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Entrenched emitters

The relationship between industry emissions, economic risk and carbon tax opinion

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Contents

Summary / Abstract

The issue of climate change is growing in saliency, but public support for effective mitigation policies is in short supply. This thesis investigates the relationship between industry emissions and employees' demand for carbon taxes. Three contributions are made to the literature: First, using a novel operationalisation of industry emissions assigned to individual employees, I identify a robust negative effect of higher emissions on carbon tax support. Second: Higher emissions have a negative effect on the support for renewable energy subsidies. These two findings suggest that climate policy preferences in high-emission workforces are aligned with the economic concerns of their employers. This alignment with business interests is termed the entrenched emitter effect. Third: I present three distinct mechanisms that can plausibly produce this effect, and find that economic risk is an unlikely driver.

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1. Introduction

1.1 Background

Climate change has become a more salient issue in recent years; European publics now perceive it as the dominating threat to the world and their own country (Fleming 2020; EU Commission 2021). International efforts to mitigate climate change, most prominently the Paris Agreement, has led signatory countries to commit to «ambitious efforts» for limiting climate change to well below 2°C of warming (UNFCCC 2015, article 3). Despite cross-border agreements, climate change is a major policy challenge, even in Europe, which is seen as a climate leader (Parker and Karlsson 2016).

While climate change is a global challenge, its solutions often take the form of domestic policies (Keohane 2015). Between-country variation in emission reductions can be partly ascribed to the policies that result from different institutional systems – systems which produce different frameworks for involving organised interests (Mildenberger 2020). In absence of a sufficiently strong central authority that can enforce solutions, climate change poses a wicked problem of policy design (Levin et al. 2012). This wicked problem manifests itself in several ways, but I will focus on two key areas.

First, business concerns about the effects on economic competitiveness has altered the politics of climate change (Victor and Cullenward 2020). Meeting these concerns with an appropriate policy response is crucial, as climate reforms are to no use if they are stripped of their most efficient aspects. Organised and sectoral interests have real and significant influence on policy (Victor 2011, Mildenberger 2020); both capital and labour shape the policy outputs, through the lobbying of business associations and trade unions (Mildenberger 2020).

Many economists point to carbon pricing as the most effective policy solution, but in its current form, low prices and exemptions for the most carbon-intensive sectors are severe caveats to the potential emission cuts that can result from putting a price on carbon emissions. Both carbon markets and direct carbon taxation are carbon pricing policies, and they both suffer from low prices and low sectoral coverage (Victor and Cullenward 2020). Because carbon pricing can have «significant impacts on income distribution and firm competitiveness» (Acosta 2015), organised interests are usually apprehensive about the adverse economic effects the policies introduce. This apprehensiveness has real consequences for the state of climate policies: business opposition has contributed to both lower coverage of carbon pricing policies and lower effective carbon prices (Acosta 2015; Mildenberger 2020).

Second, policy instrument preferences vary with contextual, cultural and material factors (Drews and van den Bergh 2015), and public preferences in many cases do not overlap with those of powerful organised interests; for example, voters prefer policy that target costs at industry over individuals. Little research has been devoted to the alignment between industry interests and individual policy demand; a recent working paper cites «paycheck preferences» as a motivation for high-emission workers to oppose climate action (Gard-Murray 2019). This thesis contributes to filling this void by focusing on how public support for carbon taxes is amenable to industry concerns that align with the high-emitting segment of the workforce. The thesis further introduces the concept of economic risk to test whether high-emitting workers are motivated by unemployment and paycheck concerns. This is done by fusing two strands of literature: Corporate climate policy opposition and economic determinants of individual policy opposition. This thesis answers the following research question:

What is the effect of high-emission employment and economic risk on carbon tax preferences?

1.2 Aims of this thesis

Carbon taxes introduce externalities that mimic unfavourable market dynamics, with adverse effects on profits and employment. In a booming economy, consumer demand rises, and companies' revenues rise with it, enabling them to expand the workforce (Pearce and Michael 2006). When tides turn, recessions drive up unemployment rates, and businesses must operate with increased competition for market supply (ibid). This can produce distress in the workforce, and consequently, firms with high emissions may facilitate opposition to such policies among their employees.

