DISCUSSION PAPER

July 2016 ■ RFF DP 16-30

Behavioral Economics and Energy Efficiency Regulation

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Abstract

Energy efficiency—using less energy to provide an equivalent level of service—is part of the climate policy portfolio. Market failures might warrant encouraging energy efficiency, but an important justification comes from the realm of behavioral economics: that people erroneously underinvest in it. This creates difficulties for policy evaluation, which assumes that people's choices, including energy efficiency investments, reflect actual preferences. The possibility of error leads to questioning whether consumers can be trusted to make "right" decisions in more complex areas and whether consumer mistakes should be perpetuated if correcting error would increase energy use. If error is convincingly present, the public could accept regulation as delegation of its choices to the government. A better remedy may be to provide consumers with sufficient information to correct alleged error; if they persist in such behavior, it should count in benefit–cost analysis.

This paper was prepared for the June 2016 issue of Network*, a research review published by the Australian Competition and Consumer Commission.*

Key Words: energy efficiency, behavioral economics, policy evaluation

JEL Classification Numbers: Q48, D03, D61

This paper originally appeared in June 2016 as "Behavioural Economics in Energy Regulation," in *Network*, a quarterly economic policy journal published by the Australian Competition and Consumer Commission.

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Timothy J. Brennan*

1. Introduction

In the United States and around the world, 'energy efficiency' is playing an ever greater role in debates regarding how to regulate energy use, particularly electricity use. The US Congress in recent years passed a law to ban the use of incandescent light bulbs, requiring people to turn to compact fluorescent lights and light-emitting diode bulbs. Their purchase has been subsidized in many locations through ratepayer-funded utility-managed programs. The US Environmental Protection Agency has long had an 'Energy Star' program to certify devices that meet its energy efficiency standards and provides an appliance labelling program with estimates of typical annual energy cost savings so that consumers can factor that information into their purchasing decisions.

Individual US states have their own energy efficiency policies. Many states have absolute or percentage targets for reductions in electricity use, and some of them target reductions in natural gas use as well (Palmer et al., 2013). To meet these goals, some states mandate subsidies of the purchase of energy-efficient light bulbs and appliances. To defuse utility opposition to energy efficiency policies that would reduce demand for their regulated services, a number of states have adopted 'decoupling' policies that separate an electric distribution company's revenues from its sales (Brennan, 2010a).

So, energy efficiency is a hot topic, but what exactly is it? The concept itself is fairly easy to understand: A device or appliance is more energy efficient if it provides more service (lighting, heating, cooling) from a given amount of energy or, equivalently, uses less energy to provide a given level of service. In that sense, more is better. However, as a matter of regulatory

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This paper was prepared for the journal *Network*, published by the Australian Competition and Consumer Commission. I thank Robert Albon for the opportunity to write this and for his helpful suggestions. Earlier ver-sions were presented at the Public Utility Research Center at the University of Florida, the Center for Research in Regulated Industries at the Rutgers Business School, and the Wilson School of Public Policy at Princeton University. I thank participants there for helpful comments and questions. Errors are my sole responsibility.

policy, it is crucial to understand that 'energy efficiency' and 'economic efficiency'— maximizing net value—are two different things.

From an economic perspective, more energy efficiency is not necessarily better because energy efficiency costs money. Sure, energy efficiency is a good thing, and if it were free, we'd want as much of it as possible. But in the real rather than ideal world, an incremental investment in energy efficiency is worthwhile only if the benefit of that investment exceeds the cost of that investment.

The benefit of that investment can be viewed in one of two equivalent ways. One way is that, holding energy use constant, the incremental benefit of more energy efficiency is the value of the added service one can obtain from that energy. A second way is that, holding the level of service constant, the incremental benefit is the reduced spending on energy needed to maintain that level of service. In practice, the household, business, or industrial plant adopting a greater increment of energy efficiency will typically balance some of both benefits against their cost.

