

# How to Get Coal Country to Vote for Climate Policy: The Effect of a ‘Just Transition Agreement’ on Spanish Election Results

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## Abstract

*Enacting stringent climate policy has proven politically challenging, not least because of concentrated losses in fossil fuel-producing communities. “Just transition” strategies have been proposed to mitigate this distributional challenge. Yet, little is known about how such strategies affect voting behavior. Using a mixed-method approach, we exploit a local climate policy in Spain—a “Just Transition Agreement” (JTA) to phase-out coalmining, support affected workers and invest in affected municipalities—which was negotiated by the incumbent Socialist Party (PSOE) government with affected unions and businesses shortly before a national election. A difference-in-differences study shows that PSOE’s vote share in coalmining municipalities increased at the 2019 election relative to similar municipalities, implying that the JTA was electorally successful. Further statistical tests and elite interviews suggest that this electoral boost was driven by unions’ support of the JTA. Our findings have implications for how parties can craft popular climate policy.*

## Introduction

Weaning the world off fossil fuels in order to mitigate climate change has proven politically challenging, not least because of politically-unfavorable asymmetries in the distribution of the costs and benefits of stringent domestic climate policies. The climate benefits are long-term and diffuse, while the costs are frontloaded and concentrated in particular sectors and regions. In the face of these asymmetries, how can political parties mobilize voters in large enough numbers to vote for ambitious climate mitigation policies? This is a crucial question for political parties, policymakers, and scholars of both distributive politics and voting behavior. Yet, little is known about how enacted or proposed climate policies affect voting behavior in general elections.

From the little we do know, political geography is an important factor: the distribution of a climate policy's costs and benefits across electoral units significantly affects voting behavior and hence the political durability of climate policy (Colantone et al. 2023; Stokes 2016; Urpelainen and Zhang 2022). The challenge of mobilizing voter coalitions supportive of stringent climate policy is undoubtedly most acute in communities dependent on the fossil fuel industry—the focus of our study. This is because voters in such communities not only face any consumer costs that result from stringent climate policies (e.g., increased energy prices) but also producer costs: such policies threaten

the competitiveness—ultimately, the existence—of fossil fuel producers and hence threaten employment and economic activity in these communities (Raimi, Carley, and Konisky 2022; Vona 2019). In response, affected communities may mobilize against climate policies and support parties and candidates that promise to preserve (or even expand) fossil fuel production. For instance, studies suggest that such anxieties drove Appalachian coal communities to support Donald Trump, the pro-coal candidate, in the 2016 US presidential election (Egli, Schmid, and Schmidt 2022; Weber 2020).

To ameliorate adverse distributional effects from climate policies, scholars have recommended that governments pursue climate policy packages that include compensation for adversely affected industries or voters (Finnegan 2022b; Gaikwad, Genovese, and Tingley 2022), often drawing on the literature on trade adjustment policy (e.g., Weber 2020). Others have argued for “just transition” strategies, which combine climate policies with redistributive policies to support affected workers and communities, and which include an important procedural dimension: these policy packages should be developed through tripartite social dialogue with affected unions and employers (International Labour Organization 2015; Smith 2017). Just-transition strategies are being increasingly endorsed by civil society actors and deployed by

governments around the world.<sup>1</sup> Yet, it is not known how such policies affect voting behavior.

We provide the first test of the effect of a just-transition strategy on voter support for climate policy. Using a mixed-method approach, we exploit the use of a geographically-targeted climate policy instrument in Spain—a “Just Transition Agreement” (JTA)—which was negotiated with stakeholders in coalmining areas by the incumbent Spanish Socialist Party (PSOE) government shortly before the 2019 national election, which PSOE went on to win (Spanish Ministry of Ecological Transition 2018). We conducted a difference-in-differences study, which shows that the increase in PSOE’s vote share in coalmining municipalities in the 2019 election was significantly greater (by 1.8 percentage points) than in similar (non-coalmining) municipalities that were not subject to the Agreement. That the effect is positive *at all* is noteworthy, since the Agreement entailed the closure of a key local industry; for comparison, studies of local job losses due to trade shocks show negative effects on incumbent vote-shares (Margalit 2011; Rickard 2022). This quasi-experimental analysis, which is robust to various alternative modelling specifications and placebo tests, implies that it was the

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<sup>1</sup> There are, for instance, just transition commissions, taskforces or policies in jurisdictions including Australia, Canada, Czech Republic, Germany, New Zealand, Scotland, South Africa, Spain, Vietnam, and the European Union.

popularity of the Agreement, which applied only to the treated coalmining municipalities, that boosted PSOE's electoral success there.

To explore the mechanisms behind PSOE's electoral performance, we complement these findings with further statistical analyses and interviews with elites who participated in the negotiation of the Agreement and other local stakeholders. Our findings suggest that PSOE's electoral boost was driven by the intermediating role of labor unions, which supported the Agreement.

Our study contributes to a growing literature on the domestic distributive politics of climate policy (Aklin and Mildenerger 2020; Finnegan 2022a, 2022b; Meckling et al. 2015; Mildenerger 2020; Stokes 2016; Urpelainen and Zhang 2022). We provide robust causal evidence that stringent climate policies can be electorally successful among fossil fuel-dependent communities who would traditionally oppose such policies, provided they are packaged with redistributive policies targeted at those communities and developed through social dialogue. If policy packages can be crafted that persuade “coal country” to support parties proposing stringent climate policies, then political parties should be able to craft policy packages that appeal to the wider public. While surveys have helpfully pointed to the potential for such outcomes (Bergquist, Mildenerger, and Stokes 2020; Gaikwad, Genovese, and Tingley 2022), surveys of hypothetical climate policies may overestimate the popularity of real-world climate

policies, which must survive the competitive rigors of public campaigning (Anderson, Marinescu, and Shor 2019; Gustafson et al. 2019). Against this backdrop, our observational findings are especially noteworthy, adding to the few studies that test the effects of climate policy on actual voting behavior in general elections (Colantone et al. 2023; Stokes 2016; Urpelainen and Zhang 2022).

Our study further contributes to this literature by illuminating the mechanisms by which just-transition strategies may build electoral support in fossil fuel communities. In terms of redistributive benefits, we find suggestive evidence that the public goods (community investment) aspects of the JTA were important in coal municipalities, corroborating survey evidence (Gaikwad, Genovese, and Tingley 2022). But our suggestive findings about the role of labor unions in influencing public awareness and perceptions of the JTA highlight that it is not only the content of redistributive policy packages that matters electorally, but also the processes by which they are designed and advocated. Our findings point to the potential facilitative role labor unions can play in climate policy reform, and we suggest some conditions under which this positive potential is likely to generalize to other contexts.

Our study is most relevant to scholars of climate and environmental politics but is also likely to interest scholars studying other public-interest reforms that have politically challenging distributive profiles—cross-sectionally, geographically, or inter-

temporally—such as trade liberalization, privatization, infrastructure siting, and sector-specific regulation. Our findings also have important implications for the design and packaging of climate policies, and for the strategies of political parties seeking to introduce such policies.

## **Theory**

### *Political challenges: Climate change voting and fossil fuel-producing communities*

Building voter support for stringent climate change mitigation policies has proven extremely politically challenging. Climate change mitigation involves high up-front, local costs for long-term, global climate benefits. Psychologically, the costs of climate impacts (and hence the benefits of climate-change mitigation) are often discounted because they are seen as temporally distant and uncertain (van der Linden, Maibach, and Leiserowitz 2015). Survey-based studies find that support for policies that impose short-term costs for long-term benefits (“policy investments”) is depressed due to uncertainty about whether long-term benefits will materialize, either because of political risks or doubts about the efficacy of the policy (Fairbrother et al. 2021; Jacobs and Matthews 2012). Meanwhile, voters are sensitive to higher energy costs on salient consumer items like electricity and fuel, making the consumer-facing aspects of the energy transition especially challenging (Ansolabehere and Konisky 2014; Rabe 2010). On the other hand, climate policies also have ancillary benefits, such as green

investment, job-creation, innovation, and reduced local air pollutants—benefits which, if sufficiently salient, voters tend to perceive favorably (Ansolabehere and Konisky 2014; Aklin and Urpelainen 2013; Bayer and Urpelainen 2016; Urpelainen and Zhang 2022).

How these costs and benefits are distributed across electorally-significant geographic units affects voting behavior and policy durability (Stokes 2016; Urpelainen and Zhang 2022). Stokes (2016) finds that voters in Ontario, Canada, located near wind energy facilities punished the provincial Liberal government for its pro-wind energy policy at the subsequent election. This localized voter backlash prompted the government to weaken its policy, despite it being supported by the overwhelming majority of Ontarians. Colantone et al. (2023) find that a ban on polluting cars in Milan led to a rise in support for the populist right party, Lega, in subsequent elections. Studies of other forms of political behavior find similar patterns. For instance, the *gilets jaunes* protests in France, which prompted President Macron to scrap his proposal for a carbon tax on transport fuels, were mainly sparked by car-dependent workers living in rural and semi-urban areas (Royall 2020). By contrast, Urpelainen and Zhang (2022) find that the ancillary benefits of wind energy facilities (investment and jobs) can drive voters in US congressional districts to support pro-wind-energy candidates in sufficient numbers to outweigh any localized backlash.



However, the costs of climate policies fall disproportionately on firms, and therefore workers, in carbon-dependent industries such as fossil fuel production.<sup>2</sup> Unsurprisingly, therefore, communities where carbon-dependent industries are clustered and generate much local economic activity pose a particularly acute challenge to climate-policy-making. In such communities, many people are economically dependent on the industry, directly (if they are employed in the industry) or indirectly through the local economic activity it generates (Carley and Konisky 2020; González-Eguino, Galarraga, and Ansuategi 2012). Accordingly, such communities not only face any consumer price increases that result from stringent climate policies (a significant challenge for climate-policy-making in its own right); they additionally bear the brunt of the effects on industrial production (Carley and Konisky 2020; Raimi, Carley, and Konisky 2022; Vona 2019; Weber 2020).<sup>3</sup>

This poses an acute political challenge, since climate policies are more likely to be opposed by voters who perceive their jobs, real wages and livelihoods to be threatened (Bechtel, Genovese, and Scheve 2019; Tvinnereim and Ivarsflaten 2016), and these

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<sup>2</sup> The term “carbon-dependent” industries includes both “carbon-intensive” firms (those that produce significant greenhouse gas emissions per unit of output value) and firms that supply inputs to, or purchase outputs from, carbon-intensive firms (Cory, Lerner, and Osgood 2020).

<sup>3</sup> Moreover, such communities are not necessarily well-placed to benefit from investments in renewable energy generation, such as wind and solar, since the profitability of such investments depends in significant part on climatic factors uncorrelated with fossil fuel deposits (i.e. the wind and solar generation profiles of the relevant region, respectively).

threats are amplified in fossil fuel-producing communities whose economic identity is tied to the industry's standing (Egli, Schmid, and Schmidt 2022; Lewin 2019; Vona 2019; Weber 2020).<sup>4</sup> Moreover, these communities are often geographically concentrated in electoral districts.<sup>5</sup> This matters politically because political parties are incentivized to attend disproportionately to voter discontent that is concentrated in a single district, since it is more likely to flip seats in the legislature than diffuse discontent (Rickard 2012). Effectively, the political signals sent by voters in such electorates echo louder in the halls of government—a phenomenon Stokes (2016) labels “spatially distorted signaling”.<sup>6</sup>

These factors also make climate change policy particularly challenging for left-wing parties: urbanized, younger, middle-class professionals increasingly demand climate action, while their traditional working-class base bears the brunt of climate policies' economic and social costs (Arndt, Halikiopoulou, and Vrakopoulos 2022). The threat of these impacts, potentially sharpened by past experiences of deindustrialization, may render voters in fossil fuel-producing communities more open to the pro-fossil fuel

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<sup>4</sup> Congressional representatives from US districts where industrial emissions are a larger share of greenhouse gas emissions are also more likely to vote against climate-change mitigation legislation (Cragg et al. 2013).