How carbon-intensive businesses influence the climate opinion of their workforce is not widely examined in the literature: the few studies that exist either study the effects on international climate treaty support (Bechtel, Genovese and Scheve 2017); or how spatial proximity to mining and fossil fuel extraction drive policy opposition (Kono 2019); or they have a narrow focus on fossil fuel workers only (Tvinnereim and Ivarsflaten 2016); or do not test assumptions about driving forces and operationalisations (Gard-Murray 2019). The first aim of this thesis is to close this research gap, by testing the effect of emissions on carbon tax support, and introducing three distinct mechanisms that may shape individual demand for climate action.

Carbon taxes do not inflict severe economic harm to polluting companies; research indicates that they are largely passed on to customers further down the supply chain (Arlinghaus 2015), and individuals in high-emitting industries should have little to fear from fossil fuel tax raises. I find that they still display significant skepticism towards economic climate policy instruments, notably without being less critical of climate policy regulations or less worried about climate change.

The second aim of this thesis concerns the ranking of pollutive industries and their expected effects on workforce opinion; the most emission intensive sectors are not necessarily the largest pollutive sectors. My findings indicate that the common practice of ranking industries by their emission intensity in search of their effects on climate policy opinion produces counterintuitive results. Assuming there is an effect of emissions on policy preferences, one would expect employees in emission-intensive sectors to be more skeptical of costly climate reforms. This is not the case. Ranking industries based on their absolute emissions, on the other hand, does give the expected results. The specific conceptualisation of emissions that is used in future research should incorporate this.

Third, this thesis aims to expose three distinct mechanisms of belief formation that can be applied to the emission effect. Earlier studies on how sectoral emissions shape individual opinion do not go far in trying to explain why. I present three distinct models of opinion formation: (i) economic self-interest, measured as concern for wages and unemployment risk; (ii) norm diffusion within enterprises; and (iii) occupational task structures that entrench reaction patterns to problem-solving, which shape preferences for solving policy problems. The scant availability of statistical data makes it impossible to test the two latter models empirically within the scope of this thesis; the variables just do not exist. But my results indicate that carbon tax opposition flows not from economic risk of unemployment or wage cuts, as has been proposed before (Gard-Murray 2019). Instead, these findings suggest that the two other explanatory mechanisms are more plausible.

1.3 Research design and hypotheses

To identify a relationship between these economic interests of individuals and their carbon tax preferences, I merge data on industrial emissions and occupational unemployment rates from Eurostat with observational data from the European Social Survey round 8 (ESS 8). This produces fine-grained measures of industry emissions and unemployment rates that are assigned to respondents from 21 countries in ESS 8 based on the industry and occupation they work in. Absolute emission statistics in tons of GHG equivalents are then computed as the share of industrial emissions within each country, meaning that the sum of available emission data will equal 100 within each country. Then, another dataset on emission intensity is assigned to respondents in the same way. I compare the codings empirically: first in the descriptive analysis, where several national cases are investigated. By juxtaposing industries with high emission intensity and high emissions in absolute numbers, it is shown that ranking industries by their total emissions contributions instead of intensity is a more logical metric.

Then I run linear multilevel models to test for effects of industry emissions on carbon tax opinion, to test four hypotheses. The first two investigate the effects of emissions directly:

H1: Industry emissions are negatively associated with individual carbon tax support.
H2: Higher emission percentages is a stronger predictor of carbon tax opposition than emission intensity.

The multilevel models show that emission intensity is not a significant predictor of carbon tax opposition, while the emission percent coding is. After standardisation, the emissions effect is similar in size as the effect of age. This indicates that emissions can substantially shape policy preferences: it is the notion of 'clean' and 'dirty' sectors that influence individual opinion on this policy instrument. Next, I test whether economic risk reinforces the emission effect.

H3: Individuals with higher risk exposure in industries with higher emissions will be more skeptical of carbon taxes than other climate policies.