An example can illustrate this. The expense of a more energy efficient air conditioner is worth incurring, holding energy use constant, when the value of the reduced temperature exceeds that added cost. If a household is not interested in cooling below a target temperature, the added cost of the temperature is worth incurring if it is less than the savings from reduced electricity purchases. Typically, in both cases the cost for the more energy efficient appliance, like the air-conditioner, is incurred up front, but the benefit from increased cooling or electricity savings is incurred over time. Consequently, whether a consumer or business thinks the energy efficiency investment is worth undertaking can depend on how much it discounts those future benefits relative to the money spent on energy efficiency in the present.

This is important for electricity regulation, for at least three reasons. First, electric utilities in many jurisdictions are often charged with the responsibility of carrying out such programs, and regulators need to be prepared to evaluate their costs and benefits and adjust prices accordingly. Second, energy efficiency can reduce demand for electricity and force adjustments in prices to keep utilities whole, especially where the fixed costs of utility service are covered with usage-based prices.[1] Third, and as a consequence of the first two, utilities may exercise their

[1] Brennan and Crew (2016) provide a formula for adjusting regulated prices in the face of declining demand, based on the elasticities of demand and of average cost.

political clout to impede or delay such programs unless regulatory prices are adjusted so that they remain whole even if demand for their services falls.

Energy efficiency policy has had a number of justifications based on failures in the market. Energy efficiency also need not reduce electricity use as much as one might expect—a ten per cent increase in energy efficiency would typically reduce energy use by less than ten per cent—and under plausible settings will increase energy use. However, the primary issue here is that energy efficiency policy is increasingly justified by appeals to the idea that consumers do not act in their own self-interest, failing to invest in energy efficiency when, by their own lights, they would be better off doing so. Such errors or biases, the subject of 'behavioral economics,' may well be valid, but they create serious difficulties for policy evaluation and necessarily substitute a regulator's judgment for that of the consumer. The behavioral economics perspective forces questions regarding what decisions consumers can be trusted to make and whether climate change policy advocates would want to 'correct' consumers when their errors reduce carbon emissions, not only when errors increase them.

2. Other Reasons to Intervene?

In principle, energy efficiency is like any desirable attribute, where the target is to have the amount where the marginal benefit just equals the marginal cost of producing more of it. The threshold question for regulatory policy has been why the market would not determine the economically efficient level of energy efficiency. To put it more directly: What is the market failure?

There is no shortage of candidates. Perhaps the oldest is geopolitical. For decades, the United States imported as much as half of the oil it used. Although some observers may have been concerned about this out of a generic discomfort with imports, basic international trade principles should provide some comfort. However, if the suppliers of that oil are able to collude and are willing to reduce supply as a strategic tactic in pursuit of their non-economic national interests, the United States (or any other importer) might want to reduce demand for oil to reduce its vulnerability to that tactic.

Efforts to improve the energy efficiency of equipment that uses oil—automobiles primarily, but also home heating furnaces and industrial boilers—would be consistent with this concern. Oil issues may not seem pertinent in an era when electricity is getting much of the focus, but it can be relevant. Although hardly any electricity in the United States or Australia is produced by burning oil, as recently as the 1970s 17 per cent of US electricity was generated using

oil. Along some margins—home heating, gasoline vs. electric cars—increased energy efficiency on the electric side can reduce demand for oil.

Another electricity-specific justification for energy efficiency policy is that the prices users pay for electricity do not track the costs of generating electricity. Retail prices have typically reflected the average cost of generation but do not vary in response to the enormous variation in generation costs as demand varies. Generators used only when demand is at peak levels may be used a small fraction of the time. In Maryland, my home state, the top 15 per cent of capacity is used less than one per cent of hours in the year.

Recovering those costs could make wholesale electricity prices 50 to 100 times the wholesale price during median demand periods. If users do not see those prices, they will use electricity too much. If using 'real-time' varying prices is not implemented, a second-best policy would be to subsidize more energy efficient appliances that use electricity during peak periods, notably air-conditioners.

