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Social License to Regulate: Consumer-Producer Collusion and Related Policy Risks for Consumer-Facing Regulation

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SOCIAL LICENSE TO REGULATE: CONSUMER-PRODUCER COLLUSION AND RELATED POLICY RISKS FOR CONSUMER-FACING REGULATION

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Abstract

Used a gas can recently? If not, prepare for a surprise—they've become harder to use due to government-mandated design changes aimed at reducing air pollution. Faced with persistent environmental and other challenges, government regulators have increasingly turned to similar regulations on consumer products. But these consumer-facing regulations create new policy and political problems for regulators, different from those associated with traditional industry-facing regulation. This paper looks in depth at three case studies of consumer-facing regulation: emissions controls on gas cans, efficiency standards for light bulbs, and European vehicle fuel economy standards. In each case, there is strong evidence for widespread evasion of the regulations by consumers and by consumers and producers working together. This evasion may substantially undercut the targeted benefits of the regulations. Moreover, consumer dissatisfaction with the regulations appears common, perhaps indicating underappreciated costs to consumers and playing in to anti-regulatory narratives. Building on these case studies, this paper explores options available to regulators for reducing incentives and opportunities to evade consumer-facing regulation and for anticipating or reducing consumer dissatisfaction. Such options include externality pricing, stricter (and smarter) enforcement, careful selection of regulatory targets, modifications to ex-ante cost-benefit analysis, and, in some cases,

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eschewing regulation entirely in favor of providing information or other less-intrusive policies.

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I. INTRODUCTION

When was the last time you used a gasoline can? If it was more than a few years ago, or more recently but the can you used was more than a few years old, the experience was likely simple and straightforward. Open the spout; open a vent at the back of the can so a vacuum does not

form; and pour away. This simple design has been used in gas containers for decades, and for liquid containers of all types for far longer. But if you use a gas can sold in the US today, you will likely have a much more frustrating experience. New cans have no vents and usually require two-handed operation of a relatively complex (usually spring-loaded) spout mechanism. They take longer to pour and have a learning curve—it is quite likely that you will pour nothing at all and/or spill some gasoline until you get the hang of it.

Why the design change? Why fix something that is not obviously broken? The answer is that the new designs *do* have an important advantage (or, conversely, that the old design *was* in a sense broken) in a way that is not immediately apparent. Moreover, the changes are only partially for your (the gas can user's) benefit. The key advantage is that new cans lose much less gasoline to evaporation (at least assuming you do not spill while pouring). With no vents to leave open and auto-closing spouts, you will never come to find that the contents of a can you have not used in months and absentmindedly left open have evaporated. Moreover, you and everyone in your area will breathe a little easier—evaporating gasoline releases volatile organic carbons (VOCs) (including benzene) and other pollutants[1] that can cause or exacerbate serious health problems.[2]

Environmental regulators, recognizing this opportunity to reduce emissions, have mandated that new gas cans meet standards that effectively ban old-style vented cans, first in California and later at the federal level.[3] These regulators have concluded that the public health benefits of the new cans outweigh their increased sticker price and added frustration. They may be correct. But if you are tempted to just keep your old can, buy one at a garage sale, or even take a drill to a new can to (damn the regulators) add the vent that God intended a gas can to have—you are not alone. These and other creative methods of regulatory evasion, some in concert with manufacturers, have become common. So too has popular backlash against the regulations, at least among those who use gas cans frequently, likely contributing to loss of confidence in environmental regulators specifically and possibly

1. *See* Assessment and Standards Division, Office of Transportation and Air Quality, EPA, *Estimating Emissions Associated with Portable Fuel Containers (PFCs)* at 1 (2007), http://goo.gl/hrQxpN (estimating pollutant emissions from PFCs).

2. *See also* Control of Hazardous Air Pollutants from Mobile Sources, 72 Fed. Reg. 8428, 8428-8430 (Feb. 26, 2007) [hereinafter "EPA PFC Rule"] (codified at 40 C.F.R. pt. 59, subpt. F) (noting that "benzene is a known human carcinogen" and that VOCs are "precursors to ozone and PM2.5", both of which are regulated under National Ambient Air Quality Standards).

3. *See* Regulations: Portable Fuel Containers and Spouts, Final Regulation Order (2000), https://www.arb.ca.gov/regact/spillcon/finalreg.pdf (initial gas can emissions rules for California) [hereinafter "1999 CARB PFC Rule"]; *see also* EPA PFC Rule, *supra* note 2.

government generally. Moreover, regulators appear not to have adequately considered the degree of creative regulatory evasion or political pushback when they decided to regulate can design. This story of the gas can's regulatory undoing is one example of a wider phenomenon of evasion and backlash against consumer-facing regulations.

Most regulatory laws, including but not limited to environmental laws, are generally understood as restricting the ability of a small group of relatively powerful actors to do things (pollution, overexploitation of resources, marketing of unsafe drugs, etc.) that harm the general welfare. Put in economic terms, regulation limits the ability of producing firms to impose external costs on consumers/everyone, at least in principle. Or in colloquial terms, regulations keep the big guys from hurting everyone else (perhaps especially from hurting the little guys). Of course, regulations may or may not be effective in practice. They impose costs on the firms, industries, and activities to which they apply, and these costs are eventually passed on to consumers. Regulations also have administrative costs paid for by tax revenues. If these costs together are greater than the benefits of the regulation, then it has failed—the cure is worse than the disease. As some economists and regulators (and all environmental justice advocates) note, distributional impacts of a regulation should also be considered in judging its effectiveness.

While this abstract model of regulation works well in many contexts, it is incomplete and sometimes inaccurate. Not all regulation applies to large producing firms, and not all costs imposed on consumers or the general public come in the form of higher prices for goods and services. Sometimes regulations apply to consumers directly, by restricting consumer choice, or indirectly, by making the products consumers use work less well for their intended purpose.

These direct effects on consumers do not mean that such regulations are not justified—benefits may still exceed costs, sometimes greatly. However, the politics and policy analyses are different. Under the "classical" view of regulation, regulated firms may oppose regulation ex ante or try to evade compliance ex post, but the general consuming public is the beneficiary of that regulation and will support it, at least so long as the public believes that the benefits they receive exceed the costs passed on to them. This analysis changes, however, when regulations impose private costs directly on consumers. Consumers who cannot buy the product they want because regulation has banned its sale, or who find that regulated products perform poorly in comparison to the unregulated products they used in the past, face private costs that may feel more real and immediate than increased costs passed on by

regulated firms do. Cost-benefit analysis of regulations may also fail to fully account for relatively hard-to-measure lost consumer welfare due to reduced choice or lower performance, making regulations seem more beneficial on net than they really are.

These effects may lead consumers themselves to attempt to avoid regulations, behaving more like regulated producers. Opposition to regulation may increase, undercutting regulators' "social license to regulate." Consumers and producers may even collude to avoid regulation, capturing and dividing private benefits at the cost of greater externalities imposed on the general public. In other words, both political support and practical effectiveness of regulation may drop. Policymakers should be aware of these risks and account for them in regulatory design (and in decisions regarding whether to regulate at all).

To be clear, attempts to evade regulation are neither new nor limited to the consumer-facing regulation discussed here. Because the distribution of costs and benefits from any regulation will not be uniform, it is possible, and indeed likely, that some groups or individuals will oppose regulations that (at least ostensibly) enhance social welfare but which they feel impose excessive private costs on them. This opposition may come in the form of lobbying or other rent-seeking behavior, or regulated parties may take matters into their own hands and attempt to evade the regulations (or, more pejoratively and precisely, to cheat).

This paper examines three case studies of consumer regulatory evasion, some of which appear to involve collusion between producers and consumers. As the case studies and subsequent discussion illustrate, evasion appears more frequent in the consumer context. This evasion can be significant—in one of the three case studies, it appears that as much as 65% of ostensible benefits of the regulation were never realized due to evasion.[4] Moreover, consumer-facing regulation appears to generate much greater consumer discontent than regulation that merely increases costs, even though those costs are eventually passed on to consumers.

These case studies therefore suggest that regulators should more honestly and deeply consider the additional administrative, economic, and political costs of consumer-facing regulation. Discussion after the case studies suggests a number of possible regulatory responses.

4. *See* Mathias Reynaert and James M. Sallee, *Self Regulation, Corrective Policy, and Goodhart's Law: The Case of Carbon Emissions From Automobiles* 3 (NBER, Working Paper No. 22911, 2016), http://www.nber.org/papers/w22911.pdf [hereinafter Reynaert & Sallee].

II. REGULATING GAS CAN EMISSIONS

Millions of Americans use portable gasoline cans to store spare fuel for cars, boats, yard tools, generators, and other vehicles and devices. The (usually red) gas can has been a fixture of American households for over a century—everyone has seen one, many households have one, and some have many. While designs varied, from the iconic rectangular military-spec "jerry can" to the common round steel container found in many garages, their basic function was similar. Most cans were sealed with two caps, one large and one small, and pouring fuel required opening both. Remove the larger cap and screw on a spout, then open the small cap and pour. The small cap allows air to enter the can as fuel is poured out, preventing uneven pours and spills (see Figure 1). If you have never used a gas can, imagine pouring a milk or water jug into the sink. You are likely to get a sloppy, gurgling pour—that is, unless you poke a small hole in the bottom of the jug before pouring. Doing so allows air pressure to equalize behind the liquid being poured from the jug. The small vent on a gas can plays the same role.

Figure 1: Pre-regulation gas cans. Note primary opening for attaching spout and secondary (open) vent.[5]

5. Image source: Washington & Jefferson College Culturally Authentic Pictorial Lexicon (CC-noncommercial license).

This basic design worked quite well, though it did have flaws. Inexperienced users could spill gas when pouring, for example by not securely attaching the spout or failing to open the vent. If either cap was left off when the can was stored, gasoline would evaporate at a surprisingly rapid rate.[6] Some materials used for cans were also permeable to gasoline vapors over time.[7] All of these potential problems have obvious negative effects on those who buy and use the cans. Spilling gasoline or allowing it to evaporate is wasteful, and spills of such a highly flammable liquid can create a major safety hazard.

A. The Gas Can Emissions Problem and Regulatory Response

The negative effects of gasoline spills and evaporation are not limited to the consumers/users of gas cans, however. Evaporating gasoline is a significant air pollutant. When gasoline evaporates, it contributes VOCs to the air, including toluene, butane, and benzene.[8] Some of these compounds, such as benzene, are themselves toxic.[9] VOCs also contribute to formation of tropospheric ozone and fine particulate matter (PM 2.5), both of which have significant negative health effects.[10] Both ozone and PM 2.5 are regulated under the Clean Air Act as "criteria" pollutants subject to national ambient air quality standards (NAAQS),[11] which states are required to meet under the Clean Air Act.[12] Atmospheric VOCs, ozone, and PM 2.5 levels depend on emissions from a variety of sources, including vehicle tailpipes and industrial processes,[13] among which evaporating gasoline is a small but not trivial contributor.[14] Spilled gasoline can also contaminate ground and surface water. In economic terms, therefore, spills and evaporation from gas cans impose both a private cost to can users (wasted gasoline) and a

6. *See Estimating Emissions Associated with Portable Fuel Containers*, *supra* note 1 at 11 (noting that CARB research estimated that 49% of PFCs in commercial use and 34% of those in residential use were stored in the "open" position).

7. *See id.* at 6 (estimating permeation rates for plastic and metal PFCs).

8. *See id. See also* Jo-Yu Chin and Stuart A. Batterman, *VOC composition of current motor vehicle fuels and vapors, and collinearity analyses for receptor modeling*, 86 CHEMOSPHERE 951 (2012) (detailing VOC composition of retail gasoline).

9. *See* EPA PFC Rule, *supra* note 2 at 8428 (noting that "benzene is a known human carcinogen").

10. *See id.* at 8430.

11. *Id.*

12. 42 U.S.C. § 7410(a)(1) (2006).

13. *See* EPA, Report on the Environment, *Volatile Organic Compounds Emissions*, *available at* https://cfpub.epa.gov/roe/indicator.cfm?i=23 (describing VOCs as precursor of ozone and PM emissions).

14. *See Estimating Emissions Associated with Portable Fuel Containers*, *supra* note 1 at 10 (estimating 327,000 tons of hydrocarbon emissions from PFCs in 2005).

public cost or negative externality to everyone in the area (air pollution).

Gas cans, as consumer products, have long been subject to some level of regulation. For example, many states require gas cans to be red for safety reasons.[15] But until recently the basic design of gas cans was not a subject of any significant regulation. Beginning in 1999, however, regulators began to take interest in gas cans (portable fuel containers, or PFCs in regulatory parlance) because of the contribution of gasoline evaporation to air pollution.[16] The California Air Resources Board (CARB) imposed the first of such regulations in the form of design restrictions on new gas cans manufactured or sold within the state starting in 2001.[17] These regulations required that new cans be made of non-permeable materials, include redesigned spouts with automatic closing features, and no longer feature separate venting holes.[18]

Figure 2: CARB/EPA compliant gas can. Note auto-closing spout and lack of separate rear vent.[19]

15. *See, e.g.*, WIS. STAT. § 168.11(2)(2015) (requiring all gasoline containers to be "substantially a bright red color").

16. *See* M. Nguyen, California Air Resources Board, *Source Inventory Category #1434: Portable Fuel Container Spillage, Base Year 1999* (1999), https://www.arb.ca.gov/ei/areasrc/districtmeth/BayArea/C1434.pdf (study identifying portable fuel containers as significant source of evaporative emissions).

17. *See* 1999 CARB PFC Rule, *supra* note 3.

18. *See* California Air Resources Board, *Regulations for Portable Fuel Containers (PFC) and Spouts* (August 16, 2010), https://www.arb.ca.gov/consprod/fuel-containers/pfc/facts/sep99_facts.htm.

19. Image source: author.

The rules aimed to reduce VOC emissions from both fundamental design characteristics of cans (permeability) and from user carelessness (leaving caps or spouts open).[20] Estimated emissions reductions from the rule were "over 68 tons per day" of reactive organic gases (ROGs), a somewhat narrower category of pollutants than VOCs.[21] These regulations were updated and revised in 2006.[22]

It is not surprising that California was the first state to impose emissions-driven regulations on gas cans. Historically it has been a leader among states in setting new environmental rules, and it has struggled for decades to meet the NAAQS in areas throughout the state, most notably the Central Valley and Los Angeles Basin.[23] Other states followed California's lead, however, largely in an effort to meet the ozone NAAQS, which have persistently proved difficult in a number of major cities.[24] New York, for example, imposed gas can regulations similar to California's in 2003, which it estimated would lead to 50 tons per day in VOC emissions reductions, along with other benefits from reduction in ground and surface water contamination.[25] In 2007, the federal Environmental Protection Agency (EPA) adopted gas can regulations under Section 183(e) of the Clean Air Act.[26] Although differing from California's 1999 approach in important ways discussed below, these rules effectively imposed the same requirements nationally.[27] The sale and manufacture of old-style gas cans was banned, in favor of new models featuring low-permeability materials and automatically-closing spouts, and lacking vents.[28]

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20. *See* California Air Resources Board, *Updated Informative Digest, Adoption of Portable Fuel Container Spillage Control Regulations* at 1 (1999), https://www.arb.ca.gov/regact/spillcon/gasinf.pdf.

21. *Id*. at 5.

22. California Air Resources Board, *Final Regulation Order: Portable Fuel Container Regulation* (2006), (amending 13 Cal Code of Reg §2467 et seq), https://www.arb.ca.gov/regact/pfc/2005/frorev2.pdf.

23. *See* California Air Resources Board, *Federal Standard Area Designations*, https://www.arb.ca.gov/desig/feddesig.htm (noting designation of a number of California counties as nonattainment areas for ozone, PM2.5, and other NAAQS pollutants).

24. *See* EPA, *8-Hour Ozone (2008) Nonattainment Areas*, https://www3.epa.gov/airquality/greenbook/hnc.html (noting designation of Los Angeles and the San Joaquin Valley as "extreme" nonattainment areas for ozone, other California areas as "severe", and cities including Baltimore, Chicago, Dallas, Denver, Houston, New York, and Phoenix as "moderate").

25. *See* New York State Department of Environmental Conservation, *Portable Fuel Container Fact Sheet*, https://web.archive.org/web/20170324054635/http://www.dec.ny.gov/chemical/8579.html.

26. EPA PFC Rule, *supra* at 8499.

27. *See id*. at 8432 ("[t]he revised California program is very similar to the program we are finalizing").

28. *See id.* at 8500 (describing requirements of the EPA standards). As discussed below, the EPA regulations are performance standards, so they do not require specific vent or spout designs. In practice, however, auto-closing spouts are required and vents are forbidden, the latter because testing procedures assume they will be left open.

