FINANCIALLY EQUIVALENT BUT BEHAVIORALLY DISTINCT? POLLUTION TAX AND CAP-AND-TRADE NEGOTIATIONS

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SUMMARY

Economic theory suggests that pollution tax and cap-and-trade regulations can be functionally equivalent. Environmentalists tend to prefer the firm emissions cap in cap-and-trade programs, while economists and business interests tend to prefer the price certainty of tax programs. But both may be overlooking behavioral distinctions between the two policies. Using a novel randomized case experiment, this Article tests whether the framing changes negotiated policies. It finds that negotiators reach more environmentally protective policies under the tax rather than the cap-and-trade frame, a finding which comports with real-world observations that carbon taxes tend to be higher than permit prices in carbon cap-and-trade programs. The findings have two important implications. First, negotiators treat pollution tax and cap-and-trade regulations differently—they are not psychologically equivalent. Second, contrary to the general environmentalist preference for cap and trade, taxes may generate greater environmental protection.

Greenhouse gases are at record levels, fisheries are collapsing, the American West is running out of water, and plastic is taking over our oceans. Policymakers are increasingly turning to market-based price (e.g., pollution tax) and quantity (e.g., cap and trade) regulations to address these and other environmental harms. Carbon tax and cap-and-trade programs in particular are of growing interest because of the critical need to mitigate climate change.[1] As of June 2022, there were 68 market-based instruments in place to regulate carbon,[2] and 96 of the 185 Paris Agreement signatories have noted that they might use carbon pricing.[3]

Market-based price and quantity instruments leverage incentives to encourage pollution reduction. They either set a price for a particular activity (e.g., a carbon tax), or set a cap on the activity and create permits under the cap for firms to trade (e.g., a carbon cap-and-trade program). In contrast with command-and-control policies that prescribe uniform technology requirements or performance standards, these market-based tools provide flexibility for firms to reduce emissions to the extent and in the manner most appropriate to their circumstances. If it costs a firm less to reduce emissions than to pay the regulatory price to pollute (the tax or permit price), the firm will reduce emissions; if it costs more, the firm will pay the price. The market naturally finds the cheapest pollution abatement options.[4]

Economists have thus long supported the use of market-based instruments generally.[5] However, there is no consen-

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1. Because carbon dioxide is the predominant greenhouse gas, we use "carbon" interchangeably with "greenhouse gases."
2. World Bank, *Carbon Pricing Dashboard*, https://carbonpricingdashboard.worldbank.org/ (last visited Aug. 3, 2022).
3. World Bank & Ecofys, State and Trends of Carbon Pricing 2019, at 53 (2019).
4. *See*, *e.g.*, Lawrence H. Goulder, *Markets for Pollution Allowances: What Are the (New) Lessons?*, 27 J. Econ. Persps. 87, 91 (2013).
5. *See*, *e.g.*, Robert N. Stavins, *Experience With Market-Based Environmental Policy Instruments*, *in* 1 Handbook of Environmental Economics 355, 358 (Karl-Göran Mäler & Jeffrey R. Vincent eds., Elsevier 2003); Jonathan S. Masur & Eric A. Posner, *Toward a Pigouvian State*, 164 U. Pa. L. Rev. 93, 96 (2015); N. Gregory Mankiw, *Smart Taxes: An Open Invitation to Join the Pigou Club*, 35 E. Econ. J. 14 (2009). *See also* Bruce A. Ackerman &

sus on *which* market-based tool (a tax or cap and trade) is better. Economists theorize that market-based price and quantity instruments can be functionally equivalent, absent uncertainty about costs of abatement.[6] A $10/ton tax that leads to 850 tons of emissions is the same as an 850-ton pollution cap that leads to a $10/ton pollution permit price.

Which tool stakeholders prefer tends to depend on which attribute they care about most. Business interests, worried about price volatility under quantity-based cap-and-trade programs, tend to prefer price-based tax regulations.[7] Environmental advocates, in contrast, generally champion cap-and-trade programs to ensure adequate emissions reductions.[8]

Counter to environmentalists' intuitions, a look at carbon tax and cap-and-trade programs already implemented suggests that *taxes* may be more environmentally protective in practice. As Figure 1 illustrates, the price for many carbon taxes is higher than for many cap-and-trade permits.

While this data on existing programs suggests that tax-based policies tend to levy a higher price on carbon than cap-and-trade policies, it is not clear why this is the case. It is possible that the choice of a carbon tax directly leads to a higher price on carbon due to behavioral dynamics. But the difference could also stem from systematic differences across the jurisdictions that choose taxes versus those that choose cap and trade (many of the high-tax countries are in Northern Europe),[9] or from complementary policies and other real-world effects.[10] These effects are difficult to disentangle here; the real world is messy.

This Article uses a randomized controlled negotiation case experiment to test whether behavioral framing effects might contribute to the tendency of taxes to be more environmentally protective than cap-and-trade policies. Under a framing effect, the presentation of two otherwise identical options can alter preferences and behavior.[11] We hypothesize that, despite equivalence of incentives and information across choice sets, the policy frame (cap and trade or pollution tax) can change mental representations of the issue and lead to meaningfully different outcomes.

To test for this behavioral bias, we designed a novel negotiation case in which two participants negotiated the specifics of a regulatory solution for a newly discovered pollutant. Participants were randomly assigned to negotiate either a pollution tax or cap-and-trade regulation. The policy options were identical: aside from whether participants negotiated a tax or a cap, tax and cap-and-trade participants could strike exactly the same deals. We ran the case as an in-class negotiation exercise for more than 500 student participants in 13 courses in well-known U.S. law, business, undergraduate, and public policy schools.

As predicted by our preregistered hypothesis, we found that tax negotiators reached more environmentally protective policies than did cap-and-trade negotiators. We draw from the broader social psychology literature to explore what dynamics might drive this difference.

To our knowledge, this is the first study to connect theory on behavioral biases to the price-quantity regulatory literature, despite significant economics literature on the various trade offs between these instruments. Our finding—that negotiations lead to more environmentally protective taxes than cap-and-trade programs—suggests that, contrary to environmental advocates' intuitions, there may be reason for environmentalists to prefer taxes to cap and trade. This finding is especially important because policymakers consistently enact market-based policies that fail to sufficiently address externalities[12]; if we are to make environmental progress, we should choose the instrument more likely to get us there.

Richard B. Stewart, *Reforming Environmental Law*, 37 Stan. L. Rev. 1333, 1341 (1985).

6. Cameron Hepburn, *Regulation by Prices, Quantities, or Both: A Review of Instrument Choice*, 22 Oxford Rev. Econ. Pol'y 226, 229 (2006); *see also* Martin L. Weitzman, *Prices vs. Quantities*, 41 Rev. Econ. Stud. 477, 480 (1974). *See infra* note 32.

7. *See*, *e.g.*, William D. Nordhaus, *To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming*, 1 Rev. Env't Econ. & Pol'y 26, 37-38 (2007) (describing spot sulfur dioxide (SO_2) prices that ranged from $66/ton in 1996 to $860/ton in 2005 and explaining that SO_2 prices are more volatile than stock prices and consumer prices); Goulder, *supra* note 4, at 95 (noting that price volatility complicates investment decisions); Mankiw, *supra* note 5, at 18 (explaining that carbon emissions vary significantly with production and that a quantity instrument would thus result in fluctuations in permit prices).

   But see David Weisbach, *Instrument Choice Is Instrument Design*, *in* U.S. Energy Tax Policy 113, 140 (Gilbert E. Metcalf ed., Cambridge Univ. Press 2011) (explaining that price volatility can be useful if it reveals new information). *Cf.* Michael A. Livermore & Richard L. Revesz, *Interest Groups and Environmental Policy: Inconsistent Positions and Missed Opportunities*, 45 Env't L. 1 (2015) (explaining that industry groups in the 1970s and 1980s initially preferred market-based quantity instruments to more prescriptive tools, but turned against them when the available alternative appeared to become no regulation at all). Business might also prefer taxes because they do not reduce earnings before interest and taxes (EBIT) or earnings before interest, taxes, depreciation, and amortization (EBITDA), though cap-and-trade credit purchases would. We thank Colleen Honigsberg for this contribution.

8. Lawrence H. Goulder & William A. Pizer, *The Economics of Climate Change* (National Bureau of Economic Research, Working Paper No. 11923, 2006); *Putting a Price on Carbon: An Emissions Cap or a Tax?*, Yale Env't 360 (May 7, 2009), http://e360.yale.edu/feature/putting_a_price_on_carbon_an_emissions_cap_or_a_tax/2148/ (Frances Beinecke, president of the Natural Resources Defense Council, citing "firm reduction targets"; Fred Krupp, president of the Environmental Defense Fund, stating "A cap puts a legal limit on pollution. A tax does not."; Robert Stavins, director of Harvard Environmental Economics Program (similar)).

   Environmental groups might also prefer cap and trade because it "help[s] obscure the costs, but make[s] benefits transparent and visible," and because cap and trade "keeps the authority in environmental Congressional committees, where the advocacy groups have considerable influence, as opposed to the tax and finance committees." Robert Stavins, *The Future of U.S. Carbon-Pricing Policy* 18 (National Bureau of Economic Research, Working Paper No. 25912, 2019).

9. In general, the policies are difficult to compare because they also cover different industries and gases.

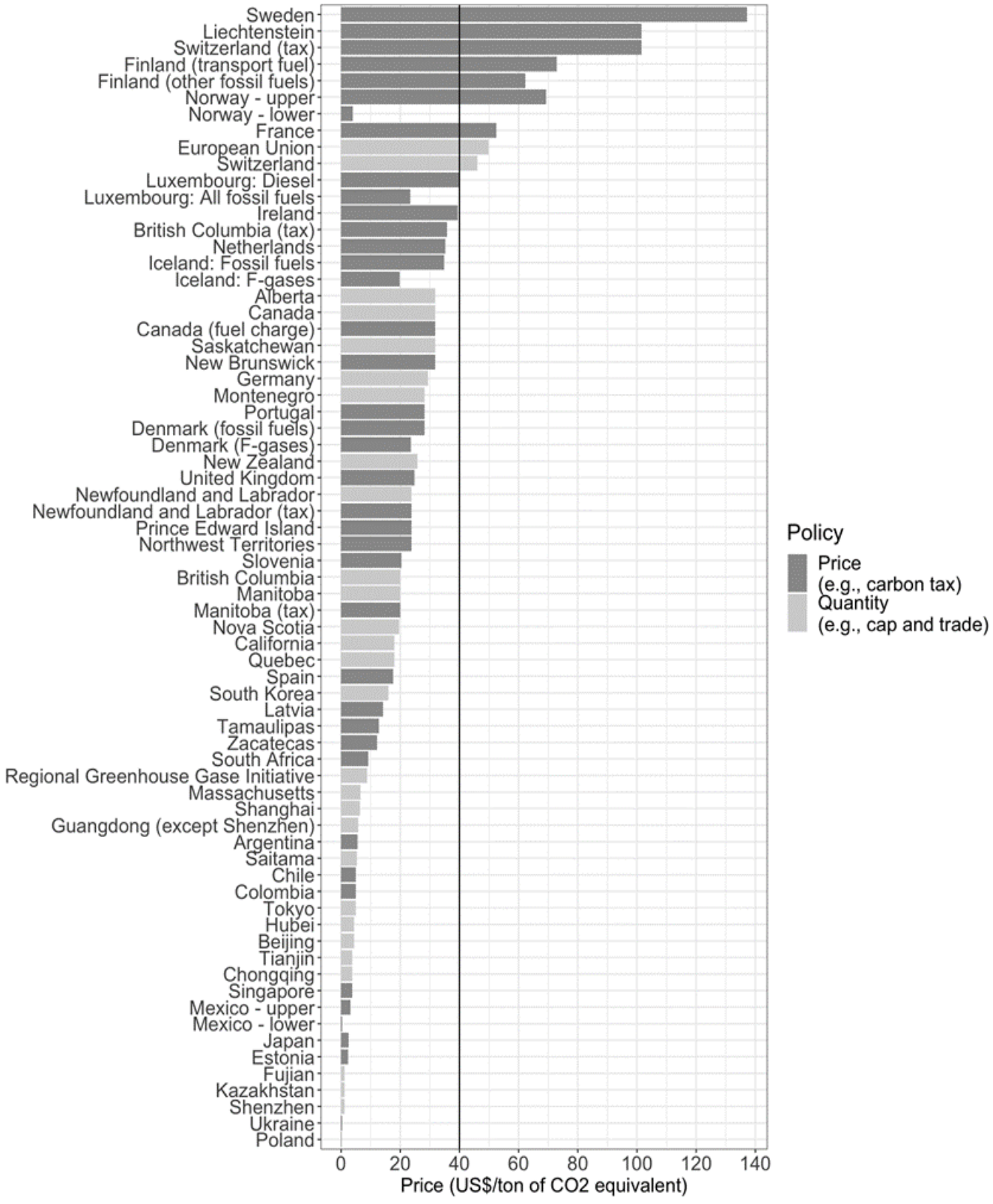
10. *See infra* notes 32-35.

11. *See*, *e.g.*, Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 Science 453, 453 (1981).

12. *See*, *e.g.*, Matto Mildenberger & Leah C. Stokes, *The Trouble With Carbon Pricing*, Boston Rev. (Sept. 24, 2020), http://bostonreview.net/science-nature-politics/matto-mildenberger-leah-c-stokes-trouble-carbon-pricing; Danny Cullenward & David G. Victor, Making Climate Policy Work 9-10 (2020).

