Public Good Perceptions and Polarization: Evidence from Higher Education Appropriations

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Abstract

To understand the causes and consequences of polarized demand for government expenditure, we conduct three field experiments in the context of public higher education. The first two experiments study polarization in taxpayer demand. We provide information to shape beliefs about social returns on investment. Our treatments narrow the political partisan gap in ideal policies—a reduction in ideological polarization—by up to 32%, with differences in partisan reasoning as a key mechanism. Providing information also affects how people communicate their ideal policies to elected officials, increasing their propensity to write a (positive) letter to an official of the other party—a reduction in affective polarization. In the third experiment, we send these letters to a randomized subset of elected officials to study how policymakers respond to constituent demand. We find that officials who receive their constituents' demands engage more with higher education issues in our correspondences.

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1. Introduction

Political partisans often come to starkly different conclusions regarding the value of public services. These cross-partisan differences, known as ideological polarization, could arise from either preference-based sorting into parties or differences in perceptions and reasoning (Alesina et al., 2020). If individuals' preferred policies trade off the perceived benefits of better services with the perceived costs of added taxes, polarization of this perceived return on investment will distort demand. By exacerbating group differences, polarized perceptions may also breed dislike and distrust of individuals and policymakers from opposing parties, known as affective polarization.

In this paper, we study how individuals within and across political parties form and express their demand for public services, specifically focusing on public investment in higher education. Despite evidence of significant social returns (e.g., Moretti, 2004; Hendren and Sprung-Keyser, 2020), state appropriations to higher education are declining (Laderman and Heckert, 2021) and support is becoming increasingly polarized. For example, whereas 67% of Democrats think that higher education has a positive effect on the way things are going in the United States, only 33% of Republicans view it positively (Pew Research, 2019). Our study addresses two main questions. How do perceptions of and reasoning about the return on investment in state public higher education contribute to ideological and affective polarization? And how does (polarized) constituent demand for higher education affect policymakers' behavior?

We answer these questions using three experiments: two framed field experiments on demand for higher education spending and a natural field experiment with policymakers. In the first two experiments, we elicit taxpayers' prior perceptions of public higher education and then shape these perceptions by randomizing exposure to information on the graduation rate at public colleges in their state (public service "outputs"), appropriations per student ("inputs"), and ranks relative to other states.[1] We then measure how information that

[1]Since public colleges receive tax revenue from state governments to produce college graduates, state

changes perceptions of the return on investment affects the demand for public spending and how individuals communicate their preferred policies with policymakers. We interpret the results through a price-theoretic model of preference formation, which formalizes possible mechanisms connecting cross-partisan differences in perceptions and reasoning to polarized demand. In the third experiment, we measure policymakers' responses to constituent demand by randomizing the timing of when elected officials receive the communications generated in the first two experiments.

At baseline, we find polarized perceptions of return on investment, demand for public expenditure, and communications with policymakers.[2] Republicans are more likely than Democrats and Independents to overestimate the amount of tax revenue spent on public higher education in their state, and are more likely to underestimate the average return on investment. Republicans also prefer 23% less spending on higher education. We also find that when given the opportunity to communicate with elected officials through a letter-writing campaign embedded in the experiment, partisans—especially strong partisans—are more likely to only contact elected officials from their own party and tend to express more positive sentiment when doing so. Both of these results are consistent with affective polarization.

In our first experiment, we test how individuals' beliefs about the return on investment affect their demand for higher education services. We find that polarized demand is driven in large part by inaccurate subjective perceptions and reasoning rather by than irreconcilable differences in tastes. On average, randomized information about state graduation rates increases demand for spending by 5% and reduces partisan differences in demand by 32%. Our information treatments mainly affect Republicans, especially those who learn that the graduation rate (and therefore the return on investment) is higher than initially perceived. Republicans who learn the graduation rate is lower, as well as Democrats and Independents,

spending per student and graduation rates serve as benchmarks for accountability and also measures of return on investment. In this context, more graduates or fewer dollars spent imply a higher return.

[2]We establish these baselines using individuals randomized into our control group in the first experiment. These individuals do not receive any information that would affect their perceptions of the return on investment.

do not meaningfully respond to information. Overall, these results imply that inaccurate perceptions of the return on investment contribute to the underprovision of higher education services and the associated polarization.

We design a second experiment to test whether differences in partisan reasoning help explain ideological polarization and the heterogeneous responses to information. We design two tests of this potential mechanism, guided by our price-theoretic model. First, we elicit spending posteriors after individuals receive graduation information. Consistent with our treatment effects from the first experiment, we find that only Republicans who learn that the graduation rate and/or rank is higher update their beliefs positively about the return on investment. Other participants tend to conclude that higher (lower) graduation rates are due to higher (lower) spending, implying no change in the return on investment. Second, we jointly randomize spending and graduation information directly pin down perceptions of the return on investment. For Republicans who underestimate graduation rates, spending information weakly reduces ideal spending levels, but it does not affect other groups on average. Together these results underscore the key role reasoning differences by party and prior perceptions play in producing polarization.

In both the first and second experiments, we find that perceptions of the return on investment also shape how partisans communicate their preferred policies to policymakers from opposing parties, a proxy for affective polarization. Information on graduation rates increases cross-party communication by 23%. Since the new letters generated by this increase are generally positive in sentiment, our treatments lead to more positive cross-aisle communication. The effects are largest for self-identified strong partisans and for Republicans, consistent with arguments that ideological and affective polarization reinforce each other (e.g., Rogowski and Sutherland, 2016). Our results suggest that credibly changing partisan perceptions could soften contentious policy conversations around higher education.

Finally, in the third experiment, we examine how policymakers respond to information about constituent demand, randomizing the timing of when 238 governors and state leg-

islators receive the constituent letters elicited in the first two experiments via email. We find that elected officials who learn about constituent demand are more likely to click on a proposed resolution to maintain state funding for public colleges, compared to those who receive a similar email without information about constituent demand. Emails including this information generate more responses but do not lead elected officials to take costlier actions. These results suggest that (polarized) demand and political engagement may have negative societal consequences because they shape policymaker behavior.

We make three main contributions. First, we document that perceptions of the return on investment on public services vary by partisanship, therefore contributing to polarized demand. We find evidence of cross-partisan differences in reasoning (as in Alesina et al., 2020; Stantcheva, 2021) and, by randomly exposing individuals to information, show that polarization arises from a combination of both cross-party differences in reasoning among taxpayers with similar priors and within-party reasoning differences among taxpayers with different priors.[3] These results also add to a rich literature on corrective information and public spending (for a review, see Haaland et al., 2023) by providing information about spending inputs and service outputs to more fully consider the role of the return on investment in policy preferences.[4]

Second, we show that social perceptions of return on investment also shape affective polarization. While research has shown that affective polarization has increased over time (Iyengar et al., 2012; Boxell et al., 2022), there is debate regarding its causes (Iyengar et al., 2019). Consistent with evidence that ideological distance augments affective polarization (Webster and Abramowitz, 2017; Desmet and Wacziarg, 2021; Bertrand and Kamenica, 2023), we find that changing individuals' perceptions of the return on public investment in higher education creates positive cross-partisan interaction, plausibly reducing the neg-

[3]This asymmetric reduction in polarization highlights an interesting contrast with evidence that individuals are motivated to reason in ways that reinforce their own incorrect priors (Thaler, 2023).

[4]Many of these survey experiments study support for education spending inputs (Howell and West, 2009; Lergetporer et al., 2018, 2020; Lergetporer and Woessmann, 2021; Giaccobasso et al., 2022) and more general public spending (Cruces et al., 2013; Kuziemko et al., 2015; Peyton, 2020; Roth et al., 2021).

ative effects of political echo chambers (e.g., Levy and Razin, 2019). To make this second contribution, we quantify affective polarization using a new revealed-preference measure. Rather than measuring affect with self-reports or nonpolitical actions,[5] we rely on political behavior by eliciting open-ended responses on taxpayers' first-order concerns (as in Ferrario and Stantcheva, 2022) while observing the extent and sentiment of cross-aisle communications. As an added benefit, these measures are inputs for our third experiment, in which we quantify policymaker responses to constituent demand.[6]

Finally, we advance contemporary debates around the causes of public divestment in higher education (e.g. Kane et al., 2005). We present causal evidence that this polarization, at least partially, reflects partisan perceptions and reasoning about the return on investment for higher education spending, rather than irreconcilable differences in preferences. Our results align with conjectures that pessimism regarding the social return on public investment in higher education has contributed to reductions in spending (e.g., see Bound et al., 2019). Furthermore, the issues raised in the letters to elected officials as part of our experiment reinforce these concerns. Overall, our results suggest that cost-effective higher education policies may be key to ongoing public support for higher education.

2. Perceptions, Preferences, and Polarization

In this section, we present a price-theoretic model that describes the demand for public services. This model motivates our experiments by formalizing how perceptions and reasoning might affect demand and, in turn, ideological polarization. According to the model, individuals' ideal spending policies are shaped by their perceptions of technology (e.g., beliefs about the return on investments made by the state) and preferences (e.g., the value they place on public services relative to lower taxes). We show that while polarization may result

[5]Like feelings thermometers, Likert scales of like/dislike, or giving behavior in a dictator game (e.g., Iyengar et al., 2019).

[6]Other experiments explore how elected officials and policymakers respond to information. See Butler and Nickerson (2011), Zelizer (2018), Vivalt and Coville (2023), Hjort et al. (2021), and Toma and Bell (2023).

from differing preferences, it also may stem from differences in baseline perceptions or from differences in how partisans update these perceptions (i.e., "reason") in response to new information.

In our model and experiments, we focus on support for public expenditure on higher education. More specifically, we examine the relationship between the six-year graduation rate at public four-year colleges (the "output") and tax expenditure (the "input"). We focus on this relationship for four main reasons, with the first three being conceptual. First, the graduation rate serves as a straightforward reflection of the level of provision, with the number of graduates constituting a college-educated workforce. Second, state spending produces graduates by causally increasing enrollment and graduation rates (Bound et al., 2010; Deming and Walters, 2017). Third, for a given level of spending, the graduation rate reflects the average social return on investment, which is the number of graduates produced per dollar of tax revenue spent. As such, a higher rate indicates that more graduates are produced from a given level of spending, the return on state investments is higher, and the state is less wasteful.

Beyond these conceptual motivations, graduation rates are a first-order policy concern for policymakers and taxpayers. As of 2021, policymakers in46 states have codified explicit attainment goals to increase the number of college-educated workers. For example, Florida aims to "increase the percentage of working-age Floridians with a high-value post-secondary certificate, degree, or training experience to 60% by 2030" (Lumina Foundation, 2021). States' investment in higher education is driven not only by its potential to promote growth, raise wages, and provide other social benefits (e.g., Moretti, 2004), but also due to inter-jurisdictional or "yardstick" competition (Agrawal et al., 2022). Taxpayers similarly care about graduation rates and believe they should be tied to state funding. For example, Doyle (2007) report that about 75% of Americans believe it is either "important but not essential" or "absolutely essential" to lower the number of college students who do not graduate. This may partly be due to the graduation rate being a key indicator for accountability. Nearly

90% of both Republicans and Democrats believe it is important for colleges to publicize information on quality indicators, including graduation rates, and about 80% believe colleges should receive less taxpayer revenue if graduation rates are low (Nguyen et al., 2023).

2.1 A Model of Perceptions, Preferences, and Demand for Public Expenditure

Consider how individuals determine their ideal public expenditure policies. Assume they have a concave utility function, $u_i(c, G, R)$, over consumption, c, and a public good composed of the graduation rate in their state, G, and their state's (percentile) rank of $R = F(G)$, for a differentiable distribution function $F()$. Consumption c is related to graduation because increasing graduation rates requires higher expenditures and higher taxes. A shared price function, $p(G; \omega)$, reflects the tax liability needed to maintain graduation rate, G, given the state's productivity, ω. In line with this argument, we use the graduation rate divided by spending per student as a heuristic for ω in our survey experiment, similar to Hoxby (2018) and Conzelmann et al. (2022).[7] Since more productive states produce more graduates per dollar of public investment, they require fewer taxes to achieve comparable graduation rates and have higher returns on investments. Individuals have information set over these three primitives $\mathcal{I} = \{G, \omega, F()\}$.[8]

When considering ideal policies, individuals trade off the benefits of having better and higher-ranked services with the costs of higher taxes, which reduce their ability to consume. The ideal bundles of public good provision and spending for each individual equalize the perceived marginal benefit of additional expenditure and the perceived marginal cost. Formally, an individual's stated preference, G^*, will satisfy the following first-order condition with respect to G (given their information $\mathcal{I}$):

$$\underbrace{v_G(G^*|\mathcal{I}) + v_R(G^*|\mathcal{I}) f(G^*|\mathcal{I})}_{\text{Perceived Marginal Benefit}} = \underbrace{v_c(G^*) p'(G^*; \omega|\mathcal{I})}_{\text{Perceived Marginal Cost}}, \tag{1}$$

[7] We fix $p()$ across individual functions like a scale normalization, allowing us to make inferences about perceptions of ω.

[8] R is not explicitly included as it is a deterministic function of $F()$ and G.

where $v(c(G), G, F(G))$ is the indirect utility, partial derivatives are denoted by subscripts, $f(G) = F'(G)$ is the perception of the probability density function of G, and $p'(G; \omega)$ is the perceived marginal price of increasing G.

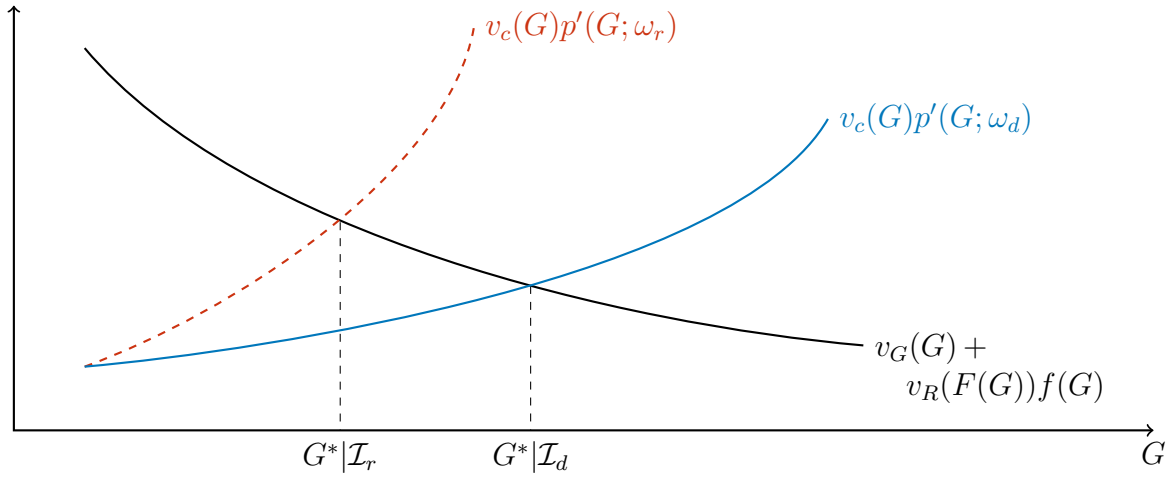
The two terms on the left-hand side of the first-order equation capture the marginal benefit from additional graduates. $v_G(G)$ measures the marginal benefit of a higher graduation rate, and $v_R(F(G))f(G)$ measures the marginal benefit of a higher rank that comes from a higher graduation rate. The right-hand side captures the marginal cost of producing graduates, or the marginal utility of consumption forgone to increase expenditure for a marginal increase in G. As such, individuals' marginal benefit and cost curves over G are determined both by both preferences ($v()$) and perceptions ($\mathcal{I}$).

Panel (a) of Figure 1 illustrates how heterogeneity in perceptions could generate ideological polarization. It shows a shared, downward-sloping marginal benefit curve alongside two upward-sloping marginal cost curves. If Democrats perceive their state as more productive (a larger ω, and higher return on investment) then their perceived marginal cost curve (solid blue) will be less steep than Republicans' (dashed red). Because the intersection of the two curves determines each individual's ideal bundle of services and expenditure (denoted by $G^*|\mathcal{I}$), perceptions of different returns on investment can polarize demand for G—even though both groups have the same underlying preferences for benefits. Analogous intuition suggests that differences in perceived marginal benefits can also generate ideological polarization. For example, Doyle (2007) finds that Democrats are more concerned about dropout than Republicans, suggesting that Democrats' perceived marginal benefit curves are higher than those of Republicans.

