

The Hidden Cost of Soft Paternalism

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Abstract

A carbon tax is widely accepted as the most effective policy for curbing carbon emissions, but is controversial because it imposes costs on consumers. An alternative, “nudge,” approach promises smaller benefits, but with much lower costs. We propose that nudges aimed at reducing carbon emissions could have a pernicious indirect effect if they offer the promise of a ‘quick fix,’ and thereby undermine support for more impactful policies. Substantiating our concern, six experiments, including one conducted with individuals involved in policymaking, show that introducing a green energy default nudge diminishes support for a carbon tax. Consistent with the idea that nudges decrease support for substantive policies by providing false hope that problems can be tackled without imposing significant costs, we show that minimizing the perceived economic cost of the tax and disclosing the small impact of the nudge both eliminate crowding-out without diminishing support for the nudge.

Keywords: environmental policy, carbon taxes, behavioral economics, nudges

The Hidden Cost of Soft Paternalism

The most effective policies for reducing carbon emissions rely on traditional “heavy-handed” government interventions, such as excise taxes, fuel efficiency standards for cars, and subsidies for adopting renewable energy sources. The most comprehensive and effective of these is a carbon tax (or the closely related cap-and-trade approach). Despite growing alarm about climate change, however, carbon taxes are exceedingly rare, and have yet to be implemented in an effective fashion. In contrast, green energy “nudges” are widespread. The most common of these, championed by the company O-Power, provides electric power users in the United States and many other countries with power bills that compare their personal energy use to that of their neighbors. This information has been shown to decrease energy consumption.¹ Another green energy nudge, which involves defaulting consumers to green energy providers, has been shown to increase uptake of such plans.² Because these approaches impose nearly zero costs on consumers, they are popular policy tools.³⁻⁷ More generally, nudges promise positive impacts on a range of problems at lower costs than those associated with standard economic policies.⁸⁻¹⁵

Yet, relying on nudges raises the potential for behavioral spillovers that may ultimately undermine their effectiveness.¹⁶⁻¹⁸ Influencing one aspect of behavior may give people moral license to offset their behavior elsewhere.¹⁹ For example, residents who were nudged to decrease their water consumption increased their use of electricity.²⁰ In fact, merely reminding people of their own past actions to reduce energy consumption has been found to decrease support for government action on climate change.²¹ Other research has found that giving people a sense of making even minor progress toward tackling problems can diminish their motivation to do more.²²

We propose that nudges can also interact with more substantive policies in an indirect fashion: by reducing support for them. In fact, as we show, the simple consideration of a

green energy nudge can “crowd-out” support for more effective, but also more burdensome, environmental policies. Policymakers keen on the appearance of tackling climate change and voters concerned about the costs of policies such as carbon taxes may rely on nudges as alternatives, rather than low-cost complements, to traditional policies. The actual or potential implementation of a nudge may thereby reduce the likelihood that a more impactful policy will be implemented. This subtle downside of nudges has been debated, but remains untested empirically.^{23,24} Here, we provide the first experimental evidence that such crowd-out occurs, focusing mainly on policies aimed at reducing carbon emissions.

The six experiments we report have four main objectives. First, and most importantly, we test whether exposing survey respondents to the potential for a green energy nudge diminishes their support for a carbon tax. While passing a nudge to reduce carbon emissions may be preferable to taking no action, the nudge can backfire if it undermines support for the more effective intervention. Second, we examine respondents’ beliefs about the relative effectiveness of the two interventions. Surprisingly, we find that the average survey participant, including some with public policy experience, view green energy nudges as comparably effective to, or in some cases even more effective than, a carbon tax when it comes to combating climate change. Although this exaggerated belief in the effectiveness of green energy nudges can help explain how and why they diminish support for taxes, we find that crowd-out occurs not only for those who believe that nudges are more effective, but also those who recognize that taxes are more effective. In all our studies, we further examined whether crowding-out is more pronounced for some demographic groups, for example those less supportive of government mandates, those who believe the carbon tax to be less effective, or those who are more skeptical of the existence of climate change. We find no systematic differences and report these additional analyses in the Supplementary Information.

The experiments are also designed to rule out artifactual explanations, further test the causes of crowd-out, and test the generalizability of this phenomenon to policies outside of

the domain of climate change. To rule out the possibility that the crowd-out effect we observe is specific to nudges and more substantive policies, Studies 3 and 4 include experimental conditions that test whether the existence of a substantive policy reduces support for a nudge. If our explanation that the nudge is perceived as a low-cost substitute is correct, then the option to tax should not influence support for the nudge. We also examine whether a nudge in one domain affects support for more substantive policies in a different domain (Study 2).

Although our main interest is in a nudge's potential to sway the general public on substantive issues, we also examined whether a similar effect might occur among those more directly involved with implementing policy. To this end, we replicate Study 3A with policy school graduates, about half of whom reported experience influencing public policy.

Our final study provides a more direct test of the mechanisms that may underlie the effect. If people are motivated to exaggerate the impact of the nudge, then correcting this belief should reduce or eliminate crowding-out. Similarly, if crowd-out occurs because the tax is seen as burdensome, then highlighting that funds can be used to offset other taxes should mitigate the effect. The finding that both of these interventions do reduce crowding-out provides insight into how it could be countered.

Experimental Results

Study 1

In Studies 1A and 1B, we introduced participants (1A: $N = 201$, 49.75% female, mean age 34.70; 1B: $N = 800$, 56.12% female, mean age 35.69) to a nudge defaulting residential consumers into a renewable energy plan²⁵ and a \$40 per ton carbon tax.²⁶ Participants were randomized to a hypothetical decision to implement the tax vs. doing nothing (single implementation), or a decision to implement the tax, nudge, both, or neither (joint

implementation). The difference in support for the carbon tax will serve as our measure of crowding-out. In Study 1B, we added a second experimental intervention in which we framed the tax as more painful, making salient higher costs for half the respondents. This additional manipulation allows us to see whether crowding-out depends on the perceived burden imposed by the tax.