   Only nine of the carbon prices in place are currently at or above the $40-$80 per ton of carbon dioxide equivalent (tCO2e) price level required to meet the two-degree Paris Agreement goal. World Bank & Ecofys, *supra* note 3, at 12. Of those, only two (the European Union (EU) and Swiss policies) are cap-and-trade programs. *See* Figure 1.

Figure 1. Carbon Prices Around the World (2021)



Source: Data from World Bank Carbon Pricing Dashboard.

We discuss other considerations in the cap and trade versus pollution tax debate in our implications. Further research is necessary to test and explore the bounds and mechanisms of our results and to consider other behavioral distinctions between the two tools.

I. Conceptual Background

Pollution tax and cap-and-trade regimes, when designed to be identical, could operate as alternative frames to the same policy problem: how much pollution are we willing to endure, and at what cost? The difference is that the tax frames the decision as fixing the price (e.g., $10/ton, with 850 tons of pollution) whereas the cap-and-trade policy frames the decision as fixing the quantity (e.g., 850 tons of pollution, at $10/ton).[13] The two policies can be functionally equivalent.[14]

How a decision is described—its "frame"—can influence preferences and behavior. A credit card *surcharge* reduces credit card use more than the equivalent cash *discount*[15]; people rated basketball players as more successful when told the players' percentages of shots made, as opposed to shots missed, though the two metrics convey identical information[16]; and more people cooperated in a prisoner's dilemma called the "Community" game than when it was labeled the "Wall-Street" game.[17] Researchers have found framing effects to influence decisions in policymaking,[18] medicine,[19] public goods contributions,[20] consumer preferences,[21] employment contracts,[22] and other domains.[23]

The framing effect occurs by altering the mental representation of the problem at hand.[24] People making what functionally might appear to be the same decision (with identical information and incentives) think about the problem differently because of the different frame. A credit card surcharge, for example, encourages purchasers to think about what they would lose if they paid with a credit card; a cash discount highlights what they would gain from paying with cash.

One question is whether we would expect framing effects to affect outcomes in this scenario where the stakes are high and decisionmakers are sophisticated. Framing effects often shrink when people take more time to think through their decisions or to elaborate on the reasons for their choices.[25] And much of the framing literature con-

13. Hepburn, *supra* note 6, at 229; *see also* Weitzman, *supra* note 6, at 480. Another way to think about this: Say Tom knows that his friends want to buy marbles, that they collectively have $5, and that he has five marbles he wants to sell. Tom could charge $1 per marble (a price instrument that leads to five marbles sold at $5 total). Alternatively, Tom could say he has five marbles to sell (a quantity instrument). His friends, bargaining over the marbles, end up giving Tom $5 for all five marbles and negotiate amongst themselves to get to a $1 per marble price. Under either instrument, Tom sells five marbles for $5 total, and each marble costs $1.

14. Oft-cited differences are often due to instrument design, not inherent distinctions between the policy types. For example, cap-and-trade programs often grandfather in incumbents, allocating permits for free, but policymakers could also create tax loopholes and exemptions for the same distributional impacts. Lawrence H. Goulder & Andrew R. Schein, *Carbon Taxes Versus Cap and Trade: A Critical Review*, 4 Climate Change Econ. 1 (2013). Both tools can theoretically raise equivalent revenue for the government. Similarly, both instruments can be applied upstream or downstream in the supply chain. *Id.* And regulators can create offsets for either regulatory form; indeed, we did so here. There is an interesting behavioral and political history question why, for example, cap-and-trade programs have often provided for free allowances, but that is not our inquiry here. *See*, *e.g.*, Bruce R. Huber, *How Did RGGI Do It? Political Economy and Emissions Auctions*, 40 Ecology L.Q. 59, 67-71 (2013) (discussing the political history for the prevalence of grandfathering in cap-and-trade programs). For our experiment, we avoided these differences by designing an equivalent policy option.

    Some true differences between the tools appear unlikely to cause taxes to be higher than permit prices. First, cap and trade may entail higher transaction costs because of the trading. But transaction costs in the lead phasedown and SO2 trading program appeared to be low and allowed for significant trading volumes, suggesting transaction costs need not demonstrably alter the efficacy of the instrument. *See* Richard Schmalensee & Robert N. Stavins, *Lessons Learned From Three Decades of Experience With Cap and Trade*, 11 Rev. Env't Econ. & Pol'y 59 (2017). More importantly, it is not obvious why transaction costs in cap and trade should lead to less protective caps than taxes; indeed, transaction costs could theoretically lead to more expensive cap-and-trade permit prices if regulated entities price in the transaction costs to permit prices.

    Second, administrative costs are higher under cap and trade because the government must regulate and oversee the market. Again, it is not evident how these higher administrative costs would lead to higher taxes than permit prices.

    Uncertainty and the effect of complementary policies could cause taxes to result in higher prices than cap-and-trade programs, but we designed around these issues. *See infra* notes 32-35 and accompanying text.

15. Expressions Hair Design v. Schneiderman, 137 S. Ct. 1144 (2017).

16. Irwin P. Levin, *All Frames Are Not Created Equal: A Typology and Critical Analysis of Framing Effects*, 76 Org. Behav. & Hum. Decision Processes 149 (1998); Lim M. Leong et al., *The Role of Inference in Attribute Framing Effects*, 30 J. Behav. Decision Making 1147, 1150 (2017).

17. Varda Liberman et al., *The Name of the Game: Predictive Power of Reputations Versus Situational Labels in Determining Prisoner's Dilemma Game Moves*, 30 Personality & Soc. Psych. Bull. 1175, 1177 (2004).

18. *See*, *e.g.*, Tversky & Kahneman, *supra* note 11, at 453. *See*, *e.g.*, Levin, *supra* note 16.

19. *See*, *e.g.*, Sammy Almashat et al., *Framing Effect Debiasing in Medical Decision Making*, 71 Patient Educ. & Counseling 102 (2008).

20. Marilynn B. Brewer & Roderick M. Kramer, *Choice Behavior in Social Dilemmas: Effects of Social Identity, Group Size, and Decision Framing*, 50 J. Personality & Soc. Psych. 543, 547 (1986).

21. Irwin P. Levin & Gary J. Gaeth, *How Consumers Are Affected by the Framing of Attribute Information Before and After Consuming the Product*, 15 J. Consumer Rsch. 374 (1988).

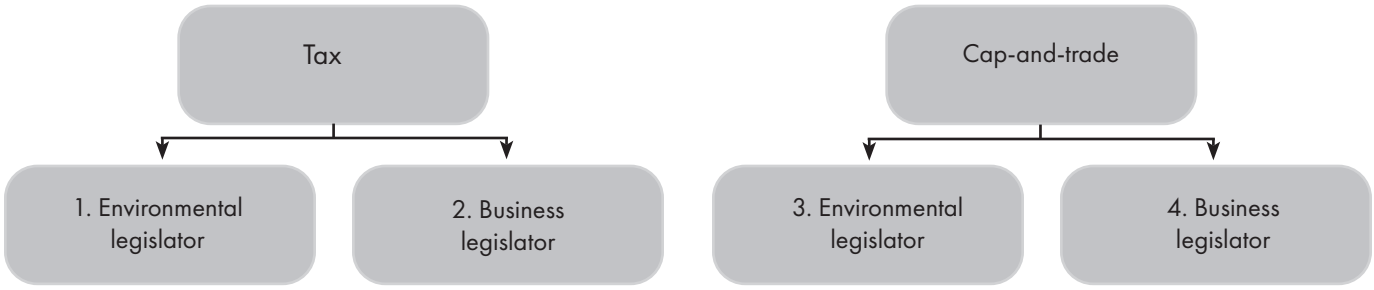
22. *See*, *e.g.*, R. Lynn Hannan et al., *Bonus Versus Penalty: Does Contract Frame Affect Employee Effort?*, *in* 2 Experimental Business Research 151, 161-63 (Amnon Rapoport & Rami Zwick eds., Springer 2005).

23. *See*, *e.g.*, Levin, *supra* note 16 (conducting a review and providing a typology of framing effects); Anton Kühberger, *The Influence of Framing on Risky Decisions: A Meta-Analysis*, 75 Org. Behav. & Hum. Decision Processes 23 (1998) (conducting a meta-analysis of framing studies).

24. *See*, *e.g.*, Tversky & Kahneman, *supra* note 11, at 453 (defining "decision frame" as the decisionmaker's "conception of the acts, outcomes, and contingencies associated with a particular choice," and pointing to "the formulation of the problem, . . . norms, habits, and personal characteristics" of the decisionmaker as contributing to a frame); Dilip Soman, *Framing, Loss Aversion, and Mental Accounting*, *in* Blackwell Handbook of Judgment and Decision Making 379, 380 (Derek J. Koehler & Nigel Harvey eds., Blackwell Publishing 2004) (defining a "frame" as a "mental model of the decision problem" that "includes details about the elements of the decision problem (i.e., information) as well as a context").

25. *See*, *e.g.*, Nancy S. Fagley & Paul M. Miller, *The Effects of Decision Framing on Choice of Risky vs Certain Options*, 39 Org. Behav. & Hum. Decision Processes 264, 269 (1987) (asking for rationales eliminated framing effects); Winston Sieck & J. Frank Yates, *Exposition Effects on Decision Making: Choice and Confidence in Choice*, 70 Org. Behav. & Hum. Decision Processes 207, 210 (1997) (finding that merely anticipating that one will write about their rationale does not reduce framing effects, but that actually writing about one's rationale does); Fei-Fei Cheng et al., *Reducing the Influence of Framing on Internet Consumers' Decisions: The Role of Elaboration*, 37 Comput. Hum. Behav. 56 (2014) (finding that elaboration and "consider-the-opposite" debiasing techniques reduced the attribute framing effect);

Figure 2. Negotiation Case Structure



siders single-participant decisions, and lay rather than expert behavior.[26]

But framing effects have been found to alter negotiated deals in research involving negotiating dyads (i.e., in contexts with multiple participants engaged in longer deliberations). When negotiators focus on achieving gains as opposed to avoiding losses, they make more concessions and reach more deals.[27] Role framing can also alter negotiations: those acting as buyers tend to outperform those acting as sellers.[28] Moreover, biases persist even in decisions with high monetary incentives, which likely involve more deliberation.[29]

II. Study

We created a novel negotiation case to test our hypothesis that participants negotiating a tax would reach more environmentally protective deals than those negotiating a cap-and-trade policy.

A. Procedure

The negotiation case concerned the development of legislation to curtail the use of a newly discovered local pollutant, Pollutant X.[30] As Figure 2 illustrates, participants were randomly assigned to negotiate either a tax or cap-and-trade bill. Within each negotiation pair, one participant was randomly assigned to represent environmental interests and the other business interests.[31] Thus, there were four roles in total: a tax environmental legislator negotiating with a tax business legislator, and a cap-and-trade environmental legislator negotiating with a cap-and-trade business legislator.

To reach a deal, each pair of negotiators had to reach agreement on four issues: (1) the level of the tax or cap; (2) the timing of regulatory phase-in (immediate, three-year delay, or five-year delay); (3) the allocation of revenue from the regulation (to split between environmental remediation and corporate income tax reductions); and (4) whether and how much offsets would be allowed. The tax/cap level was the highest priority for both parties; other priorities differed as displayed in Table 1 (page 10815), to allow for trading across issues and integrative bargaining.

Each side's priorities, rankings, and unacceptable options were confidential. Thus, participants read common, general information regarding the Pollutant X problem and policy options, as well as confidential, role-specific (environmental or business legislator) information regarding their character's preferences and priorities. The inclusion of the phase-in, revenue allocation, and offset issues both increases ecological validity (these are important and contentious elements of pollution policy design) and allows for the introduction of integrative or "win-win" opportunities for negotiators.

Almashat et al., *supra* note 19, at 105 (finding that asking participants to discuss the pros, cons, and information relevant to their decision eliminated the framing effect).

26. *But see* Art Dewulf et al., *Disentangling Approaches to Framing in Conflict and Negotiation Research: A Meta-Paradigmatic Perspective*, 62 Hum. Rels. 155, 156 (2009) (discussing framing research that considers how people jointly construct social frames in their interactions). *See also* Joshua D. Kertzer, *Re-Assessing Elite-Public Gaps in Political Behavior*, 66 Am. J. Pol. Sci. 539 (2020) (finding in a meta-analysis of 162 treatments in 48 paired experiments that elites and lay people "generally respond to [political] treatments in strikingly similar ways").

27. Margaret A. Neale & Max H. Bazerman, *The Effects of Framing and Negotiator Overconfidence on Bargaining Behaviors and Outcomes*, 28 Acad. Mgmt. J. 34, 44 (1985); Margaret A. Neale, *The Effects of Negotiation and Arbitration Cost Salience on Bargainer Behavior: The Role of the Arbitrator and Constituency on Negotiator Judgment*, 34 Org. Behav. & Hum. Decision Processes 97, 105 (1984).

28. *See*, *e.g.*, Margaret A. Neale et al., *The Framing of Negotiations: Contextual Versus Task Frames*, 39 Org. Behav. & Hum. Decision Processes 228, 237 (1987) (finding that buyers outperform sellers even though potential profits were equivalent, and further finding that the effect disappeared when roles were not labeled as buyers or sellers).

29. *See* Benjamin Enke et al., *Cognitive Biases: Mistakes or Missing Stakes?* (CESIfo, Working Paper No. 8168, 2020) (finding that base rate neglect, anchoring, and failure of contingent thinking persisted even with incentives that exceeded average monthly incomes).