This hypothesis is tested by including interaction effects of (i) latent unemployment risk and (ii) self-reported economic anxiety on carbon tax support. I find that economic risk, proxied as unemployment rates, does not have a statistically significant interaction effect on support for these climate policies. Economic anxiety is moderately significant, but sensitive to model specifications and variable parametrisation, and the proposed explanation for the emissions effect – economic self-interest – is deemed to be unconvincing. To my knowledge, these statistical relationships have not been scrutinised in academic literature before. At last, I test whether emissions affect climate worry and other climate policies.

H4: Higher risk exposure in industries with higher emissions will be more strongly negatively associated with support for carbon taxes than climate worry and other climate policies.

I run a new set of models to estimate the effects on different climate policies. I find that support for the two economic climate policy instruments, namely carbon taxes and subsidies for renewables, falls significantly with higher industry emissions. This suggests that emissions produce a policy block on two different places in a pipeline: not only do polluting companies drive employee opposition towards the payment of carbon taxes that hurt their profit margins, but the effect is equally strong for opposition to renewables.

1.4 Outline

This thesis will proceed as follows. In chapter two, the scientific basis for the effectiveness of carbon taxes is presented first, followed by an overview of the research on economic determinants for carbon tax support. From this, I draw several hypotheses on the links between certain economic drivers and carbon tax support. In chapter three, data and methods are presented, and I provide a summary of variable operationalisations. In chapter four, the analysis begins with the essential descriptive section, which compares two conceptualisations of industry emissions; this will shed light on how the the emission intensity and the emission percent codings can influence climate policy support and climate change worry. Following this, the hypotheses are tested with three sets of multilevel regression models. Then I present the political and scientific implications of these findings. At last I conclude and summarise in chapter five.

2. Carbon taxes and economic interests

Climate policy instruments can take several forms. Economic policies that incur higher production and emission costs on fossil fuels, commonly in the form of taxes, levies or emission permits, are the spearhead of European governments' attempts to curb emissions. A less intrusive alternative is to replace low-cost, high-emitting energy sources and carriers with renewables via subsidies. These subsidies can be used to level price differences and make clean energy cost-competitive. Another option for replacing energy-intensive or polluting technology is to regulate their use directly through pollution control standards (Carter 2007, 323). Of these three instruments: carbon pricing, subsidies and regulation, pricing carbon is the most effective (Hsu 2012; Haites et al. 2018; Mideksa 2021). But in recent years, carbon pricing has been as popular among economists as it is unpopular among publics (see e.g. Rabe and Borick 2012; Nordhaus 2019; Rabe 2018; Umit and Schaffer 2020). In the following section, I attempt to answer two questions: What is carbon pricing, and under which circumstances is it effective?

2.1 Carbon pricing: Cost and coverage

Carbon pricing is one of the primary instruments for curbing emissions and mitigating climate change. It is a market-based tool for adding the social cost of GHGs to their emission, either through direct taxes/fees, or via cap-and-trade mechanisms that delegate allowances to emitting companies (Nordhaus 2019). In short, putting a price on carbon is an attempt at correcting a market failure. The relative price of carbon can, alternatively or simultaneously, be offset with rewarding measures including subsidies for renewables (Davidovic and Harring 2020).

We are a long way off from implementing market-based solutions to climate change mitigation that reduce emissions sufficiently. A «reasonably ambitious carbon price» would be $40 per ton of CO2-equivalent (Cullenward and Victor 2020, 2). Almost 1 percent of global jurisdictions has priced carbon at this level, which is still a weak attempt at mitigating severe effects of climate change. The price would need to rise considerably and cover all jurisdictions in three decades – limiting warming to 2°C requires a carbon price between USD 50-450/ton in 2050 (Stiglitz et al. 2017, 33).

The Nordic countries are among the few states that have implemented carbon pricing systems that enforce meaningful emissions reductions. Finland implemented the world's first direct carbon tax in

1990. Norway and Sweden followed in 1991, Denmark did so in 1992 (OECD 2017), and support for taxing fossil fuels is, coincidentally, strongest in the Nordics (Poortinga et al. 2018). Direct carbon taxes have been passed in 15 countries (OECD), while broader carbon pricing initiatives, such as the EU Emission Trading System (ETS), cover 21.5 % of global emissions in 45 countries (World Bank 2021).