<sup>5</sup> This tends to be the case in plurality and majoritarian systems (Rickard 2012), though some proportional voting systems also divide the national electorate into geographically-specific electoral districts, as is the case in Spain.

<sup>6</sup> Malapportionment in some jurisdictions may also give rural voters disproportionate influence (Broz and Maliniak 2010).

messages deployed by political opponents of climate policy (Egli, Schmid, and Schmidt 2022; Vona 2019; Weber 2020).

*Political solutions: from compensation to just transition*

Echoing other policy domains involving public-interest reforms with concentrated costs—such as trade liberalization—scholars of climate politics have recommended that governments pursue climate policy packages that include compensation for adversely affected firms or voters to boost political support (Finnegan 2022b; Gaikwad, Genovese, and Tingley 2022; Weber 2020).<sup>7</sup> Scholars have recently begun exploring the political potential of compensation measures concentrated on fossil fuel-producing communities.<sup>8</sup> Bergquist, Mildemberger, and Stokes (2020) find that climate policy packages that include measures to retrain fossil fuel workers enjoy increased support among a nationally-representative sample of the US population relative to packages that contain no such policy. Gaikwad, Genovese, and Tingley (2022) show that respondents *in* coal-producing regions prefer redistributive spending that benefits the

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<sup>7</sup> “Compensation” is defined broadly here as monetary or non-monetary benefits intended to offset (at least partly) losses caused by a government policy.

<sup>8</sup> A longer-standing literature has explored how compensation can increase voter support for carbon pricing, where the focus has been on diffuse compensation measures to offset consumer price rises (e.g., Klenert et al. 2018). Another literature has explored renewable energy facility siting, particularly how concentrated compensation measures can build local support by offsetting negative local impacts (e.g., van Wijk et al. 2021).

entire community over funding that only benefits adversely affected workers, suggesting the importance of both material factors (such as jobs created from investment in new industries) and coal communities' shared economic identity. This is consistent with a wider literature on compensation for concentrated policy costs, which suggests that in-kind benefits and community-level public goods tend to be interpreted as more appropriate, and less like "bribes", than cash payments (Frey, Oberholzer-Gee, and Eichenberger 1996; Mansfield, Van Houtven and Huber 2002).

Compensation strategies overlap with the distributive aspects of "just transition" strategies. A just transition to a low-carbon economy, as elucidated by the labor movement (where the concept originated), means one in which affected workers and communities have a financially secure and dignified pathway into alternative, sustainable jobs and livelihoods, and in which the necessary redistributive policies are developed through fair procedures, such as tripartite social dialogue with affected unions and employers (International Labour Organization 2015; Smith 2017). In short, a just transition combines "distributive justice" with "procedural justice".

Theoretically, just-transition strategies could garner public support via direct and indirect mechanisms. The redistributive aspects of just-transition strategies, like compensation policies, aim to directly offset individual and community economic losses associated with stringent climate policies, or to facilitate adaptation to a low-carbon

economy (Green and Gambhir 2020). Workers employed in threatened carbon-dependent industries could be motivated to vote for a party proposing a just-transition strategy because they would benefit from individualized social protection measures, such as income support, early access to pensions, or subsidized retraining. All members of the community (including, but not only, directly-affected workers), meanwhile, could be so motivated because they would benefit from public goods, such as place-based investment in sustainable, low-carbon industries. Indirectly, voters could be motivated to vote for a party proposing a just-transition strategy because they are influenced by cues from trusted intermediaries. We focus on labor unions given their prominence in just-transition debates (International Labour Organization 2015; Smith 2017). Unions may endorse a just-transition strategy for distributive reasons (e.g., because their members or wider constituencies benefit from that strategy) and/or procedural reasons associated with their participation in tripartite social dialogue.<sup>9</sup> In turn, unions' support for a policy can influence the voting behavior of their members and the wider public (Radcliff and Davis 2000). These theoretical considerations lead us to expect that a political party that adopts a just transition policy will increase its vote share in fossil fuel-producing communities.

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<sup>9</sup> Tripartite social dialogue could enable stakeholders to inform participants of one another's positions, construct collective understandings of problems and solutions, encourage a longer-term perspective, and build trust that can lead participants to support inherently risky policy solutions (Martin 2013, 125).

Empirically, however, we have limited understanding of the conditions under which just-transition strategies are electorally effective. The surveys mentioned above explore compensation measures for workers in the fossil fuel industry or fossil fuel-producing communities (Bergquist, Mildenerger, and Stokes 2020; Gaikwad, Genovese, and Tingley 2022). However, surveys that refer to hypothetical policy packages cannot account for important political dynamics in real-world climate-policy battles (Anderson, Marinescu, and Shor 2019), such as public-facing campaigns by elite industrial actors, which can influence voter perceptions of policies (Dür 2019; Gustafson et al. 2019). Beyond these survey-based studies, the just-transition literature is overwhelmingly conceptual, normative/prescriptive, or based on qualitative case studies (see Wang and Lo 2021). To our knowledge, there are no quantitative studies examining the effect of just-transition strategies on voting behavior.

One reason for this absence may be a belief that climate-policy considerations are not salient enough to affect voting behavior, but as Stokes (2016) shows, this is far from universally true. Another reason may be the difficulty of isolating the effect of climate policies on voting decisions. However, policies that affect only some electoral districts present opportunities for quasi-experimental studies (Stokes 2016). Our study overcomes both limitations by exploring the electoral performance of the Spanish Socialist Party, which successfully negotiated a (salient) just transition agreement in coalmining municipalities shortly before a general election. This case study permits

causal inference of the effect of a just-transition strategy on voting behavior and provides a valuable opportunity to link the literature on climate policy with the literature on voting behavior.

### **Spanish case study**

Spanish coal production has been declining since its peak in the late 1980s, along with employment (see Appendix A.1). Fewer than 1,700 workers were directly employed in the sector in 2017 (Spanish Ministry of Ecological Transition 2018). The sector depended on state subsidies, which successive Spanish governments faced EU pressure to phase down. A 2010 EU decision required state aid for the sector to be made conditional on uncompetitive production units being closed by 31 December 2018 (Council of the European Union 2010). Despite the challenging conditions facing the industry, it remained symbolically important in the social imaginary of the Spanish working class, and there remained widespread political support for its continuation where it was geographically concentrated: in Asturias, Teruel, and León (Herrero and Lemkow 2015).

The PSOE-led government came to power in June 2018, with Pedro Sánchez as prime minister. Tackling climate change was a key priority of the incoming Sánchez

government, which meant the coalmining issue had to be addressed. Sánchez's ministry included a new portfolio of Minister for Ecological Transition, held by Teresa Ribera, an internationally-renowned climate policy expert. Ribera proposed negotiating a new instrument, a just transition agreement, with representatives of affected coalmining businesses, labor unions, and provincial governments of the mining regions (see Appendix A.2 for a list of participants). After six weeks of negotiation with stakeholders, agreement was reached on 24 October 2018 to close 28 coalmines by the end of 2019 in three provinces—Asturias, Teruel and León—and to provide €250 million in support and investment in affected municipalities over the period 2019–2027.

To enrich our understanding of the relevant context and to aid the interpretation of our main findings, we conducted interviews with elite participants in, and observers of, the JTA negotiations (N=11).<sup>10</sup> Participants in the negotiations highlighted the factors that were crucial to their acceptance of the JTA. Firstly, the redistributive measures accompanying the coalmine closures were crucial (Interviews 1, 2, 3, 4, 5, 8). With an estimated 1,677 miners and subcontractors slated to lose their jobs, the deal includes early retirement schemes for miners over 48 years old or with 25 years' service.

Younger miners receive social assistance, such as a €10,000 redundancy payment, 35

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<sup>10</sup> Interviewees are listed by number and role-description in Appendix A, Table A.2. Details of the interview, transcription, and analysis processes are described in Appendix A, section A.3.



days' pay for every year of service, and access to retraining programs to work in green industries. Union and business participants identified these individualized protections for affected workers as important to gaining their support for the JTA (Interviews 2, 3). Additional funding was provided for public goods. Coalmining municipalities would receive funding for business initiatives, economic development, and environmental restoration and amenity. Business and union negotiators specifically identified the municipal industrial development initiatives as key to gaining their support (Interviews 2, 3). Additionally, the social dialogue through which the JTA was negotiated built trust between the government and the industry participants, leading the latter to see the PSOE government as a credible policy broker (Interview 3). Both union and business participants said the government's wish to close the coalmines in 2019 was more ambitious than they preferred, but that they respected the Minister's honesty and transparency about this key issue (Interviews 2, 3). A government official responsible for just transition confirmed that fostering this trust was one of the aims of the process: "this was always a discussion, also very honest, very little tactics, it was to win the trust of the actors by honesty" (Interview 1). This trust-based social dialogue enabled the successful negotiation of the JTA among all participating actors.

Following the negotiation of the JTA, it was enshrined in law on 22 January 2019.<sup>11</sup> A week later, Prime Minister Sánchez called a snap election for 28 April. During the two-month-long campaign, PSOE promoted the JTA as part of its “Energy and Climate Framework”. PSOE’s election manifesto framed the policy package as a Green New Deal (“El New Deal Verde” or “El Green New Deal de España”)—a concept Sánchez had endorsed at the World Economic Forum summit in January 2019—emphasizing the notion of a new social contract between government, capital, and labor to promote a comprehensive and just approach to decarbonizing society. The Green New Deal package featured prominently in PSOE’s 2019 election manifesto and campaign.<sup>12</sup>

Importantly, we can test the effect of the JTA on the vote share of coalmining municipalities because it was a highly visible issue in the months preceding the 2019 elections in these municipalities. Using a media analysis that compares the coverage of just transition in coalmining and non-coalmining regions, we show that, from January 2018 to June 2019, the regional newspapers of coalmining communities contained, on average, five times more articles about it than national newspapers (see Appendix B).

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<sup>11</sup> The Royal Decree Law 25/2018 on “urgent measures for a just transition of coalmining and the sustainable development of mining regions” was supported by PSOE and numerous smaller political parties (Ciudadanos, ERC, and PNV), but three other parties abstained (PP, Podemos and Equo). The Parliamentary debate about the law is available at: [https://congresodiferido.congreso.es:8443/vod/ondemand/video/leg12/400/12\\_000400\\_168/cortes/mp4:12\\_000400\\_168\\_1\\_18988\\_637877.mp4/manifest.m3u8](https://congresodiferido.congreso.es:8443/vod/ondemand/video/leg12/400/12_000400_168/cortes/mp4:12_000400_168_1_18988_637877.mp4/manifest.m3u8).

<sup>12</sup> Other issues, such as Catalan independence, which PSOE opposed, were debated in the campaign (see Rodon 2020). It was not raised as a key issue when we asked all interviewees about alternative explanations for PSOE’s electoral boost in coalmining municipalities.

The media analysis also confirms that PSOE “owned” the issue, since 18.8% of all articles on just transition mention PSOE or related terms (cabinet, prime minister, Minister for Ecological Transition), whereas only 2% of such articles are associated with the main opposition party (PP) and only 1.8% with Podemos<sup>13</sup> or Equo (Green Party).

Our interview data provide complementary evidence of the issue’s salience and PSOE’s ownership of the issue. Many interviewees said that the future of coalmining was a salient issue for coalmining communities in the election campaign (Interviews 1, 3, 5, 6, 8). The JTA provided a basis for PSOE officials and campaigners, centrally and locally, to construct a credible narrative about the party’s commitment to the regions’ future prosperity beyond coal (Interviews 1, 3, 4, 5, 6, 8). Labor-union signatories to the JTA supported the deal, and throughout and after the negotiations the unions organized local assemblies to inform people about the negotiations and the deal (Interview 3).

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<sup>13</sup> Although Podemos at the national level favored the energy transition and campaigned for a green deal, its position in the mining regions was opposed to the Government's JTA. In fact, Podemos abstained, along with PP and Equo, from the Royal Decree Law (which enshrined the JTA) in the Parliament.