CARB and EPA analysis indicated that these regulations were cost-benefit justified, with benefits of emissions reduction exceeding costs of new cans imposed on manufacturers and consumers.[29] The regulations also achieved VOC emissions reductions at a lower cost-per-ton than alternative measures.[30]

B. Consumer Reactions

At first blush, these regulations would seem good for everyone: users of gas cans benefit from reduced spills and evaporative losses, while the public at large benefits from improved air quality. In reality, however, the regulations have generated significant consumer dissatisfaction. New-style cans are more expensive—in its 1999 revised regulations California estimated an increased cost of $6-11 per can.[31] The new style gas cans are also more difficult to operate, often requiring two hands,[32] and may have lower pour rates, taking longer to fill tanks from a can.[33] The additional complexity involved in operating spouts on the new cans is a source of consumer frustration and, anecdotal evidence suggests, more (rather than less) spilling of gasoline for some users. To give a few examples of consumer views on these new cans:

> If you've had the pleasure of buying a gas can in the past few years, then you've likely come to the conclusion that all modern gas cans suck. . . the actual implementation of these regulations has

29. *See id*. at 8430-8431 (estimating benefits substantially exceeding costs). *See also* California Air Resources Board, *Updated Informative Digest: Amendments to the Regulations for Portable Fuel Containers* at 2 (2006), https://www.arb.ca.gov/regact/pfc/2005/pfcuid.pdf (noting that "[t]he ARB staff determined that adopting the proposal is technologically feasible, cost-effective, and provides the greatest benefits to the people of California").

30. *See id*. at 8511(estimating costs per ton of hydrocarbon and benzene emissions reductions from PFC regulations at $0/ton, once fuel savings are considered, compared to vehicle emissions regulations imposed in the same rulemaking at $14/ton for hydrocarbons and $270/ton for benzene). *See also* CARB, *Regulations for Portable Fuel Containers (PFC) and Spouts*, *supra* note 18 (noting that the 1999 California regulations were estimated to impose costs of about $2/ton of reduced ROG emissions, compared to $5/ton for contemporaneous alternative regulations).

31. *See* CARB, *Regulations for Portable Fuel Containers (PFC) and Spouts*, *supra* note 18.

32. *See, e.g.,*. Acme Tools, *No Spill Gas Can*, YOUTUBE (Oct. 8, 2012), https://www.youtube.com/watch?v=KneiOE7pqj4 (video showing proper use of one model of CARB-compliant gas can, requiring one hand to hold the can while another operates the spout). *But see*, Scepter Products, *How to use your ECO Can – English*, YOUTUBE (Jul. 10, 2013), https://www.youtube.com/watch?v=nytxlA-G1Sk (video showing operation of another CARB-compliant design that relies on plastic protrusions from the spout that allow stable receptacles like vehicles or lawnmowers to stabilize the can, allowing one-handed operation).

33. *See* Greg DiBernardo, *Gas Cans that Actually Work*, TOOLS OF THE TRADE (Oct. 10, 2013), http://www.toolsofthetrade.net/trucks-equipment/gas-cans-that-actually-work_o (testing pour rates of gas cans, and finding that CARB-compliant cans take 2:23-2:37 to pour 5 gallons of fuel, while an unregulated "utility jug" similar in design to pre-regulation cans takes 1:50 to pour the same amount).

> been a disaster. These new cans have caused more gas to spill and more fumes to escape than any gas can in history. At least in my history; I don't have any statistics to report about spills outside of my own garage. Suffice to say that everyone I've talked to about these new cans hates them, and reports similarly alarming spill statistics from their own experiences in their own garages.[34]
>
> This one doesn't have a vent. Who would make a can without a vent unless it was done under duress? After all, everyone knows to vent anything that pours. Otherwise, it doesn't pour right and is likely to spill.[35]
>
> The only gas cans they sell nowadays is [sic] a plastic one with a complicated thin plastic twisty spring loaded mechanism on the spout. The directions suck and so does the spout. One little twist and the thin plastic breaks, causing the seal to break. Tip the spout towards the lawn mower and half of it spills on the ground and over your hands.[36]

In short, many gas can users do not like the new gas cans. Can manufacturers claim that more recent post-regulation designs have mitigated problems,[37] but difficulty of use and consumer dissatisfaction appears persistent.[38]

The gas can regulations may be justified based on their *public* benefits (i.e. reduction in the emissions externality), but consumer dissatisfaction suggests the regulation is a net negative considering only its private costs and benefits (i.e. to consumers). More expensive cans that do not work as well as those they replace are unlikely to be a popular option. Put differently, had they not been required by regulation it seems unlikely that new-style cans would have been successful in the

34. GAD's Ramblings, *One Man's Quest for Gas Cans that Don't Suck* (Nov. 22, 2012), http://www.gad.net/Blog/2012/11/22/one-mans-quest-for-gas-cans-that-dont-suck/.

35. Jeffrey Tucker, LAISSEZ FAIRE, *How Government Wrecked the Gas Can* (May 7, 2012), https://lfb.org/how-government-wrecked-the-gas-can.

36. Intheknow, DAILY KOS, *Has anyone purchases a new gas can lately?* (Nov. 6, 2014), http://www.dailykos.com/story/2014/11/6/1342736/-Has-anyone-purchased-a-new-gas-can-lately.

37. *See, e.g.,*. No-Spill Inc., *Features…Functions…& Benefits…*, (2017) http://www.nospill.com/Why-NO-SPILL-.html (citing ease-of-use advantages of one particular CARB-compliant model along with testimonials from customers and dealers).

38. *See* GAD's Ramblings, *supra* note 34 (describing the No-Spill can as the best of the CARB-compliant cans tested, but nevertheless concluding it has "many of the drawbacks that all of the new cans share, like hard to open, locking tops (especially in the cold), obnoxious caps that prevent the nozzle from fitting in gas tanks, what seem to be a terribly confusing spout assemblies, and finally, a ridiculously high price tag for all that pain"). *See also* DiBernardo, *supra* note 33 (finding that a No-spill can had the slowest pour rate among cans tested).

market. Some of this resistance, of course, could be due to a learning curve associated with the new cans or simple resistance to change, but that does not make it any less real.

Regulators are aware of consumer resistance to post-regulation gas can designs—the 2005 revised California regulations "changed some existing requirements for flow-rate and spout design to make them more consumer friendly" in hopes that they would "result in containers that are easier and better accepted by the public."[39] California also revised its regulations so as to no longer require spouts with automatic shut-off features in response to consumer dissatisfaction.[40]

It is even possible that the PFC regulations are counterproductive. If anecdotal evidence that the new cans lead to more spillage rather than less is correct, then it is possible that the regulations are not even justified based on their public environmental benefits. Spilled gasoline will inevitably evaporate, leading to VOC emissions. Good data on gasoline spill rates from pre- and post-regulation cans does not appear to be available, however. But even assuming that spills are not more likely in the long run, it is enough to consider the implications of customer dissatisfaction with post-regulation cans.

This dissatisfaction should come as no surprise. It is probably unreasonable to expect that consumers would be happy with the tradeoff between the difficulty of use of the new cans and their relatively small private benefits (less fuel loss through evaporation).[41] More generally, anyone subject to a regulation that imposes private costs in favor of public benefits is unlikely to be pleased with it. Certainly industry opposition to environmental and other regulation is *de rigueur*. At least among environmental regulations, however, the CARB/EPA gas can rules are unusual in that they directly affect consumers. More precisely, they affect consumer choice and specific features of consumer products, rather than simply imposing higher costs as an indirect effect of regulation on industry. Direct regulation of consumer products is common in other regulatory spheres (most notably product and food/drug safety), but it is not usually the locus of environmental regulation. Vehicles (discussed below) are perhaps the largest exception.

39. California Environmental Protection Agency, News Release, *ARB Upgrades Clean Gas Rules* (Sep. 15, 2005), https://www.arb.ca.gov/newsrel/nr091505.htm.

40. *See* EPA PFC Rule, *supra* note 2 at 8500.

41. *See id.* at 8521 (stating that "gasoline fuel savings are not included in the market analysis for this economic impact analysis because these savings are not expected to affect consumer decisions with respect to the purchase of new containers").

C. Consumer Evasion

Those subject to a regulation may oppose it in administrative, legal, or legislative venues, and even seek to skirt or evade it. Typically, regulated industries play this role, but the direct effects of gas can regulations on consumer choice give consumers an incentive to oppose or evade them as well. Consumers have strongly and creatively responded to this incentive, adopting a variety of tactics to evade gas can regulations—in the process reducing or negating any environmental benefits.

First, the gas can regulations apply only to the manufacture or sale of new cans.[42] Old-style vented cans are still legal to own and use.[43] But their supply is now limited, with the predictable result that their price has increased.[44] Therefore, users may hoard old cans, keep them in service longer (perhaps even if they leak), and, as noted, pay higher prices in the second-hand market for them. These behaviors may lead old cans to be retained in use at a greater rate than predicted by regulators, reducing expected benefits of the regulation (not to mention reducing revenues for manufacturers of new cans).[45] In principle, a black-market for old-style cans could develop. I know of no evidence for this, though there is anecdotal evidence of vented cans being purchased in Canada for use in the US, circumventing EPA's national regulation.[46]

A second option is for consumers to modify new cans, defeating the

42. *See id*. at 8432 (stating that EPA national PFC regulations apply only to containers manufactured on or after January 1, 2009).

43. *Id*. (cans manufactured before January 1, 2009 not regulated).

44. Used old-style (vented) 5 gallon cans were available at time of writing for around $35-50 shipped, compared to as little as $20 for a new condition compliant can. *Compare* eBay listings of 5-gallon used pre-regulation cans ("5 gallon preban gas can"), http:// goo.gl/5KpVPh with those for new post-regulation cans ("5 gallon gas can CARB"), https://goo.gl/gUDgow. As noted above, the regulations also increased the price of new cans relative to pre-regulation cans, by an estimated $6-11. *See* CARB, *Regulations for Portable Fuel Containers (PFC) and Spouts supra* note 18. EPA predicted at 57% increase in gas can costs, and further predicted that 99% of these costs would be passed on to consumers. *See* EPA PFC Rule at 8521, 8523.

45. In 1999, California regulators estimated the average useful life of gas cans at 5 years. Although it is possible that the analysis producing this average contemplated a long tail of gas cans with much longer useful life, the widespread availability of pre-regulation cans 16 years after the initial CARB regulations and 7 years after the national EPA regulations suggests either that this estimate was too low or that the regulations encouraged consumers to keep pre-regulation cans longer than they would have otherwise. *See* California Air Resources Board, *Hearing Notice and Staff Report: Initial Statement of Reasons for Proposed Rule Making, Public Hearing to Consider the Adoption of Portable Fuel Container Spillage Control Regulations* (Aug. 6, 1999) at 23, https://www.arb.ca.gov/regact/spillcon/isor.pdf.

46. *See, e.g.,*. Post on "The Hull Truth Boating Forum" (Dec. 20, 2012), http://www.thehulltruth.com/dockside-chat/472908-where-get-real-5-gallon-gas-cans.html (describing successful purchase of unregulated cans in Canada and importation into the US).

emissions-control features. Instructions for how to do so are easily found; one simple fix is to drill a hole in a can and mount a tire valve (with the core removed) in the hole, creating a sealable vent, as shown in Figure 3.[47] An even simpler modification, if it can be called that, is to remove the troublesome spout and pour directly from the can into a funnel.

Figure 3: Gas can modified to allow venting

D. Consumer-Producer Cooperation…or Collusion

These methods for evading gas can regulations are purely consumer-driven. Depending on one's perspective, they could be viewed as either scofflaw mischief or homespun ingenuity (or perhaps some of both). Such reactions are not surprising, though they do illustrate—in dollar terms, in the case of higher prices for old cans—the level of consumer dissatisfaction with the regulatory mandate. More interesting from a regulatory design perspective, however, are another class of reactions that are neither purely consumer nor purely producer, instead requiring tacit cooperation or outright collusion between the two to evade regulation.

47. *See, e.g.*, DoubleSurvivalists, *How to Fix a New Gas Can*, YOUTUBE (Oct. 8, 2011), https://www.youtube.com/watch?v=0lcnwdIYEfI (detailing process for modifying post-regulation cans to add a vent).

Perhaps the simplest way to evade the gas can regulations is to store gasoline in another container, one lacking the troublesome new spout and having a vent. Ready substitutes exist, most obviously cans intended for other fuels such as diesel and kerosene. One might expect such containers to be regulated at the same standards as gas cans, since all volatile petroleum fuels contribute to VOC emissions if they spill or evaporate; however, early versions of the gas can regulations excluded containers for other fuels.[48] As a result, consumers, frustrated with new gas cans, had a ready substitute that was often sold on the same shelf.[49] In 2005, California closed this loophole by including kerosene cans in its revised standards, explicitly to prevent consumer evasion of the regulation.[50] The rule does not address whether imposing restrictions on kerosene containers is justified on its own merits, i.e., considering emissions from kerosene containers used for kerosene only. The EPA followed suit in its 2007 national regulations by including diesel and kerosene containers.[51]

Including containers labeled for other fuels within the regulations does not, of course, prevent consumers from using other containers not explicitly marketed for use with fuel. One example are so-called "utility jugs" not labeled as gas cans but often with auto racing-themed branding (see Figure 4). These are fairly clearly aimed at the gas can market; as EPA notes, they are "designed and marketed for use with gasoline." [52] Recognizing this loophole in the early California rules, EPA's 2005 regulations apply to utility jugs[53] and California has clarified that its rules also apply.[54] Nevertheless, manufacturers seem to evade these requirements—utility jugs with vents and without auto-closing spouts are still available from national retailers, as shown in Figure 4.[55]

48. *See* California Air Resources Board, *Staff Report: Initial Statement of Reasons for Proposed Amendments to the Portable Fuel Container Regulations* (July 29, 2005), https://www.arb.ca.gov/regact/pfc/2005/isor.pdf (noting that "kerosene containers that were not included in the original regulations have become inexpensive PFC substitutes").

49. *Id*.

50. *See* California Air Resources Board, *New Requirements for Kerosene Containers* (Oct 2005), https://www.arb.ca.gov/enf/advs/advs338.pdf (describing revisions to the 2005 California PFC regulations to include previously unregulated kerosene containers).

51. *See* EPA PFC Rule, *supra* note 2 at 8499.

52. *Id*. at 8500.

53. *Id*.

54. *See* California Air Resources Board, *Clarified Requirements for Utility Jugs* (Dec. 2005), https://www.arb.ca.gov/enf/advs/advs342.pdf.

55. *See, e.g.*, *.VP Racing Fuel 3012 Red Fuel* Jug, Amazon.com, https://smile.amazon.com/VP-Racing-Fuel-3012-Red/dp/B003TTPHLQ.

Figure 4: "Utility jug"; note vent, lack of self-closing spout, and auto racing branding.

Another option is to use containers not designed for petroleum fuels at all. In principle, it is of course possible to store gasoline in any large container, but a container has to be a superior substitute to post-regulation gas cans to be an attractive alternative. Containers that leak, react with gasoline, or are unwieldy to pour will not tempt consumers. But at least one product will: military-style potable water containers. Such containers are made by the same manufacturers as military-style gasoline cans, and are designed to the same size specifications (presumably initially for military standardization and storage purposes).[56] Crucially, they have old-style spouts and vents.

Figure 5: Potable water can (note old-style spout and presence of vent) and similar regulation-compliant gas can from the same manufacturer

56. *Compare Scepter ECO Jerry Can*, Amazon.com, *available at* https://smile.amazon.com/Scepter-Resistant-Closures-5-Gallon-Military/dp/B000MT94TC (CARB/EPA compliant gas can) *with Scepter Water Can*, Amazon.com, *available at* https://smile.amazon.com/Scepter-04933-Water-Can-5-Gallon/dp/B000MTI0GA (Water can from the same manufacturer, in a nearly identical design, with pre-regulation spout and vent).

Although not marketed for use with fuel (and in fact clearly labeled for water use), consumers are buying these cans for use with gasoline. As Amazon reviewers have said about these cans:

> Just like the good old days. It makes a great fuel can because it's got a vent and it pours without any CARB drama.[57]

> Are you sick of gas cans with locks/valves on them? Do you want a gas can just like the old-school ones, with a bleeder and simple, unobstructed pour spout? This is the gas can for you, then, even though it's sold as a water can and even has markings on the can stating "Potable Water". As far as I can tell, the only difference is the color (blue instead of red) and writing on the side. Otherwise, it's near perfect. It pours very quickly.[58]
> Great gas can! Screw CARB.[59]

Using cans not labeled for gasoline use may be a violation of other safety-driven regulations. But these are effectively unenforceable for small-scale home use. Simply painting non-gasoline cans red and marking them "Gasoline" may be sufficient to comply.[60]

Using a new container not labeled for gasoline to evade CARB/EPA emissions regulations requires some level of cooperation between consumers and manufacturers. The degree of such cooperation varies—utility jugs are clearly marketed for use with gasoline, but there is little evidence that water jugs are. Manufacturers would likely insist that water containers should *not* be used for gasoline. One manufacturer lists its water container only among "Canada/International" fuel containers and indicates it is "not available in the U.S.," presumably to avoid the implication that it could or should be used for gasoline.[61] Despite the claim, however, the container is in fact available in the U.S.[62] Manufacturers do of course profit from cans not marked for gasoline

57. Ron Strand, Customer Review, Amazon.com (May 23, 2012), *available at* https://smile.amazon.com/review/R28CTMWIA2B76U.

