Does Paying to Pollute Make Pollution Seem Less Bad?

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Abstract

A common objection to market-based instruments is that they commodify pollution and thus reduce the moral stigma of pollution. If this anti-commodification critique is true, the increasing use of these regulatory instruments could reduce the public's concern for the environment.

This paper tests the anti-commodification critique using a preregistered and demographically representative study of over 2300 Americans. The study finds evidence contrary to the critique. Participants randomly assigned to learn about market-based regulations of a fictitious new pollutant, malzene, did not find malzene pollution to be less morally problematic than those randomly assigned to learn about a mandate dictating pollution limits. The results were sufficiently precise to rule out any decrease in moral stigma from a pollution tax (as compared to a mandate), and to rule out a decrease larger than roughly 2 points out of 100 from a cap-and-trade program. Moreover, pollution in compliance with or in violation of market-based regulations carried greater moral stigma than pollution in compliance with or in violation of a mandate. While there are many reasons one might oppose market-based instruments, this project suggests that their theorized effect on moral stigma may not be one of them.

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1. Introduction

Market-based regulations to protect the environment are becoming increasingly common. In 2009, there were just nine carbon prices (carbon taxes and cap-and-trade programs) in place around the world. Now, there are over 70 (Bank 2023). Beyond carbon pricing, wetland banks, water quality markets, tradeable fishing quotas, and other regulatory instruments have also been designed to leverage price and market incentives to address environmental externalities (see, e.g., Weisbach 2023).

These market-based policies are in theory more efficient than command-and-control mandates. But one long-asserted critique of market-based instruments is that commoditizing pollution could reduce its "moral stigma" (M. Sandel 2012; McCauley 2006; Goodin 1994; Kelman 1981). Allowing regulated entities to pay to pollute, critics assert, makes pollution "just another cost of doing business" and fails to "convey[] judgment that the polluter has done something wrong" (M. J. Sandel 1997).

If this anti-commodification critique is right—that is, if market-based instruments reduce the moral stigma of pollution—then the increasing use of market-based instruments could reduce the public's concern for the environment. Potential voters in the democratic process and corporate stakeholders (e.g., consumers, employees, and investors) might then be less inclined to advocate for stronger environmental protections. In addition, in their private lives, people may be less likely to account for potential pollution externalities in making decisions. These effects would not be a problem if we lived in a world in which governments perfectly internalized externalities—in such a world, there is no need for moral stigma to encourage still greater reductions. In our second-best world of largely inadequate pollution regulation, however, more, not less, environmental protection would likely improve social welfare.[1]

This anti-commodification critique is a live issue. In 2020, President Biden withdrew support for Mary Nichols' candidacy for head of EPA after more than 70

[1] For example, the World Bank notes "less than 5% of global greenhouse gas (GHG) emissions are covered by a direct carbon price at or above the range recommended by 2023" (Bank 2023, 19–20).

environmental justice groups sent a letter arguing that she was the wrong person for the job. Nichols was unfit to lead, the letter argued, in large part because of her "staunch pursu[it] and defen[se of] carbon trading" through California's cap-and-trade program. The letter condemned the cap-and-trade program in part for "commodify[ing] the source of the climate crisis that most severely threatens global communities of color and low-income people" ("Nichols Letter" 2020).[2] Scholars also routinely note the anti-commodification critique (see, e.g., Hepburn 2006)—sometimes simply to dismiss it as irrational (see, e.g., Aldy 2022; Weisbach 2023; Nash 2006), but at other times to emphasize its continued importance as a political constraint (Stiglitz 2019).

But there are reasons to think that the anti-commodification critique could be wrong. First, market-based instruments might not change the moral stigma of pollution at all. On one hand, in line with anti-commodification theorists, the expressive effect of the government's choice of a market-based instrument might be to reduce the moral stigma of pollution ("The government's use of a pollution tax suggests this isn't a very big problem."). On the other hand, market-based instruments might elicit *greater* moral outrage in response to pollution because of perceptions that the regulation is inadequate ("the government needs to take this more seriously—this pollution is bad!") or because of a feeling of a taboo trade-off ("this whole enterprise strikes me as wrong"). Taken together, these competing effects might result in little overall change in moral stigma.

Second, some formulations of the anti-commodification critique conflate regulatory stringency with regulatory type: Critics lament that taxes and cap-and-trade programs explicitly license pollution (see, e.g., Kelman 1981; M. Sandel 2012). But every mandate short of a full ban implicitly licenses some amount of pollution. The typical comparison is thus stacked against market-based instruments, pitting a mandate that fully bans pollution (thus rendering all pollution illegal) against market-based regulations that do

[2] Much of the letter focused on distributional issues (hot spots) from cap and trade, but Nichols herself reported that she believed opposition to cap-and-trade programs was "a moral objection to the notion of people paying to pollute" (Davenport 2020).

not (Aldy 2022; Nash 2006). A cleaner comparison would pit pollution allowed under a mandate against pollution allowed under market-based instruments (testing "compliance morality"), and pollution violating a mandate against pollution violating market-based instruments (testing "violation morality"). And market-based instruments could very well create *more* moral stigma on compliance morality measures. A typical mandate expressly grants permission to pollute within a set limit (e.g., pollution under 10 tons is allowed) with no penalty, while market-based regimes largely continue to tax such pollution.[3] The anti-commodification critique, in other words, ultimately depends on empirical claims that could move public views on pollution in either direction, and its claims have not been squarely tested.

This paper tests these claims using a preregistered and demographically representative study of over 2300 Americans. The Time-Sharing Experiments in Social Science (TESS) program peer-reviewed the study design, and the National Opinion Research Center (NORC) fielded the study. In the study, participants learned about malzene, a fictitious newly discovered pollutant, and were randomly assigned to one of four regulatory conditions: a no-regulation control, a command-and-control mandate that set a limit on allowable pollution, a malzene tax, or a malzene cap-and-trade program. Participants then answered questions on how morally bad and harmful they perceived malzene to be, to assess whether regulatory condition influenced the overall moral stigma of pollution, and other questions designed to explore how regulatory frame might influence their views.

The study provides three sets of findings, all of which undermine the anti-commodification critique. First, participants in the market-based conditions (the tax and cap-and-trade conditions) did not find malzene pollution less morally bad or harmful than those who learned that regulators had enacted a command-and-control mandate, nor did the market-based regulations change their overall behavioral intentions to, e.g., demand

[3] Pollution under market-based instruments are also "allowed" if paid for but there is typically no categorical distinction between levels of pollution.

more regulation or curb their own malzene-emitting activities. The results were sufficiently precise to rule out any decrease in moral stigma from the tax (as compared to the mandate), and to rule out a decrease larger than roughly 2 points out of 100 from the cap-and-trade program.

Second, participants evaluated compliance morality and violation morality by judging the morality of fictitious company Alpha Corp. emitting pollution in compliance with their assigned regulation and Beta Corp. emitting pollution in violation of the regulation. On these two measures, market-based instruments made pollution seem morally worse, counter to the anti-commodification critique. This difference was meaningful for compliance morality: The majority of market-based instrument participants (58% of tax and 65% of cap-and-trade participants) believed Alpha Corp. was a morally bad actor for emitting in compliance with those instruments, but only 44% of mandate participants felt that Alpha Corp. was morally bad for emitting in compliance with a mandate.

Finally, exploratory mediation analyses suggested that the competing effects discussed above might be driving the overall null effects on moral stigma. Consistent with an expressive effect, mandates provided a stronger government signal that malzene was immoral, which correlated with greater moral stigma ("the government says this is bad so it must be bad"). This relationship was stronger for participants with greater trust in the government. However, consistent with an inadequacy-aversion effect, market-based regulation participants believed that the government should do more to reduce pollution, which correlated with greater moral stigma. The study also tested, but did not find evidence of, increased moral stigma from participants who view pollution markets as a taboo trade-off. But a large majority (82%) of participants believed that markets for pollution are morally wrong. While these participants appear to share the anti-commodification critique's discomfort with pollution markets, the consequence of such discomfort may have been an *increase* in moral stigma: People often respond to taboo trade-offs with moral outrage. That so many participants felt this way may have meant

that there was not enough variation in the measure to merit an interaction effect as tested, and that, instead, market-based regulations were a taboo trade-off for nearly all.

Before proceeding, it is important to note limitations. First, it may be that market-based regulations do reduce the moral stigma of pollution, but that repeated exposures or longer time with the regulations are necessary. Second, this study considers only a sort of consequentialist argument—that market-based regulations could be bad if they reduce the moral stigma of pollution. Another objection could be that it is normatively bad to have a market in pollution, regardless of changes to moral stigma, because marrying markets with pollution is simply bad.[4] This project doesn't address this purely normative argument. Finally, there are other moral[5] and practical[6] objections to market-based regulations, but this project considers only their hypothesized effect on moral stigma.

On this question of moral stigma, however, this paper makes at least three contributions. First, market-based instruments do not, as commonly claimed, appear to reduce the moral stigma of pollution. Second, the paper theorizes and finds evidence consistent with competing mechanisms that might explain why moral stigma changes so

[4] Goodin (1994) makes several such arguments by analogizing the sale of the right to pollute to the sale of religious indulgences: For example, the right to pollute may not the government's to sell (it would be nature's right, as it is nature that is harmed). In addition, while it might be "perfectly proper for the environment to be despoiled" in certain circumstances (e.g., to save lives), it would not be proper in exchange for money, much like a sinner may be forgiven her sins if properly contrite but not just because she paid money. This can also be related to potential distributional concerns.

[5] For example, market-based regulations can lead to pollution hot spots (polluters may congregate in cheaper areas, which could exacerbate environmental justice issues) and may be unfair because they allow wealthier parties to engage in more of the regulated activity or coerce poorer parties to engage in an unwanted transaction (M. Sandel 2012, 31; Satz 2012). Some also argue that there are values (e.g., clean air, spiritual benefits) that can't be properly calculated and thus internalized (see, e.g., Anderson 1995; Sunstein 1993, 834–40), though it is not clear that mandates are superior from this standpoint. Radin (1987) argues that using market rhetoric will inevitably lead to greater valuation of and attention paid to those things that are easily monetizable.

[6] Scholars and policymakers argue that market-based regulations suffer from political economy constraints (Jenkins 2014, Cullenward and Victor, Stokes, others) and may be somewhat ineffective: Green (2021) finds in a meta-analysis of carbon prices to date that they generally reduced emissions by only 0-2% per year, but with significant heterogeneity. Many discuss the higher administrative burden of trading systems in particular, (see, e.g., Weisbach 2023), and both price and quantity measures face the same measurement problems that make enforcement difficult for performance-based mandates.

little. Market-based instruments appear to signal that the government believes the pollution is less morally bad (an expressive effect), but the paper also suggests an inadequacy aversion effect—people may rate a problem as worse because they perceive the solution to be inadequate—and finds widespread moral discomfort with markets for pollution that too could increase moral stigma. Finally, this discomfort with markets for pollution could help explain the popularity of the common critique. People seek well-reasoned explanations for their moral intuitions (Haidt 2001). The argument that paying to pollute reduces the moral stigma of pollution—while not borne out in the study—may instead function to rationalize a general discomfort with markets for pollution.

This paper proceeds in four further parts: Section 2 lays out theory and background, Section 3 explains the research design, Section 4 discusses results, and Section 5 concludes.

2. Background, theory, and previous empirical studies

This section provides background on the different regulatory tools and the importance of moral stigma (Section 2.1), discusses why in theory market-based instruments could both reduce and increase the moral stigma of pollution (Section 2.2), and provides an overview of past empirical studies on this question (Section 2.3).

2.1. Background

2.1.1. What are these different regulatory tools?

Those making the anti-commodification critique typically point to command-and-control mandates as their preferred method of regulation (M. Sandel 2012; Kelman 1981). There are two canonical forms of command-and-control mandates: technology mandates, which require that firms use a particular technology or process (e.g., the installation of a scrubber), and performance-based mandates, which require firms to achieve a particular goal (e.g., emissions of no more than 10 units of pollutant per time period). For example, many housing codes use technology mandates (e.g., requiring sprinklers at specific

intervals), while the Clean Air Act and Clean Water Act largely use performance-based mandates.[7]

In contrast, market-based instruments leverage incentives to encourage behavior change. Like with command-and-control mandates, there are two canonical forms of market-based instruments: cap-and-trade markets and pollution taxes. With cap-and-trade markets, the government sets a total quantity of pollution (the cap) for a set of firms, then allocates tradeable pollution permits under the cap to the regulated firms (by auction, free allocation, or a combination). Firms can buy and sell their pollution permits to other firms (i.e., firms can trade in pollution permits). With pollution taxes, the government sets the price of pollution (the pollution tax) that firms pay for each unit of pollution they emit. Under either system, firms respond to the price of pollution (either the permit price or pollution tax) in determining how much they will pollute. If it costs less to abate pollution than to pay the permit/tax, they will abate pollution; if it costs more, they will continue to pollute and pay the permit/tax. There is significantly more nuance to both these systems and to command-and-control mandates in the real world that is not necessary to discuss here.

These instruments can operate in similar or even identical ways. There is an enormous literature devoted to distinctions between cap-and-trade and pollution taxes, which can result in identical outcomes under certain assumptions (for example, no uncertainty, no complementary policies) (see, e.g., Weitzman 1974; Goulder and Schein 2013; Stavins 1996; Hepburn 2006; Weisbach 2011). Cap-and-trade is a quantity-based regulation—the government sets the ultimate quantity of pollution allowed—so can be considered similar to firm-specific performance-based mandates (but without the benefits of immediate trading). A performance-based mandate that bans pollution but then

[7] The mandates are often derived from technological capabilities so can confusingly be called "technology-based standards" but the actual legal requirements are in performance terms (emission and effluent limits) [cite].

implements fines per unit of pollution above that ban looks identical to a tax (Masur and Posner 2015).

Some of the distinctions among these tools might thus boil down, under simplifying assumptions, to distinctions in regulatory frame. Of course, regulatory frame itself could alter preferences and behavior related to these instruments (see, e.g., Kim and Hirsch 2022; Cherry, Kallbekken, and Kroll 2012; Kallbekken, Kroll, and Cherry 2011), and it is this distinction in frame that this project attempts to study.

2.1.2. Why does moral stigma matter?

For strong consequentialists, the moral stigma of pollution matters only for its downstream effects on behavior:[8] People who find pollution morally worse might be more likely to vote for or support greater regulation of that pollution, to protest company pollution, or to otherwise use social pressure to push for greater protections or decide in their private lives to reduce their own emissions. And these effects on behavior would be normatively appealing to consequentialists only if regulation fails to perfectly internalize externalities, or if the influence of moral stigma reduces pollution more cheaply than formal regulation can. In other words, if regulation already perfectly accounts for the social cost of pollution and does so more cheaply than moral stigma could, then moral stigma would result in overprotection of the environment and be normatively bad.

In the second- (or nth-) best world we live in today, pollution regulation often falls far short of perfectly internalizing pollution externalities, thereby making moral stigma normatively desirable for even pure consequentialists.[9] Moral stigma essentially could help

[8] For those who are not pure consequentialists, moral stigma might have intrinsic value—people may believe pollution should be viewed as morally blameworthy regardless of its effects on behavior.

[9] To stay within a 2 degrees Celsius temperature increase, carbon prices would need to be around $61-122 per ton by 2030, but less than 5% of global greenhouse gas emissions today are covered by carbon prices in that range (Bank 2023). The U.S. government uses $51 per ton as its estimate for the social cost of carbon, at the low end of the $44-413/ton range and far below the $185/ton average best estimate using new advances in economics, demography and climate science (Rennert et al. 2022). These figures do not even attempt to include damages from biodiversity loss, labor productivity, conflict, and migration. In the water

get us closer to perfectly internalizing pollution externalities. This paper thus assumes that moral stigma is useful, despite its potential irrationality in other contexts.[10]

This study focuses on moral stigma and not on downstream behaviors (though the study takes measures of downstream behavioral intentions) for two further reasons. First, the traditional critique is that paying to pollute reduces the moral stigma of pollution. Thus, the paper tests the direct critique, not its motivations. Second, assessing moral stigma is the harder lift for the paper's claim of overall null effects. If and when moral stigma does translate into downstream behaviors, those changes are likely smaller than the change to moral stigma itself and so would be harder to pick up. A null effect on moral stigma itself would thus suggest that downstream behavioral effects are similarly unlikely.

2.2. Theory

Market-based instruments can be thought to commodify pollution or more generally to allow entities to "pay to pollute." This commodification could, as claimed, reduce the moral stigma of pollution, but it might also increase it. This section discusses potential reasons going in both directions.

2.2.1. How might market-based instruments reduce the moral stigma of pollution?

The argument is that commodification degrades the object being commodified—here, the environment—when it was otherwise sacred.[11] What has a price cannot be

pollution arena, incomplete internalization of externalities is obvious because nonpoint source pollution is subject to no federal regulation and limited state and local oversight.

[10] As Nussbaum (1998) discusses, the stigmatization of other contested commodities often may rest on prejudice or other irrational beliefs. For example, the moral stigma attached to prostitution (i.e., the commodification of sex) is in part illogical in light of other, similar ways that people trade bodily services for money and the likely root of the moral stigma—moral judgments about female sexuality that are hard to defend.

[11] There is an enormous and rich literature debating the merits of commodification in other arenas—for example, vote buying (Hasen 2000; Levmore 2000), bodily services (Nussbaum 1998; Krawiec 2009); blood

priceless (see, e.g., Anderson 1995). This degradation of the sacred can happen because the fact of the market or existence of prices can move us from a more moralized frame ("pollution is morally bad") to a more calculating, rational market frame (see, e.g., Fiske 1992; Liberman, Samuels, and Ross 2004).[12] The market frame then changes what behavior is considered appropriate: Market instead of community norms apply.