PSOE won the election, significantly increasing its vote share (achieving a plurality of 28.7%). This translated into PSOE winning 123 seats (a net gain of 38) in the 350-seat Congress of Deputies (lower house), including 14 in Asturias, Teruel, and León combined (7, 3 and 4 seats, respectively).<sup>14</sup> Since PSOE was the sole political party to the JTA and “owned” the issue of just transition in coalmining municipalities, and since its re-election would facilitate the successful implementation of the JTA, we hypothesize that PSOE registered a greater increase in its vote share in coalmining municipalities compared with demographically similar, non-coalmining municipalities.

## **Municipality-level analysis**

### *Empirical Strategy*

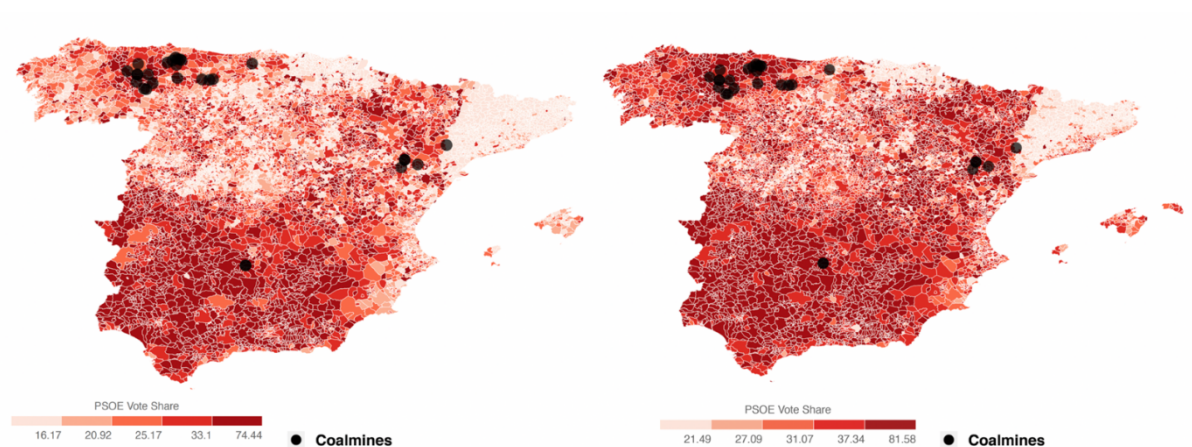
To test our hypothesis, we evaluate the effect of coalmine closures on PSOE support in municipalities affected by the JTA. Figure 1 shows the increased support for PSOE from the 2016 to the 2019 national elections in municipalities that contain or are close to the 28 coalmines slated for closure in December 2019 (black circles). Since all but

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<sup>14</sup> Seats are allocated using the D’Hondt method and a closed list proportional representation system. Under the Spanish electoral system, each province is allocated a fixed number of two seats and the remaining seats are allocated in relation to the population of the provinces. In practice, this gives greater representation to less populated provinces such as Asturias, León and Teruel (Hopkin 2005). The median district magnitude in Spain (i.e. the median number of seats in a Spanish province) is 5, which means that Asturias, with its 7 seats, has greater representation compared with the median province (Hopkin 2005).

one of these coalmines lie in the north-west and east of Spain,<sup>15</sup> we evaluate three specific provinces: Asturias, Teruel, and León.

*Figure 1: Spatial distribution of support for PSOE in 2016 and 2019 in Spanish Municipalities*



Electoral consequences of coalmining closures are better measured at the municipality level, for several reasons. First, the JTA is a place-based policy that was framed to target affected coal workers and communities at the municipal level. While the JTA directly affected 1,677 coal workers at the time of the election, we have shown that this policy also has electorally-significant implications for residents in coalmining municipalities more generally (because the government committed to invest in business initiatives, economic development, and environmental restoration, etc., in those municipalities). The most fine-grained administrative level covering these communities

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<sup>15</sup> One coalmine is located in the Ciudad Real province in the south but the mine effectively ceased operating in 2015. We therefore exclude it from our analysis.

is the municipality level. Spanish municipalities are small<sup>16</sup> and coalmining municipalities broadly approximate coalmining communities. Most people in coal regions live and work in the same municipality, and coalminers live close to coalmines. Second, municipal-level analysis makes sense because Spanish coalmining communities have strong local identities linked to the industry's historic status (Herrero and Lemkow 2015) and thus, like in coal communities elsewhere (Carley, Evans, and Konisky 2018; Gaikwad, Genovese, and Tingley 2022; Lewin 2019), members are likely to share a concern for the community's welfare. Third, the geographical scope of application of the JTA is defined in terms of municipalities (Spanish Ministry of Ecological Transition 2021). This means that the funds allocated pursuant to the Agreement are to be distributed to the municipalities. By contrast, using the individual-level post-election data from the Centro de Investigaciones Sociológicas (CIS) would have been less reliable, because the lowest level of geographic location at which individual voters are identified in that data is the "autonomous community" (N=17), which is too aggregated. Even if information on individuals' municipality were available, the sample would not have been representative of each municipality.<sup>17</sup> For all these reasons, we use the municipality-level variance in the incidence of coalmines slated for closure to test our hypothesis.

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<sup>16</sup> Municipalities in our sample have an average of 4,202 inhabitants.

<sup>17</sup> Only a panel survey would have allowed us to look at changes in municipality and respondent.

While PSOE (in negotiation with the stakeholders) set the redistributive policies applicable to coalmining communities, these policies did not affect the local incidence of coalmines. Coalmine location is mainly determined by geological factors, but our analysis will also control for other potential confounding factors between coalmining and non-coalmining municipalities, such as demographics and contextual factors.

We conduct a municipal-level analysis that examines changes in PSOE vote share in 2019 from previous election years between mining and non-mining municipalities in coalmining provinces. We use a difference-in-differences estimation strategy to examine the effects of the JTA on PSOE vote share. We consider this estimating equation in an ordinary least squares (OLS) regression:

$$PSOE_{mt} = \alpha_{mt} + \beta Coalmines_{mt} + \beta_1 2019Year_{mt} + \beta_2 (2019Year \times Coalmines)_{mt} + \gamma_m + \lambda_t + \epsilon_{mt}$$

where *PSOE* is the PSOE vote share in general elections in municipality *m* at year *t* (2008, 2011, 2015, 2016 and 2019). Electoral data is taken from the Spanish Interior Ministry website.  $\beta Coalmines$  is a dummy variable that takes the value 1 if municipalities *m* contain or are close to coalmines slated for closure pursuant to the JTA. The treated municipalities are known as *cuencas mineras*, small, geographically

isolated areas highly dependent on coalmining and identified as the beneficiaries of redistributive policies under the JTA.<sup>18</sup> The control municipalities are municipalities unaffected by these policies but located in the same three provinces (Asturias, Teruel and León).

The key reason we focus on municipalities in these three provinces in our main analysis is that they are more suitable than the entire country as a control group with which to compare coalmining municipalities. Provinces like Madrid or Cataluña have different socio-economic features, and other issues that could affect vote choice, such as Catalan independence.<sup>19</sup> This sample composition should help us ensure that the municipalities affected by coalmine closure and those that are unaffected are otherwise very similar—in line with Tobler’s first law of geography that “near things are more related than distant things” (Tobler 1970, 236). Analysis of a sub-sample within coalmining provinces also helps to eliminate potential omitted variable biases and to compare the effects for similar municipalities. Focusing on coalmining municipalities (1) or non-coalmining municipalities located in a province that has at least one coalmining municipality (0) yields 2,620 municipalities in our baseline sample. There are 108 treated municipalities and 416 control municipalities for each year (N=524).

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<sup>18</sup> The official classification of municipalities as *cuencas mineras* in Asturias, Teruel and León facilitated our selection of the treated municipalities.

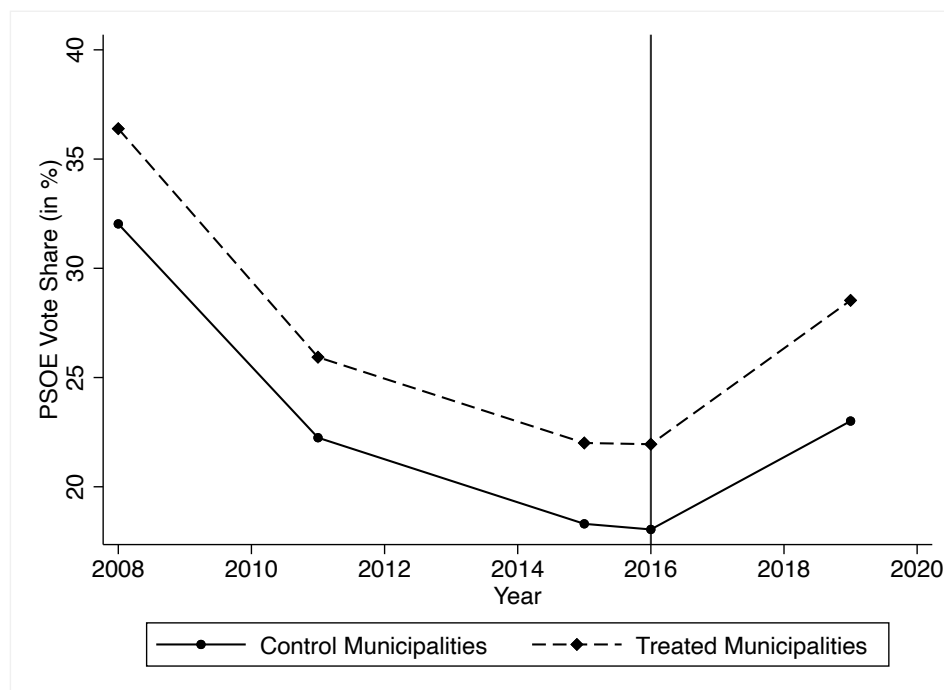
<sup>19</sup> We have no reason to think that the salience of the Catalan independence issue varies between our treated and control municipalities.



$\beta_1$  2019Year is a dummy variable with a value of 0 for the pre-treatment period (years 2008, 2011, 2015, 2016) and 1 for the treatment period (year 2019) in all municipalities  $m$ .  $\beta_2$ (Year 2019  $\times$  Coalmines).  $m$  is the estimand of interest which identifies the expected mean change in PSOE vote shares in mining municipalities in the 2019 elections.  $\epsilon$  is the error term for each municipality  $m$ . The equation includes province and election year fixed effects,  $\gamma_m$  and  $\lambda_t$  respectively, to control for province-specific, time-invariant characteristics and for province-invariant, time-specific characteristics. Standard errors are always robust and clustered at the treatment level, i.e. the municipality level. To rule out the possibility that the results are driven by an underlying trend in voting behavior that was different for treated and control municipalities, we ran a regression explaining vote shares of PSOE for general elections preceding April 2019. We interact the dummy on treated municipalities with election-year dummies preceding closure of coalmines. Table C.2 in Appendix C displays the results for these regression models. It shows there is no significant effect on PSOE support between our treated group and previous electoral years. Figure 2, which presents the graph of PSOE support for the treated and control groups in all election years since 2008, confirms that the difference between the treated and control groups is constant over time until 2016 (the treatment occurred between 2016 and the next

election year, 2019).<sup>20</sup> Overall, we are confident that the treatment effect we are detecting (the effect of the JTA) on the municipalities is not confounded by a violation of the common trend assumption.

Figure 2: DiD graph: Trends in PSOE vote share in treated and control municipalities



Another condition to be fulfilled is the balanced sample of treated and control groups.

We need to ensure that the composition of municipalities in both groups before and after the treatment are comparable. We conduct balance tests to observe the composition of these municipalities with regard to growth of unemployment from 2016 to 2019, the share of people with primary education in 2016, the 2016 population share

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<sup>20</sup> We notice that the PSOE vote share has increased in both treated and control municipalities, which means that the JTA did not reduce the support for PSOE in municipalities that were not affected by the Agreement.