Energy efficiency policy could be a 'second-best' policy to address climate change. Economists widely agree that the best response to a negative externality in using a product is to set a price equal to the costs imposed on others. For climate change, that ideal solution is a carbon tax. However, if a carbon tax is not available, a second-best option is to encourage choices that people would make as if they faced a carbon tax. On the generation side, this leads to renewable fuel–generated electricity requirements and feed-in tariffs to reduce fossil fuel use, as would happen with a tax. Energy efficiency subsidies or requirements have this rationale on the consumer end, for example: that people would buy more energy efficient appliances if they faced higher electricity prices following a carbon tax.

In some places, a further rationale is economic development. Some view energy efficiency requirements as something that will promote the growth of the energy efficiency industry and related businesses (energy management services, marketing) in that location. Some economists have noted that similarly motivated policies often fail to increase employment (Coates and Humphries, 1999, in the context of sports stadiums). Absent a recession, reallocating funds from one sector to another redistributes employment but will not increase it. And if a recession has increased unemployment, energy efficiency–related 'green jobs' will not create jobs if those out of work lack the skills needed to participate in these sectors (Brennan and Palmer, 2013).

Our focus here is on a different rationale—that markets work fine, but that consumers make wrong choices and invest too little in energy efficiency. Before getting to that, we should see whether energy efficiency reduces energy use and when it might not.

3. Does Energy Efficiency Reduce Energy Use?

The energy conservation benefits of energy efficiency are easily overstated. When an appliance—an air-conditioner, for example—becomes more energy efficient, it becomes less expensive to use. Consequently, it will be used more, turned on more often, or set to a reduced temperature. This, in turn, increases energy use above the level had the thermostat remained untouched—an outcome known as the 'rebound effect'.

The extent of the rebound effect depends on how sensitive the amount something is used is to the cost of using it. It does not take a great amount of sensitivity for the rebound effect to be so strong that energy efficiency actually increases energy use. All one needs is that the demand for the services provided by the appliance is 'elastic'; that is, if the price to use it falls by X per cent, its use will increase by more than X per cent. The increased demand created by energy efficiency will more than offset the energy saving per unit of use. For some appliances, such as refrigerators, this is generally not the case, as their use is largely uniform regardless of electricity prices. For others, such as air-conditioners, the rebound effect may be significant.

Moreover, because energy efficiency increases the value that consumers get from a given amount of energy, it will enhance the value of that energy for initial levels of use. This implies that if the price of energy is sufficiently high, increased energy efficiency will increase the demand for energy (Brennan, 2013). For example, if air-conditioners become more energy efficient, some who had been deterred from buying or using them because of high energy costs will start doing so.

4. Behavioral Economics: People Making Mistakes

In the late 1990s, electricity policy played a substantial role in an election in Maryland. The argument that something was awry rested on two premises: (1) the price of electricity is too high; and (2) people use too much of it. With any appreciation of basic economics, one cannot hold these two thoughts simultaneously without a severe headache. A price being 'too high' means that it should be lower, and if it is lower, people would be using more, not less. In standard economics, the harm from having prices too high is measured by the value to consumers of how they would be using more electricity, were it priced appropriately lower.

For these two premises to hold, standard economics cannot apply. If people are consuming too much when the price is too high, they must be failing to act rationally in economic terms—that is, failing to purchase the amount of electricity that they most prefer, given how

much they have to spend. The possibility of irrational behavior, specifically that people will fail to act in their own best interest, is the hallmark of behavioral economics.

Although laboratory experiments involving choosing between alternatives have provided some support for behavioral economics, many of the most interesting phenomena involve actions in the real world. Most celebrated and perhaps most significant is a finding that in the United States, workers are much more likely to elect to pay into an employer-subsidized pension program than not, based only on whether they have to check a box to opt out of the program rather than check a box to opt in. Another finding is that taxi drivers tend to work longer hours on days when business is slow and quit early when business is plentiful, when basic economics suggests that one would work longer during booms and work fewer hours when one is earning less. One of my favorites is that professional golfers are more likely to make a putt, holding length and other attributes equal, if it is to avoid a bogey rather than to make a birdie, when in stroke play it should not matter. A notable feature of this and the taxi driver examples is that these choices are made by experienced professionals with money on the line; they are not inexperienced students in a psychology lab.