To illustrate the point, many point to the oft-cited Gneezy & Rustichini (2000) daycare study, which found that late daycare pickups *increased* after Israeli daycares added a fine for late pickups. (There is mixed support for the findings in attempted replication studies, but the strongest evidence against the findings appear to be from a study asking online participants to imagine how late they would be to pick up their children.[13]) Regardless of the merits of that particular finding, the intuition the authors put forth helps motivate the anti-commodification critique.[14] Parents were more likely to pick up their children late with a fine, the authors suggest, because, instead of feeling guilty for being late, parents perceived the fine as the price (a fee) for additional childcare. In other words, it was more appropriate to be late if paying for extra time rather than trespassing on the goodwill of the daycare. Likewise, paying to pollute could license

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donations (Titmuss versus Arrow debate), babies (Epstein 1995; Landes and Posner 1978), identity (others)—that this project does not consider or address. [To cite Radin, Rose, White, Anderson and others.]

[12] Different strands of literature make this same basic point. For example, Fiske (1992) argues that different norms apply under different "relational frames"—it is appropriate to pay the restaurant for food (market pricing frame) but not your friends for Friendsgiving dinner (maybe a communal-sharing or equality-matching frame). Liberman, Samuels, and Ross (2004) found that participants are more likely to cooperate in a prisoner's dilemma called the "Community Game" than in the identical game called the "Wall-Street Game."

[13] Metcalf et al. (2020) found results contrary to Gneezy & Rustichini (2000a) through vignette studies on Amazon MTurk that evaluated participant estimates of how late they thought they might be to pick up children, rather than actual parent decisions picking up their children. Another attempted laboratory re-test of the hypothesis came to mixed results, with some support for the original finding (Kornhauser, Lu, and Tontrup 2020). In this project, participants had a real-effort task. Fines crowded out effort among those with prosocial value orientations.

[14] This example is imperfect because the daycares instituted a fine, not a tax or fee. But the example helps in showing what could happen when people believe they are operating in a different type of relationship than before.

additional pollution—it is just something a firm has to pay for on the market, not look bad or guilty for doing.[15]

In other words, "putting a price on an activity [can] crowd out nonmarket norms" like neighborliness or community concern (M. Sandel 2012, 90). And, because of the market's emphasis on individuality and self-interest, the market norms that take their place may reduce other-regarding feeling and behavior (see, e.g., Bowles 1998; Vohs, Mead, and Goode 2006). There are, however, competing studies on whether being in a market reduces moral sentiments (compare Falk and Szech 2013; with Bartling, Fehr, and Ozdemir 2023; Huber et al. 2023; and Henrich et al. 2005; see also D. L. Chen and Reinhart, n.d.).

Nonetheless, the fact that policymakers have deliberately chosen this change in frame could further serve to reduce moral stigma—laws can carry expressive force (see, e.g., Lessig 1995; Sunstein 1996).[16] A law that commands emissions reductions signals moral disapproval of pollution ("You must reduce pollution.") (M. Sandel 2012, 65). In contrast, a law that allows entities to pay to pollute suggests that pollution is no big deal—just pay and be on your way ("You can pollute if you pay this price.") (M. Sandel 2012, 72; Kelman 1981, 27). Surely, if pollution were really bad, we wouldn't leave it up to the market. As a result, people cueing off perceived policymaker attitudes may see a market-based regulation and feel that the pollution is less harmful and less morally bad.[17] Of course, this expressive effect depends on socially constructed perceptions of markets,

[15] And, if entities consistently tell themselves that they are reducing pollution to save money, not because of any true concern for the environment, regulated entities won't develop an environmental ethic or identity. (Doremus 2003 ("Over time, paying people for environmentally responsible behavior may erode the social desire to conserve.")). But I focus on the attitudes of observers, not regulated entities, in this project.

[16] Sunstein (1996), for example, defines the expressive function of law as "the function of law in 'making statements' as opposed to controlling behavior directly." This is distinct from the idea that the law's expressive effect is through its information and coordination functions (McAdams 2015).

[17] These arguments—that commodification degrades the sacred and that government licensing one to "pay to pollute" expresses that pollution is not so bad—are related and build on another, but can be considered distinct (Nash 2006).

prices, taxes, and cap-and-trade regimes, and those perceptions can change, especially in light of the increasing use of market-bsaed instruments.

Another reason commodification might degrade the value of the environment is mechanical. Not all values can be elicited or calculated (e.g., the spiritual utility of clean air), and those values that can't be calculated might be lost—the actual calculated value may be too low (see, e.g., Anderson 1995).[18] But this critique goes to the stringency of the instrument, not the type. A cost-benefit analysis of a mandate would suffer from the same flaws.[19]

2.2.2. How might market-based instruments increase the moral stigma of pollution?

Contrary to the common critique, market-based instruments might increase the moral stigma of pollution because perceptions either of a taboo trade-off or of insufficient regulation (inadequacy aversion) might encourage greater moral outrage.

Paying to pollute might look like a taboo trade-off. A taboo trade-off occurs when secular and sacred values are compared or traded against one another (Tetlock et al. 2000). Classic examples include the sale of body organs or democratic votes. Taboo trade-offs are morally offensive: People can respond with moral outrage (McGraw, Tetlock, and Kristel 2003). As a result, people may think more poorly of those who engaged in the taboo trade-off and be more supportive of punishment for the trade-off.

Here, people may find the application of a market frame to a sacred value (a clean environment) to be a taboo trade-off. As a result, they might respond with moral outrage to the idea of "paying to pollute." This sense of moral outrage could carry over to a feeling that emitting that pollution is morally worse by association.

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[18] Scholars and policymakers attempt to deal with this through willingness-to-pay, willingness-to-accept, and other contingent valuation methods, but they famously have many problems. [lots to cite here]. And we often just throw our hands up and do not even try. [cite e.g., Posner/Masur article]

[19] This is of course a common critique of cost-benefit analyses. [lots to cite.]

Such additional outrage would likely be stronger for those who truly view a clean environment as a sacred value and/or who especially find paying to pollute offensive (Kelman 1981, 29). The implication could be to exacerbate polarization: If the general expressive effect of a market-based instrument reduces the moral stigma of pollution for the general public but heightens the moral outrage related to pollution for those with the greatest care for the environment, the general public will care even less and true believers will care even more.

That said, market-based regulations might not elicit this taboo trade-off-related outrage at all. The regulatory form (tax, cap-and-trade) might obscure the "pay to pollute" structure (Schilke and Rossman 2018; Krawiec 2023);[20] consequentialist reasoning even with trade-offs related to human life do not always elicit moral outrage (B. M. Chen 2021); and some people are less bothered by taboo trade-offs (e.g., kidney sales) when the trade-offs create social gains (i.e., more kidney transplants) (Elías, Lacetera, and Macis 2019), and so might applaud regulations with net social benefits.

What this paper calls "inadequacy aversion" might also increase the moral stigma of pollution under market-based instruments. Some people may feel that market-based instruments are less effective at reducing pollution and thereby dislike their use—this is the wrong type of policy to use (Evers et al. 2017). They might then feel the pollution is a *more* serious and morally harmful problem. Their (likely unconscious) reasoning might be: "The government isn't taking this problem seriously! It's much worse than they think." As a result, they may emphasize how morally bad pollution is to demand further action. Relatedly, they may think more pollution remains and that the problem is thus greater and so motivates greater moral outrage.

This concept is inspired by but distinct from solution aversion. Solution aversion describes a phenomenon in which individuals are more likely to accept the gravity of a policy problem (like climate change) when they find the proposed solutions acceptable

[20] Nash (2006) and Rose (1991) and others advocate for changing labels to further obscure the market-based nature of these tools.

(Campbell and Kay 2014). Campbell & Kay (2014) find, for example, that conservatives were less skeptical of climate science when presented with market-based solutions and limited regulation. In other words, conservative dislike of the regulation (opposition to mandates) led conservatives to say climate change was *less* of a problem. But here, people's dislike of the regulations (if taxes or cap-and-trade appear ineffective) might lead people to say pollution is *more* of a problem.

2.3. Previous empirical work

The prior section considered theoretical reasons why market-based regulations might reduce or increase the moral stigma of pollution, relying on some studies on the influence of markets themselves. Prior work considering whether market-based *regulations*, not just markets, reduce the moral stigma of pollution have come to mixed results and do not definitely answer the question.

Strahilevitz (2000) found real-world evidence against the objection. In 1996, San Diego changed its highway Express Lanes access from a carpooling mandate ("no solo driving in carpool lanes") to a market-based system ("pay a fee for solo driving in carpool lanes"). That year, more people began carpooling and a smaller percentage of Express Lane users violated the system (around 15% drove solo when it was forbidden and enforced by a fine, while 3% did so without paying the solo-driving fee). In other words, the market-based regulation (a price for solo driving) appeared to both encourage the positive externality (carpooling) and reduce legal violations, thereby suggesting that the shift in legal regime enhanced the perceived morality of the good act (carpooling).

But other factors could explain the changes in behavior. The increase in carpooling might be attributed to the increased salience of and attention paid to the possibility of carpooling when San Diego changed its policy. And the drop in Express Lane-violators could be, as Strahilevitz discusses, because it was more rational to comply (pay a $2 fee to drive solo versus risk being pulled over and paying an over $200 fine) or because of increased enforcement.

Feldman & Perez (2009), in contrast with Strahilevitz's project, found experimental evidence supporting the objection. Israeli participants responded to pollution under a tax with less moral outrage and less willingness to engage in civic enforcement than to pollution that violated more traditional command-and-control tools. But the horse race in that study was between pollution that complied with the tax (the company paid the requisite tax) and pollution that violated the legal requirements set by mandates or public agreements. That the polluters obeyed the law in the tax condition while they violated it in the mandate condition might explain the difference.

Two other studies comparing fines to fees, however, failed to find similar distinctions. In Ockenfels, Werner, and Edenhofer (2020), the frame (price or fine) did not significantly change participant decisions in setting the regulatory instrument (how high a price or fine), nor did it change other participants' emissions decisions. Nolan (2017) similarly found that the using a fee versus fine to enforce contributions to a commons did not change participant decisions to informally sanction violators. These studies would suggest that regulatory frame might not matter.

Other studies comparing regulatory instruments often do not evaluate the moral stigma of behavior under the instruments.[21] Motivational crowding studies exploring when external incentives and regulations can crowd out (and thus undermine) intrinsic motivations are also distinct from this line of inquiry. Those studies, like the Israeli daycare study, typically compare behavior with and without regulation, rather than doing

[21] Cherry, Kallbekken, and Kroll (2012), for example, find differences across the acceptability of different regulatory instruments. Participants playing an externality game preferred taxes over quantity regulation (a command-and-control mandate). But participants do not rate the moral stigma of creating the negative externality in the first place. Galbiati and Vertova (2008) compare the influence of obligations (mandates) to incentives but subject participants to both to see if varying levels of obligations alter behavior in the presence of constant incentives (they find that obligation levels do matter). (Braaten, Brekke, and Rogeberg 2015) is the closest but they test whether people are willing to trading stickers (to abstract away from pollution) that can cause harm, not whether people think that the use of the stickers is more or less harmful or morally bad. They do not compare trading to a mandate.

a horse race between types of regulation (see, e.g., Bowles 2016 for a review).[22] Finally, a growing number of studies compare framing effects across different payment or market types, but do not compare mandates to market-based instruments.[23]

Building on this prior work, this project randomly assigns regulatory condition to run a clean horse race between mandates and market-based instruments, and it directly assesses the moral stigma of pollution.

3. Methods and predictions

Do participants find it less morally bad to pollute under programs that use market-based instruments than under a command-and-control mandate? The study tests this question by first introducing participants to a newly discovered, fictitious pollutant, malzene, then randomly assigning participants to learn about one of four regulatory conditions: A no-regulation control, a command-and-control mandate, a pollution tax, or a cap-and-trade program. The study captured dependent measures related to the overall moral stigma of pollution (the moral stigma of malzene pollution, its perceived harm, and behavioral intentions to, e.g., demand more regulation or boycott companies emitting malzene) and evaluated the morality of emitting malzene in compliance with the regulation and in violation of the regulation.

A more detailed description of the study protocol and preregistered predictions follow. The Time-Sharing Experiments for the Social Sciences (TESS) program peer reviewed this study design, which was among the winners of the TESS Young Investigator Competition. The full survey materials are in the Appendix.

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[22] Other studies on this topic include: Cardenas et al. (2000), Gneezy and Rustichini (2000), Bohnet and Cooter (2005), McAdams and Nadler (2005), Tyran and Feld (2006), Lynham et al. (2016).

[23] McCaffery and Baron (2006) find, for example, more support for "payments" than equivalent "taxes," suggesting a tax aversion effect. Similarly, Hardisty, Johnson, and Weber (2009) find that self-identified Independents and Republicans were more likely to buy a more expensive plane ticket with a carbon "offset" than an equivalent "tax," but that Democrats did not have a semantic preference. Add Brekke et al. (2003).

3.1. Research design

3.1.1. Manipulation

Participants in the study learned that a newly discovered pollutant, malzene, causes asthma and chest pain and can hurt plant growth. "Malzene" is a fake chemical name designed to evoke other pollutants (e.g., benzene) to make the scenario feel more realistic. Malzene's relatively mild consequences (asthma as opposed to cancer, for example) were meant to license participants against blanket, strong condemnation of the pollutant and so avoid ceiling effects.

Participants were then randomly assigned to one of four regulatory conditions (see Table 1 below for manipulation text):

(1) A no-regulation control;
(2) A command-and-control mandate limiting allowable malzene pollution;
(3) A malzene tax; or
(4) A malzene cap-and-trade system.

For these four regulatory conditions, the manipulation wording echoed language describing the tools from major newspapers to mimic what the public would typically read, but with edits for greater clarity, especially for the more complex and unfamiliar cap-and-trade regulation. Each manipulation was thus at or lower than a 10^{th} grade reading level based on the Flesch-Kincaid scale. The three treatment conditions were of similar lengths to avoid more participant fatigue in one condition versus another. In addition, to give the anti-commodification the best shot at finding a change in moral stigma, the manipulation highlighted market and price language in the market-based conditions.

The manipulation does not specify numeric limits (e.g., $40/ton tax, 400-ton cap or mandate limit). Most lay people will not know what a $40/ton carbon tax really means or how it might compare to a mandate to reduce emissions below some set numerical

threshold. And, importantly, the vagueness allows a plausible comparison across regulatory types without complicated calculations to demonstrate functional equivalence. Instead, to establish functional equivalence, each regulation resulted in equivalent estimated health benefits ($40 million) and economic costs ($30 million).[24]

Finally, the opportunity for revenue recycling under market-based instruments was not mentioned. This distinction across instrument type is separate from the anti-commodification debate and in the real world is often used to reduce moral objections to market-based instruments (by using proceeds to, for example, allay environmental justice concerns). Emphasizing the use of government revenues, even if not to reduce moral concerns, might highlight the regulatory, rather than market-based, nature of the instruments and thus reduce the strength of the test of the anti-commodification critique.

[24] Holding constant estimated health benefits suggests roughly equivalent pollution reductions occur, and holding constant estimated costs suggests roughly equivalent burdens to industry. One might think that with constant economic costs, market-based instruments can reduce more pollution because they are more efficient. But this is not a necessary result. In any case, participants believed market-based instruments were less effective instruments than mandates at reducing pollution and largely would have implemented mandates themselves, suggesting they may not have been thinking about how cost-effective they might be.

Table 1. Manipulation text

CONTROL CONDITION

- Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.
- There are no malzene regulations in place right now.

MANDATE CONDITION

- Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.
- To reduce malzene emissions, the government put a limit on the amount of malzene that each company can release into the air. Regulators set the malzene pollution limit. Companies must reduce malzene pollution from their operations below that set limit.
- Companies can reduce their malzene pollution by, for example, installing pollution controls that remove malzene from the air before it is released. If they already pollute less than the malzene limit, they can pollute more, but only up to the limit.
- Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

TAX CONDITION

- Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.
- To reduce malzene pollution, the government created a malzene tax for each ton of malzene released into the air. Regulators set the malzene tax. Companies must pay the tax for every ton of malzene pollution they emit from their operations.
- Companies have the right to pollute as much as they pay in taxes. If companies reduce how much malzene they release, they pay less in malzene taxes. If they increase how much malzene they release, they pay more in malzene taxes. The tax puts a price on malzene.
- Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

CAP-AND-TRADE CONDITION

- Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.
- To reduce malzene pollution, the government created a cap-and-trade market for malzene permits. Regulators first set a "cap" on the total level of permitted malzene pollution. They then auction permits under that cap to companies. Each permit gives a company the right to release one ton of malzene pollution. Companies must buy a malzene permit for every ton of malzene they emit from their operations.
- Companies can trade malzene permits. Companies that pollute more than their permits allow must buy extra permits from companies that have polluted less than their permits allow. This trading creates a market for malzene permits and puts a price on malzene.
- Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

After reading the manipulation, participants answered attention and manipulation-check questions designed to encourage engagement with the text and reinforce critical distinctions among treatments.[25] The main analyses exclude participants who failed these questions to give the cap-and-trade and tax conditions the best shot at reducing the moral stigma of pollution. (See the Appendix for robustness checks including all participants.) It could be that only the participants who sincerely engaged and fully understood the salient aspects of the treatments might be affected.

3.1.2. Dependent measures

Participants answered two sets of dependent measures.

First, immediately following the manipulation, participants answered questions about the overall moral stigma of pollution generally. This included questions directly about the moral stigma of malzene pollution (what I'll call "moral stigma" going

[25] Validation Q1. What problems can malzene pollution cause?

1. Asthma and harm to plants
2. Dirty water
3. Stomach problems

Validation Q2. What is the government response to malzene pollution?

1. Nothing yet - there are no malzene regulations in place right now.
2. [For control condition only] A law regulating malzene pollution.
3. [For mandate condition only] A law requiring manufacturers to reduce the malzene they release below a set limit.
4. [For tax condition only] A malzene tax that manufacturers must pay for every ton of malzene they emit.
5. [For cap condition only] A malzene cap-and-trade market. Manufacturers must buy permits to release malzene and can trade those permits.

