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Rethinking Environmental Federalism in a Warming World

William M. Shobe
University of Virginia

Dallas Burtraw
Resources for the Future

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Abstract

Climate change policy analysis has focused almost exclusively on national policy and even on harmonizing climate policies across countries, implicitly assuming that harmonization of climate policies at the subnational level would be mandated or guaranteed. We argue that the design and implementation of climate policy in a federal union will diverge in important ways from policy design in a unitary government. National climate policies built on the assumption of a unitary model of governance are unlikely to achieve the expected outcome because of interactions with policy choices made at the subnational level. In a federal system, the information and incentives generated by a national policy must pass through various levels of subnational fiscal and regulatory policy. Effective policy design must recognize both the constraints and the opportunities presented by a federal structure of government. Furthermore, policies that take advantage of the federal structure of government can improve climate governance outcomes.

Key words: climate change, subsidiarity, states, federalism, climate governance

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Introduction

Federalism concerns the allocation (or exercise) of powers, responsibilities, and constraints among different layers of government, with the layers being primarily descriptive of the geographic extent of the exercise of powers rather than the range of actual powers assigned to each layer. In a unitary state, there is no clear boundary between the governmental organizations making decisions at the national, regional, and local levels. Authority at subsidiary levels of government is derived entirely from and subject to revocation by the highest level. In a federal state, layers of decision making authority are defined according to the geographic coverage of the organization. The authority of a given layer of government overlaps with that of all geographically encompassed governments. In the United States, the main organizational differences are between the national, state, and local (county and municipal) layers. Intermediate forms beyond the traditional three add considerable complexity to the picture, from treaties that create supranational organizations with governmental powers, to interstate compacts, to regional organizations of localities, all the way down to neighborhood-level groups, which may carry out roles we traditionally associate with government at a scale much smaller than a locality.

In the case of the United States, the federal structure of the constitutional regime was the result of long deliberation and compromise, preserving considerable independent political authority for the states while limiting some of the damaging activities that the colonies had trained toward each other and moving the power to conduct foreign affairs into a governmental structure that would be able to function in the world community as a sovereign state.¹ The word *federalist* was astutely chosen by the supporters of the new, stronger central government to emphasize the voluntary joining of independent governments into the union. The result, while obviously fluid, preserved considerable independent governmental power for the states at the same time that it allocated sufficient sovereign power to the central government to bind them into an indissoluble national union. The states, in turn, have allocated numerous powers to substate local governments. The extent of the devolution of powers from state to local government is not governed by the constitutional framework that governs relations between the national and state governments.

This paper examines the design of climate policy in the context of a federal system. The central idea we pursue is that the design and implementation of climate policy in a unitary

¹ Federalism has been an important theme in the legal analysis of U.S. policy since the founding of the Republic, when the all-too-apparent difficulties arising from flaws in the design of the Articles of Confederation led to the drafting of a new constitution for consideration by the founding colonies. The key contemporary analysis of the political and economic considerations in the proposed reallocation of powers as between the state and national governments is contained in *The Federalist*, a series of essays by three proponents of a stronger national government, Alexander Hamilton, James Madison, and John Jay. Inman and Rubinfeld (1997) provide a useful, recent history of the legal conceptions of federalism addressing the economic implications.

model of government will diverge in important ways from that in a federal system. A pressing concern of economists and policymakers in general is that climate policy be cost-effective. A system that devolved climate change policies to subnational levels of government would likely achieve neither cost-effectiveness nor efficiency. By the same token, seemingly elegant theoretical policy designs implementing economic incentives at the national level are also unlikely to achieve the expected outcome if they are built on the implicit assumption of a unitary model of government. In a federal system, the information and incentives generated by a national policy must pass through various levels of subnational fiscal and regulatory policy. State and local governments engage in competition with their peers as well and must be assumed to make their best strategic responses to national initiatives. And, as independent centers of political power, subnational governments have substantial ability to change the direction of national policy. We explore some of the interesting questions raised in establishing cost-effective climate policy in countries with a federal structure of government.

In the next section of the paper we describe the tenets of environmental federalism as it has developed in the economics literature and as it has been implemented in practice. We then develop a framework for what we call climate federalism to address the unique characteristics of ubiquitous greenhouse gas emissions as a purely global externality. Subnational levels of government play a crucial role in determining the infrastructure of our economy and the nature of social relations, which in turn affect the path of emissions. We argue that the division of authority in a federal state has a very large effect on what national policies can and should be implemented. The transmission of incentives within a federal system will determine whether all levels of government contribute effectively. The active involvement of various levels of government will also influence the local political economy of climate policy. Any effective policy design must recognize both the constraints and the opportunities presented by a federal structure of government. In many cases, little is known about the likely interactions among national and subnational strategies and policies.

Environmental federalism

The term environmental federalism is frequently misunderstood as referring to the role of the national government in setting environmental policy, and to the flexibility that is offered to the states in implementing and enforcing that policy. From its roots in the study of fiscal federalism, environmental federalism should be understood to refer more broadly to the study of the normative and positive consequences of the shared role of national and subnational units of government in controlling environmental problems.

Normative analysis of the distribution of responsibilities between layers of government focuses on whether a given distribution of powers can enhance social welfare. It dates back at least as far as Adam Smith, who in his *Wealth of Nations* (1776) observed that it would be preferable for the sovereign (the authority of highest rank) to leave to local authorities decisions about the level and quality of local services such as roads and streetlights, since the

local people were in a much better position to know the quality of services and whether the services were worth the cost. The national defense, Smith pointed out, was better left to the sovereign because the scope of the problem was better matched to the scope of the powers of the sovereign.

The central result in the literature on environmental federalism mirrors those general normative principles: the control of externalities and the provision of public goods works best, other things equal, if the governmental authority for addressing the problem matches as closely as possible the geographic extent of the environmental problem itself.² The modern normative consensus among American economists³ supports the decentralization of governmental authority for both raising revenue and choosing policy to the lowest feasible geographical extent, on the grounds that echo the argument first made by Adam Smith (Oates 2005). People at the local level are in the best position to know their own preferences for government services and to observe the connection between the tax price and the value of the services. A service or authority should be moved away from its lowest geographical extent only in response to a conclusion that doing so is likely to improve social welfare by overcoming some inefficiency, or possibly inequity, inherent to the decentralized approach. These inefficiencies might arise because of strategic interaction among localities, economies of scale in providing services, spillovers across jurisdictional boundaries, constraints on the power to raise revenues, or gains from interjurisdictional uniformity, among other things (Oates 1999). In some cases issues arise outside the domain of efficiency concerns, such as the desire to ensure the environmental protection of disadvantaged or disenfranchised communities.

In contrast to normative analysis, the positive analysis of federalism focuses on why given distributions of authority developed as they did—that is, how the interaction of economic and political forces results in the organization of authority that we observe. Setting aside for now the possible social gains from decentralization of authority, policy design will be an exercise in futility without an understanding of the institutional environment and its effect on the flow of information and incentives through layers of authority (Ostrom 2010). Each governmental unit has interests at stake and will act on the basis of those interests in ways that may enhance or undermine the effectiveness of a policy established by another government with authority in the region. The strategic interactions are both vertical and horizontal. States and localities compete over resources and power with each other as well as with the other layers of government with authority over the same area. It is well established that these incentives

² Authority over rights common to the public has its roots in 14th-century English common law and derives originally from the power of the sovereign to protect his lands and interests.

³ See Oates (2005). Alm and Banzhaf (2011) summarize both the broad literature in fiscal federalism and the environmental federalism literature in particular. The legal literature on federalism appears less settled but, in any event, does not apply consistent normative principles that would allow one to compare outcomes across the variety of decision rules about allocating authority; the decision rules are roughly categorized by labels such as dual, cooperative, adaptive, and interactive federalism.

affect the type and intensity of policies implemented at each level of government (Oates 1999).

The formation of the European Union provides a recent case study in the formation of a federal union of independent states, and one where both normative and positive elements are evident. Member states voluntarily ceded some of their governmental authority to a layer of government encompassing the geographies of the member states. The ceding of power has been both partial and gradual (Farber 1997). The doctrine of “subsidiarity” provides that there is a preference for leaving governmental authority to the member states unless there is a compelling reason why the power should rest with the union (Golub 1996).⁴ Of particular interest here is the establishment of a trading scheme for greenhouse gas emissions, which in its earliest phase left to the member states the tasks of creating an inventory of emissions and deciding what portion of their emissions should be made part of the trading program and what should be regulated outside the trading program. This decentralized design was successful politically but undermined the performance of the early implementation phase, and it has been substantially modified, with more decisions to be taken centrally before the third phase of the program starts in 2013 (Ellerman et al. 2010; Wråke et al. 2012).