58. Culturejamming, Customer Review, Amazon.com (September 6, 2016), *available at* https://smile.amazon.com/gp/customer-reviews/ROUS9S4S6HNQN.

59. Corey Reynolds, Customer Review, Amazon.com (July 20, 2015), *available at* https://smile.amazon.com/gp/customer-reviews/R1HFK2Y4RUD90Q.

60. *See, e.g.,* Wis.. WI Stat. § 168.11 (2015) (containers used to store gasoline must be "a bright red color" and be marked with their contents, but the statute does not specify whether this color and marking must be applied by the manufacturer, or whether the container must be designed and marketed for gasoline use).

61. *See* Scepter, Inc., *CDN/INT'L Fuel Containers*, *available at* http://www.scepterconsumer.com/fuel_containers/regular_fuel_containers/.

62. *Scepter Water Can*, Amazon.com, *available at* https://smile.amazon.com/Scepter-04933-Water-Can-5-Gallon/dp/B000MTI0GA.

sold to consumers seeking to evade regulations. Some of these sales may cannibalize sales of compliant cans (possibly reducing profits given the higher cost of compliant cans). But the availability of unregulated retail options may also attract customers away from the secondary market for pre-regulation cans, increasing overall retail sales and manufacturer profits.

A final option for evading gas can emissions regulations is the clearest example of consumer-manufacturer collusion: some firms provide aftermarket kits for modifying cans so as to circumvent the emissions-reduction features. For example, the "EZ-Pour Universal Replacement Spout and Vent Kit" allows you to "make your gas can great again."[63] The manufacturer's website states that the kit "is designed and sold as replacement parts specifically for portable fuel containers manufactured before January 2009,"[64] and the product is marketed as a "water jug spout" in some states.[65] Presumably these statements and labeling are intended to escape regulatory scrutiny. However, a photo on the product's web page touts the kit's compatibility with a wide range of post-regulation cans,[66] and the product's instructions describe how to drill a hole in an unvented can, an unnecessary step if the kit were used only to repair a pre-regulation vented can.[67]

A similar product, the "No-Bama Replacement Spout & Vent Kit" more openly targets consumers seeking to avoid regulation.[68] This product also claims to be aimed at repair of old cans, but the seller's video installation instructions show modification of a post-regulation can and describe the advantages of the product's non-compliant traditional spout over self-closing spouts.[69] The product's name is a (perhaps knowing) misnomer: the 2005 EPA regulations were finalized under the George W. Bush administration.

63. EZ-POUR Universal Fuel and Water Jug Spout, *available at* http://ezpourspout.com/.

64. *Id*.

65. *See* EZ-POUR, *Order Water Spouts*, http://ezpourspout.com/order/order-water-can-2/ (note alternative labeling of same product as "water jug spout"; website users are directed to this page after indicating they are residents of one of 9 states, including California and New York, or the District of Columbia, which have state-level gas can regulations).

66. EZ-POUR, *Compatible Fuel Cans*, http://ezpourspout.com/compatible-cans/compatible-cans/.

67. EZ-POUR, *Installation Instructions*, http://ezpourspout.com/INSTRUCTIONS-ENGLISH.pdf.

68. No-Bama Replacement Spout & Vent Kit, alaskansongs.com, http://alaskansongs.com/product/no-bama-replacement-spout-vent-kit/.

69. 360 Productions, *No-Bama Replacement Spout and Vent Kit*, YOUTUBE (Aug. 13, 2013), https://www.youtube.com/watch?v=Hh9RlMC3G-E.

Figure 6: The "No-Bama Replacement Spout and Vent Kit"

To be clear, neither of these products appear to be made by firms that manufacture regulated cans. At least one can manufacturer does, however, supply "replacement spouts" that can be used to circumvent the regulatory requirement for self-closing spouts, but unlike the kits described above, this product does not include a vent.[70]

In short, consumers have multiple, relatively easy ways to purchase products from gas can manufacturers or third parties to effectively evade the EPA's and CARB's gas can regulations. The degree of such consumer-producer cooperation varies: major gas can manufacturers produce only compliant cans for the US market, and do not openly market substitutes (such as water cans) for gasoline use. But they do sell and profit from these products, and some offer replacement parts that can be used to circumvent the regulations. Smaller firms produce products that are more openly marketed toward regulatory evasion, from "utility cans" with racing-themed branding to the "No-Bama" retrofit spout and vent.

70. *Moeller Scepter Gas/Diesel/Water Can Replacement Parts*, Amazon.com, *available at* https://www.amazon.com/Moeller-Scepter-Diesel-Water-Replacement/dp/B000MTCQO2.

E. Environmental and Political Effects

It is difficult and likely impossible to determine the degree to which consumers have been able to evade the EPA/CARB gas can regulations. Home modifications are impossible to track, and though it may be possible to obtain sales data for water cans and modification kits, it would remain unclear to what extent these were used for their ostensibly intended uses or for regulatory evasion. It is at least clear, however, that sufficient evasion occurs to support a market in products implicitly or explicitly aimed at enabling evasion.

If evasion is significant, it erodes the environmental benefits of the regulation. Some forms of evasion also increase private costs: some consumers may buy compliant cans, install aftermarket replacements or home modifications, and discard the complex spouts that drive up prices of the new cans. Such customers must pay twice—first for the post-regulation can, then again for aftermarket kits or parts for homebrew modification. They then discard the new spout, likely the most expensive part of the can, and must spend time making the modifications. Administrative costs for regulators also increase, as evidenced by California's revisions in 2005, including utility jugs and kerosene cans so as to shut off the most obvious evasion opportunities.[71]

But perhaps less obvious are the political costs of the gas can regulations. As the consumer complaints about compliant cans and comments regarding products for evading the regulations indicate, consumer dissatisfaction is significant. Moreover, dissatisfaction is not limited to consumers whose politics might attract them to products like the "No-Bama" replacement spout. As a user of left-leaning website Daily Kos puts it:

> I love President Obama and what he has done for this country. However the gas can regulations translate to everyday people who mow yards and snow blow driveways as pure stupidity. The gas cans can be what people think about when they hear these doom and gloom Obamacare stories coming from Republicans. They see the new gas cans and believe the GOP when they charge incompetence.[72]

I suspect most readers were unfamiliar with gas can regulations, and certainly with consumer dissatisfaction and attempts at evasion. These are relatively minor environmental regulations in terms of both cost and

71. *See* California Air Resources Board, *New Requirements for Kerosene Containers*, *supra* note 50.

72. Intheknow, Daily Kos, *Has anyone purchases a new gas can lately?*, *supra* note 36.

environmental benefit.; Their visibility to and impact on frequent gas can users is non-trivial, however, or at least appears to play into preexisting anti-regulatory sentiment to a greater degree than other environmental regulations with less direct effect on consumers. The failures of new-style cans are not only a source of frustration but, for some, a vivid example of what they perceive as general regulatory overreach.

III. REGULATING LIGHT BULB EFFICIENCY

Some readers may be reminded of a similar regulatory story that received much greater public attention—the federal government's alleged ban on incandescent light bulbs. This experience shares many characteristics with that of the gas can regulation, although there are important differences. Environmental regulation directly affecting consumers is imposed (though by Congress, not regulators). It is well intentioned, appearing to generate both public and private net benefits. But many consumers are unhappy with the resulting reduction in choices, either because they find the new options to be poor substitutes or because of principled objections to regulatory interference (or both)—though there is never a complete ban on the old bulbs. Some consumers react by finding ways to evade the regulation, assisted in these efforts by industry but not by the largest firms.

Incandescent light bulbs produce light by running electric current through a metal (usually tungsten) filament, producing light as well as heat.[73] They have long been the most prevalent electric lighting technology, but are relatively inefficient (in terms of light output per unit of energy input) relative to alternatives. Less than 10% of energy input to an incandescent bulb is converted into visible light.[74] Both fluorescent lighting and electronic LED (light emitting diode) bulbs are substantially more efficient.[75] LED and compact fluorescent (CFL) bulbs only became commercially available relatively recently, however. Of the two new technologies, CFLs became available first, in the 1990s, and more widely in the early 2000s.[76] LED availability has substantially increased and prices have substantially dropped since 2008.[77] Despite

73. *See Incandescent Light Bulb*, Wikipedia *available at* https://en.wikipedia.org/wiki/Incandescent_light_bulb.

74. *See* Department of Energy, *Lighting Choices to Save You Money*, Energy.gov, *available at* https://energy.gov/energysaver/lighting-choices-save-you-money (indicating that 90% of energy input for incandescent bulbs is given off as heat).

75. *Id.*

76. *See* Department of Energy, *The History of the Light Bulb*, Energy.gov, *available at https://www.energy.gov/articles/history-light-bulb*

77. *Id.*

their superior efficiency, however, consumers were slow to adopt the new CFLs.[78] This is a specific illustration of the wider "energy efficiency paradox" or "gap," an expression of academic puzzlement at consumers' reluctance or inability to take advantage of energy efficiency opportunities that at least appear to be beneficial even considering only their private costs.[79]

Figure 7: Light bulb technologies; from left to right, an LED, incandescent, and CFL bulb. All three produce roughly the same amount of light, but the incandescent bulb uses 60 watts of electricity to do so, while the CFL uses 13 watts and the LED only 7.5 watts.[80]

78. *Id.*

79. *See, e.g.* Kenneth Gillingham and Karen Palmer, *Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence*, 8 REV. ENVIRON. ECON. POLICY 18 (2014) (analyzing empirical evidence for various explanations of an energy efficiency gap).

80. Image source: Flickr user trenttsd, CC BY 2.0 license, *available at* https://www.flickr.com/photos/84335369@N00/3258261439.

A. The Light Bulb "Ban"

Of course, energy efficiency improvements also have public benefits. Lower energy use means less air pollution from fossil fuel power plants, and less need for investment in new generation paid for by all ratepayers. The government, therefore, promotes energy efficiency through regulatory tools, from building codes to tax deductions. The most frequently used tool is probably product efficiency standards, applied to consumer products that range from vehicles to appliances.[81]

In 2007, Congress passed legislation—the Energy Independence and Security Act (EISA)—that imposed efficiency standards on most light bulbs.[82] These standards would effectively ban the manufacture of most incandescent light bulbs, at least without large efficiency improvements. The statute also directed the Department of Energy (DOE) to promulgate more stringent standards after 2014.[83] Bulbs also must continue to improve, achieving a 60-70% efficiency improvement over 2008 levels (45 lumens per watt) by 2020.[84]

The 2007 efficiency standards inspired political and consumer pushback even before entering into effect. Conservative groups attacked the regulation as "governmental interference in our lives" or "interfer[ence] with free enterprise."[85] In 2011, then-Secretary of Energy Steven Chu responded with the assertion that "We are taking away a choice that continues to let people waste their own money."[86] Republican legislators, some of whom voted for the 2007 bill,[87] passed legislation defunding enforcement of the regulation.[88] Lighting industry

81. *See, e.g.*, Department of Energy, *Appliance and Equipment Standards Program*, ENERGY.GOV, https://energy.gov/eere/buildings/appliance-and-equipment-standards-program (detailing federal efficiency standards for "more than 60 categories of appliances and equipment").

82. Energy Independence and Security Act of 2007, Pub. L. No. 110-140 § 321, 121 Stat. 1492, 1573-87 (2007).

83. Energy Independence and Security Act § 321(a)(6)(A)(i).

84. *Id*. at § 321(a)(6)(A)(v).

85. *See* Robert Farley, *Banned light bulbs? Is the government saying no to incandescents?* POLITIFACT (May 24, 2011), http://www.politifact.com/truth-o-meter/article/2011/may/24/government-banning-incandescent-light-bulbs/ (quoting from a fundraising letter sent by AmeriPAC, "a political action committee that largely supports conservative Republican candidates" and the Center for the Defense of Free Enterprise Action Fund).

86. *See* Ryan Tracy and Stephanie Gleason, *New Flare-Up in Light-Bulb Wars*, WALL ST. J. (July 9, 2011), https://www.wsj.com/articles/SB10001424052702304793504576434122693094168 (quoting Secretary Chu in a conference call with reporters).

87. *See* Sean Collins Walsh, *G.O.P. Bid to Void Light Bulb Fails*, N.Y. TIMES (July 12, 2011), http://www.nytimes.com/2011/07/13/business/energy-environment/republicans-fail-to-annul-new-light-bulb-law.html (quoting Fred Upton [R-MI] in 2007 characterizing the EISA as a "common-sense, bipartisan approach", only later to remove the statement from his website and replace it with a claim that "[t]he public response on this issue is a clear signal that markets—not governments—should be driving technological advancements").

88. *See* Stephen Dinan, *Congress overturns incandescent light bulb ban*, WASH. TIMES (Dec. 16,

firms spoke in favor of the impending regulation, however, claiming they had already made anticipatory investments; it is also possible they expected greater revenues and profits from the new, more expensive bulbs relative to commodity-priced incandescent bulbs.[89] Despite this period of public controversy and political retrenchment, the EISA remains in effect, along with its efficiency standards for incandescent bulbs.[90]

B. Consumer Reactions

Initially, many consumers felt that new bulbs were inferior. CFLs were moderately more expensive up front, often did not work with dimmer switches, produced a flicker that some found annoying, and released mercury vapor if broken, among other complaints.[91] LEDs were even more expensive up front, though their long life and low energy use made them cheaper over the long run.[92] Many consumers simply preferred incandescent bulbs, even once they became aware of alternatives and their energy-saving advantages.[93] The "light bulb ban" remains an oft-cited symbol of alleged over-regulation and government intrusion into consumer decision making.[94]

Despite this controversy, the EISA bulb regulations entered into effect more or less as planned during the 2012-2014 period.[95] Today, few if any traditional general service, non-halogen incandescent bulbs are produced in the US,[96] and are not widely available.[97] Unsurprisingly,

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2011), http://www.washingtontimes.com/news/2011/dec/16/congress-overturns-incandescent-light-bulb-ban/.

89. *See* Tracy and Gleason, *supra* note 86.

90. *See* 42 U.S.C. § 6295(i)(2018) (codifying the 2007 EISA).

91. *See, e.g.,*. Nick Davis, *Disadvantages of CFL Light Bulbs*, EHOW, http://www.ehow.com/list_6508643_disadvantages-cfl-light-bulbs.html.

92. *See* Department of Energy, *How Energy-Efficiency Light Bulbs Compare with Traditional Incandescents*, ENERGY.GOV, https://energy.gov/energysaver/how-energy-efficient-light-bulbs-compare-traditional-incandescents.

93. *See, e.g.,*. Jolie Dee, *Why people still use inefficient incandescent light bulbs*, USA TODAY (Dec. 27, 2013), http://www.usatoday.com/story/news/nation-now/2013/12/27/incandescent-light-bulbs-phaseout-leds/4217009/; Penelope Green, *Light Bulb Saving Time*, N.Y. TIMES (May 25, 2011), http://www.nytimes.com/2011/05/26/garden/fearing-the-phase-out-of-incandescent-bulbs.html (describing preference of some interior designers and restauranteurs for incandescent light).

94. *See, e.g.* The Colbert Report, *Light Bulb Ban*, COMEDY CENTRAL (Mar. 8, 2011), http://www.cc.com/video-clips/29cv4a/the-colbert-report-light-bulb-ban (satirizing the 2007 EISA); *See also* Tim Worstall, *Brexit Will Free The Bendy Banana, Incandescent Light Bulbs And Tomato Marmalade*, FORBES (June 26, 2016) (claiming that the UK's vote to leave the European Union will free it from burdensome EU regulations, including an incandescent phase-out).

95. *See* 42 U.S.C. § 6295(i)(2018) (codifying the 2007 EISA); *see also* Department of Energy, *New Lighting Standards Began in 2012*, ENERGY.GOV, https://energy.gov/energysaver/new-lighting-standards-began-2012.

96. *See, e.g.*, Peter Whoriskey, *Light bulb factory closes; End of era for U.S. means more jobs*

some consumers reacted by attempting to evade the ban. "Evade" is perhaps not the right term—few of the strategies for continuing to use incandescent bulbs described below violate the law. All do, however, circumvent its goal of pushing consumers toward alternatives.

Consumers' first and best option was to buy traditional incandescent bulbs while they remained available. The EISA did not ban sale of incandescent bulbs, only their manufacture.[98] Retailer stock persisted for some time,[99] and some consumers hoarded incandescent bulbs in advance of the ban on manufacture.[100] Industry provided a second option—manufacturers were able to produce improved halogen incandescent bulbs that could meet the 2012-2014 standards.[101] These halogen bulbs have characteristics similar to traditional incandescent bulbs, but they are more expensive.[102] This is only a temporary option, however, because halogen bulbs will not meet the stricter 2020 efficiency standards.[103] Another option is to import bulbs from countries outside the U.S. without equivalent bans. The EISA does forbid importation of bulbs that violate its efficiency standards,[104] but imported

overseas, WASH. POST (Sep. 8, 2010), http://www.washingtonpost.com/wp-dyn/content/article/2010/09/07/AR2010090706933.html.