30. We chose a newly discovered local pollutant for two reasons. First, we did not know how political discourse around climate change would change over the course of our experiment, so we wanted to avoid greenhouse gases. Second, having a local pollutant (as opposed to a global one, like carbon dioxide) allowed us to plausibly assert that each negotiating side had differing policy preferences because of the makeup of their constituents.

31. Some negotiation professors sought to prevent students from repeating partners from previous negotiation exercises. Otherwise, students were randomly assigned to partners, and all students were randomly assigned to condition (tax or cap and trade).

The case design helped isolate a pure framing effect. Aside from whether participants negotiated a tax or cap, the potential negotiation outcomes, incentives, and case set-up were identical across conditions. Tax and cap-and-trade negotiators had the opportunity to strike the same exact deals. To make this concrete, the two charts in Table 2 (page 10816), which were provided to participants, illustrate what would happen at each tax/cap level (the tax participants received the chart on the left, while cap participants received the chart on the right). The charts are equivalent, flipping only the order of the first two columns.

In the real world, uncertainty as to the position of the marginal cost curve,[32] abatement cost overestimates,[33] unexpected economic slowdowns,[34] and/or the use of complementary policies[35] could each render pollution taxes higher than cap-and-trade permit prices. But these effects influence prices only *after* policy is set. Our design precludes the influence of such effects by focusing on how negotiators set taxes and caps, not ultimate prices.[36]

32. Martin Weitzman's classic 1974 paper demonstrated that when costs are uncertain, price instruments are more efficient if firms are more sensitive to changes in price than the environment is to changes in emissions. Weitzman, *supra* note 6, at 480. Likewise, quantity instruments are better if the environment is more sensitive to changes in emissions than firms are to price changes. (In other words, price regulations are preferred if the marginal cost curve is steeper than the marginal benefit curve, while quantity regulations are preferred if the marginal benefit curve is steeper than the marginal cost curve.) For example, if a bit too much of a very toxic air pollutant would kill many, we should restrict emissions to avoid any error in emissions quantity. But if firms are very sensitive to price changes and the environment is less sensitive to emissions differences, then a slight misstep in the capped amount could devastate firms (costs would be very high) for comparatively little environmental benefit.

    Uncertainty about marginal benefits influences the relative efficiency of the two instruments if the uncertainty about marginal benefits and about marginal costs are correlated. If the uncertainty is positively correlated, quantity instruments are preferred. That is because as marginal costs increase, marginal benefits to abatement also increase (the positive correlation), but under a price instrument firms would abate less (because marginal costs are higher than expected). A quantity instrument would maintain abatement levels. In contrast, if the uncertainty is negatively correlated, a price instrument is preferred. As marginal costs increase, the marginal benefit to abatement drops (the negative correlation), so firms under a price regulation will reduce abatement efforts (because costs are higher) when the benefits to doing so are lower. Robert N. Stavins, *Correlated Uncertainty and Policy Instrument Choice*, 30 J. Env't Econ. & Mgmt. 218, 223-24 (1996).

    Weitzman's finding depends, however, on the assumption of fixed taxes and caps when marginal harm changes with quantity. Because of the fixed quantities or prices, the government must estimate *both* the marginal harm and marginal cost curves to determine the optimal level of pollution/optimal price (where the marginal harm and cost curves intersect). If, instead, the government can set taxes equal to the marginal harm schedule (e.g., if marginal harm increases with quantity, the tax would increase with quantity), the tax will always be optimal and without deadweight loss, regardless of the government's estimates of the marginal cost curve. That is because firms will always produce up to the point that the marginal cost curve, whatever it may be, intersects the marginal harm curve embodied in the tax.

    A cap could achieve the same result if the government responded flexibly by releasing or buying permits to ensure that permit prices equaled marginal harm. Uncertainty about costs of abatement when taxes or caps are set to mimic the marginal harm curve thus would not make one instrument necessarily preferable to the other. *See* Louis Kaplow & Steven Shavell, *On the Superiority of Corrective Taxes to Quantity Regulation*, 4 Am. L. & Econ. Rev. 1, 3-4, 13 (2002); Weisbach, *supra* note 7, at 128. Weitzman's result also does not hold if firms have the same estimates of abatement costs as does the government (because then they do not act as though the marginal cost curve estimate was in error), nor does it much matter if the government updates the instrument quickly to new information about marginal costs. *Id.* at 122-23.

33. If abatement costs are overestimated, taxes will be set assuming, for example, $10 will result in X emissions reductions, but X+Y emissions reductions will occur. Cap-and-trade programs will be set at X emissions reductions, but only X emissions reductions will occur—the cost overestimate will result in lower permit prices, not a change in abatement.

    In the real world, costs are often overestimated, especially because technological development can reduce the cost of abatement. *See*, *e.g.*, R. David Simpson, *Do Regulators Overestimate the Costs of Regulation* (National Center for Environmental Economics, Working Paper No. 11-07, 2011) (reviewing studies demonstrating that ex ante cost predictions for environmental regulations more often overshoot rather than underestimate, though the author notes that this finding does not necessarily mean that ex ante cost predictions are biased, because the distribution of costs may be skewed); Richard Morgenstern, *Retrospective Analysis of U.S. Federal Environmental Regulation*, 9 J. Benefit Cost Analysis 285 (2018) (reviewing 24 regulations and finding a "slight tendency to overestimate *both* benefits and costs"). (An overestimate of both marginal benefits and costs, as Richard Morgenstern found, could result in caps being underprotective or overprotective, while taxes would be overprotective.) The literature on retrospective cost-benefit analyses is scarce, however, because of lack of data and methodological difficulties.

34. Recession reduces demand for allowance permits, reducing permit costs and thus stringency of the cap-and-trade program. Taxes remain at the same level.

35. Complementary policies are additional regulations meant to address the same issue. In California, for example, regulators in 2014 predicted that only 29% of the greenhouse gas reductions mandated by Assembly Bill (A.B.) 32 would come from California's celebrated cap-and-trade program; the remaining 71% were expected to come from tailpipe regulations, the Low Carbon Fuel Standard, energy-efficiency measures, and the renewable energy portfolio standard. *See*, *e.g.*, Michael Wara, *California's Energy and Climate Policy: A Full Plate, but Perhaps Not a Model Policy*, 70 Bull. Atomic Sci. 26, 28 (2014) (citing California Air Resources Board, First Update to the Climate Change Scoping Plan: Building on the Framework 93 (2014)). These additional policies reduce demand for cap-and-trade allowances, causing allowance prices to fall (e.g., from an estimate of $15/ton to $10/ton); in contrast, taxes retain their stringency (e.g., $15/ton).

    That does not mean complementary policies are bad. Complementary policies can help build the political coalitions and support necessary to enact carbon prices, *see* Jonas Meckling et al., *Winning Coalitions for Climate Policy*, 349 Science 1170 (2015), and can help overcome market failures. Stavins, *supra* note 8, at 3 n.6.

36. Moreover, because participants design a policy for a newly discovered pollutant, we assume no complementary policies already exist. We also explained in the case materials that the bill would preempt state-level regulation and litigation, as a motivating factor for business interests to reach a deal. *See*, *e.g.*, E. Donald Elliott et al., *Toward a Theory of Statutory Evolution: The Federalization of Environmental Law*, 1 J.L. Econ. & Org. 313, 316, 330-33 (1985) (discussing "preemptive federalization, when industry groups attempt to counter the organizational successes of environmentalists at the state and local level through preemptive lawmaking at the federal level"); William W. Buzbee, *Federalism Hedging, Entrenchment, and the Climate Challenge*, 2017 Wis. L. Rev. 1037, 1069-70 (2017) (documenting support for federal cap-and-trade legislation in part because of its preemptive effect).

    That negotiators allocated revenues to environmental remediation (a complementary policy) and negotiated offsets (which might lower cap-and-trade prices, but not taxes) would matter to our study only if negotiators understood and anticipated these downstream effects. And if participants did anticipate these effects, the adjustment would be to make caps *more* protective, because the permit prices would, absent this adjustment, be lower than expected. If that happens, our case presents a conservative test of the hypothesis that tax deals will be more protective than caps.

    To further reduce uncertainty, we told participants that analysts agreed on estimated impacts of the regulatory tools. To control and test for any uncertainty that nonetheless resulted, we measured participant confidence in those estimates (of prices in the cap condition and emissions in the tax condition). We found no difference across conditions, and participants reported being relatively confident in our estimates.

    Finally, another real-world discrepancy is that fixed quantity levels automatically adjust for inflation, unlike fixed price regulations, which lose stringency if regulators do not index the tax to inflation. Maureen L. Cropper & Wallace E. Oates, *Environmental Economics: A Survey*, 30 J. Econ. Lit. 675, 687 (1992). But there were historically low U.S. inflation rates during our experiment, so this distinction is unlikely to bias our results. Juan M. Sanchez & Hee Sung Kim, *Why Is Inflation So Low*, Fed. Rsrv.

Table 1. Available Policy Options*

ISSUE	ENVIRONMENTAL (PAT)	BUSINESS (CHRIS)
Level of tax / cap	**Priority: H**	**Priority: H**
$10 / 850	**UNACCEPTABLE**	first choice
$20 / 800	**UNACCEPTABLE**	second choice
$30 / 750	**UNACCEPTABLE**	third choice
$40 / 700	not with five-year delay	fourth choice
$50 / 650	fourth choice	fifth choice
$60 / 600	third choice	sixth choice
$70 / 550	first choice	only with five-year delay
$80 / 500	first choice	**UNACCEPTABLE**
Phase-in of regulations	**Priority: L**	**Priority: M**
Immediate	first choice	**UNACCEPTABLE**
Three-year delay	second choice	second choice
Five-year delay	third choice	first choice
Allocation of revenues	**Priority: L**	**Priority: L**
Corporate income tax	second choice	first choice
Environmental remediation	first choice	second choice
Offsets	**Priority: M**	**Priority: L**
Allowed and unlimited	**UNACCEPTABLE**	first choice
Up to 20% allowed	second choice	second choice
None allowed	first choice	third choice

* There are two first-choice options for the environmentalist on tax/cap level: the second most protective option ($70/ton; 550 tons) is also first choice because we told participants that it was the social optimum.

Each participant filled out two surveys: a pre-negotiation strategy preparation log and a post-negotiation debrief log. We used these surveys both to collect data and to encourage students to reflect on their negotiation processes.

From October 2017 to November 2018, we ran this negotiation case in 13 courses (12 negotiation classes and one introduction to energy issues course) in well-known U.S. law, business, undergraduate, and public policy schools.[37] We targeted 400 participants, so that we could have 200 participants per condition (tax and cap and trade) and thus 100 negotiation pairs per condition. To reach that number of clean data entries, we ended up working with more than 500 students (288 men, 194 women, 3 of another gender; 229 Caucasian, 164 Asian, 45 Hispanic, 13 African American, and 34 of other racial backgrounds; the median participant age was 25).[38]

All participants were given advance notice that some coursework might be part of the research, all were debriefed after the negotiations were complete, and all were given the opportunity to remove their data from consideration (two asked to do so and were removed). To reduce potential demand effects, students did not know that our case

Bank of St. Louis (Feb. 2, 2018), https://www.stlouisfed.org/publications/regional-economist/first-quarter-2018/why-inflation-so-low.

37. In our preregistration, we anticipated running this case study in negotiation classes in U.S. law and business schools. To conduct the negotiations within a relatively compressed time frame to reduce potential confounding effects from political changes over time, we expanded our search to include undergraduate and public policy negotiation courses, as well as one graduate course introduction to energy issues (students in this course were provided negotiation instructions before negotiating our case).

38. These demographic figures do not include participants who filled out the pre-negotiation survey but not the post-negotiation survey, as the pre-negotiation survey did not include demographic questions. Some participants also chose not to answer demographic questions.

We needed more than 500 students because we lost some participant data: not all participants filled out the surveys, not all those who filled out the pre-negotiation survey went on to complete the negotiation, two students asked to have their data removed from research, and some participant pairs reported different deals from one another. We anticipated some of these issues and preregistered the removal of data for those who asked to be removed and those who reported mismatched deals. In addition, because of classes with odd numbers of students, there were around 10 deals that were negotiated in parties of three (two students would act as partners as either the environmental or business legislator). In these cases, we included the first student of the partner-pair to report the deal. Finally, we also removed 10 deals that could not have been struck (impossible deals) because the negotiation case noted that those options were not acceptable to one of the parties. We removed these deals because they were equivalent to not reaching a deal under the terms of the negotiation case.

Table 2. Policy Information Provided to Negotiators

Tax	Estimated Emissions	Estimated Benefit From Reduced Emissions
$10 / ton	850 tons	$130 / ton
$20 / ton	800 tons	$120 / ton
$30 / ton	750 tons	$110 / ton
$40 / ton	700 tons	$100 / ton
$50 / ton	650 tons	$90 / ton
$60 / ton	600 tons	$80 / ton
$70 / ton	550 tons	$70 / ton
$80 / ton	500 tons	$60 / ton

Cap	Estimated Permit Cost	Estimated Benefit From Reduced Emissions
850 tons	$10 / ton	$130 / ton
800 tons	$20 / ton	$120 / ton
750 tons	$30 / ton	$110 / ton
700 tons	$40 / ton	$100 / ton
650 tons	$50 / ton	$90 / ton
600 tons	$60 / ton	$80 / ton
550 tons	$70 / ton	$70 / ton
500 tons	$80 / ton	$60 / ton

was the subject of research until we debriefed them after negotiations were complete.[39] We preregistered our study and hypotheses.[40]

1. Variables

☐ *Environmental protectiveness*. We hypothesized that, much as we see in real-world carbon tax and cap-and-trade policies, tax deals would be more protective than cap-and-trade deals. Our primary measure is a combination of the full deal (including the tax/cap level, phase-in, revenue allocation, and offsets), though we also consider individual deal issues.