The “three cases”

Oates (2001) uses three cases, pure local pollution, regional spillovers, and global pollution, to illustrate how the choice of the appropriate level of government depends on the scale of the particular environmental problem. In each case, a local government must determine its response to the pollution problem, which raises local costs through taxes or costs of compliance. For a local pollutant, the locality will be forced to balance the lost business activity against the value of the cleaner environment because both businesses and people are mobile and both are valuable to the local government. Localities may find it optimal to choose a level of environmental protection that is too low or too high compared with a socially optimal policy because of limits on the tax and policy instruments at its disposal. The “race to the bottom” is said to occur when capital mobility induces a locality to choose a low level of environmental protection compared with a social optimum.⁵ The limited evidence we have does not appear to support the notion that a race to the bottom is particularly common. Many examples exist of jurisdictions’ establishing environmental standards more stringent than what is required (Oates 2001). Under these circumstances, pushing regulatory authority for the pollutant up to a layer of government with a wider geographic coverage would not be expected to generate gains and might make things worse.

⁴ The EU monetary union has been much in the news lately because of the consequences of the decision to centralize the monetary authority without, at the same time, providing central control over fiscal policies in the member states. See Rodden (2006).

⁵ A race to the top, possibly resulting in inefficient overinvestment in public goods, is also possible, but its empirical importance is not clear. See Ferrara et al. (2010).

The case of spillovers between neighboring localities raises the possibility of bargaining with the neighboring governments as an alternative to shifting control to the next encompassing layer, which may have much wider coverage than is necessary and hence may lead to its own inefficiencies. One could see the latter case as one where the localities choose to hire the next layer of government to resolve their dispute over rights. The localities involved then face a challenging principal-agent problem in controlling the performance of the dispute resolution agent (Burtraw and Shobe 2009). Negotiated resolutions between governments are hard to study. We do know that the interstate compact option provided explicitly for such purpose in the U.S. Constitution is rarely used,⁶ which seems to imply that there are significant costs to localities in using this mechanism and that some involvement by the encompassing layer of government may generate more gains than the states can achieve through bargaining.

Greenhouse gases (GHGs) are perhaps an ideal example of the global pollutant—our third case. Local actions to prevent climate change incur local costs but generate benefits that are a global public good. There is nothing unexpected in the result: even national governments underinvest in protecting the global commons, and this underinvestment should be greater at subnational levels. From this, the conclusion naturally follows that, in a country with a federal structure of government, policies to address climate change belong at the national level, and the international activities required to address climate change must arise from voluntary negotiations among sovereign nations.

Much of the rest of this paper will take issue with this overly simplistic view that a purely global externality implies a purely national regulatory regime, and particularly with the implicit assumption that it is meaningful to talk about a purely national policy on climate change or any other global pollutant in a federal union. Cross-cutting constraints, shifting incentives and strategic behavior in response to a national policy, the distribution of political power, and the flow of resources between subnational regions all play roles in how any policy regime evolves and how it operates. Our argument is not that the analytical tools of economics and political science are insufficient,⁷ only that considerable work needs to be done to understand how the particular institutional context determines the design and subsequent results of policies for limiting the effects of global warming.

⁶ The U.S. Constitution (Art. I, sec. 10) enables one or a group of states, with the consent of Congress, to enter into an agreement or compact with another state.

⁷ This is an argument one runs across in the legal literature. For example, Adelman and Engel (2007) make the curious statement that “[t]he complexity of environmental problems does not lend itself to standard optimization methods.” This statement is intended to support the argument that multiple levels of government should regulate environmental problems, since that will increase the chance that someone comes up with “an efficient regulatory solution.” They support their assertion with the informal application of ideas concerning adaptation in biological systems.

First-order exceptions

There are several circumstances that require qualifications to the three-part breakdown suggested by Oates. As we shall see later in the specific context of climate change policy, these qualifications may have important effects on policy design choices, but often little research has been done on the specific issues needed to guide those choices. We organize these qualifications into two groups: (1) institutional constraints on policy arising from the legal charter of the federalist regime, and (2) perceived gains from national policy uniformity.

Institutional constraints on policy development

Constitutional limits. The national and subnational units in a federal union operate under a set of traditional and legal constraints on the range of application of their policy tools, as exemplified by the legal structure of the U.S. constitutional order and the EU principle of subsidiarity and the laws of the constituent countries. The range of U.S. national government powers is explicitly limited by the Constitution. National influence on state or local action outside this range requires the exercise of the power of the national purse through either direct subsidies or the threat of the removal of existing funding.

The states each have a constitution that limits, at least in the short run, their own policy flexibility, and localities derive their local authority from explicit grants of power from their state government—grants that are in some cases specified in state constitutions. Traditional allocations of government power not specified in constitutional law may induce substantial stickiness in policies that may be as hard to change as legal constraints. For example, the zoning power is a jealously guarded prerogative of local governments. Efforts to constrain the local use of that power have often met with fierce and effective resistance (Fischel 2001).

States and localities operate as small, open economies embedded in national and global economies, and this places considerable limits on their ability to carry out policies—even policies with primarily local effects. The easy migration of labor, capital, and other resources across subnational boundaries means that the effectiveness of any policy initiative must account for the shifting flow of economic activity in response. Increased costs in a local jurisdiction will cause investment and economic activity to relocate. The smaller the jurisdiction, then, the more it will want to choose to design its own policies to affect the least mobile assets. This is why local governments lean heavily on the property tax for their revenues as opposed to income and sales taxes (Zodrow 2001).

For local environmental problems, a state may become involved in a race to the bottom if the mobility of investment away from higher regulation swamps the reciprocal mobility of other resources into the state in response to the cleaner environment. This logic is often invoked as a rationale for nationalizing environmental regulation and may apply well to climate change, where the consequences of a changing climate may have very different local effects in physical terms (temperature, precipitation, fire) and economic terms. Moreover, the cost of controlling local GHG emissions may vary considerably but does not have any obvious correlation with the local environmental consequences, either in absolute terms or in relation

to other states. There is no more reason to expect localities to choose stringent controls on a global pollutant or to expect firms engaged in global commerce to locate in jurisdictions that choose such controls (in fact, the opposite) than there is to expect individuals to make optimal voluntary contributions to national defense expenditures.

Policy instruments. National environmental policy in the United States falls fairly neatly into three types: (1) command, (2) bribe-and-subsidize, and (3) marketlike instruments. The command form generally establishes a national (minimum) standard directly on environmental quality or indirectly through technology standards, with state implementation and enforcement. As we will discuss at length later, the national policies frequently establish a meet-or-exceed standard for state performance, leaving more or less flexibility to the states in how they achieve the minimum standard, although some rules preempt states from diverging from the national standard. The ambient standards under the Clean Air Act, the total maximum daily loads under the Clean Water Act, the Safe Drinking Water Act standards, and recent legislative proposals for a national renewable portfolio standard all take the form of meet-or-exceed standards with state implementation (Portney and Stavins 2000).⁸

Some local activities may be beyond the constitutionally permissible reach of the national government. In this case, national policy must work through financial incentives of bribe-and-subsidize to the states and localities. The most direct mechanism for inducing subnational governments to undertake some action is just to pay for it, which works well when the state or locality would like to implement the policy but underinvests relative to the national goal. Direct payments are costly, however, and will not work where the state or locality does not want to implement the policy in question. This leaves the national government with the bribery option, where the state or locality stands to lose funding for desired programs if it does not implement some less desirable program. For example, a share of national transportation funding to the states was made contingent on the states' raising their legal drinking age to 21 and, in another case, allowing right turns at red lights unless otherwise posted. The bribe mechanism has been responsible for a significant expansion of national policy into areas traditionally the responsibility of state and local governments but has been repeatedly ruled as constitutionally permissible by the U.S. Supreme Court (Zimmermann 2008, Chapter 5). And the bribe mechanism is evident in the state-local relationship as well. For example, the State of California has repeatedly threatened to withhold sewer funds from local governments that fail to develop local plans to adequately manage air quality.