(log), and the share of men over 50 in 2016. The knowledge-based economy has restructured people's locations. After deindustrialization and globalization, older workers with routine jobs are more likely to remain in coalmining areas, while young people with greater education and skills move to cities. We therefore include the unemployment growth rate from 2016 to 2019 among men older than 50, the share of population with primary education, and the share of immigration. Given the lack of job attractiveness and upcoming closure of coalmines, coalmining municipality populations have fallen. We add change of population from 2016 to 2019 as a covariate to control for this effect. These contextual variables, which are taken from the Spanish Statistical Office (Instituto Nacional de Estadísticas), are included in a third model that uses OLS, province and election year fixed effects and clustered standard errors at the municipality level.

Since there is imbalance in the contextual variables, we include matching via entropy balancing (Hainmueller and Xu 2011) in a fourth model using OLS and province and election year fixed effects and clustered standard errors at the municipality level. This matching procedure allows us to ensure that treated and control municipalities share similar observable characteristics. The balance test before and after weighting is available in Appendix C, Table C.3.

## *Results*

Table 1 shows the results of the OLS regression of living in coalmining municipalities on PSOE vote share with the sub-sample of coal provinces. Model 1 shows the results with municipal fixed effects; model 2 presents the results with province and year fixed effects; model 3 shows the results with province and year fixed effects and contextual features; and model 4 presents the results with the entropy balancing weights. Across all specifications, we find a significant and positive effect on PSOE vote share in 2019 in mining municipalities affected by the JTA, compared with unaffected municipalities. The effect sizes are relatively stable across all models. The sub-sample of coal provinces shows that the PSOE vote share is about 1.8 percentage points higher in treated municipalities in 2019 than in control municipalities. The patterns remain almost identical in the regression with the entropy balancing and controls (models 3 and 4). These effects are relatively strong given the ceiling effects that may exist (i.e. coalmining municipalities are traditionally more supportive of PSOE) and the fact that the Agreement entailed the closure of a key regional industry. Indeed, the expected counterfactual scenario (i.e. a PSOE policy to close the coalmines without a JTA) would have been a *loss* of PSOE support if we generalize from existing studies that show that communities punish the incumbent for the loss of local jobs due to

offshoring (Margalit 2011; Rickard 2022).<sup>21</sup> Interestingly, we find similar—indeed, greater—effect sizes compared with these studies but in the opposite direction,<sup>22</sup> making our findings particularly noteworthy. These findings validate our hypothesis that coalmining municipalities have responded positively to the transition policy engineered by the PSOE government, causing a greater increase in PSOE’s vote share in 2019 compared with comparable municipalities.

Additionally, we investigate the impact of spatial proximity to coalmines slated for closure on PSOE’s vote share in 2019 compared with 2016, to gauge the policy’s impact on PSOE support. The detailed analysis and results are available in Appendix D. We find that the margin of increase in PSOE support in 2019 relative to 2016 diminishes by about 0.03 percentage points as the distance to the closest coalmine increases by 10 kilometers, controlling for contextual features. The fact that PSOE’s increased vote shares in the 2019 elections are strongest in municipalities close to the coalmines increases our confidence that this increase is attributable to the JTA.

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<sup>21</sup> PSOE was aware of the political risk associated with this policy. A government official responsible for just transition in coal provinces said “... knowing that we were going to do it [close the coalmines], be clear about it and know that we were going to be the ones to bear the political cost” (Interview 1).

<sup>22</sup> Margalit finds that a 1 percentage point increase in the share of trade-related layoffs in a US county costs the incumbent 0.15 percentage points of the vote share. Rickard finds that Spanish municipalities in which an offshoring event occurred registered a decline in the incumbent party’s vote share by 1.6 percentage points.

Table 1: Main results of DiD

	(1)	(2)	(3)	(4)
PSOE Vote Share		Among Coalmining Provinces		
Year 2019	-0.131	-11.416***	-11.359***	-0.106
	[0.248]	[0.349]	[0.354]	[0.249]
Coalmines	5.512***	5.633***	6.218***	26.001***
	[1.109]	[1.091]	[1.218]	[7.288]
Year 2019 x Coalmines	1.818***	1.818***	1.796**	1.796**
	[0.660]	[0.660]	[0.766]	[0.765]
Population Share (Log)			0.852*	1.576***
			[0.443]	[0.525]
Primary Education			0.034	0.238**
			[0.076]	[0.107]
Unemployment Growth			-0.258	-0.420*
			[0.244]	[0.251]
Share of Men Over 50 Years Old			-0.003	-0.026
			[0.069]	[0.066]
Immigration Rate			0.070	0.143*
			[0.072]	[0.079]
Constant	30.632***	46.400***	38.825***	26.058***
	[0.429]	[0.753]	[5.261]	[5.063]
Province FE		✓	✓	✓
Year FE		✓	✓	✓
Entropy Balancing				✓
Observations	2,625	2,625	2,455	2,455
R-squared	0.041	0.341	0.366	0.107

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Column 1-3 show the OLS regression for treated and control municipalities in coalmine provinces with standard errors clustered at the municipality level in parentheses and with or without province fixed effects. Column 4 presents OLS regression with entropy balancing and standard errors clustered at municipal level in parentheses.

We also report further robustness tests in Appendix E. First, we ran the models using municipality fixed effects because including them would control for unobserved variables that could vary across municipalities and bias our estimate. The results, which are displayed in Table E.1, do not change our main findings. Second, we ran the same models using an alternative control group that includes all Spanish municipalities (N=39,714) to alleviate a potential selection issue by focusing on municipalities from provinces with coalmines only. The results are comparable to the ones that focus on coalmining provinces, thus further corroborating our findings. Third, we ran an alternative model to the entropy balancing model (Model 4) in the main analysis by using the lagged dependent variable to control for the differential initial PSOE vote shares between the treated and control groups. It involved matching on the 2016 PSOE vote share and contextual variables to examine the effect of the JTA on 2019 PSOE vote share. The results, which are displayed in Table E.2, are consistent with our main findings. Fourth, we ran a series of tests to address potential alternative explanations of the varying voting behavior between treated and non-treated municipalities. We examined whether the larger PSOE support in coalmining communities could be related to changing turnout rates, or to support for a pro-environmental party that did not support the JTA (Podemos). We also examined whether our results change due to these municipalities' spatial dependence. We report these analyses in Appendix E and disconfirm each hypothesis, bolstering the robustness of our main findings.

## Mechanisms

We have established that coalmining municipalities electorally rewarded PSOE for enacting the JTA. However, it remains unclear if coalmining municipalities are more supportive of PSOE due to the redistributive measures that offset individual and/or community losses caused by the JTA, or if it is due to the intermediating role of labor unions.

We first consider the possibility that the direct payments to affected workers (i.e., the individual-level redistributive measures of the JTA) explain the outcome. If the payment of these direct benefits was the dominant explanatory factor, we would expect to see larger support in coalmining municipalities that have a greater number of direct beneficiaries of the policies, i.e. coalminers. To test this, we obtained information on the share of coalminers per municipality<sup>23</sup> and interacted this variable with the treatment period (year 2019) to observe whether the PSOE vote share in the 2019 election was higher in those coalmining municipalities that had a higher share of coalminers. We restrict our sample to the coalmining municipalities and include the same control variables as in previous analyses. We run the same models with province and election year fixed effects and standard errors clustered at the municipality level.

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<sup>23</sup> The data is taken from the 2011 Census, the latest time this information was registered.



Results are reported in the first two models of Table 2 and show that the effect is insignificant. The increase in PSOE support in coalmining municipalities is not driven by the votes of coalminers alone, suggesting that individual-level redistributive measures are not the primary mechanism.

This does not mean that the community investment (public good) redistributive measures included in the JTA played no role in building community support. Other studies suggest that coal communities are likely to favor community-level redistribution because of the wider material benefits they bring (beyond directly affected coal-workers) and because of prevailing community economic identities (Gaikwad, Genovese, and Tingley 2022). While we cannot test this quantitatively with our contextual data, our interview data provide suggestive evidence of the importance of such measures. Government, union, and business representatives and a senior local journalist, local mayor, and International Labour Organization (ILO) representative all commented on the importance of framing the JTA around a positive vision for redeveloping the regions (Interviews 1–6). The ILO representative said

a negotiation that only talks about the jobs that are going to be lost due to the closure is not the same as negotiations that also talked about the jobs as a whole in the territory, about ... the development of the territory as a whole. ... And from the point of view of the electoral results ... this is going to have its positive effects. (Interview 4)

We also tested whether unions played a role in building wider electoral support for PSOE in coalmining municipalities. If this were the case, we would expect to observe that more union-dense coalmining municipalities would register greater PSOE support than less union-dense coalmining municipalities. While there is no data on union density at the municipality level, the 2010 Working Conditions Survey has information on union density by sector at the level of Autonomous Communities (N=17). Among our provinces of interest, Asturias has a much higher level of union density in the mining sector (31.4%) than León and Teruel (respectively 20.4% and 18.9%). We therefore create a dummy variable with coalmining municipalities in Asturias coded as 1 and other coalmining municipalities coded as 0. We interact this variable with the treatment period and run an OLS with election year fixed effects and standard errors clustered at the municipality level. We display the results in models 3 and 4 of Table 2. We find a strong and significant effect.<sup>24</sup> This finding indicates that highly unionized coalmining provinces (i.e. coalmining municipalities in Asturias) are more likely to register higher PSOE support in the 2019 elections than less unionized coalmining provinces (i.e. those in Teruel and León), suggesting that the unions played an intermediating role in driving increased support to PSOE.

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<sup>24</sup> The findings are significant at the 0.05 confidence level without controls and remain significant at the 0.1 confidence level when we include other contextual variables.

Our interview data provide further suggestive evidence as to unions' supportive intermediating role. Unions are highly trusted actors in the coal regions (Interview 6), and throughout and after the negotiations, they organized local assemblies to inform members about the negotiations, the contents of the deal, and the unions' position on it (Interview 3). As one of the union representatives said:

During the negotiation and at the end, when we had the agreement, we arranged informative assemblies. Every time there is a salient milestone, we held assemblies in the territories in which we explain to our union members the whole negotiation process and the final result. (Interview 3)

Moreover, coal union representatives publicly endorsed PSOE shortly before the election (Ardura 2019).

*Table 2: Mechanisms*

	(1)	(2)	(3)	(4)
<hr/>				
PSOE Vote Share				
<hr/>				
Year 2019	-9.554***	-9.596***	-9.930***	-9.853***
	[0.950]	[1.159]	[0.976]	[1.184]
Share of Coalminers	0.912**	0.203		
	[0.391]	[0.516]		
Year 2019 x Share of Coalminers	-0.486	-0.141		
	[0.320]	[0.278]		
Union Density			0.258	-4.707*
			[1.376]	[2.388]
Year 2019 x Union Density			1.784**	1.649*
			[0.771]	[0.924]
Population Share (Log)		1.334		1.767*
		[1.169]		[0.960]

Primary Education		0.228		0.267
		[0.207]		[0.209]
Unemployment Growth		0.717		0.768
		[0.574]		[0.542]
Share of Men over 50 Years Old		-0.139		-0.130
		[0.167]		[0.168]
Immigration Rate		0.119		0.095
		[0.129]		[0.127]
<hr/>				
Constant	47.258***	38.440***	47.516***	38.853***
	[0.961]	[13.315]	[1.407]	[11.426]
Province FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	545	390	545	390
R-squared	0.285	0.330	0.236	0.327

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Standard errors are clustered at the municipality level in parentheses.*

While definitive evidence is not available to us in this case, the evidence discussed here suggests a plausible, coherent explanation for our main findings: the unions were able to negotiate an agreement in the interests of both directly affected workers and the wider community; they thus supported the agreement and communicated details about it to their members and the wider community; and this, in turn, influenced their members and wider communities to vote for PSOE.