The difference between behavioral economics and standard economics is that the former takes these anomalies as raw data, labelled as ‘biases’ of one sort or another (Zamir, 2016). On the other hand, standard economics regards them as phenomena, admittedly challenging, but worthy of effort to see how they might be subject to explanation as rational given limits on information, effort costs, and the like. This is not the place to pursue that methodological debate.

However one regards the likely outcome of such a debate, behavioral economics has found its way into the policy arena. The US government banned incandescent light bulbs on the grounds that consumers incorrectly buy those rather than more energy efficient compact fluorescent lights. The United States also requires the use of low-flow toilets because consumers do not incorporate the reduced expenditure on water in their purchase decisions. US rules forcing automobile companies to meet minimum average fuel economy standards are justified in part by the saving that consumers could get but, for whatever reason, have chosen not to get.

More generally, the UK government established a now semi-private ‘Behavioral Insights Team’ to ‘use insights from behavioral science to encourage people to make better choices for

themselves and society'.[2] Following the UK's lead, President Obama on 15 September 2015 issued Executive Order 13797 on the premise that 'behavioral research insights—research findings from fields such as behavioral economics and psychology about how people make decisions and act on them—can be used to design government policies to better serve the American people.'[3] In February 2016, the Australian government formed its own Behavioural Economics Team within the Department of the Prime Minister and Cabinet.[4]

It is consistent with these trends that behavioral economics is playing a role in energy regulation—a role that in many respects predates many of these other initiatives.

5. Behavioral Economics and Energy Regulation

In the energy sector, much of the prominence of behavioral economics is due to its role as a supporting justification for policies to cut back on energy use as a means to reduce carbon emissions and risks from climate change. Virtually every economist and policymaker facing those issues is familiar with what is known as the 'McKinsey curve', from McKinsey and Company, which delineates an upward-sloping marginal cost curve for reducing carbon emissions. A version from 2009 describing global abatement costs is available from the World Bank (Figure 1).[5]

This 'marginal cost of abatement' curve is based on a fixed cost per ton of carbon dioxide emissions avoided if various methods to do so are used, and then ranking those methods in order of cost. The specifics of the sources of these savings, in the fine print in the figure, are not important here. Rather it is that the cost of carbon is displayed relative to '0'. The abatement methods indicated by the downward sloping bars toward the left of the curve are 'negative cost' abatement methods. These methods would be worth employing even if there were no benefits from the carbon abatement itself.

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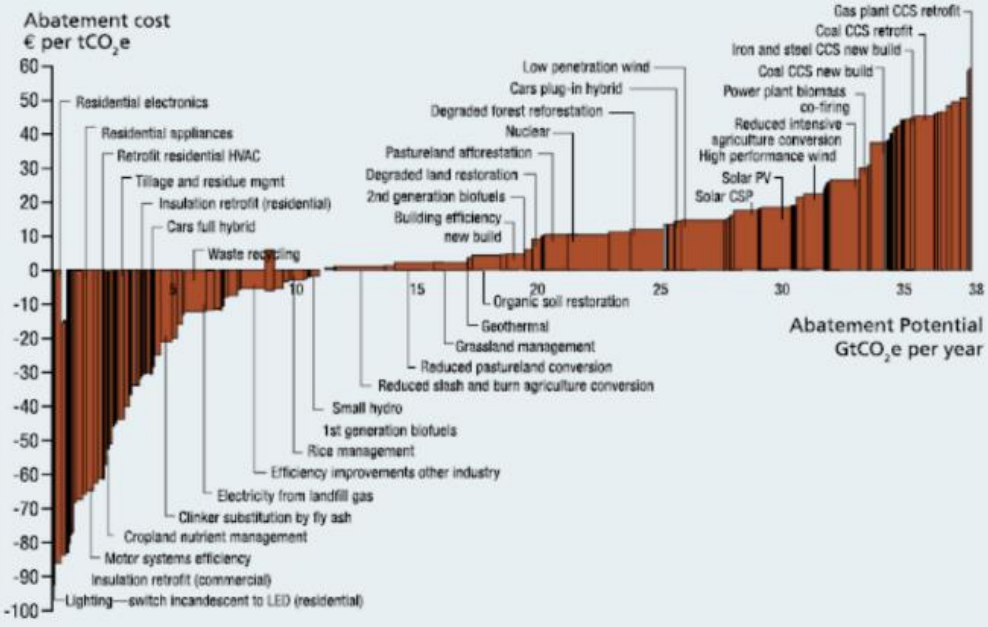
[2] http://www.behaviouralinsights.co.uk/. It is also known as the 'Nudge Unit,' following Thaler and Sunstein's (2008) prominent book. https://www.gov.uk/government/organisations/behavioural-insights-team.

