Local Political Partisanship and Industrial GHG Reductions

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Abstract

Progress fighting climate change has been hindered by a lack of consistent government policy over time, which is exacerbated by growing political polarization. We explore whether local political polarization has affected progress in reducing greenhouse gas (GHG) emissions at industrial facilities in the United States over 2010 – 2021, using US GHG Reporting Program and Toxic Release Inventory data, US county-level election returns, and state-level carbon and energy prices and policies. We find a gradual downward trend in emissions and an upward trend in the effect of local partisanship over this period, although the latter is not significantly different from the baseline until 2017. This partisanship effect accelerates over time and by 2019, the net effect of these two trends results in facilities located in more Republican areas emitting more than those in less Republican areas, after controlling for other factors. While price effects dominate non-price effects overall, non-trivial local partisanship effects cannot be readily explained by standard models of competitive strategy or economic rationality. Our results are consistent with emerging literature suggesting that CEO political attitudes and local "logics" have significant effects on corporate environmental performance. Growth of the partisanship effect since 2016 suggests that political parties adopting positions of climate denialism has real impacts on facility performance that extend beyond blocking federal carbon price policies.

Keywords: Greenhouse gas emissions; Political Polarization; Corporate Structure, Environmental Strategy, Community Norms

INTRODUCTION

There is increasing concern among scholars and practitioners that climate change threatens social and economic systems and that emissions from industrial sources play a significant role in the build-up of Greenhouse Gases (GHGs) that drives these changes. A number of factors might drive changes in emissions, from city climate action plans (Watts, 2017) to state Renewable Portfolio Standards (Lyon and Yin, 2010) to pressure from environmental groups (Drake and York, 2021) and pressure from investors (Reid and Toffel, 2010). The greatest potential reductions, however, would be expected from federal climate policy, which can put a price or a cap on carbon that drives decarbonization in a cost-effective manner and gradually tightens over time, thereby giving companies time to adjust their capital stocks (Murray and Maniloff, 2015; Shapiro and Walker, 2018).

Scholars (Nordhaus, 2019) and practitioners (McKinsey, 2023) have argued that a crucial part of effective and efficient climate policy is clarity and consistency over time and space, which allows businesses to plan future investments and focus on the most cost-effective opportunities across the organization. In contrast, uncertainty about future policy creates risks for business, and undermines incentives for investment (Fabrizio, 2013). Political polarization exacerbates uncertainty, because it creates the potential for wide swings in policy over time, including the reversal of prior policies, which may undercut the value of decarbonization investments.

The evidence on when partisanship and polarization have real economic effects is conflicting. Partisanship affects the stated economic expectations of individuals, and those expectations have a significant effect on subsequent state-level economic growth (Benhabib and Spiegel, 2019). However, individual economic expectations have no impact on actual household expenditures (Mian, Sufi and Khoushkhou, 2023). Partisanship does appear to affect real transactions in housing markets, with Republicans more willing to purchase homes in areas subject to climate risk (Baldauf et al., 2020). The partisan views of chief executives also affect the corporate social responsibility (CSR) efforts of their firms, with more liberal CEOs performing better (Chin, Hambrick, and Treviño 2013), as do aggregate political views of company employees as measured by their political contributions (Gupta, Briscoe and Hambrick, 2017).

We examine whether political partisanship and polarization at the local level has affected progress in reducing greenhouse gas (GHG) emissions at industrial facilities in the United States. This question is related to the foregoing lines of research but differs in that we study the effects of community-level attitudes rather than the attitudes of individual consumers or company employees, and we study facility-level GHG decisions, which are much more closely tied to business operations than are the CSR decisions studied in prior papers on corporate political ideology (Chin, Hambrick, and Treviño 2013; Gupta, Briscoe and Hambrick, 2017).

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

There is an enormous literature on the factors that drive facilities to reduce their emissions of toxic chemicals. That work has found that those factors include mandatory information disclosure (Hamilton, 1995; Konar and Cohen, 1997), government voluntary programs (Gamper-Rabindran, 2006; Khanna and Damon, 1999), anticipated future liabilities and local community pressures (Khanna and Anton, 2002). There is considerable heterogeneity in how firms respond to these pressures, with larger firms and privately-held firms more responsive to pressures from mandatory disclosure (Doshi, Dowell and Toffel, 2013). Moreover, acquisitions of dirty facilities by cleaner firms can lead those facilities to cut their emissions (Berchicci, Dowell and King, 2017).

In contrast, there is surprisingly little work on the factors that drive reductions of GHG emissions, and most of that focuses solely on the electric utility industry (Delmas and Montes-Sancho, 2010; Kim and Lyon, 2015). However, some recent work examining multiple industries suggests that local community beliefs about climate change are associated with GHG reductions (Dowell and Lyon, 2023), that state policies have more of an impact in driving facility-level reductions than corporate or city policies (Leffel et al., 2023), and that introduction of a carbon price in California led to an increase in toxic emissions from waste treatment plants (Lee and Kaul, 2023).

There are good reasons to question whether the received wisdom from studies of toxic chemical emissions can be applied directly to GHG emissions. Toxic emissions create health risks for local communities, which have incentives to take action to force companies to mitigate those harms. GHG emissions, in contrast, create global risks that emerge over long time horizons and create no direct local risks, so local communities have much weaker incentives to pressure companies to change their polluting behavior. Thus, in the remainder of this section we present a simple theoretical framework that lays out our expectations regarding facility-level GHG emissions reductions.

One of the most important factors driving firms' environmental performance over time is a regulatory mandate to reduce emissions (Murray and Maniloff, 2015; Shapiro and Walker, 2018). With regard to GHG emissions, the most widely touted regulatory mandate is a price on carbon, either directly (as in the case of a carbon tax) or indirectly (as in the case of a cap and trade system). The United States still does not have a price on carbon at the federal level. However, a number of states have implemented carbon prices, including California and the states that are members of the

Regional Greenhouse Gas Initiative (RGGI). We would expect facilities in these states to have lower emissions, *ceteris paribus*.

In addition to price, a variety of other types of policies, such as renewable portfolio standards (Lyon and Yin, 2010), building codes, city climate plans or state financial incentives may also drive reductions (Leffel et al., forthcoming). Thus, we expect facilities in states with more climate-related policies to have lower emissions.