97. For example, as of this writing major retailers like Home Depot no longer offer general service incandescent bulbs for sale, offering only halogen "eco-incandescent" bulbs and specialized types like flood or globe lights excluded from the EISA regulations. *See* Home Depot, *Incandescent Light Bulbs*, *available at* http://www.homedepot.com/b/Lighting-Ceiling-Fans-Light-Bulbs-Incandescent-Light-Bulbs/N-5yc1vZbmgl.

98. 42 U.S.C. § 6295(i)(2) ("it shall not be unlawful for a manufacturer to sell a lamp which is in compliance with the law at the time such lamp was manufactured").

99. *See* Patrick K. Kiger, *U.S. Phase-Out of Incandescent Light Bulbs Continues in 2014 with 40-, 60-Watt Varieties*, NAT. GEO. (Dec. 31, 2013), http://energyblog.nationalgeographic.com/2013/12/31/u-s-phase-out-of-incandescent-light-bulbs-continues-in-2014-with-40-60-watt-varieties/ ("[u]ntil the supplies run out, the old bulbs still will be available on store shelves, alongside the electricity-saving alternatives that gradually will replace them").

100. *See, e.g.*,. Nancy Smith, *How to Have Incandescent Light Bulbs for the Rest of Your Life*, PREP HAPPY (Jan. 10, 2014), http://prephappy.com/light/how-to-have-incandescent-light-bulbs-for-the-rest-of-your-life/ (detailed instructions on how to hoard pre-regulation incandescent bulbs, including instructions on long-term storage and a calculator for determining how many bulbs to buy for long-term needs); *see also* Cord Jefferson, *The American Outlaws Hoarding Lightbulbs in the Name of Liberty*, GIZMODO (Sep. 20, 2012), http://gizmodo.com/5943048/the-american-outlaws-hoarding-lightbulbs-in-the-name-of-liberty.

101. *See* Department of Energy, *Incandescent Lighting*, ENERGY.GOV, https://energy.gov/energysaver/incandescent-lighting (describing halogen bulb technology as a replacement for traditional incandescent bulbs that will be phased out due to regulation).

102. *Id*.

103. *See* Owen Comstock and Kevin Jarzomski, *LED bulb efficiency expected to continue improving as cost declines*, U.S. ENERGY INFORMATION ADMINISTRATION: TODAY IN ENERGY (Mar. 19, 2014), https://www.eia.gov/todayinenergy/detail.php?id=15471 ("[a]n additional round of standards taking effect in 2020 will likely be too stringent for halogen incandescent lamps to meet, and major manufacturers have already focused development on more-efficient technologies").

104. Energy Independence and Security Act of 2007, Pub. L. No. 110-140 § 321(a)(3)(B)(i)(IV),

bulbs nevertheless appear to be available.[105] Sellers of imported bulbs may be evading detection by regulators, or regulators may be unable to enforce the standards against smugglers due to lack of congressional appropriations to do so.[106]

C. Consumer-Producer Cooperation

No such bulb-smuggling is necessary, however, to buy as many relatively inefficient incandescent bulbs as a consumer wants. This is due to the wide range of bulb types excluded from the EISA efficiency rules. Many categories of "specialty" bulbs are excluded, including candelabra and globe style bulbs, 3-way bulbs, outdoor "bug lights," reflector/flood lights, plant grow lights, and "rough-service" bulbs.[107] In other words, only standard lamp bulbs are affected by the standards, at least initially.[108] Since many of the excluded categories can be easily substituted for lamp bulbs, circumventing the regulation is easy.[109] This is most true of "rough service" bulbs, defined in the EISA as those with extra support for filaments and "designated and marketed specifically for 'rough service' applications."[110] In short, manufacturers only need to make minor changes to bulb designs and change their labeling or marketing materials in order to continue to sell very similar incandescent bulbs.

Manufacturers have responded by making rough service bulbs, previously a niche product, widely available—in fact, they and other exempted bulbs are the only incandescent bulbs available from most major retailers.[111] Nevertheless, major lighting manufacturers have increasingly moved production to halogen, CFL and, increasingly, LED

121 Stat. 1492, 1578 (2007) (standards apply to lamps [bulbs] "manufactured or imported after December 31, 2011").

105. *See, e.g.,*. Glen Horn, Customer Review, Amazon.com (Jan. 10, 2017), *available at* https://smile.amazon.com/gp/customer-reviews/RMXAUN6FKE7YY (reporting receipt of 100-watt incandescent bulbs made in Hungary and marked "Not for Sale in the USA" after online purchase).

106. Large manufacturers, in contrast, are unlikely to restart production of incandescent bulbs even if DOE lacks funding to pursue legal action.

107. Energy Independence and Security Act § 321(a)(1)(D)(ii).

108. In early 2017, DOE finalized regulation terminating some of the EISA exemptions effective in 2020, discussed below. *See* Energy Conservation Program: Energy Conservation Standards for General Service Lamps, 82 Fed. Reg. 7276 (Jan. 19, 2017) (to be codified at 10 C.F.R. pt. 430).

109. *See id*. at 7288 (noting ease of substitution between general service incandescents and some 430).types of specialty bulbs).

110. *See* Energy Independence and Security Act § 321(a)(1)(X).

111. At the time of writing, the only A-series (traditional shape) 100-watt incandescent bulbs sold by retailer Home Depot are 3-way, rough service, and other specialty bulbs, all of which are currently exempt from the efficiency standards. *See* Homedepot.com, *Incandescent Light Bulbs* (last visited March 16, 2017), *available at* http://www.homedepot.com/b/Electrical-Light-Bulbs-Incandescent-Light-Bulbs/A-Line/N-5yc1vZbmglZ2bcoqwZ1z132pi?NCNI-5.

bulbs.[112]

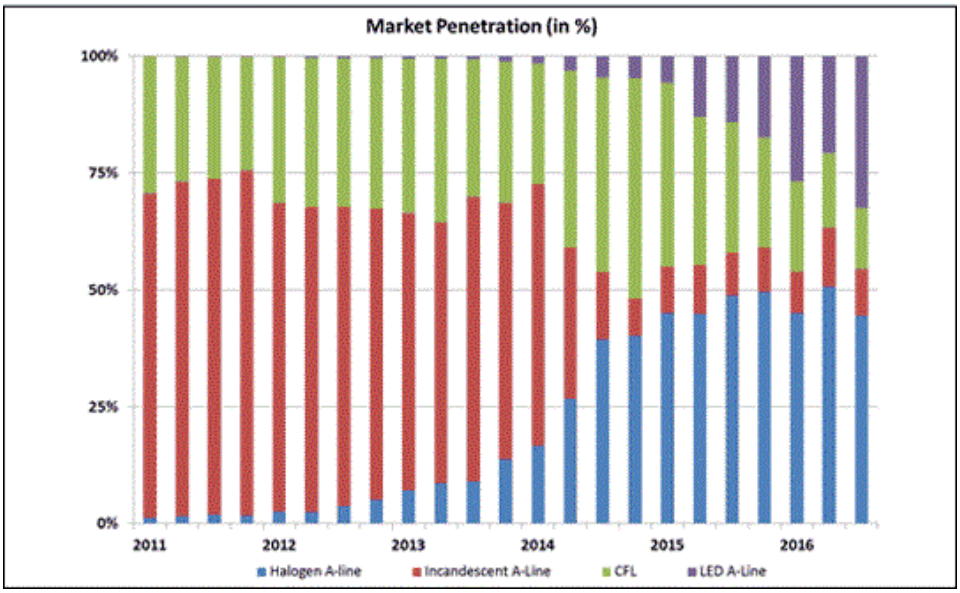

Figure 8: Market Penetration by Light Bulb Technology by Quarter[113]

Despite declining production from major firms, independent manufacturers have entered the market in an effort to meet persistent demand for incandescent bulbs. New Jersey-based "Newcandescent" produces (or perhaps just markets) a wide range of bulbs indistinguishable from traditional incandescent bulbs, most of which are marketed as rough service bulbs.[114]

There is one drawback, however: like halogens, rough service and other specialty bulbs are more expensive (at least up front) than pre-regulation incandescent bulbs, at around $2-4 per bulb, compared to the

112. *See* Tracy Cullen, *LED A-Line Lamp Shipments Increase in Third Quarter of 2016*, NEMA (Jan. 23, 2017), https://www.nema.org/news/Pages/LED-A-Line-Lamp-Shipments-Increase-in-Third-Quarter-of-2016.aspx (detailing substantial increase in market share of halogen, CFL, and LED bulbs since 2011). *See also See* LAURA JAMES ET AL.., COLORADO LIGHTING MARKET STUDY 3 (2016), https://www.xcelenergy.com/staticfiles/xe/PDF/Regulatory/CO-DSM/CO-Regulatory-DSM-Lighting-Market-Study.pdf (2016 survey of Colorado bulb availability, finding little or no pre-regulation bulbs on store shelves). *See also* Michael Nunez, *GE Will Stop Making CFL Lightbulbs Because LEDs Are Better*, GIZMODO (Feb. 1, 2016), http://gizmodo.com/ge-will-no-longer-make-cfl-lighbulbs-1756344245.

113. Cullen, *supra* note 114.

114. *See Incandescent Light Bulbs*, NEWCANDESCENT, http://www.newcandescent.com/ ("In order to address the demand by the public for the quality of light that an incandescent light bulb produces, the Newcandescent light bulb was created. This modified version of the incandescent light bulb provides the same quality of light most have come to expect…This longer lasting light bulb can also be used for "rough use" and is exempt from this recent legislation").

under a $1 prices once charged for incandescent bulbs.[115] It is unclear whether these higher prices are due to the slight modifications necessary to qualify bulbs as rough service or to reductions in economies of scale due to lower demand. At these prices for exempted bulbs, incandescent bulbs become much less attractive when compared with declining prices for more efficient bulbs, especially LEDs. For similar light output and at 2016-2017 prices, LEDs are around the same price as rough service incandescent bulbs, but have a much longer life and reduced energy requirements; therefore, these LEDs have a far smaller total cost of ownership.[116] Whatever economic arguments in favor of incandescent bulbs that may have existed in early days of the EISA regulations when LEDs were expensive and CFLs unappealing, they have now disappeared. Nevertheless, for those who prefer their light or who simply hate change, incandescent bulbs remain available.

Congress did anticipate the possibility of bulb types excluded from the EISA efficiency requirements being used to evade the regulations. The EISA contains a provision directing the Secretary of Energy to monitor sales of excluded bulb types and, if they double in sales relative to projections, issue a rulemaking setting more stringent efficiency standards for them.[117] Through 2016, the DOE monitored sales of excluded types and did not observe sufficient sales growth to issue regulations.[118] For example, 2015 sales of rough service bulbs exceeded projections, but only by 35.5%, not enough to trigger a rulemaking.[119]

In early 2017, however, the DOE issued a final rulemaking setting new, more stringent incandescent bulb standards and narrowing the categories of exempted bulbs.[120] Though critics called the regulatory

115. *Compare* Patrick J. Kiger, *Separating Myth From Fact on CFL and LED Light Bulbs: Five Concerns Addressed*, NAT. GEO. (Jan. 8, 2014), http://energyblog.nationalgeographic.com/2014/01/08/separating-myth-from-fact-on-cfls-and-leds-five-concerns-addressed/comment-page-18/ (estimating price of pre-regulation incandescent bulbs at $1/bulb); *Incandescent Light Bulbs*, HOMEDEPOT, http://www.homedepot.com/b/Electrical-Light-Bulbs-Incandescent-Light-Bulbs/A-Line/N-5yc1vZbmglZ2bcoqwZ1z132pi?NCNI-5 (last visited Mar. 16, 2017) (listing current prices of exempted bulbs; at the time of writing approximately $2-4 for 3-way bulbs and $2 for rough service bulbs, although clear "traffic light" bulbs remain available for less than $1/bulb).

116. *See* Severin Borenstein, Energy Institute at Haas Blog, *Trash those incandescent bulbs today!* (Oct. 3, 2016), *available at* https://energyathaas.wordpress.com/2016/10/03/trash-those-incandescent-bulbs-today/ (estimating savings of $2.39, 80% of purchase cost, for LEDs over incandescents in the first year alone).

117. *See, e.g.*,. 42 U.S.C. §6295(i)(4)(D)(2018) (directing Secretary of Energy to monitor sales of rough service bulbs and regulate if sales increase).

118. *See* Energy Conservation Program: Data Collection and Comparison With Forecasted Unit Sales of Five Lamp Types; Notice of data availability, 81 Fed. Reg. 20,261 (Apr. 7, 2016).

119. *Id*. at § IV(A).

120. *See* Energy Conservation Program: Energy Conservation Standards for General Service Lamps, 82 Fed. Reg. 7276 (Jan. 19, 2017) (to be codified at 10 C.F.R. pt. 430).

action a "midnight rulemaking" made in anticipation of the change in administrations,[121] the 2007 EISA does require the DOE to issue revised regulations by January 2017.[122] Specifically, the rule discontinues the rough service bulb exemption, along with those for 3-way incandescent bulbs, vibration services lamps, and certain specialized lamp types under 40 watts.[123] These categories have the largest sales volume among the exempted categories,[124] suggesting that they are being used as replacements for general service incandescent bulbs.[125]

This rulemaking appears to close the rough service loophole, bringing the regulations initially implemented by the 2007 EISA somewhat closer to a true incandescent bulb ban, and it will when and if it enters into effect in 2020.[126] Given the election of Donald Trump in 2016 and his administration's anti-regulatory agenda, it seems unlikely that the rulemaking will ever enter into effect. Moreover, by 2020 LED bulbs are likely to have fallen further in price and consumer acceptance of them will likely have grown as well. The policy and political significance of the bulb efficiency standards, therefore, may decline substantially.

In short, there never really was a "bulb ban," or if there was, consumers and the industry were able to rapidly cooperate to evade it. As with the gas can regulations, the government was largely unwilling or unable to prevent such evasion, with the notable exception of the January 2017 revised standards, should they enter into effect.

D. Environmental and Political Effects

But this does not mean that evasion was widespread—it may have been limited to a small group of incandescent bulb loyalists. As with the gas can rules, assessing the extent to which consumer evasion of bulb efficiency standards undercut the goals of regulation is difficult. But there is *some* evidence, and it is mixed on the degree to which consumers substituted specialty bulbs exempt from the regulation for traditional incandescent bulbs. The data made public by the Energy

121. *See* Timothy P. Carney, *With midnight regulation, Obama Energy Department just outlawed your three-way bulb*, WASH. EXAMINER (Jan. 19, 2017), http://www.washingtonexaminer.com/with-midnight-regulation-obama-energy-department-just-outlawed-your-three-way-bulb/article/2612397.

122. 42 U.S.C. § 6295(i)(6)(A)(iii).

123. *See* Energy Conservation Program: Energy Conservation Standards for General Service Lamps, 82 Fed. Reg. at 7291.

124. *Id.*

125. *Id.* at 7288 ("DOE has based its decision on each exemption on an assessment of whether the exemption encompasses lamps that can provide general illumination and can functionally be a ready substitute for lamps already covered as [general service lamps]").

126. *Id.* at 7276 ("[t]he effective date of this rule is January 1, 2020").

Information Administration (EIA) in 2013, as the regulation was entering into effect, showed a drop in sales of specialty bulbs, rather than the increase one would expect if consumers were shifting toward them as standard bulbs were removed from the market.[127]

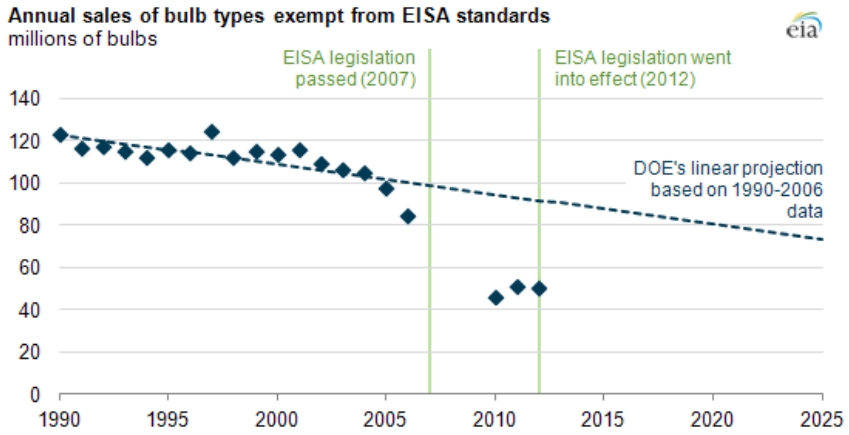

Figure 9[128]

As the EIA said, "the reduced sales of these incandescent specialty bulbs could be attributable to market transformation to more efficient lighting"—in other words, at the same time as the regulation entered into effect, technological improvements made CFL and LED alternatives more attractive, reducing demand for specialty incandescent bulbs at a faster rate than consumer evasion of the efficiency standards increased it.[129] Of course, if such technology-driven market trends dominate readily available opportunities for consumers to evade regulation, they draw into question how much of the efficiency improvement is driven by the bulb regulations at all. Perhaps, however, regulations were able to shift consumer behavior away from a suboptimal equilibrium into a mutually-beneficial LED-preferring equilibrium, or were able to give producers enough confidence in LED sales to ramp up production and take advantage of economies of scale.

