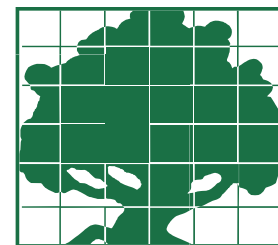


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Correct (and Misleading) Arguments for Market-Based Pollution Control Policies

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The extent to which climate change policy will rely on market-based rather than command-and-control policies is a matter of current debate. This research shows why neither policy, in general, has a greater claim to being “environmentally friendly.” However, market-based policies eliminate a type of regulatory uncertainty that arises under command-and-control policies. In addition, the anticipation that the regulator will use market-based policies leads to investment decisions that increase the value of markets.

The growing concern over climate change has led to an increased interest in designing policies to reduce greenhouse gas emissions. Three aspects of the policy question are central. First, the actual cost of reducing emissions in the future will depend on the investment decisions that firms make in the near term. Second, the nature of the future policies, in particular whether regulators will use market-based or command-and-control policies, is currently uncertain. Third, the stringency of the policies (their “level”) is also currently uncertain. New research from the Department of Agricultural and Resource Economics and Policy at UC Berkeley revisits the theory of environmental regulation and shows that a widely believed and plausible argument in favor of market-based policies is incorrect. It also shows that there are subtle and not widely recognized arguments in favor of market-based policies. The research therefore helps clarify the discussion of regulatory policy.

The current controversy over California law AB32 motivates this research. This law mandates future reductions in greenhouse gas (GHG) emissions. Chapter 5 of AB32 recommends the use of market-based mechanisms, without mentioning either taxes or tradable permits. The bill gives future regulators discretion over the manner of implementing the mandate. Governor Schwarzenegger had wanted the bill to

guarantee a market-based mechanism; shortly after signing the bill, he issued an executive order forming a Market Advisory Committee to design a cap-and-trade market. Some sponsors of the bill considered this attempt to lock in the form of implementation inconsistent with the intent of the law. The bill also gives future policymakers discretion over the extent of implementation. Article 38599 gives the governor the right to adjust the targets “in the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm.” AB32 provides a clear signal that California intends to reduce GHG emissions. It exemplifies a situation where the form of the regulation is currently unknown, and where the economic costs of reducing emissions may determine the stringency of the regulation. It is in this context that our research seeks to sort out the correct from the misleading arguments in favor of market-based regulation.

Are Market-Based Policies “Environmentally Friendly”?

There are many different types of command-and-control policies, and several different types of market-based policies. For our purposes, it is enough to consider one of each type. Under the command-and-control policy, the regulator tells each firm in the industry how much of a pollutant it can emit. The market-based policy (cap-and-trade)

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also imposes a firm-specific emissions cap, but lets firms buy and sell emissions permits. When the regulator has information about the average industry-wide abatement costs, but does not know the individual firms' abatement costs, the market-based policy is more efficient. In some circumstances, there are important differences between different types of market-based policies, such as taxes or cap-and-trade. Our discussion abstracts from those complications. Therefore, in the setting that we consider, taxes and cap-and-trade policies lead to the same outcomes. For the sake of concreteness, we consider cap-and-trade rather than taxes.

The market-based policy enables firms to trade so that the low-cost firms do most of the abatement. Therefore, the market-based policy achieves any level of abatement more cheaply, compared to the command-and-control policy. This efficiency is the basis for the argument in favor of market-based policies. Arguments of efficiency do not persuade all environmentalists, some of whom instinctively distrust markets. An economist might be tempted to convince such a market-skeptic by claiming that the greater efficiency of the cap-and-trade promotes environmental objectives. The economist's argument might proceed along these lines:

The reduction of emissions benefits the environment, but it carries an economic cost. Market-based policies have a lower cost of achieving any level of emissions reductions, compared to command-and-control policies. Therefore, if society balances economic and environmental costs in order to achieve the optimal level of emissions reductions, it will choose a larger level of reductions when the regulator uses market-based rather than command-and-control policies.

This argument has a ring of plausibility, because it reflects the idea that if something is cheaper, we want more of it. Market-based policies (compared to command-and-control

policies) make abatement cheaper, so the former policies should make society chose a higher level of abatement.