Moving beyond current climate policies, corporate expectations of *future* regulations can drive emissions reductions in anticipation of them (Harrison and Antweiler, 2003; Maxwell, et al., 2000). However, uncertainty about future regulations tends to reduce incentives for anticipatory investment (Fabrizio, 2013; Gulen and Ion, 2016; Kingsley et al., 2012). Once we recognize the importance of anticipated policies, it is clear that corporate actions to respond to climate change may depend strongly on the beliefs, expectations and political affiliations of particular market participants. For example, markets affected by climate risk, including real estate and stocks, respond in ways that are moderated by the partisan political positions of investors (Baldauf et al., 2020). Moreover, when market expectations of future regulation increase, investors reward firms that have already taken anticipatory steps to prepare for such regulation (Kim and Lyon, 2011).

Prior research shows that firms, for a variety of reasons, demonstrate considerable heterogeneity in their willingness to engage with sustainability issues (Eesley and Lenox 2006; Hillman, Bloom, and David 2007; Bundy, Shropshire, and Buchholtz 2013). One key factor appears to be the degree to which managers identify with and are sympathetic to the issue under consideration (Bundy et al. 2013; Gupta, Briscoe, and Hambrick, 2017). For example, CEOs with more liberal political leanings have been shown to do better on corporate social responsibility (CSR) measures, as more liberal executives appear more likely to value CSR initiatives (Chin, Hambrick, and Treviño 2013; Gupta, Briscoe and Hambrick, 2017). It appears, therefore, that firms' managers influence the degree to which a given issue is seen as salient and worthy of engagement (Durand, Hawn, and Ioannou 2019).

Managers' willingness to engage in unmandated socially-responsible behaviors such as GHG reductions, in turn, depends in part on their underlying beliefs and priorities (Delmas & Toffel 2004; Kassinis and Vafeas 2006). Managers in Democratic communities might hold higher expectations that climate policy is forthcoming, and make investments in anticipation of that (Dowell and Lyon, forthcoming; Howard-Grenville, Nash, and Coglianese 2008; Lee and Lounsbury, 2015). In contrast, facilities located in Republican communities are likely to face weaker local pressures to reduce GHG emissions, to have employees and managers with less concern about climate change, and to have higher expectations that Republicans will hold political control.

It is well documented that Democrats generally display greater support for passing environmental regulations than do Republicans (Fowler and Kettler, 2021; Lyon and Yin, 2010; Shipan and Lowry, 2001). There is also growing evidence that enforcement of environmental laws is influenced by partisan positions (Short, 2021). For example, Clean Air Act inspections drop significantly in the year following the replacement of a Democratic Representative by a Republican one (Innes and Mitra, 2015). State-level emissions of toxic chemicals are greater under Republican governors and when Republicans control Congress (Fowler and Kettler, 2021). In addition, states are less likely to join a federal EPA lawsuit against a polluter in their state if the defendant firm had made political contributions to Republican legislators, although making contributions to Democrats had no such effect (Gonzales and You, 2023).

In light of the foregoing framework, our primary research question is: Does local political partisanship influence GHG reductions at the facility level? If so, does this change over time, as climate change becomes a more prominent issue? If either or both of the above hold, what are the mechanisms? Do facilities in conservative areas divert managerial effort away from energy efficiency and other GHG reduction actions, perhaps because they hold different expectations about future regulations? Or do facilities in liberal areas experience tougher policies intended to compensate for federal inaction?

We expect that emissions intensity (emissions per unit of output) has declined over the sample period, with a faster decline in regions that have climate regulations in place and a slower decline in Republican regions rather than Democratic ones.

DATA AND METHODS

Dependent Variable

Our dependent variable is the level of GHG emissions emitted by a facility in a given year. These emissions are reported as the metric tons of CO2-equivalent (CO2e) emissions that the facility released through its operations over the course of the year. We use the natural log of the emissions as the dependent variable in order to reduce the skewness of the data. We also winsorize the variable at the 1% level in order to reduce the influence of outliers. The data are from the EPA's Greenhouse Gas Reporting Project (GHGRP), from its initial year of 2010 through 2021.

The GHGRP covers what are known as "Scope 1" emissions, which are those directly created by a given facility, most frequently from burning of fossil fuels to power operations. It does not cover "Scope 2" emissions from purchased electricity or "Scope 3" emissions indirectly created from activities like employee travel or customer actions. Scope 1 emissions from industrial activities are, however, a significant source of greenhouse gases, both in the United States and globally (US EPA 2017b).

Independent Variables

Our key independent variable is the Republican share of votes in the facility's local community in the most recent Congressional election. Ideally, we would map facilities to election precincts, and use precinct-cycle data. This is challenging, however, since precinct boundaries are not well documented and change over time. Moreover, ZIP codes and counties do not map perfectly onto Congressional districts. Thus, what we do is to construct ZIP code-level political variables based on the business address weighted average of congressional district variables in that ZIP code. For example, in the year 2012, for ZIP code 21409, 80.9% of business addresses lie within Maryland's 3rd Congressional district and 19.1% lie within Maryland's 4th Congressional district. We code all businesses in ZIP 21409 as having that same mix of Republican vote share from the two districts. (As a robustness check, we also use data on the League of Conservation Voters rating of each Congressional representative, and weight them in the same manner.)

We also include a number of other important independent variables. We include carbon prices for states that have imposed them. For facilities in California, we use a yearly quantity-weighted average of current auction settlement prices; for RGGI, we use a yearly quantity-weighted average of allowance clearing prices. We are careful to distinguish plants that are subject to carbon pricing within California and RGGI from plants that are not regulated due to their size or some other special attribute.

We include state-level natural gas prices from the Energy Information Administration, measured annually, and a count of state-level energy policies compiled from the DSIRE database and updated annually.

To capture facility size, we make use of the variable "Production Ratio" from the EPA's Toxic Release Inventory (TRI). This variable expresses this year's production level relative to the previous year's production ratio, using whatever physical units are most relevant for the particular facility. This allows for a much more accurate measure of productive activity than a variable such as sales revenue, which combines price with output and hence is less directly related to pollution output.