[3] https://sbst.gov/uploads/exec-order-signed.pdf. Cass Sunstein, a prominent advocate of behavioral economics, was head of the Office of Information and Regulatory Analysis, the chief regulatory oversight official in the Executive Office of the President.

[4] https://www.dpmc.gov.au/domestic-policy/behavioural-economics.

[5] http://wbi.worldbank.org/energy/Data/energy/files/Urban_Energy/SUEEP_Toolkit/Knowledge_Center/Stage_3/3_step8_agressivebut_slide11.pdf. McKinsey (2008) has produced a qualitatively similar version for Australia.

Figure 1. Global GHG Abatement Cost Curve beyond Business as Usual—2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: McKinsey, "Pathways to a Low-Carbon Economy, Version 2 of the Global Greenhouse Gas Abatement Cost Curve, 2009," https://solutions.mckinsey.com/ClimateDesk/default.aspx.

A famous joke among economists is to suppose that two economists are walking down a sidewalk. One says, 'There's a $20 bill on the ground', and the other replies, 'No, there can't be'. The point is that had a $20 bill been on the ground, someone would have picked it up. An economist looking at the McKinsey curve would say that it must be missing something, because all of those 'negative cost' abatement methods imply that there are a lot of $20 bills lying on the ground.

Nevertheless, all of these apparently profitable reductions in energy use have come to play a significant role in energy policy. They have earned their own nickname—the 'energy efficiency gap' between what people actually choose and what they should do, as illustrated by the McKinsey curve. Gillingham et al. (2009) posit a number of potential explanations for this gap, after observing and citing research suggesting that costs of energy efficiency investments, such

as reduced quality of services, could explain why consumers do not make these investments.[6] Explanations involving pollution externalities or learning effects are not consistent with the energy efficiency gap, which is defined specifically as a failure of persons and businesses to act in their own self-interest. Among their list of relevant explanations for such failures are (1) inability to borrow to pay for energy efficiency investments; (2) principal-agent problems; (3) information shortcomings; and (4) behavioral economics–identified failures.

The first two of these are not compelling. Were inability to borrow and capital market failures widespread, one would find them justifying public subsidies to upgrade kitchens, renovate bathrooms, replace roofs, purchase expensive appliances, and buy new cars as well as invest in energy-efficient appliances. The prototypical principal-agent problem in energy efficiency is that a landlord supposedly lacks an incentive to install more efficient appliances if the tenant pays for the electricity. However, rental property owners and managers compete by offering tenants all manner of goods and services to increase the quality of the space that the tenants would be renting. There is no reason to think that property owners could not and would not compete on appliances that reduce energy bills.[7]

Information is a more interesting possibility. The market for energy-efficient appliances may be hampered by asymmetric information, specifically that buyers cannot verify in advance claims made by appliance sellers regarding energy savings. This can lead buyers to assume the worst, and that could reduce incentives for manufacturers to produce more expensive but more efficient appliances. As Gillingham et al. (2009) point out, a solution for this problem is information, either private consumer goods evaluation services or public provision of information, such as expected energy cost labels.

