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Comparing public support for alternative climate policy designs: An experimental study

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Abstract

Scholars have debated how specific policy designs may generate stronger positive or negative reactions from the public, especially with regard to public expectations regarding pricing-based policy designs compared to regulatory approaches. In this study, we report the results of a survey experiment on Virginia registered voters measuring public opinion toward a regulatory versus a pricing-based policy design, both of which were included in the state's 2020 Clean Economy Act. Our data confirm several hypotheses indicating that public support is no higher for a regulatory design than for a pricing-based design, and that perceptions of the key effects of both designs are also similar. These findings suggest that public opinion should not be presumed to favor regulatory over pricing-based policy designs, nor should assumptions about public preferences hinder efforts toward an "all of the above" strategy for mitigating climate change.

KEYWORDS

carbon pricing, climate change policy, public opinion, renewable portfolio standards, state climate policy

INTRODUCTION

Scholars have identified myriad challenges associated with the passage of robust climate change policy, particularly in the U.S. (Basseches et al., 2022; Rabe, 2011). A major question has been whether certain *policy designs* face greater political challenges than others. For example, some have argued that *pricing-based* policy designs, such as carbon taxes or cap-and-trade programs, generate less public support than *regulatory* designs or mandates, such as renewable energy standards, mainly because of greater concerns about consumer energy costs and environmental ineffectiveness for the pricing-based approach. Despite the active political and scholarly debate, however, this question has been subject to minimal empirical testing. In this study, we put this question to an empirical test using a public opinion experiment comparing a cap-and-trade versus a clean energy standard policy design.

In our study, we build on an important body of work exploring public support for different climate policy designs (See generally Rhodes et al., 2017) that has argued for greater attention to the details of a particular policy, rather than sweeping conclusions about broad policy types. Consistent with this larger perspective as well as emerging research specifically on carbon pricing, we compare public opinion regarding the most widely adopted U.S. state-level clean energy regulatory policy—a renewable portfolio/clean energy standard (Basseches, 2024)—with a distinctive pricing-based policy design: cap and trade with revenue recycling for tangible "public benefits" (Raymond, 2016). This "public benefits" policy design includes cap-and-trade policies that auction emissions allowances and dedicate revenue to public purposes, either through a cash dividend, reduced energy prices from subsidies for energy conservation improvements, or through investments in new renewable energy infrastructure and jobs. Prior case studies have found this public benefits model to be an important factor in the political success of market-based climate policies such as the Regional Greenhouse Gas Initiative (RGGI) and California's cap-and-trade policy (Karapin, 2020; Raymond, 2016), as well as a cap-and-trade program that withstood a well-funded repeal effort in Washington in 2024.

In this study, we investigate public opinion regarding cap and trade with public benefits versus a renewable energy mandate with a survey experiment on registered voters in the U.S. state of Virginia. Specifically, we study public support for Virginia's recent climate policy law, the 2020 Virginia Clean Economy Act (VCEA) signed into law by Gov. Ralph Northam on April 11, 2020. The VCEA included both a regulatory policy provision (a 100% Clean Energy Mandate for the state's utilities) as well as a market-based policy with public benefits (authorizing Virginia's membership in the RGGI cap-and-trade program, which relies on public benefit spending). By including *both* policy designs, the VCEA sets up a unique natural experiment allowing us to compare public perceptions of the two approaches.

Virginia is a valuable case to study in other ways, representing an important extension of climate policy to a more politically conservative U.S. state. Virginia is also the first southern state to join a carbon cap and trade program (Rabe, 2011) and the first in the South to establish a 100% clean energy mandate through legislation. In addition, as a "purple" state that is neither a true leader nor laggard on climate policy, Virginia represents an important extension beyond more liberal Northeastern and West Coast states that have traditionally led in climate policy. Importantly, the Virginia Assembly, Senate, and Governor were all controlled by Democrats when adopting the VCEA, consistent with existing research that "Democratic trifectas" are helpful in promoting climate policy adoption (e.g. Basseches et al., 2022; Bromley-Trujillo & Poe, 2020). But Virginia has since elected a Republican Governor who has tried to undo elements of the VCEA, reflecting its more even partisan balance. Thus, as a politically competitive state in the middle of the pack

on climate policy, Virginia could be seen as a bellwether of how many other U.S. states might proceed with climate policy.

Our survey experiment tests three primary research questions. First, does the public support a regulatory mandate more than a cap and trade design with public benefits in the same policy setting? Second, is the public more concerned about consumer electricity costs and local air quality concerns for cap and trade with public benefits than for the regulatory mandate? Finally, do those who care more about energy costs or local air quality favor the mandate over the pricing approach with public benefits?