Our full sample comprises comprises 21,500 observations of 2,543 facilities representing major industrial sectors including primary manufacturing, utilities, secondary manufacturing, and food and textiles. Our sample is substantially smaller than the entire universe of GHGRP-reporting facilities because we merge the GHGRP with the Toxics Release Inventory (TRI) data in order to make use of the TRI facility-level production ratio variable.

Table 1 presents descriptive statistics and Table 2 presents correlations between variables. The average facility emits 12.206 ln metric tons (emissions of CO2-e), which translates to 199,985 metric tons of CO2 equivalent emissions in a year. For the sake of perspective, an internal combustion passenger car emits 4.6 metric tons per year, so these facilities, on average, emit as much carbon as 40,000 passenger automobiles each year.

Insert Table 1 about here

Insert Table 2 about here

Estimation Methods

Our estimation approach employs linear regressions with facility-level fixed effects to control for any time-invariant factors at a facility (e.g., industry or non-varying state-level factors).

We also include year dummies to account for overall emission trends. Our baseline estimating equation is

$$\ln(facemissions_{it}) = \beta_t^1 + \beta^2 PriceNG_{it} + \beta^3 PCarbonPlant_{it} + \beta^3 PCarbonPlantExempt_{it} + \beta^5 StatePolicies_{it} + \beta^6 ProdRatio_{it} + \tau_i + \varepsilon_{it}$$

where β_t^1 captures year effects, $PriceNG_{it}$ is the price of natural gas for facility i and year t, $PCarbonPlant_{it}$ is the price of carbon for facility i and year t for plants that are subject to carbon price regulation, $PCarbonPlantExempt_{it}$ is the price of carbon in the state to which facility i belongs and in year t for plants that are exempt from carbon price regulation, $StatePolicies_{it}$ is a count of the number of state policies on carbon emissions in the state where facility i is located and in year t, $ProdRatio_{it}$ is the ratio of physical production at facility i in year t relative to year $t-1$, τ_i captures facility fixed effects and ε_{it} is an error term. (Note that $PCarbonPlantExempt_{it}$ is included because carbon prices should not matter to exempt facilities and we want to test the reasonableness of our carbon price estimates.)

We then supplement the basic estimating equation with the political variable GOP_{it}, which captures the voting share of the Republican candidate in the district of facility i in year t. Crucially, we allow the coefficient on GOP_{it} to change yearly in order to avoid imposing any *a priori* restrictions on the temporal importance of political partisanship. (As a robustness check, we also use the League of Conservation Voters ratings of Congressional representatives.) Thus, our political specification is:

$$\ln(facemissions_{it}) = \beta_t^1 + \beta^2 PriceNG_{it} + \beta^3 PCarbonPlant_{it} + \beta^4 StatePolicies_{it} + \beta^6 ProdRatio_{it} + \beta_t^7 GOP_{it} + \tau_i + \varepsilon_{it}$$

(Note that we do not include $PCarbonPlantExempt_{it}$ in this estimation because, as we will see below, it has no significant effect.)

PRELIMINARY RESULTS

Our baseline regression results are presented in Column 1 of Table 3. Overall, these baseline findings provide strong reassurance that our estimations are capturing economically rational outcomes. We note first that Production Ratio is positive and highly significant, as we would expect. We also note that the year dummies are negative and significant and increase in magnitude over time, although the effect is not strictly monotonic. (Most notably, there is a large reduction in 2020, presumably due to COVID restrictions.) In addition, the count of state climate policies has a negative and significant effect, as expected.

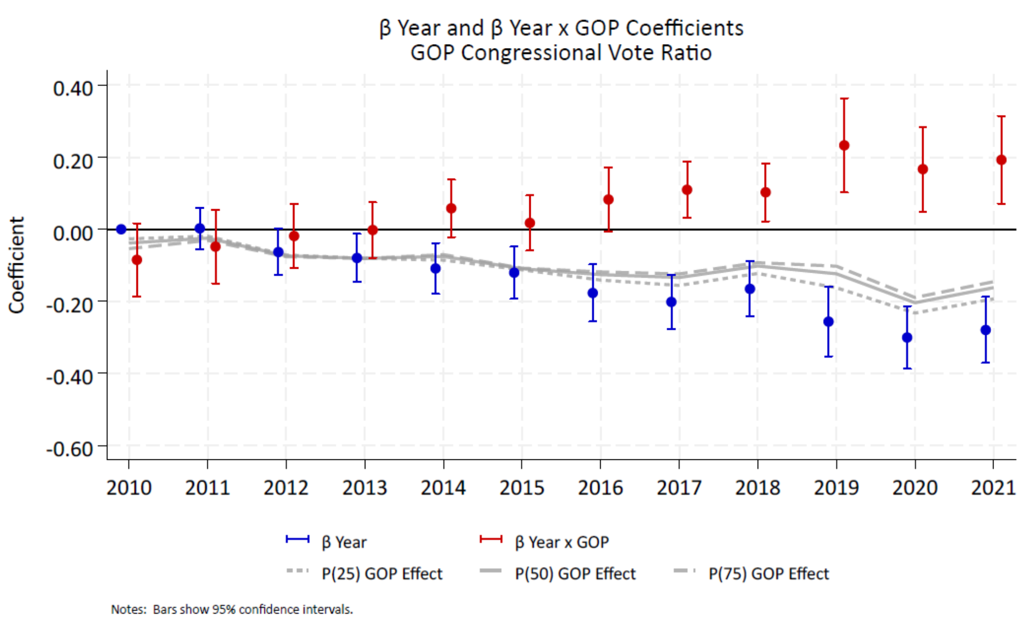
Insert Table 3 about here

Turning to the effects of prices, we find that natural gas prices have a positive but statistically insignificant effect, which is somewhat surprising since we would expect higher energy costs to motivate efforts at energy efficiency. However, carbon prices have a negative and significant effect, as expected. Moreover, carbon prices have no significant effect for plants that are exempt from them, as we would expect, lending greater confidence to our estimates. We compute the short-run elasticity of emissions with respect to carbon price, finding that at the mean the elasticity is -0.103. Thus emissions are relatively inelastic in the short run.

We turn now to our main results incorporating political variables, which are presented in Column 2 of Table 3. (We drop the variable for carbon prices on exempt plants, as it is not significant in the baseline results.) For the most part, the results from the baseline specification remain unchanged, except that natural gas prices are now positive and significant. One possible explanation could be that some facilities have the ability to substitute away from relatively clean natural gas to dirtier fuel oil or coal when natural gas prices rise.