Another information problem may be more subtle: The manufacture may be better positioned than a consumer to avoid wasteful uses. An analogy can help clarify this. Suppose someone buys a lawnmower and then injures his foot using it carelessly, perhaps by cutting the grass

[6] To put it another way, there are no $20 bills on the sidewalk because people use those to pay for the higher quality of service from less energy-efficiency equipment, be it incandescent bulbs versus compact fluorescent lights or faster, heavier automobiles versus lighter subcompacts.

[7] In principle, the property owner could internalize the incentive by purchasing the energy-efficient appliances and paying the electricity bill ('rent includes utilities'). However, if the property owner pays the electric bill, tenants will have incentives to use the appliances too much, particularly cooling in the summer and heating in the winter. This would lead to an outcome in which the property owners invest more in energy efficiency than is optimal and charge rents large enough to cover those costs as well as the cost of energy by tenants who act as if it is free.

after a couple of beers. One might assume that the buyer would be liable, but in accident law, there is a doctrine of 'foreseeable misuse' under which the manufacturer may be liable if it could easily have prevented the accident—for example, by installing an inexpensive toe guard. In economic terms, foreseeable misuse makes sense if the manufacturer can prevent an accident at lower cost than the buyer would have had to undertake to be more careful, such as forgoing beer on a pleasant weekend afternoon.

What does this have to do with energy efficiency? As perhaps with lawnmowers, the manufacturer of an appliance may be better able than the buyers to determine whether a particular performance characteristic—energy efficiency, like toe guards—is worth the cost of including it. If so, it can make sense as a policy matter to put the onus of responsibility on manufacturers to meet energy efficiency standards.

This leads to the fourth item in the list, behavioral economic failures: that is, consumers just make mistakes regarding what is in their own self-interest. The downward columns on the left of the McKinsey curve are like piles of $20 bills that consumers (residential and commercial) are leaving on the sidewalk. It may well be true that consumers make mistakes. However, trying to design regulations, such as utility-funded energy efficiency programs with that possibility in mind, presents some daunting and unappreciated challenges.

6. But How to Evaluate?

Behavioral economics plays a leading role in justifying regulatory policies, particularly directed at local distribution utilities, to encourage or mandate the use of energy-efficient equipment that consumers would, according to standard economics, already be choosing. Such policies include subsidies for purchasing more efficient appliances, directly or via tax breaks, and free or low-cost energy audits. These subsidies and audits are not without cost. Depending on how they are structured, their costs typically fall on ratepayers or taxpayers. This means that energy efficiency regulations should be subject to the overarching question all regulations should face: Are they worth it?

The basic method for evaluating regulations is benefit–cost (or cost-benefit) analysis. At its heart, it sounds simple: add up how much beneficiaries would pay for the benefits; add up how much it would cost to provide those benefits; and adopt only policies where the former exceeds the latter.

This simple formulation camouflages many empirical and ethical problems. On the ethical side, this addition assumes that benefits can be monetized—not a big problem for econo-

mists[8]—and that a dollar gain or loss to a rich person counts just as much as a dollar of gain or loss to a poor person. The response to this is that after instituting a regulation that passes a benefit–cost test, the winners could compensate the losers. But if that compensation does not take place, important distributional considerations may not get the weight they deserve. On the empirical side, a host of difficulties arise. These include, among others, how much to discount future benefits against present costs; whether to use willingness to pay for a benefit or willingness to accept the loss of a benefit; and how to measure benefits or costs when there is no market test—for example, willingness to pay to preserve habitat for rock-wallabies or marine turtles.

With or without these complications, the data that feed into benefit–cost analyses are estimates of what people would pay for the 'benefits' or to avoid the 'costs'. When one has market data to ascertain willingness to pay, one uses it; if not, one does one's best to come up with proxies for those data. The crucial premise behind using those data is that the preferences they reveal, in terms of what people are willing to buy and what they are not, are the preferences people actually have. If I pay $10 for a hamburger, I would rather have the hamburger than the $10. A regulation that gives me that hamburger instead of $10 makes me better off, so that's what the regulator should do. And if I don't pay the $10, the regulator should not give me the hamburger if doing so would deprive me of $10.