In this manner, our study brings several new contributions to the literature on public support for different climate policy designs. First, it goes beyond general or abstract questions about carbon pricing and regulation to test a specific pricing policy option, cap and trade with public benefits, and a specific regulatory approach, a 100% clean electricity mandate, that have not been compared via survey research previously. Second, it has high external validity by testing the relative popularity of the pricing and regulatory designs in a survey experiment based on actual policies adopted, both of which are leading alternatives in current U.S. climate policy; this is an important complement to prior work that has often relied on hypothetical experiments detached from real-world policy debates. Third, it explores public opinion regarding climate policy options in an important and relatively high-profile recent U.S. climate policy debate: the 2020 VCEA.

PRIOR RESEARCH ON POLICY DESIGN AND CLIMATE POLICY SUPPORT

It is well understood that the nature of anthropogenic climate change makes politics around the issue especially difficult. Potentially high short-term costs from policy action combined with potentially longer-term benefits from greenhouse gas (GHG) emissions reductions are one important part of this challenge (Klenert et al., 2018; Rabe, 2018). So is the imbalance between climate change risks and emissions for poor and less politically influential communities compared to wealthier and more powerful groups (Mendez, 2020). Climate change solutions also require costly changes to fossil fuel energy systems that affect many aspects of daily life and are controlled by some of the most powerful industries in the world (Mildenberger, 2020; Stokes, 2020). Moreover, a long-running campaign of scientific misinformation has created public uncertainty and confusion over the issue, weakening political support (Brulle, 2020; Dunlap & McCright, 2010; Oreskes & Conway, 2010). Taken together, these factors make any government action to mitigate climate change difficult.

Given the challenging nature of climate change politics, scholars and advocates have debated which policy designs might increase or decrease public support. A prominent element of this debate has focused on how price-based policies, such as carbon taxes or cap-and-trade programs, might differ from regulatory policy designs, such as renewable portfolio standards or zero-emissions requirements, in shaping public opinion.

Pricing designs increase the cost of emitting pollution, thereby changing the incentives for polluters. These policy designs were first proposed in the 1960s and 1970s, based on recommendations by environmental economists indicating that the most efficient way of reducing pollution was to make polluters pay the full costs of their emissions (e.g., Baumol & Oates, 1971). Economists proposed two approaches to change these polluter incentives.

The first is a direct tax on pollution, ideally set to the value of the environmental damage created by each additional unit of pollution (Ruff, 1970). This provides certainty with respect to

the pollution price, but ambiguity with respect to emissions reductions. The pollution tax policy design has since been supported by a variety of groups specifically for reducing carbon emissions (e.g., Citizens' Climate Lobby, 2024; Shultz & Halstead, 2018).

A second major pricing policy design is known as cap and trade. Here, policymakers create a limited number of rights to emit pollution often referred to as "allowances," and require emitters to surrender one allowance for each ton of pollution they produce. Under this design, government does not set the cost of polluting directly, as with a tax. Instead, it limits the total amount of pollution that is permitted (creating a "cap" on emissions) and lets polluters determine the price of polluting by trading allowances with one another (Dales, 1968). Under this approach, polluters are encouraged to make emissions reductions at the facilities with the lowest marginal costs of abatement, thereby reducing emissions at the lowest total social cost (Montgomery, 1972). Thus, the cap-and-trade design also uses a pricing mechanism to incentivize the most efficient reduction of emissions, but does so in a manner that strictly limits emissions under the cap while allowing polluters to buy and sell allowances to set the emissions price. A leading example of a cap-and-trade pricing approach is the 1990 U.S. Acid Rain Program (Schmalensee & Stavins, 2013), although there are also prominent cap-and-trade policies for carbon pollution, including the Regional Greenhouse Gas Initiative (RGGI) created by 10 Northeastern and Mid-Atlantic states in 2008. Cap-and-trade designs can also auction emissions allowances at the outset, using the initial allowance sale to set prices and raise funds for possible public investments. This so-called "cap-and-invest" design that can provide the public benefits we explore here.