To illustrate why the combination of issues might matter, consider hypothetical Deals A and B. Imagine that both include a 600-ton cap, split the revenue 50-50, and allow no offsets, but Deal A has a quicker regulatory phase-in (e.g., the regulation would be implemented in three years, as opposed to five). Deal A is more environmentally protective than Deal B because it will be implemented sooner. But if we considered the tax/cap level only, Deals A and B would look identical.

We thus created deal rankings that captured how well each negotiator did in terms of his or her preferences and priorities. In terms of preferences, more environmentally protective deals received higher environmental rankings and lower business rankings. In terms of priorities, doing better on higher priority issues mattered more for improving one's rank than doing better on lower priority issues. (Higher priority issues were given more weight in determining ranks, and we determined exact priority weight by using the average of how each set of participants weighed each issue in the pre-negotiation survey.) Table 1 above illustrates each side's preferences and priorities, and we discuss the specifics of rank calculations in the Appendix.

We created rankings for both the environmentalist and business person. Though the two rankings were close to the inverse of one another (when the environmentalist did well, the business person often did less well), they were not pure inverses. That is because we allowed for some integrative bargaining, such that some deal outcomes were better for *both* the environmental and the business person than others.[41]

☐ *Pre-negotiation outcomes*. We asked participants to report their target deal and walk-away deal, as well as how they prioritized the four issues and how they thought their counterparts prioritized the issues. (Participants assigned a total of 100 points across the four issues to indicate priority weight; these were the weights we used to create deal rank weights).

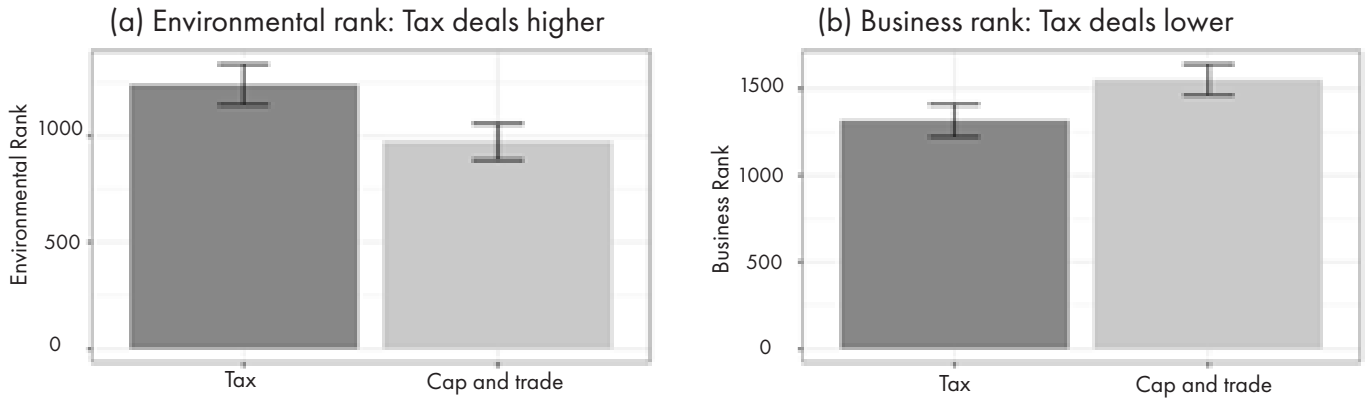
☐ *Other attitudes and beliefs*. We elicited other attitudes and beliefs in the post-negotiation debrief to explore potential mechanisms for a framing effect. We asked participants to report how effective they expected the regulation to be at limiting pollution; how important environmental factors were to their negotiations; how important economic factors were; and how much of a moral issue they viewed the choice of tax/cap level to be.

39. *See, e.g.*, Steven D. Levitt & John A. List, *What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World?*, 21 J. Econ. Persps. 153, 158-61 (2007) (collecting studies in which participants behave more prosocially when they know they are in experimental settings and under scrutiny than when they are unaware of the scrutiny).

40. *As Predicted: Price v. Quantity Negotiation (#6367)*, Wharton Credibility Lab (Oct. 25, 2017), https://aspredicted.org/3D8_HZK. We note where we deviate from our preregistration.

41. For example, the environmentalist could trade a hit on phase-in (a lower priority issue for the environmentalist, but medium priority for the business negotiator) for a gain in offsets (a medium priority for the environmentalist, but low priority for the business negotiator). That new deal would improve both environmentalist and business negotiator rankings.

Figure 3. Environmental and Business Ranks



Note: Error bars approximately represent confidence intervals for the difference in means. We used 83% confidence intervals for *each* mean to visually approximate a 95% confidence interval for the *difference* between means. *See* Mark E. Payton et al., *Overlapping Confidence Intervals or Standard Error Intervals: What Do They Mean in Terms of Statistical Significance?*, 3 J. Insect Sci. 34 (2003) (explaining that to plot confidence intervals to visually gauge a 95% confidence interval for the difference in means, as opposed to confidence intervals for the mean of each sample independently, if standard errors are roughly equal, researchers should use 83% or 84% confidence intervals) (citing Harvey Goldstein & Michael J.R. Healy, *The Graphical Presentation of a Collection of Means,* 158 J. Royal Stat. Soc'y 175 (1995)).

☐ *Controls*. We included measures of environmental identity[42] and standard demographics (i.e., age, sex, race, political leaning). We predicted that participants with stronger environmental identity measures would reach more environmentally protective regulatory packages.

☐ *Design checks*. We asked participants how difficult it was to understand each regulatory regime and how certain participants were about our estimates (for the tax, how certain they were about our emissions estimates and whether they expected actual emissions to be higher or lower; for the cap, how certain they were about our permit price estimates and whether they expected actual prices to be higher or lower). We included these measures to confirm that our case adequately explained each type of regulation and convinced participants about the relative certainty of the estimates. Doing so allowed us to rule out differences in fluency as a reason for any differences in outcome.[43]

Because each deal had two negotiators, there are two versions of each participant-specific variable (e.g., environmental negotiator age and business negotiator age). But each dyad has only one variable for deal terms (e.g., tax/cap negotiated) because each pair reached only one deal.

B. *Results: More Environmentally Protective Tax Than Cap Deals*

As predicted, tax negotiators reached more environmentally protective overall policies than did cap-and-trade negotiators. Considered alone (with no other regressors), tax participants had higher environmental-deal ranks (these were better environmental deals, see Figure 3(a) and Table 3), (b = 267.69, $t(205)$ = 2.89, p = 0.004).[44] Tax participants also had lower business-deal ranks (these were worse business deals, see Figure 3(b) and Table 3), (b = -235.35, $t(205)$ = -2.53, p = 0.012).[45] (Recall that business negotiators were tasked with reaching less environmentally protective policies, such that a lower business rank corresponds to a more environmentally protective policy.

The business and environmental ranks are not exact complements, however, because there was potential for the

42. We use the four-item environmental identity scale developed in Lorraine Whitmarsh & Saffron O'Neill, *Green Identity, Green Living? The Role of Pro-Environmental Self-Identity in Determining Consistency Across Diverse Pro-Environmental Behaviours*, 30 J. Env't Psych. 305, 308 (2010).

43. We know, for example, that people have a harder time calculating relative fuel savings when using miles per gallon as the metric than when using gallons per mile. Richard P. Larrick & Jack B. Soll, *The MPG Illusion*, 320 Science 1593, 1593-94 (2008). Because policy negotiators presumably understand the policy mechanisms they are negotiating, we wanted to ensure that our student participants did, too.

44. The difference remains statistically significant if we cluster standard errors by class (b = 267.69, t(205) = 3.45, p < 0.001). *See* Appendix Table A2. As we discus below, *see infra* note 47, we do not cluster standard errors to be conservative, as clustering with this small number of clusters (13 classes) results in smaller standard errors.

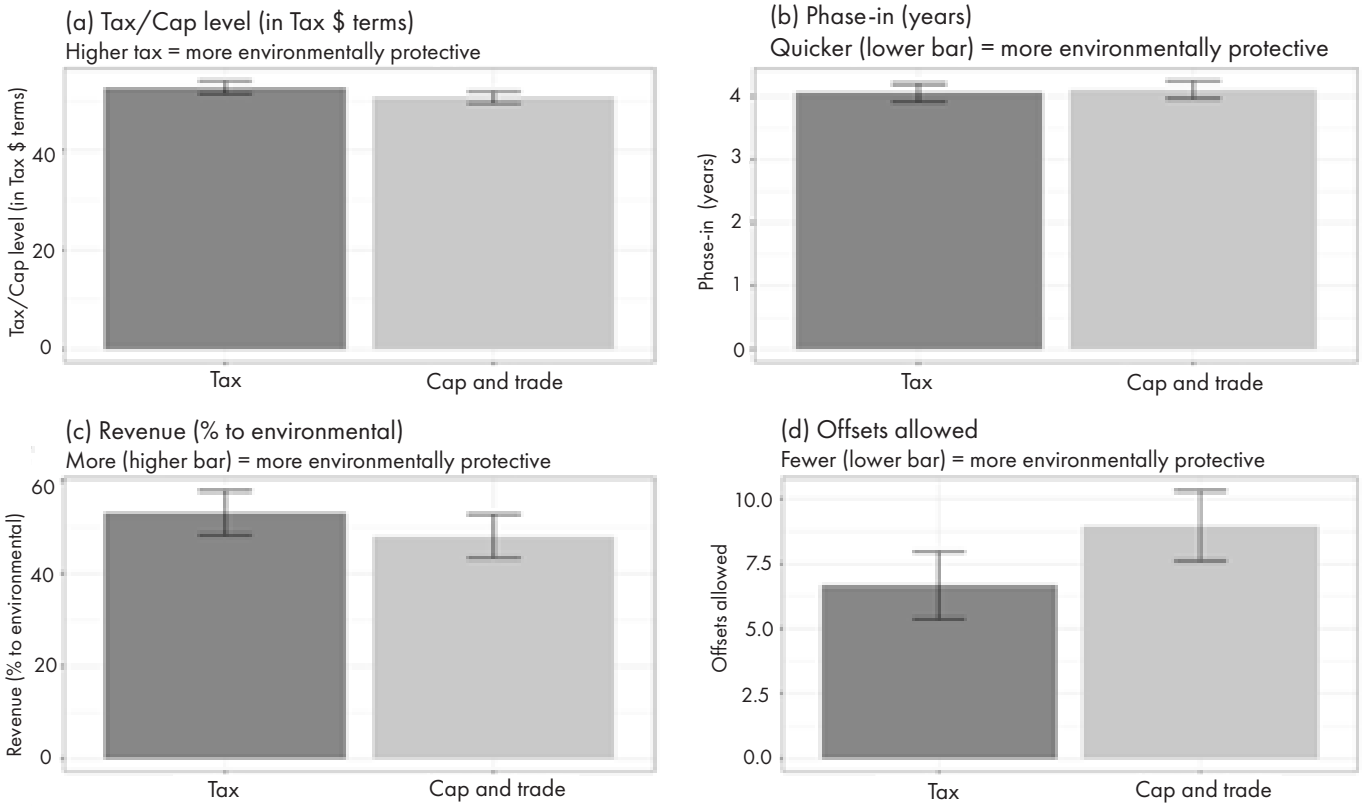
Because the rank measures are ordinal, we also applied a nonparametric test. Using the Mann-Whitney rank sum test, median environmental ranks were for the tax group 1244.5 and cap-and-trade group 929, and their distributions differed significantly (U = 41.29.5, n1 = 102, n2 = 105, p = 0.004).

We also checked whether changing how we calculated the ranks would matter. If we set all priorities to be equal across the four deal issues (thereby removing participant judgments of how strong high-, medium-, and low-priority weights should be, a "flat" weighting), the difference between conditions in environmental rank remains statistically significant (U = 4468, p = 0.039).

45. The difference also remains statistically significant if we cluster by class (b = -235.35, $t(205)$ = -2.74, p = 0.007). *See* Appendix Table A2. Using the Mann-Whitney rank sum test, median business ranks were for the tax group 1333 and cap-and-trade group 1680, and their distributions differed significantly (U = 6483.5, n1 = 102, n2 = 105, p = 0.009).

Again, if we set all priorities to be equal across the four issues (removing our judgments of how strong high-, medium-, and low-priority weights should be), the difference between conditions in business rank remains significant (U = 6241.5, p = 0.040).

Figure 4. Individual Deal Measures



Note: Error bars represent confidence intervals for the difference in means.

parties to trade across issues to arrive at a better deal for both.) Going from a cap-and-trade to a tax deal resulted in a ~11% higher environmental rank and a ~10% lower business rank.[46] Given the similarity between the environmental and business ranking results, we focus on the environmental rank measure going forward for simplicity.

When considering each individual deal item (level of tax/cap, phase-in, revenue allocation, and offsets), tax negotiators reached directionally more environmentally protective results for each individual deal issue: tax negotiators reached higher tax/cap levels, opted for quicker phase-in, allocated more revenue to environmental measures, and allowed fewer offsets (see Figure 4 and Table 3). But the differences in phase-in and revenue allocation were not statistically significant, and the tax/cap and offsets measures are statistically significant only under some specifications.[47]

A breakdown of the distribution of the tax/cap deals provides further directional support for our prediction: 38% of tax deals landed at the two more environmentally protective levels ($60 per ton; 600 tons and $70 per ton; 550 tons), as compared to 26% of cap deals.[48]

A focus on each deal issue alone can mask differences across the overall deals (e.g., two deals identical along three issues, but distinct on one). To capture these differences, we primarily considered differences in overall deal ranks, rather than individual measures.