Market instruments take the form of emissions trading programs, tradable performance standards, or Pigouvian taxes, all of which operate by creating financial incentives to avoid emissions. The United States has considerable experience with emissions trading (or cap-and-trade), the establishment of a market for a limited number of allowances to emit a pollutant.⁹

⁸ Some authors have pointed to the potential inefficiencies that likely arise from establishing stringent minimum standards on pollutants with a primarily local effect, but this issue is beyond the scope of this particular study.

⁹ Trading has also been used successfully in fisheries management for coastal fisheries regulated under national

Many air pollutants have been regulated under explicit emissions trading programs, including the well-studied national market for sulfur dioxide (SO₂) allowances. The regional market for nitrogen oxides (NO_x), which was established by the U.S. Environmental Protection Agency (EPA) as part of a program to limit interstate transport of pollutants in the East, allowed states the option of traditional emissions regulation or participation in a regional emissions trading program. All states opted for participating in the trading program. Also of interest are the northeastern states' Regional Greenhouse Gas Initiative cap-and-trade program for carbon dioxide (CO₂) emissions from electric utilities and the cap-and-trade program for controlling volatile organic compounds in the Chicago area. Examples of tradable performance standards include the lead phase-down and nutrient emissions into waterways; both provided some compliance flexibility through trading, but neither was designed primarily as a trading program. Nutrient trading, in particular, has never worked well because of the considerable frictions built into the underlying regulatory regime (Shabman and Stephenson 2011). The third instrument, Pigouvian taxes, has rarely been used in the United States.

Because those incentive mechanisms avoid direct commands to states about specific actions they must demand of emitters within their jurisdictions, it may be that the reach of national rules based on market instruments extends beyond the permissible reach of command-style regulations. At this time, there has not been enough experience with these mechanisms to delineate clearly their constitutional reach. What is clear is the constitutional authority of the national government to establish regulations on GHG emissions, and it almost certainly follows that this includes the authority to establish incentive mechanisms in lieu of regulations (Richardson et al. 2011; Wannier et al. 2011).

Later, we will investigate how the different instruments of national environmental policy might work as applied to climate change.

Common reasons given for uniform national policy

There are other reasons beyond the three cases in the environmental federalism model for elevating the geographic scope of environmental regulation. Among these reasons are (1) environmental justice, which concerns itself with fairness and the protection of individual rights against bearing an undue share of the burden of pollution, (2) reducing the costs to the economy of regulatory balkanization arising from different rules in different states, (3) promoting national commerce by ensuring that minimum standards of safety will be met everywhere in the country, and (4) preventing local actions from imposing future burdens on the national social insurance programs.

The appropriateness of these arguments depends on the circumstances, but many observers of American federalism agree that there has been a tendency to apply these rationales for centralization too liberally, resulting in a national policy reach that is inefficiently long in a number of respects (Rivlin 1992; Frerejohn and Weingast 1997). The

increasingly common use of national government policy to establish minimum standards on activities that have primarily local effects has been the subject of a rising chorus of critical commentary from observers of U.S. federalism (Rivlin 1992; Dinan et al. 1999). Below, we discuss the relevance of such criticisms with respect to climate change.

Climate change federalism

As we have already noted, the global extent of effects from climate-altering emissions provides a strong theoretical rationale to assign authority for domestic decision making over climate change policy to a national government. Because of the global nature of GHGs as a pollutant, any single locality investing in reducing its contributions to the global stock of carbon emissions will bear the costs of the investment but realize only an infinitesimally small share of any benefits, which are global in their incidence. It is obvious that, under these conditions, one would expect localities to underinvest in the global public good of reduced emissions. This does not imply that no localities will invest in reduced emissions. It does mean that significant local investments will raise costs and prices relative to jurisdictions that do not reduce emissions and will not have measurable benefit to the local jurisdiction, placing the low-emissions jurisdiction at a competitive disadvantage.¹⁰ Furthermore, local reduction efforts may not end up reducing global emissions because of the mobility of factors of production (Bushnell et al. 2008). Under these conditions, we would expect to see only modest investments in reducing emissions, at least relative to what would be required under an optimal policy.

In the simple, unitary model of climate regulation, once authority over climate change policy is assigned to the national layer, then the question of allocating governmental responsibilities is resolved. Policy and economic analyses of the climate problem typically have assumed that once engaged, the national government will undertake all policy development and implementation or direct action to be taken by subnational units; that is, policy implementation would unfold as if other decision layers no longer existed. This simple model of governmental behavior, while providing a useful starting point for discussion, does not reflect our understanding about how environmental policy (or any policy) is made in a federal union (Anton 1989; Volden 2005). At every step, from the assignment of decision making authority to policy design, implementation, and enforcement, a national climate policy will depend on national, state, and local political interests and on the relative value of centralized or decentralized institutional arrangements (Peterson 1995). Much economic

¹⁰ It is frequently asserted (see, e.g., McKinstry et al. 2007) that implementing GHG reduction strategies at the local level can save money and increase local competitiveness. If this is true, then the justification of reducing GHG emissions to address global warming is not a necessary condition for saving the money; it is profitable without regard to any local perceived benefits of lowering atmospheric GHG concentrations. By construction, any reductions beyond those that are already profitable will raise costs relative to jurisdictions that do not.

analysis has focused almost exclusively on national climate policy and even on the need to harmonize climate policies across countries, implicitly assuming that the development and harmonization of climate policies at the subnational level would be mandated or guaranteed, although we discuss exceptions in what follows.

Our theme is that the *assumption* of harmonization of subnational policies around an optimal national policy is unhelpful and may lead to the continued inability to implement a national policy or to the implementation of ineffective or inefficient policies. Because of the magnitude of the investment needed to reach the likely targets of a national policy, it is essential that the costs of achieving emission reductions be as low as feasible, but there are ample reasons to believe that the incentives created by a national program may induce state and local governments to choose policy responses that would raise the total national cost of emissions reduction, or may fail to induce them to take actions that would reduce costs.

There are very good reasons why, even in a federalist state, the national government should be the locus of decision for establishing policies for GHG reductions for the country. Ultimately, an effective program to mitigate climate change requires international cooperation, including entering into treaty obligations, a function that is the sole province of national governments. National-level policy minimizes, within a country, leakages and spillovers that drive subnational jurisdictions to choose less environmental protection than they would like since the costs are local and the benefits are not. Uniform national price signals lower the cost of achieving a given level of reductions by expanding the scope of activities over which costs may be minimized. Finally, national policies may be needed to safeguard nationally agreed-upon standards of fairness and protection of minority and individual rights, such as those explicitly mentioned in the constitutional charter and in international standards for the protection of human rights.

Juxtaposed with these reasons for national policy are reasons to include subnational jurisdictions in both designing and implementing the national policy. Recent scholarship highlights the importance of perceptions of trust, fairness, and reciprocity to the effectiveness and efficiency of policy regimes (Fehr and Gächter 2000; Ostrom 2010). Local participation in national policy regimes promotes trust and may lower the cost of achieving climate protection. Opponents of the policy, who can readily recognize the cost of climate policy, are likely to be mobilized at all levels of government, but while the benefits are diffuse, proponents are unlikely to be so mobilized (Olson 1971), especially when there is no relevant policy handle for involvement at the local level. Moreover, devolving authority to local jurisdictions engages the interest of all factions at the local level, arguably leading to more healthy local engagement. Accommodating heterogeneity in local tastes allows local jurisdictions to make policy trade-offs that more closely meet local preferences. Dispersed policymaking promotes local policy innovation, which combined with the likelihood that local jurisdictions have lower-cost access to local information raises the possibility that aggregate costs of achieving policy goals may be reduced.

In accordance with the modern consensus on policymaking in a federal state, an overarching theme of climate policy design should be to exploit, insofar as is possible, the authority of states and localities over activities within their jurisdiction. Further, legal and constitutional constraints prevent direct national control over a number of activities normally under the purview of subnational governments; changing these structural characteristics of the federal union raises the political cost of establishing a policy regime. National policy must necessarily be filtered through multiple layers of subnational policy that though unrelated to climate change will affect the transmission of incentives through the economy.