Regulatory mandates, by contrast, require specific actions to reduce emissions. The classic regulatory approach in the U.S. is a so-called command-and-control policy design, which relies on regulations compelling specific technologies or emissions reductions by each source, with fines or other penalties for enforcement. A leading example of this approach is the U.S. Clean Air Act of 1970 (Bryner, 1993). More recent regulatory designs for climate change have relied on clean energy mandates: legal requirements for utilities to produce a minimum amount of electricity from renewable or zero-emission sources (Matisoff, 2008). Mandates are a leading option among U.S. states for reducing carbon emissions, with 31 states having some form of mandatory RPS in force as of 2021 (National Conference of State Legislatures, 2021). Other examples of regulatory mandates include vehicle emissions standards or outright bans on certain high-pollution activities or technologies.

Skeptics of price-based policies argue that both carbon taxes and cap-and-trade programs increase public opposition by foregrounding potential consumer energy price increases (Green, 2019; Stokes & Mildenberger, 2020; Cullenward & Victor, 2020; Drews & van den Bergh, 2016; Rabe, 2010). Many of these studies find that carbon taxes in particular are less popular with the public than a cap-and-trade design (e.g., Lachapelle et al., 2012; Mildenberger et al., 2016; Rhodes et al., 2017), possibly due to the more prominent nature of the imposed cost on the public. But others have argued that this unpopularity also extends to cap-and-trade designs (e.g., Cullenward & Victor, 2020; Green, 2019; Stokes & Mildenberger, 2020). A fear of right-wing populist protests regarding higher energy prices tied to climate change policies feeds into this argument about carbon pricing (Lockwood, 2018; Raymond, 2020). On this account, regulatory designs garner more public support and are therefore more politically successful (Bergquist et al., 2020; Jaccard, 2020; Stadelmann-Steffen, 2011; Stokes & Mildenberger, 2020).

An emerging body of work disputes this blanket assertion, arguing that carbon pricing can generate stronger public support *when designed and communicated to stress its consumer and environmental benefits* (Driesen, 2019; Klenert et al., 2018; Raymond, 2016). Much of this research emphasizes the importance of how revenue from any carbon price system is allocated in shaping

public support. Carattini et al. (2019), for example, cite survey data in multiple nations showing that dedicating carbon tax revenue to equal payments to all citizens or to efforts to lower carbon emissions creates majority public support for the tax.

Case studies of successful carbon pricing support these survey results. Specifically, these studies find that dedicating carbon revenue to "public benefits," to reduce costs for energy consumers and to reduce emissions, has been crucial to the successful adoption of new carbon pricing policies in U.S. states and abroad (Karapin, 2020; Raymond, 2016, 2019). The most recent example of a successful public benefits strategy is Washington state's 2024 referendum vote to maintain its "cap-and-invest" program. By emphasizing the importance of the investment from the program, carbon pricing supporters garnered more than 60% of the vote in favor of keeping the carbon cap-and-trade program (Withycombe & Swanson, 2024).

These recent cases suggest that by dedicating carbon pricing revenue to programs that help reduce consumer energy costs and lower carbon emissions, public benefits designs address the two important public skepticisms of carbon pricing: worries about higher consumer energy costs (Lachapelle et al., 2012; Stadelmann-Steffen, 2011) and about the potential environmental ineffectiveness of the approach (London et al., 2013; Stadelmann-Steffen & Dermont, 2018).

It is also important to note that some studies find regulations, such as renewable energy standards or command-and-control rules, can be less popular than pricing schemes (Huber et al., 2020) and are also vulnerable to arguments about higher consumer energy costs (Mills et al., 2015; Stokes, 2020; Stokes & Warshaw, 2017). Indeed, the history of industry opposition to long-standing regulatory laws such as the U.S. Clean Air Act or Clean Water Act features prominent arguments about higher costs for consumers and other negative economic impacts (Layzer, 2012). In addition, studies finding relatively low support for carbon taxation or trading policies still report net majorities supporting both policy designs (e.g., Rhodes et al., 2017).

These results strongly suggest that the "devil is in the details" of a particular policy. Drawing this conclusion, some scholars now question the usefulness of simple policy types such as "regulatory" or "pricing-based".[1] Many of these scholars go on to demonstrate that the specific details of a policy are what determines public support—not the relatively crude distinctions between a regulatory and a market-based design (Rhodes et al., 2017; Stadelmann-Steffen & Dermont, 2018; Wicki et al., 2019). Related work urges greater attention to packages of policies, arguing that more disruptive and costly "push" policies need to be combined with additional "pull" policies (or incentives) to gain public acceptance (Thaller et al., 2024; see also Bergquist et al., 2020). These arguments about the importance of policy details support our premise that specific provisions for revenue allocation will be able to increase public support for a pricing policy using cap and trade.