46. Environmental rank: 268 ranks/2,412 possible environmental ranks = 0.085. *See* Table 3. Business rank: 235 ranks/2,412 possible business ranks = 0.083. *See* Table 3.

47. With standard errors clustered by class, the tax/cap difference is statistically significant (b = 1.98, $t(205)$ = 2.99, p = 0.003). *See* Appendix Table A2. Clustering standard errors is often considered the conservative approach. *See, e.g.*, Alberto Abadie et al., *When Should You Adjust Standard Errors for Clustering*? (National Bureau of Economic Research, Working Paper No. 24003, 2017). We ran our study in different classes, and each class followed a different syllabus and pedagogical approach. But we had only 13 classes and thus 13 clusters. Some suggest clustering can *reduce* standard errors (and thus be less conservative) when only a few clusters are present. Justin Esarey & Andrew Menger, *Practical and Effective Approaches to Dealing With Clustered Data*, 7 Pol. Sci. Rsch. & Methods 541, 543-44 (2018) (discussing problems with too few clusters).

When applying suggested methods to correct for this smaller number of clusters, the tax/cap level remains significantly different across conditions in two of the three methods. Under the pairs cluster bootstrapped t-statistics, p = 0.01; under the wild cluster bootstrapped t-statistics, p = 0.008; and under cluster-adjusted t-statistics, p = 0.201.

Without clustered standard errors, differences were not statistically significant for the tax/cap level, phase-in, and revenue allocation. The difference for offsets was marginally significant. *See* Table 3.

To be conservative going forward, we do not cluster our standard errors.

48. This difference in proportions is not statistically significant. $\chi^2(3, N = 207) = 3.62$, p = 0.305. If we combine the two more stringent and two less stringent levels each into one category, the difference is marginally significant. $\chi^2(1, N = 207) = 3.05$, p = 0.081. We did not preregister this analysis.

Table 3. Deal Outcomes

	Environmental rank (1)	Business rank (2)	Tax/cap level (tax $) (3)	Phase-in (years) (4)	Revenue to environment (%) (5)	Offsets (% allowed) (6)
Tax dummy	267.69***	-235.35**	1.98	-0.05	5.05	-2.29*
	(92.60)	(93.05)	(1.25)	(0.14)	(4.84)	(1.35)
Constant	973.63***	1,551.71***	50.67***	4.10***	48.04***	8.95***
	(62.66)	(63.29)	(0.85)	(0.10)	(3.40)	(0.98)
N	207	207	207	207	207	207

Notes:

- For environmental rank, a larger number is more environmentally protective.
- For business rank, a smaller number is more environmentally protective
- For tax/cap and revenue, a larger number is more environmentally protective.(Tax/cap is in tax $ terms, from $10-80/ton; revenue means 0-100% of revenue allocated to environmental remediation.)
- For phase-in and offsets, a larger number is less environmentally protective. (Phase-in is coded as zero years, three years, or five years; Offsets are coded as 0, 20, or 100, for 0% allowed, 20% allowed, 100% allowed.)
- Robust standard errors. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

1. Design Checks

We ran checks to make sure our results were not an artefact of differences in understanding about how the two regulations worked. We predicted that cap-and-trade regulations would be harder to understand as a system than pollution-tax regulations. We did not predict in which direction this distinction might influence the results.

Contrary to prediction, participants found cap-and-trade regulations easier to understand than pollution tax regulations. See Appendix Table A4. On average, however, participants in both conditions rated both as easy to understand (significantly easier than "neutral"), ($t(208) = -3.62$, $p < 0.001$ (tax), $t(219) = -8.71$, $p < 0.001$ (cap)). Moreover, the difference across conditions did not systematically influence deal rank: including these measures as controls did not significantly improve model fit, ($F(2) = 0.64$, $p = 0.527$), and neither measure had a significant relationship with environmental rank. See Appendix Table A5.

We also checked that our results were not influenced by inadvertent differences in how we conveyed the certainty of each estimated outcome: for taxes, we had participants set tax rates and gave them estimates of pollution abatement, and for cap and trade, we had participants set pollution caps and gave them estimates of permit prices. As designed, there were no significant differences between conditions in our uncertainty measures: tax participants did not report more or less confidence in the pollution estimates than cap participants had in the price estimates. See Appendix Table A4.

Finally, exploratory mediation analyses to probe what might be driving the tax/cap distinction did not provide a clear sense of the factors that underlie these effects. We discuss these analyses, along with demographic analysis, in the Appendix.

III. Discussion

Negotiators in this study reached more environmentally protective tax than cap-and-trade deals even though they considered equivalent choice sets. We first discuss study limitations before exploring possible implications and suggestions for future research.

A. *Limitations*

Our participants might differ from actual policy negotiators and our task from actual policy negotiations in important ways.

1. Participants

Our participants skewed young and politically liberal, but neither age nor political preferences appeared to predict deal rank nor significantly contributed to model fit. In other words, the data did not suggest that an older or more conservative population of policymakers would behave differently.

Our student participants are not yet policy experts, and some studies have found that expertise reduces framing effects. Those with more basketball knowledge, for example, are not as swayed by learning about the percentage of a basketball player's shots made versus shots missed.[49] More experienced policymakers might likewise exhibit less of a framing effect than the students negotiating in our experiment.

49. Leong et al., *supra* note 16, at 1153-54 (finding that most people judge a player to be more successful when learning about percentages of shots made rather than shots missed).

But expertise may not reduce framing effects in this context.[50] Expertise appears to reduce framing effects because it changes the inferences people make. In the basketball example, telling people about the percentage of shots made ("Player X made 65% of his shots") implies that the average player makes fewer shots. In contrast, telling people about the percentage of shots missed ("Player X missed 45% of his shots") implies that the average player misses fewer shots.[51] Knowing what the average player in fact makes/misses thus reduces the influence of such inferences.

In other words, knowledge matters because there is some "true" average percentage of shots made/missed that experts know and can mentally retrieve. Novices, with no such knowledge, rely on inferences from which metric they are told. We do not see how more expertise would analogously reduce the behavioral distinction we find here. There is no "true" correct level of a tax or a cap.[52]

Finally, our participants were mostly graduate students from elite universities. This characteristic enhances the ecological validity of our work. Our participants' high level of educational attainment and pursuit of law, business, and public policy degrees put them on professional tracks that might land them among future regulatory negotiators.[53]

2. *Task*

To fit within a classroom negotiation, our negotiation was necessarily simpler than actual policy negotiations. Our negotiations took only 30 minutes to an hour, involved only two parties (business and environmental interests) with typically only one negotiator for each interest (rather than a group negotiation), and only four policy issues. Actual policy negotiations take place over months, include many more interested parties and actors, and consider much more complex policies—policies ramp up over time, often apply to only particular subsets of industries and pollutants, and so forth. Moreover, the relevant parties setting important policy limits can change. California, for example, enacted Assembly Bill 398 to extend its cap-and-trade program, but Assembly Bill 398 left it to the California Air Resources Board (a state agency) to set price ceilings (California employs a hybrid instrument).[54]

The importance of these differences is difficult to assess because we do not fully understand the mechanism driving the tax/cap difference. That people negotiate in groups could exacerbate (because of group polarization effects), reduce (because of opposing viewpoints), or have no influence on framing effects.[55] If the bias is due to the uncertainty of the unfixed attribute (uncertainty aversion),[56] then the real world, with greater uncertainty, might increase the tax/cap deal gap. But the increasing use of hybrid instruments might reduce that uncertainty and make our research here all the more relevant.[57] Further research is necessary.

50. *Cf.* Kertzer, *supra* note 26 (not finding strong differences between elite and lay people decisionmaking).
51. Leong et al., *supra* note 16, at 1153-54.
52. To the extent one considers the social optimum to be the "true" correct level, all participants were told what that social optimum was, and few reached it.
53. *See*, *e.g.*, Congressional Research Service, Membership of the 115th Congress: A Profile (2018) ("The dominant professions of [U.S. Congress] Members are public service/politics, business, and law.").
54. *See* A.B. 398, 2017/2018 Leg., Reg. Sess. §4 (Cal. 2017), https://legiscan.com/CA/text/AB398/id/1642379/California-2017-AB398-Chaptered.html.
55. The literature on whether groups exacerbate or reduce framing effects is mixed, with some studies suggesting that groups can reduce framing effects, others suggesting that they increase them, and still others suggesting no effect. *Compare*, *e.g.*, Kühberger, *supra* note 23, at 44 (suggesting groups could reduce framing effects by discussing alternative frames), *with* Pi-Yueh Cheng & Wen-Bin Chiou, *Framing Effects in Group Investment Decision Making: Role of Group Polarization*, 102 Psych. Reps. 283, 288-89 (2008) (finding that group polarization strengthened framing effects); Paul W. Paese et al., *Framing Effects and Choice Shifts in Group Decision Making*, 56 Org. Behav. & Hum. Decision Processes 149 (1993) (finding that groups could strengthen individual framing effects if reinforced, but that group-level decisions could also reduce individual framing effects if framed in a different manner and in some cases simply had no impact). *See also* Kerry F. Milch et al., *From Individual Preference Construction to Group Decisions: Framing Effects and Group Processes*, 108 Org. Behav. & Hum. Decision Processes 242, 246 (2009) (finding no difference between individual and group decisions in one scenario, but finding in another that groups demonstrated a framing effect directionally opposite of the framing effect in individuals).

    Whether negotiating in groups will matter depends on what is driving the tax/cap distinction and on how decisions are made. *See* Norbert L. Kerr et al., *Bias in Judgment: Comparing Individuals and Groups*, 103 Psych. Rev. 687 (1996) (explaining that whether groups or individuals exhibit more bias depends on context-specific factors, such as group size and social decision schemes (e.g., decisionmaking through majority rules, "truth wins," or other approaches)). If a key individual drives decisions with little input from others, for example, then individual framing effects may be more important. If instead significant group consensus is required, then framing effects, as just discussed, could be increased (because of group polarization effects) or reduced (if there are individuals with opposing viewpoints).
56. For cap-and-trade programs, prices are uncertain. To prevent too-high prices, business negotiators may push for higher, less protective caps. For taxes, pollution quantities are uncertain. To prevent too-low abatement, environmental negotiators may push for higher, more protective taxes.
57. Hybrid instruments are designed to help avoid the emissions uncertainty that results from price instruments and the price volatility that occurs with quantity instruments. They thus render the two instruments even more alike, much as we did by telling participants that estimates of the uncertain attribute were very good and agreed-upon.

    For proposals to reduce price uncertainty in cap-and-trade programs, see, for example, Severin Borenstein et al., *Expecting the Unexpected: Emissions Uncertainty and Environmental Market Design* 3 (National Bureau of Economic Research, Working Paper No. 20999, 2015) (discussing a "price collar" approach, under which a cap-and-trade program includes both a price floor and ceiling); William A. Pizer, *Combining Price and Quantity Controls to Mitigate Global Climate Change*, 85 J. Pub. Econ. 409 (2002) (suggesting a hybrid cap-and-trade policy that would release additional permits if a trigger price is hit); Warwick McKibbin & Peter Wilcoxen, *A Better Way to Slow Global Climate Change* (Brookings Institution, Policy Brief No. 17, 1997) (proposing allocation of national permits at historic levels coupled with emissions fees to induce additional emissions reductions); Marc J. Roberts & Michael Spence, *Effluent Charges and Licenses Under Uncertainty*, 5 J. Pub. Econ. 193 (1976) (suggesting use of quantitative licenses coupled with subsidies and penalties when emissions fall below or rise above levels permitted by the licenses).

    For proposals to reduce quantity uncertainty in price regulations, see, for example, Marc Hafstead et al., *Adding Quantity Certainty to a Carbon Tax Through a Tax Adjustment Mechanism for Policy Pre-Commitment*, 41 Harv. Env't L. Rev. F. 41 (2017) (proposing a "Tax Adjustment Mechanism for Policy Pre-Commitment" under which a carbon tax would adjust automatically when emissions milestones are not met); Joseph E. Aldy, *Designing and Updating a U.S. Carbon Tax in an Uncertain World*, 41 Harv. Env't L. Rev. F. 28, 30, 31-34 (2017) (similar, but instead of an automatic adjustment, giving Congress fast track authority to adjust taxes as necessary); Brian C. Murray et al., *Increasing Emissions Certainty Under a Carbon Tax*, 41 Harv. Env't L. Rev. F. 14 (2017) (noting possibility of using carbon tax, but with Clean Air Act regulations as backstop if performance goals

There may also be other variables of interest that we did not capture here. We found no significant difference in whether people reached a deal at all,[58] but the vast majority of pairs reached a deal, as our case materials encouraged. Future research could relax this assumption and could also consider the duration of each negotiation and negotiators' perceptions about the process to better understand other differences that might emerge between the two policy tools. Finally, our number choices ($10-$80 for prices and 500-850 tons for emissions) could have influenced results,[59] though these numbers generally match the scale of numbers used in discussing carbon taxes, rendering them more ecologically valid.

B. *Implications*

Assuming our effect translates to the real world, what would it mean for policy? We discuss implications for instrument choice and negotiation strategy.