## Discussion

Our findings suggest that the electoral challenges posed by the climate imperative to phase out fossil fuel production are not insurmountable, even in the least-likely constituency of fossil fuel-producing communities. Just-transition strategies—combining stringent climate policies with sector- and place-specific redistribution, negotiated through social dialogue—can be electorally popular in such communities. Building popular support in such communities matters where electoral rules incentivize political parties to pay disproportionate attention to concentrated voter dissatisfaction, which can otherwise sink proposed climate policies even when they are popular among the wider electorate (Stokes 2016). If parties can use just-transition strategies to increase support for their climate-policy proposals among coalmining constituencies, then they may well be able to craft policy packages that appeal to the wider public, whose aversion to stringent climate policies is likely to be less acute. Indeed, in the Spanish case, it is notable that PSOE ran on a prominent Green New Deal platform, of which the coalmining just-transition strategy was but one part, and its *national* vote share increased relative to the previous election. While our research design does not permit causal inferences beyond the treated coal municipalities, the national result suggests that redistribution toward fossil fuel-producing communities need not erode political support among urbanites (see also Gaikwad, Genovese, and Tingley 2022). For left-wing parties such as PSOE, our findings suggest they could use just-transition

strategies to build supportive coalitions for stringent climate-policy packages that unite their more climate-conscious urban, professional constituents with their traditional working-class base in industrial heartland regions, defusing the “jobs vs environment” dilemma.

Our further statistical tests and interviews also shed light on the mechanisms by which just-transition strategies may build electoral support in fossil fuel-producing communities. In terms of redistributive benefits, the public goods (community investment) aspects of the JTA appear more likely to have endeared voters in coalmining municipalities to PSOE than worker-specific redistribution (though both types of support were evidently important to gaining the unions’ support for the deal<sup>25</sup>). This observational evidence is consistent with survey results in coal communities in the US and India (Gaikwad, Genovese, and Tingley 2022), and with wider literature on compensation for geographically concentrated policy costs (Frey, Oberholzer-Gee, and Eichenberger 1996; Mansfield, Van Houtven and Huber 2002).

We also find suggestive evidence that unions’ facilitative and supportive role in the JTA process contributed to PSOE’s relative electoral boost in the coal municipalities. This illustrates how unions’ positions on a given climate policy package may not only

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<sup>25</sup> Just-transition strategies may have to take greater account of worker-specific distribution in cases where unionization is weak or irrelevant.

be politically important in their own right (e.g., because of unions' influence over the policymaking process); unions can also play an important intermediating role, influencing their members' and their communities' awareness and perceptions of the package, and their voting behavior. That unions can play this intermediating role in elections is well understood (e.g., Radcliff and Davis 2000). But in the climate politics literature, it is the negative face of this role that has received most of the attention: because unions can threaten to mobilize public opposition to climate policies that adversely affect their members, they can block, or at least slow, low-carbon transitions (Finnegan 2022b; Mildenerger 2020). Our findings point to the positive potentialities of unions in climate policy reform: just-transition strategies combining redistribution with social dialogue can be used to build union support for stringent climate policies; and unions can, in turn, generate public support for the relevant package.

To what extent are our findings likely to generalize to other cases? The rich contextual understanding of our case study, enhanced through our elite interviews, sheds light on the scope conditions, and hence generalizability, of our findings.

First, the baseline (counterfactual) market conditions facing the relevant carbon-dependent industry affect the mindset and bargaining positions of the relevant stakeholders, and hence prospects for just-transition strategies. For coal production generally, these conditions include changes in demand for the industry's output (e.g.,

declining energy demand), competition (e.g., from renewable energy producers), production costs, and other regulation affecting demand or supply conditions (e.g., local air pollution regulation) (Diluiso et al. 2021). In the Spanish case, the coal industry was facing adverse structural conditions that rendered it uncompetitive and reliant on state aid, which the EU was pressuring the government to discontinue. These circumstances evidently shaped the way affected stakeholders interpreted the government's policy, put the coalmining companies and affected labor unions in a weak bargaining position vis-à-vis the government, and enabled PSOE to present itself as an ally of coal workers and communities that could credibly manage the necessary transition, rather than necessarily being seen as the cause of their problems (Interview 5). This increased the likelihood that the coal companies and unions would support a government-proposed just-transition strategy that would wind-down their industry equitably. Gaining the companies' support for the JTA removed a key source of potential obstruction to the government's policy agenda, while gaining the unions' support, as we have shown, was likely key to generating electoral support in affected communities.<sup>26</sup> This suggests that just-transition strategies are more likely to facilitate the closure of carbon-dependent industries when the industries are relatively weak, confirming case-study evidence from coal closures in other countries (Diluiso et al.

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<sup>26</sup> Still, closing the mines was not a foregone conclusion. Many voters in coal regions cling to the hope of an industry revival or at least prolongation (Cha 2020; Diluiso et al. 2021). Some of our interview participants reported their observation of widespread sentiment that the EU decision could be renegotiated, prolonging state aid for the coalmines (Interviews 4, 6).



2021).<sup>27</sup> Given that the long-term outlook for coal production is weak in many parts of the world (International Energy Agency 2022), and likely to weaken further as renewable energy costs continue to decline (independently of new climate policies in the relevant jurisdiction), these conditions are likely to become increasingly prevalent globally.

Second, the organization of businesses and unions, and the extent to which they are incorporated into policymaking processes, also affect the prospects for just-transition strategies. Countries that grant encompassing, hierarchal, and monopolistic peak associations privileged access to policymaking processes have an advantage in building consensus on climate policy reforms (Finnegan 2022b; Mildenerger 2020). Yet, our findings show that corporatist institutions of this kind are not a prerequisite to stringent climate policy. Spain's unions and business groups are moderately centralized (Visser 2019)<sup>28</sup> and the country has over recent decades built industrial consensus for policy reforms through ad hoc social dialogue processes resulting in "social pacts" (Rhodes 1998). In our case study, unions and businesses in the coal sector were sufficiently centralized for them to be reliable partners in social dialogue toward an ad

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<sup>27</sup> See also the interesting survey of UK oil and gas workers in Jeliazkov, Morrison, and Evans (2020).

<sup>28</sup> In the ICTWSS Database (v.6.1) the centralization score for Spain's unions in 2018 was 0.555. This score is an index weighting the degree of authority (or vertical coordination) in the union movement and union concentration (or horizontal coordination) (Visser 2019).

hoc agreement, the JTA. This suggests that our findings are more likely to generalize to countries with similarly modest degrees of producer-group centralization—at least in the affected sector—and a history of quasi-corporatist bargaining over policy reform. Given the relative centralization of producer groups (both business associations and unions) *in fossil fuel-related sectors* in many countries, this condition is not likely to be overly restrictive. Indeed, the Spanish experience may well indicate the wide potential for just-transition agreements to be negotiated beyond those countries with entrenched corporatist institutions.

Organizational links between producer groups and political parties likely also matter in this regard (Mildenberger 2020). In the Spanish case, PSOE had strong links to the labor unions. This suggests that just-transition strategies are more likely to emerge in countries where such linkages exist (e.g., UK, Australia, Norway, Germany) than in those where they do not (e.g., US, Canada). Still, north-American labor activism is on the rise (Milkman 2020), and this trend may conduce to strengthened ties between labor and left-wing parties. Indeed, the imperative for a low-carbon transition may itself be catalyzing such enhanced cooperation, as suggested by the broadly pro-union, industrial policy-based approach at the heart of the Inflation Reduction Act—the most ambitious federal climate policy ever enacted in the US (AFL-CIO 2022).

Finally, the size of the coal industry in Spain was, at the time the JTA was negotiated, relatively small, hence the Agreement applied to fewer than 1,700 workers and to communities surrounding only 28 coalmines. The Spanish Government had sufficient fiscal capacity to absorb the €250 million price tag (spread over 8 years) of the JTA commitments. However, in countries with much larger fossil fuel industries and/or tighter fiscal constraints, such support may be less politically feasible. Moreover, while our study has focused on the producer-facing aspects of the energy transition, governments will also face demands to support consumers vulnerable to increased energy costs through the transition. Such demands sharpen the trade-offs associated with producer-facing support packages like the JTA.

In sum, our findings should generalize to a wide range of other geographic and temporal contexts, especially contexts in which (i) carbon-dependent industries have the organizational capacity to be reliable partners in social dialogue, and (ii) those industries are in a weaker bargaining position due to their weak prospects for profitability independently of the proposed climate policy. Just-transition strategies are also likely to be more feasible where (iii) left-wing parties are in government and those parties have close links with trade unions and (iv) the relevant government has the fiscal capacity to provide transitional assistance, given the size of the affected industry.

## Conclusion

While the public-interest case for stringent climate policy is overwhelming, the costs and benefits are distributed unevenly across sectors, space, and time in ways that make it politically challenging to generate public support. These challenges coalesce in fossil fuel-producing communities such as the coal municipalities studied here.

Compensation and just-transition strategies have been proposed to mitigate these challenges. Yet existing literature contains only limited evidence of their political effectiveness, and no evidence about their effects on voting patterns. Our study of a just-transition strategy in Spain sheds light on how political parties can use such strategies to protect, and even grow, their vote-share in fossil fuel-producing communities. We found that the negotiation of a “Just Transition Agreement” by the incumbent PSOE government, business and union representatives and other stakeholders in coalmining regions shortly before the 2019 national election caused an increase in PSOE’s vote share by 1.8 percentage points in coalmining municipalities relative to similar (non-coalmining) municipalities that were not subject to the Agreement. Our further statistical tests and interviews shed light on the causal mechanisms behind this result, suggesting the importance of labor unions’ supportive intermediating role.

The study combined numerous methods to triangulate and deepen the explanations of our findings. First, our elite interviews and media analysis illuminated the context surrounding the JTA and demonstrated its salience in coal municipalities. Second, our difference-in-differences analysis explored the main causal patterns. The analysis was conducted at the municipal level. This level of analysis is very fine-grained, with a single municipality typically encompassing a geographically-concentrated coalmining community. Moreover, municipalities are the beneficiaries of public-goods funding allocated pursuant to the JTA. This allowed us to make robust causal inferences. Thirdly, our elite interviews and further statistical tests allowed us to explore causal mechanisms. These methods yielded complementary evidence that enhanced the internal validity of our study.

Nevertheless, there are some limitations to our study, which suggest avenues for future research. First, future studies could usefully build on our municipal-level analysis by testing the impact of just-transition strategies on voting behavior at the individual level in other contexts, where individual-level data are available. Using individual-level data could also enable exploration of whether support for parties that favor or oppose just-transition policies is mediated by individuals' climate-policy preferences. Second, while we used fixed effects with time-varying controls to address potential confounding factors, some unmeasured confounders that change over time between coalmining and non-coalmining municipalities may still bias our estimate, such as media coverage or

campaign spending. Finally, we can only offer suggestive evidence regarding the mechanisms at play. Further studies could usefully test the effects of specific redistributive and procedural aspects of just-transition policies on voting behavior.

We also discussed the conditions under which our findings are likely to generalize. We emphasized the importance of external conditions that weaken the economic outlook for carbon-dependent industries, which drive businesses and unions to the bargaining table, and at least a moderate degree of centralization among unions and businesses in the relevant industry, so that industrial actors can be reliable partners in tripartite negotiations with government over redistributive policy packages. Connections between incumbent left-wing parties and unions, and governments' fiscal capacity relative to the size of the affected industry, may also be important factors. Future work could fruitfully test our findings in contexts exhibiting variation in these conditions.

Our findings have important implications for public policy and for the political strategies of parties that support climate action, especially left-wing parties. First, they underscore the importance of a multi-instrument and sequential approach *to* climate policy. Since some climate policies—such as subsidies for the production and adoption of green technologies—tend to be more politically feasible, they can be used earlier in the policy sequence to grow markets for green technologies. Scholars have argued that this would weaken the economic position of incumbents and thus strengthen the

political power of green coalitions, in turn making more stringent climate policies, such as carbon pricing schemes, progressively feasible (Aklin and Urpelainen 2013; Meckling et al. 2015; Urpelainen and Zhang 2022). But carbon-dependent incumbents have proven rather resilient, as have political loyalties to them, complicating the politics of introducing more stringent climate policies (Egli, Schmid, and Schmidt 2022; Lewin 2019). Our findings underscore the importance of complementing policies that bring green technologies to market with policies that directly mandate the phase-out of fossil fuel production (Diluiso et al. 2021; Green and Denniss 2018).