Thus, based on this research showing the importance of policy details rather than basic policy typologies and specific research showing the potential for public benefit investments to increase public support for carbon cap and trade policy by lowering concerns about consumer costs, we offer our first hypotheses regarding relative support for carbon pricing versus regulatory designs:

General hypothesis

H1. Support for a cap-and-trade policy design with public benefits will be as high as or higher than support for a regulatory mandate.

Consumer cost hypotheses

H2a. The public will expect equal or better consumer cost effects from a cap-and-trade with public benefits policy design as from a regulatory mandate.

H2b. Concern about consumer energy prices will be at least as likely to predict support for a cap-and-trade with public benefits policy design as it is for a regulatory mandate.

Our additional hypotheses consider well-documented public concerns about carbon pricing's potential environmental ineffectiveness. These concerns include that a carbon price may not sufficiently reduce carbon emissions (Stadelmann-Steffen & Dermont, 2018), or may increase local air pollution from "co-pollutants" with carbon dioxide in certain areas (e.g., Cushing et al., 2018). Although empirical evidence of increases in local air pollutants from emissions trading near high emitting facilities is mixed (Cushing et al., 2018; Schmalensee & Stavins, 2017), there remains an argument that these policies provoke greater public opposition due to concerns about local air quality (Mendez, 2020). The growing political influence of environmental justice (EJ) movements has increased this concern, because of local concerns that these emission increases will happen in communities already facing higher levels of local air pollution (Basseches et al., 2021; London et al., 2013). Such EJ concerns were politically critical in the process of renewing California's cap-and-trade policy in 2017 (Basseches et al., 2021; Mendez, 2020) and have had substantial influence on federal and state climate policy in recent years (Conley et al., 2023; Raymond, 2019).

As with energy costs, there is some work suggesting that carbon cap and trade with public benefits can reduce these public concerns about local air quality impacts. Several studies have argued that carbon pricing policies can improve public support if they are also designed to reduce local air pollutants (Boyce et al., 2023; Karapin, 2020; Lachapelle et al., 2012; Petrovic et al., 2014; Raymond, 2019). We seek to test these arguments about the potential for higher support for cap-and-trade policy designs with public benefits with our third set of hypotheses regarding air quality:

Air quality hypotheses

H3a. The public will expect equal or better local air pollution effects from a cap-and-trade with public benefits policy design than from a regulatory mandate.

H3b. Concern about local air pollution will be at least as likely to predict support for a cap-and-trade policy design with public benefits as a regulatory mandate.

METHODS

We test these hypotheses with a survey experiment that leverages a recent climate policy adopted in Virginia—the 2020 Virginia Clean Economy Act (VCEA). As noted in our introduction, the VCEA is a unique natural experiment because it includes important regulatory and pricing policy elements, including a clean energy mandate for the state's utilities and an authorization to join RGGI, the multi-state carbon cap-and-trade program with public benefits. Virginia is also politically closer to

the "median" in the United States, frequently electing Democratic and Republican state governments, and has a history of fossil fuel production and use in making electricity. For these reasons, it both serves as a valuable case in its own right and offers better potential to represent public opinion in other states in the U.S. that deviate from the Northeastern and West Coast states that have been the original leaders on climate policy, especially carbon pricing.

Our data come from a telephone survey of 990 Virginia registered voters, conducted March 22–April 10, 2021, using random digit dialing. We use an iterative weighting process on region, age, race, sex, and education to closely mirror the demographics of the Virginia registered voter population at the time the survey was conducted based on data from the U.S. Census and the American Community Survey. The use of survey weights ensures that our sample is representative of the Virginia registered voter population as reported in the U.S. Census and American Community Survey. The reported margin of error includes a design effect of 1.8, which accounts for potential error induced by the use of survey weights. The full survey demographics and responses by question are reported in the article appendix.

The average call duration for the survey was 10 min and 12 s, and 5 callbacks were used in the field. The survey response rate using AAPOR's standard definition is 9%. Response rates for individual questions vary between 92% and 100%, showing no concerns about non-response bias. The margin of error for the whole survey is ±3.4%. The research was conducted with approval by the Christopher Newport University Institutional Review Board, Protocol number 1658423-1, and included informed consent for all survey participants.

