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Fossil fuels, employment, and support for climate policies

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HIGHLIGHTS

- Individual-level support for climate policy will depend on expected costs and opportunities.
- Data from three large-scale Norwegian representative opinion surveys are used.
- Those working in the oil/gas sector are less in favor of constraints on fossil fuel production.
- In the same group, support for renewables is similar to that of the population at large.
- Stimulating new avenues for employment is a necessary component of mitigation policy.

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ABSTRACT

We know that the costs of implementing various climate change mitigation policies are not uniformly distributed across individuals in society, but we do not know to what extent this unequal cost distribution influences public support for these various policies. This study shows that cost distribution is an important explanation for variations in public support for various climate policies. Using individual-level data on industry of employment and support for a range of climate policies, we find that those employed in the fossil fuel industry are less likely to support climate policies that are particularly costly to their industry, but are as likely as everybody else to support policies with lower costs to the industry. This finding challenges the traditional bifurcation between climate change "skeptics" and "acceptors." Furthermore, we find that opposition to renewable energy by large fossil fuel producers and consumers, identified in the political economy literature, is not uniformly found among these companies' employees. The most important implication of this study for policy makers is that support for climate policies is sensitive to the compensation of exposed groups and stimulation of alternative avenues for employment.

1. Economic interests and attitudes toward mitigation

To what extent do the costs and opportunities of different climate change mitigation measures affect policy support at the individual level? While there is close to full scientific consensus that emissions of greenhouse gases (GHGs) from human activities constitute a leading cause of climate change, and that such change represents a danger to human settlements, food production, and water supply (Battisti and Naylor, 2009), there is less political consensus on what types of policies and measures should be implemented to avoid its worst effects. Furthermore, which mitigation policies get implemented depends less on aggregate cost-benefit analyses than on patterns of organized interests and notably on whether costs and benefits of policies are concentrated or diffuse (Aklin and Urpelainen, 2013; Hughes and Urpelainen, 2015; Meckling et al., 2015). Consequently, understanding the socio-economic foundations of policy support and opposition is important both for explaining which mitigation policies get implemented and for formulating successful policies in the future.

We argue that support for and opposition to various mitigation policies depend on specific, individual economic interest linked to each policy, and that consequently support and opposition may vary across different types of mitigation policies. This study thus fills two gaps in the literature. First, we provide a detailed analysis of the potential gains and losses from specific mitigation policies or policy proposals from the point of view of individuals working in the fossil fuel sector. Second, we examine variation in attitudes toward these policies among sector employees and the public at large, finding variation in support and opposition levels according to the potential costs and benefits of each specific policy.

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Traditional economic models of climate change mitigation assume a high degree of economic rationality and a benevolent planner aiming to identify optimal solutions (Clarke et al., 2009; Kriegler et al., 2014). More recently, economic models have emerged that seek to integrate national diversity in policy strength and policy timing (Tavoni et al., 2015). These studies may be useful for identifying new, non-intuitive policy solutions or optima, but lack firm grounding in the complex empirical world of interest politics.

The distribution of costs and benefits among various interest groups matters because the likelihood of passage and successful implementation often depends on the relative configuration of winners and losers from a policy. For example, the policy that made Germany a world leader in wind energy was only partly motivated by a wish to mitigate GHG emissions. Rather, a coalition of farmers, skilled workers from a declining shipbuilding industry, and politicians from economically depressed regions promoted the sector (Michaelowa, 2005). Importantly, the wind industry's ability to produce new jobs helped it overcome the opposition caused by its high costs.

Looking at the issue of renewable energy promotion in reverse, Aklin and Urpelainen (2013) suggest that OECD governments are less likely to support cleaner forms of power production when fossil fuels dominate the electricity sector, due to the political clout of incumbent producers. Furthermore, beyond industrial structure, the form of political interest representation matters for which types of climate policy get implemented (Hughes and Urpelainen, 2015). The impact of economic interests on climate policy support and opposition can for example be seen from the fact that members of the US Congress vote on climate legislation in a way that is predictable based on their districts' carbon intensity (Cragg et al., 2012). Similarly, the likelihood of US local governments developing mitigation plans is found to correlate negatively with the degree to which fossil fuel extraction plays a role in local economic activity (Zahran et al., 2008).

