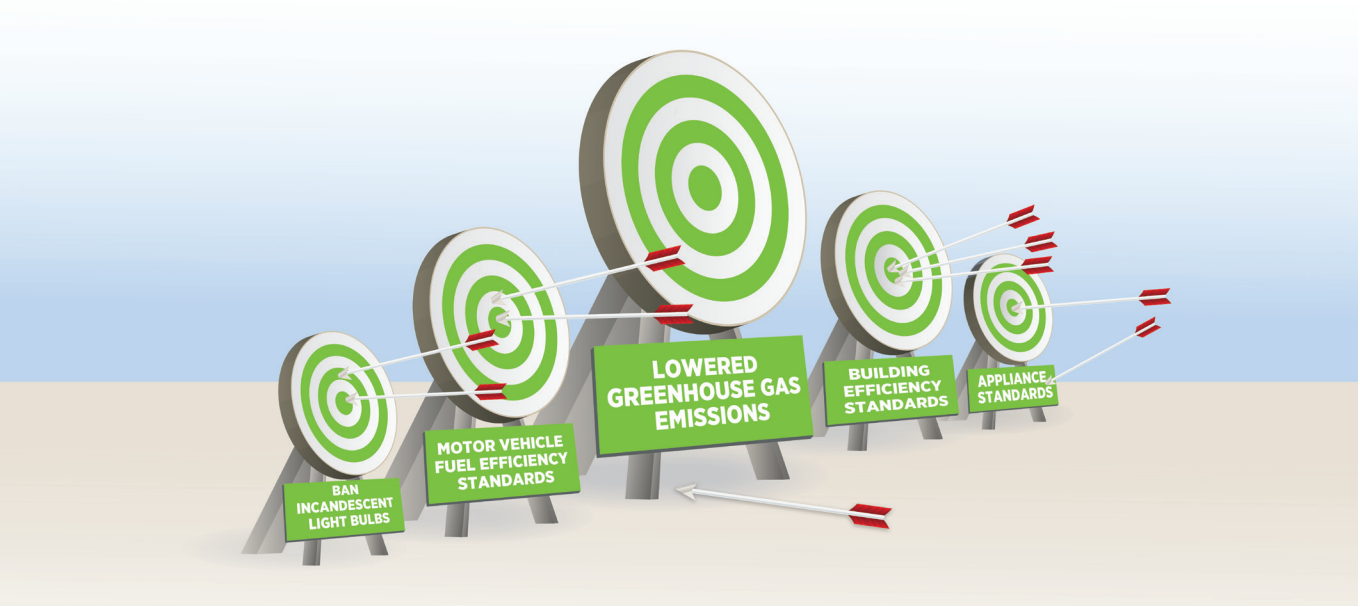
FRASER RESEARCH BULLETIN

FRASER INSTITUTE

May 2015



The Principle of Targeting in Energy and Environmental Policy

by Ross McKitrick

Summary

The Principle of Targeting is a basic and simple rule for policymaking that helps minimize the cost of government intervention. Its core idea is that if a new regulation of some sort is required, the most efficient intervention targets the specific variable of direct interest.

Many energy and environmental policies target surrogate variables that the government has no legitimate interest in. Furthermore, the rules are often expressed in forms that constrain activities the state has no reason to care about, which leads to economic inefficiency and unnecessary constraints on harmless private choices.

The Principle of Targeting is simple and intuitively obvious, but it is surprising how rarely it is followed in practice, especially in the areas of energy and environmental policy.

Its application would make government regulation both more effective and less cumbersome and costly for society.

The Principle of Targeting

Introduction

The Principle of Targeting states that, in order to minimize the cost of government intervention, regulations aimed at changing a specific aspect of the economy (such as pollution emissions) ideally should take the form of a single rule targeting that particular aspect as directly as possible (Dixit 1985, Kopczuk 2003). For example, if a regulator wants to reduce sulphur emissions from smokestacks to a certain level, a well-targeted regulation would simply set a limit on the total allowable sulphur emissions from smokestacks and otherwise leave it up to market participants to decide how they want to respond to the rule. To the extent that regulations deviate from this approach by targeting things other than sulphur, they amplify the cost of achieving the goal. If, for example, the regulation instead prescribes the ratio of sulphur emissions to the output of the plant, or prescribes a specific type of pollution control equipment that must be used regardless of the plant's operating level, it can be shown that any sulphur emission reductions achieved under such indirect rules will cost more than would have been the case under a directly targeted approach (Helfand 1991).