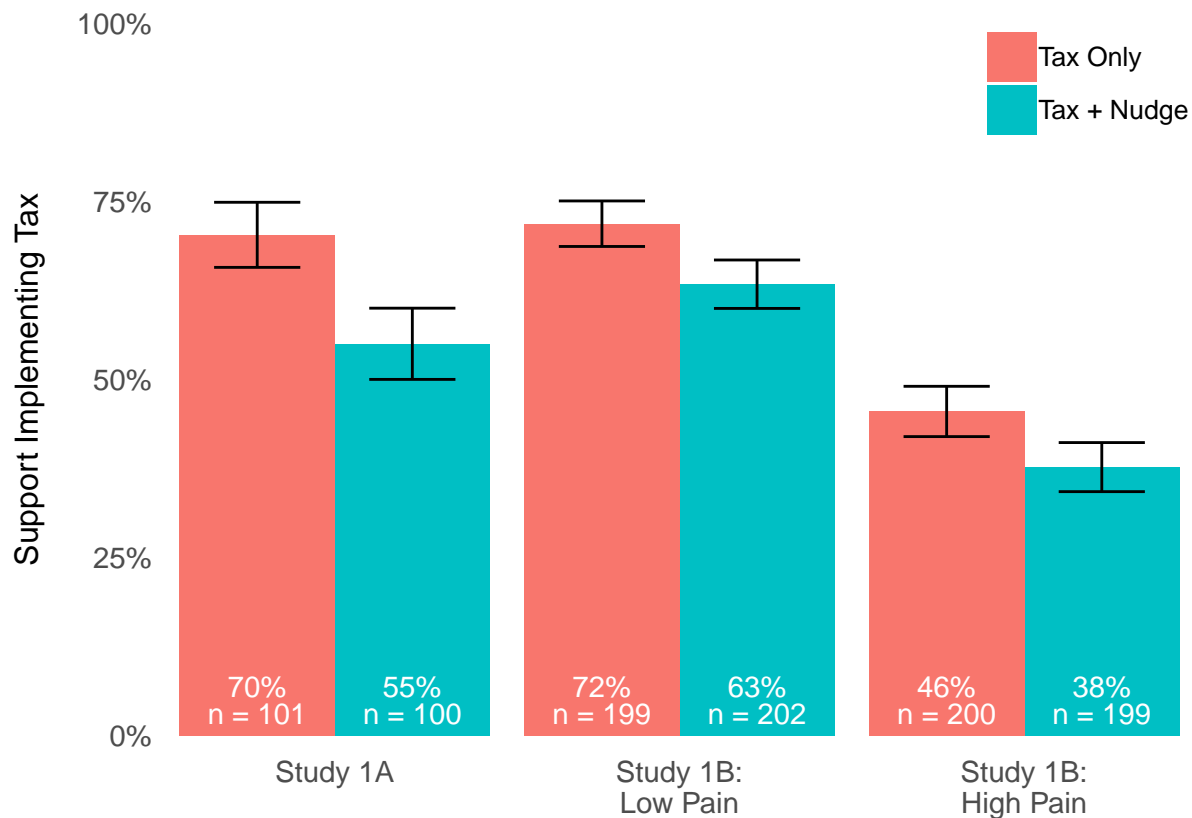


Figure 1. Introducing a green energy nudge into the choice set crowds-out support for the carbon tax (Study 1A). We replicate the findings in Study 1B and show that they hold when the carbon tax is framed as more burdensome. Error bars show \pm one standard error.

Figure 1 shows the level of support for the carbon tax (or both the tax and the nudge) in both studies. When participants can implement only the carbon tax, support for it is high (70.30%). However, when a green energy nudge becomes available to implement, far fewer respondents favor implementing either the tax only or both policies (55.00%, $t(197.23) = 2.26$, $p = .025$). For this and all other statistical analyses, we report two-tailed

test statistics.

The “low-pain” condition in Study 1B is a direct replication of Study 1A. When the nudge is unavailable, 71.86% support implementing the tax, whereas only 63.37% do when the nudge is introduced ($t(397.85) = 1.82, p = .069$). When we frame the tax as more painful (“high-pain”), highlighting that it will increase the cost of basic necessities such as transportation and heating, we observe a drop in support compared to the low-pain framing, both without the nudge (45.50%, $t(393.33) = 5.54, p < .001$) and with it (37.69%, $t(398.83) = 5.31, p < .001$). In this more painful framing, crowding-out is only directional, but no longer significant ($t(396.81) = 1.58, p = .114$). In a regression specification (see Supplementary Information, also for following studies), we observe a main effect of introducing the nudge into the choice set ($p = 0.017$) as well as the High Pain framing ($p < 0.001$), but no interaction between the framing and the introduction of a nudge ($p = 0.821$).

Furthermore, in Study 1A, the carbon tax was perceived as more painful than the green energy nudge ($M_{tax} = 2.61, SD_{tax} = 1.11$ vs. $M_{nudge} = 1.62, SD_{nudge} = 0.85$, $t(200) = -11.78, p < .001$, using a paired two-sample t-test). See Table 1 for summary statistics of these perceived painfulness and effectiveness measures for both nudge and tax policies across all studies. Unexpectedly, however, we find no difference in the perceived efficacy of the two policies ($M_{tax} = 3.16, SD_{tax} = 1.19$ and $M_{nudge} = 3.23, SD_{nudge} = 1.01$, $t(200) = 0.86, p = .390$), even though a tax would be substantially more effective at reducing carbon emissions.

Studies 1A and 1B support our central hypothesis that a green energy nudge can crowd-out support for a more effective carbon tax. Crowd-out does not appear to be moderated by the severity of the tax,.

Study 2

To rule out the possibility that the results of Studies 1A and 1B arose not from crowd-out, but from respondents' aversion to implementing more than one policy,^{27,28} in Study 2, some survey respondents were presented with a nudge in the retirement domain paired with a carbon tax. The crowd-out account predicts no effect on support for a policy of introducing a nudge in a different domain. Participants ($N = 802$, 53.74% female, mean age 35.54) read either about the green energy nudge or a nudge defaulting employees into an employer-sponsored pension plan. Both groups then read about the painfully framed carbon tax policy from Study 1B. In both conditions, as in Studies 1A and 1B, half the participants again could only implement the carbon tax (vs. nothing) and the other half could implement the tax, the nudge, both, or nothing.