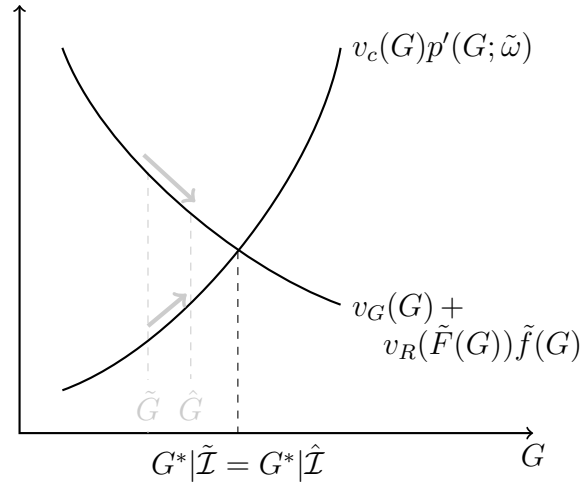
2.2 Information, Reasoning, and Polarization

Demand for public services will also be shaped by reasoning about new information. Denote prior and posterior perceptions of public services in response to some signal as $\tilde{\mathcal{I}} = \left\{\tilde{G}, \tilde{\omega}, \tilde{F}()\right\}$ and $\hat{\mathcal{I}} = \left\{\hat{G}, \hat{\omega}, \hat{F}()\right\}$, where elements of either may be inaccurate. We refer to

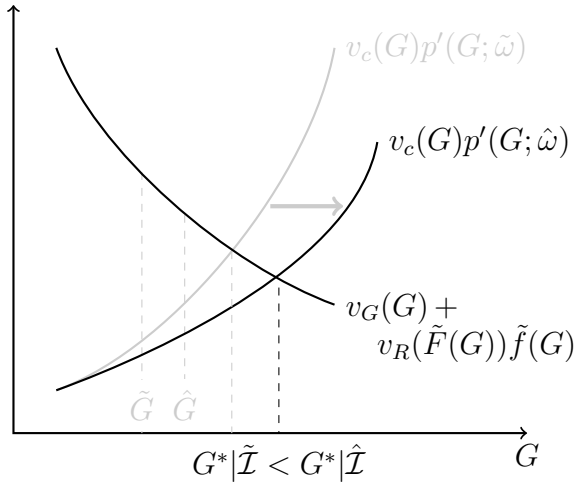
Figure 1: Perceptions, Preferences, and Ideal Policies



(a) Polarized Beliefs May Polarize Ideal Policies



(b) Info Moves Beliefs Along Marginal Curves



(c) Info Shifts Perceived Marginal Curves

Note: This figure shows how perceptions could affect polarization and the ideal public-good provision levels. Panel (a) focuses on polarization. It displays how differences in perceived productivity could generate ideological polarization even among individuals with identical preferences. Panels (b) and (c) demonstrate possible examples of reasoning through which information about public service provision may change ideal policies. Panel (b) shows the effect of a movement along the supply and demand curves. This type of reasoning may change perceptions about the current level of provision, but not their ideal policy. Panel (b) shows the effect of shifting the marginal cost curve resulting from changing perceptions of productivity. This type of reasoning will change the preferred policy.

the process of going from $\tilde{\mathcal{I}}$ to $\hat{\mathcal{I}}$ as "reasoning" and consider the effects of information that moves $\tilde{G}$ to the true $\hat{G} = G$ separately for individuals who initially over- or underestimated the graduation rate.

Consider individuals who learn that the true graduation rate is higher than initially perceived ($G > \tilde{G}$). This revelation could lead them to reason in two diverging ways about the return on state investments. On the one hand, the difference could reflect a movement along perceived marginal cost and benefit curves, as shown in Panel (b) of Figure 1. This line of reasoning from new information implies that $G > \tilde{G}$ because spending is higher than initially perceived and holds $\tilde{\omega} = \hat{\omega}$. Because movements along a marginal cost curve do not change prices, reasoning in this way will not change individuals' ideal policies despite the information about graduation rates.

On the other hand, the same information could reflect a flattening of the perceived marginal costs, as shown in Panel (c) of Figure 1. This line of reasoning implies that that $G > \tilde{G}$ because the state has a higher return on investment than initially perceived; that is, the output is higher for the same level of spending inputs. A shift of the marginal cost curve like this implies that $\tilde{\omega} < \hat{\omega}$. Because outward shifts of the marginal cost curve change the perceived price of the public service, reasoning in this way increases the individual's ideal G.[9]

Information about graduation rates could also affect the perceived return on investment if individuals also update their beliefs about the rank. Similar to the discussion about costs, learning that $G > \tilde{G}$ could alternatively reflect a movement along the marginal benefits curve. Because this line of reasoning holds $F()$ constant and updates R accordingly, it does not change ideal policies. However, if the distribution of $F()$ is higher (or more dispersed), the marginal benefits curve will shift out, so reasoning in this way will increase the graduation rate in individuals' ideal policies.[10]

[9]Note that since the state is more productive, it is ambiguous whether their ideal policies require more expenditure.

[10]For example, consider an individual who interprets her own state's high graduation rate as a signal that the full distribution of F is higher than initially perceived. Because $\hat{F}(G) < \tilde{F}(g)$, her marginal utility v_R

The overall effects of information on polarization depend on the extent to which prior perceptions vary across groups and on the differences in how group members reason about information. Specifically, are Democrats or Republicans more likely to interpret information as a movement along, or a shift of, the marginal cost and benefit curves? Moreover, while this paper mainly focus on political polarization, preferences and perceptions will drive gaps in demand for public expenditure among other groups as well. For example, aging populations demand fewer public goods like education because they benefit less from the services (Poterba, 1998; Alesina et al., 1999).

Finally, although our model explicitly considers how perceptions and information shape support for public services, the resulting ideological polarization may shape affective polarization. Specifically, if ideological polarization propagates affective polarization, it will reduce political engagement with those who do not share their partisanship (Rogowski and Sutherland, 2016). Accordingly, changes in ideological polarization from information may affect how voters share their ideal policies and how they are translated into policy in practice. We examine this possibility in the first two experiments and its implications for policymaker behavior in our third experiment.

3. Design for Experiments on Demand for Higher Education Spending

In this section, we outline the samples and procedures for our first two experiments. The first experiment measures baseline demand and perceptions and characterizes how these change in response to information about absolute and relative public college graduation rates (outputs).[11] The second experiment measures how information about both graduation and state spending affects ideal policies and allows us to identify the partisan reasoning mechanism formalized in the preceding section.[12]

will be higher and her marginal benefit curve will shift out.

[11]The first experiment and preanalysis plan were registered with the AEA RCT registry (AEARCTR-0007619).

[12]The second experiment and preanalysis plan were registered with the AEA RCT registry (AEARCTR-0009409).

3.1 Experiment 1: Information on Graduation

3.1.1 Sample

We initially recruited 3,715 participants through Qualtrics in May 2021. We requested a sample that represented the US population in terms of political partisanship (a third of each Democrats, Republicans, and Independents), education level (41% high school equivalent or less, 29% some college or associate's degree, and 30% bachelor's degree or higher), and gender. We did not include participants from Washington, DC as it does not have a traditional public higher education system. However, since the sample we were provided with was highly nonrepresentative on age, we recruited an additional 1,004 participants in August 2021 using CloudResearch.[13]

3.1.2 Procedure

After consenting to participate, participants answered demographic screening questions measuring political partisanship, gender, and state of residence.[14] Next, participants reported their beliefs regarding the US average six-year public college graduation rate, the graduation rate in their state, and the rank of this graduation rate relative to the other 49 states. They also reported their prior beliefs of the tax expenditure per student spent on public higher education in their home state and its rank relative to all other states.

Participants were then randomized to receive one of two information treatments or to receive no information (the control group). The first treatment presented the actual six-year public college graduation rate in their state, based on data from the National Center for Education Statistics. The second treatment presented both the state's graduation rate and its rank. In both treatments, participants were also reminded of their prior beliefs and shown

[13]Overall, elderly individuals are more responsive to information, so limiting our analysis to the original Qualtrics sample produces larger effects.

[14]At the end of the survey, we elicit age; employment status; whether or not the respondent has had (or does have) children attending a public college in their state; whether they believe their children will attend a public college in their state in the future; whether they themselves have attended, or are currently attending, a public college in their state; and how often they watch colleges from their state compete in sports.

the difference between that prior and the truth. Appendix Figures B1a and B1b show the information treatments, and Appendix A shows they are balanced on both demographics and beliefs.

After the information treatment, participants answered a range of survey questions. Our measure of ideal policy was asking participants to report their preferred level of state spending per student at public four-year colleges in their state.[15] Participants also answered questions targeting potential mechanisms. They shared their beliefs regarding the impacts of marginal changes in public college financing (including how much enrollment and graduation rates would change with an additional $100 spent per student), how much different groups would benefit from a $1 increase in taxes to fund higher education (including themselves, the average state resident, and new graduates from public four-year colleges), and five-point Likert scale questions gauging their general trust in how public four-year colleges use tax revenue, the extent to which students should bear the cost of funding public higher education, and whether or not the federal government should provide financial support for public four-year colleges.

Next, participants were given the opportunity to partake in two costly tasks designed to elicit revealed preferences.[16] Our first task was a letter-writing campaign. We invited participants to share open-ended written opinions about their states' spending on public four-year colleges and offered to send their letters to elected state officials of their choice.[17] Spending time writing an optional letter was costly because it lowered participants' effective wage. Similarly, their decisions about interacting with officials of the other party provide a measure of affective polarization, as do the letters' sentiments. This exercise builds on Ferrario

[15]We asked each participant two versions of this question, one "acknowledging the potential effects of the COVID-19" and the other "after the pandemic has passed." We prespecified the second question as a main outcome of interest to capture out preferences less affected by the unique context of the COVID pandemic, but the responses to both questions were highly correlated, and the treatment effects were similar.

[16]Relying solely on stated preferences to measure support will be misleading if participants suffer from "hypothetical bias" (List and Gallet, 2001; List, 2001). This bias may not present a significant issue as hypothetical and real responses to intensive margin decisions are very similar (List et al., 2006), and our main prespecified stated-preference measure is ideal spending levels, which are strictly positive for almost all of the sample.

[17]They choose from one or more of the following officials: the Republican leaders in their state legislatures, the Democratic leaders in their state legislatures, or the governor.

and Stantcheva (2022) by allowing researchers to observe participants' first-order concerns as expressed to policymakers while also studying selection into this political participation. Political participation has policy significance when politicians update policy positions to reflect voters' preferences (Sevenans, 2021), and the letters generated serve as the key input into our third experiment with elected officials.

As a second costly task, participants could donate some of their wages to a public college in their state. The median participant spent six minutes on the survey, so the $0.25 donation represented an additional hourly wage of $2.50. Our two revealed preference measures are also similar to other recent experiments that have included charitable donations (Alesina et al., 2023; Akesson et al., 2022) and petition signatures or other government notifications (Grigorieff et al., 2018; Haaland and Roth, 2020; Holz et al., 2020; Hager et al., 2023).

At the end of the survey in the CloudResearch sample, we elicited some participants' posterior beliefs. Participants in the graduation-rate-only condition were shown their treatment information page again and were then asked for a posterior belief for the corresponding rank. Those in the control condition were shown the graduation rate treatment information and were then also asked for their posterior belief for the rank. The posterior beliefs allow us to test for partisan differences in reasoning or learning from information.

3.2 Experiment 2: Information on Graduation and Spending

3.2.1 Sample

For the second experiment, we recruited 3,037 participants in May and June 2022 through CloudResearch. Again we did not include participants from Washington, DC.

3.2.2 Procedure

The procedure for the experiment follows the first with three exceptions. First, participants were randomized to receive one of three information treatments: 1) the graduation rate and rank information (as in the first experiment), 2) the amount of spending per student in dollars

and this amount's rank relative to other states, or 3) the content from both treatments 1 and 2. The second difference was extending the ways individuals could communicate with their elected officials. After writing their own letter as in the first experiment, participants could choose from a set of prespecified messages to send or add to their own letter. These messages included a request for a desired level of spending (increase, decrease, or no change) along with reasons they could choose from a list. The reasons related to yardstick competition, the social returns on investment, and the private returns to students.

Finally, at the end of the survey, we elicited posterior beliefs about the graduation rate and spending information for individuals who have no received this information. More specifically, after reminding participants in treatment groups (1) about the graduation information, we elicited spending posteriors. Similarly, participants in (2) were reminded of the spending information, and then we elicited graduation posteriors.

3.3 Variable Definitions for Experiments 1 and 2

Belief Errors. We calculate a continuous variable measuring the belief error as participants' priors minus the truth for their state's graduation rate and corresponding percentile rank, as well as spending levels and corresponding percentile rank.[18] A prior is too low if the bias is negative, that is, when an individual underestimated the truth. We observe state graduation rates and spending levels from Snyder et al. (2019) and Laderman and Heckert (2021), respectively.

Outcomes. The main survey outcomes are the preferred spending level (to address ideological polarization) and whether each individual writes a letter to their elected officials (to measure affective polarization). For the task involving correspondence with elected officials, we create four indicators: one for writing to any elected official(s), another for writing to an official of the participant's own party, a third for writing to an elected official from the opposing party, and a fourth for writing a letter with positive tone to an official from the

[18]The treatments display the information as ranks out of 50, but we convert them to percentile ranks for the analysis so that a larger number corresponds to both a higher rate and rank.

opposing party.[19] We measure the sentiment of each letter using the Syuzhet dictionary.

We also create a productivity index from our questions that elicit demand on the margin following Anderson (2008). These questions include whether a charitable donations was made to a public college, beliefs about the marginal impacts of additional spending on enrollment and graduation, and indicators for whether participants agree or strongly agree with Likert questions about the social benefits of spending, personal benefits from spending, and trust in the state to spend tax dollars well.

Demographics. Participants were coded as Republican if they indicated their partisanship as lean Republican, not very strong Republican, or strongly Republican. Following our preanalysis plan, we compare Republicans against Democrats and Independents in our analyses. We also create a family attachment indicator for whether the participants or their children has attended a public four-year college in their state. Participants are said to follow the state's public college sport teams if they watch at least two games per year. We define participants as elderly if they are 65 and older.

4. Baseline Polarization in Demand and Perceptions

In this section, we document baseline ideological polarization, polarized perceptions, and affective polarization. This allows us to characterize the nature and extent of polarization—absent any intervention—before measuring the effects of our randomized treatments on polarization and reasoning, which we do in the following section.

4.1 Polarized Demand for Higher Education Spending

We use the data from our first experiment to document the partisan gap in preferred spending levels on higher education as well as drivers of this gap. To measure differences across

[19]Note, self-identified Independents do not have elected officials from their own or the opposing party.

individuals in different groups, we estimate the following Poisson regression:

$$\mathbb{E}(\text{Ideal Spending Level}_i) = \exp(X\alpha) \tag{2}$$

where α captures role of each individual characteristic in X. Analogous results using characteristics and policy beliefs are available in Appendix E. We limit the sample to the control group in our first experiment to measure demand at baseline. The estimated coefficients are presented as blue diamonds in Panel (a) of Figure 2 and report percent differences in ideal spending levels.[20] Based on our interests in political polarization, the following discussion mainly focuses on gaps by political partisanship.

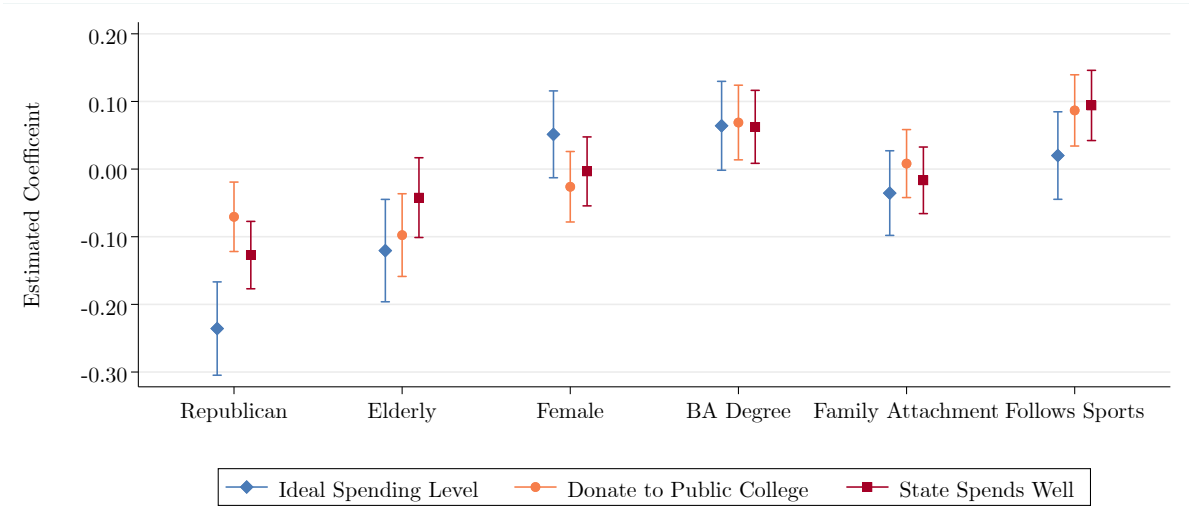
We find that demand for public higher education expenditure is highly polarized by political party. Republicans prefer 23% less public expenditure than Democrats and Independents. The only other group with differences is that elderly individuals prefer 12% less than those who are not elderly. These gaps by political partisanship and age are similar to results from two recent nationally representative PEW Research Center surveys on views of higher education (Parker, 2019) and support for free public college (Hartig, 2020).