More importantly, our findings also underscore the political value of a holistic policy approach to the low-carbon transition that extends *beyond* climate policy (in the narrow sense of policies to reduce greenhouse gas emissions), to encompass industrial, regional, social and labor-market policies. Whereas workers in carbon-dependent industries will quite understandably cling to the jobs they have, even when the industry's economic outlook is bleak, multi-dimensional just-transition strategies can provide a dignified and hopeful exit-path from polluting industries. While our study focused on the electoral significance of such policy packages in fossil fuel-producing communities, it lends credence to the political logic underlying economy-wide "Green New Deal"-style policy programs that combine ambitious climate action with wider economic and social reforms that benefit working people (cf. Bergquist, Mildemberger, and Stokes 2020; Carmack, Dolšak, and Prakash 2022; Green and Healy 2022). As our

case study suggests, such strategies are likely to be particularly attractive to left-wing political parties, which are otherwise especially vulnerable to the “jobs vs environment” dilemma.

Finally, our findings suggest that building support for a just transition to a low-carbon economy is about more than crafting the right redistributive package: process matters. Our study suggests that the process of tripartite social dialogue facilitated unions’ (and businesses’) support for the JTA, and that unions, in turn, played a constructive intermediating role that built support for the JTA and PSOE in coalmining communities. This suggests that unions’ policy positions, and their external relationships to left-wing parties and to the wider public, are likely to be important variables in the electoral success of redistributive climate policy packages.

Overall, we have contributed to understanding how political parties can manage distributive conflicts to build popular support for public-interest policies. As the impacts of a heating climate escalate, and political pressure for stringent climate policies grows, opportunities to study the electoral effects of redistributive climate policy strategies will become more frequent—and the imperative to do so, more urgent.



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## APPENDICES

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## Appendix A: Context and Interview Process

### *A.1 Spanish coal industry—historical context*

Spain has a long and proud tradition of coalmining stretching back to at least the 18<sup>th</sup> century (Del Río 2017). The sector employed close to 100,000 workers in the middle of the 20<sup>th</sup> century, though production has declined precipitously since its peak of around 35 million tons per annum in the late 1980s (Herrero and Lemkow 2015). Since 1990, the industry's decline was driven by changes in the electricity market that reduced the share of coal-fired power generation, the uncompetitive cost structure of domestic coal production relative to imports, the high costs of government subsidies to the sector, and changes in European Union (EU) regulation that sought to phase-out state aid for coal production (Del Río 2017). A 2010 EU decision required state aid for the coalmining sector to be made conditional on uncompetitive production units being closed by 31 December 2018 (Council of the European Union 2010).

Due to the declines in production, along with the gradual mechanization (a growing share of surface mining) and concentration of mining corporations, direct employment in the sector fell precipitously since the late-80s production peak (Herrero and Lemkow 2015), to below 1,700 in 2017 (Spanish Ministry of Ecological Transition 2018). While Spain does not have entrenched corporatist institutions for interest-group intermediation (Siaroff 1999), unions throughout this period opposed cuts to state production subsidies while also participating in government-led industrial planning initiatives for the sector that combined (declining) production subsidies with support for workers and regional investment (Del Río 2017). The mining unions have been historically close to PSOE, and this has tended to be reflected in PSOE's strong electoral performance in the mining regions throughout this period. Still, the sector's decline has created significant tensions between the unions and governments across the political spectrum (Del Río 2017; Herrero and Lemkow 2015).

### *A.2 Signatories of and Participants in the Just Transition Agreement*

Signatories to the Just Transition Agreement (JTA):

- José Domínguez Abascal, Secretario de Estado de Energía, Ministerio para la Transición Ecológica

- Agustín Martín Martínez, Secretario General, Federación de Industria de CCOO
- Pedro Luis Hojas Cancho, Secretario General, UGT-FICA
- Pedro Ayllón García, Secretario General, Federación de Industria-USO
- Pedro Iglesia, Presidente, Carbunión.

Other (non-signatory) participants in the JTA negotiation process:

- Víctor Fernández Vázquez, Secretario del Sector Minero, UGT FICA
- José Luis Alperi, Secretario General SOMA UGT-FICA Asturias
- Jorge Díez González, Secretario Sector Minero UGT-FICA, Castilla y león
- Francisco Montull Fornos, Secretario del sector Minero UGT-FICA Aragón
- Jesús Ignacio Crespo Torres, Coordinador de Industria y Responsable de Sector Minero Eléctrico
- Antonio Montoya Perez, Responsable de Minería FI-CCOO en Asturias
- Omar García Álvarez, Responsable de Minería FI-CCOO en Castilla y león
- Raúl Montoya González, Secretario de Acción Sindical FI-USO.

**Table A.2: Interviewees**

<b>Interviewee (Generic Description)</b>	<b>#</b>
Government official responsible for the just transition in coal provinces	1
Coal industry representative	2
Union representative	3
International Labour Organization representative	4
Mayor from a coal community in Aragón (PSOE)	5



Senior journalist from Asturias	6
Podemos MP and head of coal issues for Asturias	7
Equo MP and member of the energy transition committee	8
Partido Popular politician	9
Mayor of coal community in Asturias (United Left)	10
Business association representative	11

### *A.3: Semi-structured interviews: process and analysis*

We conducted interviews with elite participants in, and observers of, the JTA negotiations (N=11) to enrich our understanding of the relevant context, aid the interpretation of our main findings (concerning voting behavior) and explore potential causal mechanisms. Interviews were conducted in Spanish by two of the authors (one of whom is a native Spanish speaker, and the other a fluent non-native Spanish speaker<sup>29</sup>) in March and April 2022 over Zoom, and lasted 50 minutes on average. All interviewees signed a written consent form after receiving a detailed information sheet, and understood that the information would be used for research and publication purposes.

The main themes of the questions we asked interviewees concerned: the negotiation of the JTA (e.g., the policies that were debated and negotiated, the beneficiaries of the Agreement); their connection to the negotiation process; the level of trust between the main participating stakeholders (mining companies, unions, local and national PSOE government); whether and how they (and/or their organization) used the JTA as a campaign issue in the 2019 election campaign; how PSOE framed a narrative around the JTA to the local communities; how PSOE and the JTA were perceived by these communities during the course of the negotiations and

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<sup>29</sup> Interview 11 was conducted only by our native Spanish-speaking coauthor.

the 2019 April election campaign; how the Agreement was communicated to the relevant local communities; how salient an issue the JTA was during the election campaign; and how it was perceived by these communities.

Interview recordings were transcribed in Spanish and manually coded by our two Spanish-speaking coauthors.<sup>30</sup> We approached the analysis of the interview transcripts by using a deductively and inductively derived coding framework. We deductively identified themes from the just transition literature, notably the political importance of individual- and community-level redistributive measures and of fair processes (with a focus on tripartite social dialogue), which informed our theorized explanations of PSOE's performance in the treated coal municipalities in the 2019 election.<sup>31</sup> We therefore looked for observable implications of our theorized explanations by identifying key words or phrases that would support or refute each such explanation (an example is provided in the next paragraph, below).<sup>32</sup> We then grouped these key words/phrases based on patterns of similarity (see Saldana 2016). Through our interview questions, we also explicitly sought to identify alternative explanations for our main findings. Some interviewees ventured alternative explanations for our main findings that, if confirmed, would contradict our theorized explanations (e.g., other contextual factors like low population density explain the increase in PSOE support). These were inductively coded. However, each of the ventured explanations was disconfirmed by our main quantitative analysis.

To illustrate these analytical steps, consider how we coded and interpreted the following quote from Interviewee 4: “a negotiation that only talks about the jobs that are going to be lost due to the closure is not the same as negotiations that also talked about the jobs as a whole in the territory, about ... the development of the territory as a whole. ... And from the point of view of the electoral results ... this is going to have its positive effects.” The mention of the significance of “the jobs as a whole in the territory” and “the development of the territory as a whole” were

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<sup>30</sup> Quotations selected for use in the manuscript were translated into English by the coauthors who did the coding.

<sup>31</sup> We were also interested in better understanding the context in which the JTA came about and its salience in the affected communities, so we inductively identified themes related to these contextual factors.

<sup>32</sup> The qualitative research methods literature makes clear that using a prior theoretical framework is a valid approach to data analysis, and that the credibility (or internal validity) of qualitative data analysis can be improved by transparency about coding processes (Benaquisto, 2008; Saldana, 2016).

coded as evidence of “distributive justice” factors in explaining support for the JTA (a deductively-derived code), and interpreted specifically as (suggestive) evidence in support of the theorized explanation that the provision of community-level public goods explains PSOE’s increased vote share at the 2019 election. When we discuss this quote in the manuscript, we are careful to note that the evidence is only suggestive and that we cannot test this explanation quantitatively with the data available to us.

## Appendix B: Media Analysis

To test our main hypothesis, we need to provide evidence that the just transition policy was pivotal in influencing the vote choices of coalmining municipalities by comparison to non-coalmining municipalities. We conduct a media analysis to show that the JTA was a more salient local issue in Spanish coalmining communities subject to the JTA than in the rest of the country.

The media analysis compares the coverage of just transition in coalmining and non-coalmining provinces. We use three regional newspapers (*El Diario de León*, *El Comercio: Diario de Asturias* and *El Norte de Castilla*) to observe whether the levels of issue salience for provinces affected by the JTA vary compared with Spain more generally, as observed in two national newspapers (*El Mundo* and *El País*). We first scraped all the headlines of each newspaper from 1 January 2018 to 6 June 2019, covering the year leading up to the April 2019 elections. We then built a dictionary based on just transition using the *grepl* package, which identified all sentences with a keyword related to this concept.<sup>33</sup> Our final corpus has 155,022 headlines, 496 (0.32%) of which are related to the JTA.

Figure 1 shows the total share of news articles for regional versus national newspapers from 1 January 2018 until 6 June 2019. It shows that newspapers from coalmining provinces had many more articles on just transition than national newspapers. Regional newspapers

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<sup>33</sup> All terms that were included in this search were the following: “transición justa”, “transición ecológica”, “minas”, “Teresa Ribera”, “minería del carbon”, “ley de Cambio Climático”, “centrales de carbon”, “Hunosa”, “acuerdo minero”, “cuencas mineras”, “transición energética”, “carbón”, “comarcas mineras”, “acuerdo minería”, “acuerdo marco”, “SOMA”, “sindicato de los obreros mineros de Asturias”, “descarbonización”, “térmicas de carbon”, “plantas de carbón”.