1. Instrument Choice

Negotiators reached different results under market-based price and quantity regulations, even though the potential policy options available under each were identical. This suggests an update to the conventional economic wisdom that the two tools can be made functionally alike. Even with our controlled experiment, participants reached more environmentally protective tax than cap-and-trade deals.

This finding adds to a list of other reasons taxes might be preferable to cap and trade. First, complementary policies and abatement cost overestimates lead taxes to be more environmentally protective in practice.[60] Second, taxes are administratively simpler to implement because the regulator does not have to make and monitor a market and police rent-seeking,[61] and cap and trade may entail higher transaction costs because regulated entities have to make trades through the market.[62] Third, and relatedly, taxes may be easier to harmonize across borders. A border carbon adjustment is simpler with a fixed tax rate than with a floating cap-and-trade credit price complicated by complementary instruments.[63] Fourth, taxes and cap-and-trade programs alike can grandfather in incumbents (reducing the regulatory pressure on often the dirtiest entities), but cap-and-trade programs are historically more likely to do so.[64]

Moreover, business advocates already prefer tax instruments because they provide price certainty.[65] If this finding encourages environmental advocates to more strongly support tax policies, then the finding could help align business and environmental interests. The predominant disadvantage of taxes is how difficult they are to pass, both for political and legal reasons: politically, because they are disfavored[66]; legally, because taxes sometimes require higher voting standards to pass,[67] and because governments

are not met, as well as possibility of using tax revenues to achieve additional emissions reductions as needed).

In terms of real-world policies, California's cap-and-trade program had a price floor of around $13-$14 in late 2017. Robert Walton, *Carbon Cap-and-Trade Auction Between California, Quebec Sells Out*, Util. Dive (Nov. 22, 2017), https://www.utilitydive.com/news/carbon-cap-and-trade-auction-between-california-quebec-sells-out/511527/. California recently passed A.B. 398, which requires the California Air Resources Board "to include specified price ceilings" in California's cap-and-trade program. *See* A.B. 398, 2017/2018 Leg., Reg. Sess. (Cal. 2017). Before A.B. 398, California's allowance price containment reserve, which provided for the release of additional allowances if certain price triggers were hit, also acted as a sort of price ceiling. *See* Borenstein et al., *supra*, at 3.

Since January 2019, the EU has employed a quantity collar—rather than using price to create a ceiling and a floor, the EU employs quantity triggers with a market stability reserve. If there are fewer than 400 million permits in circulation, allowances from the reserve will be added for future auctions to lower price; if there are more than 833 million in circulation, allowances will be removed from future auctions to increase price. *See* Decision of the European Parliament and of the Council Concerning the Establishment and Operation of a Market Stability Reserve for the Union Greenhouse Gas Emission Trading Scheme and Amending Directive 2003/87/EC, 2015 O.J. (L 264) 1.

58. Only nine cap and trade and five tax pairs either failed to reach a deal (three cap, one tax) or reached an impermissible deal, given the instructions (six cap, four tax). $\chi^2(1, N = 221) = 0.50$, $p = 0.48$.

59. We do not have a theory for why—indeed, the larger percentage changes in tax dollars might encourage *less* movement along the tax scale. *Cf.* Barbara Mellers & Alan Cooke, *Trade-Offs Depend on Attribute Range*, 20 J. Experimental Psych.: Hum. Perception & Performance 1055 (1994) (finding that a change within a narrow range was perceived as a greater change than the equivalent change within a wider range, and that this effect was strong enough to result in preference reversals); Tversky & Kahneman, *supra* note 11, at 453, 457 (showing people are more willing to drive to save $5 on a $15 item than to save $5 on a $125 item). But future research could counterbalance the specific numbers.

60. *See supra* note 35.

61. *See, e.g.*, Reuven S. Avi-Yonah & David M. Uhlmann, *Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming Than Cap and Trade*, 28 Stan. Env't L.J. 3, 7 (2009) (arguing for taxes over cap and trade because taxes are "easier to implement and enforce," "simpler to adjust" as regulators learn, and "could be implemented and become effective almost immediately"). Cap-and-trade programs might also create opportunities for competitive rent-seeking over pollution credits. *See generally* Anne O. Krueger, *The Political Economy of the Rent-Seeking Society*, 64 Am. Econ. Rev. 291 (1974).

62. But transaction costs of this sort were low in the lead phasedown and SO_2 trading programs. First, cap and trade may entail higher transaction costs because of the trading. But transaction costs in the lead phasedown and SO_2 trading program appeared to be low and allowed for significant trading volumes, suggesting transaction costs need not demonstrably alter the efficacy of the instrument. *See* Schmalensee & Stavins, *supra* note 14. More importantly, it is not obvious why transaction costs in cap and trade should lead to less protective caps than taxes; indeed, transaction costs could theoretically lead to more expensive cap-and-trade permit prices if regulated entities price in the transaction costs to permit prices.

63. *Cf.* Michael A. Mehling et al., *Designing Border Carbon Adjustments for Enhanced Climate Action*, 113 Am. J. Int'l L. 433, 477-78 (2019).

64. *See, e.g.*, Huber, *supra* note 14.

65. *See supra* note 7.

66. Edward J. McCaffery & Jonathan Baron, *Thinking About Tax*, 12 Psych. Pub. Pol'y & L. 106, 117-18 (2006) (more support for "payments" than for equivalent "taxes"); Steffen Kallbekken et al., *Do You Not Like Pigou, or Do You Not Understand Him? Tax Aversion and Revenue Recycling in the Lab*, 62 J. Env't Econ. Mgmt. 53 (2011) (but finding that allocating tax revenues to those harmed by the externality being regulated increased support for "taxes"); David J. Hardisty et al., *A Dirty Word or a Dirty World? Attribute Framing, Political Affiliation, and Query Theory*, 21 Psych. Sci. 86, 89 (2010) (finding 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).

67. In California, Proposition 13 requires that any tax must pass with two-thirds support in both houses. And the EU requires unanimous agreement among its Members to impose a tax. *See* European Commission, *Taxation and Qualified Majority Voting*, https://ec.europa.eu/taxation_customs/general-information-taxation/taxation-qualified-majority-voting_en (last visited Aug. 3, 2022).

Of course, some argue that cap-and-trade programs also count as taxes. The California Chamber of Commerce and others brought suit on just that basis because A.B. 32 (which laid the groundwork for California's cap-and-trade system) was not passed by a two-thirds vote in each house. A California

can evade their incentive effects with domestic tax cuts or subsidies.[68] Developing a larger coalition of interests supporting pollution taxes could help.

That said, the finding that negotiators set less environmentally protective caps than taxes does not mean that tax regulations are necessarily environmentally preferable on the whole. That is because we do not know how the tax/cap distinction might alter other outcomes that matter (e.g., behavior by regulated entities).

One might wonder if taxes are more environmentally protective as a positive (descriptive) matter, if that necessarily means taxes should be favored as a normative matter. We think they should be when, as is often true, environmental regulations are underprotective. The High-Level Commission on Carbon Prices, appointed by the United Nations Framework Convention on Climate Change, recommends, for example, a $40-$80 per ton carbon price by 2020 and a $50-$100 per ton price by 2050. Most carbon prices today fall under $20 per ton.[69] And in our negotiation, only 11% of tax participants and 8% of cap-and-trade participants reached the socially optimal tax/cap level.[70]

2. Negotiation Strategy

Negotiators here reached more environmentally protective tax than cap-and-trade deals. Future negotiators could leverage our results to push for more environmentally protective caps, but it would be more difficult to use our experiment to explicitly push for less environmentally protective taxes. That is because of the inherent structure of our case design. The socially optimal tax/cap in our case was also the most environmentally protective achievable tax/cap level. Few reached this mark (only 11% of tax participants and 8% of cap-and-trade participants). That cap-and-trade participants reached even less environmentally protective results than did tax participants suggests that cap-and-trade participants were even further away from the social optimum than were tax participants.[71]

Environmental advocates negotiating a cap could thus argue that cap-and-trade policies can create a behavioral bias tending toward less protective and less socially optimal regulation. But these results do not give tax negotiators reason to push for less environmentally protective taxes. Tax participants did not reach *over*protective regulations; they reached policies only more protective than did cap-and-trade participants.

C. Future Research

Future research should test to confirm our results, with an eye toward addressing ecological validity concerns, and to extend our results to other domains. Jurisdictions around the world use price and quantity instruments to regulate environmental issues other than air pollution with tradable fishing quotas,[72] water markets for both water quality and quantity issues,[73] payments for ecosystem services,[74] and so forth. And these instruments can apply to any externality. Scholars have proposed the use of these market-based tools in domains as diverse as the misuse of personal digital information ("data pollution"),[75] patent thickets,[76] hunting licenses,[77] and airport congestion fees,[78] among others.

To help generalize when the framing effect might apply, future research could investigate how the effect changes when the purpose of regulation is to conserve a scarce resource (e.g., water, fish), rather than to reduce a negative externality (e.g., pollution). (Pollution is also about the scarcity of clean air and excess water use due to a negative externality, but there is an intuitive distinction between the two.) It would also be helpful to test the results in settings other than negotiation, as well.

appeals court rejected the argument, holding that California's cap-and-trade system does not create a tax, and the California Supreme Court declined to hear the case. *See* California Chamber of Com. v. State Air Res. Bd., 10 Cal. App. 5th 604, 649, 47 ELR 20053 (Cal. Ct. App. 2017). To avoid future challenges on the same grounds, then-Gov. Jerry Brown and the legislature worked to ensure that A.B. 398, which reauthorized and extended the cap-and-trade regime, passed by the requisite two-thirds majority.

68. *See* Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 Yale L.J. 677, 752 (1999) (describing fiscal cushioning).

69. Carbon Pricing Leadership Coalition, Report of the High-Level Commission on Carbon Prices (2017).

70. In our negotiation, the socially optimal tax/cap level was $70 per ton/550 tons. This is where marginal costs ($70 per ton) equaled marginal benefits from reduced emissions ($70 per ton). Students saw this information in their version of Table 2. We highlighted this line in students' charts and explained its significance in the negotiation case text. Every participant was thus told that $70 per ton/550 tons was the socially optimal level of regulation.

    This socially optimal level of the tax/cap was the most environmentally protective tax/cap deal option attainable. Though Table 2 lists one more environmentally protective option ($80 per ton/500 tons), that option was unacceptable to the business negotiator (this was confidential information for the business negotiator) and thus was not effectively an available option.

71. Because we set the tax/cap level as the highest priority for both sides, and because the socially optimal tax/cap level was the highest achievable tax/cap level, we can very roughly say that more environmentally protective deals in our case were closer to the social optimum.

72. *See*, *e.g.*, Trevor A. Branch, *How Do Individual Transferable Quotas Affect Marine Ecosystems?*, 10 Fish & Fisheries 39 (2009) (discussing the impacts of individual transferable fishing quotas in the United States, New Zealand, Canada, Iceland, and other jurisdictions).

73. *See*, *e.g.*, Dennis M. King, *Crunch Time for Water Quality Trading*, 20 Choices 71 (2005) (discussing water quality trading).

74. For example, water users paying upstream landholders to keep trees intact to reduce erosion and thus flooding and water quality impacts. *See*, *e.g.*, James Salzman et al., *The Global Status and Trends of Payments for Ecosystem Services*, 1 Nature Sustainability 136 (2018).

75. Omri Ben-Shahar, *Data Pollution* (University of Chicago Coase-Sandor Institute for Law and Economics, Research Paper No. 854, 2017) (evaluating the possibility of using regulatory taxes on the overuse of personal digital information).

76. Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights*, 60 Stan. L. Rev. 863 (2007) (proposing a fixed patent cap and tradable permits when "multiple patents . . . cover a single product or technology").

77. Douglas MacMillan, *Tradeable Hunting Obligations—A New Approach to Regulating Red Deer Numbers in the Scottish Highlands?*, 71 J. Env't Mgmt. 261 (2004) (proposing a tradable obligation to hunt deer to reduce red deer overpopulation in Scotland).

78. Jan K. Brueckner, *Price vs. Quantity-Based Approaches to Airport Congestion Management*, 93 J. Pub. Econ. 682 (2009) (analyzing quantity—fixed slot distribution—and price—congestion tolls—applied to reduce airport congestion).

Do agencies using notice-and-comment procedures, for example, likewise reach more protective tax than cap-and-trade regulations?

IV. Conclusion

Economic theory suggests that market-based price (e.g., pollution tax) and quantity (e.g., cap and trade) instruments can be functionally equivalent. Environmental advocates typically prefer cap and trade because caps ensure certain emissions reductions.

This Article finds that negotiators behave differently under the two tools, rendering the policies distinct, contrary to economic theory. And contrary to environmental advocates' intuitions, these biases lead negotiators to reach more environmentally protective tax than cap-and-trade policies. Our results thus connect theories on behavioral biases to the market-based price-quantity regulatory instrument literature, and provide guidance to policymakers thinking through questions of instrument choice. Our study is a first step in what we hope is a new line of inquiry into psychological distinctions relevant to these important regulatory tools.

Appendix

A. *Rank Measure Calculations*

To look at overall deals, we created deal rankings: how well did each negotiator do in representing their party's (environmental or business) preferences and priorities? For preferences, more environmentally protective deals received higher environmental rankings and lower business rankings. For priorities, higher priority issues were given more weight for the rankings. Table 1 in the text illustrates each side's preferences and priorities.

We first created a ranking table with every deal possibility. We assigned points to each possible outcome for each of the four issues to create a total deal score, ranked each possible deal based on that score, and then used the resulting rank table (of every deal possibility) to give each actual deal reached its corresponding rank. We also created alternative point assignment weights as a robustness check.