Economic interests also influence public opinion related to climate change at the individual level. One study conducted in the US, Germany, France, and the UK shows that the carbon intensity of an individual's employment sector correlates negatively with individual support for participation in international climate cooperation (Bechtel et al., 2014). More generally, employment in oil and gas extraction in Norway has a negative effect on individuals' propensity to agree that climate change constitutes a threat (Tvinnereim and Austgulen, 2014). By contrast, a German study shows that individuals who display skepticism toward climate science are less likely to support renewable energy, but finds no association between employment type or unemployment and climate skepticism (Engels et al., 2013). Thus, there is evidence that distributive concerns influence attitudes toward climate policy, but these attitudes have so far been of a unidimensional kind, ranging from general opposition to general support.

The political economy literature suggests that different policy proposals should garner different levels of support according to their respective expected costs and benefits to specific groups. Notably, broad-based mitigation policies such as carbon taxes often produce concentrated costs to well-organized groups such as fossil fuel companies, while producing diffuse benefits to the population at large. As a consequence, Meckling et al. (2015) argue that policies that promote selected "green" industries with new sources of employment and future lobbying potential are more likely to succeed in the long run than more universal carbon taxes or caps. These results also imply a potential differentiation of public opinion whereby individuals tied to fossil fuel producers (e.g., the oil and gas industry) or consumers (e.g., coal-fired power plants) should oppose policies producing concentrated costs to their sector while supporting or showing indifference to policies with more diffuse costs to their industries.

A number of studies examine the public's willingness to support different climate policy proposals, yet no study has to our knowledge attempted to explain variation in support across policies with reference to economic interests. Policies evaluated in these surveys may range from renewable energy support via building energy efficiency to gasoline taxes (Krosnick and MacInnis, 2013); some studies also gauge the public's willingness to pay for various kinds of climate policy (Aldy et al., 2012; Kotchen et al., 2013). A clear tendency across this research is that proposals involving support for renewable energy garner more support than tax increases. Yet few studies exist that seek to explain variation across individuals for different types of proposals. Indeed, in some cases (e.g., Smith and Leiserowitz, 2014), the various policy proposals are combined in an index, underlining the fact that attention is concentrated on general rather than specific policy support.

The political economy of climate change mitigation implies that different types of policies should have different levels of support also at the individual level. Our present study asks specifically how individuals employed in the fossil fuel industry evaluate a set of mitigation policies with different effects on their economic interests in the form of employment prospects.

Distributional concerns have an additional potential for solving a problem in the study of public perceptions of climate change. Recent research casts climate change as a complex issue, in relation to which people tend to base their views on cues from their peer groups or from trusted sources such as selected political leaders (Kahan et al., 2012; Malka et al., 2009). Once established, this strain of studies find that motivated reasoning – by which "people routinely seek out and accept evidence that supports their existing views, while ignoring or discounting disconfirming evidence" (Whitmarsh, 2011) – makes the selected views more resilient. However, it remains unexplained where these group opinions and identities originate. Economic interests may play this role as a first mover.

Our study uses data from a nationally representative survey in a country where a substantial share of the working-age population has a direct interest in the fossil fuel industry—Norway. Here, about eight per cent of the workforce are employed in oil and gas production or closely related industries (Eika et al., 2010); others estimate up to 13% (Blomgren et al., 2015). The high fossil fuel share of total employment means that there will be enough respondents in this category in a national poll to produce statistically meaningful results – no oversampling of the sector is needed.

The IPCC divides policy instruments into economic instruments (taxes, tradable allowances, and subsidies), regulatory approaches, information programs, government provision of public goods and services, and voluntary actions (Somanathan et al., 2014 Table 15.2). Key sectors are energy, transport, buildings, industry, forestry/land use, and human settlements/infrastructure. Notable policies include subsidies for renewable energy (Blyth et al., 2009), cap-and-trade for electricity and heavy industry emissions (Tvinnereim, 2013), emission or fuel economy standards in transportation and buildings, and measures to protect tropical rainforests.

Our classification of policy proposals differs from the established literature as we discern between policies based on detailed analysis of their expected effects on people working in the fossil fuels industry. For example, limits on new oil and gas exploration is classified as negative for fossil fuel employment because fewer wells will be drilled. By contrast, support for geothermal energy may produce new employment opportunities for individuals and companies already specializing in drilling. An intermediate position may be occupied by cap-and-trade, which imposes a price on GHG emissions but which could be seen as more flexible for the oil and gas industry, given high abatement costs, than outright regulation or a high CO2 tax.

Rather than rejection across the board, we expect Norwegians employed in the oil and gas sector to exhibit a pattern of support for or opposition to climate policies that depends on the nature of the policy in question. Specifically, if the proposal is directly costly to individuals employed in the fossil fuels industry, then we expect this group to oppose the policy more than other groups in society do. If, however, the climate policy proposal does not place specific and direct costs on individuals with skills associated with fossil fuel extraction, we expect this group to support the policy as much as other groups in society support it. Finally, for policies that may produce new opportunities for employment, we expect similar or even higher support for the proposals among oil and gas employees compared to the population at large.