Behavioral economics adds not just another wrinkle to benefit–cost analysis, it undercuts its very foundation (Brennan 2014). Its defining claim is that revealed preferences are not actual preferences because of the biases and errors they entail. If the behavioral economists are correct in that one cannot infer actual preference from revealed preference, then the data used to do benefit–cost analyses are irrelevant. The revealed benefits of a regulation may be less than their costs, but the actual benefits might exceed them from the behavioral economists' perspective. Following benefit–cost analysis would, for them, give the wrong answer.

The McKinsey curve provides an important and relevant illustration. In standard economics, choices not to make the 'negative abatement cost' choices on the left side of the McKinsey curve not only reveal a preference not to do so but imply that people are better off not having done so—because that is the choice they made. Behavioral economics questions this logic, saying that people actually preferred to make those negative abatement cost choices but mistakenly

[8] The most compelling example may be that in benefit–cost analysis, one values an expected saving of a life from an environmental or safety regulation is inferred from observing how much people pay for safety equipment or give up to avoid a dangerous job.

failed to do so. A regulation to mandate or subsidize energy efficiency may fail a standard benefit–cost test, but the behavioral economist can claim that the people chose in error and that they'd really be better off under such a regulatory mandate.

One could be precise about this if one had an independent measure of actual benefit that overcame the putative limitations of revealed preference. So far, there is not one. Cass Sunstein, the chief regulatory oversight officer in the Obama administration and a leading advocate for incorporating behavioral economics into policy design, proposed a connection between behavioral economics and benefit–cost analysis (Sunstein, 2000). The connection, however, does not point to a method for undertaking benefit–cost analysis when the underlying data cannot be trusted because of consumer error. Rather, Sunstein argues that people have the same biases and make the same mistakes when they vote as when they make purchases in the market. Consequently, public sector decisions, such as regulation, should be made through benefit–cost analysis because decisions made by voting will be error-prone.

Sunstein does not specify how benefits and costs should be calculated. Perhaps a natural choice would be to attribute as benefits what mistaken consumers would have received had they made the right choice. This is the implicit standard for evaluating energy efficiency subsidy programs in the *California Manual* (State of California, 2002), used widely in the United States. The *California Manual* defines a number of different benefit–cost tests looking separately and together at net effects on customers who adopt energy efficiency, ratepayers as a whole, and utilities, where one includes the cost of administering the energy efficiency program. Going into the weeds of the *California Manual* tests is considerably beyond the scope of this paper. The crucial point is that the benefits of the program depend on the idea that some of the consumers who had erroneously not adopted energy efficiency prior to the subsidy do so, and in doing so realize their mistakes and now regard the previously forgone cost reductions as benefits (Brennan, 2010b,). If electricity users do not make erroneous choices, there is no benefit boost from the subsidy program. Energy efficiency subsidies will not be beneficial unless the price of electricity is below its cost of generation (including unpriced externalities).

Regulators will have to decide whether the benefits to consumers from giving them something they could have chosen before (but did not) should count. In the United States, these benefits are called 'private benefits', to distinguish them from the public benefits that normally count when a policy corrects a market failure. Miller (2015) finds that of the US$26.6 billion in benefits that the Department of Energy attributed to energy efficiency standards promulgated between 2007 and 2014 US$23.4 billion were private benefits from giving consumers what they could have but failed to choose for themselves. TDOE's estimated cost of these regulations was

US$7.8 billion. Counting private benefits, these regulations collectively pass a benefit–cost test, but if one does not count the private benefits, the benefit of the standards is only US$3.2 billion, far below the costs.

The debate, then, rests not purely in the ivory tower. The merits of regulatory requirements to promote energy efficiency, whether placed on utilities or the wider energy sector, are closely tied to whether consumer behavior is interpreted as a revealed preference or a mistake. A very useful debate between advocates of counting private benefits (Allcott and Sunstein, 2015a, 2015b) and those opposed (Mannix and Dudley, 2015a, 2015b) provides insights from both sides. I lean toward the side of the opponents in this debate, admittedly because leaping to irrationality as an explanation pre-empts the search for theories to explain the previously inexplicable. Economics would have failed to develop theories based on incomplete information, strategic behavior, and transaction costs had one just assumed a bias. But there are larger concerns as well, both in electricity regulation and beyond.