With regard to time trends and partisanship, we find a gradual downward trend in emissions and an upward trend in the effect of local partisanship over our sample period. These results are presented in Figure 1. The partisanship effect accelerates over time and by 2020 the net effect of these two trends results in facilities located in more Republican areas emitting significantly more than those in less Republican areas, after controlling for other factors. While state policies, energy prices, and carbon prices affect emissions, these factors alone do not account for these changes. Moreover, these are results for the balanced panel of facilities that are present for all years, so the change does not reflect dirtier facilities moving to Republican-dominated states.

Figure 1: Temporal Effects and Political Effects for the Full Sample



FURTHER ANALYSES

Our results are intriguing and raise interesting questions about the mechanisms at play. The first thing we check is whether our results are robust to substituting League of Conservation Voters ratings of Congressional representatives for GOP ratio. Those results are presented in Column 3 of Table 3. We see that the results are very similar to those obtained using GOP ratio, which is reasonable since environmental issues are among the mostly hotly polarized issues in American politics, unlike the 1970s and 1980s when the American electorate largely agreed on the importance of environmental protection.

It is important to note that Figure 1 shows a growing divergence between Republican and Democratic districts but does not distinguish whether this is because facilities in Republican districts are reducing their decarbonization efforts or facilities in Democratic districts are increasing their decarbonization efforts. For example, one might argue that perhaps Democratic states increased their carbon prices or policy stringency over time, and this explains the growing divergence rather than a reduction of effort in Republican communities. However, we have already controlled for state policies and the level of carbon prices, so these cannot explain the growing divergence. One might also argue that perhaps cities in Democratic states implemented climate plans that were not captured in our state policy variables. Leffel, Lyon and Newell (forthcoming) test the effect of city climate plans on facility GHG reductions using CDP data and find no significant effect. Nevertheless, we could include this variable in future work just to check its impact.

In addition to the foregoing considerations, it is possible that there are important differences across the key industries represented in the sample: power plants, chemicals, minerals, metals, and waste. Separate industry-level regressions are presented in Table 4 and the associated time trends are presented graphically in Figures 2-6. Because sample sizes are greatly reduced, the statistical significance of these results is substantially weaker than in our full sample. Nevertheless, we obtain some interesting results. For all regressions, Production Ratio remains positive and highly significant.

Insert Table 4 about here

Figure 2 presents the temporal results for the 541 power plants in our sample. The annual rate of reductions in GHG emissions is highly significant. Regression results show neither natural gas prices nor carbon prices had a significant effect, which is surprising given the energy-intensive and carbon-intensive nature of this industry. The temporal partisanship effects are similar to those for the entire sample, but have wider error bands.

Figure 2: Temporal Effects for Power Plants

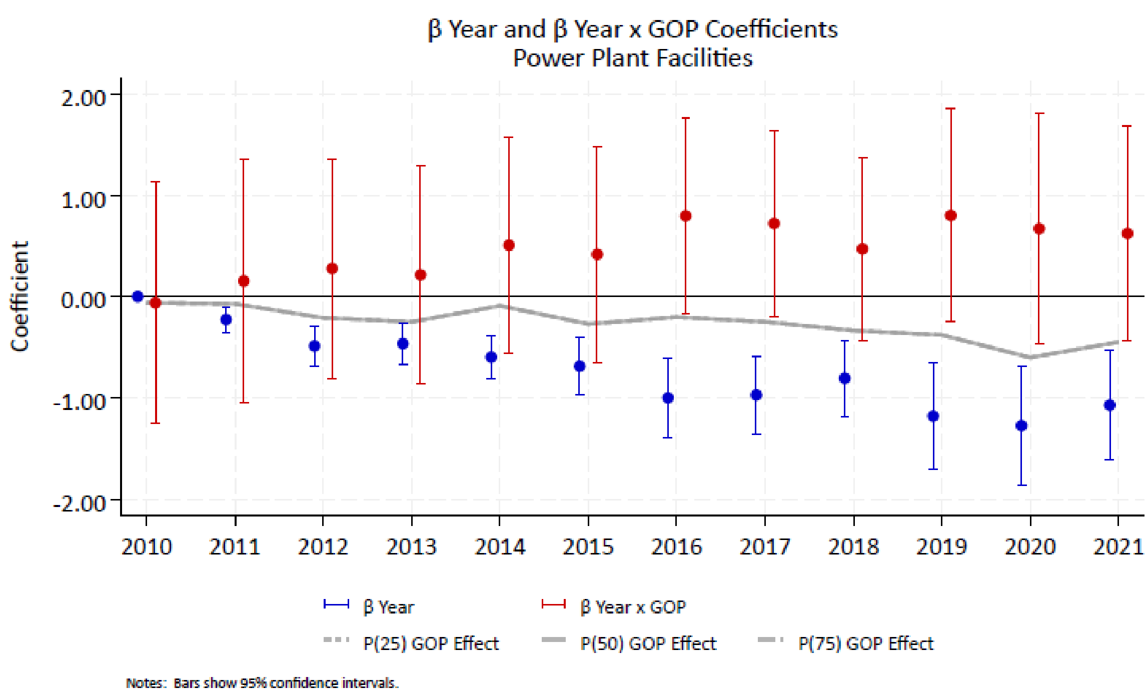


Figure 3 presents the results for the 388 chemical plants in our sample. Interestingly, these plants show very little change in emissions over time overall, and very little evidence of increased partisan effects over time. This may be because chemical plants had already undertaken most of the available options for decarbonization as early as 2010. Moreover, they show no effect of changes in the production ratio, suggesting that their emissions are associated with large overhead consumption of energy.