Our results display the expected pattern of policy support across seven different mitigation policy proposals for the energy sector. Notably, three policies which would impose significant constraints on activity in the oil and gas sector receive much less support among those employed in the sector. Conversely, four policies with more diffuse costs and potential benefits show insignificant differences in support between oil/gas employees and the rest of the Norwegian population. We therefore argue that future studies of the interest politics of climate change should not conceive policy support in unidimensional terms, but rather pay close attention to variation in the distributional consequences of different types of climate policies. Specifically, effects on employment – whether positive or negative – are likely to play a key role in the success or failure of mitigation policies.

The remainder of the paper is structured as follows: The next section details the seven mitigation policies evaluated in our survey. The subsequent section outlines our data and estimation procedure. Section four presents the results, whereas the final section concludes and draws implications for policy and future research.

2. Classification of mitigation policies by expected impacts on employment

Our study focuses on seven different mitigation measures that vary with respect to the costs they entail for the fossil fuel workforce. Three of the measures impose particularly high costs on the fossil fuel workforce, because they imply direct constraints on oil and gas production or new investments; three measures are low cost, because they involve support for emission reduction technology; while one final measure has an intermediate position.

2.1. High-cost policies

Reducing oil production Since most of Norwegian-produced fossil fuels are exported and burned elsewhere, their contribution to the national emission budget is limited. Nevertheless, meeting the internationally agreed two-degree target would involve leaving much of fossil fuels undeveloped, including some oil and gas (McGlade and Ekins, 2015; Meinshausen et al., 2009). One strategy that has been suggested in Norway is to decide not to develop a certain set of potential oil fields, thus reducing Norwegian oil and gas production. We ask respondents whether this is a climate policy tool they support.

Postponing Lofoten oil exploration The waters off the Lofoten archipelago in Northern Norway constitute a potential new area for oil and gas production. One proposal supported by several political parties would keep the area off limits for oil and gas exploration. The area harbors rich fisheries and great natural beauty and has great symbolic value for the environmental movement of Norway. Others see great potential employment and business opportunities from relatively accessible oil and gas fields, notably at a time of declining activity in the industry.

Tightening the exploration tax regime would imply stronger fiscal constraints on prospecting for new oil and gas fields. The combined tax on fossil fuel extraction in Norway is currently 78% of profits. In return, oil and gas companies are entitled to a refund of a corresponding percentage of their exploration costs from the Norwegian government, strongly incentivizing companies to look for new fields (most of the revenue from which will befall the state) but at the same time supporting risky ventures as failed exploration will cost companies limited amounts. Calls have therefore been made to tighten this tax regime so as to reduce government financial risk from exploration that yields either no result or results with costs too high to make them profitable in a world of carbon constraints and lower oil prices, producing stranded assets among so-called "unburnable" resources (McGlade and Ekins, 2015). A tightening by two percentage points was effected in 2013.[1]

2.2. Policy with ambiguous cost

Tighten emission ceiling Heavy industry installations in Norway are subject to the European Union Emission Trading Scheme (ETS), which caps the overall emissions of 14,000 facilities across Europe and covers almost half the EU's emissions. Companies receive or buy allowances to pollute, and may use these to cover their own annual emissions or sell them at a market price to others. The aggregate nature of the ETS cap means that companies able to reduce emissions at low cost (such as coal-fired power generators) may sell surplus allowances to companies facing a higher abatement cost (such as steel mills and oil/gas drilling).

While the EU ETS thus introduces a price on GHG emissions, it enables oil and gas producers to pay others to reduce emissions rather than demanding absolute cuts within the sector. Furthermore, the ETS has to some extent replaced a higher national Norwegian carbon dioxide (CO_2) tax on oil and gas drilling. Finally, a European CO_2 price favors lower-emitting gas-fired power plants over coal, increasing demand for North Sea gas. It would also favor fossil fuels extracted with low emissions from the production process, an advantage asserted by producers on the Norwegian continental shelf. For these reasons, and despite the overall CO_2 constraints, the Norwegian Oil Industry Association favors the EU ETS (Norwegian Oil Industry Association, 2014).