Post-2013 data presents a more mixed picture of exempted bulb sales. One study reported that incandescent bulbs made up 43% of retail bulb

127. *See Sales of specialty incandescent bulbs decline despite exemption from efficiency standards*, U.S. ENERGY INFORMATION ADMINISTRATION: TODAY IN ENERGY (Apr. 2, 2013), http://www.eia.gov/todayinenergy/detail.php?id=10631.

128. *Id.*

129. *Id.*

sales in Colorado in 2014 and concluded that many or most of these were post-regulation specialty bulbs.[130] On the other hand, the same study showed significant reductions in market share for 75 and 100-watt incandescent bulbs that were subject to regulation earlier, in 2012 and 2013.[131] This suggests that regulation did decrease consumer use of incandescent bulbs, including specialty bulbs. However, because stocks of standard incandescent bulbs may have remained available in the years immediately following imposition of the standards, it is possible that demand for specialty bulbs only increased after 2013. The more recent 2015 market data cited by the DOE's 2017 rulemaking suggests increasing demand for specialty bulbs, up to 35.5% year-on-year for rough service bulbs.[132]

Even if there has not been a persistent increase in the sales of specialty bulbs, however, there appears to be at least a persistent long tail of demand for incandescent bulbs given their continued availability in the market. The size of this market, and therefore the extent to which it undercuts the efficiency goals of the EISA regulations, may be small, but it is not trivial.

Despite increasing consumer adoption of efficient LED bulbs, political fallout from the "bulb ban" persists. A similar EU regulation limiting sales of incandescent bulbs even became a minor issue in debates surrounding the UK's decision to exit the EU.[133] At least one scholar has cited bulb regulation as an example of regulatory overreach in a larger critique of the "unbound" administrative state.[134] Regulation with similar overall economic costs that does not directly affect consumers rarely gets such attention.

IV. GAMING VEHICLE EMISSIONS TESTS

Perhaps the clearest example of collusion between producers and consumers to evade consumer-facing environmental regulation comes from a recent study of fuel economy regulations in the European vehicle market.[135] Partly due to their effect on consumer choice, vehicle efficiency and emissions standards are among the most high-profile

130. *See* LAURA JAMES ET AL., COLORADO LIGHTING MARKET STUDY 4 (2016), https://www.xcelenergy.com/staticfiles/xe/PDF/Regulatory/CO-DSM/CO-Regulatory-DSM-Lighting-Market-Study.pdf .

131. *Id*. at 24.

132. *See* Energy Conservation Program: Data Collection and Comparison With Forecasted Unit Sales of Five Lamp Types; Notice of data availability, 81 Fed. Reg. 20,261 § IV(A) (Apr. 7, 2016).

133. *See* Worstall, *supra* note 96.

134. *See* Christopher DeMuth, *Can the Administrative State Be Tamed*?, 8 J. Legal Analysis 121 (2016).

135. Reynaert and Sallee, *supra* note 4.

environmental regulations. Almost all developed countries have such standards for light-duty vehicles, as do China, Brazil, and some other developing countries.[136]

However, manufacturer compliance with vehicle emissions standards has often been suspect. To give a few examples, General Motors faced multimillion-dollar fines and forced recalls of hundreds of thousands of Cadillacs in 1995 after design features that evaded carbon monoxide tests were discovered.[137] In the late 1990s, seven heavy truck manufacturers were hit with over $80 million in fines due to discovery of devices that shut down emissions controls during highway driving conditions.[138] In 2014, South Korean automakers Hyundai and Kia settled with the EPA after the firms admitted providing incorrect "road load force" data to laboratories, leading to inaccurate tests that overstated fuel economy.[139] Most famously, Volkswagen was busted in 2015 for implementing software in a large number of diesel vehicles that selectively employed emissions controls in test conditions, but disabled them in normal driving, increasing fuel economy and performance but increasing nitrogen oxide (NOx) emissions above legal limits.[140]

A recent paper by economists Mathias Reynaert and James Sallee uncovered evidence of yet more cheating (or, as they term it, "gaming") of vehicle emissions tests by a wide range of manufacturers subject to recently imposed European fuel economy standards.[141] Before new fuel economy standards were imposed in 2007, the data analyzed by the study showed a modest and stable difference between lab-tested fuel economy and that in real-world conditions, around 4-18%.[142] This difference increased to over 50% after standards were imposed, a change best explained by manufacturer gaming; in short, the manufacturers were designing "to the test" rather than to real-world conditions.[143] Explaining why this might occur, and what implications it might have for regulatory design in the future, requires a deeper look at the regulations in question.

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136. *See Global Comparison: Light-duty Emissions*, TRANSPORT POLICY, http://transportpolicy.net/index.php?title=Global_Comparison:_Light-duty_Emissions.

137. *See* Jeff Plungis, *Carmaker Cheating on Emissions Almost as Old as Pollution Tests*, BLOOMBERG (Sep. 23, 2015), https://www.bloomberg.com/news/articles/2015-09-23/carmaker-cheating-on-emissions-almost-as-old-as-pollution-tests.

138. *Id*.

139. *See Hyundai and Kia Clean Air Act Settlement*, EPA (Nov. 3, 2014), https://www.epa.gov/enforcement/hyundai-and-kia-clean-air-act-settlement.

140. *See Learn About Volkswagen Violations*, EPA (May 19, 2016), https://www.epa.gov/vw/learn-about-volkswagen-violations.

141. Reynaert and Sallee, *supra* note 4.

142. *Id*. at 3.

143. *Id*.

A. Private and Public Costs and Benefits of Fuel Economy Standards

Vehicle standards generally set limits on emissions of certain pollutants, such as NO_x,[144] and set minimum fuel economy levels.[145] More efficient vehicles emit less pollution, with their greenhouse gas emissions strongly correlated with fuel economy.[146] In short, regulators imposed standards because the standards generate public benefits in the form of reduced air pollution.

Of course, increased fuel economy also has private benefits for vehicle owners—all else equal, consumers prefer more efficient cars. But all else is never equal. Fuel economy improvements come at a cost: more efficient cars may be more expensive up front, as with CFL and LED light bulbs.[147] They may also be less appealing to consumers for other reasons, such as less attractive styling, slower acceleration, smaller size and weight, or other factors.[148] For simplicity, these drawbacks of more efficient cars will be referred to here as "performance."

Consumers (again, all else equal) prefer more efficient cars, and a manufacturer offering such vehicles might gain market share, be able to charge higher prices, or both. Of course, producing more efficient vehicles requires investment in new technology and designs, cutting into any profits that might be obtained. If a manufacturer cannot sell a more efficient car at a price consumers are willing to pay, it will not be attractive, and the firm could *lose* profits or market share. Like any business research and development decision, the best option is rarely clear.

But if manufacturers can cheat on emissions tests, they can get the best of both worlds—greater profits and market share without the actual

144. *See, e.g., Light-Duty Vehicles and Light-Duty Trucks: Clean Fuel Fleet Exhaust Emission Standards*, EPA (March 2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100O9ZJ.pdf (detailing EPA light-duty vehicle emissions standards for NOx, carbon monoxide, particulate matter, and other pollutants).

145. *See* Thomas Klier and Joshua Linn, *Comparing US and EU Approaches to Regulating Automotive Emissions and Fuel Economy*, RESOURCES FOR THE FUTURE, POLICY BRIEF 16-03 (2016), http://www.rff.org/files/document/file/RFF-PB-16-03.pdf (describing and contrasting US and EU vehicle fuel economy standards).

146. *See* 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,623, 62718 (Oct. 15, 2012) (describing close relationship between vehicle fuel economy and CO2 emissions). *But see id.* at 62891 (discussing 10% "rebound effect" of increased emissions due to consumers driving more efficient vehicles more).

147. *See, e.g.*, Nicholas Chase and John Maples, *Fuel economy and average vehicle cost vary significantly across vehicle types*, U.S. ENERGY INFORMATION ADMINISTRATION: TODAY IN ENERGY (July 22, 2014), https://www.eia.gov/todayinenergy/detail.php?id=17211 (estimating price increase of about $2000 for midsize passenger cars to meet 2025 fuel economy standards).

148. *See* DONALD WARREN MACKENZIE, TRENDS AND DRIVERS OF THE PERFORMANCE : FUEL ECONOMY TRADEOFF IN NEW AUTOMOBILES (MIT 2009), https://dspace.mit.edu/handle/1721.1/52758.

investment in better fuel economy. This would clearly harm consumers who, believing the false claims of fuel economy, would find the vehicle more attractive at the time of sale only to find later they have overpaid for an inferior product.[149]

All of this is true regardless of whether testing and labeling is simply voluntary or required by regulation. One might conclude that manufacturer cheating on vehicle tests is always detrimental to consumers as well as the wider public that is harmed by greater emissions. But this is not necessarily the case. In the presence of regulatory standards, it may be in consumers' interest for manufacturers to cheat.

The reason for this depends on a basic principle: fuel economy regulations almost always require greater fuel economy than consumers prefer on their own. If they did not, there would be no reason for the regulation—market forces alone (assuming rational, informed consumers) would push fuel economy up to the desired, socially optimal or at least beneficial level.[150] Therefore, when firms comply with fuel economy standards, vehicle consumers likely face private costs that exceed the private benefits of fuel economy, in at least three ways.

First, more efficient cars are likely to be more expensive up front.[151] If this cost exceeds the consumer's long-term savings from fuel, then there is a net private cost. Depending on the amount of increase in up-front vehicle costs, this might be true for a broad segment of consumers or only for those that drive rarely or short distances. Note that the regulation might still be cost-benefit justified from a social perspective due to the environmental and health benefits of reduced emissions. Second, customers with wealth constraints or high discount rates may prefer vehicles with lower initial costs even if they would achieve long-term savings from reduced fuel use. Finally, as mentioned above, there is typically a performance-fuel economy tradeoff.[152] Even if consumers' total cost of ownership over the life of the car (considering initial cost and fuel) is lower, they may nevertheless be worse off if they are forced to sacrifice performance characteristics that they value. Consumer utility

149. *See, e.g. Ford Fusion and C-MAX Fuel Economy Litigation*, Case No 13-MD-2450 (S.D. NY 2013), Consolidated Amended Class Action Complaint and Demand for Jury Trial, http://www.girardgibbs.com/wp-content/uploads/Ford-MPG-Complaint.pdf (detailing claims by owners of hybrid vehicles that Ford allegedly overstated the vehicles' fuel economy).

150. This argument assumes that consumers are rational. It is possible that consumers would benefit from more efficient vehicles than they think they prefer (and therefore buy), at least for some definitions of "benefit." Compare former Energy Secretary Chu's claim that light bulb efficiency standards "tak[e] away a choice that continues to let people waste their own money." S*ee* Tracy , *supra* note 88.

151. *See, e.g.*, EIA, *supra* note 149.

152. *See* MacKenzie, *supra* note 148.

from vehicle performance is much harder to measure than vehicle or fuel cost, but it is no less real.

Fuel economy rules are therefore likely to impose net private costs on vehicle buyers. This can mean manufacturer cheating on emissions tests may be beneficial to consumers. In simplest terms, such cheating allows customers to opt out of the costly regulation. Vehicles that evade the test requirements are likely to be initially cheaper, have better performance, or both compared to those that actually achieve the required fuel economy. Volkswagen's infamous NO_x test evasion is an example of this: meeting NO_x emissions requirements under lab conditions but then disabling NO_x controls under real-world conditions, allowed affected VW vehicles to offer performance and fuel economy at a price point that competitors found impossible to match.[153]

If only one firm cheats on emissions tests, it may be able to capture much of the private benefits for itself. For example, such a firm could invest less in emissions technology but still sell its cars at market prices, increasing profits. As another example, it could capture market share or charge above-market prices by offering higher performance vehicles that do not actually meet emissions or fuel economy standards. However, if any one firm cheats and is able to temporarily secure such an advantage, other firms will have a powerful incentive to cheat as well. Reynaert and Sallee demonstrate this theory in their paper, modeling a 16% reduction in profits if a firm is "honest" while its competitors cheat, compared with a 20% increase in profits if the firm is the only one to cheat.[154] If all firms cheat, the modeled change in profits is quite small in most cases.[155] This theory illustrates that widespread cheating allows consumers to capture more of the benefits of cheaper or better-performing vehicles.

Considering solely private costs, consumers stand to benefit most from manufacturer cheating if they can identify which manufacturers are cheating, and by how much. Consumers may in fact be able to do so, at least to some extent. They are not limited to rigid testing procedures, and may have real-world knowledge that regulators lack. Independent reviews of vehicle fuel economy and performance, word-of-mouth information, or information obtained from salespeople may give consumers a more accurate picture of true vehicle performance, fuel

153. *See* Jeff S. Bartlett, Michelle Naranjo, and Jeff Plungis, Consumer Reports, *Guide to the Volkswagen Emissions Recall* (Jan. 6, 2017), *available at* http://www.consumerreports.org/cro/cars/guide-to-the-volkswagen-dieselgate-emissions-recall- (detailing independent testing showing a decline in fuel economy and acceleration when "cheat" mode was enabled on affected VW cars).

154. Reynaert, *supra* note 4) at 35.

155. *Id.*

economy, and relevant tradeoffs than data from regulators' tests. Consumers also have access to aggregated real-world data. For example, consumers have access to crowd-sourced data through services like Fuelly, which provides a platform for vehicle owners to track their fuel economy and view aggregated reports on a per-model and per-manufacturer basis.[156] However, consumers can benefit from manufacturer cheating even if they are unaware of its extent. At least assuming cheating is widespread, consumers will have more vehicles to choose from with greater performance at lower cost.

Of course, some consumers may be disappointed to discover that their vehicles do not perform as promised, at least in terms of fuel economy, but also in emissions terms if the consumer has green preferences.[157] Even a consumer who openly prefers a less-efficient but cheaper or better-performing vehicle would surely prefer to be able to rely on manufacturers' stated performance information. But when regulation makes a consumers' preferred fuel economy/performance/price effectively illegal, the ability to buy a vehicle that matches those preferences despite falsely claiming to meet the standards will be appealing to many.[158] In short, vehicle standards motivate manufacturers and consumers to collude to evade the regulation.

The tests themselves create an opportunity to do so. Typically, compliance with standards is enforced by testing each model of vehicle before it can be sold, rather than by post-sale real-world emissions testing. Laboratories conducting tests are generally privately owned and often financed by vehicle manufacturers, although they must obtain certification from regulators.[159] Laboratories also test vehicles in narrowly specified conditions in an effort to achieve consistent and comparable results.[160] This testing regime, however, lends itself to abuse or gaming. It is possible for manufacturers to evade regulation if they

156. *See* Fuelly.com, *Aggregated User Vehicle Data*, *available at* http://docs.fuelly.com/aggregated-user-vehicle-data.

157. By green preferences, I mean consumer's private utility function has internalized some or all of the emissions externality.

158. In other words, for at least some consumers the disutility from being lied to or the increased search costs to find a vehicle with preferred real-world performance characteristics will be smaller than the utility gain from buying a vehicle that avoids the costs of regulation. This disutility disappears if consumers are able to easily discover the true characteristics of a vehicle before purchase.

159. *See* Peter Mock and John German, International Council on Clean Transportation, *The Future of Vehicle Emissions Testing and Compliance How to Align Regulatory Requirements, Customer Expectations, and Environmental Performance in The European Union*, White Paper (Nov. 2015) at 9-15, *available at* http://www.theicct.org/sites/default/files/publications/ICCT_future-vehicle-testing_20151123.pdf (detailing the common practice among EU member states of licensing private testing laboratories, and EPA's practice of relying on internal manufacturer tests plus government testing of about 15% of vehicles).

160. *Id*. (describing lab testing conditions).

can achieve emissions or fuel economy standards in the lab environment, regardless of their vehicles' ability to do so on the road. Examples of such gaming are common.[161]

It is worth noting the obvious reason why evasion of vehicle standards is a problem, despite its apparent benefits for both manufacturers and consumers. Vehicle emissions have a social welfare cost, to the extent that they damage health and the environment. Assuming that emissions regulations are socially beneficial, evasion reduces social welfare. Consumers get the cars they want; manufacturers may get higher revenues and profits; but respiratory disease cases increase and climate change is exacerbated. If everyone cheats, the tests become an administratively complex and costly form of theater. Even if only some cheat, the benefits of the regulation are reduced and the credibility of regulators is undercut.