The survey asks respondents about their familiarity with the Virginia Clean Economy Act, of which the large majority (77%) indicated they were unfamiliar. This high degree of unfamiliarity suggests that responses to our policy questions were based primarily on the experimental treatments we provided about the two policy designs, increasing confidence in the internal validity of our experiment. Subjects were informed that the law had two parts: one requiring the state to generate 100% of its electricity using renewable sources, and the other formalizing Virginia's entry into the Regional Greenhouse Gas Initiative cap-and-trade program to reduce carbon pollution. Subjects were then randomly assigned to one of two treatment conditions where they were asked their opinion on either the clean energy mandate or the cap-and-trade provision of the law. We refer to these as the *regulation* and *pricing* conditions, respectively.

Subjects in each condition received a short summary of how the relevant provision of the law worked. The regulation condition used the following policy description:

> The 100% renewable electricity mandate requires the state's private electric utilities to produce an increasing amount of renewable energy over time until all of the state's electricity is from renewables by 2050. The utilities must pay penalties if they fail to meet these requirements.

Subjects in the pricing condition received the following description, including the requirement to purchase allowances and the public benefit spending in the RGGI program design:

> The Regional Greenhouse Gas Initiative is a program joined by eleven states, which sets a cap on the amount of carbon pollution that power plants in these states can release. Companies that produce energy must buy credits for the carbon pollution they release. The revenue raised from selling these credits goes to things like energy efficiency programs, credits to help consumers pay their electric bill, and worker training for clean energy jobs.

In each condition, we asked subjects to indicate their level of support for the policy described, on a 4-point scale from "Strongly oppose" to "Strongly support." We test H1 by comparing support across the two treatments to see if mean support for the pricing policy is higher than or equal to support for the regulatory provision.

We test our consumer cost and local air pollution hypotheses with an additional set of questions. Immediately following the treatment descriptions, respondents were asked:

> Now, still thinking about the part of the Virginia Clean Economy Act I just described, do you think this provision will have a positive effect, a negative effect, or no real effect either way on each of the following in the state of Virginia.... [jobs and economic growth; local air quality; reducing pollution differences between wealthy and disadvantaged communities; consumer energy prices; climate change threats in Virginia, such as extreme weather and; on taxes in Virginia].

We test H2a (about expected consumer price effects) and H3a (about expected local air pollution impacts) by comparing mean answers to these questions across the two treatment conditions. If respondents expect a more positive (or statistically indistinguishable at conventional p values of $<.05$) effect from the VCEA under the pricing condition to the expected effect under the regulatory condition, we find support for these hypotheses.

Finally, we use the following question to measure general concern about consumer energy prices or local air quality to test H2b and H3b:

> In thinking about government efforts to address climate change, how important is each of the following in whether or not you would support a given law? [the law's effect on reducing greenhouse gas emissions, jobs and economic growth, local air quality, reducing pollution differences between wealthy and disadvantaged communities, consumer energy prices, climate change threats in Virginia, such as extreme weather, and taxes in Virginia]
>
> Is it very important, somewhat important, not very important or not at all important to you?

H2b and H3b predict equal or higher support for the pricing design among those with higher concerns about consumer costs or air quality. We test these hypotheses by using the responses from this question as independent variables in a linear regression. If the coefficient on responses regarding the importance of consumer energy prices or local air quality is significant and larger (or statistically indistinguishable) for predicting policy support in the pricing policy condition as in the regulatory policy condition, we find support for the hypothesis.

RESULTS

As shown in Table 1, we find confirmatory evidence for our first hypothesis regarding higher public support for the pricing design: Subjects in the pricing condition supported the policy slightly more ($M=1.94$) than those in the regulatory condition ($M=1.84$) (independent samples comparison of means test $p=.12$). These results indicate Virginia residents were as or more supportive of the pricing-based aspect of the VCEA as they were of the law's clean energy mandate, consistent with H1.

TABLE 1 Support for pricing versus regulatory policy design.

Policy design	Weighted mean support
Pricing (cap and trade public benefits)	1.94
Regulation (clean energy mandate)	1.84

Note: Two tailed independent samples *t*-test, 4 Point scale: (0 – strongly oppose to 3 – strongly support), $N = 943$, $p = .12$.

Consumer cost hypotheses

Our consumer cost hypotheses predicted subjects would expect equal or better consumer cost impacts from the pricing design as from the regulatory design (H2a), and that greater concern about consumer costs in general would be as good a predictor of support for the VCEA in the pricing as in the regulatory condition (H2b). Our results largely confirm these hypotheses.