Carbon pricing measures do not impact all emissions and industries equally. In the European context, the EU ETS – the main mechanism for carbon pricing in the EU, which includes all 31 countries of the European Economic Area – only covers about 40 percent of the EU's emissions (European Commission 2018, 12).

Globally, 85 percent of emissions are not covered by a carbon price, and effective prices can be as low as USD 1/ton (Stiglitz et al. 2017). The effective price of carbon emissions is dependent on three sets of tax rates: environmental taxes, energy taxes, and emission allowances under the EU ETS (OECD). Effective carbon tax rates vary between countries and between sectors, with tax exemptions for some key carbon-intensive sectors (EU Commission 2020). A 2019 OECD report estimated ETS allowance prices to be EUR 25/ton, but sectoral coverage is low; since the Paris Agreement was signed in 2015, in only three European countries (Denmark, the Netherlands and Switzerland) did the average effective carbon tax rates, outside road transport, increase more than EUR 10 per metric ton of CO2 (OECD 2019). The high allowance ceiling in the EU ETS has received criticism for undermining the carbon pricing effect (Green 2021); emission reductions are small due to exemptions and low effective prices, which rise at a glacial pace.

2.2 Carbon pricing: Effects and opposition

For carbon pricing to result in necessary emission cuts, public support is essential. Theoretically, there are two significant reasons for supporting carbon taxes: environmental effectiveness (Aldy & Stavins 2012) and economic efficiency (Fujiwara et al. 2006). But causal effects estimates of their performance are few (Sterner 2015), and a recent meta-review indicates that the *ex-post* performance of carbon taxes is limited, though the author notes that carbon taxes have a stronger effect than emissions trading (Green 2021). Case studies on the *ex-post* performance indicate that carbon taxes produce substantial emissions cuts. A recent study estimates the causal effect of carbon taxes on carbon reductions in the Finnish transport sector (Mideksa 2021). In the period 1990–2005, emission reductions compared with the counterfactual was 31 percent. The study does not examine the effect of emissions trading; the sample period is limited to stop in 2005, when the EU ETS was introduced (ibid, 4).

Can the result from Finland's transportation sector be generalised to the whole economy? It is difficult to construct natural randomisation trials, so whether the causality holds in other sectors depends on how these sectors are taxed. Counterfactual estimates for Norway estimated that the 1991 implementation of a carbon tax caused cumulative emissions in the period 1991–2005 to be 55 Mt less than if the tax had not been introduced (Kallbekken and Mideksa 2012). This cumulative amount over a 15-year period is roughly amounting to the yearly emissions of the country: 110% of Norway's emissions for the single year 2020 (Statistisk sentralbyrå 2020), or 98 percent of Norway's emissions in 1999 (Bruvoll and Larsen 2004). A contrasting finding, combining decomposition and applied general equilibrium methods, estimates that the carbon tax only contributed to a 2 percent reduction in emissions from its implementation until 1999 (Bruvoll and Larsen 2004). Increased energy efficiency and a relative decoupling of emissions from growth was held to be more important explanations for the drop – the latter is a process that is partially driven by higher carbon prices, but also happens naturally over time, pushed by technological development (ibid). The low coverage of the carbon tax may be to blame as well; pivotal sectors were exempt or taxed at a lower rate, even though a uniform tax would drive more cost-effective mitigation (Aldy and Stavins 2012).

While these results are promising, carbon pricing has received critique for its incrementalism, incapable of delivering sufficient emissions reductions (Green 2021; Tvinnereim and Mehling 2018). Still, as part of a policy package, carbon taxation may be the single most important instrument for mitigating climate change. This is an important reason for the well of studies on how public policy preferences are shaped by various factors. Opposition can be sourced from two groups with distinct interests: individuals and business. Before outlining the theory that connects high-emitting individuals to carbon tax opposition, I turn to polluting industry, as business interests are aligned with – and may shape – the opinions of the high-emitting workforce.

2.2.1 Industry opposition

«[T]he influence of strong and organised lobby groups from industries resulted in governments postponing or abandoning the implementation of carbon taxes» (Acosta 2015).