Validation Q3A. [For mandate condition only] Does this regulation create a set limit on how much companies can pollute? 1 = Yes; 2 = No

Validation Q3B. [For tax condition only] Does this regulation put a price on malzene? 1 = Yes; 2 = No

Validation Q3C. [For cap condition only] Does this regulation create a market for malzene pollution permits? 1 = Yes; 2 = No

forward),[26] how harmful they believed malzene to be ("harm"),[27] and their behavioral intentions with respect to malzene pollution ("behavioral intentions," e.g., whether they would demand further regulation).[28]

Second, for the treatment conditions only, participants also evaluated the morality of a firm, Alpha Corp., emitting malzene in compliance with the regulation ("compliance morality"),[29] and the morality of a firm, Beta Corp., emitting malzene in violation of the

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[26] Stigma. To what extent do you believe that... (alpha = .91, scale 0-100)

A. It is morally bad to emit malzene

B. A company that emits malzene has bad moral character

C. Emitting malzene is shameful

For this and other multiple-indicator measures, I randomized the order the statements were provided. I used multiple indicators for most measures for greater reliability. *See, e.g.*, Multiple-Indicator Measures, SAGE Encyclopedia on Social Science Research, https://methods-sagepub-com.proxy.uchicago.edu/reference/the-sage-encyclopedia-of-social-science-research-methods/n602.xml. For t-tests, I created composite variables by taking the average of the sub-indicator measures. For the structural equation models, I used lavaan() in R and mostly coded these variables as latent variables.

Unless otherwise noted, I developed and pretested all measures.

[27] Harm. To what extent do you believe that... (alpha = .95, scale 0-100)

A. Malzene is harmful

B. Exposure to malzene hurts people

C. Malzene is dangerous

I separately test perceptions of harm and moral stigma because they are not necessarily correlated. A large literature tests the perceived morality of harm-reducing measures that appear to some to be taboo (e.g., needle-exchange programs) (see, e.g., MacCoun). I preregistered moral stigma as my key variable of interest.

[28] Behavioral intentions. How likely would you be to... (alpha = .90, scale 0-100)

A. Support more malzene regulation

B. Limit activities in your life that cause malzene pollution

C. Boycott companies that emit malzene

D. Sign a petition for stronger malzene regulation

[29] Compliance morality. Imagine that Alpha Corp. is a manufacturing company that emits 10 tons of malzene pollution.

Alpha Corp. is polluting malzene IN COMPLIANCE with the new [limit on malzene pollution/malzene tax/malzene cap-and-trade market.]

regulation ("violation morality").[30] (The control group did not answer these questions because, without regulation, it is impossible to comply with or violate a regulation.) To create equivalence, Alpha Corp. in all conditions emitted 10 tons of malzene (which was within its legal limit or for which it had paid the appropriate taxes or malzene permits for). Beta Corp. in all conditions emitted 13 tons, 3 tons more than allowed (based on its legal limit of 10, or for the 10 tons of malzene taxes or permits it had paid for).

To avoid confusing participants answering the mediator questions that follow, participants answered the mediator questions first, then answered these questions on the new Alpha and Beta Corp. scenarios.

3.1.3. Mediators

Participants answered mediator questions designed to explore why a shift in moral stigma might occur.[31]

To test for an expressive effect, participants answered how morally bad and harmful they thought *the government* believed it is to emit malzene: Does the choice of

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That means that Alpha Corp. is [polluting less than or equal to the legal limit/paying a tax for every ton of malzene it emits/buying enough malzene permits to cover its malzene pollution.]

To what extent do you agree or disagree that...(alpha = .93, scale 0-100)

A. Alpha Corp. is morally bad
B. Alpha Corp. is shameful
C. Alpha Corp. is a bad actor

[30] Violation morality. Imagine that Beta Corp. is another manufacturing company.

Beta Corp. emits 13 tons of malzene pollution.

Beta Corp.'s pollution VIOLATES the law. Beta Corp. is polluting 3 tons MORE than [the set limit of 10 tons of malzene pollution/the 10 tons of malzene pollution it pays taxes on/ the 10 tons of malzene pollution it bought permits for from the cap-and-trade market.]

To what extent do you agree or disagree that...(alpha = .94, scale 0-100)

A. Beta Corp. is morally bad
B. Beta Corp. is shameful
C. Beta Corp. is a bad actor

[31] Mediation questions typically follow the manipulation and precede measurement of the dependent variables. However, on the advice of a reviewer and to ensure the cleanest measurement of the dependent variables here, I measured mediation questions after the main dependent measures.

a market-based instrument convey that the policymakers believed emissions to be less morally bad ("government stigma") or harmful ("government harm")?[32]

To test for inadequacy aversion, participants answered how effective they believed the instrument was at reducing pollution ("effective") and whether they felt the government should take the problem more seriously ("Government should do more").[33] If they perceived market-based instruments to be less effective or a need for greater regulation, they might have been more apt to say the pollution problem is greater.

Participants also answered a set of questions designed to elicit their general beliefs about each regulation type (government motivations; how punitive, costly, and appropriate the tool was; which tool they themselves would choose; and so on). I asked these questions for a separate analysis on general lay perceptions of regulatory type and how regulatory choice affects trust in government, so do not discuss them at length here.

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[32] Government stigma. If you had to guess, to what extent do you think THE GOVERNMENT believes that... (alpha = .93, scale 0-100)

A. It is morally bad to emit malzene

B. A company that emits malzene has bad moral character

C. Emitting malzene is shameful.

Government harm. If you had to guess, to what extent do you think THE GOVERNMENT believes that... (alpha = .96, scale 0-100)

A. Malzene is harmful

B. Exposure to malzene hurts people

C. Malzene is dangerous

[33] Efficacy. How much do YOU agree with the following statements? (alpha = .74, scale 1-6)

A. This regulation will be effective at reducing malzene pollution

B. This regulation will do enough to reduce malzene pollution

Government should do more. How much do YOU agree with the following statements? (alpha = .88, scale 1-6)

A. The government should take the malzene problem more seriously

B. The malzene regulation should be stronger

3.1.4. Moderators

Participants answered questions designed to identify characteristics that might make them respond differently to pollution regulations than other participants.

Participants began the study by answering two sets of moderators: how much they trust the government (Government trust)[34] and how strongly they identify as environmentalists (Environmental identity).[35] Those who trust the government more might be especially influenced by regulatory choice (the expressive effect of government tool choice might be greater). Strong environmentalists might especially be outraged by tools perceived to be ineffective or feel that market-based instruments are especially taboo.

But whether market-based instruments strike participants as engaging in a taboo trade-off might also be uncorrelated with environmental identity. Participants thus answered more direct questions about whether they felt it was wrong to have markets and prices for pollution (Norm violation).[36] Because this question could influence

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[34] Government trust. How much do you agree with the following statements? (alpha = .88, scale = 1-6)

A. I trust the government to appropriately regulate pollution.

B. I believe the government is competent at its job.

C. I feel that the government has the best interests of its constituents at heart.

I developed these measures loosely based on Grimmelikhuijsen & Knies (2017)..

[35] Environmental identity. How much do you agree with the following statements? (alpha = .69, scale = 1-6)

A. I think of myself as an environmentally-friendly consumer.

B. I think of myself as someone who is very concerned with environmental issues.

C. I would be embarrassed to be seen as having an environmentally-friendly lifestyle. (reverse-coded)

D. I would not want my family and friends to think of me as someone who is concerned with environmental issues. (reverse-coded)

I based these measures on Whitmarsh & O'Neill (2010).

[36] Norm violation. How much do you agree with the following statements? (alpha = .84, scale = 1-6)

A. It is wrong to have a market in pollution.

B. The government should not sell the right to pollute.

C. Companies should not be able to pay to pollute.

participants responses to the dependent measures, participants answered this question at the end of the survey,[37] with some demographic questions.[38]

3.1.5. Questionnaire order

Psychological studies often ask questions in this order: moderator questions, manipulation, mediation questions, and finally dependent measures [to cite]. Moderators are interaction terms that distinguish how participants react to the manipulation. For example, the expressive effect of a regulation might be stronger for those who trust the government more. Moderators typically precede the manipulation to avoid influence from the treatment. For example, and as I find in a related project, whether people see that the government has enacted a cap-and-trade regime or a mandate can influence how much they trust the government.

Mediation questions, in contrast, are intermediary variables meant to capture the causal cognitive path. For example, learning that the government has enacted a pollution tax might lead people to think that the *government* thinks the pollution is not harmful (the mediator), which might then lead people to say that *they* think it is less morally bad to pollute (the dependent measure). Surveys often match the order of this cognitive path, such that participants first read the manipulation, then answer mediation questions, then finally answer dependent measures.

This study deviated from this order in two ways to ensure clean measures of the main moral stigma dependent variables (as discussed above but expanded upon here). First, participants answered one moderator (how much people dislike pollution markets)

[37] The reverse is also possible—people in the market-based conditions might, after engaging with those regulatory types, think that markets and prices for pollution are more or less morally bad than those in the control or mandate conditions. But this measure was less important than the dependent measures to keep free from bias, and I did not find that condition affected this measure.

[38] NORC, the survey provider, already had most demographic information for their participants and only had participants answer questions after the survey for a handful of additional demographic questions if participant information was missing.

at the end of the survey to avoid contaminating the dependent measures.[39] Second, participants answered the main moral stigma dependent measures immediately after the manipulation (and thus answered mediation questions after those dependent measures). Participants answered dependent measures on Alpha Corp. emissions in compliance with and Beta Corp. emissions in violation of the regulation after these mediators to ensure participant answers to the mediation questions were not keyed to these new Alpha and Beta Corp. scenarios.

The full study materials, in order of presentation to participants, are in the Appendix.

3.2. Preregistration

The study was preregistered with As Predicted.[40] The preregistration predicted that regulatory type (market-based vs. mandate) would have little effect on the overall moral stigma measures (moral stigma, harm, behavioral intentions).[41] The prediction was one of competing effects: The government's expression of greater concern might increase the stigma of pollution under a mandate, but moral outrage in response to a perceived taboo trade-off and/or in response to the perception of a less effective instrument that necessitates a greater governmental response could increase the stigma of pollution under a tax or cap-and-trade system.

On compliance morality, the preregistration predicted that participants would find Alpha Corp. morally worse for pollution in compliance with a market-based instrument than for pollution in compliance with a mandate. This is contrary to the oft-made claim motivating the paper. That prediction was because the mandate's expressive effect here would be to permit the pollution, and compliance with a command-and-control mandate may absolve the polluter of even more moral stigma than does compliance with a market-

[39] The manipulation did not influence responses to this measure.

[40] As Predicted #143457, https://aspredicted.org/J6K_ZLJ.

[41] Statistically insignificant or very small effects (Cohen's $d < 0.2$).

based instrument. The mandate may send a stronger, more categorical signal of what is approved and not approved—some pollution is legal, and other pollution is not. In a market-based system, all "allowed" pollution is still subject to a price (a tax or allowance fee) and thus less explicitly endorsed by the state. A mandate that allows pollution likely thus operates as a stronger license for that deliberately permitted pollution than a tax or cap-and-trade regime does.

On violation morality, the preregistration did not have a directional prediction. On one hand, Beta Corp.'s violation of a mandate might incur greater moral outrage—this pollution is clearly not allowed (expressive effects). In addition, market norms in the market-based instruments might also lead participants to feel they are in a more amoral context that reduces the stigma of Beta Corp.'s pollution violations. However, Beta Corp. violating a market-based instrument might also elicit more outrage because the market-based instrument might seem easier to comply with. All a firm must do to comply is pay money (Strahilevitz 2000).

Finally, the preregistration included exploratory analysis of the potential mediation and moderation paths that might help explain the null effects on overall moral stigma. The prediction was that expressive measures might operate in conflict with inadequacy aversion, and that a feeling of taboo trade-off might act as a moderator.

3.3. Study Administration

The National Opinion Research Center (NORC), which partners with TESS, ran the study from September 14 to October 13, 2023 through its AmeriSpeak panel, a probability-based panel designed to represent the U.S. population. NORC targeted ~2,300 participants and delivered 2,474 responses.[42] Participants included 1,197 men and 1,277 women. Appendix Table 1 provides information on demographics of the participants.

[42] NORC policy is to remove participants who skip more than 50% of the questions or complete the survey in less than one third of the median time to complete.

4. Results

As an overview, market-based instruments did not reduce the overall moral stigma of malzene, and companies polluting in compliance with and in violation of market-based regulations looked morally worse than those polluting in compliance with and in violation of a mandate. The data are consistent with the hypothesis that the overall economically insignificant effects on moral stigma are due to competing effects.

Following the pre-registration protocol, all results exclude participants who failed attention checks to give the manipulation the best shot at finding a significant result.[43] The main analyses are unweighted (see, e.g., Franco et al. 2017; Miratrix et al. 2018; Gelman 2007). Robustness checks with analyses including participants who failed attention checks, analyses using survey weights calculated by NORC to adjust for sampling differences and nonresponse bias, and analyses using full information maximum likelihood estimation to handle missing data are in the Appendix [*some still being written up*]. None of the robustness checks changed results substantially.[44]All results include two analyses, comparing tax to mandate participants and cap-and-trade to mandate participants. See the Appendix for additional analyses with the control group [*preliminary analysis*].

4.1. Overall moral stigma: Moral stigma, Harm, Behavioral Intentions

The study considered three overall measures of moral stigma: Moral stigma itself, how harmful malzene appeared, and behavioral intentions to act more on malzene emissions. As intended, participants generally found malzene pollution morally bad (~66 on a 100-point scale, from not at all to extremely) and harmful (~80 on a 100-point scale),

[43] The main prediction was for a null result, so excluding people who did not pay close attention was a conservative measure.

[44] Conducting weighted t-tests changes one qualitative result: Tax participants no longer felt that malzene pollution was morally worse than mandate participants. Because the small difference with unweighted data is not economically meaningful, this does not substantially change the interpretation of the results. See Appendix [*not yet written up.*]

and they voiced intentions to act further to reduce malzene emissions (to, e.g., support more regulation and boycott companies emitting malzene; ~69 on a 100-point scale).

The focus in this research is on how the different treatment conditions impacted these assessments. These primary results are reported in Figure 1, which illustrates both the tax vs. mandate and cap vs. mandate differences, and Table 2. In the tax v. mandate analysis, tax participants ($M_{tax} = 67.2$) found malzene emissions slightly morally worse than mandate participants did ($M_{mandate} = 62.9$). The difference is contrary to the common critique that market-based instruments *reduce* the moral stigma of pollution, but it amounts to only a ~4-point difference on a 100-point scale and so is likely not economically meaningful.[45] Nor were there meaningful differences on the other two measures. Tax and mandate participants did not differ on how harmful they found malzene ($M_{tax} = 82.1$, $M_{mandate} = 80.1$). Tax participants reported marginally greater behavioral intentions to act than mandate participants, but the difference was only ~3 points on a 100-point scale ($M_{tax} = 70.2$, $M_{mandate} = 67.1$).[46]

Likewise, cap-and-trade did little to alter the moral stigma of malzene pollution. Cap-and-trade and mandate participants did not differ on how morally bad they found malzene pollution to be ($M_{cap} = 64.0$, $M_{mandate} = 62.9$), how harmful they felt malzene pollution was ($M_{cap} = 81.9$, $M_{mandate} = 80.1$), nor in their behavioral intentions to act ($M_{cap} = 69.7$, $M_{mandate} = 67.1$).

[45] To be conservative, no Bonferroni or other correction for multiple-hypothesis testing was used where the prediction was for a null or economically insignificant effect. The correction would make it harder to find a significant but small effect. The preregistration predicted null or very small effects (Cohen's $d < 0.2$). The tax difference effect size was 0.15.

[46] The effect size was 0.08. This was driven by differences in willingness to boycott companies emitting malzene. The other individual behavioral intentions (support for further regulation, willingness to limit one's personal activities, and signing petition for more regulation) did not differ between the mandate and tax conditions.

Figure 1. Comparing the Moral Stigma of Pollution (Moral Stigma, Harm, and Behavioral Intentions) Between Market-based Regulations and Mandates

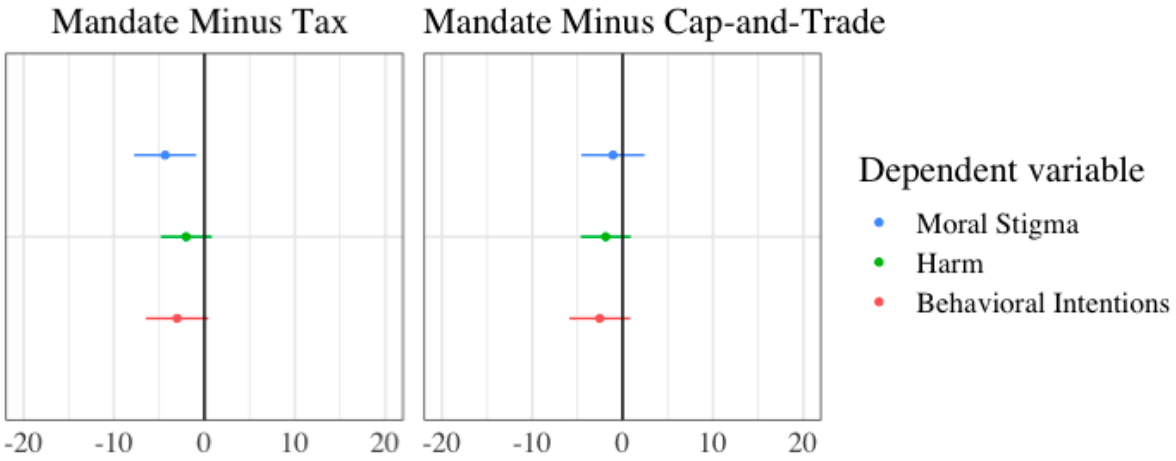

Figure note: Plots provide means and 95 percent confidence intervals confidence intervals for differences between mandate and market-based regulation participants.