B. Evidence of Cheating on European Fuel Economy Tests

Does such cheating actually happen in practice? Is it widespread? Reynaert and Sallee claim that the answer to both questions is yes, based on analysis of real-world and reported emissions data.[162] Their analysis compares the stated fuel economy of a wide range of vehicle models based on lab test results with real-world fuel economy data obtained from a database of Dutch vehicles.[163] The data covers the period between 2004-2015 with cars dating back to the 1998 model year, a particularly useful range because the EU imposed mandatory vehicle fuel economy standards in 2008; before 2008, testing was mandatory but only voluntary standards were in place.[164] The dataset, therefore, includes both pre-regulation and post-regulation data, making it a good natural experiment.

The study found that lab tested fuel economy for 1998-2006 model-year vehicles—those produced before mandatory fuel economy standards—was quite close to their on-road fuel economy, differing only around 5% in most years, as evinced in Figure 10.[165] For 2007-2009 model-year cars—those produced as the fuel economy regulations enter into effect—this average increases, with the difference between lab tested and on-road fuel economy growing rapidly for some firms (up to

161. *See* Russell Hotten, BBC News, *Volkswagen scandal: Are car emissions tests fit for purpose?* (Sep. 24, 2015), *available at* http://www.bbc.com/news/business-34340301 (detailing highly specific lab testing conditions and opportunities for manufacturer gaming, including removal of wipers, mirrors, and spare tires, and taping doors to reduce drag).

162. Reynaert, *supra* note 4 at 1.

163. *Id*. at 17-18.

164. *Id*. at 15-16.

165. *Id*. at 3.

over 30%).[166] 2010-2014 model year vehicles show very large differentiation between lab tested and on-road fuel economy, up to 45% for some manufacturers and with no manufacturer lower than about 20%, as demonstrated in Figure 11.[167]

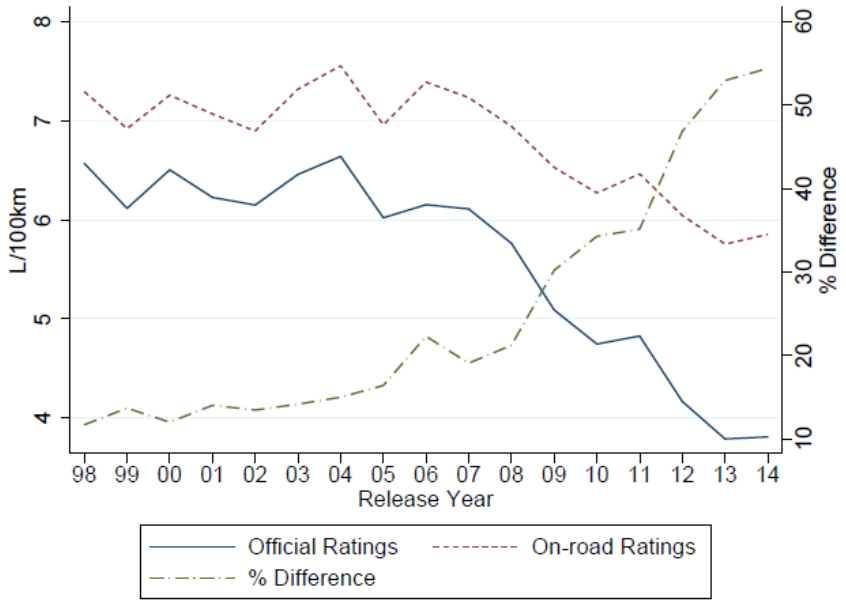

Figure 10: On-road and lab tested (official) fuel consumption by vehicle release year[168]

Reynaert and Sallee concluded that these observations were strong indicators of manufacturers cheating on lab tests after the imposition of mandatory fuel economy standards in 2008.[169] Some difference between laboratory and on-road fuel economy is expected, but it is difficult to explain why this would increase so dramatically after 2008 if it was not due to industry manipulation of the tests. As Reynaert and Sallee stated, "[t]he rise in the performance gap implies that around 65% of the gains in fuel economy as measured by laboratory tests are false."[170] Reynaert and Sallee further argued that these results were consistent with

166. *Id.* at 22.
167. *Id.* at 22.
168. *Id.* at 3.
169. *Id.* at 1.
170. *Id.* at 3.

independent research suggesting, and media reports on manufacturer cheating.[171]

The authors considered and rejected a few alternative explanations, such as a "rebound effect" might lead to customers driving less economically (perhaps by using air conditioning more often), eroding fuel economy gains and in the process widening the difference between lab and real-world fuel economy.[172] By cleverly using comparisons with diesel vehicles exempt from the fuel economy regulations, they found no evidence for such an effect.[173] The 2007-2009 period was particularly interesting, in that test results and on-road fuel economy diverged significantly for only some manufacturers. This suggests that these firms began cheating on the tests before their competitors, with other firms catching on, or succumbing to competitive pressure to cheat, only in the 2010-2014 period.

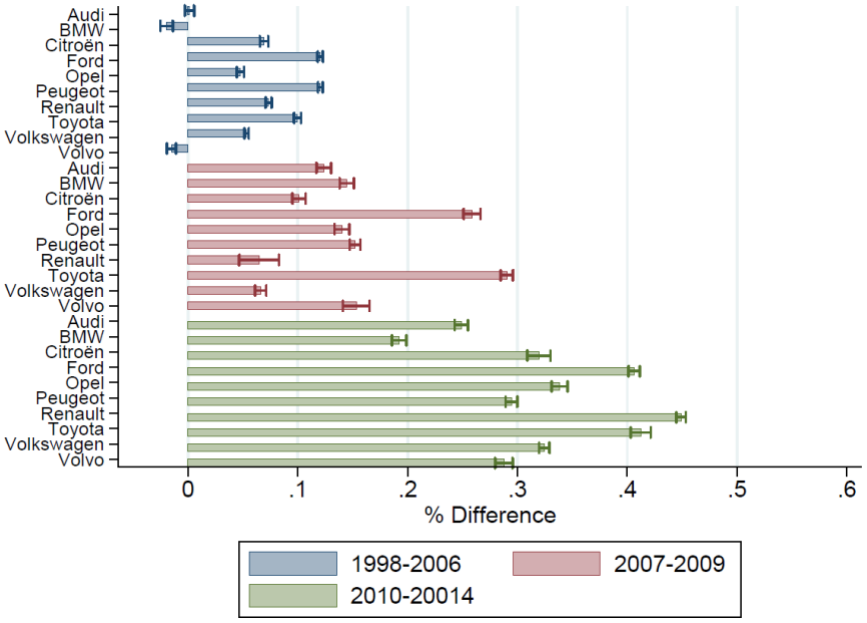

Figure 11: Gap between on-road and official fuel consumption by vehicle manufacturer[174]

171. *Id*. at 3.
172. *Id*. at 25.
173. *Id*.
174. *Id*. at 22.

C. Environmental and Political Effects

For Reynaert and Sallee, this cheating (or, as they are careful to call it, "gaming") behavior by manufacturers is an illustration of "Goodhart's Law"—the maxim that "when an economic measure becomes the target of regulation, its measurement accuracy is eroded by strategic manipulation."[175] A strong interpretation of Goodhart's Law can lead to policy nihilism, but even if one does not go that far the manipulation it implies can severely undercut policy goals. As noted above, Reynaert and Sallee estimate that 65% of the improvement in fuel economy of European vehicles attributed to the 2008 fuel economy standards was in fact the illusory result of manufacturers cheating on the tests.[176] At a social cost of carbon of $40/ton, the fuel economy standards generate $1.2 billion less in annual benefits due to cheating.[177]

However, as discussed above, individual vehicle buyers likely benefit from this cheating. It is unclear to what extent buyers may know or suspect that on-road fuel economy of vehicles will not match manufacturers' claims, much less the degree to which consumers may be aware that this gap has increased in recent years. But, as noted, consumers need not be aware of cheating to benefit from it. Cheating allows manufacturers to supply vehicles with better performance (in terms of factors other than fuel economy), very likely at a lower price than models that actually met the standards under road conditions. Consumers could demand vehicles that actually have real-world fuel economy that matches or approaches stated and required fuel economy, but they do not appear to be doing so.[178] Whether they are aware of it or not, consumers and manufacturers are effectively able to cooperate to substantially avoid the EU fuel economy rules. In addition to the loss in public benefits from emissions reductions, this risks undercutting regulators' credibility, especially considering the high-profile discovery of evasion of similar lab tests for NOx emissions by Volkswagen in 2015.

V. IMPLICATIONS

These case studies provide three examples of evasion of environmental regulations benefiting manufacturers and product

175. *Id.* at 1.

176. *Id.* at 3.

177. *Id.*

178. It is possible that consumer preferences will change if the degree of manufacturer evasion becomes widely known, but there is little evidence of such a change 6-8 years after the regulation entered into effect.

consumers while reducing broader environmental and health benefits (sometimes substantially). The level of cooperation between consumers and the industry, and the degree of evasion vary, however. In the case of gas can regulations, there is strong evidence of widespread evasion of the regulations and some evidence of industry-consumer cooperation in such efforts, although there is only modest evidence of major manufacturers producing products to evade the rules. With light bulbs, in contrast, there is open marketing of products circumventing the incandescent ban by major manufacturers (rough-service bulbs) to holdout consumers, but this market appears to be small, with little effect on overall efficiency gains (perhaps because CFLs and LEDs have become dominant regardless of regulation). The Reynaert and Sallee study provides evidence of widespread and significant evasion of a major environmental regulation, benefiting vehicle manufacturers and consumers at the expense of the public, although evidence of consumer knowledge of the degree of evasion is mixed.

In each of these cases, there are two costs of evasion. One, as noted, is reduced benefits of regulation, i.e., more pollution than anticipated. This reduction in benefits can be large: for evasion of the European vehicle fuel economy standards, Reynaert and Sallee foudn that 65% of alleged benefits were not realized due to evasion.[179] Similar data for gas can and light bulb regulations is not available, but anecdotal evidence suggests widespread evasion that necessarily means at least some reduction in benefits. More quantitative study of the effects of consumer evasion of regulation is undoubtedly needed.

There is another, deeper risk of consumer-facing regulation: reduced political credibility. As vividly illustrated by consumer complaints about gas can and light bulb regulations, environmental rules that directly affect consumers may inspire greater pushback and dissatisfaction than "traditional" environmental regulations focused on large firms with similar economic costs, as traditionally calculated. When consumer-facing regulations are evaded, not only has a regulator expended political capital to implement an underperforming rule, it also risks undercutting its long-run credibility.

Consumers who fumble with new gas cans and spill fuel, who see their neighbors hacking their cans to add vents or repurposing water cans for fuel, who see incandescent bulbs available in stores despite a "ban", and who conclude that car fuel economy tests are not credible are all unlikely to take environmental regulations or regulators seriously. This plays into preexisting critiques of environmental regulators as meddling and incompetent bureaucrats, solidifying that narrative to an

179. Reynaert, *supra* note 4 at 3.

extent that may be difficult to counteract no matter how much evidence of regulatory successes elsewhere is offered. This is exacerbated further if consumers are not aware of evasion, even if they privately benefit from it; consumers assume regulation is effective, and may blame regulators for problems with products or for price increases, while manufacturer evasion undercuts the regulation's environmental benefits. If consumers then discover the evasion, they may add incompetence to their list of complaints about regulators, but they are unlikely to retroactively lift blame from regulators for product and price complaints.

In democracies, political creditability of administrative agencies and other regulators matters. Elected officials are unlikely to fund or give regulatory powers to agencies that are not trusted and respected by the electorate. Agencies also depend on support from the executive and the judiciary for effective regulation, and both may be influenced by public views.

To be clear, none of this is to suggest that there should necessarily be less regulation overall, or even that consumer-facing regulation is always unwise. When CARB, and later the EPA, decided to regulate gas cans, they were, by all evidence, generally doing what good regulators should: continually updating their regulations in response to new information and choosing the regulatory tool and target based on their best cost/benefit estimation. This Article's critique here is narrower: regulators are less likely to accurately anticipate the economic, administrative, and political costs associated with consumer-facing regulation, and are, therefore, likely to find it more attractive in cost-benefit terms than it really should be. The next section addresses how regulators can respond to these challenges.

VI. WHAT CAN REGULATORS DO?

In short, regulations with direct (i.e. non-price) effects on consumers both create disproportionate political opposition and opportunities for consumers and industry to collude to evade them, reducing public benefits. This does not mean, however, that regulators should avoid consumer-facing regulations entirely. Consumer products and the choices consumers make between them can and do have serious consequences, with road vehicle purchase decisions being the most obvious environmental example. Eschewing regulation of these products entirely is probably unrealistic; but regulators can do more to avoid unintentionally creating incentives for consumers and industry to evade such regulations. This section discusses ways that regulators can do so by changing the tools they use or the target of their regulations. It is worth noting at the outset, however, that none of these solutions is

perfect—all have drawbacks of their own that may overwhelm their advantages in terms of reducing incentives to evade. Unsurprisingly, regulators face tough choices. The goal here is merely to discuss how a previously undervalued factor—incentives to collaboratively evade regulation, and the political consequences thereof—should play into regulator decision-making.

A. Attack Evasion Directly

One option is for regulators to directly regulate attempted evasion and collusion . Doing so is a standard feature of regulation, both when initially written and continually through the life of a rule. But countering evasion requires administrative resources, imposes political costs, and can never be perfect.

To the extent that regulators anticipate an easy method of evasion, they will likely address it in the initial regulation. Vehicle safety regulations not only require seatbelts, but also require alerts that flash or sound if the car is driven without seatbelts buckled, which cannot be easily disabled by drivers.[180] Product-design regulations themselves can be seen as regulatory attempts to block easy routes of consumer evasion. For example, in response to the VOC emissions problem from gas cans the EPA and CARB could have regulated gas can *use* rather than *design*, perhaps by requiring users to keep vents closed when pouring gas, or to buy and install replacement low-emissions spouts. Regulators likely concluded that such measures would be less effective than requiring low-emissions can designs because use regulations would be easily evaded and impossible to enforce against a large number of consumers. If it is impossible to regulate how a product is used, regulating its design, and therefore limiting customer choice, becomes much more attractive, and may be the only realistic option available to regulators.

Regulators cannot anticipate all evasion in advance, however, and, therefore, must often respond to evasion they discover only after regulations are issued. A variety of regulator strategies are available here. Many regulations do not explicitly ban circumvention attempts, forcing regulators to revise the rules as consumers discover ways to evade them. CARB's decision to revise its regulations to include cans labeled for kerosene and so-called utility cans are examples of such responses.[181] Regulators may eventually decide to regulate cans labeled

180. *See* 49 C.F.R. §571.208 S7.3 (requiring audible or visual alert car is started without seatbelts fastened).

181. *See* California Air Resources Board, *New Requirements for Kerosene Containers* (Oct 2005), *available at* https://www.arb.ca.gov/enf/advs/advs338.pdf, California Air Resources Board, *Clarified Requirements for Utility Jugs* (Dec. 2005), *available at* https://www.arb.ca.gov/enf/advs/advs342.pdf.

for water use in the same way, or to ban aftermarket gas can modification kits. These ex-post efforts undoubtedly reduce evasion to some extent, but they are a "red queen's race"—there is no limit to consumer ingenuity.

Alternatively, some statutes and regulations forbid attempts to evade. The most well-known of such limitations is probably the Clean Air Act's ban on "defeat devices."[182] Of course, forbidding evasion does not mean it will not happen, however, as the repeated violations of the defeat device provision described above vividly illustrate. Regulators must verify manufacturer compliance, usually through government or third-party testing requirements. Such testing adds to the cost of regulation, and may still be ineffective at detecting evasion, as evidenced by Reynaert and Sallee's study of emissions cheating in the European auto market suggests. Here too, there is an iterative arms race between regulators and manufacturers.

Ever more onerous regulations and testing requirements also likely increase the political cost of regulation. Anti-evasion designs may prove ever more unfriendly to users. Regulators may cause collateral damage—kerosene cans were initially unregulated, presumably because CARB determined the cost of doing so was not worth the benefits. But after kerosene cans were included in revised regulations to prevent evasion of the gas can standards, users of kerosene cans were subjected to the same frustrating designs. The light bulb regulations attempted to avoid this collateral damage problem by exempting "rough service" and other specialized bulbs, but at the cost of leaving open an easy route for regulatory evasion.

As these examples illustrate, regulators face tough choices. Fail to address evasion, and the benefits of regulation may be rapidly eroded, if they are ever realized at all. But zealous pursuit of evasion may carry large administrative and political costs, as well as increasing the economic cost of regulations beyond the optimal level. Reputational factors matter too: regulators want to earn a reputation for being tough but fair, so as to deter cheating while promoting compliance.