Figure 3: Temporal Effects for Chemical Facilities

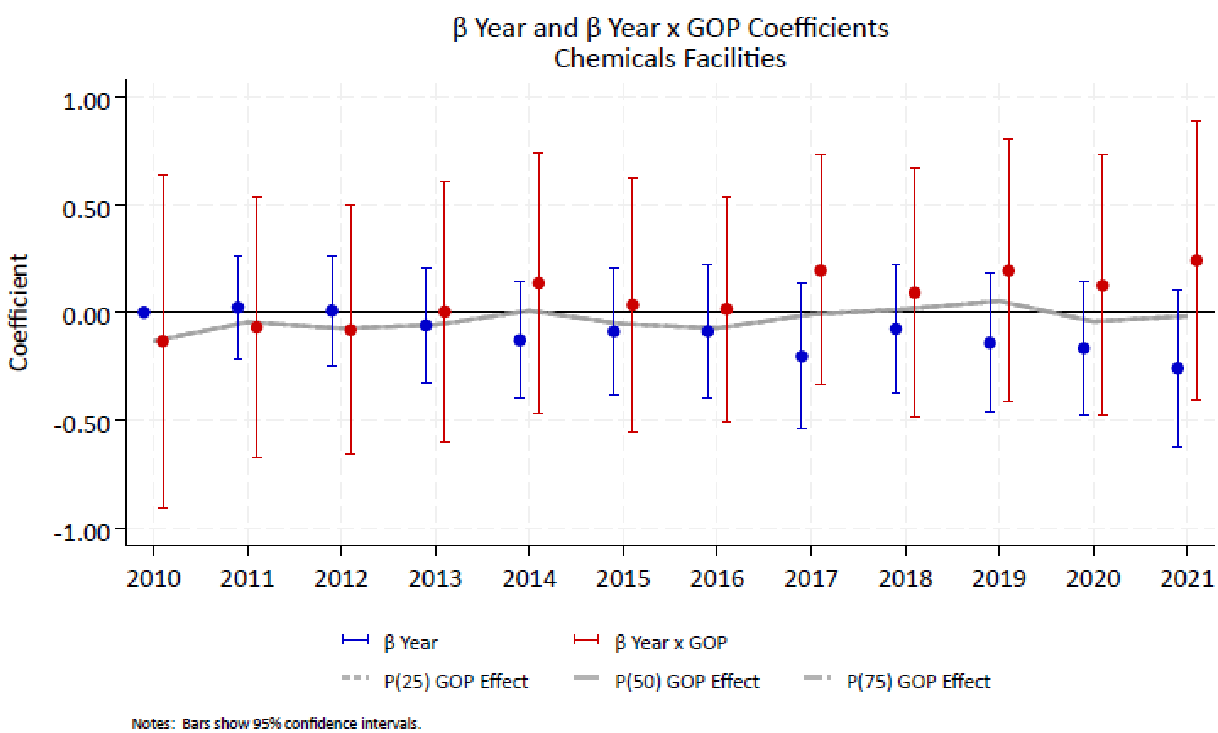


Figure 4 presents the results for the 317 minerals facilities in our sample. Interestingly, the carbon price variable was dropped for this regression since there are no minerals plants in states with carbon prices. These plants show very little change in emissions over time overall, and if anything a reversed effect of partisanship on emissions, though it is far from significant.

Figure 4: Temporal Effects for Minerals

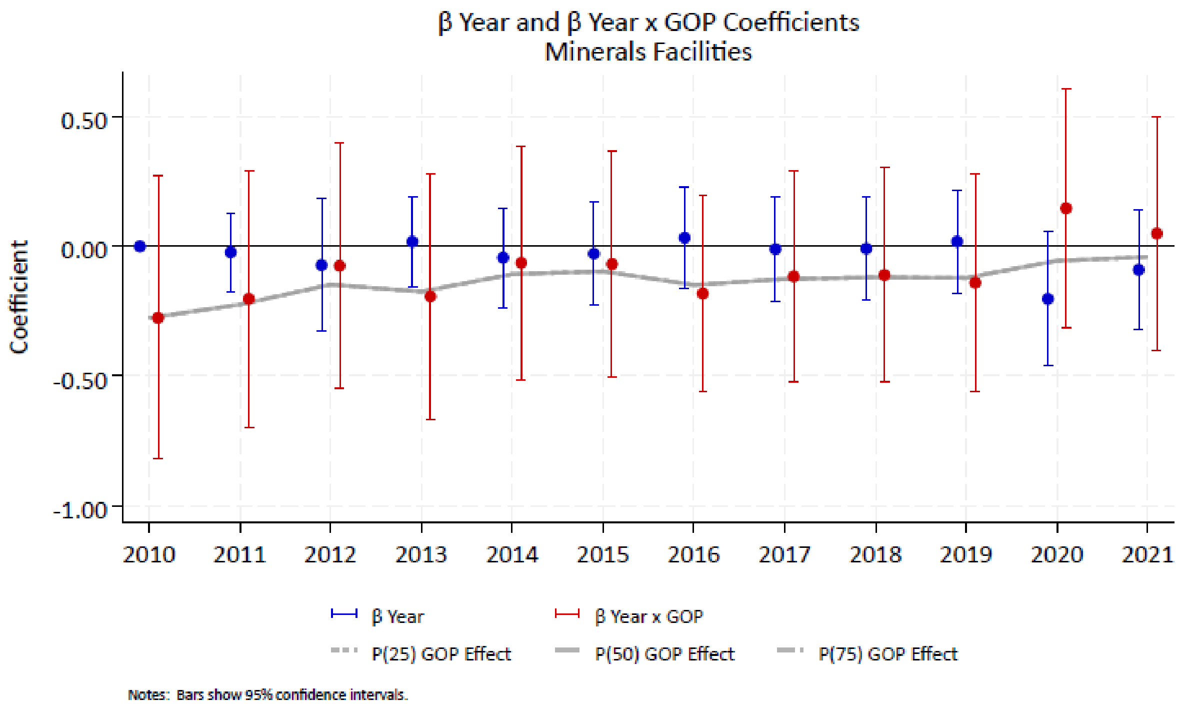


Figure 5 presents the results for the 294 metals facilities in our sample. Once again, the carbon price variable was dropped for this regression since there are no metals plants in states with carbon prices. These plants show a small decrease in emissions over time overall, and again, if anything a reversed effect of partisanship on emissions, though it is not significant.