One of the largest obstacles to meaningful climate reform is corporate opposition to various climate policies. The lobby power of Big Oil is vast – the five largest publicly-traded oil and gas companies has spent more than USD 1 billion on lobbying since the Paris Agreement was signed (InfluenceMap 2019) – and corporate displays of support for climate policy are either strategic concessions (Meckling 2015) or motivated by the possibility of gaining a competitive advantage (Vormedal, Gulbrandsen and Skjærseth 2020).

Companies in high-emission industries oppose and shape climate policies (Markussen and Svendsen 2005; Kim, Urpelainen and Yang 2015). Expected winners (renewable energy companies) lobby more individually than losers (coal users), who utilise trade associations and larger lobby networks (Kim, Urpelainen and Yang 2015). Opposition is substantial in certain industries and sectors, which «clearly» have strong interests and are able to influence tax proposals (Kallbekken and Sælen 2011). In states where the clean technology industries are strong, «targeted industrial policies» are implemented; similarly, weak energy intensive industries promote environmental policies (Hughes and Urpelainen, 2015).

Business influences policy, and policy influences business. A useful framework for understanding this relationship has been constructed by Nina Kelsey. Faced with climate policies, there are four broad categories of affected companies: 'winners', 'losers', 'convertible industries' and 'resource managers', according to Nina Kelsey et al. (2018). Renewable energy companies are winners; they see only gains from more ambitious climate policies, whether they take the form of regulations, nudges, subsidies or carbon taxes. Extractive industries and production processes that are very hard to decarbonise are losers; coal mining have limited options for being profitable in a world that meets the 1.5 °C target in the Paris agreement, and cement production require expensive carbon capture and sequestration (CCS) technology to become cleaner.

While certain high-emitting sectors can cut their emissions substantially, mitigating emissions is costly. Industries such as coal-fired electricity generators can be replaced with renewable power sources, but sunk costs in infrastructure and facilities constitute a barrier. Similarly, there may be potential for emissions reductions from manufacturing plants if they are retrofitted with low-carbon technology, but earlier investments may be an obstacle. Some major emitting industries, especially petrochemicals, steel and cement, have less potential for decarbonising because the chemical reactions in the production processes is technologically dependent on carbon dioxide, in contrast to energy production, which is only economically dependent. The production processes and facilities involved in making petrochemicals, steel and concrete – blast furnaces for making iron, steam crackers separating petrochemicals, and calcination reactions producing clinker for cement – either require extreme heat, which is costly without fossil fuels, or involve chemical reactions that generate carbon dioxide as a by-product (IEA 2020). These companies are set to lose out when fossil fuels are phased out of European energy systems.

Taxes that target specific industries can introduce external economic pressure. Specifically, high carbon tax rates affect carbon-intensive companies and industries. These industries may compete against more advantaged industries that receive renewable energy subsidies to make them more competitive. Alternatively, they may compete for customers with limited purchasing power – a scarce resource that is further limited when taxes are passed on to consumers and increase prices.

2.2.2 Individual opposition

Business interests can influence climate policy outside the lobbying arena. In this section, I will provide an overview of how individual economic interests can shape opposition. Individual citizens have voting power, and many are motivated by financial concerns, both for themselves, and the economy and unemployment at large (Shwom et al. 2010). Therefore, the perceived costs of carbon taxes can be an obstacle to raising the tax rates to the levels necessary for substantial GHG reductions, because individual workers may perceive that carbon taxation on their company will affect themselves through the ebbs and flows of the market.