While the underlying idea is obvious once stated, it is rarely followed in the fields of energy and environmental regulation. Instead, there has been a proliferation of indirect regulations. For instance, some or all types of incandescent light bulbs have been banned in Europe and North America, ostensibly because governments are concerned about air contaminants and greenhouse gases emissions from power plants. But if that is the goal, it would be more efficient to regulate the emissions directly (as is already done in most cases) and leave consumers free to choose their light bulbs. Likewise appliance standards, motor vehicle fuel efficiency standards, bans on plasma screen TVs, bans on plastic shopping bags, etc., reflect a failure to appreciate the inherent inefficiency of regulating something one actually doesn't care about (whether someone uses a plastic or cloth bag for groceries, for example), in the hopes of indirectly achieving a goal concerning something one actually is interested in (reducing litter, for example).

The targeting concept

Consider again the light bulb example. Under the category of "clean air policy," many countries, including Canada in 2014, have banned 100 watt incandescent light bulbs. Yet these bulbs do not directly emit anything to the air, and are mostly used in the privacy of peoples' own homes. Why then were they banned? The reasoning is that they use more electricity than alternative kinds of light bulbs, and because some electricity generating systems emit air pollution, the use of these light bulbs might be associated with slightly higher energy consumption and, hence, higher air emissions, compared to use of other bulbs. But it is obvious how little sense this makes. All sorts of air contaminants (sulphur dioxide, particulates, nitrogen oxides, volatile organic compounds, carbon monoxide, etc.) are subject to direct regulation and there are hard caps on total allowable emissions from power plants. These caps are unaffected by one's choice of light bulb, much less by regulations banning this or that lighting option. Also, most electricity in Canada comes from nuclear or hydroelectric generators which produce no air emissions, so again, the choice of light bulb has no effect on the environment. Light bulb regulations, in the context of the existing air quality regulations, are superfluous and needlessly costly.

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But suppose there were no air pollution regulations. It would still be illogical to regulate light bulbs if our goal was to reduce air emissions. Instead it would make sense to regulate the air emissions themselves, directly. And having done so, there would be no need to regulate one's choice of light bulbs, or any other appliance.

The point can be illustrated more concretely. Picture a traditional fossil fuel-fired power plant with a smokestack on one end, and power lines coming out the other. The power lines run hundreds of miles up the road, joining with other power lines coming from hydroelectric and nuclear plants, then branching out and splitting into tens of thousands of smaller and smaller transmission lines, each of which finally enters one of a million or more separate buildings, and within each building, branching further so as to eventually power tens or hundreds of millions of individual appliances and tools. The regulator wishes to control the amount of smoke coming out of the large smokestack back at the power plant. Which would be more efficient: to manipulate the purchase decisions over some of the tens of millions of appliances along the vast profusion of power lines in the hope that the influence of all this indirect rule-making would travel back along the network and eventually lead to a small reduction in the amount of smoke coming out of the smokestack, or simply to cap the amount of smoke the fossil-based power plant is allowed to release? It ought to be obvious that the latter option is better, and will achieve the target at the minimum possible cost,[1] while allowing people the freedom and convenience to manage their own appliance choices. Even worse would be a situation in which, having placed a direct limit on the amount of smoke, the regulator then also regulates the appliances, since in this case such a secondary intervention would be completely redundant. Unfortunately this is typically the strategy regulators follow today.