Perceptions of the economic effects of spending are also important predictors even conditional on partisanship and other demographics. Appendix Figure B1 shows that individuals who believe a $100 increase in per-student expenditure would have large enrollment effects demand 19% more spending than those who do not. Similarly, those who think such an increase would have large graduation-rate effects demand 16% more spending. The beliefs that increasing taxes to fund public higher education benefits the state and graduates are also linked to higher demand. These within-party differences in demand are just as large as, or larger than, the differences across party lines.

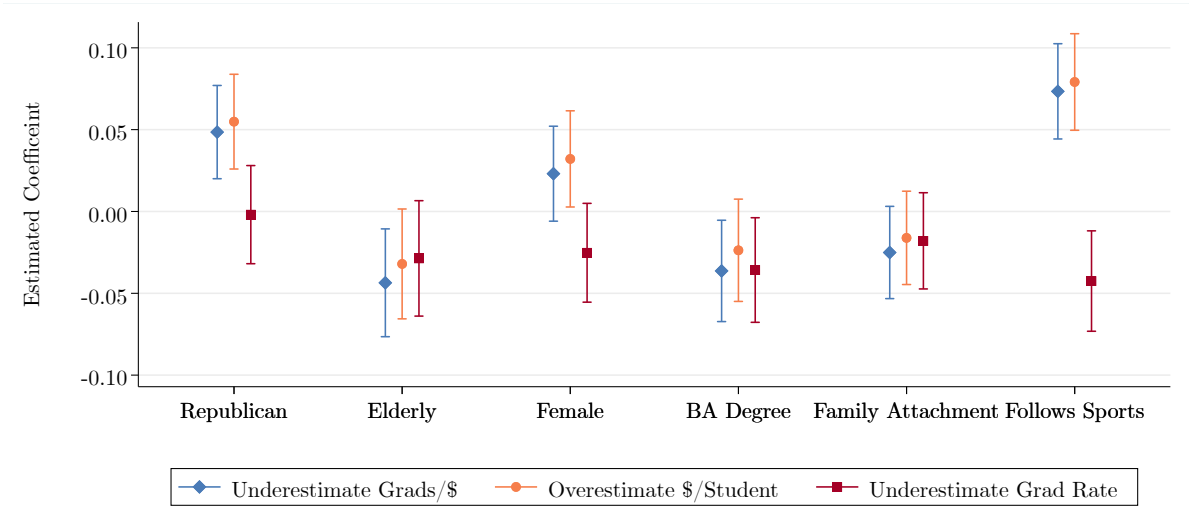
In addition to characterizing ideological polarization in *optimal* policies, we consider two complementary measures of demand for additional spending on the margin. Because

[20] We estimate a Poisson regression so that the percentage differences are comparable to our other measures of demand also presented in Panel (a) of Figure 2, but the observed patterns remain consistent when estimated with OLS.

Figure 2: Ideological Polarization and Perceptions of Public Higher Education



(a) Polarization in Ideal Public Higher Education Policy



(b) Polarization in Perceived Return on Investments in Higher Education

Note: This figure shows the relationships between observable characteristics and individuals' ideal policies and perceptions. The three series in Panel (a) are measures of support for public higher education. The markers with blue diamonds are estimates from a Poisson regression of the ideal spending level, those with orange circles are estimates from a linear regression on an indicator that the individual made a donation to a public college in their state, and those with red squares are estimates from a linear regression on an indicator that the individual agrees or strongly agrees that they trust the state to spend tax revenue well on public higher education. Panel (a) uses only the control group who do not receive any information. The three series in Panel (b) are measures of perceived productivity. The markers with blue diamonds are estimates for indicator variables for underestimating the graduation rate in their state, the markers with orange circles for overestimating the per-student spending on public higher education in their state, and the markers with red squares for underestimating the number of graduates per $10,000 spent on public higher education in their state. Both panels reflect responses from the Qualtrics and CloudResearch samples for the first experiment.

participants who believe that provision is too low may be willing to increase spending at the cost of their own personal consumption, the first measure is whether participants choose to make a private donation to public colleges. The second measure is whether participants express trust that the state uses taxpayer dollars well to fund public higher education. We report estimates linear-probability estimates for each outcome as orange circles and red squares in Panel (a) of Figure 2). Both Republicans and the elderly are less willing to give up their own consumption, than Democrats and Independents and the young respectively, to help finance the public services, but only Republicans are less likely to agree that tax revenue is well spent. These partisan differences are partially mediated by individuals' policy beliefs (with beliefs that marginal tax increases would increase graduation rates, welfare, their own utility, and the careers of graduates accounting for most cross party differences—see Appendix Figure B1.

4.2 Polarized Perceptions of Returns on Investment

Our model suggests that polarization in perceptions of "reality" (Alesina et al., 2020) may polarize demand. To explore this, we examine differences across partisans in their perceptions of the return on higher education investments in their state. Specifically, we ask whether Republicans and the elderly prefer lower investment because they perceive a lower return, as modeled in Section 2. In our analysis, we measure return on investment as the number of graduates produced per dollar spent[21] or the total public goods produced divided by the total cost. A higher value of this measure indicates that the state has a higher return because it produces more public goods for a given cost.[22] This measure is analogous to the one used by Conzelmann et al. (2022)—who document the spatial distribution of the social return on investment for higher education across labor markets and states—and that of Hoxby (2018).

Using a linear probability model, we test for polarization in the perceived return on

[21]Specifically, we observe perceptions of the graduation rate, or graduates/students, and spending/student. Taking the ratio gives graduates per dollar spent.

[22]Or the same number of public goods at a lower cost.

investment by estimating the association between individual characteristics and the tendency to underestimate this average return on investment.[23] Since individuals can underestimate the return on investment by underestimating the graduation rate and/or overestimating expenditure, we then decompose the perceptions of productivity into those two channels. We plot the gaps for all three specifications in Panel (b) of Figure 2.

While most group characteristics are essentially unrelated with perceived return on investment, the largest differences are by political party (and by following public college sport teams). Republicans are about 5 percentage points more likely to underestimate the state's productivity based on this measure compared to Democrats and Independents. Interestingly, this gap is entirely driven by differences in perceptions of spending. Republicans believe they receive the same public goods based on the graduation rate but that the state spends much more to produce them. Elderly individuals, on the other hand, (slightly) overestimate the return on investment in their state but still demand low levels of expenditure.

4.3 Affective Polarization in Letters to Elected Officials

Having documented strong ideological polarization by party, we examine how individuals engage with elected officials along partisan lines, allowing us to measure affective polarization. With affective polarization, individuals' dislike and distrust for members of the opposing party will make cross-party engagement more costly and writing a letter to elected officials across the political aisle less likely. In Panel (a) of Figure 3, we plot the likelihood that participants in our control group from experiment 1, who do not receive information, send a letter to an elected official as a function of both their and the official's political affiliation. The pattern shown in the figure provides evidence of affective polarization since partisans are more likely to interact with members of their own party. While all individuals are most likely to send their letter to officials of both parties, Republicans are more likely to only send a letter to Republican officials, and Democrats exhibit a similar tendency toward Democrat

[23] Specifically, the dependent variable equals 1 if an individual perceived graduates per dollar spent is less than the true value.

officials. The difference in the likelihood of reaching across the aisle is largest for "strong Republicans."

As a second measure of affective polarization, we examine the letters' content. For each letter, we calculate the sentiment based on the Syuzhet lexicon and then plot how the content varies by both the senders' and receivers' ideologies in Panel (b) of Figure 3. A value of 0 indicates neutral sentiment, while a positive number indicates positive sentiment. Our approach treats the text as data to capture revealed preferences rather than relying on stated preferences of affective polarization.[24]

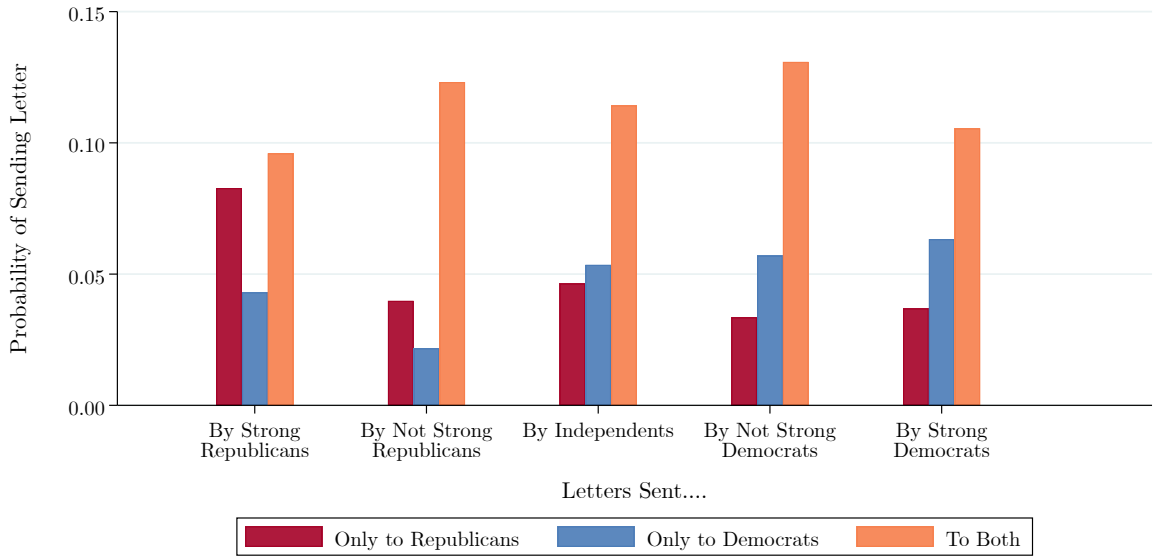
The results in Panel (b) show that letters from individuals who write members of their own party, or both parties, are more positive in sentiment than those who choose to reach across the aisle. This provides further evidence of affective polarization: when people choose to reach across the aisle, they are more negative, indicating dislike or distrust. The difference in average sentiment between letters sent to members of their own party and those sent to the other party is also largest for self-described "strong Republicans." These differences arise from both the strength of affective polarization across individuals and selection into the types of individuals who choose to send a letter only to members of their own party instead of both parties.

5. Information, Reasoning, and Ideological Polarization

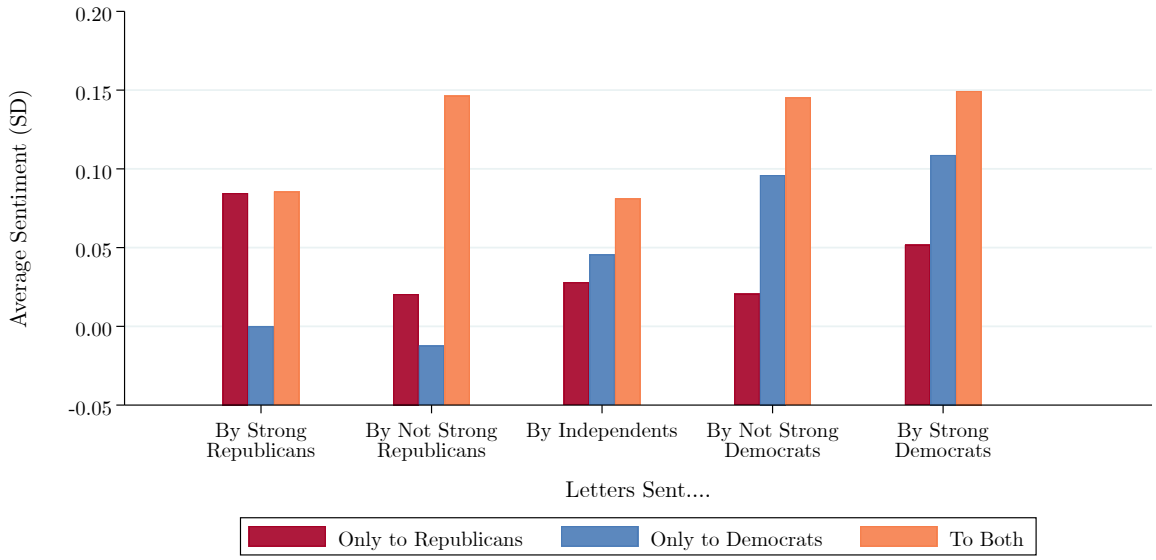
In this section, we measure to what extent providing information about public higher education affects ideological polarization. Since the information treatments shape perceptions, heterogeneity in the effects of information can inform the extent to which perceptions and reasoning drive ideological polarization. We present the main results from experiments 1 and 2 along with additional analyses highlighting the key role of reasoning about returns on investment.

[24]Druckman and Levendusky (2019) provide an overview of affective polarization measures.

Figure 3: Affective Polarization in Public Higher Education



(a) Extent of Political Engagement by Political Affiliation



(b) Affect of Political Engagement by Political Affiliation

Note: This figure shows two measures of affective polarization across party lines. In Panel (a) each bar plot presents the probability that an individual with a self-described political identity writes only Republican-elected officials, only Democrat elected officials, or both. And Panel (b) reports the sentiment of letters sent by these groups to each type of elected official. Sentiment is measured as the average sentiment of words in the letters from the Syuzhet Lexicon, with no letter being zero, and are reported in standard deviation units (from the control group standard deviation). Both panels reflect responses of individuals recruited from Qualtrics and CloudResearch for the first experiment.

5.1 Graduation Information Reduces Polarization

We first consider how information about the graduation rate and rank affect the demand for public expenditure in higher education from experiment 1. We estimate the average treatment effects of receiving information about the graduation rate only, D_1, and both rate and rank, D_2, on stated ideal spending from the following linear regression:

$$Y_i = \tau_1 D_{1i} + \tau_2 D_{2i} + \beta X + \varepsilon_i \tag{3}$$

where X is a vector of demographics plus an indicator that the participant was recruited from Qualtrics and a constant, as before.[25] Based on the documented gaps in Section 4, we divide the sample by political affiliation and age and also estimate the treatment effects by subgroups. All participants appear in three specifications out of the five shown in the figure: 1) all individuals, 2) either Republicans or Democrats and Independents, and 3) either elderly or non-elderly. Figure 4 presents all five sets of results as well as the control means.

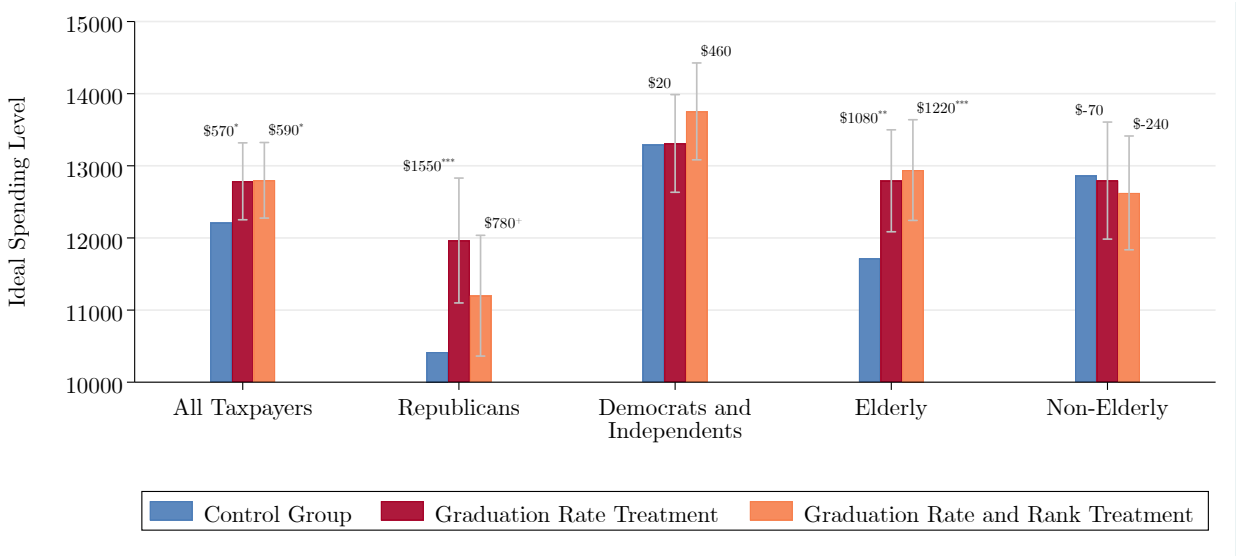
On average, information about the absolute and relative public good outputs in an individual's state raises her ideal spending level by over \$500 per student per year, or about 5%.[26] The effects are largest for Republicans and the elderly. Because these groups have lower baseline ideal spending levels, information significantly reduces ideological polarization. The political partisan gap in ideal spending falls by 32%, and the gap between the elderly and non-elderly is eliminated. Part of the effect, but not all, comes from extensive-margin reductions in the likelihood of stating an ideal spending level of \$0—2.4 percentage points (46%, $p = 0.016$) for Republicans and 1.2 percentage points (36%, $p = 0.072$) for the elderly.[27] This indicates a notable reduction in extreme polarization. Furthermore, since

[25] We estimate a linear regression since about 2% of the sample indicate 0 as their ideal spending level. Using a Poisson regression does not change the results.