None of this is easy, and as the gas can regulations illustrate, a process of continual revision of regulations and testing requirements is necessary. Such regular revision is difficult enough for regulators, but may effectively be impossible where standards are set by legislatures.

182. *See* 42 U.S.C. §7522(a)(3)(A) (illegal to "manufacture or sell, or offer to sell, or install, any part or component intended for use with, or as part of, any motor vehicle or motor vehicle engine, where a principal effect of the part or component is to bypass, defeat, or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations").

B. Adopt More Flexible Regulatory Tools

Another option available to regulators anticipating evasion of consumer-facing regulation is to change regulatory tools. Much consumer-facing regulation is traditional command-and-control. CARB's initial ban on vented gas cans is a typical example. But other regulatory tools are available: performance standards or externality pricing might be more cost-effective while also reducing administrative and political costs by preserving some degree of consumer (and manufacturer) choice. They are not without important drawbacks, however.

1. Performance Standards

Performance standards, as the name indicates, require a specified level of performance, rather than adoption of a particular design or practice as command-and-control regulation would require. For example, a factory might be required to emit no more than a specified amount of a pollutant under a performance standard, rather than installing a regulator-specified scrubber device under a command-and-control rule. Performance standards also have a number of advantages. They are more responsive to differing on-the-ground circumstances (or, conversely, less sensitive to regulators' lack of good information); and they maintain incentives to innovate: if techniques can be found for complying with regulation at lower cost or while maintaining or improving other performance metrics, they will be adopted.

In the context of consumer-facing regulations, the advantages of performance standards over command-and-control are readily apparent. Faced with command-and-control product design standards, manufacturers have no choice but to supply compliant products, even if consumers find them less useful. If regulations are performance standards, however, manufacturers can innovate to produce products with better performance and utility that still meet the standards.

Many consumer-facing regulations recognize this benefit of performance standards, including of course the largest such program—vehicle emissions standards. Vehicle manufacturers must only ensure their vehicle fleets comply with the emissions standards; they are free to innovate on vehicle design, performance, and efficiency. The result has been steady improvement in vehicles across many dimensions important to consumers while (usually) complying with standards that have tightened over time. The 2007 EISA also used performance standards to regulate light bulbs, with an additional and common wrinkle: the standards increased over time, allowing manufacturers time to innovate and consumers time to adapt. Even gas can regulations have moved

toward performance standards as well, with CARB's revised regulations eschewing command-and-control in favor of a performance standard. In short, all three of the regulatory programs discussed above began as performance standards or evolved in that direction.

This evolution, however, illustrates a limitation of performance standards. Where evolution has occurred, it is not clear that the performance standards were meaningfully different from the earlier command-and-control rules—there is little apparent evidence of improved gas can designs that comply with the performance standards but which would have been illegal under the original command-and-control rules. If performance standards are too strict, or if there are simply no options available for manufacturers to innovate, then they are effectively indistinguishable from command-and-control rules. Put simply, if there's only one way to achieve the standard (e.g., removing secondary vents from gas cans) then the regulation is effectively a command-and-control rule requiring that approach. It is the flexibility inherent in well-designed performance standards, not their form alone, that gives them their advantages.

Moreover, enforcement of performance standards is more difficult. Instead of simply verifying whether designs meet stated command-and-control requirements, regulators must test them for compliance with the standards. These tests may be expensive, with costs likely borne by manufacturers and, ultimately, by consumers. As the experience with vehicle emissions standards shows, these tests are themselves vulnerable to cheating and evasion. Testing regimes can and should be improved; but here too there are drawbacks. For example, EPA's gas can emissions tests require all vents to be open during testing, on the assumption that customers are likely to leave them open in actual use.[183] This testing requirement effectively bans vents because meeting the performance standards with open vents is impossible, at least for current designs. In this way, strict testing requirements, just like strict performance standards, effectively become command-and-control requirements. To consumers, the two are indistinguishable. In fact, if there is enough cheating or if administrative costs of testing are sufficiently high, command-and-control regulation might be superior, i.e., both more cost-effective and no less likely to promote evasion and consumer discontent.

More broadly, advising regulators to move toward performance standards for consumer-facing regulation is not that helpful for the simple reason that such regulations already are performance standards. To put it a different way, regulating with performance standards may reduce incentives to evade regulation and their political cost, but

183. *See* EPA PFC Rule at 8500.

persistent evasion and consumer discontent show it clearly cannot eliminate either problem.

2. Pricing Externalities

An even more flexible regulatory option is for regulators to simply price the negative externality a regulation is intended to address. Instead of limiting harmful conduct directly with command-and-control regulations, such an approach permits the conduct, so long as the regulated parties are willing to pay. The two simplest forms of such regulation are Pigouvian taxes and cap-and-trade. Under the former, the regulator sets a price for the externality (such as units of emissions) that must be paid. Under the latter, the regulator fixes a quantity and allows trading of credits totaling that fixed quantity, with the market setting the credit's price. In simplest terms, therefore, the regulator either sets the price or quantity of the externality. Carbon taxes and cap-and-trade for greenhouse gases are the most well-known examples of these regulatory tools, but they are not necessarily restricted to large-scale air pollution.

In principle, regulators could tax the sale price of vehicles based on their emissions performance, rather than forbidding sale of those that fail to meet performance standards. Or, in a crude version of cap-and-trade, CARB could allow sales of only a limited number of vented gas cans per year, with the market setting their price. Hybrid performance standard/externality pricing approaches are also possible. For example, the EPA could set a target fleet average fuel economy for vehicle manufacturers, but let manufacturers trade credits to meet it (with over-complying manufacturers trading credits to those that fail to meet the target). This, in fact, is more or less how the EPA's current fuel economy standards work.[184]

To an even greater extent than a similarly stringent performance standard, externality pricing incentivizes innovation and preserves consumer choice. If a manufacturer can design a more efficient light bulb, lower-emissions gas can, or cleaner vehicle, it can pay lower taxes or buy fewer credits. These savings may be passed on to consumers. Similarly, a consumer that strongly prefers an old-style vented gas can would still be able to buy one under a tax, but would have to pay more for it than for an unvented low-emissions can. Consumers that love the warm glow of incandescent light bulbs, or need their heat for an Easy-Bake oven, could still buy them, but at a higher price than they would

184. *See* Benjamin Leard and Virginia A. McConnell, *New Markets Under US Vehicle Fuel Efficiency and Greenhouse Gas Standards: Credit Trading*, Resources (Sep. 24, 2015), *available at* http://www.rff.org/research/publications/new-markets-under-us-vehicle-fuel-efficiency-and-greenhouse-gas-standards (describing how modern fleet fuel economy standards allow inter-manufacturer trading).

have paid before the pricing regulation. Consumers would surely grumble about price increases, but, as discussed above, restricting choice by regulation seems to inspire much greater dissatisfaction than mere price increases.

Externality pricing may also reduce incentives to evade regulation. For example, Reynaert and Sallee showed that car manufacturers would have had no incentive to cheat on EU emissions regulations had they come in the form of higher fuel taxes (Europe's traditional approach) rather than US-style emissions standards.[185] As they said, "gaming offers an opportunity to avoid a regulation but not a fuel tax, which breaks the symmetry and provides an enforcement rationale for preferring the tax over a regulation."[186] To illustrate why, consider the standard example of cheating: a manufacturer that produces a vehicle with lower actual fuel economy than indicated by lab testing, but better performance or a lower cost to the manufacturer than would be possible if the vehicle truly had the tested fuel economy. Under a performance standard, the vehicle slips through the testing, and consumers can get a vehicle they prefer (because of its lower price or better performance) but would not otherwise be able to buy. With a fuel tax instead of a performance standard, however, all customers get is a vehicle with greater cost of operation than was apparent when they bought it. Sure, the vehicle does have better performance or lower cost, but in the absence of the performance standard, customers could have just purchased such a vehicle with those characteristics *and* with accurate information on fuel economy. In short, what was mutually beneficial consumer-producer collusion under a performance standard becomes consumer-harming false advertising under a fuel tax.

Note that in principle the regulator, acting on behalf of the public in general, is indifferent between the two options—the goal is reduced emissions, not a particular mix of vehicles on the road or price of fuel. Therefore, if one option is subject to not only cheating but also *collusive* (and presumably more lucrative) cheating, and the other is not, that is an important advantage for the latter.

This advantage is not necessarily dispositive, however. Externality pricing has its disadvantages, and is ill-suited to some types of externalities. Most obviously, externality pricing still requires similar compliance testing to performance standards. If high-emitting vehicles or gas cans are subject to a tax, for example, regulators must still test vehicles and gas cans to determine their emissions and, therefore, their tax. These tests are as equally subject to manufacturer evasion (though

185. Reynaert, *supra* note 4 at 12.

186. *Id.*

not consumer-producer collusive evasion) as those for performance standards.

Moreover, incentives to evade may remain after products have been sold and the tax paid. The above discussion of fuel taxes shows that such incentives may be reduced, but they do not go away entirely. For example, if old-style vented gas cans are taxed—making them more expensive than new-style cans—some consumers may still buy the cheaper new-style cans and modify them to evade the regulation. Instead of modifying the cans to get features barred by regulation, they would be modifying them to avoid the tax. To be sure, it will not be worth the time, the effort, and the cost (the "No-Bama" aftermarket vent kit retails for $13.95 plus shipping)[187] for many consumers to modify untaxed new-style cans. However, these consumers presumably would also not evade command-and-control regulations by modifying cans.

It is also possible that evasion of a tax has a different moral valence or reputational effect than avoiding a command-and-control rule. Avoiding traditional income tax and other taxes is widely seen as freeloading—failing to pay one's fair share of the benefits of government. In principle, avoiding externality taxes should be seen the same way—failing to pay for the costs one's behavior imposes on others. Avoiding minor regulations, from speed limits to gas can modifications, seems not to carry the same social stigma, even if those rules are similarly aimed at reducing costs imposed on others (risk of traffic accidents or VOC pollution, respectively).

The perceptive reader will have noted some tension between the previous paragraph and Reynaert and Sallee's claim, discussed above, that switching to a fuel tax would eliminate manufacturer's incentive to cheat on emissions standards. Does externality pricing eliminate evasion incentives or not? The answer, of course, is that it depends, for reasons discussed further in the next subsection. Some other points about externality pricing are worth making first, however.

Another problem is that the target price or quantity can be difficult for regulators to determine. This is true generally; it is hard to know what level of tax will lead to sufficient emissions reductions to achieve desired benefits, or how low to set an emissions cap without driving up credit prices so high that the regulation's costs exceed its benefits. There are also specific reasons why externality pricing for consumer products is difficult.

The largest such problem is monitoring. Regulators generally can only interact with consumer decisions at the time of purchase. An

187. No-Bama Replacement Spout & Vent Kit, alaskansongs.com, *available at* http://alaskansongs.com/product/no-bama-replacement-spout-vent-kit/.

emissions tax is paid, if at all, when a product (say a gas can or light bulb) is initially bought.[188] There is no practical way for a regulator to monitor use or emissions through a product's life, and adjust the tax accordingly, even though the externality imposed may differ greatly between consumers. A gas can used daily by a landscaping company is likely to lead to much greater VOC emissions, for example, than a can used only once a year for an emergency generator. The efficiency benefits of a light bulb in a light that stays on most of the time are far greater than those for, say, a closet light that is used a few hours a year. The best regulators can do for consumer products is to set the tax based on an estimate of average usage. However, consumers have better information and will act on it. The landscaper is much more likely to pay the tax for an old-style gas can than the generator user, and will, therefore, have *much* higher VOC emissions. Taxes on large industrial emitters, rather than consumers, do not generally have these problems because regulators can monitor emissions and tax them on an ongoing basis, rather than by estimating in advance.

Externality pricing may also be a poor fit for some regulatory goals. For example, if the purpose of regulation is paternalistic or is to mitigate impacts of customers' bounded rationality, rather than externality-reducing, pricing will not work. Take seatbelts, for example. Allowing customers to buy a car without seatbelts (or with the ability to disable seatbelt alarms) on payment of a tax defeats the purpose of the regulation. Light bulb efficiency standards might arguably be justified on the grounds that they save consumers money in the long run, but that consumers' irrationally high discount rates or status-quo biases prevent them from appreciating and realizing these savings. If so, allowing customers to escape the efficiency standards by paying a higher price on incandescent bulbs due to a tax might make the problem worse. The price increase might cause some customers to reassess their decision and buy a more efficient CFL or LED, while others might just keep buying the same bulbs they always have and pay more for them.[189]

A final and more practical drawback of externality pricing is that traditional regulatory statutes often do not give regulators the authority to implement them. The Clean Air Act, for example, generally allows the EPA only to set health or technology-based regulations and standards, although it does allow states to use market-based tools to

188. More likely, it is paid when the product is *produced*, with the cost then passed on to the consumer at the time of sale.

189. Of course, consumers who persist in buying incandescent bulbs might not be irrational at all, rather they may have rational reasons not considered by regulators, like high perceived search costs—i.e., they hate shopping or change—or a preference for incandescent bulb characteristics other than efficiency.

comply with EPA standards.[190] This means legislative action is likely necessary for regulators to adopt large-scale externality pricing for consumer-facing regulation.

3. Change the Point of Compliance

If fuel taxes make cheating on emissions standards less attractive, why do taxes on gas cans necessarily make aftermarket consumer modifications similarly unattractive? The answer is that there is a bit of sleight-of-hand in the fuel tax example. Switching from vehicle emissions standards to a fuel tax involves both a change in regulatory tool (performance standard to Pigouvian tax) *and* a shift in the regulation's point of compliance (from manufacturers to fuel sellers or, practically, to consumers themselves).

It is the latter shift that is doing most of the work in making evasion less attractive. Neither consumers nor manufacturers have much ability to avoid a fuel tax. More precisely, they do not have any way to avoid it *without also reducing their emissions* and thereby fulfilling the goals of the regulation—manufacturers can make more efficient vehicles, and consumers can drive less, but neither is "evasion" in any meaningful sense.

In contrast, regulations on product design—whether command-and-control, performance standards, or taxes—can be evaded. Manufacturers may produce designs that evade regulators' tests, possibly colluding with consumers to do so, or consumers may evade the regulations on their own by making post-sale (and therefore post-testing) modifications. This difference arises from two facts. First, fuel consumption (for vehicles or for fuel stored in cans) is closely correlated with emissions, much more so than vehicle or can design is. Second, as discussed above, tests of designs can be evaded while measurements of fuel consumption generally cannot (black-market fuel purchases aside).

As noted above, externality prices on product designs are necessarily based on an estimate of the externality imposed by use of a product, which can vary greatly among users. It is often impossible to measure the externalities imposed by consumer products on an ongoing basis. But in some cases this measurement is possible—most obviously when the externalities come not from the use of the product itself, but from the consumption (or waste through evaporation) of the fuel. It is gasoline, and the pollutants it contains or produces on combustion, that is the

190. *See* 42 U.S.C. §7410(a)(2)(A) (directing states to include "enforceable emission limitations" in their state plans for compliance with federally-set air quality standards, and further defining such emission limitations to include "economic incentives such as fees, marketable permits, and auctions of emissions rights").

environmental problem addressed by vehicle and gas can fuel standards. It should, therefore, come as no surprise that regulating gasoline directly (through fuel taxes) should prove a more effective regulatory tool.

To generalize, regulators may reduce both incentives to evade regulation and a great deal of the political and administrative costs of consumer-facing rules by shifting the regulatory point of compliance closer to the source of the externality. This intuition is applicable beyond gasoline. For example, a tax on electricity might better incentivize customers to switch to more efficient light bulbs (and other appliances). Such a tax would be suboptimal, however, because it is not electricity itself but the pollution associated with its generation that leads to negative externalities. Taxes, therefore, on the production or combustion of polluting fuels in proportion to their environmental impact (most notably coal) would almost certainly be more cost-effective, easier to administer, and more politically acceptable than light bulb phase-outs. Of course, such taxes would increase the cost of electricity for consumers, but without restricting consumer choice.

While pricing fuel externalities appears to be a better choice than the three consumer-facing regulations discussed here, it is no panacea. Many externality problems do not have such ready opportunities to shift the point of regulation. Take, for example, regulations aimed at reducing water usage. Design regulations such as low-flow toilets and showerheads are one option, but another is to increase the price of water delivered to homes. That may work in cities, but in rural areas that use well water there is no easy way to tax overall water consumption. Other externality problems, like discarded plastic bags, lack any clear point of compliance other than the product itself.

Moreover, different uses of the same fuel may have very different environmental costs. The environmental effects of evaporating fuel from vented gas cans are different from those of combustion byproducts of burned fuels, and those combustion byproducts vary depending on a variety of factors, including when and where the emissions occur and the characteristics of the engine using the fuel. In other words, there is often no single measure of externalities associated with a fuel, and any externality price set by regulators will almost certainly be less than the external costs imposed by some uses. A case for regulating product designs related to these high-external-cost uses therefore persists, and in these cases we are back where we started.