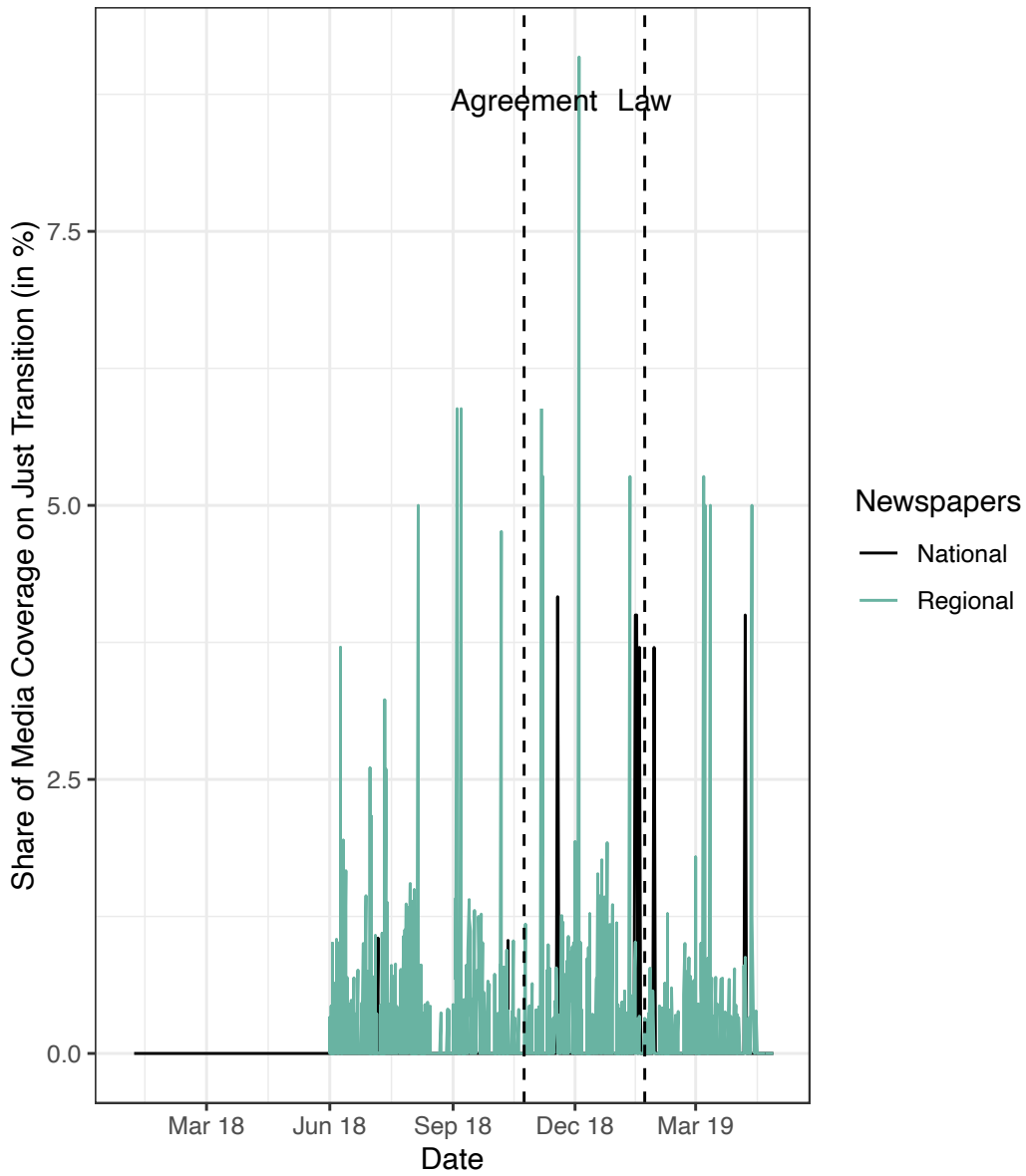
contained, on average, five times more articles about just transition than national newspapers (0.35%<sup>34</sup> vs 0.07% respectively). Residents in coalmining regions therefore received more articles about just transition than the rest of the population. We also find that 18.8% of all articles on just transition mention PSOE and related terms (cabinet, prime minister, Minister for Ecological Transition), whereas only 2% of such articles are associated with the main opposition (PP) and only 1.8% with Podemos or Equo (Green Party). This shows that just transition received greater visibility in coalmining provinces (i.e., the JTA was more salient there than elsewhere), and that PSOE was identified as the party responsible for it.

Since the just-transition strategy was more salient in coalmining municipalities and PSOE “owned” the issue, we can indeed test if this strategy was pivotal in influencing PSOE’s vote share in coalmining municipalities, compared with demographically similar, non-coalmining municipalities.

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<sup>34</sup> The share of reports is similar to the share of articles on climate change found in studies covering ten other countries. The most recent study by Hase et al. (2021) finds that only 0.53% of all articles per month focus on climate change.

Figure B.1: Share of media coverage on just transition in national vs regional newspapers



## Appendix C: Descriptive Statistics and Placebo Test

*Table C.1: Summary Statistics*

Variables	Observations	Mean	SD	Min	Max
PSOE Vote Share	2,625	31.826	11.931	0	80.224
Year 2019	2,625	.2	.400	0	1
Coalmines	2,625	.208	.406	0	1
Population Share (Log)	2,625	6.175	1.633	1.609	12.526
Primary Education	2,625	11.996	7.583	0	60
Unemployment Growth	2,465	-1.319	1.874	-10.559	5.604
Share of men over 50 years old	2,615	32.796	9.443	10.064	73.347
Immigration Rate	2,615	6.252	6.956	0	47.042
Share of Coalminers	2,625	.128	.721	0	9.884
Union Density	2,625	.149	.356	0	1

Table C.2: Placebo test

	(1)
<hr/>	
PSOE Vote Share	
<hr/>	
Coalmines	5.783
	[2.328]
Year 2011	-11.441**
	[1.999]
Year 2015	-16.578**
	[1.849]
Year 2016	-16.995**
	[1.861]
Year 2019	-11.385**
	[2.044]
Baseline Category (Year 2008)	
Coalmines x Year 2011	0.229
	[0.953]
Coalmines x Year 2015	-0.623
	[0.418]
Colamines x Year 2016	-0.204
	[0.580]
Colamines x Year 2019	1.668***
	[0.114]
<hr/>	
Constant	41.860***
	[1.268]
Province FE	✓
Observations	2,625

R-squared 0.319

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table C.3: Covariates adjustment via entropy balancing

Covariates	Treated Municipalities			Control Municipalities			Diff
	Mean	Variance	Skewness	Mean	Variance	Skewness	
<b>Before weighting</b>							
Population Share (Log)	6.495	3.573	.02464	6.139	2.461	.805	-.209***
Primary Education	13.94	64.53	.5196	11.66	56.95	2.24	1.572***
Unemployment Growth	-1.533	3.102	.7552	1.286	3.587	-.5525	.255**
Share of Men Over 50 Years Old	31.31	92.32	.8072	33.13	89.52	.6399	1.621***
Immigration Rate	6.617	76.65	2.356	6.063	41.16	2.087	.976***
<b>After weighting</b>							
Population Share (Log)	6.495	3.573	.02464	6.495	3.201	.8297	-
Primary Education	13.94	64.53	.5196	13.94	108.6	2.344	-
Unemployment Growth	-1.533	3.102	.7552	-1.533	3.286	.5742	-
Share of Men Over 50 Years Old	31.31	92.32	.8072	31.31	85.35	.5145	-
Immigration Rate	6.617	76.65	2.356	6.617	46.14	1.825	-

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



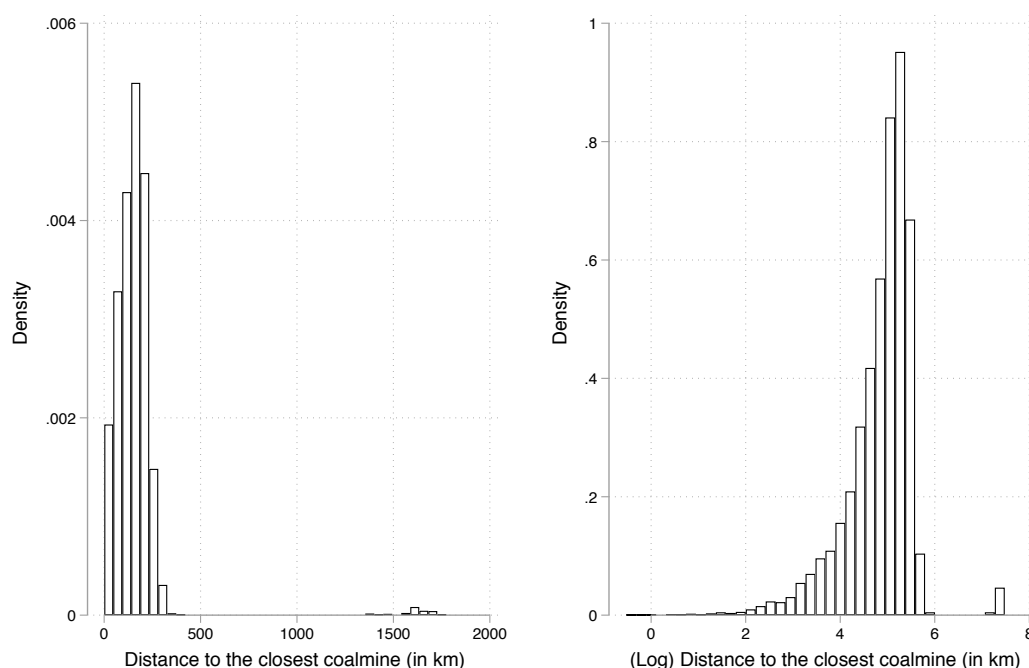
## Appendix D: Analysis with the Distance to Coalmines

### *Empirical strategy*

In this section, we use additional information on the distance of municipalities to coalmines slated for closure to assess if the change in PSOE vote shares is related to proximity to those coalmines. This analysis also helps us to control for potential geographic spillovers, because we can expect the effects of the JTA to extend beyond coalmining municipalities into neighboring municipalities which are not considered *cuencas mineras*.

To investigate the specific effect of coalmine closures and spillover effects, we use the geographical coordinates of all coalmines slated for closure pursuant to the JTA<sup>35</sup> to obtain the shortest distance to each municipality, calculated as the distance between the polygon's centroid of a given municipality and the closest coalmine (in kilometers) using the Haversine formula. We use the logarithm of the shortest distance to coalmines, since the variable skews heavily left. Figure D.1 shows the distribution of distances to the nearest coalmine and the log of the distances.

*Figure D.1: Distribution between a municipality's centroid and the closest coalmine*



<sup>35</sup> Coalmines that are not covered by the JTA and are already closed are not included.

Since we do not compare treated and control municipalities, we use an OLS regression<sup>36</sup> where we consider the following equation:

$$\Delta PSOE_m = \alpha_m + \beta \text{Distance to coalmines}_m + L_m + Z_m + \epsilon_m \quad (1)$$

where  $\Delta PSOE$  is the change in vote shares of PSOE from 2016 to 2019 for each municipality<sub>m</sub>.  $\beta \text{Distance to coalmines}_m$  denotes the main variable of interest, the (log of the) distance to the closest coalmines for each municipality<sub>m</sub>.  $L_m$  is the lagged dependent variable of vote support in 2015, as the PSOE vote share is highly determined by the previous vote.  $Z_m$  refers to contextual controls that could mitigate the risk of geographic sorting bias. We use the controls that were used in the main analysis: unemployment growth among men over 50, population share (log), share of people with primary education, and immigration share. We use the whole sample of the Spanish municipalities and province fixed effects to control for province-level heterogeneity. Following our main hypothesis, we expect the change in PSOE support from 2016 to 2019 to decrease as the distance from the closest coalmines increases.

## *Results*

Table D.1 reports the effect of the shortest distance to coalmines on PSOE vote change from 2016 to 2019 using no controls (model 1), combining vote share in 2015 and contextual controls that could have influenced the PSOE vote share (model 2), and excluding outliers (model 3). Model 3 excludes municipalities not in mainland Spain (e.g., Mallorca, Canary Islands). All models show that an increase in distance from the closest coalmine has a negative and marginally significant effect on the PSOE vote change from 2016 to 2019. This means the margin of increase in PSOE support is larger in municipalities closer to coalmines. This effect is substantial: model 3 suggests that a 10 km increase in distance to the closest coalmine is associated with around a 0.03 percentage point decrease in change in PSOE vote share. These findings are further evidence that the increased support for PSOE in 2019 is linked to coalmine closures. Coal communities reward the incumbent for the JTA.

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<sup>36</sup> We used a log-linear model due to the absence of a U-shaped pattern that would justify the inclusion of a quadratic term. We include the marginal plot of the change in PSOE vote share by the distance to the closest coalmine (in km) in Appendix F.

