Further, if the regulatory approach alters the EPA's Clean Air Act authority, legislators would need to agree on how to amend the act. Including Clean Air Act amendments in carbon tax legislation could make the congressional committee process considerably more complicated.

Unlike the tax adjustment mechanism, a regulatory approach does not lend itself to fine-tuning. Nor is there symmetry: it would be difficult to undo the regulation if the emissions goal is overachieved after various regulatory tools are implemented. Given this challenge, it may make sense to be more cautious when deciding how such regulation is triggered. In other words, relative to a tax adjustment, policy makers might establish a trigger for a regulatory approach on the basis of even more clarity about the magnitude and likely persistence of a deviation from the established goal.

Revenue Spending for Emissions Reductions

In addition to tax rate adjustments and regulatory tools, legislators could use part of the revenue from a carbon tax to fund programs that subsidize mitigation within or outside the sectors covered by the carbon tax, particularly if emissions are higher than expected. This method is similar to offset mechanisms under a cap-and-trade program, particularly if designed to offset exactly the taxed emissions that exceed an established emissions goal. However, because the revenue programs would be based on government procurement rather than private sector trading, this mechanism operates quite differently. In particular, the government has the ability to scrutinize and adapt to developments in the mitigation market, creating procurement guidelines that presumably could ensure better quality.[2] The government could also use its purchasing power to get a better deal on the emission reductions it buys.

Unlike tax rate adjustments or regulatory tools, this mechanism requires government expenditure when triggered. However, the revenue requirement arises when emissions—and hence revenue—exceed the emissions goal. Moreover, the unexpected revenue requirement could be less than the unexpected revenue gain because outside mitigation options are often cheaper than those that are covered easily by a carbon tax. For example, changes in forest and agricultural practices, land use changes, and methane capture, domestically and abroad, can be difficult to include in a tax (or cap-and-trade) program for practical and political reasons, but these activities may provide inexpensive mitigation options.

Challenges and Opportunities: Unlike the above-described approaches, this mechanism imposes neither an additional regulatory burden nor increased tax rates when emissions exceed the goal; rather, it uses the additional revenue collected from the higher emissions base to improve emissions outcomes. That distinction is an advantage for those being taxed or

[2] The government can also oversee quality in cap-and-trade offset markets in a regulatory capacity, but it might be a more effective monitor as the direct buyer of the reduction unit.

regulated. One question about this approach is whether and how quickly such mitigation credits might be available. Unless there are other places where suppliers can sell mitigation when government demand is low, it may take considerable time to incentivize new mitigation activities. This issue may mean that the government will need to smooth its purchases, perhaps committing to spend a portion of carbon tax revenues on an ongoing basis, to bolster the performance of such a mitigation market.

Perhaps the main challenge is that the revenue spending approach does not ensure a particular emissions outcome. If the tax is too low, revenue may not be sufficient to buy enough mitigation elsewhere. Alternatively, it may take some time to incentivize additional mitigation activities. Establishing how much of the emissions mitigation purchased through the tax revenues is additional to mitigation that would have happened anyway is difficult, though the same issue arises under cap-and-trade programs. Under cap-and-trade programs, a verification system is used to help ensure that purchased mititgation leads to additional efforts that would not have otherwise occurred. It is worth noting that the previous approaches also may fail to ensure a particular emissions outcome. However, they do ensure additional effort by domestic regulated entities toward that outcome. The revenue approach risks being viewed as (or being in reality) a transfer of payments without additional mitigation effort.

Two additional challenges relate to implementation of such an approach. First, legislators or the administering body must decide how to allocate spending among mitigation options. Offset programs often target particular sectors outside the policy's coverage, such as forestry, agriculture, and landfills. A revenue spending mechanism could also include spending in sectors covered by the tax. For example, in addition to taxing emissions from coal burning, the government could spend money to subsidize retirements of coal-fired power plants. Other programmatic expenditures could be directed to complementary programs in energy efficiency or zero-emitting power sources, such as renewables or nuclear units. Under a tax system, such expenditures decrease emissions. Under a standard cap-and-trade system, these complementary policies serve only to reduce the price needed to meet the fixed emissions target.

Second, the revenue approach requires new government infrastructure, which could be housed at an existing agency—such as the EPA or U.S. Department of Agriculture—or at a new agency created for this purpose. The government could also fashion a role for states in this program, one similar to federal-state responsibilities under the Clean Air Act.

Hybrid Approaches

Two or more of the above-described mechanisms could be combined, perhaps better addressing the range of stakeholder concerns. For example, legislation could pair an adjusting carbon tax rate with a regulatory approach only as a last resort. In this situation, modest refinements could be achieved using the carbon tax rate adjustments. This approach could, on the one hand, limit the conditions wherein a regulatory approach would replace the tax, while on the other hand providing an alternative to higher and higher tax rates if additional mitigation is needed. Although using hybrid approaches may help achieve such balance, they may also be relatively complicated to design, requiring additional consensus.

Activating an Emissions Certainty Mechanism

When including any of the above mechanisms in a carbon tax, policy makers will need to determine the conditions that initiate their use. This brief generally assumes use of an automatic trigger, but the trigger could also be discretionary. Because Congress can always undo its own laws, discretionary adjustment could be viewed as the default. However, the discretionary option also includes variations that would either delegate authority or create nuanced differences in the kind of congressional action required, as discuss below.

Automatic Adjustment

Any of the above mechanisms could have an automatic trigger, meaning that the enabling statute forces the mechanism to initiate under given circumstances. Using examples from the discussion of tax adjustment options above, if the emissions performance of the United States exceeds a predetermined emissions range in period 1, the tax would automatically increase to a higher level for some specified time period beginning in period 2. This approach requires no further political action to adjust the tax rate or implement whatever mechanism has been triggered. Rather, the policy can initiate automatically according to emissions data.