Figure 5: Temporal Effects for Metals

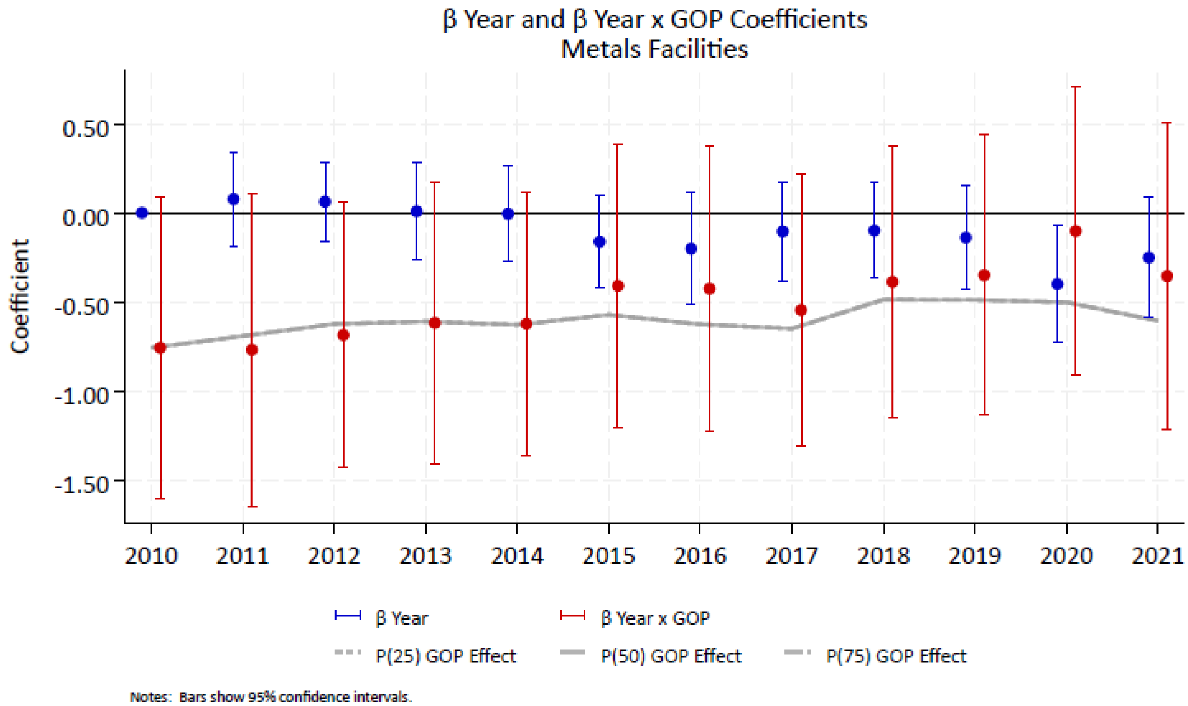
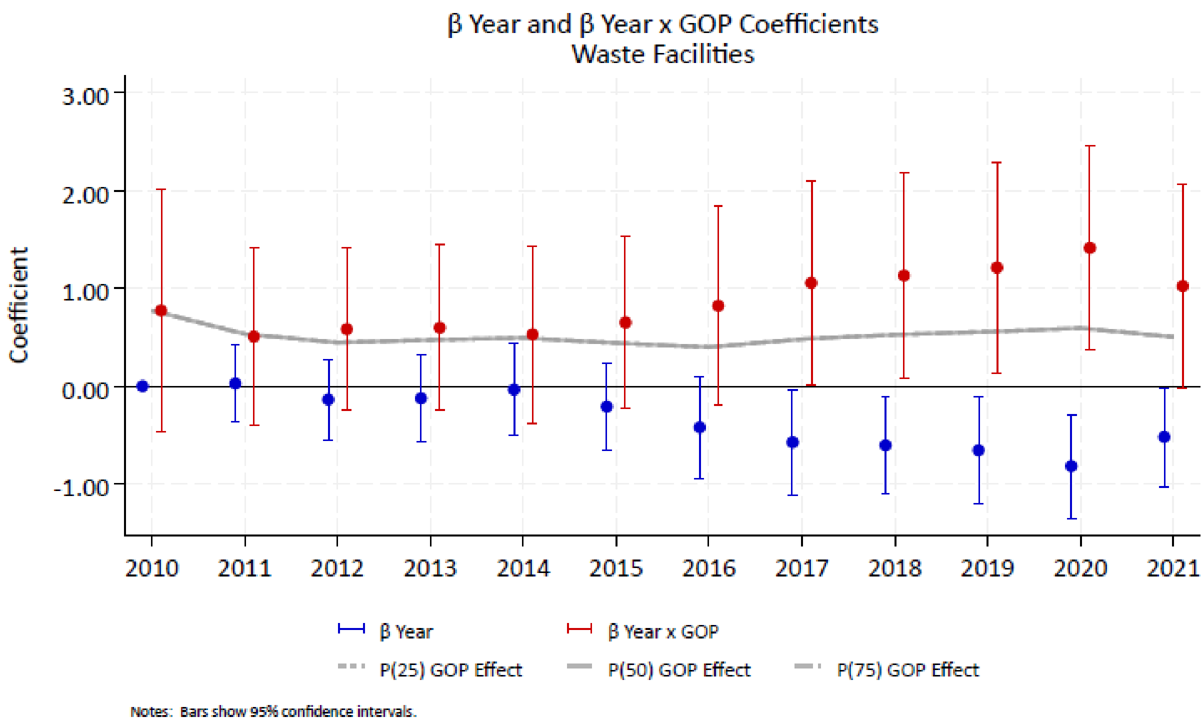


Figure 6 presents the results for the 296 waste facilities in our sample. Waste facilities appear to be more sensitive to prices than the other industries we study. Natural gas prices have a negative and significant effect on emissions, and carbon prices have a large and highly significant negative effect on emissions. These effects suggest that waste facilities may have more opportunities for emissions reductions than the other industries. These plants show a significant decrease in emissions over time, beginning in 2017, and an increasing and significant effect of partisanship on emissions.

Figure 6: Temporal Effects for Waste Facilities



Overall, all five industries display similar trends but chemicals, minerals and metals have effects that are far from significant. It appears that our aggregate results are driven most strongly by effects in the electric utility and the waste industries, suggesting that these industries employ technologies for which short-term efficiency improvements may beare more readily available than other industries.