C. Pick Your Battles—Or Be More Subtle

There appears to be no way to completely avoid the problems of consumer-facing regulation. Regulators will always face some risk of

evasion and some degree of political backlash. Consumer-facing regulations perhaps inevitably have lower benefits (due to greater evasion) and higher costs (if political and administrative costs are included) than equivalent industry-only regulations. An overly simple response would be for regulators to eschew consumer-facing regulations entirely. To some extent this has been regulators' historic approach. Air pollution regulations initially focused on large stationary sources, typically operated by large firms. This is likely because regulators correctly perceived that the administrative, and perhaps also political, costs of regulating a few large emitters were smaller than regulating many small sources of emissions, including consumer products.

Over time, however, the lowest-hanging fruit has been picked while achieving health and environmental benefits continues to require greater emissions reductions. Regulating so-called "area sources" and consumer products, therefore, has become more attractive to regulators.[191] This trend can be clearly seen in California's efforts to reduce tropospheric ozone, initially with regulations on point sources, then with vehicle emissions standards, and eventually with consumer products like paints and gas cans.

1. Do Not Regulate Consumers at All?

Regulators are not naïve—they are more aware than anyone that it is easier and less controversial in most cases to regulate a few industry actors than many consumers and their purchase decisions. But they have nevertheless concluded in many cases that consumer-facing regulation is justified, and superior to alternatives that may be available, such as tighter restrictions on already-regulated industrial sources, or simply not regulating at all and accepting current health and environmental conditions.

Some evidence from the case studies above suggests, however, that regulators may underappreciate the costs of consumer-facing regulation. Evasion of testing by manufacturers appears common or at least frequent, and while better testing regimes are surely needed, they may not be able to substantially reduce evasion without large increases in regulators' administrative costs. Enforcement against consumer evasion (such as home modification of gas cans) seems impractical in most contexts. Consumer discontent with choice-limiting regulation seems disproportionately high relative to regulators estimates of program cost.

Regulators could learn from these experiences and update their

191. An alternative, cynical explanation is that some industries were able to organize and exert sufficient political pressure that caused regulators to conclude that the political costs of consumer-facing regulation were lower than those for continued industry-facing regulation.

models and heuristics accordingly. Regulators always anticipate some degree of enforcement failure, administrative cost, and political backlash to regulations, and include these costs (formally or informally) in their decision-making processes.[192] These ex ante cost estimates should be continually revised based on experience with similar past regulations. Ideally, it would be possible to predict and quantify lost benefits due to evasion and increased costs due to higher administrative burdens, and include these estimates in cost-benefit analysis; however, these may be difficult to predict with any precision, and political costs may be impossible to quantify. Regulators do not have it easy, but they do regularly consider unquantifiable benefits.[193] Perhaps some psychological costs to consumers in terms of lost choice, forced change in habits, and other sources of consumer discontent should be treated as unquantifiable costs and similarly incorporated into regulatory decisions.

It is unsurprising that regulators appear to underestimate regulatory costs imposed on consumers. Small costs imposed on many consumers throughout the economy, each of them using products in idiosyncratic ways, are likely to be hard to estimate and aggregate. Moreover, regulators probably do not get reliable information from consumers during the regulatory process. If regulators propose a rule affecting large firms or a well-organized industry, they can count on robust participation from industry in the notice-and-comment rulemaking process. In theory, this participation will identify any costs or inefficiencies regulators failed to initially appreciate, and final rules can be revised accordingly. However, individual consumers are unlikely to know regulations affecting them and the products they buy have been proposed, are unlikely to know how to participate in notice-and-comment, and are unlikely to have the resources to or interest in doing so. Regulators will, therefore, be deprived of information on costs of consumer-facing regulation that might have led to revisions in final rules.

Even if one takes a more cynical view of the notice-and-comment process as merely a venue for rent-seeking behavior, results are similar. Industry lobbyists will be able to shape rules ex-ante in notice-and-comment (or even through ex parte communications with agency officials), while consumers will not be able to similarly participate. Regulators will, therefore, see the political costs of industry regulation

192. *See, e.g.* 2017 DOE Bulb Standards, *supra* note 108 at 7291 (revising initial regulations to foreclose the easiest methods of consumer evasion via substitution of excluded light bulb types, while maintaining other exclusions despite awareness that some substitution is likely to persist).

193. *See, e.g.* EPA PFC Rule, *supra* note 1 at 8513 (detailing unquantified health and environmental benefits from reduced emissions from fuel containers).

but fail to appreciate those costs for consumer-facing rules. Viewed in this way, loud consumer dissatisfaction in response to choice-restricting rules can be seen as the ex-post rent-seeking equivalent of ex-ante agency lobbying.

Another view is that under appreciation of the costs of consumer-facing regulation is a symptom of a wider problem: regulators' general failure to retrospectively review the effectiveness (costs and benefits) of past regulations, or, to be more charitable to regulators, executive failure to lead and legislative failure to direct and fund such efforts. If regulators rarely or never review past consumer-facing regulations, the risks and costs of evasion and political backlash are likely to be underappreciated. If they are understood by regulators, it will likely be in an anecdotal, institutional memory sense, rather than in any systematic way, making it hard to apply lessons to future rulemaking. To make this suggestion more concrete, imagine CARB conducted a retrospective review of its gas can regulations, including updated emissions estimates taking into account observed consumer and consumer-producer evasion, as well as harder-to-quantify lessons like anecdotal evidence of consumer backlash. Such a review would be likely to influence CARB's future marginal decisions on what emissions sources to regulate. Again, this is not to suggest that CARB would as a result eschew consumer-facing regulation entirely, but rather that future decisions on whether to do so would be better informed.

Sometimes such greater appreciation of the costs of consumer-facing regulation will, however, lead regulators to decide against regulating a product at all. This does not necessarily mean more air pollution or other externalities, however; it just means regulators will choose another target. CARB regulated gas cans because it determined that it was the most cost-effective way to achieve marginal reductions in VOC air pollution at the time. CARB could instead have imposed further regulations on other VOC sources, such as industrial facilities, and might have done so had it anticipated the extent to which consumers would evade the gas can rules (or the degree to which consumer/citizens would be inconvenienced by the rules). Finally, perhaps CARB would have gone ahead with the gas can rules anyway, but it would have done so based on better information.

2. Consumer-Transparent Regulation

Another regulatory response is to regulate aspects of consumer products that are transparent to consumers. If a design characteristic is completely transparent, it is perceived by consumers only as a price increase. For example, CARB and the EPA's gas can regulations

undoubtedly make gas cans harder to use by requiring complex spouts and removal of vents. It is end users who must bear this burden, but the regulations also require gas can manufacturers to use less permeable materials, thereby reducing the rate at which stored fuel evaporates from closed containers. Presumably the less permeable materials are more expensive (or manufacturers would have already used them), so the permeability regulations probably do drive up the cost of cans incrementally. But consumers are not otherwise burdened—in contrast to spout and vent changes, this change is largely or perhaps completely transparent to consumers. A plastic gas can is more or less a plastic gas can. It is possible that CARB and the EPA could have achieved the emissions reductions they predicted from spout and vent changes by imposing even-stricter permeability standards, or by regulating other consumer-transparent (or lower-consumer-impact) emissions-reducing aspects of cans.

3. Subsidies

An even more radical change in regulatory approach would be to eschew regulation in some cases, at least initially, in favor of subsidizing research into product features that reduce externalities with minimal impact on consumers—such as high-quality LED light bulbs or easy-to-use low-emissions gas can spouts. The Department of Energy, for example, does subsidize some such efficiency research. Advocates for regulation will respond that well-designed regulation is technology-forcing, and that pressure from regulation and consumers together over time will result in products that meet consumer demand while also minimizing externalities. The success of LED light bulbs and, to some extent the improvement in vehicle features while emissions have declined, is evidence of this. For gas cans, however, manufacturers seem to be unable to replicate the ease of use of traditional cans, and may never be able to do so. To generalize, it will always be ambiguous ex ante whether research and development subsidization or regulation is a more cost-effective means to reduce externalities. In practice, regulators and the government usually use a mix of the two. Evidence that consumer-facing regulation is particularly prone to evasion and breeds consumer discontent (possibly undercutting the social license to regulate) should be considered when deciding between subsidy and regulation.

Alternatively, it may be possible to explain part of the apparent preference (particularly in the US) for subsidy over regulation, despite its apparent higher cost by reference to un- or under-observed political, administrative, and enforcement costs of consumer-facing regulation.

4. Information

In addition to subsidies, regulators have another alternative: information. Extensive research suggests that providing information to consumers about products' environmental effects and other externalities leads to changes in consumer behavior. Government labeling like Energy Star or private labeling like that from the Forest Stewardship Council may be effective. Information is a major component of regulators' emissions reduction strategy with road vehicles: federal regulators require detailed and easily-comprehensible labeling of new vehicles' fuel economy.[194] Regulators clearly believe such labeling will induce or allow consumer purchase decisions with both private (lower cost of ownership) and public (emissions-reducing) benefits. To be sure, labeling and other information strategies are unlikely to adequately address many externality problems alone. However, as with subsidies, regulators are making decisions at the margin. A regulatory program that looks superficially superior to an information program may not be so once the high evasion risk and political cost of consumer-facing regulation is considered.

To be sure, it is possible for manufacturers to cheat on labeling requirements too—EPA's fuel economy labels are based on standardized test procedures just like its emissions regulations are. But at least there is no incentive for producer-consumer collusion—as Reynaert and Sallee demonstrate for a fuel tax, if consumers still have freedom of choice among designs, manufacturer cheating makes consumers worse off.

5. Green Defaults

A final alternative option for regulators, suggested by Cass Sunstein and Lucia Reisch, are so-called "green defaults"—regulations that make environmentally-friendly "green" options the default for consumers, forcing them to actively choose dirtier "gray" options.[195] This suggestion is an extension of Sunstein's (and Richard Thaler's) concept of policy "nudges" capitalizing on humans' behavioral status-quo biases, rather than regulatory mandates or subsidies to achieve policy results.[196] For example, Sunstein & Reisch noted that consumers in most

194. *See* EPA, *Gasoline Vehicles: Learn More About the New Label*, https://www.fueleconomy.gov/feg/label/learn-more-gasoline-label.shtml.

195. *See* Cass Sunstein and Lucia Reisch, *Automatically Green: Behavioral Economics and Environmental Protection*, 38 HARV. ENVTL. L. REV. 127 (2014).

196. *See generally* RICHARD THALER AND CASS SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS, Penguin Books (2009).

markets currently receive "gray" electricity generated by the lowest-cost mix of generation technologies (including fossil fuels) by default, but may often choose to instead receive "green" renewable energy from the grid.[197] Their suggestion is to flip this default rule, providing more-expensive "green" electricity unless consumers specifically request the cheaper "gray" energy.[198]

"Green defaults" appear to work best when a third party—a utility, the government, or a contractor—is providing a service or making a decision. It is harder to imagine them in contexts where consumers make specific purchasing decisions, as they usually do for gas cans, light bulbs and cars. Sunstein & Reisch discussed research indicating that customers were more likely to adopt CFL light bulbs if they were presented as a default option by a contractor during a remodeling project.[199] However, hardware stores selling individual bulbs do not, in most senses of the term, provide a default option for consumers. Perhaps regulators could require that more efficient bulbs (or low-emissions gas cans) be given more attractive shelf space, or perhaps the business model for bulbs could change to a "bulbs-as-a-service" subscription model, with new bulbs regularly shipped to homeowners. LED bulbs could then be presented as the default subscription. This would also have the advantage of presenting the lower lifetime costs of LED bulbs up front. Still, however, it is not obvious how infrequent purchases like gas cans could be influenced by a "green default" option. That said, perhaps a clever regulator would be able to come up with a better way to impose a "green default" than those suggested here.

VII. CONCLUSIONS

Regulators often impose rules that directly affect consumers and the products they buy. Regulations may ban or substantially restrict sale of some products like incandescent light bulbs, force major design changes like removal of vents in gas cans, or force compromise between features regulators and consumers want, like vehicle emissions, cost, and performance. Regulators would not implement these regulations if they had not concluded that benefits (in these cases, environmental benefits) exceeded regulatory costs. There is evidence from each of these regulations, however, that regulatory costs are greater than they initially appear, and that these regulations are not as cost-effective as they appear on paper.

This is for three reasons. First, many consumers appear eager to evade

197. Sunstein, *supra* note 195 at 134-137.

198. *Id.*

199. *Id.* at 137-138.

the regulations in an almost infinite variety of ways. Consumers add vents to new-style unvented gas cans with drills and spare parts, repurpose unregulated water or kerosene containers for gasoline use, and hoard pre-ban incandescent bulbs, to give only three examples of consumers' evasive creativity. This evasion is either very difficult or impossible for regulators to prevent, driving up administrative costs and at least to some extent undercutting regulatory benefits.

Second, consumers and producers effectively collude to avoid some regulations. Manufacturers may market similar but unregulated products to consumers, such as "utility jugs," or may circumvent regulations with aftermarket modification kits, profiting from and simplifying consumers' evasion attempts. Manufacturers even appear to cheat on regulators' product tests, providing customers with products they prefer in tacit collusion. Reynaert and Sallee showed strong evidence that such consumer-producer collusive cheating has occurred in the European car market. Preventing such regulatory evasion requires regulators to participate in an arms race or a red queen's game with consumers and producers, including ever more products within their regulatory ambit and improving testing regimes, only for producers and consumers to find new ways to evade. This, too, drives up the administrative cost of regulations, perhaps substantially. It also causes collateral damage, with "dual use" products like kerosene cans (and possibly water cans in the future) regulated to prevent evasion of gas can rules despite having little or no environmental impact when used for their intended purpose.

Finally, many consumers resent regulation that limits their choices or forces design changes, apparently to a greater degree than they resent regulation that merely increases the cost of end products. At times, this discontent can be out of all proportion to the apparent inconvenience imposed by the regulation. Legislation largely phasing out incandescent light bulbs inspired significant popular backlash, despite the fact that replacement bulbs had a lower cost of ownership. Gas can regulations have inspired similar discontent, albeit at a lower profile. Paradoxically, however, vehicle emissions standards do not seem to have inspired widespread or deep consumer discontent, despite their large cost and large effects on vehicle design. It appears to be regulations that ban (or are viewed as banning) existing, familiar products that cause particular discontent among consumers.

Such discontent ultimately undermines regulators' credibility and political capital, again out of proportion to the predicted benefits of the regulation. In other words, at least some consumer-facing rules risk damaging regulators' "social license to regulate" in a way that industry-facing rules that raise costs ultimately borne by consumers do not.

Regulators should, therefore, more carefully consider the additional

administrative and political costs of consumer-facing regulation. As a first cut, attempting to estimate these costs (or estimate them better than current regulators) and include them in cost-benefit analyses is likely to lead to better decision-making. Doing so may sometimes lead regulators to reject otherwise-appealing consumer-facing regulation, perhaps in favor of superficially more costly regulation of firms.

However, such shifts in regulatory target are not the only option available to regulators. Shifting to more flexible regulatory tools such as performance standards and externality pricing may reduce or, in a few cases, eliminate consumer incentives to evade regulation or collude with producers to do so, and can preserve consumer choice, thereby preventing the most serious consumer discontent. That said, regulators have already moved strongly toward more flexible regulation without eliminating the problems with consumer-facing regulation discussed above.

Other options include changing the compliance point of regulation (e.g., from products to fuels) or targeting aspects of products that affect only price, not the consumer experience (like gas can vapor permeability rather than spout design). More broadly, regulators should consider whether research and development subsidies, consumer information/labeling campaigns, or "green default" rules might be more effective than direct consumer-facing regulation.

In short, regulators should take a broader view than they have in the past, and take consumers as they are, including their irrationality, bounded rationality, and occasional overreactions. Regulators should also recognize that they have limited ability to measure and appreciate the costs their regulations impose on consumers, who may find it more difficult than typical regulated firms to change their habits and preferences. Integrating this awareness into regulatory design choices is likely to lead to more better outcomes, not only in the form of more cost-effective regulation but also in a more secure social license to regulate.

To put it as simply as possible, regulations with direct effects on consumers both create disproportionate political opposition and opportunities for consumers to evade them, sometimes in collusion with industry. These factors should receive greater consideration in policy design, likely leading to selection of different regulatory tools and/or targets.

Regulation is not a goal in and of itself, but rather a means to achieve socially beneficial goals, such as an appropriate balance between environmental protection and economic growth. Where to set that balance is a political choice. Consumers are citizens, and it is ultimately they who decide what level of regulatory protection from environmental

or other harms they want government to supply. If regulators are perceived as ineffective or overbearing, citizens are likely to constrain or eliminate them, choosing a lesser degree of protection from externalities than they would ideally prefer were regulators perceived to be effective. Consumer-facing regulation appears to play a disproportionate role in citizen views on regulators, perhaps unsurprisingly. Regulators should therefore consider such regulation more carefully.