[26] Since participants tend to overestimate per-student spending at baseline, ideal preferences tend to be much higher than current spending.

[27] Dropping participants who state their ideal policy is \$0 shrinks the effects by about \$100, suggesting that the extensive margin is 15-20% of the total effect.

Figure 4: Information Affects Ideal Spending for Public Higher Education



Note: This figure presents stated ideal spending per student by treatment group and characteristics along with 95% confidence intervals on the effects of the two treatments. The sample is the 4,679 individuals who completed surveys through Qualtrics and CloudResearch for the first experiment. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}p < 0.1$

we find no differences in average perceptions about graduation rates by political party or age (Figure 2), the effect heterogeneity suggests possible differences in reasoning about the information provided. We provide support for this hypothesis in Section 5.3.

In addition to effects on stated ideal policies, information might affect demand for marginal expenditure in the status quo, that is, how strongly participants want perceived spending levels to increase. Whereas only shifts the marginal cost and benefit curves will affect individuals' ideal policies, both shifts and movements along the marginal curves can change the distance between participants ideal and perceived policies. Information that does not affect ideal policies, may therefore still affect demand for marginal spending if it makes participants care more about an increase relative to the status quo. In Appendix F, we create an index of eight related questions (Anderson, 2008), and show that our treatments weakly increase demand for public expenditure on the margin.

5.2 Heterogeneous Responses by Perceptions and Partisanship

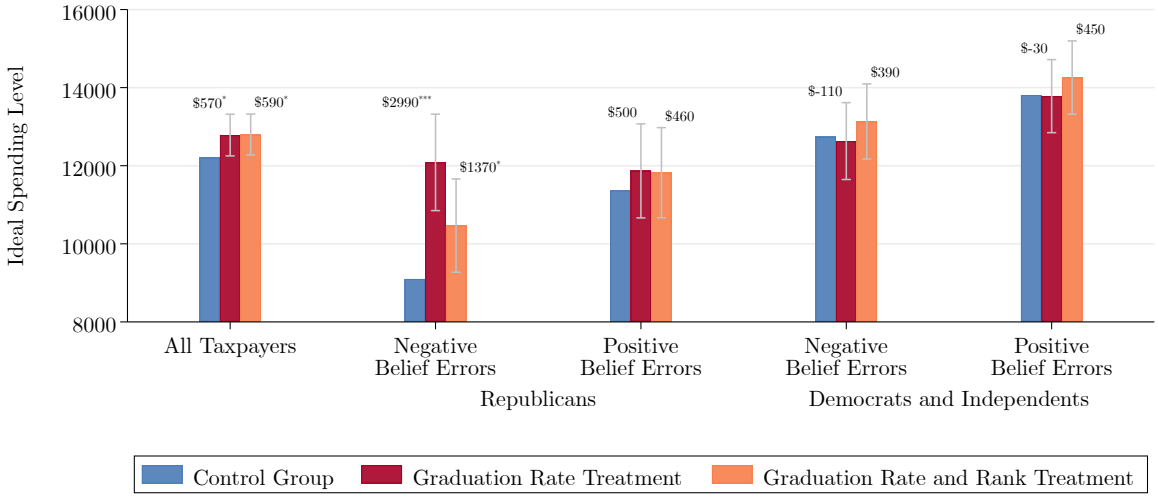
Our model in Section 2 highlights one rationale for why Republicans, and Democrats and Independents tend to respond differently to information: partisan reasoning about the return on investment. Partisans may even respond differently after learning qualitatively similar information (e.g., graduation rates are higher than initially perceived). As a first test for the relevance of this mechanism, we consider whether graduation information deferentially affects ideal spending policies by initial perceptions and political affiliation. More specifically, we separately estimate our treatment effects as specified in our pre-analysis plan, as in Equation 3 dividing the sample into four groups: {Republican; Democrat and Independent} $\times$ {Negative rate belief error; Positive rate belief error}.

Figure 5 shows that although Independents and Democrats with both positive and negative belief errors only respond minimally to information, Republicans' large average response to information is driven by individuals who otherwise underestimate their state's graduation rate—those with a negative belief error. Among these Republicans, receiving information that the graduation rate is higher increases their ideal spending levels by 28% ($p < 0.001$), and the graduation rate plus rank information increases this level by 14% ($p = 0.023$).[28] We find no effect of information on Republicans who initially perceive that the graduation rate is high.

Overall, this heterogeneity by partisanship and initial perceptions is consistent with partisan reasoning being an important mechanism through which our treatments decrease ideological polarization. Republicans who learn that the graduation rate is higher than their initial perception respond differently to this news than Democrats and Independents who receive the same information. Viewed through the lens of the model in Section 2, this suggests they reason differently from information—after learning the true graduation rate, they have

[28] Yardstick competition could explain the difference between the two treatments if learning the state is highly ranked decreases the competitive pressure Republicans feel to spend more, but the effect could also be driven by mixed signals from simultaneously learning about a high graduation rate and low rank. However, in our second treatment, only 30% of respondents who find out that the graduation rate is high learn that the state is lower ranked.

Figure 5: The Impact of Graduation Information by Partisanship and Perceptions



Note: This figure presents average treatment effects of information on ideal spending per student vary by partisanship and by prior perceptions of the state graduation rate. A negative belief error indicates that a treated individual learns the graduation rate is higher, while a positive error indicates she learns the graduation rate is lower. The sample is those recruited from Qualtrics and CloudResearch for the first experiment.

different processes of going from $\tilde{\mathcal{I}}$ to $\hat{\mathcal{I}}$, and particularly $\tilde{\omega}$ to $\hat{\omega}$. Moreover, since the distribution of initial perceptions for Republicans, and Democrats and Independents are similar, the results in Figure 5 suggest that reasoning differences from the same information, and not differences in treatment content, underlie our average treatment effects. We design our second experiment to explicitly consider partisan reasoning about the return on investment, and ω, as the potential mechanism.

5.3 Partisan Reasoning about Returns on Investment

We design our second experiment to test for differences in partisan reasoning, and to understand the extent that these differences explain heterogeneous responses by party to receiving graduation information. First, for individuals who receive both the graduation rate and rank information, we measure their reasoning about spending by eliciting posterior perceptions (Section 5.3.1). Second, we provide a subset of individuals with additional spending information which limits the extent to which they can reason differently. The joint graduation

and spending information treatments therefore serve as a second test of partisan reasoning (Section 5.3.2).

5.3.1 Partisan Differences in Reasoning about Graduation Information

We first estimate posterior perceptions about spending after receiving information about the graduation rate. To begin, we plot the difference between participants' posterior and prior beliefs about spending as a function of their initial beliefs and the graduation information they receive. More specifically, we estimate the following equation separately by political affiliation, p:

$$\begin{aligned}\hat{S}_i - \tilde{S}_i = \gamma_{0,p} + \gamma_{1,p}(\tilde{G}_i - G_{s(i)})\mathbb{1}[\tilde{G}_i - G_{s(i)} \leq 0] \\ + \gamma_{2,p}(\tilde{G}_i - G_{s(i)})\mathbb{1}[\tilde{G}_i - G_{s(i)} > 0] + X_i\gamma_{3,p} + \varepsilon_i \end{aligned} \tag{4}$$

where S are participants perceived state spending percentile ranks and $\tilde{G} - G$ the graduation rates or rank belief errors (prior perceptions minus the truth). As before, we allow individuals who receive information that the graduation rate is higher to update their beliefs differently, based on γ_1, than those who learn that it is lower (γ_2), based on our previous results.[29] Implicitly, Equation 4 is a first difference, where the true graduation rate or rank, G, is treated as the posterior after receiving that information.

We measure the extent to which different types of individuals update their beliefs about spending, and therefore return on investment, after learning their state's true graduation rate and rank. Because the γs are identified by nonrandom variation in baseline perceptions (and therefore the size of information shocks), it reflects the change in perceived spending from learning the graduation rate (rank) is one percentage point (percentile) higher. Under a causal interpretation, reasoning based only on movements along the marginal cost curve

[29]This specification is a linear spline with a knot at $\tilde{G} - G = 0$, which imposes that the amount respondents update is a continuous function of belief errors. When we allow for separate intercepts, the results don't change meaningfully.

would be consistent with a negative *gamma*, and reasoning based only on shifts of perceived productivity, $\gamma = 0$. In practice, we caution the interpretation of these estimates since priors are not exogenous, and provide randomized information about both graduation rates and spending in Section 5.3.2. Instead in this section we focus on differences by party and prior $(\gamma_R - \gamma_D)$ and $(\gamma_1 - \gamma_2)$, as in a difference-in-differences.

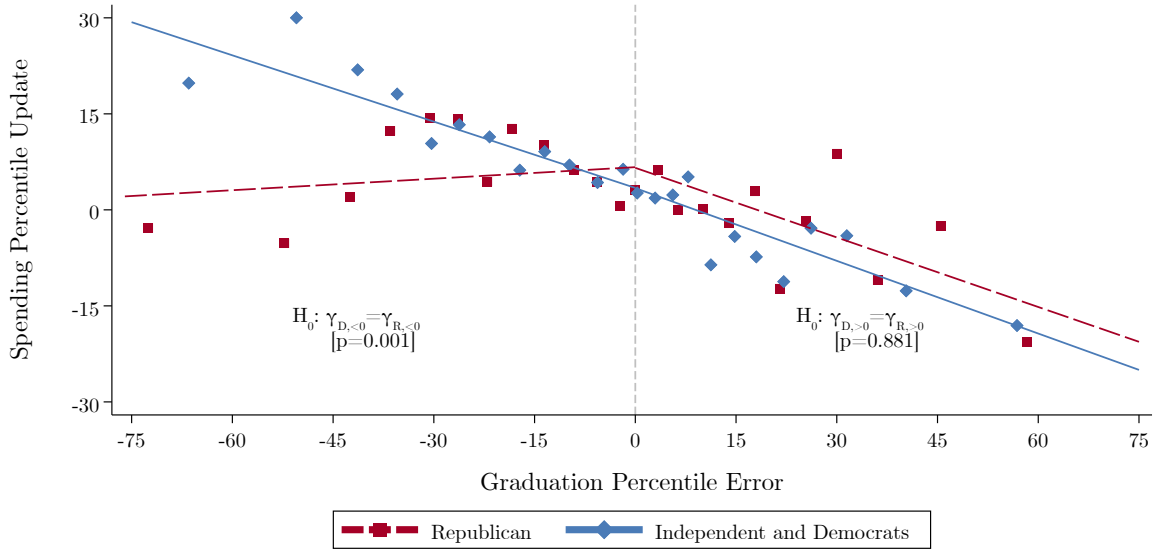
We first consider how individuals reason about their state's spending rank relative to others after learning its graduation rank. We estimate Equation 4, where S and G are each percentile ranks. Panel (a) of Figure 6 presents a binned scatterplot with the implied lines of best fit from the regression. On average all Democrats and Independents interpret the information that the graduation rate is relatively high compared to other states as evidence that their state spends more, indicated by the downward-sloping lines. Republicans who overestimate their states' graduation rate update in a nearly identical fashion. In terms of our model in Section 2 they reason that differences in graduation rank imply differences in spending rank—a movement along the marginal curves. As such, the model predicts they will not change their ideal policies, consistent with the effects in Figure 5.[30]

In contrast, on average Republicans who learn the state has a higher graduation rank do not update their beliefs about relative spending at all. The estimated slope, $\gamma_{1,R}$ is slightly positive but not different from 0. In terms of the model, perceiving a higher graduation rank with no change in spending belief, implies a higher perceived return on investment. As such, the model predicts they will increase their demand for public expenditure, consistent with Figure 5.[31] This reasoning process differs from that of Democrats and Independents with similarly negative belief errors, as indicated by the different slope estimates ($p = 0.001$). This suggests that partisan reasoning plays a significant role in mediating the effects of receiving information. Appendix B provides similar, but weaker evidence, on how Republicans update their beliefs about the spending level, compared to Democrats and Independents.

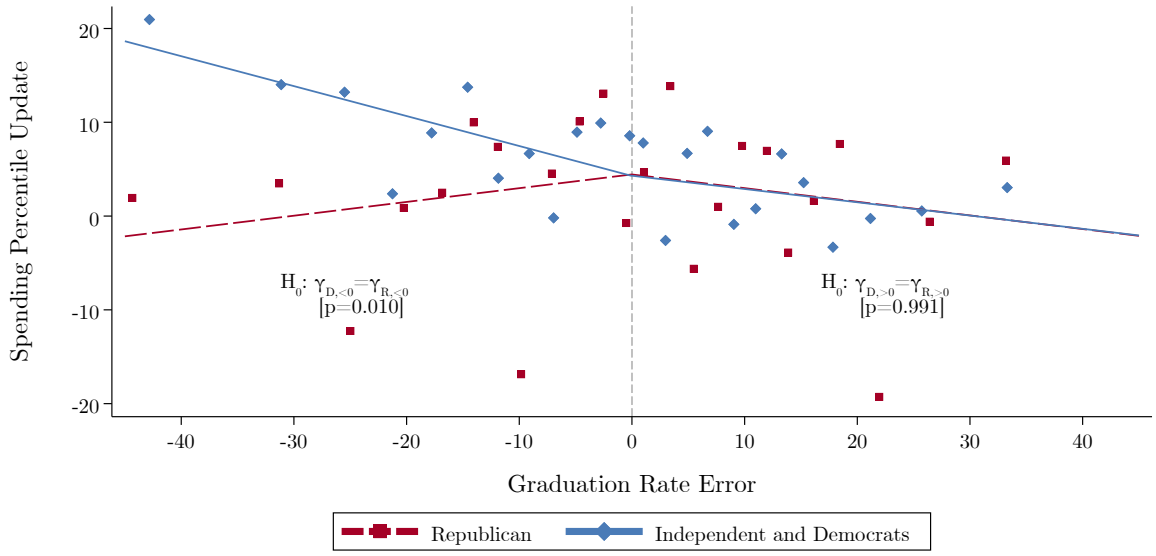
[30]Note that Figure 5 is from experiment 1 and Figure 6 is from experiment 2, and so these correspond to different samples.

[31]Similar to this implication, Doyle (2010) finds that conservative US senators are more likely to vote in favor of issues regarding the efficiency of colleges and universities.

Figure 6: Evidence of Partisan Reasoning about Productivity from Graduation Information



(a) Graduation Rank Information Changes



(b) Graduation Rate Information Changes

Note: This figure illustrates differences in updating by partisanship and by prior perceptions. Each panel presents the change in the perceived state spending percentile rank for individuals with different partisan identities over their belief errors, i.e., the prior perceptions minus the true rate. Panel (a) shows updating over the support of their belief error about the state graduation percentile rank and Panel (b) shows updating over the support of their belief error about the state graduation rates. In both graphs, markers represent averages of 12 quantiles above and below zero and lines represent regression lines with varying slopes for good and bad news, restricted to be continuous at zero. Points and lines are regression adjusted for the prespecified regression controls. Panels reflect responses of participants recruited for our second experiment from CloudResearch.