As before, we find high support for the carbon tax when participants could implement the carbon tax but not a nudge (45.05% of participants supported the tax when they read about the green energy nudge and 43.72% when they read about the retirement savings nudge, $t(398.94) = -0.27$, $p = .789$). When we introduced the relevant green energy nudge into the choice set, we replicate our prior result and find a reduction in support for the tax (26%, $t(394.74) = 4.06$, $p < .001$). When the nudge available for implementation is in the retirement savings domain, however, we find no similar displacement (44.28%, $t(397.97) = -0.11$, $p = .910$). Regressions (see Supplementary Information) show that there is indeed a significant interaction: crowding-out occurs only when both policies are in the environmental domain ($p < 0.001$).

Study 3

Studies 3A and 3B adopt a different methodology to test for crowd-out. Instead of asking respondents about their support for different configurations of policies, Studies 3A

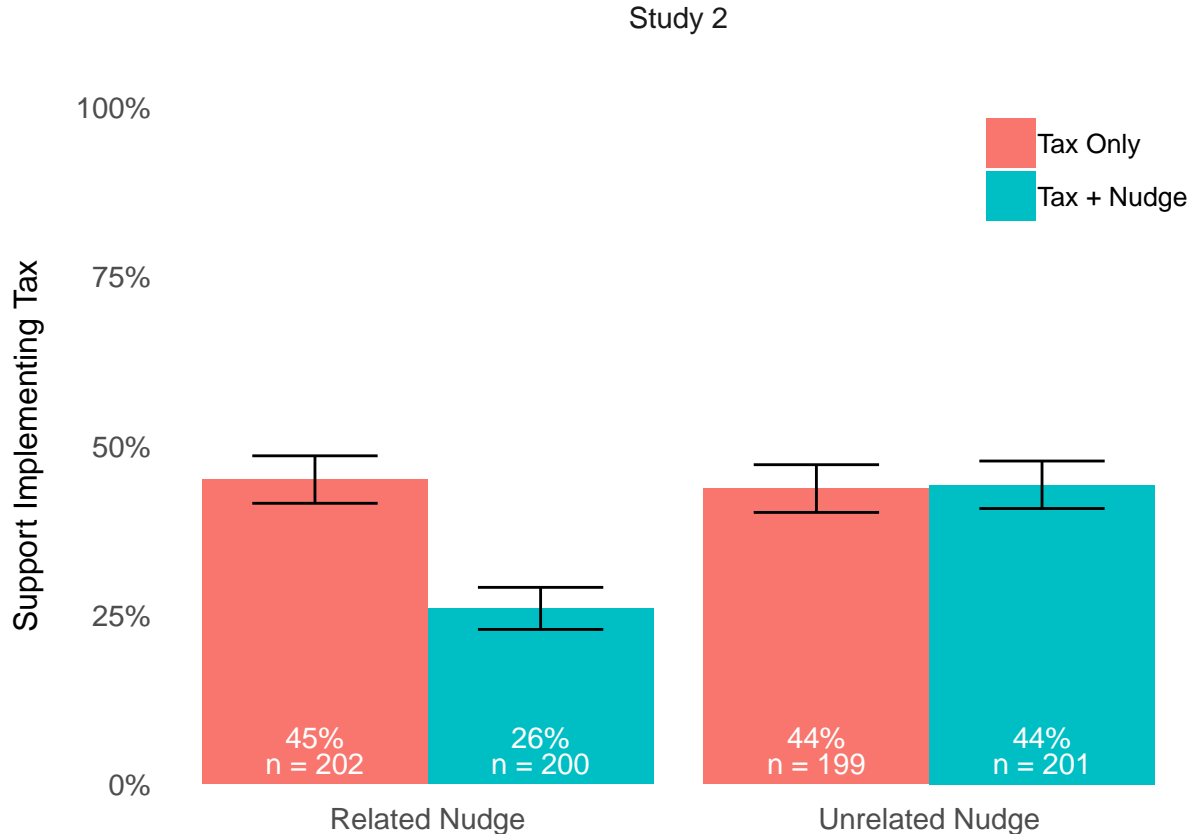


Figure 2. When the nudge tackles a different policy problem than the tax, we observe no crowding-out. When the policies are related, we replicate the findings from Studies 1A and 1B. Error bars show \pm one standard error.

and 3B test whether asking their opinion about support for a nudge first leads to diminished support for a tax. In addition, to test the robustness of the crowd-out effect across policy domains, we test whether a nudge to promote retirement savings (a 401(k) default nudge) diminishes support for a more heavy-handed policy: expanding the social security tax. In Study 3B, we also extend our results to alumni of a public policy school, many of whom report involvement with policymaking. This allows us to generalize our finding to a sample of experts who have more informed policy views and who, consequently, might be less susceptible to being influenced by the availability of a nudge.

In Study 3A, we randomly assigned participants ($N = 1208$, 55.96% female, mean age 36.19) to conditions in a between-subjects 2×3 design. Participants were presented either

with the green energy nudge and the low-pain carbon tax from Study 1 (“Environment”) or a 401(k) savings default nudge and an expansion of social security (“Retirement”). As a different approach to testing for crowding-out, we varied whether participants first learned about the nudge and got the choice to implement it before doing the same with the tax (“Nudge First”), vice versa (“Tax First”), or learned about both policies before having the opportunity to implement either one, both, or neither as in our previous studies (“Joint Implementation”). We preregistered the study design, hypotheses, and analyses on AsPredicted.org.