CONCLUSIONS

We have analyzed the drivers of GHG emission reductions from industrial facilities in the United States over the period 2010-2021. We found that standard economic factors, such as changes in production, state climate policies, carbon prices, and natural gas prices have significant effects on emissions, and that there is a general trend towards greater GHG emissions efficiency over time. These results are all consistent with standard notions of competitive strategy and innovation. However, we also find that political partisanship in local communities has a significant effect on emissions reductions, something that would not be suggested by standard competitive analysis. Moreover, this effect has become increasingly important over time, especially since 2016.

These results must be interpreted with some care, since multiple mechanisms may be at work. For one thing, the Paris Agreement of 2015 marked a major shift in climate policy and motivated many cities, states and companies to adopt more aggressive plans for climate action. For another, the election of Donald Trump in 2016, who has been a vocal climate denier, helped to legitimate the denial of science that was consistent with the financial interests of many manufacturing firms that would prefer not to pay for the carbon externalities they impose. The combination of these two effects surely helped to drive a wedge between firms that were forward-looking and backward-looking with regard to climate action. One way to interpret our results is that managers' expectations about future climate policy were strongly influenced by their partisan interpretation of the election results, with Democratic-leaning firms factoring in an expectation of stronger climate policy and Republican-leaning firms expecting that the forces of climate denialism would hold sway for the foreseeable future.

Although the foregoing interpretation is reasonable, it is rooted in a firm-level perspective while our results are rooted in local community political attitudes. To apply it to our results requires that local managers must have the discretion to indulge their own personal beliefs about the future of climate policy rather than taking direction from headquarters. This is plausible, since prior research suggests that climate attitudes at both the headquarters level and the facility level have significant effects on GHG emissions reductions (Dowell and Lyon, forthcoming). From the perspective of the firm as a whole, however, this hardly seems rational or likely to maximize shareholder value. However, it is possible that local facility managers are incorporating relevant local information about the likelihood of future local and or state-level policy measures, so that delegating some degree of discretion to them is rational.

Our results shed new light on the relative importance of mandatory and voluntary GHG reductions, finding that while price effects dominate non-price effects, non-trivial local partisanship effects cannot be readily explained by standard models of economic rationality. These results are consistent with an emerging literature suggesting that CEO political attitudes and local "logics" have significant effects on corporate and voluntary environmental performance, respectively. Growth of the partisanship effect since 2016 suggests that political parties adopting positions of climate denialism has real impacts on facility performance that extend beyond simply blocking federal carbon price policies.

Of course, these results are both preliminary and incomplete. We find that facilities, on average, behave differently in locations with differing political environments. However, we are confident that this average effect obscures significant variation, and that strategic choices and managerial beliefs may moderate this response. Future work could usefully incorporate information about the political preferences of top management, partisanship in headquarters communities, and city-level climate policies that changed over the course of our sample. It may also be possible to incorporate information about corporate climate commitments made in the wake of the Paris Agreement. In future iterations of this paper, we plan to investigate these relationships, and hope to shed further light on the ways that firms do (and do not) respond to changed expectations in their institutional environments.

Table 1: Summary Statistics

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Ln Facility Emissions	12.01948	1.703329	8.532838	16.24552
Production Ratio	1.053448	.4656944	.01	9.741
Count of state policies	40.91497	18.64764	10	100
Price Natural Gas	6.03754	2.35466	2.04	30.89
Price of Carbon Plant	.1617872	1.251222	0	22.23563
GOP Ratio House	.5466148	.239241	0	1
LCV Ratio	.6670286	.3873641	0	1

Table 2: Correlation Coefficients

	Ln Facility Emissions	Production Ratio	Count of State Policies	Price Natural Gas	Price of Carbon Plant	GOP Ratio House	LCV Score
Ln Facility Emissions	1.0000						
Production Ratio	-0.0096	1.0000					
Count of State Policies	-0.0988	-0.0089	1.0000				
Price Natural Gas	-0.0443	0.0298	0.1962	1.0000			
Price of Carbon Plant	0.0293	-0.0062	0.2538	0.1188	1.0000		
GOP Ratio House	0.0024	-0.0074	-0.2041	-0.2294	-0.1462	1.0000	
LCV Score	0.0423	-0.0191	-0.3026	-0.2677	-0.1694	0.6430	1.0000

Table 3: Facility Fixed Effects GHG Emissions

	(1) Baseline	(2) House GOP Ratio	(3) House LCV Score
Year 2011	0.0162* (0.099)	0.0025 (0.932)	0.0078 (0.720)
Year 2012	-0.0415*** (0.001)	-0.0632* (0.054)	-0.0547* (0.051)
Year 2013	-0.0455*** (0.000)	-0.0796* (0.019)	-0.0418 (0.109)
Year 2014	-0.0381*** (0.007)	-0.1088*** (0.002)	-0.0653** (0.024)
Year 2015	-0.0824*** (0.000)	-0.1204*** (0.001)	-0.0998*** (0.001)
Year 2016	-0.1055*** (0.000)	-0.1770*** (0.000)	-0.1396*** (0.000)
Year 2017	-0.1117*** (0.000)	-0.2017*** (0.000)	-0.1657*** (0.000)
Year 2018	-0.0770*** (0.000)	-0.1655*** (0.000)	-0.1261*** (0.000)
Year 2019	-0.1085*** (0.000)	-0.2563*** (0.000)	-0.1730*** (0.000)
Year 2020	-0.1908*** (0.000)	-0.3004*** (0.000)	-0.2438*** (0.000)
Year 2021	-0.1379*** (0.000)	-0.2795*** (0.000)	-0.2102*** (0.000)
GOP Ratio House (LCV Score) 2010		-0.0849 (0.101)	-0.0362 (0.262)
GOP Ratio House (LCV Score) 2011		-0.0481 (0.355)	-0.0168 (0.586)
GOP Ratio House (LCV Score) 2012		-0.0188 (0.677)	0.0031 (0.919)
GOP Ratio House (LCV Score) 2013		-0.0022 (0.955)	-0.0252 (0.347)
GOP Ratio House (LCV Score) 2014		0.0581 (0.155)	0.0135 (0.653)
GOP Ratio House (LCV Score) 2015		0.0175 (0.652)	0.0138 (0.639)
GOP Ratio House (LCV Score) 2016		0.0826* (0.067)	0.0427 (0.161)
GOP Ratio House (LCV Score) 2017		0.1097*** (0.006)	0.0675** (0.016)
GOP Ratio House (LCV Score) 2018		0.1027** (0.012)	0.0564* (0.061)
GOP Ratio House (LCV Score) 2019		0.2329*** (0.000)	0.0941*** (0.008)
GOP Ratio House (LCV Score) 2020		0.1669*** (0.005)	0.0852** (0.024)
GOP Ratio House (LCV Score) 2021		0.1926*** (0.002)	0.0991*** (0.008)
Price of Natural Gas		0.0069 (0.195)	0.0064 (0.234)
Price of Carbon Plant	-0.0122** (0.048)	-0.0096 (0.129)	-0.0100* (0.098)