An established carbon tax and automatic adjustment mechanism provide transparency to firms and individuals about what will happen in the future. On the other hand, unforeseen events and new information could make automatic adjustments unnecessarily disruptive. Therefore, a well-defined but discretionary approach may be more appealing.

Discretionary Adjustment

A well-defined discretionary approach would specify a timeline, process, and guidance for Congress or the Executive to implement some combination of the mechanisms described above or other mechanisms. By placing parameters around a discretionary decision, firms and individuals can be well informed about the timing and range of a possible policy adjustment even if the exact outcome remains to be determined.

Although Congress always has the option to adjust a tax or institute a regulatory program through new legislation, one discretionary approach would require regular congressional review of the carbon tax to ensure it is achieving its stated objectives. This review could be undertaken in lieu of, or in tandem with, an automatic adjustment. For example, the initial legislation could mandate that if Congress failed to legislate an update, the automatic mechanism would proceed subject to the specified performance and response parameters.

Another alternative is to delegate carbon tax adjustment authority to the Executive Branch. This option would allow an Executive Branch entity (whether an agency or independent board) to determine whether and how to implement a particular mechanism on the basis of data on the effects of the program and other extenuating factors. This approach parallels the 2009 Waxman-Markey Bill's recommendation of a carbon market board that would have, among other things, been charged with protecting against price uncertainty in the carbon market. Such a body would provide flexibility for dealing with unanticipated changes in circumstances or with policy indicators beyond those anticipated when the legistlation is passed. By delegating carbon tax adjustment authority to the Executive Branch, policy could adapt to changes in our understanding of climate change impacts and risks as well as to economic developments and other world events.

One question with this approach, however, is whether Congress would consider or pass legislation providing an agency or independent board with the authority to change carbon tax rates or implement other adjustment mechanisms. In part, the question may be whether the balance of emissions and economic concerns are sufficiently resolved to define clear objectives for the delegated authority. These objectives are clear, for example, for the Federal Reserve Board in managing monetary policy, namely full employment and stable prices. Regarding climate change, it is not clear that all parties would be able to agree on such objectives. There may be agreement on a particular carbon tax level and emissions goal, but if that level and goal prove incompatible, there may not be agreement about how much the goal should be sacrificed or the carbon tax should be raised. If Congress cannot resolve such high-level issues about the burden and benefit of climate change policy, it is unclear why Congress would be willing to delegate that decision to the Executive Branch.

Conclusion

As long argued in the literature and demonstrated in practice, the use of economic incentive mechanisms—both taxes and cap-and-trade—to achieve emissions outcomes can offer significant economic welfare improvements over less flexible approaches. Both mechanisms can be modified to more flexibly balance competing economic and environmental interests. Such balance may be helpful or necessary to reach agreement for policy enactment.

This policy brief describes three possible adjustment mechanisms applicable to carbon taxes: tax adjustments, regulatory tools, and revenue spending. Each has advantages and disadvantages, some of which are described here. Moreover, variants and combinations of each mechanism exist. For any mechanism, it is possible to imagine an automatic adjustment, triggered when a particular emissions threshold is reached, or to imagine that such an intervention would be at the discretion of Congress or a delegated authority. Alternatively, policy could establish the prospect of periodic intervention with a clear timeline for Congress or a delegated authority to act before default, automatic adjustments come into play.

This policy brief intentionally raises more questions than it answers (see Table 1). As discussions of a possible carbon tax advance, such questions will be important to explore in ways that can provide guidance to policy decisions and design.

Table 1. Future research questions

Subject area	Research questions
Measuring emissions performance	• Over what period would we expect emissions deviations to be relatively persistent versus transitory? • Are there ways that sources of emissions data, projections, or both need to be improved? • Are there projections suitable for a regulatory mechanism to adjust on their basis?
Tax adjustments	• How might an "optimal" policy be defined in terms of minimizing emission uncertainty subject to adjustment costs (e.g., a high and a low tax schedule)? • What are other bases for determining adjustment trigger, size, and frequency? • What is the appropriate time interval and data basis for adjustment? • What kind of adjustment formula could legislators consider? • To what extent are firms able to shift emitting activity forward in response to anticipated increases in a carbon tax? How important is such an effect likely to be? • Are there concerns for the U.S. Treasury regarding fluctuations in revenue?
Regulatory tools	• What type of triggering event would be appropriate for a regulatory approach? • Is there any way to tailor such an approach, or is it all or nothing? • How might existing authority under the Clean Air Act be modified?
Revenue spending	• Who creates and administers the programs? • On which programs would the administering body spend tax revenue? • How quickly should a revenue program attempt to achieve mitigation outcomes? • How rigorous should the program be regarding additionality or might additionality be addressed by seeking excess mitigation? • What options are there to provide ongoing incentives for the "outside" mitigation activities targeted by revenue spending if the conditions triggering that spending are not activated?
Triggers	• How might timelines, processes, and guidance make discretionary adjustments more predictable? • What kind of congressional procedures might be available to ensure efficient action? • Are some mechanisms, such as revenue spending, more amenable to discretion?
Overall	• What precedents are there for articulating environmental or other purposes for a tax in legislation? • What other precedents, both domestic and international, exist for different adjustment mechanisms? • What other precedents exist for congressional delegation of authority over tax rates and schedules? • How might decisions by other countries to regulate their own emissions affect the design and adjustments to a carbon tax?

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