There is good reason, then, to favor national GHG reduction targets. To minimize the cost of achieving the national emissions reduction target, in the longer run a nationally recognized mechanism for establishing a price on emissions will be needed, and the price should be chosen such that national emissions targets will be achieved. We will argue that, in the short run, it may be possible to accomplish relatively cost-effective reductions through emissions standards implemented through flexible regulatory instruments that fall short of market-style regimes. That subnational entities will have a role in establishing both the reduction path and the mechanism design has received attention from political scientists but little scrutiny from economists. The allocation of newly instantiated resource rents plays a critical role in the outcome of this process and therefore demands attention for its part in the policy process.

Design of the national mechanism must take into account the effect of the policy on the incentives of subnational governments. Because of both a presumed cost advantage and the allocation of responsibilities in the federal charter, local jurisdictions will certainly have a substantial role in implementation of any national GHG reduction strategy. Localities are agents of the national government, but their own separate payoffs to the implementation of the national program and to other local activities may affect the cost or success of the national program. Of obvious relevance is the division of responsibilities and costs for enforcement and monitoring. Less obvious are the incentives for subnational governments to minimize costs by adjusting policies traditionally under their control, such as building codes and land-use controls. Any national policy should take into account localities' incentives to undertake costly local policies to shift the costs and benefits of the national program.¹¹

Setting the national goal

There is circularity about setting the national emissions path in a federal union like the United States. Assuming that one can sensibly estimate a national willingness-to-pay function for reducing emissions, then one estimates the costs of achieving any level of reduction and propose to the national political institutions the emissions path that equates our estimated marginal costs and marginal benefits. Subnational governments would be distributed around the chosen path according to whether they prefer a steeper or flatter reduction path; some

¹¹ There is much to be learned about these influences from the literature on fiscal federalism (Oates 1999; Oates 2005).

may even prefer a positively sloped path. Since state and local governments have political power independent of the national government, they will have some influence on the eventual emissions reduction path chosen. Unfortunately, the costs of reduction also depend on details of the national program, due in no small measure to the incentives or disincentives that it offers the states and localities to use their authority and expertise to reduce the costs of reductions and to implement policies that support or impede the national goal.

So, to have a national policy at all, and especially to have one that minimizes costs, there must be a certain level of support from the states. But the state support may be contingent on choosing a program design that is not cost minimizing from a national perspective. For example, states would presumably argue that some share of the proceeds of emissions taxes or allowance sales be distributed to the states rather than used to lower marginal national tax rates on labor and capital. The more revenues apportioned to the states, the more likely they may be to support deeper emission reductions.

Costs of achieving the national trajectory

We assume that in a federal union, the national government will have the primary responsibility for establishing the national emissions target for a global pollutant. This target will be optimally set by equating estimated marginal costs and benefits. If this choice is made based on national costs and benefits, how is this calculus affected if a state chooses to impose greater costs on itself? If a state should choose to implement a policy in a way that is more costly than necessary, perhaps to give an advantage to its own businesses or citizens, does this change the efficient emissions reduction target by altering the national cost of abatement? The origins of this problem are in the separate and distinct preferences that are necessarily part of the policy choice in a federal union. There is no longer a single set of national preferences to apply to the choice of emission targets. And subnational governments may be willing to trade higher compliance costs for other, more preferred policy outcomes.

State and local incentives under national regulation

A national cap-and-trade program may erode the ability or the incentive for state and local action to reduce emissions. This possibility is of concern because subnational activities are important to achieving overall emissions reductions at least cost. These activities can take different forms, from explicit climate policy to the vast set of ancillary activities that affect the cost of achieving emissions reductions goals. We discuss formal climate policies here, and ancillary issues in the next subsection.

The leading legislative approach to comprehensive climate policy in much of the world, including the United States and the European Union, is emissions cap-and-trade. This approach limits the total quantity of emissions allowed during each compliance period but offers flexibility as to where and when those emissions occur. A limit on the total quantity of emissions would introduce a scarcity value on the ability to emit, and that value would be reflected in the market price of tradable emissions allowances.

Several authors (Stavins 2007; Ellerman and McGuiness 2008; Goulder and Stavins 2011) have worked through the cases in which state-imposed emissions caps might interact with a national cap-and-trade program. Two factors that affect the outcome are the relative stringency of the two programs and their scope of coverage. If a state program is less stringent than a federal program for the set of sources that it regulates, the shadow value (allowance price) of the emissions constraint in the state would be zero and the state program would have no effect on behavior. In fact, the Regional Greenhouse Gas Initiative (RGGI), the cap-and-trade program among 10 Northeast states, anticipates such an outcome explicitly in its memorandum of understanding.¹²

Although described as an emissions cap, such a policy is also an *emissions floor* because any effort to reduce emissions by one entity, including state and local governments or private parties, does not affect the overall level of emissions (Burtraw and Shobe 2009; Goulder and Stavins 2011). Under an emissions cap, efforts to reduce emissions by one party make possible additional emissions by another party. The emissions floor undermines the incentive for state and local governments to adopt measures unilaterally that may contribute to local emissions reductions because leakage of emissions to other jurisdictions would be 100 percent.

Hence, a cap-and-trade program at the national level introduces effective preemption of measures to achieve additional emissions reductions by other layers of government or, for that matter, by private individuals and organizations. If the state cap-and-trade program were more stringent than the national program, it would impose additional costs on sources in the state and would lead to lower emissions in the state, but there would be no change in emissions at the national level.¹³ The only method available for reducing aggregate emissions is to purchase and retire national allowances. For example, a subnational government could buy and retire additional allowances or could require sources to surrender allowances to the state in addition to national authorities, effectively forcing compliance at greater than one allowance per ton. Such efforts by some states to retire additional allowances simultaneously would raise the marginal cost of emissions reductions for the entire country and would be fought by other jurisdictions that would see their costs rise.¹⁴

There are also ways that the national and state programs might interact with respect to the timing of emissions. The value of banking under a state program would be affected by the expectation of how a bank might be treated in the future. Congressional discussions (and awareness of the 20 senatorial votes representing the RGGI states) suggest that the intent of

¹² “When a federal program is proposed, the Signatory States will advocate for a federal program that rewards states that are first movers. If such a federal program is adopted, and it is determined to be comparable to this Program, the Signatory States will transition into the federal program.”

¹³ If the state program has a broader scope of coverage than the national program, then the outcome will depend on the relative marginal costs of covered sources.

¹⁴ As pointed out in Bianco et al. (2009), there is symmetry here with localities wishing to encourage local expansion of GHG-intensive industries. Doing so imposes a pecuniary externality on other states by increasing the demand for allowances and raising the equilibrium price. Part of the cost of a local subsidy to GHG-intensive industries is paid by others.

the proposed S. 3036 in 2008 (Lieberman-Warner) and language in H.R. 2454 (Waxman-Markey) in 2009 would have provided credit for early reductions equivalent to the value of allowances in the RGGI bank.

Burtraw and Shobe (2009) point out that the same issues do not arise under a national tax on emissions. A jurisdiction with a greater willingness to pay for emission reductions than the level at which the tax is set could pay something more than the tax by establishing local policies more stringent than those implied by the current tax rate. In this case, unlike under a quantity constraint, net reductions in emissions can be achieved without raising compliance costs in other jurisdictions. In an economic framework, one should note that if the tax were set at a social optimum from the national perspective, such a policy would result in a loss of social surplus, since the value of the resources used for the additional GHG reductions would be more than the social value of the incremental reduction in GHG emissions.

Williams (2011) has used an analytical approach to evaluate the incentives and efficiency of separate national- and state-level actions and of combined actions. As summarized in Table 1, the paper evaluates three classes of policies: prescriptive regulations to achieve an emissions cap, taxes calibrated to achieve the same cap, and emissions trading. (He does not consider mixes among these types of policies.) In every case, state governments acting unilaterally do not have adequate incentive for an efficient outcome because of the spillover of benefits to other jurisdictions. Any of the policies implemented at the national level can achieve the efficient result if the national government can differentiate the policy among jurisdictions, an unrealistic outcome.

The more interesting results obtain under the assumption that the national government cannot differentiate the policy. In this case, prescriptive policies concurrently pursued by national and state governments will not achieve the efficient outcome, but they will be at least as efficient as action at just one level of government. Unilateral cap-and-trade at either level of government also will not achieve an efficient outcome, but in this case concurrent caps at the national and state levels are likely to reduce efficiency (assuming state-level caps bind and are additional) because it leads to a distribution of marginal costs that are not equal across states. Again, unilateral taxes at either level of government will not achieve an efficient outcome. However, in this case states are more likely to supplement the national tax with their own taxes, and in most cases this will lead to a more efficient outcome than a national tax alone or national cap-and-trade.