Table D.1: Distance to coalmines

	(1)	(2)	(3)
PSOE 2016-2019			Without Outliers
Distance to coalmines (Log)	-0.374** [0.159]	-0.293* [0.175]	-0.294* [0.175]
2015 PSOE vote share		-0.040*** [0.007]	-0.040*** [0.007]
Population Share (Log)		0.435*** [0.061]	0.433*** [0.061]
Primary Education		-0.024*** [0.009]	-0.024*** [0.009]
Unemployment Growth		-0.277*** [0.067]	-0.279*** [0.067]
Share of Men Over 50 Years Old		0.031*** [0.009]	0.031*** [0.009]
Immigration Share		-0.004 [0.010]	-0.003 [0.010]
Constant	6.477*** [0.770]	3.539*** [1.065]	3.561*** [1.066]
Province FE	✓	✓	✓
Observations	7,674	6,029	6,008
R-squared	0.001	0.018	0.018

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Appendix E: Robustness Tests

In this section, we report a series of sensitivity analyses that test the plausibility of alternative mechanisms and the robustness of our findings.

We first tested whether our results remain consistent when including municipality fixed effects. Using municipality fixed effects would allow us to control for any other municipality-specific, time-invariant characteristics. The results, which are reported in Table E.1, are comparable to the main analysis. Second, we conducted a model with the lagged dependent variable to control for the differences in the initial PSOE vote shares between the treated and the control groups. We matched on the 2016 PSOE vote shares and contextual variables to test the average treatment effect of the JTA on the 2019 PSOE vote share (we dropped the previous years). The results, which are shown in Table E.2, are consistent with the main analysis conducted using entropy balancing, with the effects showing similar magnitudes, even though the statistical significance level is at 0.1. conventional significance. Third, we ran the same models as in the main analysis using the remaining sample of municipalities as the control group in Table E.3. Re-estimating the DiD models does not change our findings, even though the effects are slightly stronger in magnitude when we include the full sample with all municipalities. The PSOE vote share increases by around 2.25-2.3 percentage points in treated municipalities (compared with the rest of the municipalities) in the full sample. These findings confirm that the main analysis is not affected by different modelling strategies.

*Table E.1: With municipality fixed effects*

	(1)
PSOE Vote Share	
Year 2019	-0.131 [0.248]
Coalmines	
Year 2019 x Coalmines	1.818*** [0.659]
Constant	31.776***

	[0.047]
Municipality FE	✓
Year FE	✓
Observations	2,625
Number of municipality	525
R-squared	0.002

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\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Column 1 shows the OLS regression for treated and control municipalities in coalmine provinces with municipality fixed effects and standard errors clustered at the municipality level in parentheses.*

*Table E.2: With the Lagged Dependent Variable (and entropy balancing)*

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	(1)
2019 PSOE Vote Share	

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Coalmines	1.739*
	[1.034]
Population Share (Log)	0.516*
	[0.292]
Primary Education	0.087*
	[0.052]
Unemployment in 2016	-0.117
	[0.143]
Share of Men Over 50 Years Old	-0.022
	[0.050]
Immigration Rate	0.044

	[0.068]
2016 PSOE Vote Share	0.908***
	[0.042]
<hr/>	
Constant	6.285*
	[3.523]
Province FE	✓
Entropy Balancing	✓
Observations	491
R-squared	0.735

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Column 1 shows the OLS regression with entropy balancing for treated and control municipalities in coalmine provinces with province fixed effects and standard errors clustered at the municipality level in parentheses.*

*Table E.3: With the full sample of municipalities*

	(1)	(2)	(3)	(4)
PSOE Vote Share	Full Sample (All Provinces)			
Year 2019	-0.606***	-11.691***	-11.820***	-0.751***
	[0.057]	[0.095]	[0.106]	[0.064]
Coalmines	7.409***	5.710***	5.882***	189.411***
	[1.029]	[1.076]	[1.184]	[71.052]
Year 2019 x Coalmines	2.247***	2.248***	2.365***	2.365***
	[0.612]	[0.612]	[0.722]	[0.722]
Population Share (Log)			1.111***	1.597***
			[0.107]	[0.206]
Primary Education			0.193***	0.265***

			[0.025]	[0.037]
Unemployment Growth			-0.307***	-0.290***
			[0.071]	[0.071]
Share of Men Over 50 Years Old			0.023	0.117***
			[0.019]	[0.038]
Immigration Rate			0.001	-0.002
			[0.016]	[0.016]
<hr/>				
Constant	28.784***	38.114***	37.367***	21.878***
	[0.140]	[0.543]	[1.451]	[2.091]
Observations	39,719	39,719	32,129	32,129
Province FE		✓	✓	✓
Year FE		✓	✓	✓
Entropy Balancing				✓
R-squared	0.004	0.559	0.589	0.426

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Column 1 shows the OLS regression for treated and control municipalities in coalmine provinces with province fixed effects and standard errors clustered at the municipality level in parentheses. Column 4 presents OLS regression with entropy balancing and standard errors clustered at municipal level in parentheses.*

We also test alternative hypotheses in this section. We first considered whether the results presented so far could be connected to changing turnout rates. One might speculate that the increase in support for PSOE could be due to a general increase in turnout in the coalmining municipalities, since coalmining communities may be going to the ballot box in greater numbers than other communities: the closure of coalmines may trigger these communities to mobilize. It would be problematic to our results if only inhabitants in coalmining municipalities changed their behavior and voted in greater numbers compared with other, unaffected

communities (in the control group). We therefore replicate the main analysis,<sup>37</sup> and substitute the dependent variable with turnout rates in 2016 and 2019. Turnout rate is calculated as the percentage of eligible voters who cast a vote in the 2016 and 2019 elections. This placebo test is shown in Table E.4 (model 1). It shows no significant effect between coalmining and non-coalmining municipalities in the sub-sample of coalmining provinces, confirming that turnout is not affected by coalmining closures in these coalmining municipalities. It also suggests that the increase in PSOE support resulted primarily from a shift among voters who previously voted for other parties, not from engaging non-voters.

Another placebo test compares voting support for Podemos in treated and control municipalities. Although Podemos focused on Green New Deal policy at national level during the election campaign in April 2019,<sup>38</sup> its MPs did not vote in favor of the Royal Decree Law 25/2018 (which enshrined the JTA in Spanish law) in the Spanish Parliament in January 2019. We replicate our analysis and change our dependent variable to the change of support for Podemos from 2016 to 2019. Table E.4 (model 2) reports the results. We see the lack of significant effect among coalmining provinces, which confirms that Podemos does not appeal to these mining communities. Many reasons may explain why these communities do not support Podemos, but it seems that Podemos' national support for an ecological transition but lack of support for the JTA did not attract local voters. This corroborates our argument that the just-transition strategy motivated coalmining communities to support PSOE.

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<sup>37</sup> We include only the 2016 and 2019 election years in these robustness checks. Standard errors are clustered at the municipality level.

<sup>38</sup> This includes calling for the creation of public companies, including a bank and a public energy company, to transition Spain to 100 percent renewable electricity in 20 years.



Table E.4: Placebo tests

	(1)	(2)
	Turnout	Podemos
Year 2019	2.996***	-4.522***
	[0.228]	[0.180]
Coalmines	-0.632	0.929
	[0.945]	[2.270]
Year 2019 x Coalmines	0.503	-0.832
	[0.564]	[0.520]
Constant	72.957***	14.106***
	[0.330]	[0.463]
Observations	1,055	1,055

Standard errors are clustered at the municipality level in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Finally, one potential concern with these analyses is that our OLS models may not correctly account for the potential presence of spatial autocorrelation, or may not be the best way to model spatial dependence. To address this, we run spatial models that estimate spatial effects for panel data. In particular, we show results for a spatial lag model (SLM), which controls for spatially endogenous interactions, a spatial error model (SEM), which accounts for spatial autocorrelation in the error term, and a spatial Durbin model (SDM), which includes spatially dependent and explanatory variables. We include a spatial weight based on the inverse distance criteria. This matrix involves an element of distance between the municipalities whose value is continuous in building the weighting matrix so that each municipality receives a weighted matrix according to that distance. We use this matrix because it is the most appropriate matrix with continuous data and with features close in space (here municipalities). We focus on the sample of our coalmining provinces, since it is where spatial autocorrelation is most likely to be. We use similar OLS models as in previous regressions with municipality and year fixed effects.

Table E.5 presents the results for the three models. We see evidence of spatial diffusion, with significant effects of the spatial lag of coalmines and the spatial error term on PSOE support. Nevertheless, we find a significant and positive effect on PSOE vote share in 2019 in mining municipalities affected by the JTA as opposed to those that are not, albeit only at 0.1 confidence levels for the SEM and SDM models (the effect size is similar to the main analysis an increase of 1.16–1.29 percentage points). These findings confirm that the main models are not sensitive to the presence of spatial autocorrelation.

*Table E.5: Spatial models with the spatial weighting matrix  $W$*

	(1)	(2)	(3)
	SLM	SEM	SDM
Constant	4.599***	4.486***	4.557***
	[0.071]	[0.070]	[0.070]
Year 2019	-0.033	2.045*	2.055
	[0.252]	[1.059]	[2.080]
Coalmines	-2.333	-0.328	-1.640
	[5.146]	[5.009]	[5.064]
Year 2019 x Coalmines	1.222**	1.155*	1.292*
	[0.555]	[0.612]	[0.729]
W * PSOE	1.043***		0.947***
	[0.012]		[0.015]
W * Year 2019			-4.106***
			[1.253]
W * Coalmines			-605.335***
			[89.318]
W * Year 2019 × Coalmines			0.360
			[3.560]

W \* Error Term 0.919\*\*\*  
 [0.036]

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Observations	2,620	2,620	2,620
Number of Municipality	524	524	524
Municipality FE	✓	✓	✓

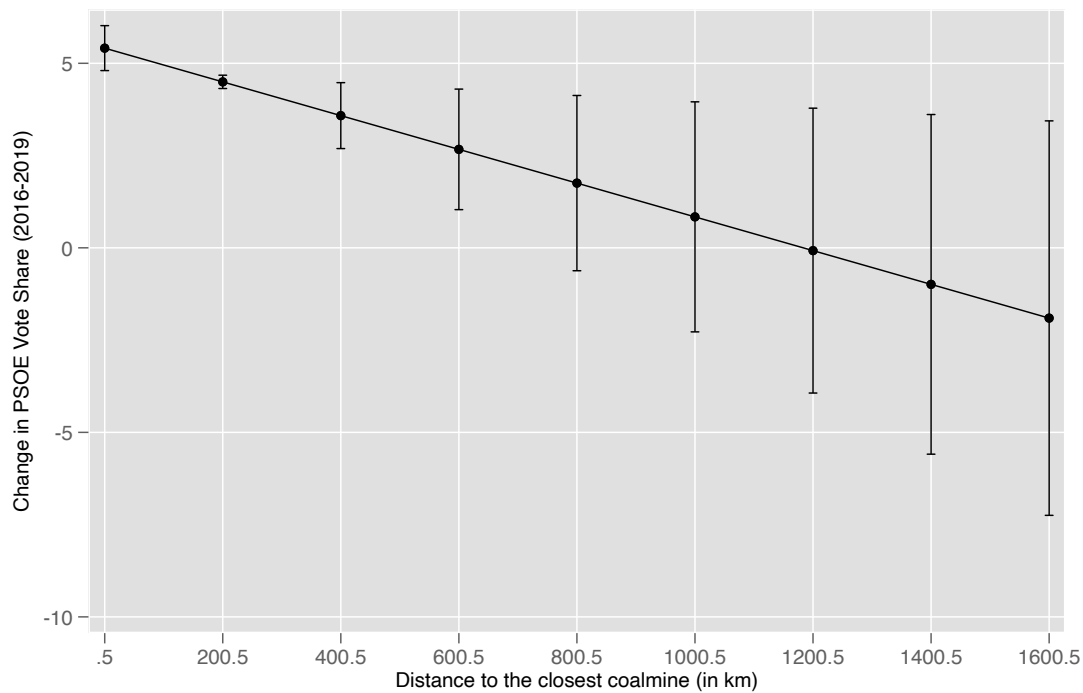
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Robust Standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Appendix F: Marginal plot

Figure F1: Marginal plot of the distance to the closest coalmine on the change in PSOE Vote Share (2016-2019)



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