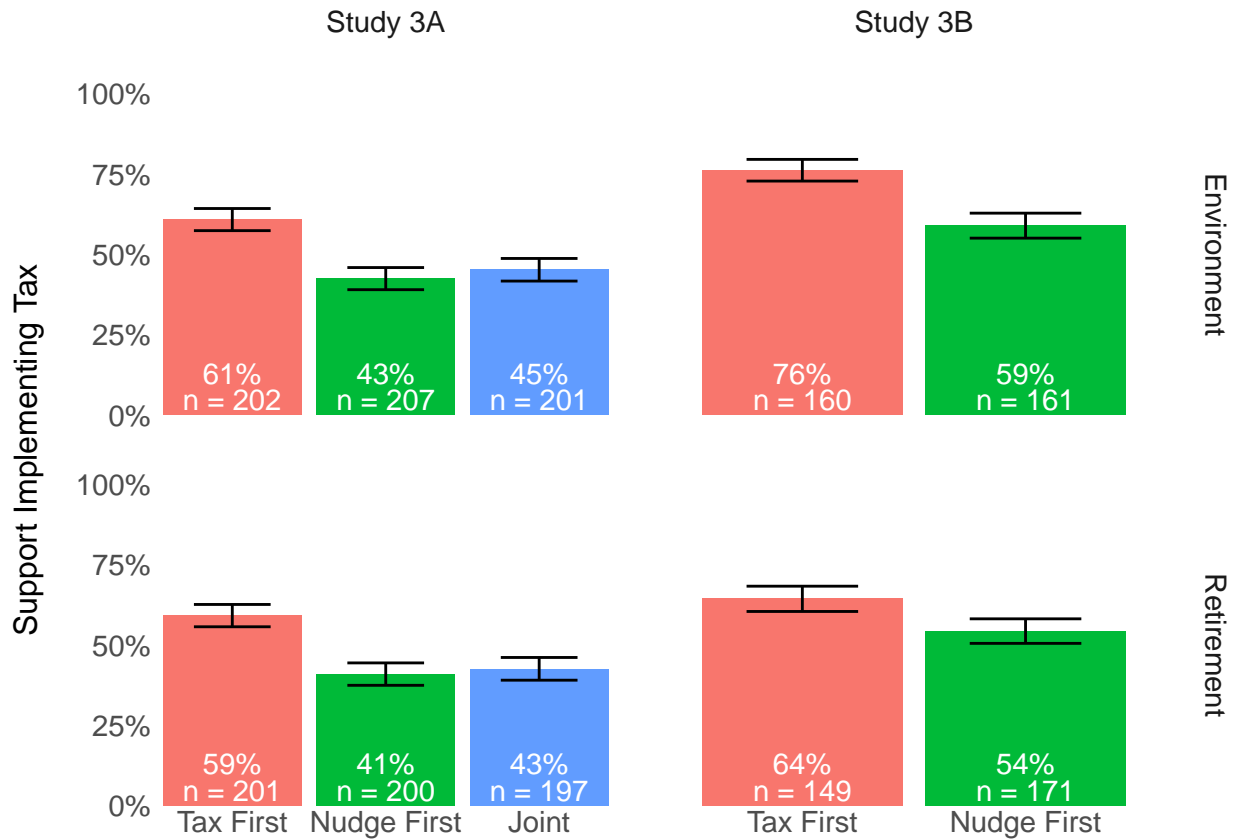


Figure 3. When participants make sequential implementation decisions, choosing whether to implement the nudge first reduces support for the tax similarly to the joint implementation decision previously (Study 3A). Our findings replicate with a sample trained in public policy (Study 3B) and occur in both the environment and retirement domains (3A and 3B). Error bars show \pm one standard error.

The left panel of Figure 3 shows the fraction of participants who supported

implementing the tax in the two domains. Beginning with the environmental domain, we observe that support is greatest when the decision to implement the tax was offered first (60.89%) but drops when participants could first implement the nudge (42.51%, $t(406.95) = 3.77$, $p < .001$) or made both decisions simultaneously (45.27%, $t(400.75) = 3.17$, $p = .002$). We observe no difference between the “Nudge First” and the “Joint Implementation” conditions ($t(405.46) = 0.56$, $p = .575$), which suggests that our findings are not merely a result of asking about two policies at once. The results are similar in the retirement domain, which points to the generality of the crowd-out effect. Support for expanding social security is greater when the choice was offered first (59.20%), compared to when the nudge could be implemented first (41%, $t(398.99) = 3.70$, $p < .001$) or when the decision for the two policies was made jointly (42.64%, $t(395.72) = 3.34$, $p = .001$). Here, too, we observe no difference between the last two conditions ($t(394.83) = 0.33$, $p = .741$).

To rule out that respondents were merely averse to implementing two policies on one issue (single-action bias^{27,28}), we examine whether evaluating the more substantive policy first reduces support for the nudge. We find no evidence that it does either in the environmental domain, in which support for the nudge averages 86% across the three conditions ($F(2, 607) = 0.45$, $MSE = 0.12$, $p = .640$) or the retirement domain, in which 75% support the nudge ($F(2, 595) = 0.59$, $MSE = 0.19$, $p = .553$).

For Study 3B, we recruited alumni of a public policy school ($N = 641$, 46.80% female, mean age 46.90). The sample is highly educated (87.99% have a Master’s Degree and 11.86% have a PhD) and 54.13% report holding or having held a position in which they influenced public policy. We preregistered the study design, hypotheses, and analyses on AsPredicted.org.

As with our non-expert sample, we find that respondents in this study thought the carbon tax was more painful than the green energy nudge ($M_{tax} = 2.69$, $SD_{tax} = 1.00$ vs. $M_{nudge} = 1.59$, $SD_{nudge} = 0.83$, $t(620.43) = -15.10$, $p < .001$) and the social security

expansion more painful than a 401(k) nudge ($M_{tax} = 2.44$, $SD_{tax} = 1.02$, vs. $M_{nudge} = 1.53$, $SD_{nudge} = 0.83$, $t(610.57) = -12.40$, $p < .001$). Curiously, this sample believed the carbon tax to be less effective than the green energy nudge ($M_{tax} = 2.96$, $SD_{tax} = 1.05$, vs. $M_{nudge} = 3.12$, $SD_{nudge} = 0.94$, $t(631.90) = 2.06$, $p = .040$), and an expansion of social security to be less effective than the 401(k) savings nudge in promoting retirement savings ($M_{tax} = 2.94$, $SD_{tax} = 1.28$, vs. $M_{nudge} = 3.27$, $SD_{nudge} = 0.98$, $t(596.54) = 3.74$, $p < .001$).

The right panel of Figure 3 shows the fraction of participants who supported implementing either the carbon tax (“Environment”) or expanding the social security tax (“Retirement”). When the tax was presented first, we see greater support for its implementation in both the environmental domain (76.25% vs 59.01%, $t(313.08) = -3.35$, $p = .001$) and in the retirement domain (64.43% vs 54.39%, $t(314.91) = -1.83$, $p = .068$), albeit statistically significant only in the environmental domain. Looking separately at the subset of participants who report applied policymaking experience, we observe significant crowding-out in both domains (both $ps < 0.05$, see Supplementary Information).