2.3. Low-cost policies/opportunities

Carbon capture and storage (CCS) involves capturing CO_2 from combustion processes and storing it underground for millennia. The technique has been considered to have great potential for reducing GHG concentrations in the atmosphere. Notably, CCS with biofuels constitutes an essential ingredient in models including negative emissions by the end of this century needed to reach the politically determined two-degree target for global warming (Kriegler et al., 2014). CCS is also one of the four areas where EU legislation has been passed to reach the union's 2020 climate and energy goals.[2] However, CCS project implementation has so far fallen short of projections (Scott et al., 2013). In Norway, a CCS project for the Mongstad refinery constituted a flagship climate policy initiative for the Stoltenberg coalition government (2005–13) but was canceled at the end of the cabinet's tenure amid cost overruns and political controversy around its effectiveness (Mildenberger, 2015).

CCS projects are typically developed by companies in the fossil

[1] Revised national budget for 2013, Norwegian Ministry of Finance, p. 10.

[2] http://ec.europa.eu/clima/policies/package/index_en.htm

fuel sector and thus offer business and employment opportunities for firms and individuals in the sector. CCS is a capital-intensive technology and political economy studies suggest that government support is needed beyond traditional carbon pricing to ensure development and deployment in sufficient volumes (Blyth et al., 2009; Torvanger and Meadowcroft, 2011). We therefore ask survey participants to voice their support for or opposition to public financing of such projects.

Offshore wind power includes electricity-producing turbines mounted on the sea floor and, at the developmental stage, floating turbines. While offshore wind plays an important role in the renewable energy expansion plans of countries such as Germany, the UK, and Denmark, Norway has seen little offshore wind because of cheap hydroelectric power and competition for personnel from the oil and gas industry. At the same time, offshore wind power requires many of the same types of technology and skill sets as those found in the offshore oil and gas extraction industry, and could thus be a future source of employment for those currently working in oil and gas.

Geothermal energy production exploits temperature differences between deep geological formations and the earth's surface to produce heat and electricity, often using fluids to transport the heat. Reservoir dynamics constitute a dual-use skill needed in both oil production and geothermal energy, and specialized drilling companies find applications in the exploitation of both types of energy (Midttømme et al., 2015). In Norwegian public debate, geothermal energy is often used as an example of how oil and gas technology may create a "green" energy transition.

3. Data and methods

3.1. Data

Our data were collected in the first three waves of the Norwegian Citizen Panel, in the fall of 2013 and in the spring and fall of 2014 (Ivarsflaten et al., 2014a, 2014b). The Norwegian Citizen Panel is an Internet panel based on random recruitment from the Norwegian population registry and owned by the University of Bergen. The sample is representative of the Norwegian population on most indicators as further discussed in the data documentation reports.[3] Since the study is conducted in Norway where a sizable share of the workforce is employed in the fossil fuel industry and since the sample size available for our study is large (N=6371), this study affords a rare opportunity to compare the policy preferences of the fossil fuel workforce to those of the rest of the population.

New respondents were recruited in the fall of 2013 and 2014. In 2013, 2866 respondents were recruited for this study, among whom 297 or 10.4% reported working in or closely with the oil and gas industry. In 2014, the respective numbers were 3124 and 381, or 10.9% oil/gas workers. The share of respondents working in or in close connection with the oil and gas sector is similar to that seen in the population at large (Blomgren et al., 2015; Eika et al., 2010). The two samples are relatively well-balanced and similar on key demographic variables such as age and gender, which makes us confident to pool respondents from the two recruitment waves.

Table 1 shows balance statistics for Waves 1 and 3 of the Norwegian Citizen Panel. Overall, young men are somewhat underrepresented, as are older women; by contrast, the share of middle-aged men is very close to that of the population at large while females in this age group are overrepresented (Skjervheim and Høgestøl, 2014). As might be expected, individuals with higher education levels are also overrepresented; the same holds for residents of the capital region. We use weights in the regression analysis to compensate for this observed bias. The weights are based on the relative distributions of age, education, gender, and region in the sample and in the population at large, and give weights above one for respondents belonging to underrepresented groups and lower than one for overrepresented groups.

Table 2 shows some key characteristics of the fossil fuel workforce in our sample. It shows that they are slightly younger than the population at large, with a median age group of 36–45 relative to 46–55 in the overall sample. The fossil fuel workforce is furthermore disproportionately male, with 26–28% women depending on category, against a balanced 49% in the overall sample. As regards education, the share of university or college educated respondents working directly in the oil and gas industry is similar to that of the population at large, whereas for those working indirectly with oil and gas it is somewhat lower. Finally, incomes were significantly higher in the oil industry than among the population at large, at 38% above the mean counting both direct and indirect employment; 46% above for direct oil/gas employment only.