Political distrust is a central theme in much of the recent scholarship that investigates the financial fallout of carbon taxation. The public can be skeptical of how carbon tax revenue is used; paying a tax to the government coffers involves an uncertainty about whether the proceeds are spent on projects that the tax payer prefers (Heres, Kallbekken and Galarraga 2017). Public skepticism aimed at how the government handles carbon tax revenue can explain some of this distrust. Political trust and political efficacy – beliefs about government responsiveness to public demands – can positively influence carbon tax support (Umit and Schaffer 2020). Under experimental conditions, public willingness to pay environmental taxes is increased when revenue neutrality is proposed (Fairbrother 2017). When the tax burden is offset through other tax cuts, support rises sharply, and this relationship is moderated by political distrust. These distrust problems are not present in the case of subsidies instead of carbon taxes. While subsidies for renewables have diffuse costs split over the tax bill, earlier studies indicate that voters are not concerned about how subsidies are paid for (Kallbekken and Aasen 2010). A Norwegian study indicates that when the expected costs of climate policies rise, support falls among employees in the Norwegian oil and gas sector, who are more opposed to climate policies that directly affect their industry (Tvinnereim and Ivarsflaten 2016). But for policies that do not target their industry – e.g. subsidies – there is no difference in the preferences of workers in the petroleum sector and the rest of the population (ibid). These results are explained to be a consequence of policies' impact on employment prospects and individual economic interests (2016, 365, 368). There are contrasting findings on whether societal or individual costs are the strongest predictors of policy support. Research by Kallbekken and Sælen indicates that individuals are not particularly dissuaded by fuel tax costs on personal consumption (2010), but research from Germany indicates that individual preferences are stronger concerns (Beiser-McGrath and Bernauer 2020). In sum, the cost-distribution of carbon taxes and how governments use the tax revenue seem to be primary reasons for skepticism about taxation on the individual level.

Individual support can be shaped by country-level factors. Recent studies indicate that there is a weak correlation between country-level carbon intensity and policy support (Hao, Liu and Michaels 2020), but no effect of per capita emissions (Pohjolainen et. al 2021). One four-country study suggests that individual support for carbon taxes is lower in countries with high economic dependency on petroleum production (Harring, Jagers and Matti 2019). Specifically, support was lower when carbon pricing targeted consumers than if it was directed at industry, and the highest when it targeted fossil fuel production (ibid). High emissions drive a feedback loop: Countries that are dependent on high-carbon sectors will have greater difficulties cutting production and accelerating the transition to low-carbon energy. It is not particularly striking that climate action is less favourable where there is economic dependence on a fossil economy.

In research on international climate politics, emission intensity on the sectoral level has been shown to negatively influence support for climate agreements (Bechtel, Genovese, and Scheve 2017); in addition, trade openness exacerbates this effect (Genovese 2019). Despite focusing on international competition concerns rather than domestic carbon pricing schemes, these two studies point towards two salient explanations: the costs of mitigation and social norms. If the climate policy opinion of firms disperse through the organisations, this effect may also be present when it concerns domestic climate policies.

2.3 Hypotheses

There is a considerable literature on the determinants of carbon tax support. Employees in high-emitting sectors – termed 'high-emitters' throughout this thesis – may be swayed by pocketbook concerns, and diffusion of values in the workplace. To my knowledge, the effect of sectoral divides on carbon tax support has not been subjected to academic investigation beyond a few studies: one is constrained to a binary: the Norwegian petroleum industry versus the rest of the population (Tvinnereim and Ivarsflaten 2016), and the other is a working paper (Gard-Murray 2019). The latter, unpublished work resembles this thesis most closely; however, methods, data and operationalisations are different. I further contribute to this research field by modelling the effects of other variables that are conceptually linked: economic anxiety and economic risk. In this section, I will discuss how the economic interests of high-emitting industries and companies can have ripple effects on individual support for fossil fuel taxes, and propose four hypotheses.

2.3.1 Self-interest

Carbon taxes are meant to raise the price of carbon emissions. In a bid to protect their competitiveness and profit margins, enterprises with severe emissions may choose to alleviate the tax burden by exacerbating employees' job conditions; this can apply downward pressure on wages, lead to termination of contracts, or worsen work conditions. If producers don't succeed in passing on a substantial share of the carbon tax bill to consumers through higher prices, they may cut their losses internally, with repercussions for salaries and benefits. This is the general assumption about how carbon taxes can drive opposition among high-emitters; whether wages are actually affected in a significant manner is a separate empirical question, which is addressed in a few existing studies. According to a review by Arlinghaus (2015), «carbon taxes have no significant effects on firms' competitiveness», and in practice, companies are shielded from the full cost of carbon taxes by passing on cost increases to consumers. This ability to pass on a large share of the costs – the high pass-through rates – is not entirely conditional on the decisions of individual companies; the supply and demand elasticities of goods and services play a bigger part (Metcalf et al. 2008). Despite high pass-through rates, employees in vulnerable industries may fear that they end up bearing the cost of carbon taxes.