Table 2. Mandate vs. Market-Based Instruments on Overall Moral Stigma Measures

	Mandate Mean (SD)	**Tax** Mean (SD)	**Cap-and-Trade** Mean (SD)	**Mandate – Tax** Mean difference Confidence interval	**Mandate – Cap & Trade** Mean difference Confidence interval
Moral stigma	62.9 (26.4)	67.2 (26.0)	64.0 (27.4)	-4.3 CI [-7.79, -0.90]**[47]	-1.1 CI [-4.56, 2.42][48]
Harm	80.1 (22)	82.1 (21.7)	81.9 (21.4)	-2.0 CI [-4.84, 0.82][49]	-1.8 CI [-4.64, 0.91][50]
Behavioral intentions	67.1 (25.7)	70.2 (26.1)	69.7 (25.5)	-3.1 CI [-6.47, 0.43]*[51]	-2.6 CI [-5.91, 0.85][52]

Table note: Table provides 95% confidence intervals for Welch's t-tests, excluding participants who failed attention checks and without corrections for missing data. For robustness checks including those participants and using full information maximum likelihood estimation to handle missing data, see Appendix. T-statistics and p values in footnotes. *** $p < .001$, ** $p < .05$, * $p < .1$.

[47] $t(879) = -2.47$, $p = .014$.

[48] $t(904) = -0.60$, $p = .547$

[49] $t(910) = -1.39$, $p = .164$.

[50] $t(919) = -1.32$, $p = .188$.

[51] $t(857) = -1.72$, $p = .086$.

[52] $t(860) = -1.47$, $p = .142$.

Because the motivating question is about moral stigma, and following the preregistered protocol, I focus on moral stigma (rather than harm) going forward.

4.2. Compliance and violation morality

Did market-based regulations change how people judged companies complying with and violating the law? Yes. In both cases, market-based regulations made companies look morally worse—in other words, market-based regulations increased the moral stigma of pollution. Figure 2 illustrates both the tax vs. mandate and cap-and-trade vs. mandate differences, and Table 3 provides results for both analyses, which are discussed below.

Figure 2. Comparing Compliance and Violation Morality Between Market-based Regulations and Mandates

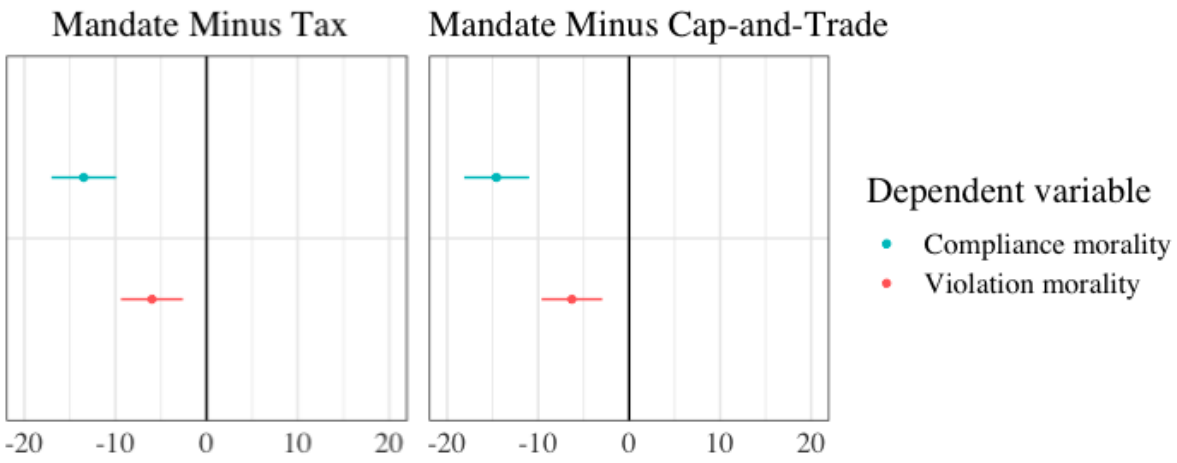

Figure note: Compliance morality variable created by asking participants to agree on a 0-100 scale, where 0 = strongly disagree and 100 = strongly agree, whether Alpha Corp. is a morally bad, shameful, or bad actor for polluting in compliance with its regulation. The three measures were averaged. Violation morality variable created in the same manner for Beta Corp., which was polluting in violation of its regulation. Plots provide means and 95 percent confidence intervals confidence intervals for differences between mandate and market-based regulation participants.

Table 3. Mandate vs. Market-Based Instruments on Compliance and Violation Morality

	Mandate Mean (SD)	**Tax** Mean (SD)	**Cap-and-Trade** Mean (SD)	**Mandate – Tax** Mean difference Confidence interval	**Mandate – Cap & Trade** Mean difference Confidence interval
Compliance morality	43.6 (26.1)	57.1 (26.8)	58.2 (27.2)	-13.5 CI [-17.01, -9.95]***[53]	-14.6 CI [-18.12, -11.04]***[54]
Violation morality	69.6 (26.5)	75.6 (25.5)	75.9 (25)	-6.0 CI [-9.41, -2.59]**[55]	-6.3 CI [-9.64, -2.94]***[56]

Table note: Table provides 95% confidence intervals for Welch's t-tests, excluding participants who failed attention checks and without corrections for missing data. For robustness checks including those participants and using full information maximum likelihood estimation to handle missing data, see Appendix. T-statistics and p values in footnotes. *** $p < .001$, ** $p < .05$, * $p < .1$.

For compliance morality, as predicted, Alpha Corp. looked morally *worse* for polluting in compliance with the tax and cap-and-trade regulations than for polluting in compliance with the mandate.[57] The roughly 14-point difference (on a 100-point scale) in compliance morality also appears economically significant. Figure 3 illustrates, by condition, participant agreement or disagreement with whether Alpha Corp. was morally bad for polluting in compliance with the mandate (unlike Figures 1 and 2, which illustrate differences between conditions). On average, participants disagreed that Alpha Corp. was morally bad for polluting in compliance with the mandate ($M_{mandate} = 44$, where 0 is strongly disagree and 100 is strongly agree), but on average agreed that it was morally bad for polluting in compliance with a tax or cap-and-trade regime ($M_{tax} = 57$, $M_{cap\text{-}and\text{-}trade} = 58$). Another (not preregistered) way of looking at the data is that 44% of mandate participants agreed (>=50) that Alpha Corp. was morally bad, shameful, or a bad actor, while 58% of tax and 65% of cap-and-trade participants agreed. See Figure 3. This result

[53] $t(850) = -7.49$, $p < .001$.

[54] $t(858) = -8.09$, $p < .001$.

[55] $t(876) = -3.45$, $p = .001$.

[56] $t(874) = -3.69$, $p < .001$.

[57] These results remain significant after Bonferroni corrections (i.e., $p < .025$). See Table 4.

accords with the idea that a categorical mandate expresses greater permission to pollute when in compliance than do tax or cap-and-trade instruments.

Figure 3. Moral stigma of polluting in compliance with the regulation

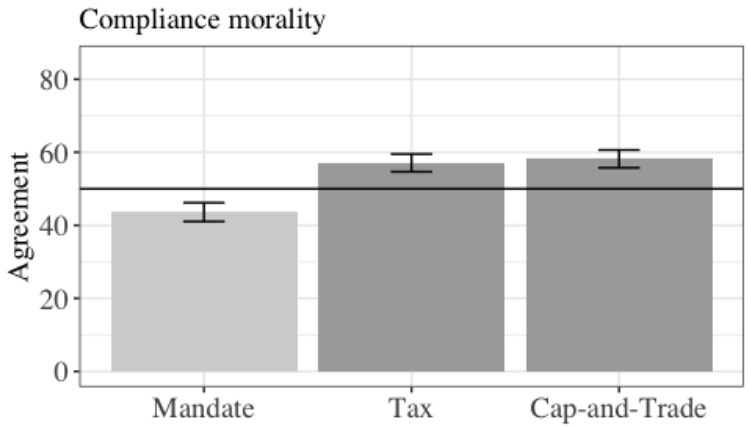

Figure note: Participants were asked to agree on a 0-100 scale, where 0 = strongly disagree and 100 = strongly agree, with whether Alpha Corp. is a morally bad, shameful, and a bad actor. The three measures were averaged to create the composite compliance morality variable (and were already all on a 0-100 scale so were not here standardized). Dark grey bars help distinguish the market-based instruments (tax, cap and trade) from the command-and-control mandate.

For violation morality, as Figure 2 illustrates, Beta Corp. looked worse for polluting in violation of a tax or cap-and-trade regulation than for polluting in violation of the mandate. The roughly 6-point difference, however, appears less meaningful.[58] In contrast with compliance morality, participants in all three conditions on average agreed that Beta Corp. was morally bad for polluting in violation of the regulation ($M_{mandate} = 70$, $M_{tax} = 76$, $M_{cap} = 76$).

One potentially unexpected implication of these results is that, for a reputation-conscious company, the marginal incentive to comply with the law is lower under the market-based instruments than under the mandate. Under a market-based instrument,

[58] These results remain significant after Bonferroni corrections (with which each test would need to meet $p < .025$ for significance). But the differences are small. Cohen's $d = .17$ for the tax vs. mandate comparison, which is a small effect size, and Cohen's $d = .23$ for the cap-and-trade vs. mandate comparison, which is a small effect size. There was no directional prediction for this analysis in the preregistration.

companies look somewhat morally bad whether they comply or not; under a mandate, they look affirmatively good for compliance and bad for violating the law. Put another way, the difference between violation and compliance morality is greater under the mandate than under the market based instruments.[59]

4.3. Mechanisms

The previous section found that market-based instruments, as compared to mandates, do not reduce the overall moral stigma of pollution. Why don't they? It could be that market-based instruments simply do not matter—that regulatory frame does not influence how people view the morality of pollution—or that participants here simply did not care. These possibilities seem less likely, however, given the strong distinction participants drew between complying with market-based instruments and complying with mandates. Complying with market-based instruments was markedly worse, suggesting both that frame can matter and made a meaningful difference for participants here.

The null or economically insignificant effects may instead be because of competing effects. The theory is that, with a market-based instrument, an expressive effect might push to reduce the moral stigma of pollution: The government's choice of a market-based instrument suggests that the government thinks malzene is less harmful and morally bad to emit, thus prompting people to themselves think malzene is less morally bad to emit. Pushing in the opposing direction could be an inadequacy-aversion effect: Reactions to perceptions of regulatory inadequacy might lead people to express greater moral outrage to perceptions of a greater remaining problem. A taboo trade-off effect might, for those who dislike the marriage of markets and pollution or for whom the environment is sacred, also result in greater moral outrage.

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[59] Violation minus compliance morality, mandate vs. tax: $t(767) = 4.58$, $p < .001$.

Violation minus compliance morality, mandate vs. cap: $t(784) = 4.70$, $p < .001$.

This analysis was not preregistered.

Appendix Section A.4. provides an in-depth discussion of an exploratory mediation analysis using structural equation modeling (SEM) to investigate these causal paths. In short, the data are consistent with both an expressive effect and an inadequacy-aversion effect, though some of these indirect effects are small. There is no evidence of the conceptualized taboo trade-off effect, but, as discussed below, that does not conclusively rule one out. Importantly, this analysis finds patterns consistent with these causal pathways but cannot fully claim causality, as discussed below and in the Appendix.

To provide a flavor for this analysis, this section walks through the high-level intuition of just the tax versus mandate analysis. The analysis begins with a two-step variable selection process for each proposed mediation path (expressive effect, inadequacy aversion): First, does the tax change the proposed mediator? Second, is the mediator associated with moral stigma in the conceptualized direction? After variable selection, a full structural equation model simultaneously estimates all remaining mediation and moderation paths to determine the significant of the proposed pathways.

4.3.1. Variable selection

Starting with variable selection or the expressive effect, in step 1, tax participants perceived the government to believe that malzene was less harmful (Government harm) and less morally bad to emit (Government stigma) than mandate participants did. Those effects were not large: moving to a tax resulted in a .18 standard deviation drop in Government harm and .13 standard deviation drop in Government stigma. In step 2, government harm was not associated with moral stigma, and so dropped out of the analysis. Government stigma did have a positive correlation with moral stigma: A one standard deviation increase in Government stigma was associated with a 0.29-0.30 standard deviation increase in moral stigma at average levels of trust in government. Government stigma had a greater positive relationship with moral stigma for participants with greater trust in government (i.e., the expressive effect of the law was greater for

those who trust the government more). Thus, the Government stigma mediator and Trust moderator remain in the model.

On the inadequacy-aversion side, in step 1 of variable selection, tax participants, compared to mandate participants, felt that their regulation was less effective and that government should do more (the regulation should be stronger). The influence of regulatory tool on effectiveness was large: moving to a tax resulted in a .50 standard deviation drop in perceived effectiveness, but only a .13 standard deviation increase in perceptions that the government should do more. More effective regulations correlated with less moral stigma, and greater beliefs that the government should do more correlated with more moral stigma, supporting the inadequacy-aversion effect. The influence of beliefs that government should do more was stronger than the influence of perceived effectiveness: A one standard deviation increase in the Government should do more variable was associated with a .43-.44 standard deviation increase in moral stigma, as compared to the .12-.13 standard deviation drop in moral stigma from the same increase in the effectiveness variable. Thus, both effectiveness and Government should do more remain in the model.

The data did not provide evidence of a taboo trade-off effect particularized to those who especially disliked markets in pollution (norm violation) or with especially strong environmental identities. This was tested using interaction terms (tax x norm violation and tax x environmental identity). Neither of the interaction terms were significant.

However, a taboo trade-off effect may have still been afoot. A large majority of participants (82%) found markets in pollution taboo (they agreed with statements like "It is wrong to have markets in pollution"), and 87% of participants suggested they had strong environmental identities(e.g., with agreement with statements like "I think of myself as an environmentally-friendly consumer"). There may not have been enough variation in these variables (norm violation, environmental identity) to capture changes in moral outrage people feel in response to a taboo trade-off because nearly everybody felt

there was a taboo trade-off. If almost everybody dislikes markets for pollution or feels like they care a lot about the environment, then there is little power to detect an interaction.

4.3.2. Structural Equation Model

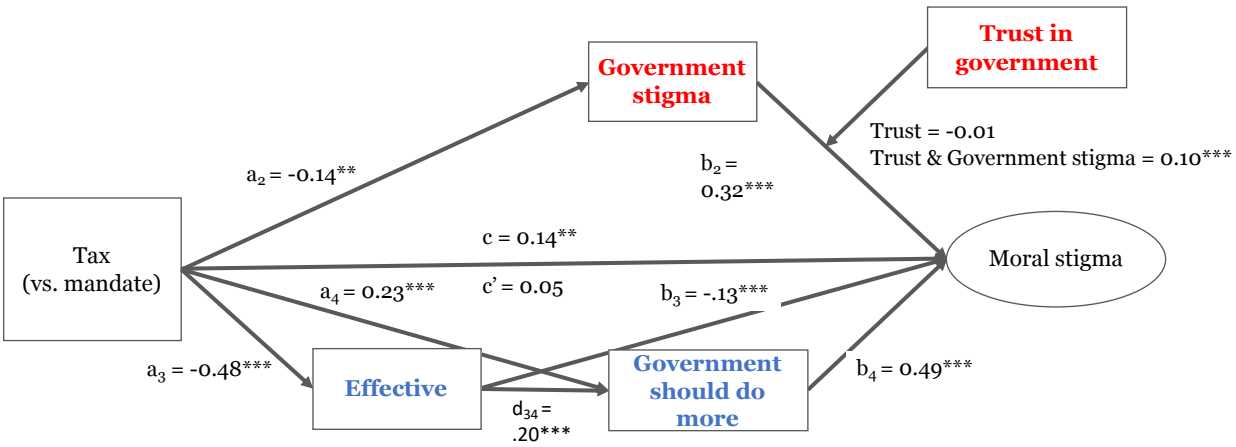
Figure 4 below presents the conceptual model tested in the full SEM for the tax versus mandate comparison. On the expressive effect of law path (red text), the indirect influence of Government stigma on moral stigma, moderated by trust in government, was significant and negative, providing support for the expressive effect (that tax reduced the moral stigma of pollution through this effect). At an average level of trust, this was a small to medium effect: A 1 standard deviation increase in Government stigma from moving to a tax was associated with a .04 standard deviation drop in moral stigma.[60] At high levels of Trust in government (one standard deviation above the mean), this indirect effect was -.19, a close to large effect; at low levels, the indirect effect was positive, at .1, a medium effect.

On the inadequacy aversion path, the indirect effects of both variables on moral stigma were separately significant and positive, providing support for an inadequacy-aversion effect (that tax increased the moral stigma of pollution through this effect). The indirect effect of the effectiveness variable was relatively small: a one standard deviation change through that variable from a move to tax was associated with a .06 standard deviation change in moral stigma. The indirect effect of the Government should do more variable was larger and associated with a 0.11 standard deviation change in moral stigma. The indirect path running through both variables (tax → effective → government should do more → moral stigma) was, contrary to the theory, significant and negative. This path

[60] David Kenny recommends squaring Cohen's d benchmarks for small, medium, and effect sizes because these indirect effects are the products of two effects. Cohen's d benchmarks for correlation or regression coefficients are 0.1 for small, .3 for medium, and .5 for large effect sizes (note that this is distinct from the Cohen's d benchmarks for mean differences, which are are .2, .5, and .8) (Cohen 2013). Squaring these creates benchmarks of .01 for small, .09 for medium, and .25 for large effect sizes ("Mediation Page (David A. Kenny)" n.d.).

was negative because beliefs that the regulation were effective and that the government should do more were positively correlated, contrary to theory.