In sum, the characteristics of the fossil fuel workforce in our sample squares well with what we know about Norwegians working in the industry: They are somewhat younger and have about the same or marginally less education than the population at large, while consisting of a significantly higher share of males and having considerably higher incomes than average.

3.2. Estimation

We use the following estimation equation:

$$Policy\_support_j = Oilwork + Age_{CAT} + Gender + Education_{CAT} + IncomeLOG + Region_{CAT} + Error$$

The constituent variables are as follows:

$Policy\_support_j$ is the set of dependent variables, representing the level of support for each of the seven mitigation measures detailed in Section 2 (see Appendix for question wording). All variables are standardized on a 0–1 scale.

Oilwork is the key explanatory variable. It equals one if the respondent reports working in the oil/gas industry, or in a business closely related to this industry (see Appendix for question wording). All others are coded as zero.

The following variables are included as controls:

Age_{CAT} consists of five dummy variables indicating age categories 26–35, 36–45, 46–55, 56–65, and 66 and above. Ages 18–25 constitute the reference category. The variable is based on the registry data from which the survey participants were sampled. In order to preserve the anonymity of the respondents, age is not made available in exact years.

Gender is one for female, zero for male, based on registry data.

$Education_{CAT}$ consists of three dummy variables indicating the following educational levels: High school, college/university, and no response. The reference category represents no education/primary school.

$Income_{LOG}$ is the natural logarithm of the respondent's self-reported annual income in Norwegian crowns (NOK).

$Region_{CAT}$ contains five dummy variables indicating the respondent's region, based on registry data. The values are East, South, West, Central, North; the Oslo area is the reference category.

In addition, for the questions about changes to the oil tax regime and the cap-and-trade system, dummy variables are introduced to control for slight variations in wording, see Appendix.

[3] The data documentation reports are available from the Norwegian Citizen Panel website, http://www.uib.no/en/citizen. Reports, codebooks and datasets can be downloaded from the Norwegian Social Science Data Services.

Table 1
Balance statistics for Norwegian Citizen Panel, waves 1 and 3.
Source: Skjervheim and Høgestøl (2014), Table 6.

		Population		Wave 1		Wave 3	
		Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)
No edu./elementary school	18–29 years	4.5	3.6	1.0	1.5	1.1	1.1
Upper secondary education		4.0	3.3	4.9	4.3	4.1	3.8
University/university college		1.9	3.0	2.7	3.7	2.6	3.9
No edu./elementary school	30–59 years	6.4	5.5	2.2	1.8	2.0	1.6
Upper secondary education		11.9	9.2	10.4	8.3	10.4	7.9
University/university college		8.4	10.7	15.8	18.7	14.5	20.3
No edu./elementary school	60 and above	3.4	5.2	2.2	2.7	2.5	2.8
Upper secondary education		6.2	7.0	4.4	3.2	4.4	3.2
University/university college		3.1	2.6	7.3	5.2	8.1	5.8

Education, age, and gender distributions are given for the population at large and for the new recruitment in each of the waves.

Table 2
Characteristics of survey sample and respondents employed in oil/gas sector.

	Oil worker: direct	Oil worker: indirect	Oil worker: all	Remaining sample	Full sample
Median age group	36–45	36–45	36–45	46–55	46–55
Share women	0.28	0.26	0.27	0.52	0.49
Share college/university degree	0.6	0.52	0.56	0.62	0.61
Average income (NOK '000)	337	299	318	221	231
Number of respondents	345	333	678	5693	6371

Medians and averages are taken from pooled results from respondents entered in the first and third waves of the Norwegian Citizen Panel, 2013–14.

The wording variation has no substantive effect on the results.

We use ordinary least squares (OLS) regression for the five dependent variables that have a bipolar response scale with seven categories ranging from “strongly positive” to “strongly negative.” The exception is the question about reducing oil production, where logistic regression is used because the variable has a binary outcome, see Model 3 in Table 3.

4. Results

To compare the fossil fuels workforce with the rest of the population when it comes to support for various climate policies, we run regression models with each of our selected policy support indicators as dependent variables, controlling for age, gender, education level, and logged income. Table 3 summarizes the results for the models using control variables. Overall, the tests support the policy-cost hypothesis. Specifically, the policies shown in Models 1-3, which imply concentrated costs for the oil and gas sector, display strong differences between the fossil fuels workforce and the rest of the population. Models 4-7, which represent policies imposing more diffuse costs or even opportunities, show insignificant differences. For carbon capture, the coefficient on the Oilwork variable even shows a positive sign, but the effect remains small and insignificant.