1. Point Assignment

We gave more environmentally protective outcomes more environmental points and fewer business points. We weighted each priority level by using the average priority weights that participants themselves reported in their pre-negotiation surveys (participants reported how much weight, out of 100 points, they wanted to allocate to each issue—tax/cap, phase-in, revenue allocation, and offsets). Because environmental and business negotiators had distinct instructions on how to prioritize the issues, we calculated a separate average for each role. We found that both roles gave on average slightly more than 50% weight to the tax/cap level (53.8% for environmentalists; 54.1% for business people), around 25% for their medium priority issue (23.8% for environmentalists for offsets; 25.6% for phase-in for business people); and around 10% for their low priority issues (11.6% for phase-in and 10.8% for revenue allocation for environmentalists; 10.8% for revenue allocation and 9.4% for offsets for business people).

We did not use pre-assigned points to each deal measure because in pilot tests participants focused entirely on point values, and that focus seemed artificial.

We added the point scores from each of the four issues to get to an overall score for each possible deal (total points = tax/cap points + phase-in points + revenue allocation points + offset points).

2. Ranking

We ranked all deal scores from 1 on, with the worst outcome for each side ranked as 1 (because it is intuitive to think of a "higher" ranking as a larger number). Ties were considered equivalent and calculated as the average of their ranks.[79] For the main results, we included only the universe of acceptable deals to create the rankings (some deal results were unacceptable to one party, in which case a deal at that level could not be struck). This procedure created a deal ranking table with all possible deals and their ranks.

3. Assignment

We used the deal ranking table to give each actual deal its rank. For example, if a deal was for 600 tons, three-year phase-in, 50% to environment, and no offsets, we looked at what that deal rank was in the ranking table for the environmentalist and the business person and assigned those ranks.

4. Robustness Check

As a robustness check for the participant weightings, we tested an extremely conservative alternative "flat" weighting. The flat weights assume no difference in priorities across the four issues and remove subjectivity because each issue has equal weight. As discussed, the difference remains significant under this more conservative measure.[80]

To be complete, we reported results for both environmental and business ranks. These two rank measures are not pure inverses of one another: a higher environmental rank for one deal did not necessarily mean a lower business rank. That is because environmentalists and business interests had different priorities, as Table 1 in the text illustrates. For example, business negotiators could trade a hit on offsets (low priority for business; medium for environmentalists) for a gain in phase-in (medium priority for business; low for environmentalists), and the ranks for both would improve.

79. For example, instead of ranking the numbers 1, 2, 3, 3, 4, as 1, 2, 3, 4, 5, the ranks would be 1, 2, 3.5, 3.5, 5.
80. *See supra* notes 44-45.

Table A1. Descriptive Statistics of Dependent Variables

	Tax group (N=102)	Cap group (N=105)	Overall (N=207)
Environmental rank			
Mean (SD)	1240 (689)	974 (642)	1110 (677)
Median [Min, Max]	1240 [1.00, 2410]	929 [1.00, 2250]	1120 [1.00, 2410]
Business rank			
Mean (SD)	1320 (689)	1550 (648)	1440 (677)
Median [Min, Max]	1330 [1.00, 2410]	1680 [81.0, 2410]	1460 [1.00, 2410]
Deal: Tax/Cap (in tax $)			
Mean (SD)	52.6 (9.33)	50.7 (8.69)	51.6 (9.04)
Median [Min, Max]	50.0 [40.0, 70.0]	50.0 [40.0, 70.0]	50.0 [40.0, 70.0]
Deal: Phase-in (years)			
Mean (SD)	4.06 (1.00)	4.10 (0.999)	4.08 (0.999)
Median [Min, Max]	5.00 [3.00, 5.00]	5.00 [3.00, 5.00]	5.00 [3.00, 5.00]
Deal: Revenue (% to environment)			
Mean (SD)	53.1 (34.8)	48.0 (34.8)	50.5 (34.8)
Median [Min, Max]	50 [0, 100]	50.0 [0, 100]	50.0 [0, 100]
Deal: Offsets (% allowed)			
Mean (SD)	6.67 (9.47)	8.95 (9.99)	7.83 (9.78)
Median [Min, Max]	0 [0, 20.0]	0 [0, 20.0]	0 [0, 20.0]

Table A2. Deal Outcomes, With Clustered Standard Errors

	Environmental rank (1)	Business rank (2)	Tax/cap level (tax $) (3)	Phase-in (years) (4)	Revenue to environment (%) (5)	Offsets (% allowed) (6)
Tax dummy	267.69***	-235.35***	1.98***	-0.05	5.05	-2.29
	(77.56)	(85.77)	(0.66)	(0.13)	(5.17)	(1.45)
Constant	973.63***	1,551.71***	50.67***	4.10***	48.04***	8.95***
	(76.09)	(97.86)	(0.82)	(0.12)	(2.96)	(1.00)
N	207	207	207	207	207	207

Note: *p < 0.10; ** p < 0.05; *** p < 0.01.

B. Additional Data Tables

Additional data tables follow. Appendix Table A1 provides descriptive statistics of our dependent variables.

Appendix Table A3 analyzes the association of environmental identity and demographic measures on environmental rank (the dependent variable for all of these regressions). Because each deal had two negotiators (an environmental negotiator and a business negotiator), there are two versions of each participant-specific variable. The environmental negotiator is marked with "env" and the business negotiator with "bus." Black business negotiators were more successful negotiators (they achieved a lower environmental rank and thus higher business rank) than white negotiators. Other demographic metrics did not have a strong association with environmental rank.

As discussed in Section II.B.1, Appendix Tables A4 and A5 present design checks.

C. Mechanism Analysis: What Might Drive the Behavioral Distinction?

We conducted exploratory analyses of possible mechanisms for the tax/cap difference. Knowing what causes negotiators to set more protective taxes than caps would help us better understand policy implications. If, for example, caps feel more constraining to business negotiators, and that

Table A3. Environmental Identity and Demographic Measures

	Environmental Rank (1)	Environmental Rank (2)	Environmental Rank (3)	Environmental Rank (4)	Environmental Rank (5)	Environmental Rank (6)	Environmental Rank (7)
Tax dummy	264.23***	270.92***	265.48***	240.11**	265.00***	220.90**	224.95**
	(94.19)	(94.40)	(94.42)	(96.37)	(93.95)	(100.29)	(100.05)
Env identity (env)	145.32*						139.42
	(81.76)						(92.99)
Env identity (bus)	-24.35						-16.06
	(69.03)						(78.22)
Female (env)		-53.14				-80.57	-88.23
		(97.14)				(105.10)	(108.32)
Other sex (env)		231.42**				143.88	223.85
		(91.79)				(230.98)	(265.21)
Female (bus)		-99.28				-125.23	-140.99
		(96.20)				(102.91)	(103.71)
Age (env)			-2.67			-5.69	-6.53
			(11.01)			(11.72)	(12.66)
Age (bus)			-5.75			-6.01	-5.16
			(7.92)			(8.63)	(8.78)
Black (env)				-114.49		-206.42	-151.55
				(232.66)		(216.28)	(219.29)
Hispanic (env)				76.80		18.35	50.23
				(149.15)		(166.08)	(181.17)
Asian (env)				-113.32		-105.97	-86.94
				(117.80)		(121.70)	(121.39)
Other race (env)				-184.86		-175.57	-153.88
				(213.37)		(220.80)	(213.09)
Black (bus)				-294.42		-542.51**	-526.58**
				(219.98)		(263.74)	(239.59)
Hispanic (bus)				-206.68		-183.93	-220.24
				(153.26)		(171.93)	(170.53)
Asian (bus)				58.49		65.07	38.77
				(111.80)		(113.77)	(115.45)
Other race (bus)				-107.45		-125.11	-126.96
				(169.88)		(190.28)	(196.55)
Politics (env)					-41.17	-49.03	-24.66
					(36.45)	(39.99)	(42.14)
Politics (bus)					-6.60	-22.46	-24.59
					(36.60)	(38.50)	(40.09)
Constant	449.04	1,028.86***	1,187.43***	1,040.35***	1,108.70***	1,641.64***	1,056.99*
	(474.45)	(82.01)	(270.95)	(92.71)	(164.76)	(341.54)	(628.03)
N	202	204	204	203	202	201	200

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.

Table A4. Design Checks I: The Effect of Condition on Possible Mediators

	Difficulty understanding regulation (env) (1)	Difficulty understanding regulation (bus) (2)	Confidence in estimates (env) (3)	Confidence in estimates (bus) (4)	Expected actual prices/pollution (env) (5)	Expected actual prices/pollution (bus) (6)
Tax	0.41**	0.52**	0.19	-0.22	0.04	-0.02
dummy	(0.20)	(0.21)	(0.15)	(0.16)	(0.13)	(0.14)
Constant	3.28***	3.02***	2.95***	3.18***	4.19***	4.29***
	(0.14)	(0.14)	(0.11)	(0.12)	(0.08)	(0.09)
N	206	205	206	204	206	205

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.

feeling of constraint encourages negotiators to enact more lenient regulations, we might consider building in more release valves into cap-and-trade policies. (Many cap-and-trade systems now do this: California and the European Union, for example, have release valves at particular price and quantity triggers, respectively.)

We hypothesized that taxes might be set more protectively than caps because of psychological reactance or because of uncertainty aversion.

1. Reactance

When individuals feel threatened by loss of control, they may feel psychological reactance and seek to restore control.[81] Children told not to eat sweets may desire sweets more; being told to select a particular choice can cause people to seek and prefer the alternative.[82] Because cap-and-trade policies place a firm cap on the level of pollution regulated entities can emit, this ceiling could feel more controlling than a tax. Under a tax, firms know they can always pay for additional units if they need to. Business negotiators might seek to restore their freedom under a cap by pushing for a more lenient policy.

2. Uncertainty Aversion

Despite our efforts, negotiators may be unable to fully set aside the uncertainty of what will happen in the real world. Under a cap, businesses might worry that prices will rise too high. To protect against too-high prices, business negotiators might demand more lenient (less environmentally protective) caps. Under a tax, environmentalists might worry that emissions will rise above estimates. To protect against too-high emissions, environmental negotiators might demand higher (more environmentally protective) taxes. Together, the two forces would push taxes to be more environmentally protective and caps to be less so.

Relatedly, because environmentalists prefer fixed quantities under cap and trade while businesses prefer fixed prices under taxes, each side might have to compromise on the level of the policy they set if they are negotiating under their preferred policy type. This dislike for uncertainty may be related to the certainty effect (an overweighting preference for 100% certain events)[83] or ambiguity aversion (a preference to avoid ambiguous options).[84] The dislike for the type of tool may be related to solution aversion.[85]

If uncertainty about the unfixed attribute (emission levels in taxes and prices in cap-and-trade programs) is unavoidable, then the effect we found is not a pure framing effect because the two tools are not identical. But the policy relevance of our result would be stronger because uncertainty (outside of hybrid instruments) in the real world is likely greater than in our experiment.

Two countervailing influences might push caps to be set more protectively than taxes: bounded awareness and moral concerns.

3. Bounded Awareness

People tend to "focus on one especially salient aspect of a choice or evaluation problem and ignore or fail to integrate

81. *See, e.g.*, Anca M. Miron & Jack W. Brehm, *Reactance Theory—40 Years Later*, 37 ZFSP 3, 4 (2006) (explaining that "if individuals feel that any of their free behaviors . . . is threatened with elimination, the motivational state of psychological reactance will be aroused" and that state will be "directed toward the restoration of the threatened or eliminated behavior").

82. *See, e.g.*, Jack W. Brehm & John Sensenig, *Social Influence as a Function of Attempted and Implied Usurpation of Choice*, 4 J. Personality & Soc. Psych. 703 (1966).

83. For example, people tend to prefer "a sure gain of $30" to an "80% chance to win $45 and 20% chance to win nothing," but do not have a clear preference between "a 25% chance to win $30 and a 75% chance to win nothing" and a "20% chance to win $45 and 80% chance to win nothing." This is true even though the probability of each option in the second-choice set was just divided by four; in other words, the difference from certainty had an outsized impact. *See* Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, 59 J. Bus. S251, S266-67 (1986).

84. People prefer gambles with certain probabilities (e.g., choosing from a set of 100 balls, in which 50 are black and 50 are red) to those with uncertain odds (e.g., choosing from a set of 100 black and red balls, without information on how many are black or red). *See* Daniel Ellsberg, *Risk, Ambiguity, and the Savage Axioms*, 75 Q.J. Econ. 643 (1961). *See also* Tom Baker et al., *The Virtues of Uncertainty in Law: An Experimental Approach*, 89 Iowa L. Rev. 443, 462 (2004) (finding that uncertainty increases compliance because people are less likely to risk punishment when the probability of punishment—either of detection or of sanction size—is unknown).

85. *See generally* Troy H. Campbell & Aaron C. Kay, *Solution Aversion: On the Relation Between Ideology and Motivated Disbelief*, 107 J. Personality & Soc. Psych. 809 (2014).

other less salient items."[86] That creates bounded awareness—"an individual's failure to 'see' and use accessible and perceivable information while 'seeing' and using other equally accessible and perceivable information."[87]

Price and quantity regulations might steer people's attention to consequences of the attribute being fixed: those setting a tax might focus on economic costs, while those setting a cap might focus on pollution and related harms. Similar order effects occur with consumer product evaluations: viewing product prices before the products themselves leads people to think more about item value than attractiveness, while viewing products first encourages more consideration of attractiveness.[88] These effects would lead to stricter caps (negotiators more heavily weight pollution) than taxes (negotiators more heavily weight economic costs).