Figure 4. SEM Path Diagram for Tax vs. Mandate



Note: Single arrows on a straight line from one variable X to another Y represent a predicted causal relationship to the variable with the arrow (e.g., tax caused a change in government stigma). Mediation paths are thus those that go from one variable to another and then to the dependent measures. Moderators are represented with arrows from the proposed moderators (trust in government) into the causal paths they might moderate (Government stigma to Moral stigma). Moderation relationships are interactions. Thus, both the coefficient for Trust in government and for the interaction (Government stigma: Trust) are reported. Red text represents expressive function of law paths that might reduce the moral stigma of pollution from market-based instruments, while blue text represents countervailing paths that might increase the moral stigma of pollution. Following convention, ovals represent latent variables (constructs inferred with multiple measurements), while rectangles represent observed variables.[61] To reduce complexity, error terms and correlations between variables are omitted.

The cap-and-trade analysis came to qualitatively similar results as the tax analysis, with the exception that regulatory effectiveness did not correlate with moral stigma for the cap-and-trade analysis. See Appendix Section 4.1.

For the mediators, the analyses here can make causal claims for the first step: regulatory condition was randomly assigned so it is clear that the effect of condition on, for example, government stigma is causal. However, the test for the second step (the effect

[61] All of the mediators and moderators here are multi-indicator measures, but those in rectangles are fixed as the average of the indicators instead of being coded as latent variables. This was done for "effective" and "government should do more" because they each had only two indicators. This was done for "government stigma," and "trust in government" because the lavaan package in R does not yet know how to handle latent variable interactions.

of the mediator on the dependent variable, e.g., the effect of government stigma on moral stigma) uses correlations, without random assignment of the mediator. It may thus be that an omitted variable explains the correlations, or even that the causal order is flipped. This is particularly plausible with the inadequacy-aversion hypothesis: People who think malzene is morally worse are likely to think the government should do more. Follow-on research should thus separately manipulate the mediators (e.g., government stigma, effectiveness of the regulation) to test their causal effects on moral stigma. Follow-on research could also devise a way to capture a generally shared taboo trade-off effect.

4.4. Demographics

Controlling for various demographic variables (age, gender, race, education, income, ideology, political party, environmental identity) did not change the overall results for the effect of regulatory type on moral stigma (tax participants continued to find malzene morally worse than mandate participants, and there was still no difference for the cap-and-trade versus mandate comparison). See Appendix Tables 9 and 10.[62] None of the demographic variables differentially affected participant responses to regulatory condition (there were no significant interactions between condition and demographic variables).

Overall (across both sets of regressions, tax vs. mandate and cap-and-trade vs. mandate), participants tended to find malzene morally worse if they were women, lower income, less conservative, more strongly Democratic, or had stronger environmental identities. Significant prior research has found that women have stronger pro-environmental attitudes (Ramstetter and Habersack 2020), and that those on the political

[62] This is particularly important for the ideology variable, where, despite random assignment to condition, tax participants ended up more politically conservative than mandate participants ($t(1108.9) = -3.06$, $p = .002$). See generally Appendix Table 1. Because tax participants found malzene morally worse but politically conservative participants generally found malzene morally less bad, controlling for ideology increases the degree to which being in the tax condition appeared to increase the moral stigma of pollution.

left and with stronger environmental identities found pollution morally worse is unsurprising.

However, the fact that *lower* income participants found malzene pollution morally worse is contrary to research that suggests that higher income correlates with stronger environmental concern (see, e.g., Franzen and Meyer 2010; Franzen and Vogl 2013). Indeed, even in this study, higher income predicted higher environmental identity measures (but lower moral stigma of malzene pollution).[63] However, environmental attitude measures (as is the case in the two cited studies above) often include questions about willingness to pay to protect the environment and willingness to accept cuts in standard of living to protect the environment, both of which might conflate budget constraints with environmental attitudes. Environmental identity as measured in this study included measures on being an environmentally friendly consumer and being seen as having an environmentally friendly lifestyle, which might face similar issues.

5. Discussion & Conclusion

Contrary to the anti-commodification critique, this study found that market-based regulations have economically insignificant effects on the overall moral stigma of pollution. Competing influences may explain these very small or null effects. An expressive effect of the market-based regulations appears to reduce the stigma of pollution (because the government seems to express through its choice of market-based instrument that malzene is less morally bad). But the perceived inadequacy of the market-based regulations appears to encourage greater moral outrage. And because most participants stated opposition to markets in pollution and declared themselves environmentally concerned, a taboo trade-off effect might also have been in operation generally across the sample.

Moreover, participants viewed companies polluting in compliance with and in violation of taxes and cap-and-trade programs as morally worse than companies polluting

[63] $B = 0.02$, $SE = 0.004$, $p < .001$.

in compliance with and in violation of a set limit on pollution. This difference on the violation measure was small, but it was economically significant on the compliance measure: Participants on average disagreed that a company polluting in compliance with a mandate was morally bad but on average agreed that a company polluting in compliance with a tax or cap-and-trade program was morally bad.

To be clear, the greater moral stigma on compliance and violation morality measures is not necessarily evidence that market-based instruments, contrary to the common critique, *increase* the moral stigma of pollution. Laypeople may not, in their everyday thinking about pollution, think explicitly about firms emitting in compliance with and in violation of regulations. Rather, the greater stigma in these contexts provides extra support for the contention that market-based instruments are unlikely to *reduce* the moral stigma of pollution. Moreover, the greater moral stigma on compliance morality for market-based instruments would of course likely disappear if these instruments also explicitly allowed (without requiring payment) a set limit of pollution, creating a hybrid instrument—it is the explicit permission that is likely doing this work.

That said, one potentially unexpected implication of these results on compliance and violation morality is that, for a reputation-conscious company, the incentive to comply with the law is lower under the market-based instruments than under the mandate. That is evident from the compliance morality measure alone—companies complying with market-based instruments look somewhat morally bad while companies complying with a mandate look somewhat morally good. But the marginal benefit to companies for complying with instead of violating the law under market-based instruments is also worse—the difference between violation and compliance morality is smaller under the market-based instruments than under the mandate.[64] This was not a preregistered prediction. But, if the result holds, the implication would be that while

[64] Violation minus compliance morality, mandate vs. tax: $t(767) = 4.58$, $p < .001$.

Violation minus compliance morality, mandate vs. cap: $t(784) = 4.70$, $p < .001$.

This analysis was not preregistered.

market-based instruments may not reduce the moral stigma of pollution overall, they might reduce moral or social rewards for legal compliance. On the other hand, the extra moral credit companies obtain for complying with a mandate might also lead to moral licensing and thus create room for greater moral or reputational transgressions.

Before concluding, a few limitations to this analysis are important to note. First, the null effect for cap-and-trade could be because the regulatory regime is just too complicated for people to understand. However, the manipulation used simplified language and the main results included only participants who passed three validation questions. Moreover, the manipulation text was based on major newspaper descriptions of these regulatory types. If it turns out people do not understand these manipulations, then they might in the real world likewise not understand the regulations, blunting their impact on moral stigma.

Second, it could be that market-based regulations do reduce the moral stigma of novel harms, but that people are already relatively fixed in how they view the moral stigma of *pollution*, regardless of whether the *pollutant* (here, malzene) is new. Future research could test the moral stigma of some new, fictitious harm altogether. That said, if the moral stigma of pollution is already relatively fixed and unalterable from regulatory form, the original worry that paying to pollute will reduce the moral stigma of pollution is less concerning.

Third, and more importantly, market-based instruments might reduce the moral stigma of the regulated act over longer time periods and repeated exposures. Here, the study tested only a single exposure and measurement. But why would greater exposure reduce moral stigma in a way that a single exposure would not? Perhaps more familiarity with market-based instruments would reduce inadequacy aversion (because people learn that the instruments *are* effective) and moral outrage from a taboo trade-off (because the instruments become more normalized). But, in doing so, the expressive effect would likely also diminish: A government instituting an appropriate, effective tool is unlikely to be signaling that pollution is less morally bad.

And greater exposure to market-based instruments might instead *heighten* inadequacy aversion. Some scholars argue that market-based regulations are especially likely to end up being underprotective because they make so clear to regulatory entities the costs of regulation (see, e.g., Mildenberger and Stokes 2020). If true, a sense of inadequacy aversion could be accurate because, for a given level of political power, it may be easier to pass a relatively more stringent mandate than market-based instrument. This empirical thesis is worth testing: Because of the relative efficiency and perceived lighter touch of market-based instruments, the opposite prediction is also possible.[65] And, even if true, sequencing of policies can and have brought up market-based regulatory standards after the fact (Pahle et al. 2018).

Another reason greater exposure to the market-based instruments might matter is that people might be responding with more moral outrage about pollution under a market-based instrument because they, like Sandel and others, are worried that the instrument *will* normalize pollution and reduce its moral stigma. This is distinct from believing the instrument is less effective—the concern would be not over the instrument's direct effects on polluters, but rather on societal norms. If true, then greater exposure to market-based instruments that do not reduce the moral stigma of pollution might likewise ameliorate this concern and thus, ironically, lead to reductions in the moral stigma of pollution. But, if true, then this concern would in theory be revived and could itself act as a protective measure to maintain moral stigma.

A final limitation is that this study evaluated a lay population of Americans and targeted a demographically representative sample. Market-based regulations could reduce the moral stigma of pollution or change downstream behaviors for particular subsets of the population who are especially important for policy. For example, environmental activists may feel less motivated to lobby for a higher tax than to lobby for more stringent mandates. This study does not find these subpopulation effects but the population of

[65] A third possibility might be that market-based instruments are easier to establish in the first instance, but that, conditional on enactment, it is easier to enact more environmentally protective mandates..

politically active environmental activists may be too small to adequately capture in this well-powered but broad sample. In addition, it is especially important to understand how regulated entities themselves react to different regulatory frames, a question this study cannot address. It might be that the greater control asserted under mandates prompts greater reactance and thus motivated reasoning against the moral stigma of pollution, but the clearly identified costs involved under market-based instruments might do the same.

In reflecting on the findings here, the perhaps most surprising result was that so many people reported that markets in pollution are morally wrong despite the increasing use of (and thus, presumably, familiarity with) these regulatory instruments. But the finding might help explain the sustained power of the anti-commodification critique. In general, our moral reasoning tends to follow our instinctive moral emotions—we look for seemingly rational and well-reasoned explanations for our moral emotions (Haidt 2001). The idea that markets for pollution reduce the moral stigma of pollution could therefore persist because it helps rationalize the lay intuition that pollution should not be bought and sold. It may thus be the case that addressing the critique on empirical terms—showing that market-based regulations do not reduce the moral stigma of pollution—is insufficient to fully satisfy anti-commodification critics. Further research on the roots of the discomfort is necessary.

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Appendix

A.1. Questionnaire

Q1. How much do you agree with the following statements?

RANDOMIZE GRID ITEMS:

A. I trust the government to appropriately regulate pollution.
B. I believe the government is competent at its job.
C. I feel that the government has the best interests of its constituents at heart.

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

Q2. How much do you agree with the following statements?

RANDOMIZE GRID ITEMS:

A. I think of myself as an environmentally-friendly consumer.
B. I think of myself as someone who is very concerned with environmental issues.
C. I would be embarrassed to be seen as having an environmentally-friendly lifestyle.
D. I would not want my family and friends to think of me as someone who is concerned with environmental issues.

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

Q3.

This page contains information you will need to accurately respond to questions throughout this survey. Please read the below text carefully. The continue button will appear shortly, but please take the time you need to review this page carefully.

[SHOW IF CONDITION = CONTROL]

Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.

There are no malzene regulations in place right now.

[SHOW IF CONDITION = MANDATE]
Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.

To reduce malzene pollution, the government put a limit on the amount of malzene that each company can release into the air. Regulators set the malzene pollution limit. Companies must reduce malzene pollution from their operations to below that set limit.

Companies can reduce their malzene pollution by, for example, installing pollution controls that remove malzene from the air before it is released. If they already pollute less than the malzene limit, they can pollute more, but only up to the limit.

Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

[SHOW IF CONDITION = TAX]
Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.

To reduce malzene pollution, the government created a malzene tax for each ton of malzene released into the air. Regulators set the malzene tax. Companies must pay the tax for every ton of malzene pollution they emit from their operations.

Companies have the right to pollute as much as they pay in taxes. If companies reduce how much malzene they release, they pay less in malzene taxes. If they increase how much malzene they release, they pay more in malzene taxes. The tax puts a price on malzene.

Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

[SHOW IF CONDITION = CAP-AND-TRADE]
Imagine that researchers recently discovered a new air pollutant, malzene, caused by common manufacturing processes. Breathing in malzene can cause asthma and chest pain. Malzene also hurts plant growth. But reducing malzene pollution can be costly.

To reduce malzene pollution, the government created a cap-and-trade market for malzene permits. Regulators first set a "cap" on the total level of permitted malzene pollution. They then auction permits under that cap to companies. Each permit gives a company the right to release one ton of malzene pollution. Companies must buy a malzene permit for every ton of malzene they emit from their operations.

Companies can trade malzene permits. Companies that pollute more than their permits allow must buy extra permits from companies that have polluted less than their permits allow. This trading creates a market for malzene permits and puts a price on malzene.

Analysts estimate that the regulation will create around $40 million in health benefits a year and $30 million in economic costs.

[Reminder text: This will always look like the below. For concision, I don't repeat it.]

[IF CONDITION = CONTROL]

A reminder of what you've read:

There are no malzene regulations in place right now. Malzene can cause asthma and harm to plants.

[IF CONDITION = MANDATE]

A reminder of what you've read:

To reduce malzene pollution, the government set a limit on the amount of malzene that companies are allowed to emit. Malzene can cause asthma and harm to plants.

[IF CONDITION = TAX]

A reminder of what you've read:

To reduce malzene pollution, the government created a malzene tax, which puts a price on malzene. Malzene can cause asthma and harm to plants.

[IF CONDITION = CAP-AND-TRADE]

A reminder of what you've read:

To reduce malzene pollution, the government created a cap-and-trade market for malzene permits. Malzene can cause asthma and harm to plants.

Q4. What problems can malzene pollution cause?

RANDOMIZE RESPONSE OPTIONS:

01 Asthma and harm to plants
02 Dirty water
03 Stomach problems

[Reminder text]

Q5. What is the government response to malzene pollution?

RANDOMIZE RESPONSE OPTIONS:

01 Nothing yet - there are no malzene regulations in place right now.
02 [IF CONDITION = CONTROL] A law regulating malzene pollution.
03 [IF CONDITION = MANDATE] A law requiring manufacturers to reduce the malzene they release below a set limit.
04 [IF CONDITION = TAX] A malzene tax that manufacturers must pay for every ton of malzene they emit.
05 [IF CONDITION = CAP-AND-TRADE] A malzene cap-and-trade market. Manufacturers must buy permits to release malzene and can trade those permits.

#[SHOW IF CONDITION = MANDATE,TAX, CAP]
[Reminder text]

Q6.

[IF CONDITION = MANDATE]
Does this regulation create a set limit on how much companies can pollute?

[IF CONDITION = TAX]
Does this regulation put a price on malzene?

[IF CONDITION = CAP-AND-TRADE]
Does this regulation create a market for malzene pollution permits?

RESPONSE OPTIONS:

01 Yes
02 No

[Reminder text]

Q7. To what extent do you believe that...

RANDOMIZE GRID ITEMS:

A. It is morally bad to emit malzene
B. A company that emits malzene has bad moral character
C. Emitting malzene is shameful

RESPONSE OPTIONS:

[SLIDER, 0-100, “Not at all” to “Extremely”]

[Reminder text]

Q8. To what extent do you believe that...

RANDOMIZE GRID ITEMS:

A. Malzene is harmful
B. Exposure to malzene hurts people
C. Malzene is dangerous

RESPONSE OPTIONS:

[SLIDER, 0-100, "Not at all" to "Extremely"]

[Reminder text]

Q9. How likely would you be to...

RANDOMIZE GRID ITEMS:

A. Support more malzene regulation
B. Limit activities in your life that cause malzene pollution
C. Boycott companies that emit malzene
D. Sign a petition for stronger malzene regulation

RESPONSE OPTIONS:

[SLIDER, 0-100, "Not at all" to "Extremely"]

[Reminder text]

Q10. If you had to guess, to what extent do you think THE GOVERNMENT believes that...

RANDOMIZE GRID ITEMS:

A. It is morally bad to emit malzene
B. A company that emits malzene has bad moral character
C. Emitting malzene is shameful

RESPONSE OPTIONS:

[SLIDER, 0-100, "Not at all" to "Extremely"]

[Reminder text]

Q11. If you had to guess, to what extent do you think THE GOVERNMENT believes that...

RANDOMIZE GRID ITEMS:

A. Malzene is harmful
B. Exposure to malzene hurts people
C. Malzene is dangerous

RESPONSE OPTIONS:
[SLIDER, 0-100, "Not at all" to "Extremely"]

[Reminder text]
Q12. If you had to guess, how important do you think the following factors are to THE GOVERNMENT?

RANDOMIZE GRID ITEMS:
A. Health effects of malzene
B. Costs to the economy of reducing malzene
C. Environmental effects of malzene
D. Jobs that would be lost because of the new regulation

RESPONSE OPTIONS:
01 Not at all important
02 Slightly important
03 Moderately important
04 Very important
05 Extremely important

#[SHOW IF CONDITION = MANDATE,TAX, CAP]
[Reminder text]
Q13. How much do YOU agree with the following statements?

RANDOMIZE GRID ITEMS:
A. This regulation will be effective at reducing malzene pollution
B. This regulation will do enough to reduce malzene pollution
C. The government should take the malzene problem more seriously
D. The malzene regulation should be stronger

RESPONSE OPTIONS:
01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

#[SHOW IF CONDITION = MANDATE,TAX, CAP]
[Reminder text]
Q14. How much do YOU agree with the following statements?