Study 4

Finally, in Study 4 we look at two potential mechanisms that could lead to crowding-out. People might believe the nudge to be more effective than it is, or they might be motivated to avoid a painful tax. In two conditions, we present additional information about the nudge and the tax aimed at reducing crowding-out. We preregistered the study on AsPredicted.

In the “Tax First” condition, we ask participants about their support for the carbon tax, followed by their support for the green energy nudge. The three remaining conditions ask about the nudge first, either providing no additional information (“Nudge First”), highlighting the small total effect of the green energy default and that most carbon emissions

are due to other sources (“Nudge Ineffective”), or making the tax appear less costly by highlighting that revenue can be used to offset other taxes (“Tax Attractive”).

Figure 4 shows, in the left panel, that support for the carbon tax declines from 69% to 62% when we change the ordering of the policies from tax-first to nudge-first, a smaller difference than in previous studies that is not statistically significant ($t(387.36) = 1.53$, $p = .126$). Presenting the nudge and its relative ineffectiveness first, however, increases support for the tax significantly (71%, $t(385.69) = -1.99$, $p = .047$), as does highlighting that other taxes could be lowered to offset the additional costs (73%, $t(378.00) = -2.36$, $p = .019$). As before, we observe no difference in support for the nudge across conditions ($F(3, 794) = 1.30$, $MSE = 0.16$, $p = .272$). Notably, although adding information about the impact of the nudge does affect support for the tax, it does not affect support for the nudge (82% and 79%, respectively, $t(394.35) = 0.59$, $p = .556$). See Table 2 for tax and nudge support across conditions.

Discussion

Across six studies, support for a carbon tax declines when a green energy nudge is introduced. In tests reported in the online supplement, we find no consistent heterogeneous treatment effects that would suggest that such crowding-out is more pronounced for those more opposed to government intervention, less certain that climate change is occurring, or who believe the nudge is more effective than the other policy.

It appears that, while people are generally concerned about societal problems such as climate change, they may not be willing to incur large costs to achieve a solution.^{29,30} With the perceived existence of a low-cost solution (a nudge), motivated reasoning may tempt some to exaggerate its ultimately small environmental impact. This may explain why participants generally thought the nudge was as or more effective at reducing pollution than

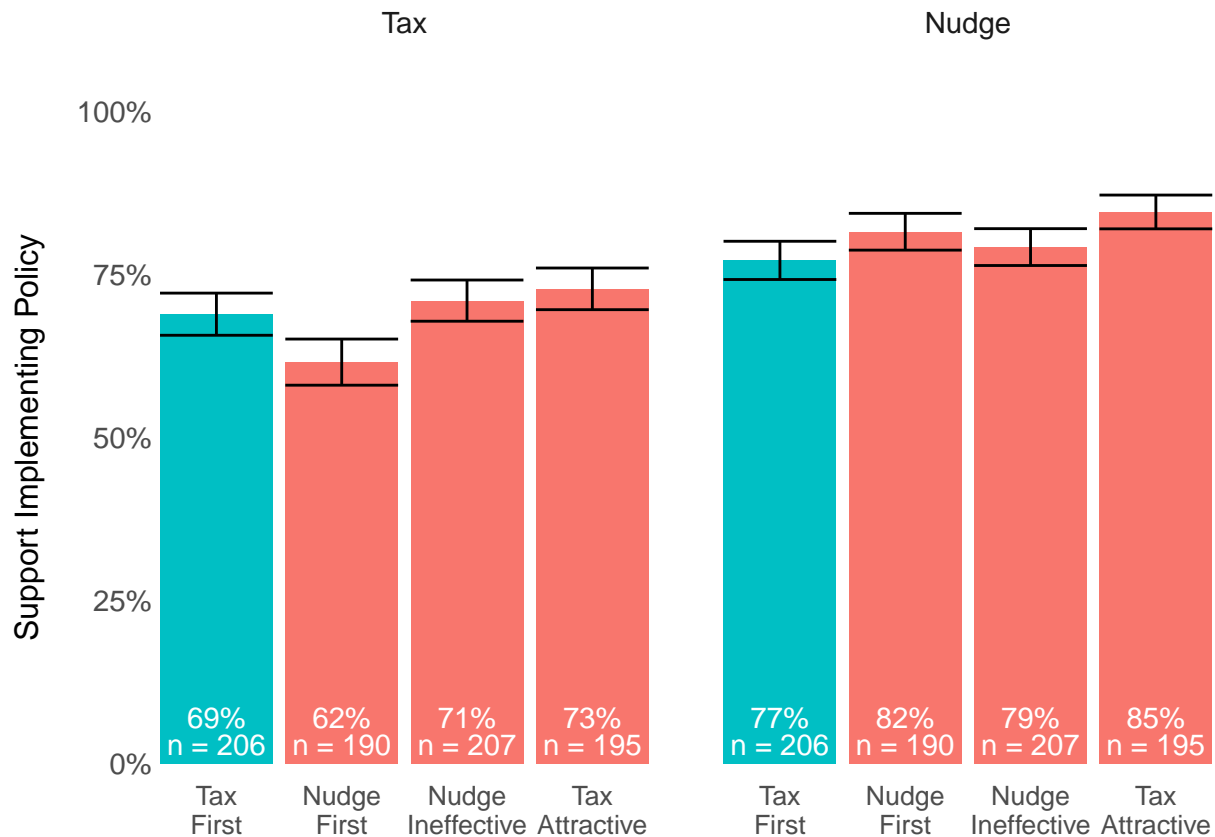


Figure 4. Support for implementing the carbon tax and the green energy default nudge by condition. Being explicit about the nudge’s effect size eliminates crowding-out on the tax, but does not diminish support for the nudge. The same holds when increasing the attractiveness of the nudge. Error bars show \pm one standard error.

the carbon tax. However, even those who knew that the carbon tax is more effective than the green energy nudge were discouraged from implementing the tax when a nudge became available, suggesting that crowding-out is not merely the result of incorrect perceptions of relative effectiveness. When these perceptions are corrected at the time of decision, however, motivated reasoning is difficult and crowding-out disappears.