Table 1. Jurisdictional combinations in climate policy (Williams 2011)

	National (Undifferentiated policies meaning MC equal across states)	State	Mixed
Regulation	MC=AvgMD Not first best.	MC _i =MD _i Spillovers not accounted for. (Presumably less efficient than national regulation.)	MC _j =AvgMD for j where national reg binds. MC _i =MD _i otherwise. Not first best, but at least as efficient as national regulation. ¹
Taxes	MC=AvgMD Not first best.	MC _i =MD _i Spillovers not accounted for.	MC ^{national} =AvgMD States likely to supplement. ² In most cases more efficient than national cap-and-trade. ³
Cap-and-trade	MC=AvgMD Not first best.	MC _i =MD _i Spillovers not accounted for.	MC _j =AvgMD for j where national cap binds. Binding state caps probably reduce efficiency. ⁴

Notes: MC=marginal costs; MD=marginal damages; AvgMD=average marginal damages. Subscripts indicate perspective of an individual state. Differentiated national policies (tailored for each state) can achieve first best in every case. Results assume spillovers and heterogeneity across states. Tax revenue or permit value returned per capita to states. Williams does not consider interaction among types of instruments.

1. State regulation would not bind when spillovers are large or when there is little heterogeneity across states in MD.
2. Some states may subsidize emissions.
3. This is true if MD_i approximates i's share of tax revenue. Note that directed transfer or expenditure of revenue to match damage yields first best (a differentiated policy).
4. Assumes states' programs withdraw national permits from market, changing national cap.

The results examine agency in the formal context of explicit climate policy, but they do not address the important role that subnational levels of government play in implementing such policies. A national policy, such as an emissions cap (i.e., floor) on GHG emissions does not itself require additional state or local mandates, but it does require state and local cooperation for implementation to be cost-effective through the land-use planning and other activities of these entities. In this regard, the performance of each type of policy at the national level will vary substantially with respect to the transference of price signals and incentives for state and local cooperation and innovation.

Transmission of price signals and incentives

One deficiency in the standard analysis of market-based approaches to climate policy is an understanding of how price incentives from national tax or trading schemes are transmitted through the economy and, hence, through the layers of state and local regulatory and tax policies. For instance, a state's choice about whether to have a regulated or a competitive

electricity industry has important implications for how GHG prices propagate through to the consumers and producers of electricity. Other less well-studied examples are the influence of state sales and income taxes, local property and business licensing taxes, state and local building codes, zoning and land-use planning rules, even real estate regulation and occupational licensing. Another local choice — albeit one subject to considerable restrictions in the case of interstate highways — is whether to charge for the use of roads. We do not yet have much helpful research on how national policies to price GHGs might affect state and local choices about any of these policies.

This issue has two distinct but related parts: what effect do prices have on the behavior of local governments themselves, and what happens to the transmission of price signals to individual decision makers once the effects of local taxes and regulations are taken into account? Ever since Tiebout (1956) pointed out the possibility of a competitive equilibrium among jurisdictions, we have had good reason to believe that state and local authorities do respond to incentives. They have some incentive to provide a preferred mix of policies and to do so efficiently. If they do not, then mobile economic resources will relocate to jurisdictions that do a better job. This logic applies to local responses to national climate policies. When facing a national emissions price or regulatory regime, a locality has some incentive to choose a cost-effective response but will often face a trade-off between cost-effectiveness and the preferences of consumers and businesses for a given set of local policies.

The electricity sector is an important example. Although it is responsible for about 40 percent of the nation's CO₂ emissions and one-third of GHG emissions, engineering and economic-based modeling suggests it would provide two-thirds to three-quarters of the emissions reductions over the first few decades of a cost-effective climate policy (Energy Information Administration 2009). About half of electricity customers are served under cost-of-service regulation, where the value of emissions allowances would be included in the calculation of total cost and passed on to consumers indirectly, as part of the average cost of production over the 24-hour cycle. Producers in these regions can expect to recover the cost of pollution charges as part of average prices. In competitive regions the pollution price is transmitted through to the consumer price only when the polluting technology is the marginal technology and thereby determining the consumer price. Clearly, these different regulatory environments lead to different electricity prices and different cost recovery for producers, with significant implications for the cost of implementing of climate policy (Burtraw et al. 2001; Parry 2005).

The sulfur dioxide trading program, labeled “the grand experiment” (Stavins 1998), has served as a template for GHG trading. Yet the SO₂ program interacted with state regulation in an unanticipated way. At the outset of the program, all states were under cost-of-service regulation. A voluminous literature documents the often successful efforts of public utility commissions to influence through the cost recovery rules the compliance activities of regulated electricity generators, in particular to support other in-state interests including in-

state coal mining, with some impact on the costs of the program especially in the early years (Rose 1997; Arimura 2002; Sotkiewicz 2002; Swinton 2002). Whether the program design could have anticipated this behavior is unclear, but observers noted that implementation of the program could have helped remedy this issue through greater involvement by the Federal Energy Regulatory Commission in outreach to state public utility commissions. In any event, economists wholly failed to anticipate the issue of agency in modeling the program's implementation (Bohi and Burtraw 1992), an important lesson for the study of climate policy.

That example reminds us that local governments will make their best strategic response to any national policy, and depending on the nature of the national policy, their response may not be to support the pass-through of effective marginal price signals to consumers. That said, localities do face costs in not selecting efficient outcomes. In the U.S. eastern regional NO_x market, states were granted a fixed number of allowances and may do with them as they choose. With only two minor exceptions,¹⁵ the states have chosen to use updated grandfathering to allocate allowances to regulated emitters. This has a substantial opportunity cost in terms of lost revenues for the state government as well as induced inefficiencies in electricity sector investment. Each state has some reason to be concerned that if it is the only state to sell its allowances, then some electricity generation will "leak" to states that grant them for free.

More generally, though, subnational units of government pervasively shape the long-lived infrastructure that will constrain our options to address climate concerns for decades into the future. Depending on how a policy is implemented, compound layers of agency may exist between national-level policy and local decision makers. Information asymmetries in these multiple layers of government responsibility imply that a cost-effective outcome is dependent on decentralized policies and behavior. State and local governments are uniquely positioned to implement many aspects of an overall climate strategy, and an important question is whether the price signal from a cap-and-trade program (or a tax) would provide incentive for these governmental actors to do so.

What state and local governments actually do is omitted from virtually all economic models of climate policy. They conduct a variety of functions with substantial environmental consequences that federal authorities could not possibly provide, based on their available information.¹⁶ For example, local authorities decide whether streets and individual building footprints are aligned so that houses achieve maximum solar gain, and eaves are designed so that at specific latitudes they let in maximum light in the winter and shade in the summer. They decide building standards that determine whether glazing is optimized, buildings have

¹⁵ Kentucky has sold a small share (around 5 percent) of its allowances in some years, and Virginia auctioned some allowances in 2004 to help balance the state budget. In Virginia's case, legislation specifically forbade the future auction of allowances to avoid giving incentive to electricity producers to move to neighboring states (Porter et al. 2009).

¹⁶ It is noteworthy that H.R. 2545 (Waxman-Markey) had provisions providing incentives and requirements for local government.

cool roofs, and landscaping is designed to buffer against seasonal winds. Perhaps trivially, they decide about ordinances or covenants that may disallow outdoor clotheslines. But as in ancient Rome, local governments also decide about protection of solar access. They decide whether asphalt surfaces are minimized to lessen heat gain, and importantly they determine transportation systems that influence where people live in relation to their work. The sum of these activities will determine the infrastructure of communities for the next century, and the influence on the global climate, in the aggregate, is profound.

Some of the models of economic approaches to climate policy consider the role for subnational policies, such as cap-and-trade at the state level, but virtually all ignore the planning function at the subnational level. The implicit assumption is that the price signal will influence economic behavior throughout the economy. However, we suspect the planners and policymakers in local jurisdictions who determine the outcome of these issues may respond slowly or only partially to the direct incentives of price signals stemming from the national emissions quantity constraint. They have substantial concern for the preservation of the status quo and protection of values associated with existing land use. Perhaps surprisingly, it is typically developers who take the role of innovator but encounter substantial friction at the local planning department. Indeed, an individual homeowner who wants to introduce innovative architecture or align a house differently to maximize solar gain is likely to encounter stiff resistance.