RANDOMIZE GRID ITEMS:

A. It will be hard for companies to comply with this regulation
B. This regulation will hurt the economy
C. This regulation teaches a lesson: Pollution is bad

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

[Reminder text]
Q15. How much do YOU agree with the following statements?

RANDOMIZE GRID ITEMS:

A. I trust the government to appropriately regulate pollution
B. I believe the government is competent at its job
C. I feel that the government has the best interests of its constituents at heart

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

#[SHOW IF CONDITION = MANDATE,TAX, CAP]
[Reminder text]
Q16. How much do YOU agree with the following statements?

RANDOMIZE GRID ITEMS:

A. This regulation is the right type of tool to regulate malzene pollution
B. I like this regulation

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree

04 Slightly agree
05 Agree
06 Strongly agree

Q17. In YOUR view, what would be the best way to regulate malzene pollution?

RESPONSE OPTIONS:

01 No regulation
02 A law requiring manufacturers to reduce their malzene pollution below a set limit
03 A malzene tax that manufacturers must pay for every ton of malzene emitted
04 A malzene cap-and-trade market under which manufacturers must buy (and can trade) permits to emit malzene
05 Other (please explain) [TEXTBOX]

#[SHOW IF CONDITION = MANDATE,TAX, CAP]

Q18.

Imagine that Alpha Corp. is a manufacturing company that emits 10 tons of malzene pollution.

Alpha Corp. is polluting malzene IN COMPLIANCE with the new [INSERT IF CONDITION = MANDATE: limit on malzene pollution.] [INSERT IF CONDITION = TAX: malzene tax.] [INSERT IF CONDITION = CAP-AND-TRADE: malzene cap-and-trade market.]

That means that Alpha Corp. is [INSERT IF CONDITION = MANDATE: polluting less than or equal to the legal limit.] [INSERT IF CONDITION = TAX: paying a tax for every ton of malzene it emits.] [INSERT IF CONDITION = CAP-AND-TRADE: buying enough malzene permits to cover its malzene pollution.]

To what extent do you agree or disagree that...

RANDOMIZE GRID ITEMS:

A. Alpha Corp. is morally bad
B. Alpha Corp. is shameful
C. Alpha Corp. is a bad actor

RESPONSE OPTIONS:

[SLIDER, 0-100, left side = "Strongly disagree", midpoint = "Neither agree nor disagree", right side = "Strongly agree"

#[SHOW IF CONDITION = MANDATE,TAX, CAP]

Q19.

Imagine that Beta Corp. is another manufacturing company.

Beta Corp. emits 13 tons of malzene pollution.

Beta Corp.'s pollution VIOLATES the law. Beta Corp. is polluting 3 tons MORE than [INSERT IF CONDITION = MANDATE: the set limit of 10 tons of malzene pollution.] [INSERT IF CONDITION = TAX: the 10 tons of malzene pollution it pays taxes on.] [INSERT IF CONDITION = CAP-AND-TRADE: the 10 tons of malzene pollution it bought permits for from the cap-and-trade market.]

To what extent do you agree or disagree that...

SHOW GRID ITEMS IN SAME ORDER AS Q18:

A. Beta Corp. is morally bad
B. Beta Corp. is shameful
C. Beta Corp. is a bad actor

RESPONSE OPTIONS:

[SLIDER, 0-100, left side = "Strongly disagree", midpoint = "Neither agree nor disagree", right side = "Strongly agree"

Q20. How much do you agree with the following statements?

RANDOMIZE GRID ITEMS:

A. It is wrong to have a market in pollution.
B. The government should not sell the right to pollute.
C. Companies should not be able to pay to pollute.

RESPONSE OPTIONS:

01 Strongly disagree
02 Disagree
03 Slightly disagree
04 Slightly agree
05 Agree
06 Strongly agree

[Demographics questions are asked here if any are missing.]

A.2. Demographics

Appendix Table 1. General demographics (unweighted)

	control (N=604)	mandate (N=596)	tax (N=630)	cap (N=644)	Overall (N=2474)
Age					
18-24	45 (7.5%)	50 (8.4%)	43 (6.8%)	68 (10.6%)	206 (8.3%)
25-34	155 (25.7%)	134 (22.5%)	146 (23.2%)	120 (18.6%)	555 (22.4%)
35-44	91 (15.1%)	108 (18.1%)	114 (18.1%)	121 (18.8%)	434 (17.5%)
45-54	73 (12.1%)	84 (14.1%)	95 (15.1%)	94 (14.6%)	346 (14.0%)
55-64	108 (17.9%)	103 (17.3%)	107 (17.0%)	110 (17.1%)	428 (17.3%)
65-74	89 (14.7%)	85 (14.3%)	89 (14.1%)	88 (13.7%)	351 (14.2%)
75+	43 (7.1%)	32 (5.4%)	36 (5.7%)	43 (6.7%)	154 (6.2%)
Gender					
Men	290 (48.0%)	296 (49.7%)	311 (49.4%)	300 (46.6%)	1197 (48.4%)
Women	314 (52.0%)	300 (50.3%)	319 (50.6%)	344 (53.4%)	1277 (51.6%)
Race					
White	379 (62.7%)	371 (62.2%)	375 (59.5%)	417 (64.8%)	1542 (62.3%)
Black	74 (12.3%)	78 (13.1%)	92 (14.6%)	65 (10.1%)	309 (12.5%)
Other	4 (0.7%)	9 (1.5%)	9 (1.4%)	10 (1.6%)	32 (1.3%)
Hispanic	102 (16.9%)	103 (17.3%)	116 (18.4%)	110 (17.1%)	431 (17.4%)
2+, non-Hispanic	20 (3.3%)	15 (2.5%)	17 (2.7%)	15 (2.3%)	67 (2.7%)
Asian	25 (4.1%)	20 (3.4%)	21 (3.3%)	27 (4.2%)	93 (3.8%)
Education					
< High school	38 (6.3%)	27 (4.5%)	27 (4.3%)	37 (5.7%)	129 (5.2%)
High school graduate or equivalent	113 (18.7%)	111 (18.6%)	125 (19.8%)	114 (17.7%)	463 (18.7%)
Some college/ associates degree	235 (38.9%)	253 (42.4%)	248 (39.4%)	259 (40.2%)	995 (40.2%)
Bachelor's degree	137 (22.7%)	111 (18.6%)	148 (23.5%)	133 (20.7%)	529 (21.4%)
Post grad study / professional degree	81 (13.4%)	94 (15.8%)	82 (13.0%)	101 (15.7%)	358 (14.5%)
Income					
<$5K	12 (2.0%)	13 (2.2%)	16 (2.5%)	13 (2.0%)	54 (2.2%)
$5,000-$9,999	15 (2.5%)	16 (2.7%)	21 (3.3%)	13 (2.0%)	65 (2.6%)
$10,000-$14,999	34 (5.6%)	19 (3.2%)	19 (3.0%)	18 (2.8%)	90 (3.6%)

	control (N=604)	mandate (N=596)	tax (N=630)	cap (N=644)	Overall (N=2474)
$15,000-$19,999	12 (2.0%)	16 (2.7%)	24 (3.8%)	28 (4.3%)	80 (3.2%)
$20,000-$24,999	28 (4.6%)	20 (3.4%)	29 (4.6%)	24 (3.7%)	101 (4.1%)
$25,000-$29,999	34 (5.6%)	31 (5.2%)	31 (4.9%)	26 (4.0%)	122 (4.9%)
$30,000-$34,999	26 (4.3%)	22 (3.7%)	31 (4.9%)	28 (4.3%)	107 (4.3%)
$35,000-$39,999	16 (2.6%)	22 (3.7%)	23 (3.7%)	29 (4.5%)	90 (3.6%)
$40,000-$49,999	49 (8.1%)	38 (6.4%)	59 (9.4%)	52 (8.1%)	198 (8.0%)
$50,000-$59,999	59 (9.8%)	74 (12.4%)	52 (8.3%)	62 (9.6%)	247 (10.0%)
$60,000-$74,999	75 (12.4%)	67 (11.2%)	71 (11.3%)	53 (8.2%)	266 (10.8%)
$75,000-$84,999	27 (4.5%)	27 (4.5%)	30 (4.8%)	32 (5.0%)	116 (4.7%)
$85,000-$99,999	58 (9.6%)	64 (10.7%)	51 (8.1%)	56 (8.7%)	229 (9.3%)
$100,000-$124,999	57 (9.4%)	58 (9.7%)	56 (8.9%)	59 (9.2%)	230 (9.3%)
$125,000-$149,999	40 (6.6%)	30 (5.0%)	40 (6.3%)	49 (7.6%)	159 (6.4%)
$150,000-$174,999	14 (2.3%)	34 (5.7%)	31 (4.9%)	45 (7.0%)	124 (5.0%)
$175,000-$199,999	14 (2.3%)	14 (2.3%)	15 (2.4%)	16 (2.5%)	59 (2.4%)
$200,000+	34 (5.6%)	31 (5.2%)	31 (4.9%)	41 (6.4%)	137 (5.5%)
Ideology (1 = liberal; 5 = conservative)					
Mean (SD)	3.04 (1.08)	2.92 (1.12)	3.10 (1.12)	2.95 (1.04)	3.00 (1.09)
Median [Min, Max]	3.00 [1.00, 5.00]	3.00 [1.00, 5.00]	3.00 [1.00, 5.00]	3.00 [1.00, 5.00]	3.00 [1.00, 5.00]
Missing	11 (1.8%)	9 (1.5%)	11 (1.7%)	11 (1.7%)	42 (1.7%)
Political party (1 = Strong Dem, 7 = Strong Rep)					
Mean (SD)	3.70 (2.00)	3.71 (2.09)	3.74 (2.07)	3.60 (1.98)	3.69 (2.03)
Median [Min, Max]	4.00 [1.00, 7.00]	4.00 [1.00, 7.00]	4.00 [1.00, 7.00]	4.00 [1.00, 7.00]	4.00 [1.00, 7.00]
Missing	2 (0.3%)	1 (0.2%)	3 (0.5%)	2 (0.3%)	8 (0.3%)
Environmental Identity (5 = most environmental)					
Mean (SD)	4.56 (0.800)	4.49 (0.861)	4.50 (0.839)	4.59 (0.772)	4.53 (0.819)
Median [Min, Max]	4.50 [1.25, 6.00]	4.50 [1.00, 6.00]	4.50 [1.00, 6.00]	4.50 [2.00, 6.00]	4.50 [1.00, 6.00]
Missing	2 (0.3%)	4 (0.7%)	3 (0.5%)	12 (1.9%)	21 (0.8%)

A.3. Robustness checks

A.3.1. Main results (repeated from text for comparison)

Appendix Table 2. Mandate vs. Market-based Instruments. Main Results

	Mandate Mean (SD)	**Tax** Mean (SD)	**Cap-and-Trade** Mean (SD)	**Mandate – Tax** Mean difference Confidence interval	**Mandate – Cap & Trade** Mean difference Confidence interval
Moral stigma	62.9 (26.4)	67.2 (26.0)	64.0 (27.4)	-4.3 CI [-7.79, -0.90]**[66]	-1.1 CI [-4.56, 2.42][67]
Harm	80.1 (22)	82.1 (21.7)	81.9 (21.4)	-2.0 CI [-4.84, 0.82][68]	-1.8 CI [-4.64, 0.91][69]
Behavioral intentions	67.1 (25.7)	70.2 (26.1)	69.7 (25.5)	-3.1 CI [-6.47, 0.43]*[70]	-2.6 CI [-5.91, 0.85][71]
Compliance morality	43.6 (26.1)	57.1 (26.8)	58.2 (27.2)	-13.5 CI [-17.01, -9.95]***[72]	-14.6 CI [-18.12, -11.04]***[73]
Violation morality	69.6 (26.5)	75.6 (25.5)	75.9 (25)	-6.0 CI [-9.41, -2.59]**[74]	-6.3 CI [-9.64, -2.94]***[75]

Table note: Table provides 95% confidence intervals for Welch's t-tests, excluding participants who failed attention checks and without corrections for missing data. For robustness checks including those participants and using full information maximum likelihood estimation to handle missing data, see Appendix. T-statistics and p values in footnotes. *** $p < .001$, ** $p < .05$, * $p < .1$.

[66] $t(879) = -2.47$, $p = .014$.

[67] $t(904) = -0.60$, $p = .547$

[68] $t(910) = -1.39$, $p = .164$.

[69] $t(919) = -1.32$, $p = .188$.

[70] $t(857) = -1.72$, $p = .086$.

[71] $t(860) = -1.47$, $p = .142$.

[72] $t(850) = -7.49$, $p < .001$.

[73] $t(858) = -8.09$, $p < .001$.

[74] $t(876) = -3.45$, $p = .001$.

[75] $t(874) = -3.69$, $p < .001$.

A.3.2. Robustness check: Including participants who failed attention checks

[*to redo tables to match the tables in A.3.1.*]

Appendix Table 4. Mandate vs. Tax. Including failed attention checks

	Mandate		Tax					
	Mean	SD	Mean	SD	Difference	df	t value	p
Moral stigma	62.6	26.1	66.9	25.4	-4.3	1124.9	-2.80	.005
Harm	78.5	22.7	79.8	22.7	-1.3	1168.6	-1.02	.307
Behavioral intentions	66.3	25.9	68.4	26.1	-2.1	1097.3	-1.33	.185
Compliance morality	45.3	26.7	56.3	26.8	-11.0	1089.2	-6.82	<.001
Violation morality	68.8	26.6	73.2	26.1	-4.4	1133.6	-2.85	.004

Appendix Table 5. Mandate vs. Cap and Trade. Including failed attention checks

	Mandate		Cap-and-Trade					
	Mean	SD	Mean	SD	Difference	df	t value	p
Moral stigma	62.6	26.1	63.9	26.8	-1.3	1149.6	-0.83	0.407
Harm	78.5	22.7	80.3	22.1	-1.8	1177.4	-1.44	0.151
Behavioral intentions	66.3	25.9	68.6	25.4	-2.3	1097.5	-1.49	0.135
Compliance morality	45.3	26.7	58.7	26.8	-13.4	1089.9	-8.31	<.001
Violation morality	68.8	26.6	74.6	24.9	-5.8	1124.8	-3.84	<.001

A.3.3. Robustness check: Using full information maximum likelihood to handle missing data

[*not yet written up in table form*]

High-level results:

- Moral stigma. Tax > Mandate. No difference in Cap vs. mandate
- Harm. No difference in tax vs. mandate. Cap > Mandate (marginal; no difference in main results)
- Behavioral intentions. Tax > mandate (marginal); Cap > Mandate (no difference in main results)
- Compliance morality. Tax > mandate; Cap > Mandate
- Violation morality. Tax > mandate; Cap > Mandate

A.3.4. Robustness check: Including sample weights

[*not yet written up in table form*]

High-level results:

- Moral stigma. No difference tax vs. mandate (was tax > mandate in main results); No difference in cap vs. mandate.
- Harm. No difference for either analysis.
- Behavioral intentions. No difference for either analysis. (was tax > mandate marginally in main results)
- Compliance morality. Tax > mandate. Cap > mandate.
- Violation morality. Tax > mandate. Cap > mandate

A.3.5. Preliminary analyses including the control group

No control group analyses were preregistered and so are all exploratory. [*Will add tables with confidence intervals and other results.*] Appendix Figure 1 illustrates each group's responses to overall moral stigma; Appendix Figure 2 illustrates responses on harm; and Appendix Figure 3 illustrates responses on behavioral intentions. This analysis uses the raw responses (rather than difference plots, as in the main text) to allow for comparisons between the control group and the three other groups.

On overall moral stigma, the control group felt that malzene was morally worse than the mandate group did (a difference of ~6 points out of 100, $t(892) = 3.72$, $p < .001$) and than the cap-and-trade group did (a difference of ~5 points out of 100, $t(1004) = 3.18$, $p = .002$). The control group did not differ from the tax group on moral stigma. See Appendix Figure 1.

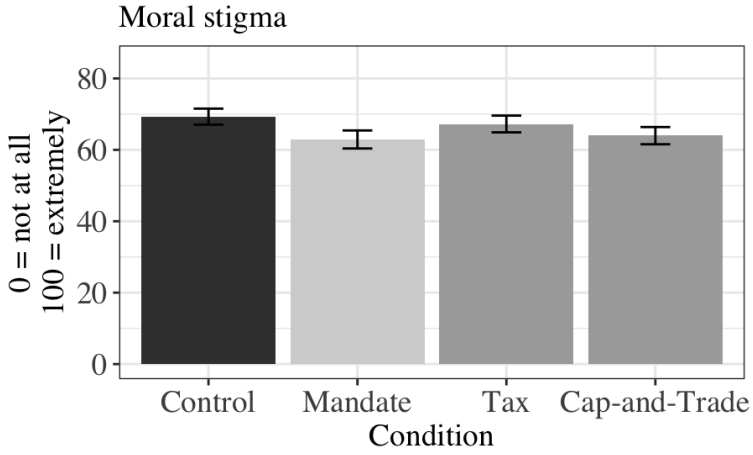
On harm, the control group did not differ from the mandate group. Surprisingly, however, the control group reported malzene to be less harmful than the cap-and-trade group (a difference of ~4 points out of 100, $t(1052) = -3.01$, $p = .003$) and than the tax group (a difference of ~4 points out of 100, $t(1048) = -3.05$, $p = .002$) did. See Appendix Figure 2.

On behavioral intentions, the control group reported greater intentions to act than the mandate group (a difference of ~4 points out of 100, $t(871) = 2.30$, $p = .022$), but the difference is not statistically significant after a Bonferroni correction. There were no differences in behavioral intentions between the control and cap-and-trade groups and the control and tax groups. See Appendix Figure 3.