Fig. 1 provides a visualization of the main regression results, based on simulations of expected values with confidence intervals, setting the *Oilwork* variable at either zero or one, and keeping all other explanatory variables at their means. Again, the gaps between the two groups are particularly clear for the policies related to tightening the tax regime, postponing drilling in Lofoten and reducing oil production. Note also that respondents in the oil and gas sector oppose these policies on average (scores below 0.5) while the remainder of the population supports them (above 0.5). Finally, as in Table 3, CCS scores slightly higher among oil and gas employees than among the remaining population, but the difference is small and not statistically significant. This result likely relates to the fact that CCS promotion is the clearest case, among the seven presented here, of a mitigation measure that generates opportunities that fall more or less exclusively within the oil and gas sector.

In addition, a breakdown of the effect of direct oil/gas sector employment compared with employment closely related to the sector is given in Supplementary Table 1. As might be expected, direct oil/gas sector employment has a greater effect than less direct ties to the industry on individual views on mitigation policies. Still, both groups differ clearly from the remaining population when it comes to their views on policies that may harm employment prospects in the oil and gas sector, while showing no significant difference on the policies with potentially positive effects on future employment prospects. This is in line with our overall result that climate mitigation policies are evaluated to a large extent by individual economic interests and notably on their effects on employment.

5. Conclusions and policy implications

We have shown that employment sector influences specific preferences over climate change mitigation policy using a nationally representative sample. The findings have both theoretical and policy implications. First, and theoretically, we offer an explanation for variation in preferences across different types of climate policies, and suggest that taking into account the uneven distribution of costs of such policies is needed to explain variation in support across them. Factors that do not vary according to policy, such as cultural cognition or world views, are, we suggest, less important explanatory factors when seeking to explain such variation.

Second, our results show that support for climate change mitigation policies is not a unidimensional issue. Rather, levels of support for various policies depend on characteristics of the measures themselves, and notably on their potential to generate new economic activity and employment opportunities. This finding suggests that further scholarly work on support for climate

Table 3
Support for mitigation measures with concentrated or diffuse costs for oil/gas workforce.

	Oil tax regime	Lofoten drilling	Reduce oil prod (logit)	Tighten CO_2 cap	Offshore wind	Geothermal	CCS
Model no.	1	2	3	4	5	6	7
Work with oil/gas	−0.100***	−0.105***	−1.552**	−0.034	−0.013	−0.036	0.019
	(−4.578)	(−4.895)	(−2.871)	(−1.594)	(−0.368)	(−1.180)	(0.693)
Age: 26–35	0.031	0.004	−0.703	−0.039	−0.034	0.010	0.035
	(0.770)	(0.113)	(−1.146)	(−1.103)	(−0.615)	(0.172)	(1.047)
Age: 36–45	0.029	−0.011	−0.089	0.013	−0.002	0.054	0.031
	(0.761)	(−0.328)	(−0.147)	(0.442)	(−0.045)	(0.960)	(1.032)
Age: 46–55	0.005	−0.030	−0.026	0.029	−0.053	0.060	0.036
	(0.144)	(−0.906)	(−0.045)	(0.982)	(−1.043)	(1.072)	(1.192)
Age: 56–65	0.045	−0.001	0.021	0.035	−0.061	0.052	0.047
	(1.156)	(−0.016)	(0.034)	(1.140)	(−1.095)	(0.958)	(1.474)
Age: 66 and above	−0.011	0.001	0.218	0.056	−0.103	0.038	0.051
	(−0.175)	(0.015)	(0.224)	(1.457)	(−1.074)	(0.504)	(1.158)
Gender (F=1)	0.056***	0.091***	0.541*	0.065***	0.050	−0.060*	−0.032*
	(3.612)	(8.310)	(2.305)	(4.743)	(1.937)	(−2.551)	(−2.243)
Education: Upper secondary	−0.006	−0.019	0.559	0.004	0.043	−0.026	0.006
	(−0.212)	(−0.858)	(1.001)	(0.167)	(0.865)	(−0.754)	(0.228)
Education: University/college	0.066*	0.061**	1.101*	0.062*	0.028	0.015	0.026
	(2.379)	(2.831)	(2.067)	(2.513)	(0.625)	(0.462)	(1.067)
Education: No response	−0.006	0.000	0.867	0.007	0.048	−0.100	−0.009
	(−0.139)	(0.010)	(1.177)	(0.182)	(0.744)	(−1.726)	(−0.185)
$Income_{LOG}$	−0.005	−0.001	−0.006	−0.001	−0.001	−0.001	0.002
	(−1.390)	(−1.161)	(−0.124)	(−0.295)	(−0.554)	(−0.273)	(0.701)
Region: East	−0.045*	−0.014	−0.025	−0.037*	−0.005	−0.011	−0.025
	(−2.187)	(−0.910)	(−0.089)	(−2.043)	(−0.163)	(−0.394)	(−1.265)
Region: South	−0.040	−0.057*	−1.851**	−0.054	−0.154**	−0.085	−0.040
	(−0.986)	(−2.194)	(−2.870)	(−1.897)	(−2.602)	(−1.729)	(−1.243)
Region: West	−0.025	−0.053***	−0.091	−0.010	−0.049	−0.021	0.016
	(−1.234)	(−3.476)	(−0.317)	(−0.565)	(−1.562)	(−0.658)	(0.838)
Region: Central	−0.046	0.021	−0.021	−0.030	−0.084	−0.033	0.009
	(−1.661)	(0.854)	(−0.049)	(−1.300)	(−1.716)	(−0.851)	(0.394)
Region: North	−0.041	0.012	−0.846	−0.063	−0.071	−0.045	−0.057
	(−1.125)	(0.545)	(−1.404)	(−1.786)	(−1.432)	(−0.816)	(−1.793)
Oil tax wording	0.029						
	(1.946)						
Emission cap wording				-0.049***			
				(−3.880)			
Constant	0.517***	0.538***	−1.415	0.700***	0.745***	0.737***	0.523***
	(8.091)	(12.719)	(−1.551)	(13.556)	(11.439)	(11.677)	(9.419)
R-squared	0.081	0.064		0.086	0.059	0.057	0.024
N. of cases	1389	5190	513	1410	534	550	1396