Through the vested economic interests of carbon intensive businesses, policy opposition can flow to their employees. High-emission workers – especially those on precarious contracts or who experience economic insecurity – may believe that carbon taxes expose them to economic insecurity. According to this logic, opposition to carbon taxes is a result of material interests that link policy support and the occupational vulnerability they are perceived to incur, by exacerbating economic anxiety. This economic interest/risk mechanism has been proposed in earlier research that resembles this thesis (Tvinnereim and Ivarsflaten 2016; Gard-Murray 2019).

2.3.2 Diffusion effects

Industry concerns can shape individual policy preferences beyond aligned economic interests. In addition to the financial impact workers believe that carbon taxes have on their pocketbooks, workplace norms can influence the values of employees, including their political opinions. Isomorphic processes can bring employees to learn and adapt values from the organisation they work for, and enhances similarities between organisations within the same field or the same country (DiMaggio and Powell 1983). According to institutional isomorphism theory, employees in polluting industries will have economic motivations that prevail over environmental ones, despite not being at risk of economic insecurity. This logic has been employed to explain how industry emphasis on energy security can displace environmental concern among employees in distinct occupational groups (Sovacool et al. 2012). The management class in an organisation can have political opinions, and these opinions can spread throughout the organisation, where individuals affect each other via social networks.

Political behaviour can be strongly affected by employer opinion. In the American context, employees have been shown to donate three times more to political candidates supported by their CEO than others – and employees who donate to other candidates have a higher likelihood of leaving (Babenko, Fedaseyeu and Zhang 2020). Donating money to employer-picked candidates is a robust display of political support that is aligned with management and shareholders. This suggests that there can be a top-down diffusion of political opinion; employees with beliefs at odds with higher management are less able to influence others, and their politics will be marginalised. This effect is not a consequence of hiring employees who are already politically aligned, and it is maintained through CEO turnovers; changes in the preferences of CEOs also change employee donating behaviour (ibid 2020). Research by Ansolabehere, de Figuereido and Snyder (2003) suggest that the workforce «may be a large source of firms' political influence» (Babenko, Fedaseyeu and Zhang 2020).

When employees align their views with their employer, there can certainly be an element of cognitive dissonance; wage differences will likely produce contrasting demands for redistribution, for example. Motivated reasoning for resolving cognitive dissonance is a common psychological explanation for the discrepancy between climate change opinion and climate policy demand. Stated in another way, those who are worried about climate change should be more supportive of solutions that limit global warming. The cultural cognition thesis explain why this relationship does not always hold: the perception of risk is not only based on the acknowledgement of the existence of risk – it is rather consistent with the group values that individuals identify with (Kahan et al. 2012). Even the perception of climate anomalies can be politically motivated, though individuals are not blind to extreme weather events (Ripberger et al. 2017). This mechanism can drive internal workplace processes of norm adaptation through elite cueing from management. Outside the domain of the workplace, this process has been shown to drive political behaviour when political elites signal their position on climate policy issues (Kousser and Tranter 2018; Rinscheid, Pianta and Weber 2020). Adaptation of norms can occur via individuals' private network and from elite politicians.

This norm-based explanation for an industrial emissions–policy opposition effect is not based on pocketbook preferences; there are other reasons than wages to be protective of one's occupation; both at company and industry level. A livelihood can be a source of pride, and people could view tighter fiscal barriers from carbon taxes as a devaluation of their work. Political propositions and rhetoric that target this source of pride and constrict profit margins may be experienced as criticism of their place in, and value to, society. Psychological mechanisms like these can fortify political opposition to policies that target exposed groups in society.

2.3.3 Occupational effects

About a century ago, Max Weber held that «jobs shape citizens' positions in the social hierarchy» (Weber 2009 [1922] cited in Azzollini 2021). In the same vein, traditional class analysis indicates that occupational experience, like many social phenomena, can be shaped by class position (Olin Wright 2000). But the link between occupation and political outset does not require a class lens. Using occupational characteristics to explain tax preferences is not unconventional in political science, Philipp Rehm notes: «Almost all political economy contributions conjecture that developments within an individual's industry are shaping his or her redistributional demand» (2009, 856).