The effects documented in these studies are likely generalizable beyond the domains of climate change and retirement savings, or nudges and more substantive policies. An information campaign teaching people how they can personally cut their emissions, for example, might be perceived as even less invasive than a green energy nudge and crowd-out

support for the latter.³¹ However, a mere ordering effect cannot explain the presented findings: such an alternative account would suggest that a carbon tax would crowd-out support for the nudge, which was not the case.

The six studies presented respondents with hypothetical decisions, and elicited their support for policies using subjective measures. Although the findings replicated even among participants trained in public policy and among a subset with policymaking experience, we cannot know whether the legislative or regulatory processes involved in crafting and implementing environmental regulation might limit its impact on policy. However, as Reisch and Sunstein write, “public officials are inevitably responsive to what people think,”³² and to that extent, reduced support for a carbon tax may indeed render it less likely to be implemented.

An ideal world would have a place for both nudges and more heavy-handed interventions to combat climate change. However, our results suggest that an effort to deploy both can backfire by reducing the likelihood that the most effective policies will be implemented. Such a policy cost must be accounted for when determining the potential benefit of nudges in combating climate change.³³ Our last study suggests that we may be able to avoid this cost by informing the public that nudges are not a substitute for more substantive policies, even if they are cost-effective. Encouragingly, this disclosure does not diminish support for the nudge, suggesting that it may provide a means for capitalizing on both tools.

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Methods

Experimental materials for all studies are presented in the online appendix.

Studies 1A and 1B

In Study 1A, we recruited 201 participants via Amazon Mechanical Turk for a “Study on Decision Making” that was expected to take 5 minutes to complete and offered a fixed payment of 50 cents. We began by asking participants whether they agreed that global average temperatures had been increasing over the past 50 years (independent of the cause) and, for all but those who strongly disagreed, we asked whether they believed human activity to be the primary cause.

We next presented them with a brief description explaining default nudges. Participants were informed that mandating a default can lead to an option being chosen more frequently, without prohibiting people from choosing differently. We then introduced them to the green energy nudge, using the description from previous work examining attitudes toward this nudge.²⁵ Participants then rated how effective they believed the policy to be at reducing pollution and carbon emission on a 5-point Likert scale from “Not effective

at all” to “Extremely effective.” On the same screen, they also rated how painful they thought the policy would be for someone like them, on a 5-point Likert scale from “Not painful at all” to “Extremely painful.” Next, we introduced them to a \$40/ton carbon tax that would be levied on companies and individuals. This tax was described as capturing the economic costs of carbon emissions.²⁶ Participants then evaluated this policy on the same two dimensions as the nudge.

We then randomly assigned participants to one of two conditions. In the “Tax Only” condition, participants imagining themselves in the role of a policymaker were asked to choose whether to implement the carbon tax policy. They were told that the alternative, if the policy is not implemented, is that no other policy would be implemented. They could then choose to implement the tax or not implement the tax. In the “Tax and Nudge” condition, participants were also asked to imagine themselves as policymakers. However, they had more choices: they could implement the tax, the nudge, both, or neither. They were also told that if neither of the policies were implemented, no other policy would be passed in their place. The survey concluded with basic demographic questions: gender, age, ethnicity, education, and political orientation.

In Study 1B, we recruited 800 new participants via Amazon Mechanical Turk for a five minute study on decision making that paid 50 cents. Participants were randomly assigned to one of four conditions: “Low Pain, Tax Only,” “Low Pain, Tax and Nudge,” “High Pain, Tax Only,” and “High Pain, Tax and Nudge.” The two “Low Pain” conditions were identical to the two conditions reported in Study 1A and are direct replications. The two “High Pain” conditions differed in that they included additional descriptive information about the carbon tax conveying the cost to consumers. In particular, for those in the high cost condition, we point out that this policy would substantially raise the price not just on transportation, but also on heating and air conditioning, on electricity, and on other goods and activities.

Study 2

We recruited 802 participants from Amazon Mechanical Turk for a five minute study on decision making in exchange for a fixed payment of 50 cents. When participants entered the survey, they were informed that they would be asked to evaluate two policies aimed at addressing longstanding problems. Half the participants were then randomly assigned to the “Related Nudge” condition. They first read about the green energy nudge from Study 1A, in which the government would require large electricity providers to enroll consumers into plans with environmentally friendly energy suppliers; but noting that consumers could opt-out if they wished. We then asked them to evaluate how effective the policy would be if it were implemented and how painful it would be for someone like them. Both responses were reported on a 5-point Likert scale from “Not effective (painful) at all” to “Extremely effective (painful).” The other participants were assigned to the “Unrelated Nudge” condition and instead read about a retirement nudge in which large employers would be required to enroll employees into a pension plan, but would allow them to opt out if they wished.²⁵ They, too, evaluated these policies according to their effectiveness and painfulness.

Next, all participants read about the same carbon tax policy: a \$40/ton tax. We used the “High Pain” phrasing from Study 1B, noting that the policy would substantially raise the price on transportation, on heating and air conditioning, on electricity, and on other goods and activities. Participants evaluated this policy, too, on the effectiveness and painfulness dimensions. Finally, participants were asked to imagine themselves as a policymaker and were given a decision to implement a policy. In the “Tax Only” condition, we asked them if they wanted to implement the carbon tax. We noted that no other policy would be passed if they decided not to do so. In the “Tax and Nudge” condition, we offered them four choices: implement the carbon tax only, implement the nudge only, implement both the tax and the nudge, or implement neither the tax nor the nudge. Which nudge participants got to implement depended on which one they had randomly been assigned to

read about: either the green energy nudge or the retirement savings nudge.

Study 3A

In Study 3A, we recruited 1208 participants and randomly assigned them to conditions in a 2×3 between-subjects design. On the first dimension, we varied whether participants faced policies in the domain of climate change (“Environment”) or retirement savings (“Retirement”). In all conditions, participants were asked to evaluate on 5-point Likert scales how effective and how painful each of two policies would be (from “not at all” to “very”).

In the “Environment” domain, we began by introducing the threat of climate change and told participants that they would be asked to evaluate two policies aimed at combating it. The two policies were the green energy nudge (identical to previous studies) and a carbon tax. For the tax, we used the framing from Study 1A and, identically, the “Low Pain” condition of Study 1B. In the “Tax First” condition, participants began by evaluating the carbon tax, then made a decision about whether or not to implement it. They then were presented with the green energy nudge and, after evaluating it, were asked about whether or not they would implement that policy. In the “Nudge First” condition, we reversed the order: participants first decided whether to implement the nudge, then made the decision about the tax. Finally, the “Joint Implementation” condition matches our previous design: participants first read about the nudge, then about the tax, and only at the end got to decide which of the policies, if any, to implement.