Economic theory is well suited to testing this kind of argument, because it uses mathematics to make the argument precise. Our research shows that this argument is not correct in general. Market-based policies certainly reduce the *average cost* of abatement, but they might either increase or decrease the

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marginal (incremental) cost of abatement. The optimal level of abatement depends on marginal, not average costs. Thus, a switch from command-and-control to market-based policies could either increase or decrease the optimal level of abatement. The direction depends on factors that are difficult to measure. The point, thus far, is that the economist should not attempt to persuade the market-skeptic that market-based policies are environmentally friendly. They may not be.

Regulatory Uncertainty

There are, however, powerful arguments in favor of market-based policies that are not directly tied to efficiency, and are not widely known. The nub of the matter is that command-and-control policies give rise to "regulatory uncertainty," and market-based policies eliminate this type of uncertainty. In order to understand this point, it helps to consider a simple example. This example obviously does not capture the tremendous complexity of the real world, but it does help to illuminate something that would otherwise be obscure.

Suppose that an industry consists of a large number of firms, which are

approximately the same; i.e., they have the same costs of reducing emissions. Each firm individually decides whether to invest in a new technology that requires an up-front payment, and which reduces their abatement cost. In the next period, the regulator knows the fraction of firms who made the investment, and announces a per-firm ceiling on emissions. The regulator is not able to give different firms different ceilings, because to do so would set up perverse incentives at the investment stage. Using this example, we want to see what differences arise under the command-and-control and the cap-and-trade policies.

First, consider the scenario where the regulator will use a command-and-control policy. In this case, each firm has an incentive to make the same investment decision as the other firms, for a rather obvious reason. If most of the other firms make the investment, then the industry-wide abatement costs will be relatively low, and the regulator will impose a tight ceiling on emissions. This tight ceiling makes the investment in cost-reducing technology attractive.

In contrast, if most firms do not make the investment, then the regulator will face an industry with high abatement costs, in which case it will be optimal to permit a high level of emissions. This high ceiling makes the investment unattractive. In other words, each firm wants to do what most of the other firms do. At an "equilibrium" no firm wants to change its investment decision, given the decisions of other firms. In the situation here, there are two equilibrium outcomes (in general): either all firms or no firms make the investment. In the former equilibrium, the regulation is strict and in the latter, the regulation is weak. These two equilibria are "equally likely" and they involve very different levels of regulation. From the standpoint of the individual firm, the difficulty of predicting what the industry will do translates into a difficulty in predicting what the regulator will do. Thus, the

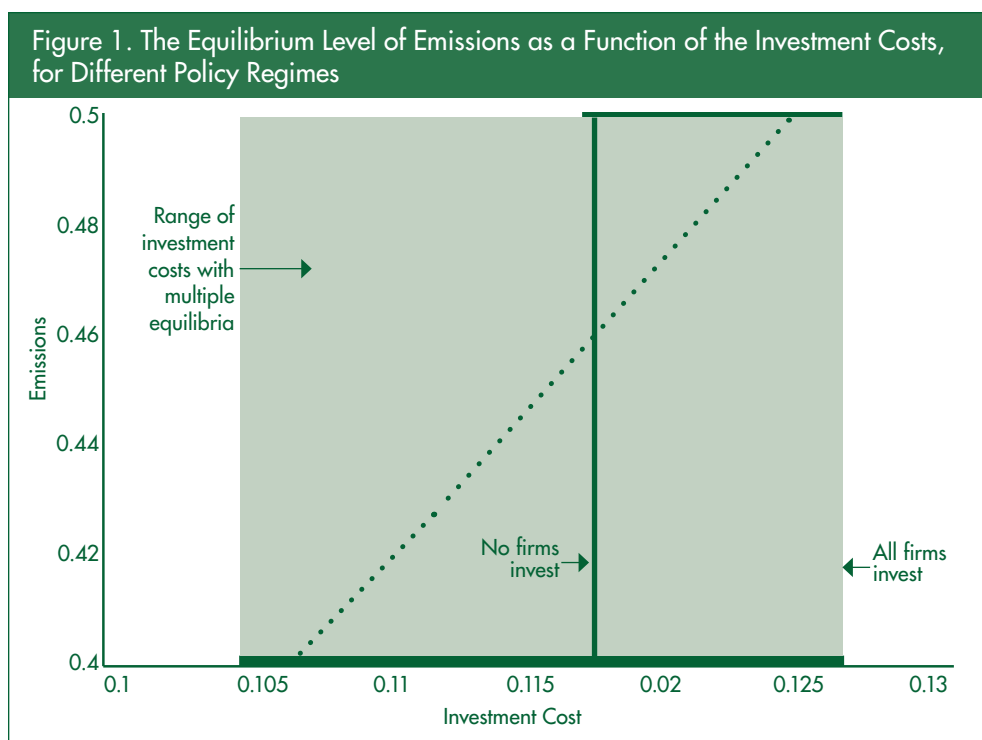
anticipation that the regulator will use a command-and-control policy creates regulatory uncertainty at the investment stage. Firms do not like uncertainty.