Price of Carbon Exempt Plant	0.0038 (0.131)		
Count of State Policies	-0.0067** (0.025)	-0.0069** (0.023)	-0.0061** (0.049)
Production Ratio	0.0662*** (0.000)	0.0719*** (0.000)	0.0722*** (0.000)
N	21,500	21,500	21,500
R-squared	0.9652	0.9656	0.9656
Within R-squared	0.0372	0.0417	0.0407

P-values in parentheses except for Variance Facility, Firm, and Residual levels, where standard errors are reported
***, **, * indicate significance at 1%, 5%, and 10% respectively
All models include facility fixed effects

Table 4: Industry Specific Facility Fixed Effect GHG Emissions

	Power Plants	Chemicals	Minerals	Metals	Waste
Year 2011	-0.2263*** (0.000)	0.0234 (0.847)	-0.0224 (0.772)	0.0769 (0.566)	0.0271 (0.893)
Year 2012	-0.4882*** (0.000)	0.0084 (0.949)	-0.0725 (0.578)	0.0624 (0.578)	-0.1379 (0.513)
Year 2013	-0.4651*** (0.000)	-0.0602 (0.662)	0.0185 (0.836)	0.0085 (0.951)	-0.1247 (0.577)
Year 2014	-0.5983*** (0.000)	-0.1290 (0.352)	-0.0437 (0.657)	-0.0054 (0.968)	-0.0362 (0.880)
Year 2015	-0.6884*** (0.000)	-0.0888 (0.559)	-0.0280 (0.781)	-0.1624 (0.222)	-0.2096 (0.356)
Year 2016	-1.0002*** (0.000)	-0.0883 (0.573)	0.0331 (0.743)	-0.2009 (0.211)	-0.4208 (0.116)
Year 2017	-0.9728*** (0.000)	-0.2047 (0.235)	-0.0103 (0.920)	-0.1047 (0.460)	-0.5737** (0.039)
Year 2018	-0.8072*** (0.000)	-0.0764 (0.620)	-0.0086 (0.933)	-0.0994 (0.468)	-0.6039** (0.016)
Year 2019	-1.1806*** (0.000)	-0.1414 (0.391)	0.0190 (0.853)	-0.1394 (0.349)	-0.6552** (0.018)
Year 2020	-1.2751*** (0.000)	-0.1662 (0.289)	-0.2026 (0.127)	-0.4007** (0.018)	-0.8183*** (0.003)
Year 2021	-1.0726*** (0.000)	-0.2592 (0.166)	-0.0903 (0.439)	-0.2515 (0.146)	-0.5191** (0.045)
GOP Ratio House 2010	-0.0618 (0.919)	-0.1337 (0.735)	-0.2758 (0.323)	-0.7586* (0.079)	0.7722 (0.220)
GOP Ratio House 2011	0.1540 (0.801)	-0.0688 (0.824)	-0.2023 (0.424)	-0.7699* (0.087)	0.5058 (0.272)
GOP Ratio House 2012	0.2777 (0.615)	-0.0822 (0.780)	-0.0750 (0.757)	-0.6870* (0.071)	0.5823 (0.170)
GOP Ratio House 2013	0.2152 (0.695)	0.0027 (0.993)	-0.1931 (0.425)	-0.6190 (0.128)	0.5971 (0.168)
GOP Ratio House 2014	0.5074 (0.349)	0.1363 (0.658)	-0.0636 (0.782)	-0.6240 (0.102)	0.5283 (0.253)
GOP Ratio House 2015	0.4169 (0.445)	0.0349 (0.908)	-0.0683 (0.759)	-0.4104 (0.314)	0.6493 (0.149)
GOP Ratio House 2016	0.7966 (0.108)	0.0157 (0.953)	-0.1818 (0.349)	-0.4260 (0.297)	0.8193 (0.116)
GOP Ratio House 2017	0.7225 (0.124)	0.1952 (0.474)	-0.1158 (0.580)	-0.5464 (0.163)	1.0537** (0.048)
GOP Ratio House 2018	0.4717 (0.308)	0.0916 (0.756)	-0.1105 (0.601)	-0.3884 (0.318)	1.1296** (0.036)
GOP Ratio House 2019	0.8007 (0.136)	0.1941 (0.532)	-0.1403 (0.511)	-0.3503 (0.384)	1.2104** (0.029)
GOP Ratio House 2020	0.6720 (0.250)	0.1244 (0.687)	0.1472 (0.532)	-0.1023 (0.805)	1.4107*** (0.008)
GOP Ratio House 2021	0.6233 (0.250)	0.2418 (0.464)	0.0499 (0.828)	-0.3555 (0.420)	1.0215* (0.056)
Price of Natural Gas state	-0.0112 (0.304)	0.0125 (0.357)	0.0001 (0.991)	0.0162 (0.327)	-0.0449** (0.045)
Price of Carbon Plant	-0.0062 (0.763)	0.0025 (0.493)			-0.1164*** (0.000)

Count of State Policies	-0.0063 (0.467)	-0.0088 (0.313)	0.0023 (0.624)	-0.0069 (0.307)	0.0030 (0.655)
Production Ratio	0.1332*** (0.000)	0.0004 (0.990)	0.0483* (0.096)	-0.0494** (0.036)	0.0445** (0.038)
N	6,492	4,656	3,804	3,528	3,552
R-squared	0.9443	0.9695	0.9768	0.9468	0.9607
Within R-squared	0.2255	0.0161	0.0284	0.0540	0.0676

P-values in parentheses except for Variance Facility, Firm, and Residual levels, where standard errors are reported
***, **, * indicate significance at 1%, 5%, and 10% respectively
All models include facility fixed effects

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