As Table 2 indicates, we find that the public has no statistically significant difference in their perceptions of the consumer cost impacts of the pricing policy versus the regulatory policy. Expectations for impacts on consumer energy prices are slightly negative for both policy designs: 0.94 on a scale from zero to two for the regulatory part of the law, and 0.90 for the pricing provision of the VCEA. Although subjects expect a slightly more negative effect on energy prices from cap and trade with public benefits than from the renewable energy mandate, the difference is minimal and statistically indistinguishable (Independent samples *t*-test, $p = .57$), consistent with H2a.

We also explored expected effects of both policy designs by comparing the *percentage of subjects* who think the policy will have positive versus negative effects. These results are also largely consistent with our consumer cost hypothesis (2A) that cost perceptions will be similar or better for the pricing condition. Table 3 shows that 44.4% of respondents expected the pricing policy to have a negative (harmful) effect on consumer prices, slightly more than the 43.0% who expected negative price impacts from the clean energy mandate, a difference that is statistically indistinguishable (Difference in proportions independent samples test, $p = .66$). Similarly, although a slightly larger percentage think the mandate will have a positive effect on consumer prices than cap and trade with public benefits (37.1% vs. 32.8%), this difference is also statistically insignificant (Difference in proportions independent samples test, $p = .17$).

Our second consumer cost hypothesis indicated that subjects' beliefs about the importance of consumer energy costs should predict support for the pricing policy design as well as or better than for the regulatory design. As discussed, we test this hypothesis by regressing respondents' levels of support for each policy design on their beliefs about the importance of different considerations in climate policy.

Our regression models (Table 4) are significant ($p < .01$) and display tolerable levels of collinearity among the independent variables (VIF scores no higher than 3.7). In terms of consumer energy pricing, the degree of importance a subject gives to this issue had no better ability to predict support for a regulatory design than for a pricing policy design, consistent with H2b. Indeed, this variable had no significant association with a subject's approval for either policy design. This is a surprising finding, given prior research indicating that economic concerns are central to public support for climate policies. (This result may be due in part to the lack of variance on this variable: Over 80% of respondents rated consumer energy prices as very or somewhat important to their evaluation of any climate policy.)

TABLE 2 Mean expected effects of pricing versus regulatory policy designs.

	Weighted mean pricing	Weighted mean regulation	*p*-value
Consumer energy prices	0.90	0.94	.57
Local air quality	1.62	1.63	.76

Note: Two tailed independent samples *t*-test, 3 point scale: (0 = negative effect, 1 = no effect, 2 = positive effect) based on question on expected effects detailed in methods section.

TABLE 3 Percentage of respondents expecting negative or positive effects by condition.

	Pricing	Mandate	*p* value
Negative effect on consumer energy prices	44.4%	43.0%	.66
Positive effect on consumer energy prices	32.8%	37.1%	.17
Negative effect on local air quality	3.9%	6.9%	.03
Positive effect on local air quality	65.8%	70.7%	.10

Note: Percentage of respondents indicating they expect type of effect under treatment condition. Difference in samples calculated with two-tailed independent samples proportions test.

TABLE 4 Association of policy priorities with support for policy designs.

	Pricing policy		Regulation policy	
	Estimate	*p*-value	Estimate	*p*-value
Intercept	0.72	<.01	0.43	.01
Reducing GHG emissions	0.20	<.01	0.25	<.01
Economic development	−0.04	.44	0.03	.56
Local air quality	0.29	<.01	0.15	.08
Reducing pollution inequalities	0.06	.13	0.15	<.01
Consumer energy prices	0.03	.51	0.08	.19
Climate change threats in Virginia	0.16	<.01	0.20	<.01
Taxes in Virginia	−0.13	.01	−0.19	<.01
F-statistic	67.13	<.01	65.41	<.01
Adjusted R-squared	0.51		0.53	
N	440		406	

Note: Support for policy design regressed on relative importance of different policy goals, measured on 4 point scale: (0 – Not at all important to 3 – Very important). Estimates are unstandardized coefficients.

Local air quality hypotheses

In terms of our local air quality hypotheses, the results are quite similar. Returning to Table 2, we find the public expects a positive effect on local air quality from the policy's regulatory provision (M = 1.63). It expects almost exactly the same effect from the pricing provision (M = 1.62). Although the expected air quality impact for the regulatory policy is slightly higher, this difference is statistically indistinguishable (Independent samples *t*-test $p = .76$), consistent with H3a.

In addition, Table 3 shows that although more respondents think the mandate will have a positive effect on local air quality compared to the pricing policy (70.7% vs. 65.8%), this

difference is also not statistically significant ($p = .10$). More notably, a significantly higher percentage of respondents ($p = .03$) believe the mandate would have a *negative* effect on local air quality than the RGGI provision (6.9% vs. 3.9%).