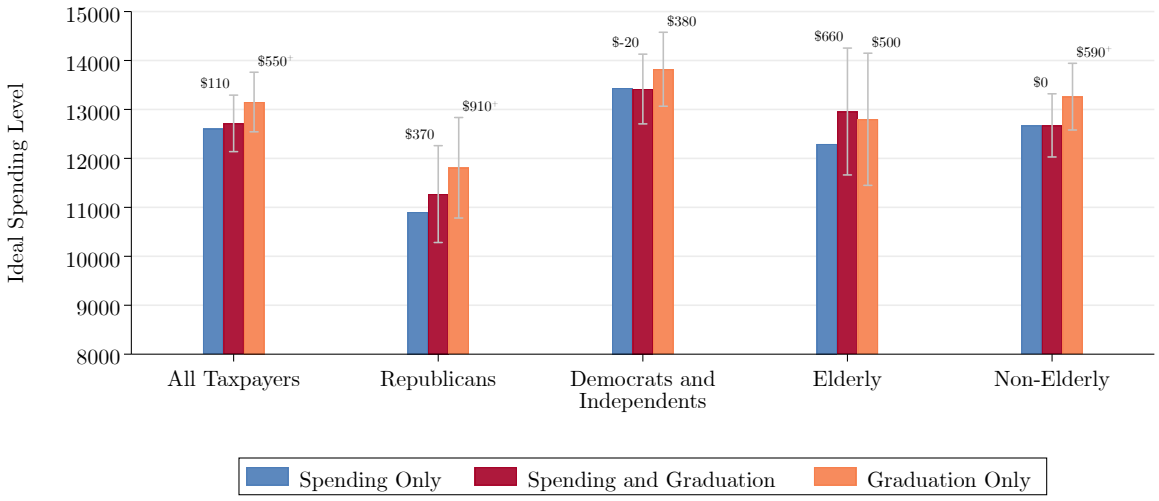
We find similar evidence of partisan reasoning when measuring how individuals respond to graduation rate information (Panel (b) of Figure 6). Republicans who learn that the graduation rate is high do not update their beliefs about the spending rank. Democrats and Independents who receive similar information reason that the state is spending relatively more. On average Republicans, Democrats, and Independents who learn that the graduation rate is low all reason that the state is spending relatively less. These findings provide further suggestive evidence that pessimistic Republicans are more likely to interpret the information treatments as a shift of the marginal curves and therefore respond by demanding more spending. Interestingly, there are differences both across party conditional on prior perceptions, and within party by prior. Overall, our results suggest that perceptions importantly determine ideological polarization.

5.3.2 Spending Information Limits Partisan Reasoning

Our previous results indicate that providing information decreases ideological polarization because Republicans demand more spending and suggest reasoning about their state's return on investment as a mechanism. To directly test this mechanism we study how perceptions of both components of the return on investment—graduation rates and spending—jointly influence perceptions and polarization. If, as we illustrate in our model, information about the graduation rate decreases polarization due to partisan reasoning, then providing spending information should (partially) undo the previous positive effects. More specifically, Republicans who learned that the graduation rate is higher, and therefore updated positively about state productivity, should update less positively (marginal cost curve shifts out by less). At the same time, others should see minimal effects from this new spending information because the graduation information already lead them to update their beliefs about spending.

In this experiment, individuals were randomized to receive one of three information treatments: 1) spending per student and its rank, 2) the spending information and the graduation rate and rank information, as in treatment 2 of the first experiment; or 3) only the graduation

Figure 7: The Effect of Graduation and Spending Information on Demand



Note: The figure presents the average treatment effects and heterogeneity by political partisanship and age from our second experiment. We report the estimated treatment effects on ideal spending per student from receiving information about the graduate rate and its rank relative to other states, as well as the effect of receiving both the graduation information and additionally information about level and rank of state appropriations (spending) per student, compared to only receiving spending information. $^{+}p < 0.1$

rate and rank information. Since our main outcome on ideological polarization is the ideal spending level, the first treatment is important to account for how spending information anchors ideal spending and return on investment. The goal of the second treatment is to shut down partisan reasoning about spending from graduation information to study its impact on polarization. If Republicans update their beliefs too much about productivity, then those randomized into the second treatment may demand less than those in in the third. Figure 7 presents evidence consistent with this, showing that since spending information weakly reduces demand compared to graduation information only, especially among Republicans.

To further estimate the joint role of graduation and spending perceptions on ideological polarization, we estimate how different types of individuals respond to different types of

information from

$$Y_i = \sum_t \Big[\beta_{0,t} + \beta_{1,t}(\tilde{G}_i - G_{s(i)}) \mathbb{1}[\tilde{G}_i - G_{s(i)} \leq 0] + \beta_{2,t}(\tilde{G}_i - G_{s(i)}) \mathbb{1}[\tilde{G}_i - G_{s(i)} > 0] \Big] + X\beta_3 + \varepsilon_i \quad (5)$$

where Y_i are participants' ideal spending per student; $\tilde{G} - G$ their graduation rate belief errors; and t their randomized treatment assignment.[32] This comparison directly explores the intuition reflected above. If certain Republicans over-correct about the return on investment, learning about spending should (weakly) reduce their ideal spending; furthermore, the model would predict there to be no noticeable effects among groups who correctly update about spending.

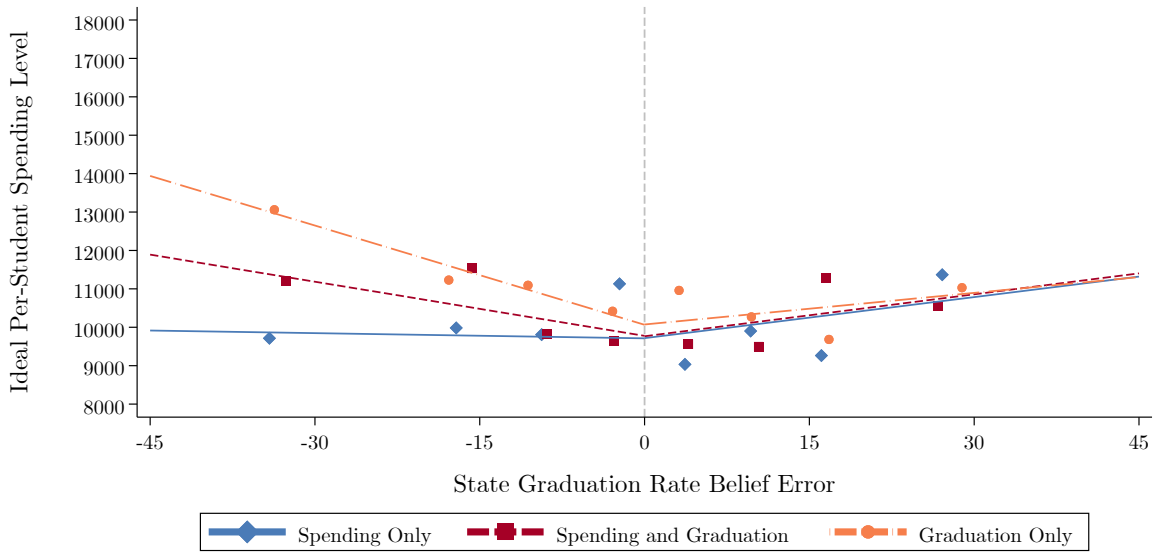
Figure 8 presents the estimates by partisanship and treatment. Among Republicans who learn that the graduation rate is high, those who receive spending and graduation rate information report ideal spending policies that are $919 lower than those in the graduation-only treatment.[33] The difference is not statistically significant (the right half of Panel (a)) but suggests that the spending information may prevent Republicans from over-correcting their views on state productivity.[34] This correction slightly increases ideological polarization but does not revert it to the baseline level. Republicans who underestimate graduation rates but only learn about their state's spending demand an average of $1,327 less spending than similar Republicans who only learn the graduation rate ($p = 0.099$). This pattern provides additional evidence that partisan reasoning helps explain our earlier findings, but the results are noisy.

[32] Again, this specification is a linear spline with a knot at $\tilde{G} - G = 0$, so that demand is a continuous, linear function of belief errors. Estimating separate intercepts a local polynomial does not change the results meaningfully.

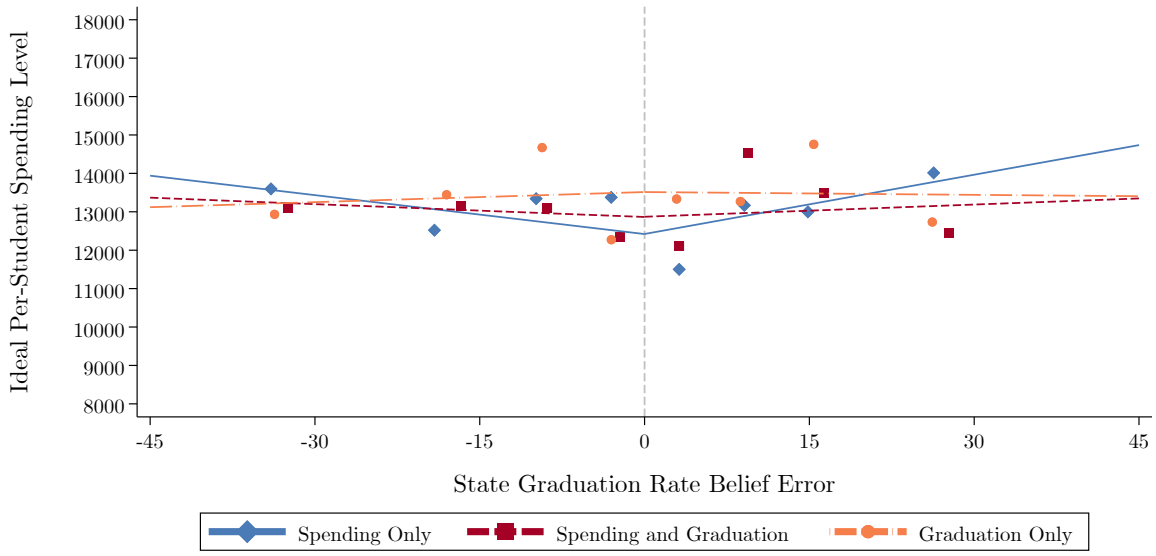
[33] Sixty-one percent of these Republicans have initial spending priors that are less than the true spending amount.

[34] Technically ideal spending could go down either because of over-correcting about productivity or because the combination of both spending and graduation information makes participants think the state is so productive that they can spend less money than the baseline perception and produce more graduates. While somewhat underpowered, comparisons between the mechanisms suggest that over-correcting is more likely at play.

Figure 8: The Effect of Graduation and Spending Information by Partisanship and Perceptions



(a) Republicans



(b) Democrats and Independents

Note: This figure illustrates how the effects of information vary by partisanship and by prior perceptions of the state graduation rate. Each panel presents the ideal policies for individuals in different treatment groups over the support of their belief error about the state graduation rates, i.e., the prior perceptions minus the true rate. Panel (a) contains Republicans and Panel (b) Democrats and Independents. In both graphs, markers represent averages of four quantiles above and below zero and lines represent regression lines with varying slopes for good and bad news, restricted to be continuous at zero. Points and lines are regression adjusted for the prespecified regression controls. Both panels reflect responses of taxpayers recruited for the second experiment.

Moreover, receiving additional spending information does not affect Republicans who learn that the graduation rate is lower than perceived (right side of Panel (a)) or Democrats and Independents (Panel (b)). This indicates that information about spending does not seem to interact with graduation information for these groups. Instead, this pattern provides additional evidence that learning about the graduation rate and/or rank leads them to reason accurately that spending is lower, a movement along the marginal curves.

6. Information and Affective Polarization

We now examine whether our information treatments shape affective polarization in the form of increased, positive cross-aisle political engagement. Prior work finds that greater ideological polarization is associated with greater affective polarization, including aversion toward lawmakers from the opposing party. However, this evidence is mixed (e.g., Lelkes, 2018). Accordingly, partisans may be unwilling to interact with lawmakers of the opposing party when they perceive them to hold preferences that are far from their own. Given that our information treatments reduce ideological polarization by increasing pessimistic Republicans' preferred spending levels, they may also increase their political engagement by making them more inclined to engage (positively) with Democratic lawmakers.

We test the impact of graduation information on affective polarization by measuring how receiving this information affects letter writing (communications with policymakers) in our first experiment. If information reduces affective polarization, then the personal cost of interacting with a member of the opposing party will be lower and partisans will be more willing to engage across party lines. Furthermore, the sentiment of text of the letters captures whether interactions are positive or negative. As such we estimate effects on whether partisans send letters across party lines and whether partisans send a letter with positive sentiment to an elected official of the opposing party.[35] If information only induces more partisans to reach across the aisle to express their distaste or distrust, then affective

[35]Independents are excluded from this analysis since they do not have a party affiliation.

polarization will have increased.

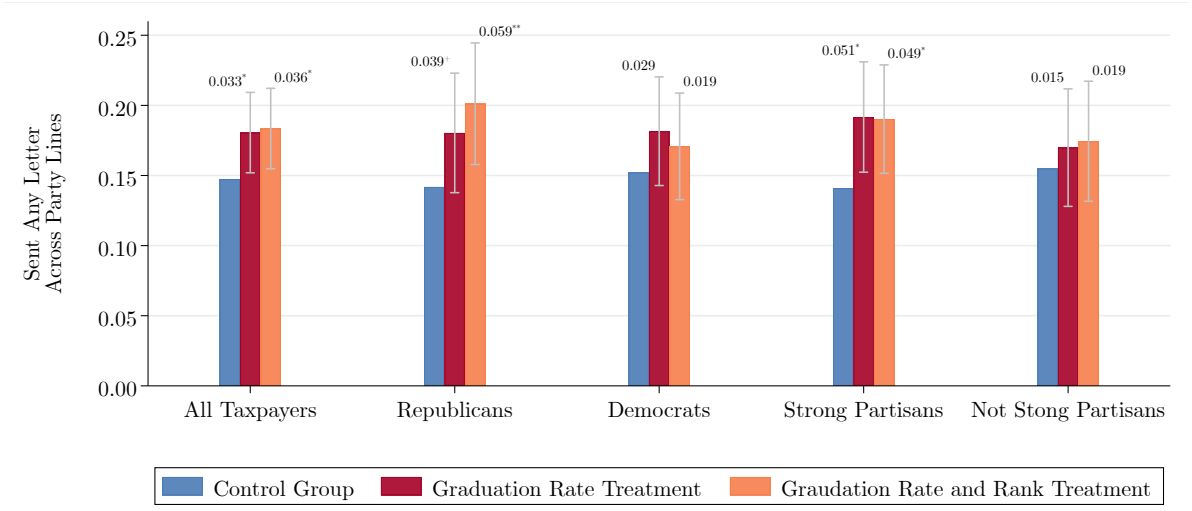
Panels (a) and (b) of Figure 9 present the results by party and strength of partisanship. Across all partisans, the information treatments increase the likelihood of sending any letter to an elected official of the opposing party by about 3.5 percentage points, or about 24%. This effect is largest for Republicans, consistent with our results on ideological polarization, and for strong partisans. The treatment effects on whether an individual sends a positive letter directly mirror the effect on their propensity to send any letter across party lines. While the effects in percentage points are slightly smaller in magnitude, they are similar or even exceed the control mean when expressed as a percentage. As such, Republicans and strong partisans who are induced to reach across the aisle are creating positive interactions, on average, with elected officials of the opposing party.

Overall, our results imply that information that decreases ideological polarization also decreases affective polarization. However, in our framework, we cannot disentangle if information directly affects the sentiment of the letters themselves or if it induces additional political participation among taxpayers with (latent) positive sentiment. In either case, information leads taxpayers to have more, and more positive, interactions with elected officials. In our third experiment in Section 7, we consider the policy consequences of this change in a natural field experiment where we send these letters to elected officials.