In the “Retirement” domain, we introduced the problem of undersaving and told participants that they would be asked to evaluate two policies that may increase the income people have available in retirement. In the “Tax First” condition, participants evaluated an expansion of social security. The program would increase contribution rates for employees and employers, but would also increase benefits and eliminate uncertainties about the

availability of future benefits. They then read about a 401(k) savings nudge, in which large employers would be required to enroll workers into a retirement plan and contribute 8% of their income by default. Employees would have the option to change the savings rate or opt-out entirely. In the “Nudge First” condition, we reversed the order in which the two policies were presented: participants first read about (and got to implement) the 401(k) savings nudge, then read about (and got to implement) the expansion of the social security program. Finally, in the “Joint Implementation” decision, participants read about and evaluated first the 401(k) savings nudge, then the expansion of the social security program, and only at the end had the option to implement one of the policies, both, or neither.

We concluded the survey with basic demographic questions from the previous studies (gender, age, ethnicity, education, and political affiliation). The experimental design, sample size, hypotheses, and planned analyses were preregistered on AsPredicted.org #5424. A link to this preregistration report will be available in the publication version of this paper.

Study 3B

For Study 3B, we recruited a sample of participants with training in public policy. We contacted all 4,455 alumni of the Heinz College of Public Policy at Carnegie Mellon University whose email addresses were on file with the alumni office. Of those contacted, 835 clicked on the link in the email and 641 completed the survey. The average age was 46.90 and 53.20% were male. The sample was highly educated: 87.99% had a Master’s Degree, 11.86% a doctorate, and 41.34% had taken a graduate-level behavioral economics class.

Many respondents reported active involvement in the shaping of public policy: 54.13% stated that their current or past roles involved public policy either directly or indirectly. We refer to this subgroup as “policymakers” and perform all our analyses separately on them as an additional robustness check. Within this sample of policymakers, the average age was

45.75 and 58.79% were male. Among policymakers, 83.57% obtained Master's Degrees, 16.14% obtained doctorates, and 42.65% had taken a graduate-level behavioral economics class.

The design follows closely that of Study 3A, and aimed to replicate its findings with a more informed sample. However, as we did not want to risk being underpowered on our main comparison of interest, we dropped the "Joint Implementation" condition, leaving the "Tax First" and "Nudge First" conditions. Moreover, participants saw a tax and a nudge in each of the two policy domains (Environment and Retirement). We randomized between-subjects the order in which the policies and the domains were presented, using a Latin Square design. Those who first saw the tax and then the nudge in the first domain subsequently first saw the nudge, followed by the tax, in the second domain. This allows us to test for spillover across domains, where the decision to implement policies in the retirement domain might allow them to anticipate the policies they will face in the environmental domain, and vice versa. Absent spillover, we could collapse across the domain ordering and increase our sample size. In addition to analyzing the full sample of respondents, we perform separate analyses on the subset of respondents who reported being directly involved in shaping public policy.

In both the domains of climate change and retirement savings, participants read about two kinds of policies: taxes and default nudges. In the environmental domain, the standard policy imposed a carbon tax on companies based on how much emissions they create, which in turn raises the price of goods. The nudge consisted of a mandate on large energy providers to automatically enroll consumers into a green power plan, though consumers can elect to opt-out if they wish. The standard economic policy for retirement savings consisted of an increase in the social security tax for both employees and employers, along with a commensurate increase in social security benefits. The corresponding nudge was a mandate for employers to enroll workers into contributing 8% of their salary into a 401(k) plan, but allowing workers to opt-out or change their allocation.

After reading about each of the four policies, participants were asked how effective the policy would be at increasing retirement savings or reducing pollution and mitigating CO₂ emissions, and whether they wished to implement the policy. They then proceeded to the next policy. The survey concluded with demographic questions. The study and analyses, including the test for spillover across the two domains and the subgroup analysis for policymakers, were preregistered on AsPredicted.org #5624. The preregistration report mistakenly notes that we had already collected some data, which is inaccurate; the timestamp of the preregistration report precedes the distribution of emails by two days.

Study 4

We recruit participants from Amazon Mechanical Turk for a five minute study in exchange for a 50 cent fixed payment. We targeted a sample of 800 people who passed an attention check included at the end of the experiment. After recruiting 954 participants, we ended up with 798 participants who passed. The sample size, exclusion criteria, along with the following experimental design, hypotheses, and analyses were pre-registered on AsPredicted #15694.

We began by introducing all participants to the threat of climate change and the effect of pollution on premature deaths. Next, participants read that they would be asked to evaluate two policies that governments might consider to combat pollution and global climate change. We then randomly assigned them to one of four between-subjects conditions. In the “Tax First” condition, participants read about the \$40/ton carbon tax from the previous studies and rated it on effectiveness and painfulness (again on a 5-point Likert scale from “Not at all” to “Very”). On the next screen, they were then asked if they would vote to implement the carbon tax (using the low-pain framing from Study 1A and Studies 3A and 3B). Independent of their answer, they were then presented with the green energy nudge, also identical to the previous experiments. Similarly, they evaluated it on effectiveness and

painfulness and stated whether they would vote to implement it.

The experimental survey then asked a series of demographic questions: gender, age, ethnicity, education, political affiliation and political orientation. We also asked participants how they believe their carbon emissions compared to the average household (more, less, or the same) and which one of four statements most closely reflected their views on climate change. They could express that climate change was primarily caused by human activity and governments should take measures to reduce emissions; primarily caused by human activity, but actions to reduce should be left to individuals; primarily caused by natural factors, but governments should take measures to reduce emissions; and primarily caused by natural factors and governments should not take measures to reduce emissions. We did not preregister any hypotheses related to these questions, but collected the responses for descriptive purposes.