To recap, the Principle of Targeting states that, if a case can be made for a policy to control some variable observed in the economy, the most efficient form of regulatory intervention is a single rule targeting that exact variable, taking a form that directly expresses the intended outcome. The less direct the rule, or the more it encompasses other variables than the one of direct interest, the less economically efficient is the outcome, or in other words, the more the cost of the policy is inflated unnecessarily. In the example above, it should be obvious that the regulator does not (or should not) actually care which light bulb each homeowner chooses. A policy-maker has no legitimate interest in such private decisions. But he or she may, depending on the circumstances, have a legitimate public interest in the smoke coming out of a smokestack. In that case a policy can be devised that limits the amount of smoke, or that places a special charge per tonne on the emissions so as to make the polluter pay the estimated marginal social damages from the smoke, thus expressing the public interest in a precisely-targeted form. Once such a rule is in place, users of electricity end up paying higher prices because the cost of compliance is built into the price of electricity and consumers therefore pay the full social cost of their power consumption. At that point, the regulator's work is done, and the household should be left free to decide what devices to use, and

[1] If there are multiple emission sources, it is more efficient to use a price signal, through emission charges or tradable permits, rather than a prescribed cap on each source. This example assumes there is only one large emission source, in which case a direct regulatory cap is a better option than appliance standards.

how much to use them, and thus how much electricity to use. Nothing further is gained by dictating product or lifestyle choices for households. One family's choice of light bulb does their neighbour no harm, nor does anybody's choice of dishwasher harm anybody else. If someone up the street prefers incandescent light to fluorescent light and is willing to pay for the electricity it requires, it is entirely his or her concern.

The state's interest in air pollution emissions from power plants has long been addressed through direct clean air legislation. Air pollution levels in Canada have fallen dramatically since the 1970s through use of conventional pollution control measures (see data at www.yourenvironment.ca). Canadians now get most of their electricity from non-emitting sources like nuclear and hydro. Some fossil fuel-powered generating is necessary both for cost control and for managing the variability of hourly demand, but such power plants in Canada typically operate with highly effective emission control systems.

We have all paid a great deal over the years for these innovations. The massive increases in electricity rates in Ontario in recent years have been driven to a large extent by reliance on nuclear power plants and the introduction of wind and solar energy (McKitrick and Adams, 2014). Having paid once to get an electricity system that contributes only negligible amounts to local air pollution, it makes no sense to force people to pay again in the form of superfluous bans on cheap light bulbs or bureaucratic rules for appliance efficiency standards. Any emission reductions that might conceivably be attributable to such policies (which are likely negligible) could have been achieved at a fraction of the cost simply by adjusting the standards and regulations that directly control emissions. (See the appendix for an explanation of the mathematical logic behind the Principle of Targeting.)

The efficiency mirage

The problems inherent in indirect targeting are not resolved by changing the policy rationale to a vaguer notion like "energy efficiency." The term "efficiency" always refers to one particular dimension in a multi-dimensional context, and trying to constrain one dimension does not necessarily yield efficiency in an overall sense. Increasing energy efficiency, or, in other words, reducing the amount of electricity used per unit of output, is not necessarily efficient if it requires such a large additional expenditure of capital or labour that overall costs rise. A strategy that is "energy" efficient may end up being inefficient with respect to labour and all other resources.

Also, it can be difficult to compare across different qualities of outputs, as opposed to the mere quantity. We might be told that incandescent bulbs are "inefficient" because the energy they use creates heat as well as light. This only means that, if you want fluorescent light, an incandescent bulb is an inefficient appliance to use. But if you want incandescent light, an incandescent light bulb is likely your best, cheapest, and most efficient choice. The light from a 100 watt incandescent bulb is, for some purposes, of greater visual quality than that from a fluorescent bulb that produces the same amount of illumination. Likewise, the picture quality from a large plasma-screen television is likely of higher quality than that from a small LCD screen. To argue that the plasma screen TV ought to be banned since it uses more power than an LCD screen misses the point that the LCD screen does not produce plasma-screen-quality images.

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It is illegitimate to argue that tighter appliance standards "save consumers money" by reducing energy consumption. On this reasoning, we could "save" consumers even more money by banning appliances altogether. But it would not make consumers happier—they are willing to pay for the energy needed to use appliances because the appliance characteristics are valuable to them. The amount they pay to use the appliance is an indication of the minimum value they place on the appliance characteristics; it is thus a measure of benefits, not costs. Manufacturers offer a range of efficiency ratings based on consumer preferences and the costs of bringing different features to market. Consumers choose which model they want by balancing the various features, such operating power versus energy costs, and manufacturers offer those features based on the cost of developing them. Since consumers prefer lower operating costs, firms already have an incentive to improve energy efficiency.