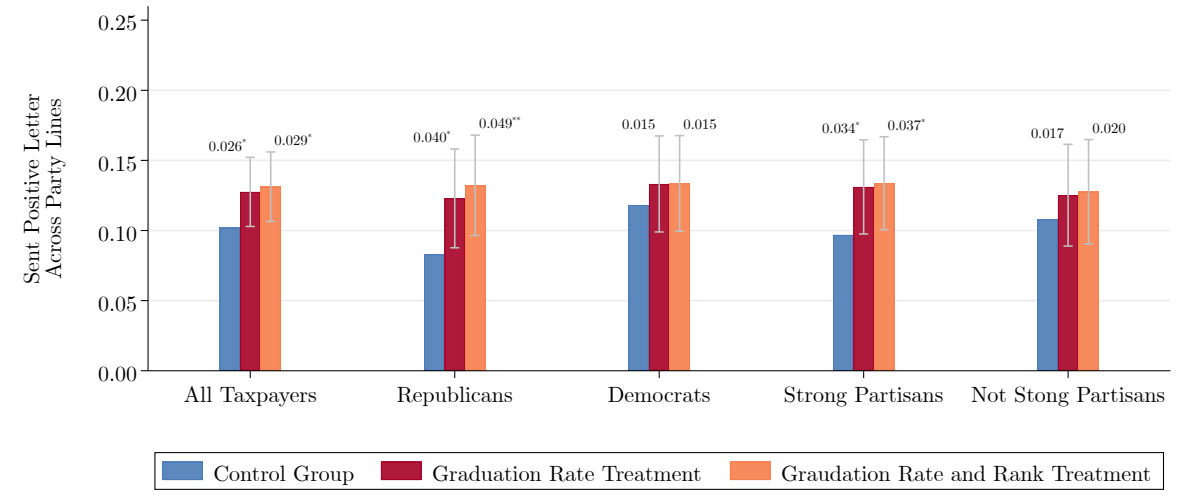
Next, we consider the joint effect of graduation and spending information on affective polarization based on letter writing in the second experiment. Figure 10 presents average treatment effects for each measure of affective polarization by political party and strength of partisanship. Spending information, does not eliminate the cross-party interactions sparked by learning graduation rates. Interestingly, the effect of spending information on positive interactions seems to be largest for those who learn their state spends less, and therefore learn that the return on investment is higher.[36]

[36]For example, note that Republicans who learn their state spends less are 10 percentage points more likely to send a positive letter across the aisle ($p = 0.004$) compared to Republicans in the graduation information treatment with similar priors. However, we find no difference across our treatments for Republicans who initially perceive spending to be lower than the true level. Spending information may therefore be more

Figure 9: Information Affects Political Engagement



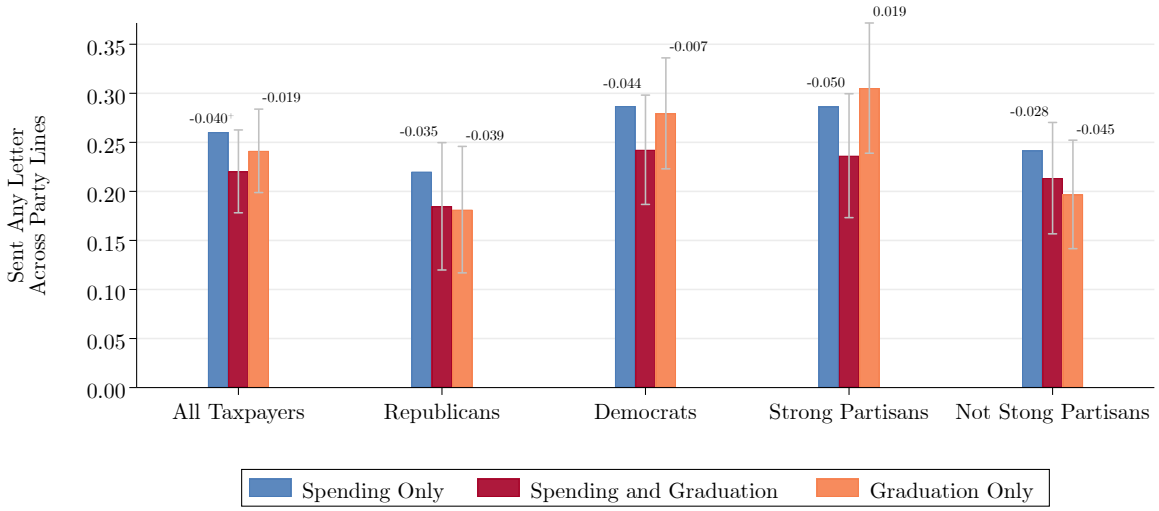
(a) Sent Any Letter Across the Aisle



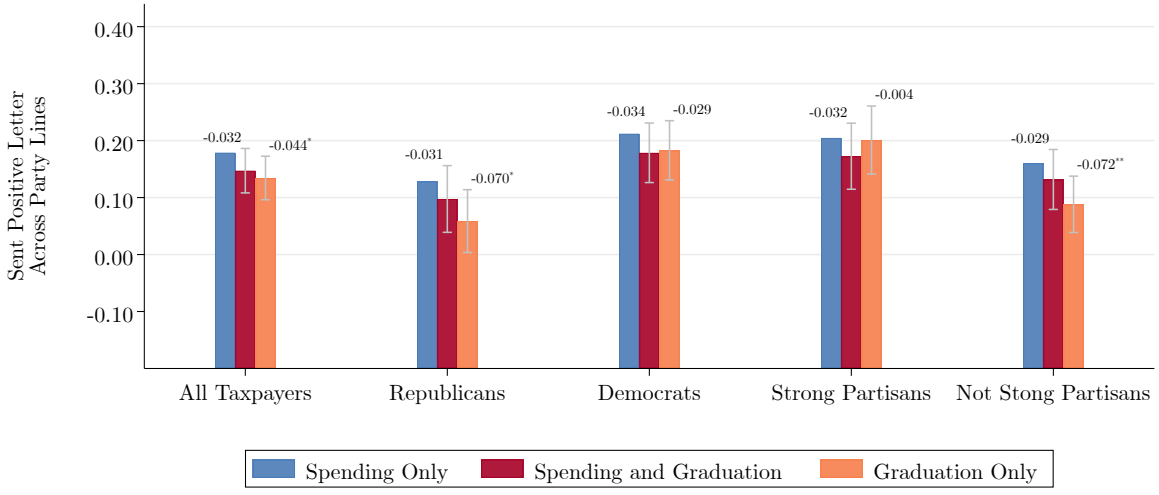
(b) Sent A Positive Letter Across the Aisle

Note: Each figure presents an outcome of interest by treatment group and characteristics along with 95% confidence intervals on the effects of the two treatments. Panel (a) reports the share that wrote a letter to an elected official from the opposing party. Panel (b) reports the share that wrote a letter with positive Syuzhet sentiment score to an elected official from the opposing party. Both panels reflect responses from 3,787 participants who completed surveys through Qualtrics and CloudResearch for the first experiment and who at least lean toward a political affiliation.

Figure 10: Spending Information and Political Engagement



(a) Sent Any Letter Across the Aisle



(b) Sent A Positive Letter Across the Aisle

Note: Each figure presents an outcome of interest by treatment group and characteristics along with 95% confidence intervals on the effects of the two treatments. Panel (a) reports the share that wrote a letter to an elected official from the opposing party. Panel (b) reports the share that wrote a letter with positive Syuzhet sentiment score to to an elected official from the opposing party. Both panels reflect responses from 2,464 individuals who completed surveys for the second experiment and who at least lean toward a political affiliation.

7. Policymaker Behavior and Information about Constituent Demand

In the first two experiments, we measure demand for public investment in higher education, in part, by collecting letters from the constituents of 48 governors and 190 state legislators.[37] We conduct a third experiment to understand policymakers' responses to (polarized) constituent demand. If constituent demand does in fact shape policymakers' engagement with higher education issues, then polarization in stated ideal policies could polarize actual policies. In that case, shaping the set of individuals who express their opinions on state spending and how they choose to express them could have important consequences for the quality of services provided, in addition to the other negative effects of living in a polarized society.

7.1 Design for Experiment on Policymaker Behavior

We randomize whether elected officials receive the constituent letters and information about demand in April 2023 or early 2024. We then estimate the causal effect of receiving information about constituent demand on elected official behavior by comparing the 2023 behavior of officials who receive the information earlier to those who will receive it later.[38]

Each state party (e.g., Michigan Republicans) is randomized into one of three conditions. Half of the state parties are randomized into our main treatment group, Constituent Demand. These parties receive an email containing the following:[39] 1) summary statistics from the demand experiments highlighting how stated ideal spending is higher than actual national spending in the US, on average, by political partisanship, and by age; 2) up to three highlighted positive letters about the need for more public investment in higher education in their state; 3) a link to a document with all collected letters; 4) a second link to a state-specific resolution for maintaining the level of higher education appropriations per student

salient and easier to interpret.

[37] Individuals in each state could send a letter to up to five elected officials (except in Nebraska, due to its unicameral legislature). While our sample includes individuals from all states, we did not have enough letters from North Dakota and South Dakota and therefore excluded them from our randomization.

[38] The experiment and preanalysis plan were registered with the AEA RCT registry (AEARCTR-0011306).

[39] For elected officials where an email was not publicly available, we use their online contact form.

for them to consider and propose; and 5) an offer to discuss the survey findings with us.

The remaining state parties are split equally into a pure control group, which are not contacted until 2024, and a Contact Only control group, which receives an initial email from us in 2023 but without specific demand information, containing only the resolution and an offer to discuss more. Each state has one state party in the Constituent Demand treatment and one in either of the two control groups.

7.2 Policymakers Respond to Constituent Demand

For each contacted elected official, we measure their engagement with higher education policy by whether they view the attached resolution, whether they reply to the email, and whether they meet with us to discuss further.[40] For each of our higher education engagement outcomes of interest, H_l, for legislator l, we estimate our treatment effects from the following linear regression:

$$H_l = \phi_0 + \phi_1 \text{Constituent Demand}_l + \phi_2 \text{Contact Only}_l + X\psi + \varepsilon_l \tag{6}$$

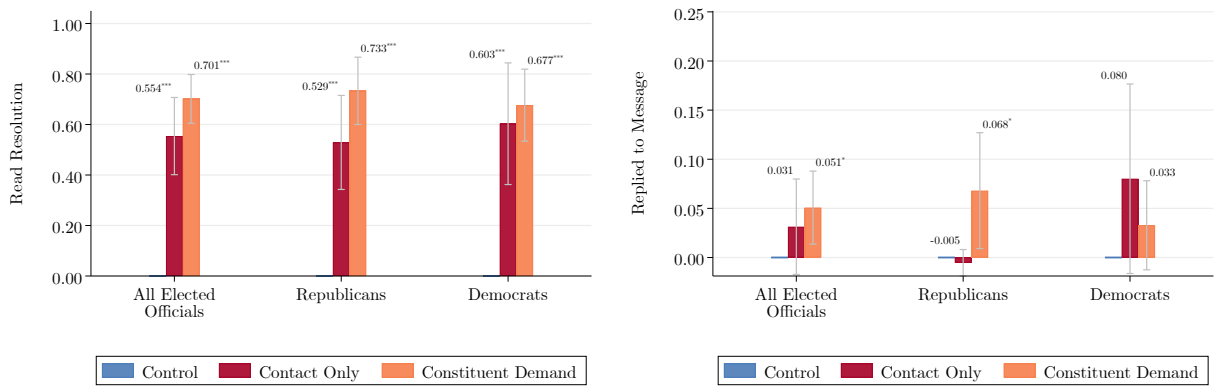
where ϕ_1 and ϕ_2 give the causal effect of receiving information about constituent demand on elected official engagement on higher education issues. In our specifications, we also control for the elected official's party and their chamber. Since we conduct a clustered paired experiment, we cluster our standard errors by state and do not include state fixed effects (following discussion in de Chaisemartin and Ramirez-Cuellar, 2020).[41]

Figure 11 presents the results. We find that providing information about constituent demand increases engagement from elected officials. Elected officials in the *Constituent Demand* treatment are 15 percentage points more likely to open our resolution to maintain higher education funding compared to those who only receive a generic email from us

[40] We also observe whether each official in the *Constituent Demand* and *Contact Only* groups opens the email and whether those in the *Constituent Demand* treatment view the full list of letters.

[41] Including state fixed effects has a minimal effect on our main estimates for all legislatures. However, we cannot include them when limiting our analysis to Republicans or Democrats.

Figure 11: Elected Official Engagement on Higher Education Issues from Constituent Demand



(a) Open Resolution to Maintain Spending

(b) Send an Email Reply

Note: Each figure presents an outcome of interest by treatment and elected official characteristics along with 95% confidence intervals on the effects of the two treatments. Panel (a) reports the share of that elected official who open our resolution to maintain higher education funding. Panel (b) reports the share of elected officials who reply to our email. Both panels reflect responses from the 238 elected officials in our sample. Standard errors are clustered by state. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}p < 0.1$

($p = 0.034$). This is largely driven by Republican officials ($p = 0.079$), with a much smaller effect for Democrats that is not statistically significant. Similarly, the *Constituent Demand* treatment also leads elected officials, especially Republicans, to engage more on higher education issues by responding to our emails, while our *Contact Only* treatment does not lead officials to engage in this way.[42]

The results from our three experiments suggest that elected officials may be shaping higher education policy in response to distorted constituent demands,and incorrect constituent perceptions that state higher education is wasteful or has a low return on investment. This likely heightens polarization in public discussions around higher education policy, ultimately influencing which policies are implemented.

[42]For Republican-elected officials, the difference in the likelihood they respond to our *Constituent Demand* email, compared to the generic *Contact Only* email, is statistically different from 0 ($p = 0.024$).

8. Conclusion

Despite its positive effects on critical student outcomes (Bound and Turner, 2007; Bound et al., 2010; Zimmerman, 2014; Deming and Walters, 2017) and society more broadly (Moretti, 2004), public investment in higher education has been a low priority for states and is increasingly marked by strong partisan disagreements. Our findings suggest that perceptions of the returns on state investment in higher education are an important driver of both limited public support and increasingly polarized attitudes. When taxpayers, especially Republicans, believe their state spends a lot on public higher education without producing a sufficient number of graduates, they are less inclined to support the system with their tax dollars. Moreover, we find that these sentiments have real policy stakes, as they affect how constituents communicate with policymakers and in turn affect policymaker behavior.

Our findings indicate that state policymakers seeking to build support for spending on higher education may benefit from tying public investment in higher education to productivity measures and then effectively communicating the associated return on investment to taxpayers. Comments in the letters to elected officials collected in our experiment suggest that taxpayers may be more open to funding students who are likely to graduate and remain in state, thereby increasing the perceived or actual return on investment.[43] The "Excelsior Scholarship" in New York, which funds study at in-state public higher education intuitions, represents a recent effort in this direction. Nevertheless, while efforts to tie funding to students' commitments to stay in state may be political tractable, they may be impracticable given that college-educated workers are exceptionally mobile. Moreover, efforts to tie funding to graduates' choice of residence may complicate colleges' use of out-of-state and international student tuition to subsidize in-state students (e.g., Bound et al., 2020). In this case, the federal government may be better suited to ensure sustained support for colleges.

[43] As one respondent commented, "If we give more money toward students should be requirement [sic] they reside in Wisconsin for period of time or are required to reimburse rather than taxpayer funding education for them to get money and then move elsewhere. Possibly State tax credit after than graduate as long ad [sic] paying Wisc taxes."

Which policies are implemented affects not only provision but how partisans view each other, impacting social cohesion. Our results suggest that low spending levels leading to underfunded and low-quality services can worsen affective polarization. Our work contributes to the somewhat divided literature on the connection between ideological and affective polarization, providing evidence that they do in fact appear to reinforce one another. Therefore, state divestment in public higher education may not only negatively affect colleges and students but also have broader implications for societal interactions.

Overall, our results highlight the role of perceptions and the value of information about public higher education and state productivity in the provision of public goods. In our setting, information decreases ideological and affective polarization because Republicans initially believe their states are less productive, but they are more likely to interpret high graduation rates as a signal of state productivity compared to Democrats and Independents. Altering perceptions for other public goods and services may not yield the same benefits for reducing either ideological or affective polarization, based on how different types of people reason about tax and expenditure policy. Nonetheless, our results help us understand the extent to which partisan reasoning matters, and our work provides a framework for assessing its role in other settings.