Returning to Table 4, we test Hypothesis H3b about the power of concerns about local air quality in general as a predictor of support for the law in the pricing condition versus the regulatory condition. Here our results strongly support our hypothesis H3b about local air quality being as good or better a predictor of support for the pricing policy as for the regulatory option: Subjects who rated local air quality impacts as very important to them supported cap and trade with public benefits by 0.87 points higher on a 4-point scale than those who thought air quality was not at all important, whereas the same belief was not significantly associated with any change in support for the clean energy mandate.

Interestingly, concerns about the importance of *reducing pollution differences* were associated with greater support for the regulatory policy but had no relationship to policy support for the pricing policy. That result suggests that specific concerns about *pollution inequalities* may be a better predictor of support for a regulatory approach than concerns about local air quality in general. This difference merits further exploration, as we discuss below.

DISCUSSION

To summarize our results, the experiment presents new empirical evidence that the public does not show a clear preference for a regulatory mandate over a pricing-based policy design. Virginia registered voters were slightly more supportive of a pricing-based policy design in their state's recent climate change law compared to the law's clean energy mandate. In this instance, combining a cap-and-trade design with revenue investment in public benefits that lower energy costs and increase environmental efficacy appears to be a relatively effective way to design and promote a climate policy for public acceptance. This is consistent with our hypothesis, and contrary to at least some arguments that pricing-based policies are politically handicapped by lower public support. When designed appropriately, pricing policies appear to be able to generate similar public support to regulatory alternatives.

Digging deeper, we find the public does not always conclude that pricing designs will create higher consumer energy prices or worse local air quality. In our survey experiment, Virginia residents expected similar effects from the two policy designs on consumer energy costs and on local air quality: an improvement in air quality and a negligible effect on energy costs. It is especially notable that public perceptions of the two policy designs did not display statistically significant differences in terms of expected effects on consumer energy prices, given the level of debate over energy price impacts of carbon taxes or carbon cap-and-trade policies.

Finally, we found that a respondent's level of concern over energy prices was not a good predictor of support for either policy design, consistent with our hypothesis that these concerns would be as good a predictor of support for the pricing policy as for the regulatory mandate. More notably, we found concerns about local air quality to be one of the strongest predictors of support for the VCEA's pricing provision, but not to be a reliable predictor of support for the clean energy mandate, consistent with our hypothesis about local air quality and support for cap and trade with public benefits.

In looking at concerns about local air quality, we also highlight our additional finding that a subject's concern about reducing air pollution *inequalities*, rather than local air quality in general, was a positive predictor of support for the regulatory mandate. This suggests that pricing-based policies could be more vulnerable to EJ arguments about the risk of concentrating pollution in

certain areas, consistent with the broad opposition to market-based policy designs for climate change by EJ movements. This finding merits additional research to investigate how individual concerns about local air quality interact with concerns about local pollution inequalities in shaping public opinion on these policy designs, including cap-and-trade designs limiting trading allowances into "overburdened" areas (Boyce et al., 2023).

There are of course limitations of this study's focus on a single political jurisdiction. Although the controlled context of a state that passed both policy designs at the same time is helpful for internal validity, it limits generalizability. As such, our results indicate a need for additional empirical research in other states and political contexts to inform this debate about public support for different policy designs.

It is also important to recognize that most respondents in the survey were not familiar with the VCEA, meaning one could challenge the relevance of these perceptions as being uninformed or related to an issue that lacks salience. Here we note that Virginia is no exception: public ignorance of the details of these policy designs is widely recognized (e.g., Mildenberger et al., 2022). More importantly, the public's ignorance allowed us to provide respondents with a consistent explanation of either policy design, again improving our internal validity. In this sense, we argue that the fact that the public does not start with a pre-conceived sense of support for either design, or for their expected effects, is an important foundation for any subsequent study over how different messages stressing higher energy costs or local air quality problems are likely to affect public support for either design.

Finally, there is an important limitation in our reliance on failed difference of means tests for accepting some of our hypotheses. Although it would have been a stronger result to find that expectations for the pricing policy were better than those for the regulatory policy, we only find these expectations to be within the widely used margin of error for several basic statistical tests. This is weaker evidence for hypotheses H2a and H3a, but evidence that still calls into question the assertion that pricing designs should generate significantly higher concerns about local air quality and consumer prices than regulatory alternatives. A similar limitation affects our results from the regression analysis, where we found no relationship at all between concerns about energy prices and support for either policy. Although technically consistent with our hypothesis, this is a surprising result that may well be attributable to the very high level of agreement among our respondents about the importance of consumer energy prices.