The cap-and-trade policy eliminates this uncertainty, because it leads to a unique equilibrium at the investment stage. As more firms decide to make the investment, the equilibrium price of permits falls. As the price of permits falls, a firm is less inclined to make the investment, because the firm knows that it has a cheap means of satisfying the emissions ceiling: buy permits. This fact leads to an equilibrium in which (in general) only a fraction of firms (rather than all firms or no firms) decide to invest.

This example illustrates another point. If firms anticipate that the regulator will use a command-and-control policy, then firms have an incentive to all make the same decision. As a consequence, firms that began with the same cost structure will continue to have the same cost structure. In this case, the gains from trade would be small, even if regulation permits trade. Thus, it appears that the inability to trade is unimportant. This conclusion is wrong, because it ignores the fact that the investment decisions depend on the regulatory policy. If firms anticipate that the regulator will use a cap-and-trade policy, in contrast, some firms will invest and other will not invest. Therefore, there will be substantial cost differences, leading to large gains from trade. The point here is simple: the anticipation that there will be a market causes firms to behave in a way that makes the market valuable.

A Numerical Example

Figure 1 uses a numerical example to illustrate the points made here. The cost of investment, together with the type of regulation, determines the fraction of firms that invest in equilibrium, and this fraction determines the socially optimal level of emissions. The figure graphs the equilibrium level of emissions as a function of the



cost of investing in the technology, under different policy regimes. If all firms invest, the socially optimal emission level is 0.4 and if no firms invest, the optimal emissions level is 0.5. The shaded area identifies interval of investment costs for which there are two equilibria (either $e=0.4$ or $e=0.5$) when the regulator chooses the non-tradable emissions level after investment. There is a substantial range of costs for which there are multiple equilibria (indicated by the shading in the figure), and thus regulatory uncertainty. The positively sloped dashed curve shows the equilibrium level of emissions (as a function of investment costs) when permits are tradable.

The figure also illustrates the outcome in a third policy regime, where permits are not tradable but the regulator is able to credibly commit to a level of emissions before investment (thus eliminating the regulatory uncertainty). In this regime, if investment costs exceed the critical level indicated by the heavy vertical line, then in equilibrium no firms invest and $e=0.5$; if investment costs are below this heavy line, then all firms invest and in equilibrium $e=0.4$.

This example shows that, for a broad range of investment costs, the use of tradable permits rather than command-and-control has an ambiguous effect on the equilibrium level of emissions. The ranking of the level of emissions could go either way, regardless of whether the regulator announces the level of the emissions target before or after firms invest.

Conclusion

In summary, this research shows that one plausible argument in favor of market-based policies, the idea that these promote environmental goals, is not correct in general. However, there are two other arguments in favor of market-based policies that are seldom recognized. (i) Market-based policies eliminate the kind of regulatory uncertainty that arises under command-and-control policies. (ii) The anticipation that a regulator will use market-based policies causes firms to make decisions that increase cost differences and therefore lead to higher gains from trade.

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