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A. Balance

Table A1: Balance Table for Experiment 1

Panel A: Belief Errors	Mean	Control	Rate	Rate and Rank	Control - Rate	Control - Both
US graduation rate	1.283	1.078	2.052	0.704	-0.974	0.375
	(17.5)				[p=0.114]	[p=0.556]
State Graduation Rate	0.591	0.246	1.195	0.316	-0.950	-0.070
	(19.1)				[p=0.166]	[p=0.918]
State Graduation Rank	6.799	6.619	6.756	7.021	-0.138	-0.402
	(16.0)				[p=0.809]	[p=0.485]
State Per-Student Spending	2894	2786	2873	3023	-87	-238
	(7019)				[p=0.730]	[p=0.346]
State Spending Rank	3.359	2.848	3.309	3.913	-0.461	-1.065
	(18.2)				[p=0.474]	[p=0.105]
Panel B: Respondent Characteristics	Mean	Control	Rate	Rate and Rank	Control - Rate	Control - Both
Female	0.500	0.494	0.494	0.512	0.000	-0.018
	(0.500)				[p=0.991]	[p=0.315]
Republican	0.368	0.377	0.362	0.367	0.015	0.010
	(0.482)				[p=0.385]	[p=0.579]
No College	0.348	0.345	0.349	0.349	-0.004	-0.004
	(0.476)				[p=0.802]	[p=0.801]
BA Degree	0.364	0.364	0.361	0.367	0.003	-0.003
	(0.481)				[p=0.878]	[p=0.845]
Age	61.98	61.11	60.93	60.89	0.18	0.23
	(16.2)				[p=0.755]	[p=0.699]
Attend Public	0.314	0.313	0.319	0.310	-0.007	0.002
	(0.464)				[p=0.695]	[p=0.893]
Child Attended	0.239	0.238	0.244	0.233	-0.006	0.005
	(0.426)				[p=0.709]	[p=0.746]
Child May Attend	0.722	0.708	0.734	0.724	-0.026	-0.016
	(0.448)				[p=0.111]	[p=0.323]
Follows College Sports	0.363	0.366	0.374	0.350	-0.007	0.016
	(0.481)				[p=0.670]	[p=0.357]
Observations	4,679	1,535	1,585	1,559	3,120	3,094

Note: Each row presents the overall sample mean, mean by treatment group, and the difference between the two treatments and control. The standard deviations are also listed in parentheses in the overall mean column.

Table A2: Balance Table for Experiment 2

Panel A: Belief Errors	Mean	Rate Only	Spending Only	Spending and Graduation	Spending - Both	Spending - Graduation
US graduation rate	0.662	0.269	1.219	0.498	-0.951	-0.229
	(16.25)				[p=0.184]	[p=0.753]
State Graduation Rate	-0.068	-0.861	0.788	-0.126	-1.649	-0.735
	(18.44)				[p=0.042]	[p=0.374]
State Graduation Rank	3.405	3.703	2.988	3.524	0.715	0.179
	(14.97)				[p=0.287]	[p=0.786]
State Per-Student Spending	1775	1590	2073	1660	-483	-70
	(6643)				[p=0.101]	[p=0.815]
Sate Spending Rank	2.210	3.052	1.720	1.844	1.332	1.207
	(17.26)				[p=0.081]	[p=0.119]
Panel B: Respondent Characteristics	Mean	Rate Only	Spending Only	Spending and Graduation	Spending - Both	Spending - Graduation
Female	0.555	0.548	0.558	0.560	-0.010	-0.012
	(0.497)				[p=0.661]	[p=0.576]
Republican	0.326	0.329	0.322	0.328	0.008	0.001
	(0.469)				[p=0.715]	[p=0.970]
No College	0.226	0.215	0.231	0.232	-0.016	-0.017
	(0.418)				[p=0.379]	[p=0.357]
BA Degree	0.429	0.423	0.429	0.436	-0.006	-0.013
	(0.495)				[p=0.789]	[p=0.559]
Age	45.2	45.3	45.0	45.3	0.3	0.0
	(16.0)				[p=0.671]	[p=0.955]
Attend Public	0.453	0.468	0.436	0.456	0.032	0.012
	(0.498)				[p=0.144]	[p=0.590]
Child Attended	0.165	0.166	0.154	0.174	0.012	-0.008
	(0.371)				[p=0.474]	[p=0.646]
Child May Attend	0.778	0.779	0.777	0.778	0.003	0.001
	(0.416)				[p=0.892]	[p=0.949]
Follows College Sports	0.397	0.418	0.382	0.393	0.036	0.025
	(0.489)				[p=0.093]	[p=0.245]
Observations	3,037	1,024	1,017	996	2,041	2,020

Note: Each row presents the overall sample mean, mean by treatment group, and the difference between the two treatments and control. The standard deviations are also listed in parentheses in the overall mean column.

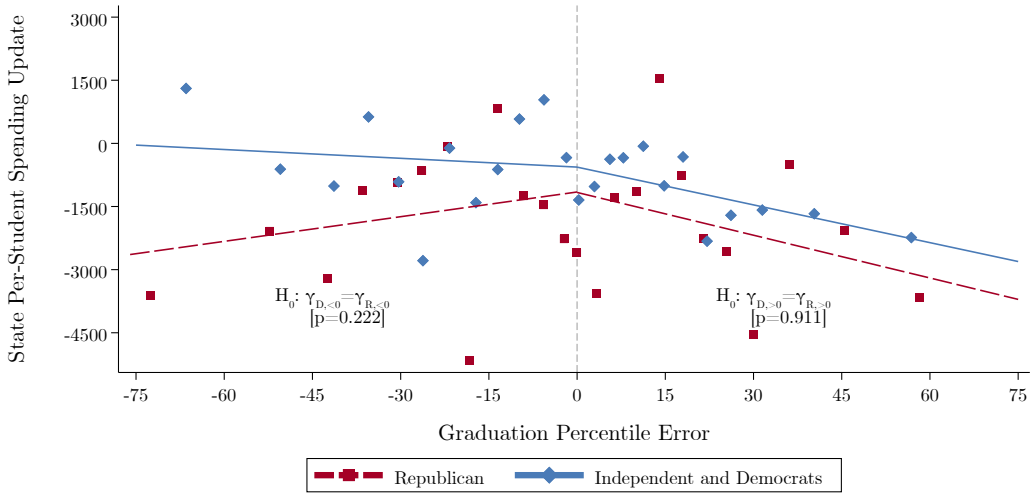
Table A3: Balance Table for Experiment 3

	Mean	Pure Control	Contact Control	Constituent Demand	Constituent - Either Control	Constituent - Contact
Republican Governor	0.202	0.190	0.226	0.195	-0.013	-0.031
	(0.402)				[p= 0.777]	[p= 0.541]
Republican House	0.395	0.397	0.387	0.398	0.007	0.011
	(0.490)				[p= 0.777]	[p= 0.659]
Republican Sentate	0.403	0.414	0.387	0.407	0.007	0.020
	(0.492)				[p= 0.777]	[p= 0.448]
Per student spending in respondent's state	8058	7883	7898	8227	337	330
	(3969)				[p= 0.148]	[p= 0.502]
Spending Rank (/50)	25.4	25.9	26.2	24.8	-1.2	-1.4
	(14.7)				[p= 0.156]	[p= 0.539]
State Rate (%)	59.0	59.1	59.8	58.5	-1.0	-1.3
	(8.7)				[p= 0.053]	[p= 0.360]
State Rank (/50)	25.0	25.0	23.4	25.8	1.6	2.3
	(14.6)				[p= 0.062]	[p= 0.342]

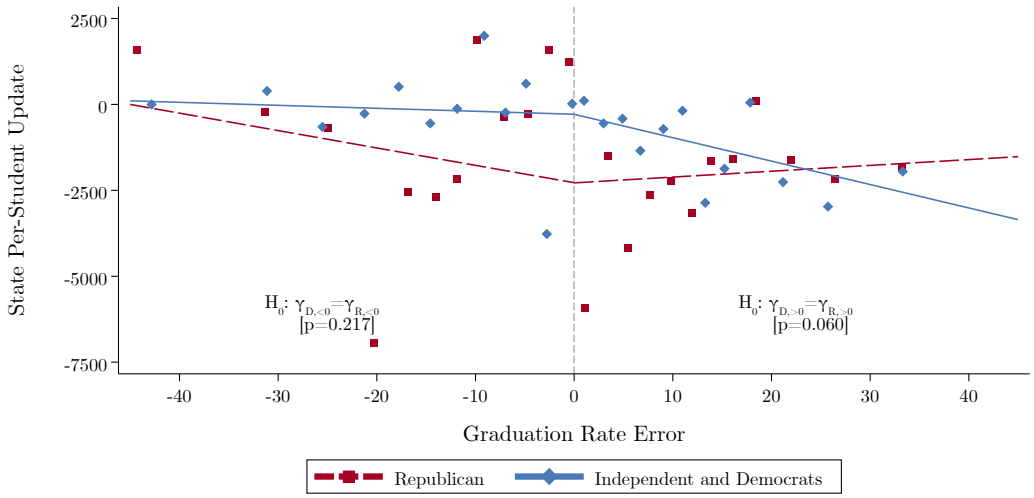
Note: Each row presents the overall sample mean, mean by treatment group, and the differences between the two controls and constituent demand and between the contact control and constituent demand. The standard deviations are also listed in parentheses in the overall mean column.

B. Other Evidence of Partisan Reasoning

Figure B1: Additional Evidence of Partisan Reasoning from Graduation Information



(a) Graduation Rank Information Changes



(b) Graduation Rate Information Changes

Note: This figure illustrates differences in updating by partisanship and priors. Each panel presents the change in the perceived state per-student spending for individuals with different partisan identity over their belief errors, i.e., the prior perceptions minus the true value. Panel (a) shows updating about the state graduation percentile rank and Panel (b) shows updating about the state graduation rates. In both graphs, markers represent averages of 12 quantiles above and below zero and lines represent regression lines with varying slopes for good and bad news, restricted to be continuous at zero. Points and lines are regression adjusted for the prespecified regression controls. Panels reflect responses of taxpayers recruited for our second experiment from CloudResearch.

C. Survey Questions and Treatments for Experiments 1 and 2

*Only included in Experiment 2

C.1 Measuring Priors

- What percent of students who enroll in public four-year colleges in the United States graduate within six years of enrollment? Use the slider below to indicate your guess.[*Sliding scale from 0 and 100 (increments of 1)*]
- What percent of students who enroll in public four-year colleges in **STATE** graduate within six years of enrollment? Use the slider below to indicate your guess. [*Sliding scale from 0 and 100 (increments of 1)*]
- Where does [Participant's State's] graduation rate rank relative to other states? Use the slider below to indicate your guess. NOTE: A rank of 1 means you believe **STATE** has the country's lowest graduation rate. [*Sliding scale from 1 and 50 (increments of 1)*]
- In 2019, how many tax dollars did **STATE** spend per student at public four-year colleges? Use the slider below to indicate your guess in $1000s. [*Sliding scale from 0 and 25 (increments of 0.1)*]
- How does **STATE**'s spending per student rank relative to other states? Use the slider below to indicate your guess. NOTE: A rank of 1 means you believe **STATE** spends more tax dollars per student than any other state; a rank of 50 means you believe **STATE** spends fewer tax dollars per student than any other state. [*Sliding scale from 1 and 50 (increments of 1)*]

C.2 Information Treatments

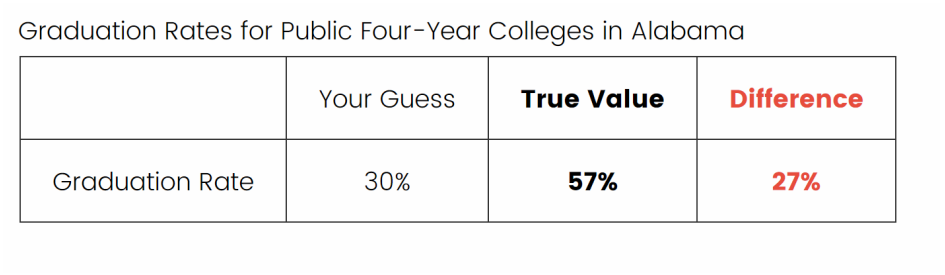
Please take a moment to review these tables and see how close your guesses were to the true values. [*Participants in the first experiment are randomized to see either Figure B1a or Figure B1b, or to not see this screen at all. Participants in the second experiment are randomized to see only Figure B1b, Figure B1b and Figure B1c, or to not see this screen at all.*]

C.3 Survey Outcomes

- How much do you think **STATE** should spend per student each year at public four-year colleges (in $1000s)? [*Sliding scale from 0 to 25 (increments of 0.1)*]
- Imagine **STATE** spends an additional $100 per student on public four-year colleges next year. As a result of this additional spending... how much would you expect enrollment at public four-year colleges to increase (in percent)? A negative number indicates fewer students would enroll. [*Sliding scale from -5 to 5 (increments of 0.1)*]

Figure B1: Information Treatments

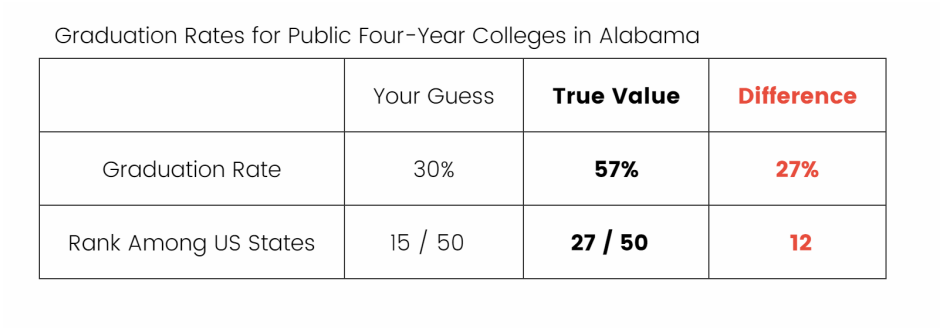
(a) Graduation Rate



Graduation Rates for Public Four-Year Colleges in Alabama

	Your Guess	**True Value**	**Difference**
Graduation Rate	30%	**57%**	**27%**

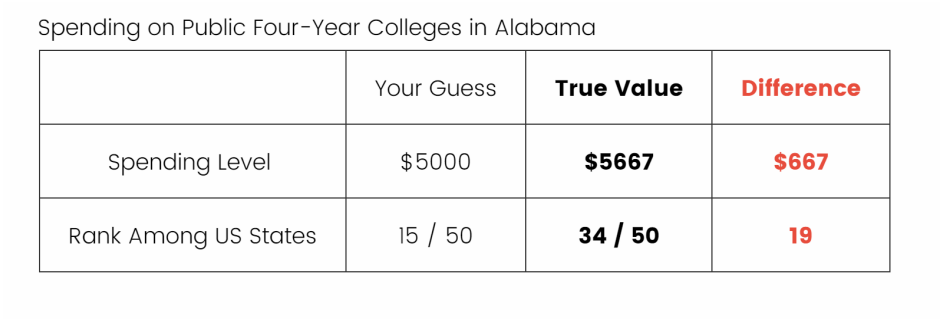
(b) Graduation Rate and Rank



Graduation Rates for Public Four-Year Colleges in Alabama

	Your Guess	**True Value**	**Difference**
Graduation Rate	30%	**57%**	**27%**
Rank Among US States	15 / 50	**27 / 50**	**12**

(c) Spending Level and Rank



Spending on Public Four-Year Colleges in Alabama

	Your Guess	**True Value**	**Difference**
Spending Level	$5000	**$5667**	**$667**
Rank Among US States	15 / 50	**34 / 50**	**19**

- ...how much would you expect the graduation rate for four-year colleges to increase (in percent)? A negative number indicates a lower proportion of students would graduate. [*Sliding scale from -5 to 5 (increments of 0.1)*]
- Now imagine **STATE** collects an additional $1 in tax revenue each year from every resident in the state to spend on public four-year colleges in **STATE**. To what extent do you agree with the following statements regarding this change? ... The average person in **STATE** would be better off. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]
- ... I personally would be better off. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]
- ... New graduates from public four-year colleges would have better careers.[*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]

- To what extent do you agree with the following statements? ... I trust that public four-year colleges in **STATE** use taxpayer dollars well. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]

- ... I personally would be better off. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]

- ... **STATE** should shift the cost of public higher education from taxpayers to students by charging higher tuition. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]

- ... The federal government should increase financial support for public four-year colleges. [*Strongly disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Strongly agree*]

C.4 Behavioral Outcomes

- Thank you for sharing your opinions regarding state spending on public four-year colleges in **STATE**. We'd now like to give you a chance to share your thoughts about public higher education with your elected officials. We will compile any comments you make in a report for **STATE** state officials. If you wish to make any comments, please provide them here: [*Long text entry*]

- Who would you like us to send these preferences to? Please select at least one. [*The Governor of **STATE**; The Republican leader in the **STATE** House of Representatives; The Democrat leader in the **STATE** House of Representatives; The Republican Leader in the **STATE** Senate; The Democratic Leader in the **STATE** Senate; I do not wish to make any comments*]

- *Thank you for sharing. [for those who wrote: In addition to what you just wrote] would you like to add one of the below statements to your message to your representative? I believe **STATE** should (select least one)... [*increase its spending on public higher education; decrease its spending on public higher education; not change its spending on public higher education; I do not want to add any of these additional statements*

- *because... (select at least one) [*it's important for **STATE** to be a leader on public higher education, it's not important for xx to be a leader on public higher education, **STATE**'s spending on higher education generally strengthens the economy, **STATE**'s spending on higher education generally goes to waste, **STATE** is responsible for providing college education for students, **STATE** is not responsible for providing college education to students, I do not want to add any of these additional statements*]