Despite these limitations, we argue that these results are successful at raising empirical questions about arguments challenging public support for any pricing policy design. In this manner, they justify additional research using more detailed measures of key factors such as public concern about energy prices to address some of our statistical limitations. In addition, they justify additional research exploring public perceptions of cap and trade with public benefits versus different regulatory policy designs, as we discuss below.

These results also add new external validity to existing research in this area using choice experiments to test public support for different policy designs combined at random to meet a given climate change goal (e.g., Stadelmann-Steffen & Dermont, 2018; Thaller et al., 2024; Wicki et al., 2019). While those studies provide critical information on how public support for different designs varies for the same climate goal, our study adds information about how widely used examples of these policy designs (the RPS vs. cap and trade with public benefits) fare in terms of public opinion, increasing the policy relevance of the results.

For example, it would be valuable to build on these preliminary findings with future experiments comparing the effects of more strategic frames stressing air quality or consumer price impacts on either of these policy designs, or on related designs such as a carbon tax. This includes looking at framing conflicts where opponents of cap and trade describe it as a "hidden tax", much

as Virginia Governor Youngkin did in 2021 when trying (unsuccessfully) to withdraw the state from RGGI (Paullin, 2024). In addition, it would be useful to test similar negative and positive frames on regulations and mandates targeting similar emissions reduction goals.

There is also an important limitation of these results in terms of their policy implications. In practice, policymaking is a complex process informed not only by public opinion, but also by interest group politics, political party agendas, and policy entrepreneur motivations. Indeed, implicit in drawing policy implications from our findings is the assumption that public opinion matters when it comes to climate policy design. Although some may be skeptical of the importance of public opinion in shaping actual policy enactment compared to the power of corporate and other interest groups (Stokes, 2020), there is good evidence that politicians are electorally motivated and therefore care what the public thinks of their activities (e.g., Bromley-Trujillo & Poe, 2020; Mayhew, 2004).

Finally, we note the limitations of the simple distinction between pricing and regulatory policy designs. Despite revenue use for public benefit being a defining characteristic of carbon pricing approaches, cap-and-trade policies do contain a mandate-like element of an overall cap.[2] Meanwhile, regulatory policies such as renewable portfolio standards can contain certain market-based elements, such as "unbundled" renewable energy credits (RECs) that can be bought/sold/traded as a means of compliance (Fischlein & Smith, 2013). Still other policies do not fit neatly in either category, such as the recently adopted U.S. Inflation Reduction Act, a "green industrial policy" that relies on investment of taxpayer dollars in private sector development and renewable technology subsidies, but contains neither a mandate nor a price-based scheme. Thus, it is important to remember that policy design is much more than a blunt choice to use a "pricing" or a "regulatory" scheme, and that a public benefits design and messaging is likely to be important for any successful climate change policy.[3]

CONCLUSION

Our findings provide the first empirically based suggestion that the voting public views a common pricing-based policy design (cap and trade with public benefits) quite similarly to a leading regulatory design (a 100% clean electricity mandate). In our controlled experiment, Virginia voters slightly favored the cap-and-trade design and evaluated the two designs similarly in terms of their expected economic and local air pollution effects. This finding is consistent with research suggesting that pricing-based policies can generate public support when designed to help consumers or environmental quality. While several factors are relevant to policy design, such as EJ concerns and demonstrable policy success, our findings suggest that public opinion should not be presumed to favor one design over the other, nor should our assumptions about public preferences hinder efforts toward a strategy for mitigating climate change that is open to a wide range of policies. Instead, scholarship should move beyond simple distinctions between pricing and regulatory schemes and continue to focus more on the details of all possible designs, both for their effectiveness in reducing GHG emissions and for their political viability.

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Endnotes

[1] Notably, studies do not always agree on how to classify key policies like cap and trade. Despite being widely seen as a price-based policy in current political discourse (dating back to its prominent introduction in the 1990 U.S. Acid Rain Program as a market-based alternative to regulation), cap-and-trade designs are sometimes categorized as a regulatory policy in the academic literature (e.g., Rhodes et al., 2017).

[2] Leading to their classification by some studies as a regulatory design, as noted in endnote 1.

[3] As was done for the Inflation Reduction Act, which explicitly incorporated designs to provide job gains and other benefits for the public beyond emissions reductions.

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