4. Morality

Relatedly, taxes may encourage more focus on prices, and consideration of prices and numbers can encourage moral disengagement.[89] Likewise, caps may encourage focus on pollution and attendant harms, highlighting the salience of moral concerns.

To test these potential mechanisms, we asked participants to answer additional questions about their negotiation, including[90]:

- For reactance and uncertainty aversion hypotheses: In their pre-negotiation strategy preparation, participants reported target deal packages ("favorable deals") and the worst deals they would accept ("walk-away deals"). If caps feel more constraining and/or if participants are uncertainty-averse, business people will want more lenient caps and environmentalists will want more protective taxes. We assigned deal rankings to these preferred and walk-away packages, much as we created deal rankings for the ultimate deal outcome (environmental and business rank) variables above. The one difference is that we included for these rankings the universe of all possible deal combinations, including deals that are impossible for reasons confidential to the other side, because participants cannot know those confidential limits in their preparation.
- For uncertainty aversion: We asked how effective participants expected the policy at issue to be at reducing emissions ("efficacy").
- For bounded awareness: We asked how important health and environmental factors ("environmental factors") and economic factors ("economic factors") were to the participant's negotiation.
- For morality: We asked participants the extent to which they viewed the choice of tax/cap level as a moral issue (i.e., a matter of right and wrong ("morality")).

We treated these analyses as exploratory, not confirmatory, as these were early hypotheses and we did not have strong priors on what combinations of factors might matter. We conducted two sets of analyses: a more traditional Baron and Kenny mediation analysis, considering each potential mediator and suppressor alone, and a structural equation modeling approach to analyze the combination of factors.

The Baron and Kenny four-step mediation analyses considering each factor alone suggest that morality concerns could be suppressing the difference between tax and cap-and-trade deals. Tax participants viewed the choice of tax/cap level as less of a moral issue than did cap-and-trade participants (see Table A7). But viewing the choice of tax/cap level as more moral was not associated with a different deal rank (see Table A8).

The only other potential mediator or suppressor that differed across condition was the environmentalist's "favorable deal," which would suggest uncertainty aversion by the environmentalists. See Table A6, and Tables A6 and A7 generally, for results of all listed variables. But when included in a regression on deal rank with condition, that uncertainty-aversion variable was not a statistically significant factor (see Table A8).

To assess how these variables might operate in combination, we employed the exploratory mediation analysis approach via regularization (XMed, through the regsem package in R, version 1.9.0).[91] We found no significant mediators using this approach.

86. McCaffery & Baron, *supra* note 66, at 109. *See also* Max H. Bazerman & Dolly Chugh, *Bounded Awareness: Focusing Failures in Negotiation*, *in* Negotiation Theory and Research 7-26 (Leigh L. Thompson ed., Psychology Press 2006). The "focusing effect" term often describes errors in affective forecasting (people make inaccurate predictions about what will make them happy), *see* Timothy D. Wilson et al., *Focalism: A Source of Durability Bias in Affective Forecasting*, 78 J. Personality & Soc. Psych. 821, 821-23 (2000), but it also describes cognitive errors. *See*, *e.g.*, *id*. (noting that focalism might help explain the planning fallacy).

87. Bazerman & Chugh, *supra* note 86.

88. Uma R. Karmarkar et al., *Cost Conscious? The Neural and Behavioral Impact of Price Primacy on Decision-Making*, 52 J. Mktg. Rsch. 467 (2015).

89. *See*, *e.g.*, Kathleen D. Vohs et al., *The Psychological Consequences of Money*, 314 Science 1154 (2006) (priming people with monetary concepts lowered helpfulness toward others). *Cf.* Timo Goeschl & Grischa Perino, *Instrument Choice and Motivation: Evidence From a Climate Change Experiment*, 52 Env't & Res. Econ. 195 (2012) (carbon taxes crowded out intrinsic motivation to reduce emissions while a command-and-control mandate did not, suggesting that prices induce a more amoral frame than traditional mandates).

Some view this lack of stigma to be a feature. Because everyone contributes to carbon pollution, it is "difficult to demonize emitters as immoral." Shi-Ling Hsu, The Case for a Carbon Tax 27 (2012).

90. We preregistered morality, environmental factors, economic factors, and efficacy as potential mechanisms. We also consider participants' stated favorable and walk-away deals as potential mechanisms in this exploratory analysis.

91. Instead of a confirmatory approach, XMed uses the least absolute shrinkage and selection operator (lasso) to "select" mediators from a larger set of potential mediators that researchers would like to explore. XMed uses a "relaxed" lasso approach, first selecting mediators with non-zero effects, then refitting the selected model to obtain coefficient estimates. *See* Sarfaraz Serang et al., *Exploratory Mediation Analysis Via Regularization*, 24 Structural Equation Modeling 733 (2017).

Table A5. Design Checks II: The Association of Difficulty of Understanding Each Tool on Environmental Rank

	Environmental Rank (1)	Environmental Rank (2)
Tax dummy	270.63***	288.72***
	(94.16)	(93.47)
Difficulty understanding regulation (env)		-34.33
Difficulty understanding regulation (bus)		-7.68
Constant	968.64***	1,103.75***
	(143.92)	(63.07)
N	204	204

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01

In sum, our data were unable to provide much purchase on possible mediators. In future research, we can test our uncertainty-aversion hypothesis more directly by varying uncertainty about the unfixed attribute itself. If business participants push for more lenient caps to avoid potentially too-high prices and environmentalists push for more protective taxes to avoid potentially too-low emissions reductions, we would expect to see an increase in uncertainty-aversion (and thus a greater tax/cap disparity) with increased uncertainty.

Three other hypotheses, which we cannot assess with the current data, are also of interest. First, there may be differences that operate in the context of the negotiation itself, rather than in forming preferences before negotiating.[92] For example, environmentalists may have a harder time asking business people to agree to lower caps in the moment during face-to-face negotiations, because the cap feels more heavy-handed.[93] We would not see this result show up in pre-negotiation favorable and walk-away deals. Rather, this mechanism would influence only the interaction leading to the deal itself.

Second, participants may be accounting for perceived distinctions in political reversal risk.[94] Participants might believe that taxes are more subject to reversal than cap-and-trade policies.[95] Indeed, with much fanfare, the U.S. Congress in December 2017 passed significant tax reductions in the Tax Cuts and Jobs Act.[96] In contrast, cap-and-trade programs have often strengthened over time.[97] That said, British Columbia's carbon tax has also increased steadily since 2017, after a five-year freeze.

92. *See* Dewulf et al., *supra* note 26, at 156 (distinguishing between frames that change cognitive representations and frames that change how "parties negotiate meaning in interactions").
93. We thank Joe Bankman for this hypothesis.
94. We thank William Buzbee for this hypothesis.
95. Buzbee argues that taxes are "less likely than cap-and-trade schemes to create the invested constituencies that would fight against implementation failures and policy reversal." Buzbee, *supra* note 36, at 1109. In contrast, offsets under cap-and-trade programs would "immediately create a host of businesses and perhaps governments here and abroad that would be substantially invested in the value of their carbon allowances or offset credits." *Id*. But both tax and cap-and-trade programs can use offsets. And, as Buzbee also explains, taxes could create invested constituencies by refunding revenues as dividends, as British Columbia's carbon tax does.
96. Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017). The "yellow vest" protests in France that led to the cancellation of planned fuel tax increases began on November 17, 2018, after data collection for this study was complete. In 2019, also after data collection was complete, Alberta repealed its carbon tax. Alberta, Canada, *Carbon Tax Repeal*, https://www.alberta.ca/carbon-tax-repeal.aspx (last visited Aug. 3, 2022).

    In contrast, however, British Columbia's carbon tax has increased steadily since 2017, after a five-year freeze. *See*, *e.g.*, Bethany Lindsay, *How B.C. Brought in Canada's 1st Carbon Tax and Avoided Economic Disaster*, CBC (Apr. 4, 2019), https://www.cbc.ca/news/canada/british-columbia/carbon-tax-bc-1.5083734.

    When we look separately at just the classes who negotiated six months after the passage of the Tax Cuts and Jobs Act (for whom tax cuts might not be as top of mind), taxes are more environmentally protective than caps, suggesting the same pattern holds, but the difference is not statistically significant, $t(143.90) = -1.58$, $p = 0.116$. It is hard to infer anything from this lack of significance, however, because only 60 deals are included in this group—the power is likely too low to see a distinction. (Indeed, looking at just the deals negotiated within six months of the Tax Cuts and Jobs Act provides only a barely marginally significant distinction, likely also because of power issues, $t(52.71) = -1.70$, $p = 0.095$.) "Yellow vest" protests against increased fuel taxes in France began in mid-November 2018, after data collection for this study was complete. *See*, *e.g.*, Noemie Bisserbe, *French Protesters Hang Up Their Yellow Vests*, Wall St. J. (June 16, 2019), https://www.wsj.com/articles/french-protesters-hang-up-their-yellow-vests-11560677402.

    Participants did not mention the likelihood of political reversal in their comments, but this concern might be of greater salience in the real world than in our experiment.
97. The EU Emissions Trading System has gotten more stringent over time. In Phase 3 from 2013-2020, the cap has declined by 1.74% each year, and it is set to decline 2.2% each year in Phase 4 from 2021-2030. *See* European Commission, *Emissions Cap and Allowances*, https://ec.europa.eu/clima/policies/ets/cap_en (last visited Aug. 3, 2022). The Regional Greenhouse Gas Initiative (RGGI) likewise implemented stricter controls, proposing an extra 30% decline in the emissions cap by 2030 in 2017. *See* Press Release, RGGI, Inc., RGGI States Announce Proposed Program Changes: Additional 30% Emissions Cap Decline by 2030 (Aug. 23, 2017). With the passage of A.B. 398 in 2017, California extended its cap-and-trade program to operate through 2030, though it is not obvious that the extension is necessarily more stringent than the predecessor policy under A.B. 32. *See* A.B. 398, 2017/2018 Leg., Reg. Sess. (Cal. 2017) (requiring the California Air Resources Board to create price ceilings, price containment points, and industry assistance (i.e., free allowances) but also reducing offset limits).

Table A6. Mechanisms: Favorable and Walk-Away Deals, Perceived Efficacy

	Favorable deal (env)	Favorable deal (bus)	Walk-away deal (env)	Walk-away deal (bus)	Efficacy (env)	Efficacy (bus)
	(1)	(2)	(3)	(4)	(5)	(6)
Tax dummy	470.74**	-226.50	-27.30	-175.77	0.01	-0.22
	(220.61)	(390.09)	(247.26)	(282.19)	(0.13)	(0.14)
Constant	11,644.98***	10,292.47***	7,060.17***	3,800.66***	3.24***	3.37***
	(177.66)	(277.50)	(202.31)	(193.67)	(0.09)	(0.09)
N	195	193	195	193	205	204

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.

Table A7. Mechanisms: Importance of Environmental and Economic Factors, Morality

	Environmental factors (env)	Environmental factors (bus)	Economic factors (env)	Economic factors (bus)	Morality (env)	Morality (bus)
	(1)	(2)	(3)	(4)	(5)	(6)
Tax dummy	-0.19	-0.18	-0.06	-0.10	-0.37**	-0.33**
	(0.14)	(0.14)	(0.13)	(0.14)	(0.16)	(0.17)
Constant	4.18***	2.65***	2.83***	4.27***	3.38***	2.79***
	(0.09)	(0.10)	(0.09)	(0.09)	(0.11)	(0.12)
N	206	205	206	205	206	205

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.

Table A8. Mechanisms

	Environmental Rank	Environmental Rank	Environmental Rank	Environmental Rank	Environmental Rank
	(1)	(2)	(3)	(4)	(5)
Tax dummy	267.69***	255.60***	291.50***	285.70***	296.15***
	(92.60)	(97.17)	(95.00)	(92.37)	(100.75)
Favorable (env)		0.04			0.03
		(0.04)			(0.04)
Morality (env)			50.54		51.02
			(40.36)		(44.75)
Morality (bus)				60.37	41.08
				(38.55)	(42.81)
Constant	973.63***	865.34***	802.77***	800.30***	594.61***
	(62.66)	(150.61)	(145.01)	(118.32)	(211.86)
N	207	191	206	205	189

Note: Robust standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.

Finally, it may be that "paying to pollute" elicits a feeling of a taboo trade off—a transaction that violates social norms, such as attempts to sell a baby.[98] People recoiling from such norm violations experience moral outrage and consequently require higher prices to participate in such transactions (when they agree to participate at all).[99] Both cap and trade and pollution taxes could elicit feelings of a taboo trade off (paying to pollute).[100] But that feeling might be greater for taxes, which look more like direct payments, than for cap-and-trade programs, which may seem closer to traditional coercive quantity mandates. Future research is necessary.

98. Philip E. Tetlock et al., *The Psychology of the Unthinkable: Taboo Trade-Offs, Forbidden Base Rates, and Heretical Counterfactuals*, 78 J. Personality & Soc. Psych. 853 (2000).

99. A. Peter McGraw et al., *The Limits of Fungibility: Relational Schemata and the Value of Things*, 30 J. Consumer Rsch. 219 (2003).

100. *See*, *e.g.*, Michael J. Sandel, *It's Immoral to Buy the Right to Pollute*, N.Y. Times (Dec. 15, 1997), http://www.nytimes.com/1997/12/15/opinion/it-s-immoral-to-buy-the-right-to-pollute.html; Steven Kelman, What Price Incentives? Economists and the Environment (1981).