On the other hand, state and local authorities do respond to other types of incentives, such as revenue transfer mechanisms and prizes. And localities are often innovators—for example, with the development of building codes. Ultimately, they are responsive to the interests of the local building industry. Unfortunately, we do not know much about how responsive local authorities will be to a modest market signal associated with the introduction of pollution prices.

To be sure, economic forces will ultimately influence local tastes in planning functions if one can wait long enough and prices rise high enough. In the meantime, these local decisions lay the foundation that constrains society's options for decades to come.

The salience of price

The notion that price signals may not be transmitted through layers of government in a frictionless way has an analogue in discussions of market failures and the so-called efficiency gap. Doremus and Hanemann (2008) make an extended argument that a price signal created by a national cap-and-trade policy is not enough to induce changes in behavior at all the margins necessary to achieve the desired reductions. They argue from intuition that many facets of individual behavior need to change and that price signals from a cap on emissions are not “visible enough to the decision maker” or “salient and meaningful enough to prompt a shift in behavior.” Because consumers will not respond sufficiently to prices under a cap, they believe, the national government will need to force states to regulate these activities by

imposing emissions reduction requirements directly on the states, which would in turn prepare “climate implementation plans.” These plans would require states to regulate enormous numbers of activities for the purpose of reducing emissions, with national approval of the proposed plans.

While superficially protecting the states’ ability to choose their own approaches to reducing emissions, such a program would intrude on the prerogatives of the states to a degree far beyond anything we have yet experienced. To avoid as much as possible the intrusion into traditional state and local responsibilities, it is critically important to understand more about how the economy would respond to the prices under a cap (or an emissions-equivalent tax).

Under an emissions cap, since maximum emissions are fixed, it is not clear why the price would not rise enough to achieve the target reductions. The concern raised by Doremus and Hanemann is actually more about the cost of achieving reductions. They implicitly argue that market failures prevent important sectors of the economy from responding effectively to the price signals under the cap. Meeting the reduction targets under the cap would then require the cap to be met only by those sectors that do respond to price, and this would raise the cost of reductions. Costs could be lowered if the national government forced states to directly regulate the unresponsive sectors, such as requiring the development of building code energy efficiency standards. But without careful program design, including recognition of the incentives that would elicit the intended innovation and response at the local level, there can be little reason to expect that such a strategy would lower the costs of compliance.

It is also not clear why a nation operating under a cap (or an equivalent price-induced emissions trajectory) would need to specify that subnational units achieve cost-effective reductions within their jurisdiction unless there are nonprice spillovers between jurisdictions. Localities may have very different objectives or very different willingness to use market allocation for public goods. Political forces lead both national and local governments to choose implicit taxes over explicit ones, even at substantial cost in efficiency. If state competition is effective, then there may be little reason to try to change these local choices.

As we have noted, when a national policy involves regulations that are implemented at least in part by subnational entities, then the national and subnational governments may be in a principal-agent relationship, and the policy design must take this into account. When the national policy takes a market-based approach, then the local response to the price signals is no longer that of an agent responding to a principal but rather a market-mediated response. There may be some tendency to view state responses to national market instruments in the same light as their responses to traditional regulatory regimes. This may be one reason why numerous commentators assert the need to supplement market incentives with direct controls on local activities. Without some explanation of why localities should not be allowed to impose higher compliance costs on themselves, the asserted need for direct national control cannot be convincing.

Effective climate policy design requires that we understand more about the response of different economic sectors and layers of government to mandates, incentives, information, and price. Is it true that emissions prices are not salient enough to induce innovation in consumer goods, as some commentators assert? Is an emissions market different from other markets where consumers face the indirect effects of changes in the price of inputs in the production of the final goods they consume? Will emissions prices induce state and local governments to change the nature of their planning functions and find innovative ways to reduce the costs of emissions reductions? Are there market failures or institutional failures at work, and if so, are there ways of resolving them short of large intrusions into traditional state and local policy arenas?

Policy innovation

If states and localities are to retain significant flexibility and autonomy under national climate change rules, what will be their role in policy innovation? To what extent will they serve as policy laboratories? There has been some research on the effectiveness of policy innovation among the states, but little has focused on how national policies could maximize the creative potential of states and localities. Policy research and evaluation by states is a public good. It is hard to see how state and local governments could retain more than a small share of the value of this research. Little is yet known about how national policies might improve the return to investing in policy innovation by subnational governments.

A widely recognized justification for national policy is that it moderates differences among states and can thereby lower the costs of interstate commerce. In addition, national-level policies and agencies are expected to have better information and resources to develop and implement policy than do state governments. Lastly, national policy might help answer questions about the enforceability of subnational policies, including emissions caps, that would otherwise have to rely on civil law of contracts for enforcement, especially in the face of interstate commerce issues and without the ability to engage in international negotiations.

Nonetheless, it is also widely recognized that national policymakers can benefit from policy innovation among the states (Rose-Ackerman 1980; Strumpf 2002). By testing many independently developed policies, a system of decentralized policy development might quicken the development of new, cost-reducing policies. Federal climate policies may benefit by exploring ways to encourage state experimentation and to facilitate the evaluation of state efforts and the adoption of proven initiatives.

Many examples of state innovation and leadership

State prerogative to regulate in areas not been addressed by national regulations, and to supplement national regulation, has led to successful and lasting initiatives, many of which have found their way into national standards. This is especially true in climate policy, where state and local governments took action while the national government stood aside until 2011,

with regulations under the Clean Air Act. Probably most noteworthy is the role played by California, which exercised its unique ability among the states to seek a waiver to national preemption, allowing it to implement vehicle fuel efficiency standards that exceeded national standards. That special status was afforded in the Clean Air Act of 1970, when California had the worst air quality in the nation and had already implemented vehicle emissions performance standards before the national government began to do so. To prevent the further proliferation of vehicle standards and models that would raise the cost of vehicle manufacturing, under the Clean Air Act other states can either adopt California standards or use the national standards; they cannot develop additional alternatives. Legislation in 2002 (Assembly Bill 1493, the “Pavley Bill”) authorized the state’s Air Resources Board to develop regulations to reduce GHG emissions from passenger vehicles; the regulations were approved in 2004. California’s request in 2005 to implement the rules was initially denied in 2008 but ultimately approved in an agreement brokered with the national government and automakers. These standards were adopted as national standards in 2011. This pattern has played out in the propagation of a variety of state-level environmental and energy standards.

Eastern states undertook an extended set of negotiations among themselves and including EPA over the issue of interstate transport of ozone precursors. The states ultimately recommended an optional regional cap-and-trade regime with individual emissions budgets allocated to the states (Farrell 1999).

Specific to climate policy, the design of the Northeast’s Regional Greenhouse Gas Initiative was strongly reflected in the proposed national legislation under H.R. 2454, including, for example, the role for auctions and the auction design with a reserve price. The sale of allowances for revenue first occurred in Kentucky, with over-the-counter sales, and Virginia which in 2004 held an auction for NO_x allowances.

The state experimentation with the Open Market Trading Rule offers an example of cooperation between the state and national governments in trying a new regulatory design. That this design was seen as unsuccessful and eventually scrapped demonstrates how state experiments can be allowed to fail if the results turn out to be disappointing; workable designs, on the other hand, can propagate as states emulate the early adopters.

States have experimented widely in looking for ways to lower the cost of cleaning up waterways. One of the early trading programs was along the Fox River in Wisconsin. Nutrient trading schemes have been tried in North Carolina’s Tar-Pamlico River basin, the Chesapeake Bay watershed, and Long Island Sound. Water temperature trading has been tried in Oregon.

Local experiments follow local interests

Unfortunately, using states as policy laboratories is not without its difficulties. Local policies on climate change will often be driven in part by local interests not necessarily related to climate change. Competition among the states may lead states to choose policies that

undermine, rather than support, the goal of cost-effective emission reductions at the national level. For example, states may be tempted to subsidize the cost of GHG emissions if the net economic benefits of doing so are less than the cost of the subsidy. This action by states reduces the marginal incentive for reducing emissions by emitters and will generally be associated with increased overall cost of meeting a federal cap.¹⁷ In general, one would expect to observe differences in state policies that reflect differences in the expected *local* gains, the *local* distribution of those gains, and the relative influence of various interests at the *local* level.