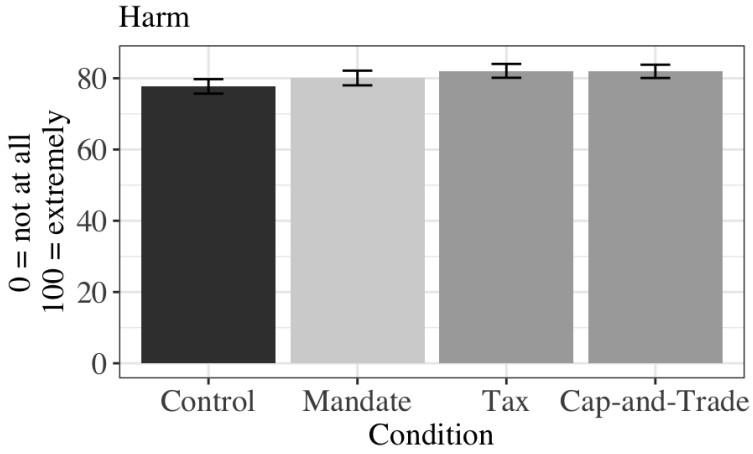
The greater overall moral stigma in the control than the mandate and cap-and-trade groups might not be meaningful—5-6 point swings out of 100 are small—but to the extent that they matter, the finding might lend extra support to the inadequacy aversion hypothesis: Given that there is no regulation in the control group, the added moral stigma the control group reported might be because they felt that the government's response was inadequate. (It is interesting that malzene under the tax looks just as morally bad as under no regulation. If truly due to inadequacy aversion, this finding would imply that people believe taxes to be equivalent to no regulation.)

However, if inadequacy aversion were driving the response, one would expect to see similar and perhaps stronger patterns in behavioral intentions. If the government response is inadequate, people should be extra likely to support additional regulation. This pattern did not materialize. It might just be that these small differences are not very meaningful, and that regulatory frame makes little difference even in comparison to the no-regulation control group.

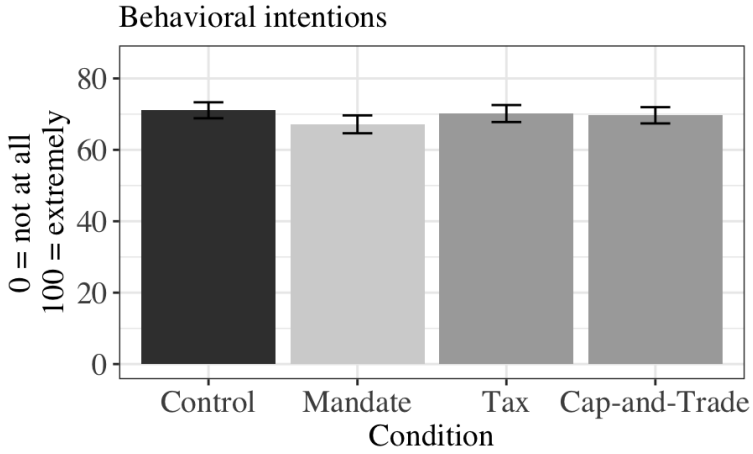
Appendix Figure 1. Moral stigma.



Appendix Figure 2. Perceived harm.



Appendix Figure 2. Behavioral intentions.



A.4. Mechanism Analysis

Why do market-based instruments fail to reduce the moral stigma of pollution here? It may be because of competing effects. The theory is that, with a market-based instrument, an expressive effect might push to reduce the moral stigma of pollution, while an inadequacy-aversion effect and/or a taboo trade-off effect might push to enhance it. This section explores those potential competing effects using a structural equation model (SEM) to simultaneously estimate possible causal paths.[76] This analysis was preregistered as exploratory.

The section proceeds in three sections: First, a path diagram formalizes and walks through the overarching conceptualized theory of competing impulses (Section A.4.1.). Second, a series of regression analyses help select which potential mediation and moderation paths to include in the SEM (Section A.4.2.). Finally, the SEM is conducted using the mediation and moderation paths selected (Section A.4.3.).

A.4.1. Setting the Stage: Conceptualized Theory

Before beginning, it's worth pausing briefly on what mediation analyses are and why SEM is appropriate. Mediation analyses investigate causal pathways: If an independent variable (IV) changes a dependent variable (DV), is it because of the influence of the IV on an intermediary variable (M)? In other words, does the causal path look like this: IV → M → DV?

To investigate, traditional mediation analyses proceed in steps: First, does the IV influence the mediator? Then, is the mediator also associated with a predicted change in the dependent measure (while controlling for the independent variable) (see, e.g., Baron and Kenny 1986)?[77] There is thus a strong causal claim for the first step in the chain (IV

[76] This analysis was preregistered as exploratory.

[77] Step 1 of the Baron & Kenny (1986) approach first searches for an effect from the independent variable (here, regulatory condition) on the dependent variable (moral stigma). Here there is no such effect in the

→ M), because of random assignment of the independent variable. There is only an associational claim for the second (because the mediator is not randomly assigned). Importantly, this means that the analysis evaluates only whether the data are consistent with a particular causal model without making a full causal claim.

SEM does not resolve this issue but is preferable to this step-by-step method because it simultaneously estimates all potential causal paths. As relevant here, it can simultaneously estimate the two predicted parallel mediation paths (an expressive effect path and an inadequacy-aversion path) and moderated mediations (a taboo trade-off effect, and an enhanced expressive effect when participants have greater trust in government).

SEM starts with path diagrams to illustrate the theorized connections between variables. Turning to the theory here, Appendix Figure 4 illustrates the overarching theory of the competing impulses that could be at play here. Across the top is the expressive effect of the law path (red text): The tax or cap-and-trade regulation might make it seems like the government believes malzene is less harmful (Government harm) and thus less morally bad (Government stigma), which may be associated with less moral stigma. This relationship between government stigma and moral stigma is likely stronger the more trust one has in the government (the "Trust in government" moderator).

The bottom paths (blue text) illustrate possible reasons tax or cap-and-trade might increase the moral stigma of pollution. First, the inadequacy aversion mediation path: People may believe that taxes or cap-and-trade regulations are less effective than mandates (Effective), and thus that government should do more (Govt should do more), which may be associated with greater moral stigma and behavioral intentions to push for more action on malzene. Second, there may be a taboo trade-off effect that acts as a moderator: People who believe pollution markets are especially taboo (Norm violation), who dislike these regulatory tools (right tool), or with stronger environmental identities

cap-and-trade analysis. But further mediation analysis is warranted because competing mechanisms might help explain the null effect.

may as a result express greater moral outrage in response to malzene tax or cap-and-trade regulations.[78]

Appendix Table 6 details a list of these potential paths and foreshadows results.

Appendix Figure 4. Simplified path diagram for structural equation model

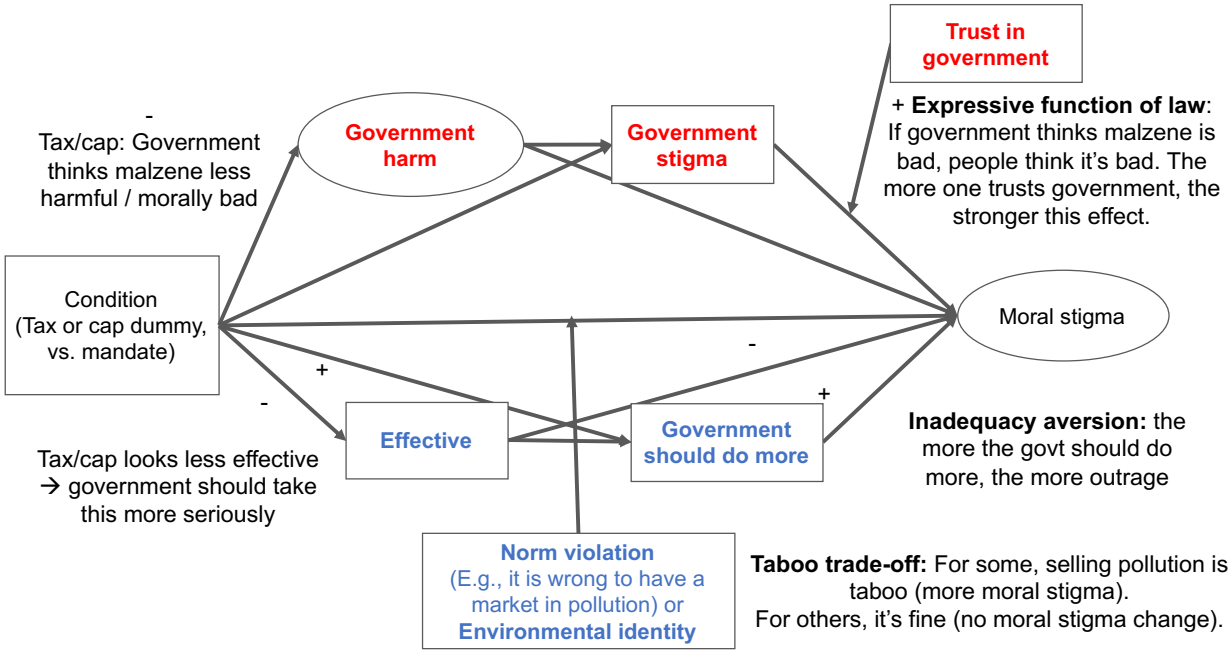


Figure note: Path diagram representing the conceptual model. Single straight arrows on a straight line from one variable X to another Y represent a predicted causal relationship to the variable with the arrow (e.g., condition caused a change in government harm). Mediation paths are thus those that go from one variable to another and then to the dependent measures. Moderators are represented with arrows from the proposed moderators (trust in government, norm violation) into the causal paths they might moderate. Red text represents expressive function of law paths that might reduce the moral stigma of pollution from market-based instruments, while blue text represents countervailing paths that might increase the moral stigma of pollution. Following convention, ovals represent latent variables (constructs inferred with multiple measurements), while rectangles represent observed variables.[79] To reduce complexity, I omit error terms and correlations between variables.

[78] The taboo trade-off effect is not conceptualized as a mediator because it did not seem plausible that learning about tax or cap-and-trade regulations would make people believe that pollution markets are more taboo.

[79] All of the mediators and moderators here are multi-indicator measures, but I fixed those in rectangles as the average of the indicators. I did this for "effective" and "government should do more" because they each had only two indicators. I did this for "norm violation," "government stigma," and "trust in government" because the lavaan package in R does not yet know how to handle latent variable interactions.

Appendix Table 6. Possible causal paths

	Tax paths	**Results**
Expressive effect	Tax --> Govt harm --> Moral Stigma	Excluded in Step 2
	Tax --> Govt stigma --> Moral Stigma	Significant, negative path ***
	Tax --> Govt stigma * Trust in government --> Moral Stigma	Low trust: Significant, positive path *** High trust: Significant, negative path ***
	Tax --> Govt harm --> Govt stigma --> Moral Stigma	Excluded in Step 2
	Tax --> Govt harm --> Govt stigma * Trust in government --> Moral Stigma	Excluded in Step 2
Inadequacy aversion	Tax --> Effective --> Moral Stigma	Significant positive path **
	Tax --> Govt should do more --> Moral Stigma	Significant positive path **
	Tax --> Effective --> Govt should do more --> Moral Stigma	Significant negative path ** (contrary to prediction)
Taboo trade-off	Norm violation * tax	Excluded in Step 2
	Environmental identity * tax	Excluded in Step 2

	Cap-and-trade paths	**Results**
Expressive effect	Cap --> Govt harm --> Moral Stigma	Excluded in Step 2
	Cap --> Govt stigma --> Moral Stigma	Significant, negative path ***
	Cap --> Govt stigma * Trust in government --> Moral Stigma	Low trust: Significant, positive path *** High trust: Significant, negative path ***
	Cap --> Govt harm --> Govt stigma --> Moral Stigma	Excluded in Step 2
	Cap --> Govt harm --> Govt stigma * Trust in government --> Moral Stigma	Excluded in Step 2
Inadequacy aversion	Cap --> Effective --> Moral Stigma	Excluded in Step 2
	Cap --> Govt should do more --> Moral Stigma	Significant positive path **
	Cap --> Effective --> Govt should do more --> Moral Stigma	Excluded in Step 2
Taboo trade-off	Norm violation * cap	Excluded in Step 2
	Environmental identity * cap	Excluded in Step 2

A.4.2. Variable Selection

It does not make sense to test the full complex model if it is already evident that some of the paths do not operate as conceptualized. Thus, two sets of regression analyses help select which potential mechanisms to include in the structural equation model. Only if two conditions are met is a potential mediator included in the SEM: if (1) condition influences the mediator and (2) the mediator is associated with moral stigma in the conceptualized direction. Moderators are included if they have the conceptualized moderation effect. For the ultimate analysis, SEM is preferable to this type of step-by-step regression (the traditional Baron & Kenny approach) because SEM simultaneously

estimates multiple mediation paths (R. M. Baron and Kenny 1986; Hoyle and Smith 1994; Iacobucci, Saldanha, and Deng 2007).[80]

First, did condition influence the predicted mediators? *Expressive effect*: Both tax and cap-and-trade participants believed the government found malzene less harmful (Govt harm) and less morally bad (Govt stigma) than mandate participants did. Cap-and-trade made a greater impact than tax did: Moving from a mandate to cap-and-trade resulted in a 0.30 drop in standard deviation on the Govt harm variable and 0.24 drop in the Govt stigma variable, while moving from a mandate to tax resulted in a 0.18 standard deviation drop in the Govt harm variable and a 0.13 drop in the Govt stigma variable. See Appendix Table 7, Regressions 1, 2, 5, 6.

Inadequacy aversion: Both tax and cap-and-trade participants thought the regulations less effective than mandate participants found theirs (effective), and both sets of market-based regulation participants felt that the government should do more (Govt should do more). Both market-based instruments had a larger impact on the effective variable: Moving to a tax led to a 0.50 standard deviation decrease in the effective variable and to a cap-and-trade to a 0.41 decrease. Moving to a tax led to only a 0.13 standard deviation increase in the Govt should do more variable and to a cap-and-trade program to a 0.20 increase in the same variable. See Appendix Table 7, Regressions 3, 4, 7, and 8.

[80] The analysis compares the covariance structure predicted by the conceptual model to the observed covariance structure to arrive at model fit indices.

Appendix Table 7. Influence of condition on predicted mechanisms (full information maximum likelihood to handle missing values)

	Tax				Cap-and-trade			
	Govt harm (scaled)	Govt stigma (scaled)	Effective (scaled)	Govt should do more (scaled)	Govt harm (scaled)	Govt stigma (scaled)	Effective (scaled)	Govt should do more (scaled)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market-based instrument	-0.18**	-0.13**	-0.50***	0.13**	-0.30***	-0.24***	-0.41***	0.20**
(vs. mandate)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
N	958	958	958	958	981	981	981	981

Notes: Significant at ***1%, **5%, *10% levels. Dependent measures are standardized to have a mean of 0 and standard deviation of 1. Regressions were estimated using full information maximum likelihood(using the lavaan package in R) to handle missing values and bootstrapped standard errors. Government harm and government stigma are latent variables.

Next, did the mediators and moderators predict moral stigma as predicted? Each analysis (tax vs. mandate and cap-and-trade vs. mandate) included three sets of regressions: One with the tax or cap-and-trade condition alone (Regressions 1 and 4 in Appendix Table 8); one with all of the mediators that survived the first step above, including an interaction between trust in government and regulatory stigma, and with norm violation (people's beliefs that markets in pollution are wrong) as a moderator to test a taboo trade-off effect (Regressions 2 and 5 in Appendix Table 8); and finally one with all of the same mediators and the same Trust x Government stigma interaction, but with environmental identity as the moderator to test a taboo trade-off effect (Regressions 3 and 6 in Appendix Table 8). All continuous variables are standardized.

Expressive effect: For both analyses, government harm falls out at this step because it is not significantly associated with greater moral stigma (for the cap-and-trade analysis, there's a marginal association, but in the opposite direction as conceptualized). For both analyses, greater beliefs that the government thought malzene was morally bad (Government stigma) was associated with more moral stigma, and this relationship was stronger when participants reported more trust in the government (the interaction effect of Government stigma and Trust in government was significant). The association

appeared relatively meaningful: a one standard deviation change in Government stigma was associated with 0.29-0.33 standard deviation change in moral stigma. See Appendix Table 8.

Inadequacy aversion: For the tax analysis, greater regulatory effectiveness was associated with less moral stigma, and greater beliefs that the government should do more was associated with more moral stigma. Contrary to Step 1, the role of effectiveness here was smaller while the role of government should do more was greater: A one standard deviation increase in effectiveness corresponded to a 0.12-0.13 of a standard deviation drop in moral stigma, while the same change in Government should do more was associated with a 0.43-0.44 increase. See Appendix Table 8.

For the cap-and-trade analysis, regulatory effectiveness in one specification (with norm violation as a moderator) was not associated with moral stigma, and in the other (with environmental identity as the moderator) was associated with moral stigma, but with a small effect (a 0.06 of a standard deviation fall in moral stigma). As predicted, greater beliefs that the government should do more was associated with more moral stigma. Similar to the tax analysis, a one-standard deviation increase in this variable was associated with a 0.45-0.47 of a standard deviation increase in moral stigma. See Appendix Table 8. To be comprehensive, both a SEM with and without effectiveness are estimated. The model without effectiveness fit the data better and so is used going forward.[81]

Taboo trade-off: The regressions failed to find evidence of a taboo trade-off interaction effect. People who expressed greater outrage to markets in pollution (Norm violation) or stronger environmental identities (Environmental identity) were not more likely to find pollution morally worse in the tax or cap-and-trade conditions. See Appendix Table 8. These moderators are excluded going forward.

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[81] Model fit indices for the model including effectiveness: $\chi^2(21, N = 981) = 133.67$, $p < .001$; CFI = .953; TLI = .920; RMSEA = 0.074; SRMR = 0.054.