Models 1-3 represent regression analyses of public support for mitigation policies that would bring specific costs to those currently employed in the Norwegian offshore oil and gas sector. Policies evaluated in Models 4-7 are more likely to bring more diffuse costs and may generate new employment in roles where experience from offshore oil/gas would be valuable. The models shown use ordinary least squares (OLS) regression on seven-point response scales, except Model 3, which has a binary outcome variable and uses logistic regression. We control for age, gender, education level, and logged income. Weights are used to compensate for observed bias in age, education, gender, and region. T-statistics in parentheses (z-scores for Model 3). Dummy variables to control for minor wording variations are included in two cases, see Appendix for details. These variations are described in Tvinnereim and Steinshamn (2016) but do not affect the substantive results of the present study. Significance levels:

*** $p < 0.001$.
** $p < 0.01$.
* $p < 0.05$.

policy needs to pay closer attention to the specifics of proposed policies and of the distribution of costs that they entail in given institutional contexts. That is, political economy needs to be integrated into the study of public opinion on climate change mitigation. Besides fossil fuel employment, suitable explanatory variables could be work in sectors such as transport or heavy manufacturing, or individual consumption patterns such as daily commuting distance by car. Conversely, individual employment in renewable energy could be used in future studies to explain heightened support for policies such as feed-in tariffs or other types of subsidies.

Our results depart from the previous findings of Hughes and Urpelainen (2015) and Meckling et al. (2015) in one important respect. We find that support for renewables is as high within the fossil fuel industry as elsewhere in society, not lower as would have been implied by their findings. The diverging results are likely due to this study′s examination of the individuals working within the fossil fuel-intensive sectors, rather than of organized business interests. This potential discrepancy found between the business and employee level should be followed up in new studies that directly compare the two.

The sectoral result from our research suggests that mitigation policies in countries with a substantial fossil fuel sector are unlikely to succeed if they are seen to reduce employment. The most important policy implication is that policy makers may benefit from emphasizing opportunities for individuals rather than new developments within the framework of fossil fuel extraction and companies involved in such extraction. Both offshore wind and geothermal energy represent alternative career paths as well as new sources of income for fossil fuel companies, whereas CCS may have the unintended consequence of strengthening the bargaining power of the fossil fuels sector and thus potentially postponing the energy system transition implied by the two-degree target.