Policy experiments create entitlements that are hard to eliminate

It naturally follows that once a local policy has been established, it will likely be hard to change because those receiving the benefits of the current policy will be willing to pay through rent-preserving behavior to retain the benefit. Their willingness to pay will be directly related to the size of the benefit received. This implies that policy experiments have a natural stickiness or inertia; they are hard to eliminate once they are in place. Policy inertia arises from the tendency of beneficiaries to view the benefits from the policy as an entitlement: every public policy is an entitlement to someone. This policy inertia creates yet another divergence between the ideal laboratory model and actual policy development by the states. Policy inertia and policy capture by interested groups has been amply demonstrated in many areas of regulatory policy (Stigler 1971; Posner 1974).

Experimentation implies learning from mistakes

“Follow-the-leader” policy development occurs frequently, where one state or a few states implement new policies, and these new policies diffuse across other states often before a careful evaluation can be made of the true impact of the new policies. State policies are infrequently evaluated *ex post*, and this is true especially at the local level, where the significant resources needed for policy evaluation are rarely available. Unfortunately, without undertaking analysis, state policymakers cannot be in a position to make a fully informed decision about whether a policy experiment has promoted the intended goal and, if so, whether it has been worth the cost.

Economic analysts almost uniformly argue that technological innovation is the key to reducing GHG emissions, but most commentators have focused almost exclusively on engineering advances at the point of combustion of fossil fuels. Innovation also may be required in providing the infrastructure that governs the ways that people live and interact. This kind of innovation occurs at the state and local government levels, but incentives to pursue such innovative measures may be weakened under a national emissions floor, such as a national cap-and-trade program. Emphasis should be placed on the design of national policies

¹⁷ In an oddly perverse example, the State of Tennessee recently lured a German manufacturer of polycrystalline silicon, used in producing solar cells, to locate its manufacturing facility in the state by promising to cover the cost of any future federal programs that would raise the cost of GHG emissions. This policy eliminates the exposure of the manufacturer to the incentives to reduce GHG emissions provided by the federal program in return for investment in the state.

that maximize local incentives to invest in innovative solutions and to effectively evaluate the performance of new programs.

Ownership of the climate asset

There has been considerable analysis and debate about how national government climate programs might distribute the proceeds from a national tax or trading program but less discussion of why the national government should be deciding about the distribution of the proceeds at all. In fact, the historical role of states and localities in controlling nuisance provides a reasonably strong argument for viewing states and localities as the default “owners” of any environmental assets created by a national climate policy. How would an acknowledgement of subnational ownership of environmental assets created by a national tax or trading program affect the cost of implementation or the political dynamics of the approval of the program in the first place?

One of the revolutionary aspects of emissions markets and taxes is their instantiation of a hugely valuable asset that previously did not appear in any accounts. It is truly a case of creating value out of thin air. In most of the environmental economics literature and specifically the literature on national climate policy, there is an unstated but important assumption that, since the value of the air quality asset is created by national legislation, then the national government should control or own it. In the earliest implementations, such as the SO₂ market under the acid rain regulations and Phase I of the EU Emission Trading Scheme, the value of the asset created by the cap was simply grandfathered to the regulated firms. As our understanding of the importance of the allocation of this new asset began to improve, investigators examined different approaches to allocation, but always from the assumption that the asset was the national government’s property. That the annual value of allowances under recent proposals for a national cap on GHG emissions would amount to 10 percent or more of annual state tax revenues illustrates the importance of the stakes.

Raising the issue of ownership of this new asset requires consideration of how ownership shares might be established. The distribution of proceeds among subnational jurisdictions will vary tremendously depending on what basis for distribution is chosen. For example, the distribution of actual emissions, economic activity, population, and emissions per capita all lead to very different outcomes for any given year chosen as the baseline.¹⁸ These distributions will change dramatically across the business cycle, since GHG-intensive sectors are affected more by recessions than other sectors. Claims on asset values will also be made as compensation for the local incidence of economic costs arising from the new policy regime (Burtraw and Palmer 2008). Localities will also seek compensation for their costs of carrying out their responsibilities under a national program (National Association of Clean Air Agencies 2008).

¹⁸ Paul et al. (2010). For a discussion of this issue and other considerations from the perspective of state regulatory agencies, see National Association of Clean Air Agencies (2008).

Although the “rightful” ownership of this newly created value may not be clear, what is clear is that we need to inquire about the possible policy options for distributing its actual ownership among the governments in the federal union. As the intense bargaining over allowance allocation under the proposed national climate legislation made abundantly clear, asset allocation provides a tool for compensating states for real and perceived economic dislocations resulting from the cap on emissions. Naturally, states could use emissions revenues in the same way that is assumed in the models of national revenue recycling: they could use the revenues to offset existing sources of revenue, or expand services according to their local priorities. It is often viewed as politically attractive to spend some of the proceeds from a revenue source on purposes closely related to the source. A tax that is closely matched to the services that it provides is referred to as a benefits tax, and there is considerable evidence that benefits taxes have an enhanced status with taxpayers compared with taxes far removed from their spending (Zodrow 2001).

RGGI provides an interesting case in point. Since RGGI is a voluntary confederation,¹⁹ the states retain ownership of the allowances sold by RGGI, Inc., their agent for auctioning the allowances. The revenues are returned to member states, and a major fraction is used for funding energy conservation, renewable energy, and other activities related to the climate change policies that produce the income. This seems to have generated a substantial measure of political support for the program.

Significant research exploring the effects of state allocation of allowances or allowance proceeds is lacking. What level of allocation would effectively compensate localities for their economic losses? What would be the difference between allocating allowances or income from allowances sold by the national government? Would there be advantages to reserving some income for funding state research and policy experimentation? Should states be rewarded with increased payments based on their success in lowering the emissions intensity of their economies? If states are the owners of the asset, how would each state’s share of the total be determined?

Climate federalism under the Clean Air Act

A comprehensive legislative approach to addressing climate change has stalled in the U.S. Congress, placing the Clean Air Act in the central role in the development of regulations that will reduce GHG emissions. In 2007 the Supreme Court confirmed this authority with respect to the regulation of GHGs in a lawsuit brought by the Commonwealth of Massachusetts against EPA.²⁰ It remains noteworthy, in passing, that without state initiative, the development of regulations under the Clean Air Act would not have moved forward.

¹⁹ RGGI and its agent, RGGI, Inc., are the product of a contractual relationship between the member states. RGGI does not qualify as an interstate compact because none of the states in the agreement relinquish any of the fundamental state powers. In particular, they retain all powers of enforcing their own environmental regulations.

²⁰ 549 U.S. 497 (2007).

Subsequent to the Court's decision, the agency made a formal, science-based determination that GHGs were dangerous to human health and the environment. This "endangerment finding" compelled the agency to mitigate the harm and formed the basis for the agency's regulation of GHG emissions. Burtraw et al. (2011) suggest that these reductions could plausibly match the level of reductions in the domestic economy and at similar cost as would have occurred under national cap-and-trade legislation (H.R. 2454).

In response to the endangerment finding, in 2011 EPA implemented regulations affecting new corporate average fuel efficiency (CAFE) standards for cars and trucks, and construction permitting (new source review) for major new and modified sources, such as power plants and industrial facilities. It is especially noteworthy that the fuel efficiency standards, which were endorsed by the automobile industry, were initially developed by California and then spread to other states. EPA's third regulatory action will be the development of performance standards for GHGs affecting new and, in particular, existing stationary facilities.²¹ The application of performance standards for new sources is familiar, but it is nearly unprecedented for existing sources.²² The first standards, expected in 2012, will target steam boilers at power plants fueled with coal, oil, and natural gas, along with petroleum refineries. These sources represent more than one-third of GHG emissions in the United States (Energy Information Administration 2011).

The development of performance standards for existing sources activates the historic federalist relationship embodied in other aspects of the Clean Air Act. The relevant language, in §111(d), prescribes a process in which states develop implementation plans for compliance with national standards. EPA may constrain the latitude of states but it is likely to give states considerable discretion, and in turn, states could invoke innovative methods of compliance. Wannier et al. (2011) conclude after a review of the scholarly legal literature that states could adopt flexible mechanisms, including trading of performance standards within broad emissions source categories and with other states. RGGI states may submit their memorandum of understanding that establishes the program as their implementation plan to achieve emissions reductions from the regulated sources, and the emerging trading program in California may do the same. This degree of flexibility may be viewed as an advantage by other states, and a plausible scenario is that other forms of compliance flexibility, including tradable performance standards, might be proposed by other jurisdictions. Surprisingly, then, state governments may emerge as the vehicle for the propagation of flexible and relatively cost-effective approaches to climate policy.