Model fit indices for the model without effectiveness: $\chi^2(17, N = 981) = 69.01$, $p < .001$; CFI = .977; TLI = .962; RMSEA = 0.056; SRMR = 0.044.

Appendix Table 8. Influence of mechanisms on the stigma of pollution (full information maximum likelihood to handle missing values)

	Morally bad to pollute (higher = worse; standardized)					
	Tax vs. mandate			Cap-and-trade vs. mandate		
	(1) SEM	(2) SEM	(3) SEM	(4) SEM	(5) SEM	(6) SEM
Market-based regulation	0.14**	0.08	0.06	0.04	0.01	-0.02
(vs. mandate)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
Government harm (scaled)		0.05	0.05		-0.06	-0.07**
		(0.04)	(0.04)		(0.04)	(0.04)
Government stigma (scaled)		0.29***	0.30***		0.30***	0.33***
		(0.04)	(0.03)		(0.04)	(0.04)
Trust in government (scaled)		-0.00	-0.03		-0.02	-0.04
		(0.03)	(0.03)		(0.03)	(0.03)
Govt stigma (scaled) * Trust (scaled)		0.10***	0.11***		0.11***	0.12***
		(0.03)	(0.03)		(0.03)	(0.03)
Effective (scaled)		-0.12***	-0.13***		-0.03	-0.06**
		(0.03)	(0.03)		(0.03)	(0.03)
Govt should do more (scaled)		0.43***	0.44***		0.45***	0.47***
		(0.03)	(0.03)		(0.03)	(0.03)
Norm violation (scaled)		0.12**			0.12**	
		(0.04)			(0.04)	
Market reg * Norm (scaled)		0.04			0.04	
		(0.05)			(0.05)	
Environmental identity (scaled)			0.09**			0.09**
			(0.04)			(0.04)
Market reg * Env identity (scaled)			0.02			-0.01
			(0.05)			(0.05)
N	958	958	958	981	981	981

Notes: Significant at ***1%, **5%, *10% levels. Continuous regressors are standardized to have a mean of 0 and standard deviation of 1. Regressions were estimated using full information maximum likelihood(using the lavaan package in R) to handle missing values and bootstrapped standard errors. The dependent variable (moral stigma) and government harm are latent variables.

A.4.3. Structural Equation Model

The selection process resulted in two conceptual models represented in Appendix Figure 5 (for tax versus mandate) and Appendix Figure 6 (for cap-and-trade versus mandate). For the tax analysis, this included one moderated mediation path for the expressive function of law path (government stigma interacted with trust in government) and two for the inadequacy aversion path (effective and government should do more). See Appendix Figure 4. For the cap-and-trade analysis, this included a moderated mediation path for the expressive function of law (government stigma interacted with trust in government) and one mediator for the inadequacy aversion path (government should do more). See Appendix Figure 6.

I used the lavaan package (version 0.6-16) in R to fit these two predicted models to estimate coefficients for each relationship and used bootstrapped standard errors. To facilitate effect size comparisons, all continuous variables, including the moral stigma dependent measure, are standardized to have a mean of 0 and standard deviation of 1.

Tax analysis: The model fit the data well on most measures,[82] and the indirect paths were significant and in the conceptualized directions. See Appendix Figure 5. On the expressive effect path, the data are consistent with the hypothesis that tax reduced the moral stigma of pollution by making participants believe that the government thought malzene was not as morally bad (Government stigma).[83]

Following David Kenny, this analysis uses these benchmarks for effect sizes: .01 for small, .09 for medium, and .25 for large effect sizes.[84] The main effect was relatively small: A 1 standard deviation change in Government stigma from moving to a tax was

[82] $\chi^2(17, N = 958) = 2531.78$, $p < .001$; CFI = .989; TLI = .976; RMSEA = 0.042; SRMR = 0.031.

[83] Indirect effect of Tax on Moral stigma through Government stigma (main effect): B = -0.04, SE = 0.02, p = .038.

[84] Cohen's d traditional benchmark is 0.1 for small, 0.3 for medium, and 0.5 for large effect sizes for correlation coefficients, which Kenny recommends squaring because indirect effects are the product of two effects ("Mediation Page (David A. Kenny)" n.d.)). Note that these Cohen's d benchmarks are for correlation coefficients; the 0.2 for small, 0.5 for medium, and 0.8 for large effects are for mean differences.

associated with a drop of .04 of a standard deviation in moral stigma. But there was a larger effect for those with greater trust in government: At high levels of Trust (one standard deviation above the mean), the indirect effect was -.19, close to a large effect, and it was .10 at low levels of Trust.[85]

Both inadequacy aversion mediators also separately fit the conceptualized pattern, increasing moral stigma. The tax made the malzene regulation appear less effective, and less effective regulations correlated with greater moral stigma (but not directly stronger behavioral intentions).[86] Again, the effect was relatively small: A one standard-deviation change in effectiveness from a move to tax was associated with a 0.06 increase in standard deviation in moral stigma. Likewise, the malzene tax led participants to greater reports that the government should do more, which was associated with greater moral stigma and greater behavioral intentions.[87] This indirect path was larger, a medium effect: A one-standard deviation change in Government should do more from a move to tax was associated with a 0.11 increase in standard deviation in moral stigma. The indirect serial mediation path (from tax to effective to government should do more) was in the opposite direction as predicted. More effective regulations correlated in the model with *greater* reports that government should do more, resulting in a statistically significant *negative* serial mediation path with an effect size of -0.05.[88] This is not an implausible relationship: The more effective people believe government regulation is, the more they might believe the government should engage in more regulation.

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[85] At high of policymaker trust (one standard deviation above the mean), the indirect effect of Tax on Moral stigma through Government stigma: B = -0.19, SE = 0.09, p = 0.034.

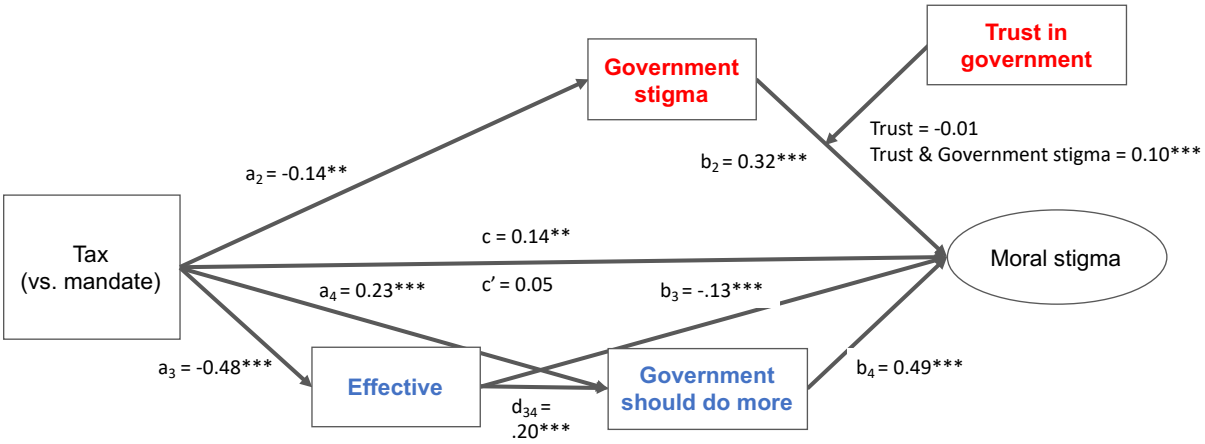
At low of policymaker trust (one standard deviation below the mean), the indirect effect of Tax on Moral stigma through Government stigma: B = 0.10, SE = 0.05, p = 0.034.

[86] Indirect effect of Tax on Moral stigma through Effective: B = 0.06, SE = 0.02, p < .001.

[87] Indirect effect of Tax on Moral stigma through Government should do more: B = 0.11, SE = 0.03, p < .001.

[88] Indirect effect of Tax on Moral stigma through Effective, then through Government should do more: B = -0.05, SE = 0.01, p < .001. This path is contrary to prediction.

Appendix Figure 5. SEM: Tax vs. Mandate



Note: Path diagram representing the conceptual model tested after excluding proposed mechanisms that were unaffected by the tax, that did not correlate with moral stigma (government harm), or did not have the proposed interaction effect (norm violation, environmental identity). Single straight arrows on a straight line from one variable X to another Y represent a predicted causal relationship to the variable with the arrow (e.g., condition caused a change in government harm). Mediation paths are thus those that go from one variable to another and then to the dependent measures. Moderators are represented with arrows from the proposed moderators (trust in government, norm violation) into the causal paths they might moderate. Red text represents expressive function of law paths that might reduce the moral stigma of pollution from market-based instruments, while blue text represents countervailing paths that might increase the moral stigma of pollution. Following convention, ovals represent latent variables (constructs inferred with multiple measurements), while rectangles represent observed variables.[89] The Trust in government variable is a moderator and, per convention, is represented as an arrow pointing into the relationship it moderates (Government stigma to Moral stigma). Moderation relationships are interactions (Government stigma * Trust in government, or, equivalently, Government stigma + Trust in government + Government stigma:Trust in government). Thus, both the coefficient for Trust in government and for the interaction are reported. To reduce complexity, I omit error terms and correlations between variables.

Cap-and-trade analysis: The model fit the data well on most measures,[90] and the indirect paths were significant and in the conceptualized directions. See Appendix Figure 6. On the expressive effect path, the data are consistent with the hypothesis that cap-and-trade reduced moral stigma by making participants believe that the government

[89] All of the mediators and moderators here are multi-indicator measures, but those in rectangles are fixed as the average of the indicators instead of being coded as latent variables. This was done for "effective" and "government should do more" because they each had only two indicators. This was done for "government stigma," and "trust in government" because the lavaan package in R does not yet know how to handle latent variable interactions.

[90] $\chi^2(17, N = 981) = 69.01$, $p < .001$; CFI = .977; TLI = .962; RMSEA = 0.056; SRMR = 0.044.

thought malzene was not as morally bad (Government stigma).[91] The positive relationship between perceptions of Government attitudes (Government stigma) and participant attitudes (Moral stigma) was stronger for participants with greater trust in government (Trust in government); indeed, at low levels of trust in government, there was a negative relationship between government stigma and moral stigma.[92] At average levels of trust, this was a close to medium indirect effect (-.08 standard deviation change in moral stigma). At high levels of trust, however, this was a large effect (-.34 standard deviation change in moral stigma).

On the inadequacy aversion path, the data are consistent with the hypothesis that cap-and-trade increased the moral stigma of malzene pollution by making participants more apt to believe that the Government should do more.[93] The indirect effect size was around .10 standard deviations in moral stigma, a medium effect size.

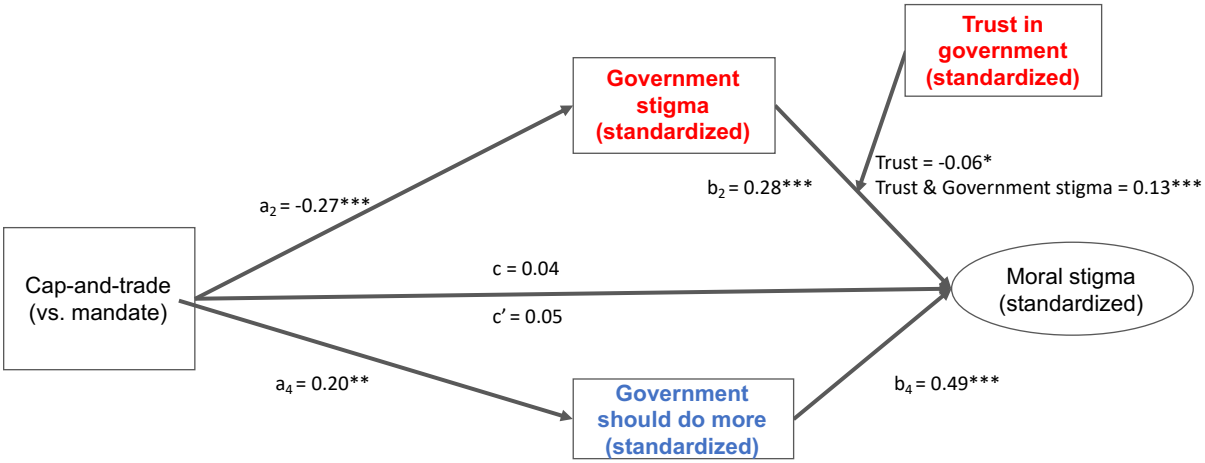
[91] Indirect effect of Cap on Moral stigma through Government stigma (at average levels of trust in government): $B = -0.08$, $SE = 0.02$, $p < .001$.

[92] At high of policymaker trust (one standard deviation above the mean), the indirect effect of Cap on Moral stigma through Government stigma: $B = -0.34$, $SE = 0.08$, $p < 0.001$.

At low of policymaker trust (one standard deviation below the mean), the indirect effect of Cap on Moral stigma through Government stigma: $B = 0.19$, $SE = 0.05$, $p < 0.001$.

[93] Indirect effect of Cap on Moral stigma through Government should do more: $B = 0.10$, $SE = 0.03$, $p = .001$.

Appendix Figure 6. SEM: Cap and Trade vs. Mandate



Note: The Trust in government variable is a moderator and, per convention, is represented as an arrow pointing into the relationship it moderates (Government stigma to Moral stigma). Moderation relationships are interactions (Government stigma * Trust in government, or, equivalently, Government stigma + Trust in government + Government stigma:Trust in government). Thus, I report both the coefficient for Trust in government and for the interaction.

One might worry that the greater expressions of moral outrage that appear due to an inadequacy-aversion effect might simply be an *expression* that the moral stigma of pollution is greater, untethered to actual feelings of moral stigma. The intuition could be: "I don't think malzene is actually morally worse because of the inadequate regulation. Rather, I just want the *government* to think it is morally worse and so will emphasize how morally bad it is." If true, then you might observe a distinction in the sub-indicators for behavioral intentions: People might more strongly agree that they would support more malzene regulation but be less eager to "limit activities in [their] life that cause malzene pollution." But there are no significant differences between those measures across conditions.[94]

[94] Mandate (n = 431, M = 1.31, SD = 22.09) vs. tax (n = 478, M = 0.86, SD = 23.69), difference between support for more regulation and for limiting activities: t(905.96) = 0.30, p = .766. Mandate (n = 431, M = 1.31, SD = 22.09) vs. cap (n = 502, M = 1.62, SD = 25.79), difference between support for more regulation and for limiting activities: t(931) = -0.20, p = .845. [*to redo using full information max likelihood]*

A.5. Demographic Analyses

Appendix Table 9. Influence of demographics on moral stigma, tax vs. mandate *[to redo using full information maximum likelihood to handle missing data]*

	Morally bad to pollute (higher = worse)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tax dummy	4.29***	4.23***	4.19***	4.21***	4.29***	4.19***	5.59***	4.41***	4.13***	4.63***
	(1.53)	(1.53)	(1.52)	(1.53)	(1.53)	(1.53)	(1.49)	(1.49)	(1.44)	(1.42)
Age		0.61								0.71*
		(0.44)								(0.43)
Woman			7.17***							4.35***
			(1.51)							(1.46)
Black				2.92						1.72
				(2.32)						(2.25)
Other race				7.26						6.24
				(6.14)						(5.79)
Hispanic				3.92*						4.65**
				(2.07)						(1.96)
2+ non-Hispanic				3.78						1.31
				(4.80)						(4.42)
Asian				7.72*						10.15**
				(4.34)						(4.10)
Education					-0.37					-2.32***
					(0.72)					(0.75)
Income						-0.32*				-0.28
						(0.18)				(0.18)
Ideology							-5.93***			-3.34***
							(0.67)			(0.85)
Political party								-2.99***		-0.77*
								(0.36)		(0.46)
Environmental identity									10.34***	8.70***
									(0.86)	(0.95)
Constant	62.61***	60.34***	59.09***	61.11***	63.80***	66.00***	79.52***	73.55***	16.00***	39.95***
	(1.10)	(1.99)	(1.32)	(1.24)	(2.58)	(2.17)	(2.20)	(1.69)	(4.02)	(5.71)
N	1,136	1,136	1,136	1,136	1,136	1,136	1,117	1,132	1,129	1,110

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Appendix Table 10. Influence of demographics on moral stigma, cap vs. mandate *[to redo using full information maximum likelihood to handle missing data]*

	Morally bad to pollute (higher = worse)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cap	1.29	1.29	0.98	1.40	1.30	1.44	1.67	1.14	0.43	0.65
	(1.56)	(1.56)	(1.55)	(1.56)	(1.56)	(1.55)	(1.53)	(1.52)	(1.50)	(1.47)
Age		0.12								0.17
		(0.44)								(0.44)
Woman			6.94***							3.84***
			(1.55)							(1.49)
Black				1.03						-2.37
				(2.53)						(2.52)
Other race				3.43						-0.31
				(6.30)						(6.04)
Hispanic				5.26**						4.65**
				(2.13)						(2.05)
2+ non-Hispanic				9.16*						5.33
				(5.09)						(4.83)
Asian				-2.16						-1.04
				(4.14)						(3.94)
Education					-1.34*					-2.82***
					(0.72)					(0.77)
Income						-0.63***				-0.44**
						(0.18)				(0.19)
Ideology							-5.99***			-3.55***
							(0.71)			(0.90)
Political party								-2.90***		-1.00**
								(0.37)		(0.48)
Environmental identity									9.66***	8.27***
									(0.92)	(1.00)
Constant	62.61***	62.15***	59.21***	61.37***	66.92***	69.34***	79.69***	73.22***	19.03***	49.81***
	(1.13)	(2.01)	(1.35)	(1.28)	(2.58)	(2.20)	(2.32)	(1.76)	(4.29)	(5.96)
N	1,158	1,158	1,158	1,158	1,158	1,158	1,138	1,155	1,143	1,124

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.