New employment may not need to be limited to the energy sector, however. Michaelowa (2005) cited above showed how shipbuilders joined the energy sector by starting to build wind turbines; a

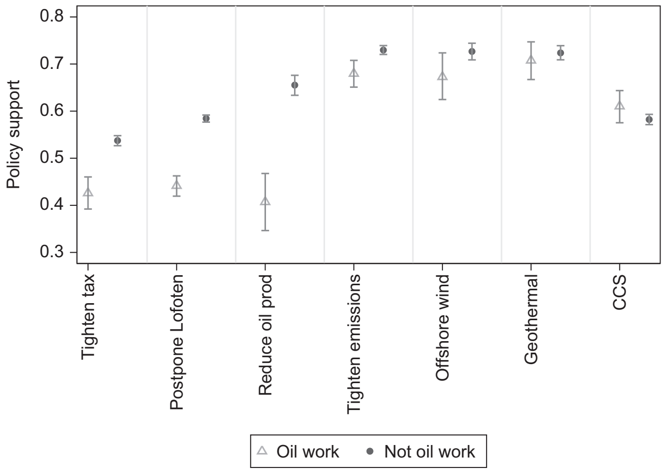

Fig. 1. Simulated support levels for mitigation measures over employment sector. The figure shows simulated support levels based on the regression models detailed shown in Table 3. For each model, 1000 simulations have been run using the Clarify software (Tomz et al., 2003), representing unweighted results. Aside from the *Oilwork* variable, which takes values of zero or one, all explanatory variables have been held at their means.

reverse direction, for example from fossil energy to toward low-emission shipping, is also imaginable for current oil and gas workers skilled in maritime construction. One possible extrapolation of the main result of this article is that those employed in fossil fuel extraction are as favorably inclined to energy-related mitigation as everybody else as long as alternative areas in which to gainfully employ their skills can be found. Or, stated less positively, individuals working in fossil fuel-intensive sectors are likely to resist climate mitigation policies if the prospects of alternative employment are weak, making a successful transition unlikely without significant employment growth outside fossil fuels.

Data deposition

Replication data and code are available at the Harvard Dataverse Network (Publication no. doi/10.7910/DVN/ECCJOB). The full data set is also available from the Norwegian Social Science Data Services (NSD): http://www.nsd.uib.no/nsddata/serier/norsk_medborgerpanel.html.

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Appendix : Full question text

1. Battery questions, common introduction

We would now like to ask your opinion on certain measures that have been proposed to reduce climate change. Many experts believe that the measures mentioned below will work. However, there may be disagreement on whether these are good measures to implement. How positive or negative are you towards the measures mentioned here?

Common response scale for these battery questions:

Very positive - Positive - Somewhat positive - Neither positive nor negative - Somewhat negative - Negative - Very negative

1.1 Oil tax regime (variables w01_km13_5 and w01_km13_6)

a. Reduce tax incentives for oilfield exploration.

b. Tighten tax rules for oilfield exploration.

1.2 Tighten CO_2 cap (variables w01_km13_1 and w01_km13_2)

a. Tighten the rules for how much CO_2 industry in Norway and Europe may emit.

b. Tighten the rules for how much CO_2 industry in Norway and Europe may emit, by cutting the total number of permits that these may use.

1.3 CCS (w01_km13_3 and w01_km13_4)

a. Increase the effort to capture and store CO_2 under the seabed or the Earth's surface.

b. Increase the effort to capture and store CO_2 under the seabed or the Earth's surface, as done for example in the so-called "moon landing" project at [the] Mongstad [refinery in Western Norway].

The wording difference has no effect on responses (see Tvinnereim and Steinshamn, 2016); hence no dummy variable has been included in regressions.

1.4 Offshore wind (w03_r3km37_2)

Increased government support for developing wind power at sea (offshore wind power).

1.5 Geothermal (w03_r3km37_4)

Increased government support for developing geothermal energy where one drills down to the high temperatures under the Earth's surface.

1.6 Biomass (w03_r3km37_3)

Increased government support for building biofuel facilities (for example firewood, pellets, and biogas).

2. Questions without the common battery introduction

2.1 Lofoten drilling (w03_r3dvh_1)

To what extent do you agree or disagree with the following statements:

– We should not allow oil and gas extraction in the area around Lofoten and Vesterålen.

Response options: Strongly agree – Agree – Somewhat agree – Neither agree nor disagree – Somewhat disagree – Disagree – Strongly disagree.

2.2 Reduce oil production (w02_km213a and w02_km213b)

Should Norway, in your opinion, reduce, maintain or increase its oil production in a climate perspective?

Response options: Reduce, Maintain, Increase.

Coded so that Reduce = 1; Maintain = 0; Increase = 0.

3. Work in oil/gas sector (w01_k24 and w03_r3k24)

Is your workplace in the oil and gas sector, or closely related to it?

Response options:

1. Yes, I work in the oil and gas sector
2. Yes, my work is closely related to the oil and gas sector
3. No

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.enpol.2016.05.052.

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