²¹ Standards under §111(b) of the Clean Air Act apply to new sources (these are termed New Source Performance Standards), and those under §111(d) to existing sources.

²² Existing sources regulated under other provisions of the Clean Air Act are not eligible for regulation under §111(d) (Richardson 2011).

Preemption versus meet or exceed

State prerogative to address climate change is held as a poker chip in many political discussions. Observers will entertain the notion that national compromise might be achieved if opponents can be given sufficient incentive. What better incentive than to remove the engine from the vehicle that has driven climate policy action thus far?

In fact, we have shown that state actions can be efficiency enhancing in some situations and can raise costs in other situations, depending not only on actions taken at the state level but also on the structure of national policy (such as regulations, taxes, or cap-and-trade). Efficiency is an especially important feature of climate policy because the measures that may be asked of society might be extensive and costly, and reducing that cost is probably essential to the implementation of policies that can achieve effective limits on atmospheric concentrations of GHGs.

Hence, a fundamental question is whether state and local prerogatives raise or lower the cost of achieving emissions reductions. We have examined this from two viewpoints already. One is a structural view, involving the technical relationship between policy architecture at the national and subnational levels. For instance, national cap-and-trade introduces an emissions floor that effectively preempts subnational efforts by rendering them not additional, and subnational efforts will only raise national costs. On the other hand, a national emissions tax preserves the incentives for subnational action. Unless the national cap under these two regimes is different, then the difference in the choice of a national policy instrument implies a different target path of emissions. We do not know enough to say which might be more efficient.

A second view emphasizes the functions that state and local governments perform and the ability of national policy, especially market-based policy, to provide incentives that affect that performance. If national policy fails to do so, it will raise the cost of achieving emissions reductions. Moreover, if it evokes effective preemption, as would a national emissions cap (floor), then it removes the incentive for emissions reductions at the subnational level, thereby blunting to some extent the incentive for states to serve as laboratories for innovation and increasing the cost of national policy.²³

A third view is historical. Our scientific understanding of climate change is rapidly unfolding, and a social consensus on how to respond is far from mature. This is analogous to early periods in other historical social movements. When the national government acts, and when it preempts state and local governments from acting, it removes from the bubbling policy caldron the development of ideas that work their way through subnational political decision making.²⁴ In other words, subnational activity is not just about innovation in policy

²³ States do retain incentive to lower local costs of achieving reductions under the cap.

²⁴ For example, at the time of passage of the Sherman Antitrust Act, 17 states were enforcing antitrust actions geared in particular at protecting local establishments from the intrusions of national companies. For two decades after its passage there was little action at the federal level enforcing the act. Indeed, the act enabled the

design, but also about the development of a national consensus. The political process at the subnational level may be very important to that process as climate science continues to develop. The history of RGGI clearly indicates that the organization of the regional program was at least partly intended to act as a spur to national climate legislation. So, state and local actions to address climate change may have as part of their local justification the purpose of signaling a willingness to cooperate in the formation of a national climate policy. Preempting local actions would interfere with this signaling.

Conclusion

The activities of government take place through a dizzying array of organizational forms with entities extending across a great variety of geographies. This geographical diversity presents both challenges and opportunities that, if better understood, could have a substantial effect on the evolution of national climate change policies.

Because energy is used in every aspect of economic activity, the large reductions in energy and fossil fuel use needed to meet reasonable emissions reduction goals, if implemented through direct national standards, would require an unprecedented involvement of the national government in state and local autonomy—an involvement that may easily run afoul of constitutional restrictions on the reach of national authority. The intrusiveness of national authority would certainly engender considerable political resistance as emissions reduction requirements became more stringent, which argues strongly for finding methods of implementing reductions that maximize local flexibility.

At every step, from the assignment of decision making authority to policy design, implementation, and enforcement, a national climate policy will be shaped by national, state, and local political interests and on the relative value of centralized or decentralized institutional arrangements. Policy analysis has focused almost exclusively on national policy and even on the need to harmonize climate policies across countries, implicitly assuming that the development and harmonization of climate policies at the subnational level would be mandated or guaranteed.

In this paper we survey several aspects of the federalist relationship as it applies to the new paradigm of climate policy and governance. Our main observations are summarized in Table 2. Subnational action has several advantages, although none are without caveat. There exists better information on local conditions and opportunities at the subnational level upon which to base actions. Competition between states can lead to innovation in policy design, and subnational decision making offers commensurately better opportunities to exploit diversity.

trusts that it was ostensibly intended to obstruct, by stripping the states of their ability to enforce their own laws. The Sherman Antitrust Act set the stage for expansive economic growth, a two-edged sword that was especially good for Sears, Roebuck, and especially bad for local hardware stores.

Local policy choices can better conform to local tastes even as they are aimed at achieving a specified level of emissions.

Table 2. Jurisdictional advantages

Subnational action
Better information on local conditions
Greater diversity of approaches
Policy design that reflects local tastes
Healthy political economy; enhanced trust and reciprocity
National action
Participation in international agreements
Less leakage and spillover
Equal marginal effort across jurisdictions
Enforcement of ethical imperative for collective action
Open questions
Ownership of wealth created under price-based program
Transmission of price signals to local decision makers
Emissions caps that may erode local initiative

In general, competition among jurisdictions can improve welfare when the competition for capital investment is balanced by competition for people. But reduced carbon emissions probably do not present a very compelling reason for migration and Tiebout sorting according to preferences concerning climate change because of the global nature of the commons. So, states are left competing with each other over the economic activities tied to GHG emissions and the costs of abatement. Thus far, this incentive has been enough to induce states and localities to undertake a limited variety of efforts with at least the stated intention of reducing the damage from GHG emissions. Unfortunately, because of the mobility of economic resources, subnational governments wishing to have an effect on global emissions must choose to regulate only the relatively immobile resources under their control, and this almost certainly leads to regulatory choices that do not minimize the cost of controlling emissions.

Moreover, differences in the stringency of climate initiatives across jurisdictions inherently produce different marginal costs of emissions reductions, undermining the cost-effectiveness and the fairness of policy. In contrast, a national standard or rule may enforce ethical imperatives through national-level nondiscrimination, despite opposition by some localities or individuals.

Consequently, we see a convincing case for national policy, but less convincing evidence for the form of that policy within a federalist system of government. Any approach that removes the policy dialogue from state capitols is destined to surrender that forum to detractors who can readily recognize the cost of climate policy; the benefits, meanwhile, are inherently less apparent. At once, a national policy also silences the supporters who, given an opportunity to shape policy in their own jurisdictions, may otherwise be a positive force in the political economy of climate policy at the subnational and ultimately at the national level.

Finally, there are at least three overarching questions that must be reconciled for policy in a federalist system to be efficient and effective. First, we emphasize that national policies such as emissions taxes and markets instantiate the enormous economic value of the CO₂ disposal services of the atmosphere, and analysts need to evaluate what different program designs imply about the ownership of the new wealth. The implicit assumption in previous national policy debates is that it is a prerogative of the national government to allocate the value of the atmosphere as part of national policy choices. Given the states' traditional role in controlling the use of the air and water for disposal of waste, the assumption of national ownership should not be assumed, but rather should be the outcome of explicit analysis because it will certainly affect the political debate.

We have also argued that under a national policy, price signals may not be clearly transmitted to regulators and investors involved in land-use and infrastructure planning at the local level. Furthermore, a national emissions tax would have a very different effect on local incentives than would a national cap-and-trade policy. An emissions tax would preserve greater incentive for innovation and initiative at the local level. A national emissions cap might erode those attributes unless it is coupled with policies to encourage them. The implications of this difference on the cost and effectiveness of a national program are not yet understood. We also note that it is possible to design national performance standards that retain for the states considerable discretion over implementation, albeit at some loss in cost-effectiveness.

Given the traditional and constitutional allocations of governmental power in the United States, much greater attention should be given to how any national program can provide incentives to and preserve the autonomy of state and local governments. The future of climate policy would seem to be one that embraces and addresses the heart of the federalist relationship.

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