But regulators have, in recent years, promulgated laws banning the sale of certain types of appliances in the belief that consumers systematically make irrational decisions by not favouring low energy consumption above everything else, and would therefore be better off if they were prevented from doing so. Note: Governments are not just claiming that society would be better off from the reduction of externalities, but that each individual purchaser would be privately better off by being forced to make a different purchase. This paternalistic assumption now accounts for between 80 and 90% of the conjectured benefits of new regulations, and without it they would fail benefit-cost tests by a wide margin (Gayer and Viscusi, 2013). There are many flaws in this reasoning (see Gayer and Viscusi, 2013, and Dudley and Mannix, 2015 for excellent discussions). We would not want the government to alter the outcomes of elections based on the belief that voters systematically make irrational decisions, and neither should we accept the idea that governments are justified in altering market outcomes for the same reason. If consumers truly can be made better off by being forbidden from buying energy-intensive appliances, that implies they would be willing to pay to be forbidden from doing so. But not buying such appliances is always a freely available option, and it makes no sense to suppose people would be willing to pay to be forced to choose an option they were already free to choose.

Gayer and Viscusi (2013) discuss the example of motor vehicle fuel efficiency regulations introduced in 2011. The US Environmental Protection Agency estimated they would cost consumers $192 billion yet would only yield environmental benefits of $54 billion. However, they also claimed that consumers would save $444 billion on lifetime fuel purchases, and on this basis the rule was deemed to pass a benefit-cost test. Gayer and Viscusi rightly point out that this requires us to assume that consumers repeatedly make irrational decisions about the type of car they want to drive and the amount of fuel they want to use, and bureaucrats can competently override these decisions to the consumer's benefit. They also point out that in 2011 the EPA implemented the Motor Vehicle Fuel Economy Label rule, which forces vendors to provide buyers with detailed information about lifetime fuel costs for each vehicle. The justification for this rule was that this information would lead to rational consumer purchase decisions; yet the other rule assumed such information would have no effect. In other words, two rules were promulgated in the same year, with the argument for each one implying that the argument for the other was untrue.

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The fundamental bureaucratic error is that the $444 billion figure is not a "cost" of owning the cars in question, it is a measure of the benefit people perceive from the vehicle characteristics, and is therefore a measure of the cost of depriving vehicle owners of these options. At present, consumers are willing to pay that much extra to drive cars with features they want but which entail more fuel use. It therefore measures the minimum consumer surplus associated with the features the EPA proceeded to ban. To call a ban on these purchases a "benefit" gets things exactly backwards. Correcting this error, the EPA's analysis actually shows that their policy costs $636 billion and yields $54 billion in environmental benefits, which is obviously a net loss.[2] The large excess of costs over benefits arises because the EPA is targeting something it is not interested in (the types of cars people buy) rather than focusing on what it is interested in (in this case, greenhouse gas emissions).

Some further examples

Ontario's Green Energy Act

In 2009, the Ontario government introduced the Green Energy Act, which provided lavish financial incentives for builders and operators of wind turbines and solar panels. The stated purpose was to reduce air pollution and greenhouse gas (GHG) emissions. Applying the Principle of Targeting, we note that the government did not claim to be interested in the types of generating systems used; instead, it claimed to be interested in air emissions. Promotion of wind and solar power was presumably only a means to the indirect end of emission reductions. So why didn't the province just regulate air emissions directly? The answer is that it does, and it has since the 1950s. The government's own air pollution records show that emissions and concentrations have been falling dramatically for decades (see www.youren-vironment.ca). As for greenhouse gases—chiefly carbon dioxide (CO_2)—these cannot be controlled using conventional smokestack scrubbers, but CO_2 can be directly reduced using offset contracts in which people find strategies to sequester it from the air in other locations and sell the resulting credits. Such credits are not only logically direct but can be far less expensive than indirect measures. Credits cost $15 per tonne of CO_2 in the Alberta market, and frequently much less in the European Emission Trading System. McKitrick (2013) showed that, had Ontario's goal been to reduce air contaminants and GHGs, a combination of CO_2 offsets and conventional air pollution scrubbers would have achieved the same emission reductions as the Green Energy Act sets out to, but at about one-seventieth the cost.