7. Manipulating Consumers and the Slippery Slope

Although alleviating consumer error enables energy efficiency mandates to pass benefit–costs tests, concern for mistaken consumers is not the motivation behind those mandates. Rather, the motivation is that such policies will produce public environmental benefits, such as mitigating climate change, because they reduce energy use. This leads to an unstated question: What if consumer error is good for the environment or for climate?

Automobiles offer two examples. Electric cars are often characterized as ‘zero emissions’. Of course, they typically are not, as they draw energy from electricity generated by coal or natural gas plants. Hence, consumers are likely to overstate the environmental benefits.[9] Another error going beyond electric cars involves how US consumers understand fuel efficiency. The United States, unlike most countries, uses distance/fuel quantity (miles per gallon) rather than fuel quantity/distance (litres per 100 km). Consequently, it is easy for consumers to assume that going from 40 to 50 miles per gallon has the same benefit as going from 20 to 30 miles per gallon, when the former increases efficiency only 25 per cent compared with 50 per cent for the latter. But if consumers are more willing to buy electric or high-mileage cars based on mistaken

[9] Zivin et al. (2014) found that in areas of the United States where coal generation is prominent, an electric car charged at night is responsible for greater emissions than the average gasoline-powered car.

beliefs, will the 'private losses' be included in assessing policies to promote their use? I have my doubts.

Going beyond the energy sector, regulators and policymakers face a very slippery slope in considering whether to enact policies on the basis of consumer mistakes. If regulators believe that people cannot make rational purchasing decisions regarding energy-efficient lighting or air-conditioners, what decisions can they be trusted to make? Will they pick the right careers? Buy the right house or car? Get the correct medical treatment? Attend the right university? Save for their retirement? For some of these, we have policy interventions, such as accrediting universities, licensing physicians, and mandating contributions to public pension systems, which may be responses to consumer mistakes. But those hardly limit the scope of what could be justified by such errors.

In large measure, this viewpoint undercuts the broad reliance on markets characteristic of Australia, the United States, and most modern developed economies. If consumers make mistakes, the quantities determined by supply and demand will not typically generate the greatest net economic benefit. Maximizing net economic benefit is not the only defense of markets. They can be defended as being most consistent with freedom of action, apart from whether the outcome is best in a benefit–cost sense. This libertarian justification of markets, however, undercuts state actions to address market failures—correcting for externalities, ameliorating market power, overcoming asymmetric information, providing public goods. If one thinks these are important goals but that markets in general cannot be trusted, one may be left with a more aggressive form of central planning.

8. How Might Regulators and the Public Respond?

Three options come to mind. The first, and probably foremost, is to put a high burden on showing that consumer error, and not some underlying preference or information shortcoming, is sufficiently compelling to warrant replacing private choices with regulatory mandates. Otherwise, one gives up the ability to let disinterested benefit–cost analysis provide appropriate information for what regulators should do.

If consumer error is sufficiently compelling to warrant superseding choices with mandates, the problem then becomes who gets to make those regulatory choices. This can be thought of as a higher-order choice question for the public: Whom would you like to make choices in contexts where you think you would make the wrong ones? This is not an unusual question; people delegate choices all the time to doctors, financial advisers, auto mechanics, and the like. The

outcomes are hardly perfect, but one could view regulation as a similar kind of rational delegation through a democratic process of authority to an agent (the regulator) to make choices on behalf of a principal (the public).

A final suggestion in these potential error contexts is for a regulator not to act until it gives people the information and time to understand that they are making a mistake. A useful methodological principle in limiting the scope of behavioral economics is to acknowledge that people make mistakes. But if they continue that behavior after they understand why it seems to be a mistake, then it becomes a revealed preference to be respected, even if the regulator does not understand its rationale. If consumers say they still want the less energy efficient air-conditioner despite the energy savings that have been explained to them, that is their choice. Taking that away from them is a cost, not a private benefit.

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