- We'd also like to give you a chance to directly support public higher education in **STATE**. As part of this survey you can donate up to $0.25 to higher education in **STATE** , keeping any money you do not donate as a bonus payment (for example, you could choose to donate $0.10 and keep $0.15). In the first box below, please

type the name of the public university in **STATE**. Please use the slider to choose the amount you wish to donate. College name: [*Text entry*]

- Amount: [*Sliding scale from 0 to 0.25 (increments of 0.01)*]

C.5 Demographic Questions

- To start, select the state where you live: [*Dropdown list.*]
- What is your gender? [*Male; Female; Non-binary/third gender; Prefer not to say*]
- What is the highest level of education you have completed? [*Less than a high school degree; High school degree or equivalent; Some college but no degree; Associate degree; Bachelor's degree; Graduate degree (e.g., Master's, JD, MD, PhD)*]
- Generally speaking, do you consider yourself to be a:[*Strong Republican, Not very strong Republican, Independent leaning Republican, Independent, Independent leaning Democrat, Not very strong Democrat, Democrat*]
- How old are you? [*Numerical response*]
- Which of the following best describes your current employment situation? [*Employed, working 40 or more hours per week; Employed, working 1-39 hours per week; Not employed, looking for work; Retired; Disabled, not able to work*]
- What is your residential zip code? [*Numerical response*]
- Choose one or more races you consider yourself to be. [*White; Asian; Black of African American; Native Hawaiian or Pacific Islander; American Indian or Alaska Native; Other (with text box in which to specify)*]
- Are you Spanish, Hispanic, Latino, or none of these? [*Yes; None of these*]
- How frequently do you watch **STATE**'s public colleges' sports teams compete? This can includes both in-person and remote (radio, television) [*Never; Once a year; 2-5 times a year; 6-15 times a year; 16+ times a year*]
- Do you have any children who have attended (or are currently attending) a public college in **STATE**? [*Yes; No*]
- How likely is it that one of your children will someday attend a public college in **STATE**? [*Very Unlikely; Unlikely; Likely; Very Likely; NA*]
- Previously, you indicated that you have attended at least some college. Have you attended or are you currently attending a public college in **STATE**? [*Yes, I am currently attending a public college in **STATE**, Yes, I have attended a public college in **STATE**; No. I have attended public college, but not in **STATE**; No, I have never attended a public college.*]

C.6 Additional Questions

- *Before we finish, we're interested in how you think about state spending on higher education. When you said that **STATE** should spend **ANSWER** per student annually on public higher education, what were the main considerations that came to your mind? [*Long text entry*]

- *What do you think the graduation rate and its rank relative to other states says about public higher education in **STATE**? [*Long text entry*]

C.7 Updating Questions

- *As a final exercise, please take a moment to review this table and see how close your guess regarding graduation rates in **STATE** was to the true value. Please also review your previous guess regarding how this rate ranks relative to other US states.

  Considering the information above, please again provide an estimate as to how much you believe **STATE** spent in tax dollars per student at public four-year colleges in 2019. As before, Use the slider below to indicate your guess in $1000s. [*Sliding scale from 0 to 25 (increments of 0.10)*]

- *Considering the information above, please again provide an estimate as to where you believe **STATE**'s spending on higher education ranks relative to other states. As before, please use the slider below to indicate your guess. NOTE: A rank of 1 means you believe **STATE** spends more per student on higher education than all other states; a rank of 50 means you believe **STATE** spends less per student on higher education than any other state. [*Sliding scale from 1 to 50 (increments of 1)*]

- *Considering the information above, please again provide an estimate as to what percent of students who enroll in public four-year colleges in **STATE** graduate within six years of enrollment. Use the slider below to indicate your guess. [*Sliding scale from 0 to 100 (increments of 1)*]

- *Considering the information above, please again provide an estimate as to where **STATE**'s graduation rate ranks relative to other states? Use the slider below to indicate your guess. NOTE: A rank of 1 means you believe **STATE** has the country's highest graduation rate; a rank of 50 means you believe **STATE** has the country's lowest graduation rate. [*Sliding scale from 1 to 50 (increments of 1)*]

D. Treatments for Experiment 3

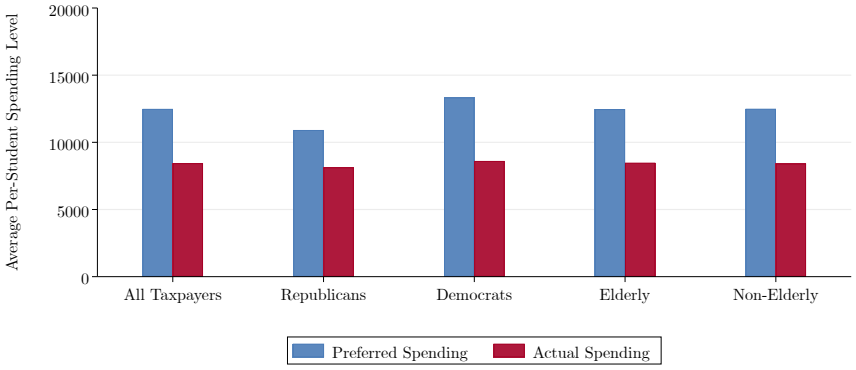
In experiment 3, a set of state politicians, including governors as well as Democratic and Republican leaders of states' houses of representatives and senates, were randomized to receive emails. All of these emails included an invitation to review a draft resolution preventing further reductions in state higher education appropriations. The randomized difference was whether these messages included or did not include information about information regarding preferences for higher education spending gathered from our survey experiments. The emails were sent from one of the authors' official university account. For illustration, here are the control and treatment emails for politicians in Montana.

D.1 *Constituent Demand* Treatment

Dear **OFFICIAL**,

My name is **RESEARCHER**, and I am an economist at the **UNIVERSITY**. My collaborators and I study support for higher education at state colleges and universities.

We recently surveyed taxpayers in all fifty states and found that, on average, they would prefer their states to spend more per student on four-year colleges than they currently do. The figure below summarizes our findings, revealing that across partisan and generational lines, taxpayers would prefer 30-60% more spending on public higher education.



In addition to these findings from our nation-wide survey, a number of responding taxpayers in Montana specifically asked us to share their support for public higher education with you.

- Public higher education in Montana is important and should be supported by Montana's government. By providing support to higher education, the state of Montana will grow as more people become college graduates. (Republican, Age 54)
- Investing in our young people will benefit the state more then not investing in them. (Democrat, Age 74)

A full list of comments directed to you can be found here: **LINK**

Despite this taxpayer preference for higher spending, over the last few years many states have drastically cut spending on public higher education. In light of this and our survey

results, we invite you to propose a resolution preventing further reductions of higher education appropriations in Montana. A draft resolution for Montana, including information on historical appropriations, can be found here: **LINK**

Finally, we would appreciate the opportunity to talk more about higher education in Montana. If you would like to meet, please send us a few times when you are available. If you have any other questions, comments, or further considerations, we would also love to hear from you.

Sincerely, **RESEARCHERS AND AFFILIATIONS**

D.2 *Contact Only* Treatment

Dear **OFFICIAL**,

My name is **RESEARCHER**, and I am an economist at the **UNIVERSITY**. My collaborators and I study support for higher education at state colleges and universities.

Over the last few years many states have drastically cut spending on public higher education. In light of this and our survey results, we invite you to propose a resolution preventing further reductions of higher education appropriations in Montana. A draft resolution for Montana, including information on historical appropriations, can be found here: **LINK**

Finally, we would appreciate the opportunity to talk more about higher education in Montana. If you would like to meet, please send us a few times when you are available. If you have any other questions, comments, or further considerations, we would also love to hear from you.

Sincerely, **RESEARCHERS AND AFFILIATIONS**

E. Additional Tables and Figures

F. Demand for Public Higher Education Expenditure on the Margin

We combine all of our questions that elicit demand on the margin, including charitable donations to public colleges and beliefs about the value of additional spending for students and the state, into an index, following Anderson (2008). This approach allows us to focus on a single outcome while accounting for correlations across questions, thereby maximizing the amount of information captured in the index. We estimate the treatment effects on the index using Equation 3 and present the results in Figure B2.

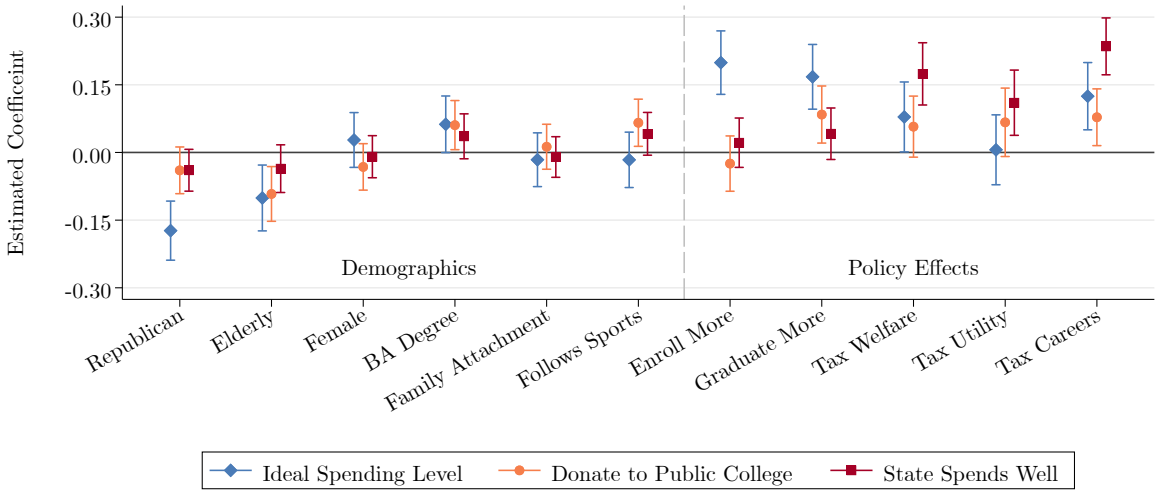
The index contains eight questions that elicit demand for expenditure on the margin. We include beliefs about how much an additional $100 of state spending per student would affect (1) the number of students who enroll and (2) the graduation rate;[44] and whether participants agree that an additional $1 in tax expenditure on higher education per taxpayer would benefit (3) the average person in the state, (4) the participant personally, or (5) the careers of new graduates.[45]. We also include (6) whether participants trust that the state uses taxpayer dollars well, (7) whether the participant donated to a public college, and (8) the amount donated.[46]

[44]These items capture how marginal changes in spending affect the amount of public goods produced

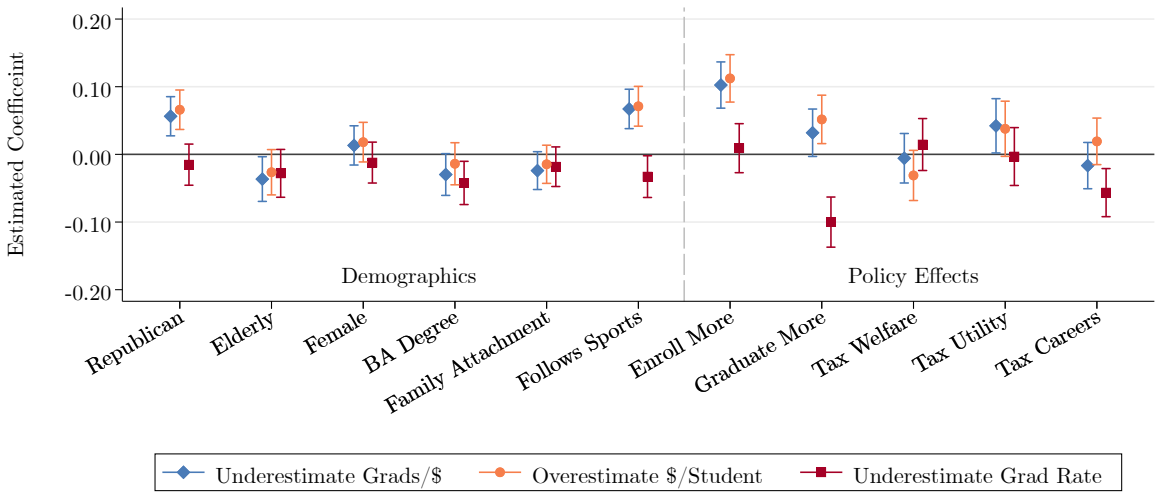
[45]These items explicitly ask about the effects of marginal changes in spending

[46]Items 3-6 were measured with a five-point Likert scale. Following our preanalysis plan, we first convert

Figure B1: Effects of Characteristics and Policy Beliefs on Demand



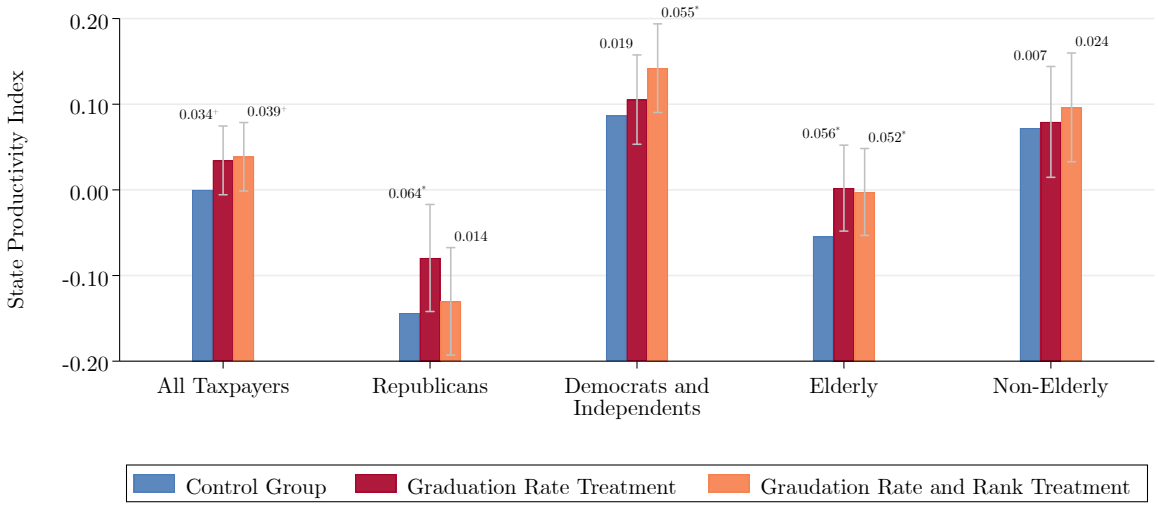
(a) Ideal Policies



(b) Return on Investments in Higher Education

Note: This figure shows the relationships between observable characteristics and individuals' ideal policies and perceptions. To make all predictors binary we split each policy belief by above and below average. The three series in Panel (a) are measures of support for public higher education. The markers with blue diamonds are estimates from a Poisson regression of the ideal spending level, those with orange circles are estimates from a linear regression on an indicator that the individual made a donation to a public college in their state, and those with red squares are estimates from a linear regression on an indicator that the individual agrees or strongly agrees that they trust the state to spend tax revenue well on public higher education. Panel (a) uses only the control group who do not receive any information. The three series in Panel (b) are measures of perceived productivity. The markers with blue diamonds are estimates for indicator variables for underestimating the graduation rate in their state, the markers with orange circles for overestimating the per-student spending on public higher education in their state, and the markers with red squares for underestimating the number of graduates per $10,000 spent on public higher education in their state. Both panels reflect responses from the Qualtrics and CloudResearch samples for the first experiment.

Figure B2: Demand for Public Higher Education Expenditure on the Margin



(a) Marginal Spending Increase Index

Note: This figure presents the covariance-weighted index of survey outcomes stated in the text by treatment group and characteristics along with 95% confidence intervals on the effects of the two treatments. The sample is the 4,679 participants who completed surveys through Qualtrics and CloudResearch for the first experiment. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}p < 0.1$

Overall, we find that our treatments weakly increase demand for public expenditure on the margin. Republicans who receive information on the graduation rate demand more expenditure, but receiving rank information diminishes the effect. We also find that elderly individuals in both treatments increase their demand on the margin. This pattern of results is similar to our results on ideal spending levels. Based on some of the participants' comments we received as part of the survey, we believe some of the results are noisy because some participants misinterpreted marginal changes from questions (1)-(5) to be effectively no change.

We also find that unlike our previous results on ideal spending levels, Democrats and Independents who receive graduation rank information demand more spending on the margin ($p = 0.038$). This further suggests that participants interpret a change in the rank as a movement along the marginal cost and benefit curves rather than as a shift.

the scale into an indicator that equals 1 if the participant agrees or strongly agrees.