Biofuels mandates

Beginning in 2006, the Canadian government announced a major increase in its support for biofuels production. The stated goal was to encourage reductions in GHG emissions. Assuming that that is the actual goal, as noted above, CO_2 offset credits could be purchased for around $15 per tonne. But as Auld and McKitrick (2014) show, reducing CO_2 by producing biofuels costs between $400 and $3,300 per tonne. By targeting something that the state is not reasonably interested in (namely, the ethanol content of gasoline) instead of what it is interested in (GHGs), the cost of reaching

[2] The EPA also attributed benefits to the fuel economy rule of additional driving, reduced refueling time, and "energy security," but these amounts are small and do not make the policy a net benefit.

the policy target is grossly and unnecessarily inflated.

CAFE standards

For many decades, governments in Canada and the United States have prescribed Corporate Average Fuel Economy (CAFE) standards on automakers, which have recently been tightened and are scheduled to be tightened further in the future. CAFE rules require that the average car sold in the automaker's fleet must achieve a certain level of fuel efficiency. These standards have never been justified with reference to fuel efficiency itself. Instead, they were introduced in the early 1970s as a response to the perceived threat of running out of oil. But as oil prices fell and the concern about supply diminished, regulatory agencies began instead promoting them as an environmental policy measure and a means for emission reductions. So it is clear in each case that the government was not interested in the average miles-per-gallon (MPG) rating of new vehicles, but was actually interested first in the supply of oil and, later, air pollution. But pollution emissions from cars are directly regulated and since the 1960s have fallen by about 98% on a grams-per-mile basis (McKitrick, 2010: table 1.2). Additionally regulating fuel economy is therefore redundant, and costs consumers an estimated $7.8 billion per MPG increment (Klier and Linn, 2012).

Conclusion

The Principle of Targeting is a basic and simple rule for policymaking that helps minimize the cost of government intervention. Its core idea is that if a new regulation of some sort is required, either in the form of a restriction on an economic quantity or price, the most efficient intervention targets the specific variable of direct interest, rather than trying to manipulate it through indirect regulations on surrogate quantities or activities where the regulators have no actual, legitimate interests. While the idea is obvious once stated, it is surprising how rarely it is followed in practice, especially in the areas of energy and environmental policy, and how costly it is for citizens and society that it is ignored.

Appendix: The mathematics behind constrained optimization

There is a mathematical logic to the Principle of Targeting. Many types of regulatory problems can be analyzed using a tool from calculus called constrained optimization. An unconstrained optimization is simply the process of calculating where the highest point of a function is, rather like finding the top of a hill. A constrained optimization problem is, to use an analogy, like supposing that the Canada-US border runs over one side of the hill, and the problem is to find the highest spot you can get to without crossing the border. But suppose that you add another constraint: say you can go no more than 100 paces away from a building at the base of the hill where you started. This second constraint cannot lead you to a higher point than you could have reached before, but it may constrain you to a lower point. So if our goal was to get to the highest spot possible without crossing the border, and there was no particular reason for imposing the 100-pace rule, we should not have imposed it.

When economists model regulatory problems, the "hill" is a function representing the net benefits of the activity that also generates the problem, and the "border" represents the amount of the problem we are willing to put up with. The constrained optimization then

says that we should maximize the net benefits of the activity while staying within the limit of the agreed-upon amount of the problem. Adding any other constraint cannot lead us to higher net benefits, and will likely hold us down to lower levels. So the redundant constraints should be removed.

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Acknowledgments

The author wishes to thank the anonymous reviewers for their comments, suggestions, and insights. Any remaining errors or oversights are the sole responsibility of the author. As the researcher has worked independently, the views and conclusions expressed in this paper do not necessarily reflect those of the Board of Directors of the Fraser Institute, the staff, or supporters.

ISSN 2291-8620

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