Participants in the “Nudge First” condition faced a survey that was identical except in that they first evaluated the green energy nudge, then the carbon tax. The remaining two conditions, “Nudge Ineffective” and “Tax Attractive,” followed the same order as the “Nudge First” condition. However, participants in those two conditions received additional information. In the “Nudge Ineffective” condition, we told participants that green energy nudges have been found to only shift a fraction of the population toward green energy, that residential electricity use is responsible for only a small part of carbon emissions, and that the policy would hence have very little impact on emissions. This information was truthful.²

In the “Tax Attractive” condition, we instead provided more information about the carbon tax. We told participants that British Columbia had implemented a similar tax and uses part of the revenue to lower income taxes. We further highlighted that revenue could be used to lower other taxes and fund projects we thought would be appealing to participants. Moreover, we noted that a previous ballot initiative in Washington would have returned the revenue to residents, which would lead households that emit less carbon than average to

receive a greater rebate than what they paid in taxes.

The survey concluded with an attention check. We first showed participants an image of a bell pepper and asked them what they saw in the image. Anyone whose response included the word “pepper” was marked as having passed the attention check. We then asked participants to write the date “08/06/2018” in words. We treat anyone whose response included the word “August” as having passed the attention check.

Ethical Approval

For all studies, we obtained ethical approval from the internal review board at Carnegie Mellon University and complied with all relevant ethical regulations for research with human participants. None of our studies involved deception.

Data Availability

The raw data from all our experiments and statistical code for all analyses and figures reported in the paper and the supplementary analyses will be available via Github and as an R library on CRAN following publication of the paper.

Table 1

Summary statistics (M and SDs) for painfulness and effectiveness of policies for all studies. P-values test for a difference between the tax and the nudge within an experimental condition.

Study		Painfulness			Effectiveness		
		Nudge	Tax	p-value	Nudge	Tax	p-value
Study 1A		1.62 <i>0.85</i>	2.61 <i>1.11</i>	< 0.001	3.23 <i>1.01</i>	3.16 <i>1.19</i>	0.56
Study 1B	Low Pain	1.67 <i>0.92</i>	2.06 <i>1.11</i>	< 0.001	3.20 <i>0.98</i>	3.12 <i>1.16</i>	0.32
	High Pain	1.77 <i>0.98</i>	3.16 <i>1.12</i>	< 0.001	3.16 <i>1.05</i>	3.00 <i>1.18</i>	0.04
Study 2	Related	1.71 <i>0.95</i>	3.24 <i>1.18</i>	< 0.001	3.25 <i>0.99</i>	2.90 <i>1.03</i>	< 0.001
	Unrelated	1.71 <i>0.93</i>	3.19 <i>1.25</i>	< 0.001	3.65 <i>0.93</i>	2.92 <i>1.17</i>	< 0.001
Study 3A	401k	1.98 <i>1.07</i>	2.86 <i>1.10</i>	< 0.001	3.17 <i>1.02</i>	2.96 <i>1.11</i>	< 0.001
	Green	1.67 <i>0.91</i>	3.01 <i>1.12</i>	< 0.001	3.28 <i>1.02</i>	2.91 <i>1.08</i>	< 0.001
Study 3B	401k	1.59 <i>0.83</i>	2.69 <i>1.00</i>	< 0.001	3.12 <i>0.94</i>	2.96 <i>1.05</i>	0.04
	Green	1.53 <i>0.83</i>	2.44 <i>1.02</i>	< 0.001	3.27 <i>0.98</i>	2.94 <i>1.28</i>	< 0.001
Study 4	Tax First	1.78 <i>1.04</i>	2.19 <i>1.15</i>	< 0.001	3.08 <i>1.04</i>	2.80 <i>1.00</i>	< 0.001
	Nudge First	1.65 <i>0.88</i>	2.37 <i>1.25</i>	< 0.001	3.13 <i>0.97</i>	3.12 <i>1.15</i>	0.92
	Nudge Ineffective	1.59 <i>0.81</i>	2.33 <i>1.13</i>	< 0.001	2.44 <i>0.94</i>	3.12 <i>1.18</i>	< 0.001
	Tax Attractive	1.57 <i>0.83</i>	1.98 <i>1.08</i>	< 0.001	3.19 <i>0.99</i>	3.34 <i>1.04</i>	0.15

Table 2

Percent of participants who supported implementing the tax and nudge across studies and conditions. P-values test for a difference across conditions and, in Study 4, for a difference between Nudge First and each remaining condition.

		Support Tax	Support Nudge
Study 1A	Tax	70.3	
	Tax + Nudge	55	77
	<i>p</i>	<i>0.04</i>	
Study 1B	Low Pain - Tax	71.86	
	Low Pain - Tax + Nudge	63.37	81.68
	<i>p</i>	<i>0.09</i>	
	High Pain - Tax	45.5	
	High Pain - Tax + Nudge	37.69	80.4
	<i>p</i>	<i>0.14</i>	
Study 2	Related Nudge - Tax	45.05	
	Related Nudge - Tax + Nudge	26	82.5
	<i>p</i>	<i>< .001</i>	
	Unrelated Nudge - Tax	43.72	
	Unrelated Nudge - Tax + Nudge	44.28	81.09
	<i>p</i>	<i>0.99</i>	
Study 3A	Environment - Tax First	60.89	86.63
	Environment - Nudge First	42.51	84.06
	Environment - Tax + Nudge	45.27	87.06
	<i>p</i>	<i>< .001</i>	<i>0.64</i>
	Retirement - Tax First	59.2	77.11
	Retirement - Nudge First	41	72.5
	Retirement - Tax + Nudge	42.64	75.63
	<i>p</i>	<i>< .001</i>	<i>0.55</i>
Study 3B	Environment - Tax First	72.53	86.88
	Environment - Nudge First	54.65	85.71
	<i>p</i>	<i>0.02</i>	<i>0.89</i>
	Retirement - Tax First	67.86	81.21
	Retirement - Nudge First	48.84	84.8
	<i>p</i>	<i>0.02</i>	<i>0.48</i>
Study 4	Nudge First	61.58	81.58
	Tax First	68.93	77.18
	<i>p</i>	<i>0.13</i>	<i>0.28</i>
	Tax Attractive	72.82	84.62
	<i>p</i>	<i>0.02</i>	<i>0.43</i>
	Nudge Ineffective	71.01	79.23
	<i>p</i>	<i>0.05</i>	<i>0.56</i>