The work experiences of different occupational groups – such as managers, professionals and skilled and unskilled workers – can drive political preference formation through authority, task structures and skills (Kitschelt and Rehm 2014). Spending a third of life in the workplace can shape problem-solving behaviour, and may influence attitudes towards e.g. redistribution. An individual's place in the chain of command, whether they are free to dispose the organisation's resources at their own discretion and motivate subordinate employees with monetary performance bonuses, can cement learnt behaviours. Task structures can influence politics through this simple conceptual logic: when learnt task-solving builds on specific heuristics that vary between occupations and industries, solving tasks in the work domain can influence personal opinion outside the workplace, and thereby influence carbon tax opposition.

The three lines of reasoning outlined above point to a mechanism that is not fully understood in the carbon tax preferences literature: higher carbon prices affect material interests, which can manifest itself as either economic risk on the individual level, diffusion on the organisation or industry level; or task structures – problem-solving habits that shape redistributional demand. These are three distinct mechanisms that can shape the relationship between industry emissions and individual climate policy opinion.

Following this logic produces the hypothesis:
H1: Industry emissions are negatively associated with individual carbon tax support.

2.3.4 Which sectors are dirty? Conceptualising industrial emissions

While free allocation of EU ETS allowances shield certain industries from carbon pricing initiatives, most employees arguably do not know the specific economic effects of fossil fuel taxes on the profit margin of the company they work at. Despite this *a priori* uncertainty, employees may still have some notion of whether their industry is relatively 'clean' or 'dirty'. What constitutes a dirty sector?

A comparison of absolute emissions from industries within different countries would be skewed by the relative magnitude of the economies. Constructing a meaningful measure of industrial emissions thus requires a way of controlling for the importance and size of industries. A common solution is to use emission intensity (Bechtel and Genovese 2017; Gard-Murray 2021): the quotient of the GHG source's emission level by the economic activity the source produces, either measured in monetary output or value added. Emission sources can be particular companies or machines on the micro level; industries, such as steel manufacturing or electricity generation on the meso level; sectors, e.g. road transport or chemicals manufacturing; or countries and regions on the macro level.

Relative emission shares – the percentage of emissions that an industry contributes to the country total – depend not only on each industry's carbon emissions, but also on the relative GHG contributions of other industries. If all but one sector produce low emissions, this sector would appear to be exceptionally dirty in the emission share statistics. Consequently, public demand for decarbonisation policies would target this singular sector, since it would be immensely carbon intensive compared to all others. The coding dilemma can be reduced to a single question: How do the emission intensive workforce perceive their industry emissions? This is important, as it is a necessary precursor for their perception of how carbon taxes will impose relative costs on their sector.

Emission intensity controls for industrial output, which has a very specific benefit. The emissions of a specific business do not need to be directly related to the carbon intensity of the industry, but firms with high emissions do have in common that their output is usually contingent on higher-level parameters that affect the emission intensity. These parameters can include the energy mix in the national power grid, the share of clean transportation, or the consumer demand for low-emission materials. Industries with high emissions and high output will produce emission intensity levels that account for this output and minimises the intensity, despite still being severe sources of pollution. Public framings of 'green' and 'grey' industries are not necessarily swayed by the dampening effect of high industry output.

The Norwegian petroleum industry is an illustrative example. The sector is large – including upstream and downstream operations, it employs >200 000 people in a country of 5.4 million – and it is the largest domestic source of emissions, clocking in at about 14 percent (SSB 2019). The sector's share of industrial emissions is 25.4 percent, with an emission intensity of 0.24 kilograms per euro (current prices) of production output – nearly a fifth of the emission intensity of the Norwegian agricultural sector, which stands at 1.19.

Popular knowledge of polluting activities is arguably limited to overarching impressions of clean and dirty sectors. Individuals do not compute some cognitive calculus of weighting sectoral emissions by their relative share of economic output. In the context of policy preferences, employees would have to be well-informed about their specific industry emissions if emission intensity is a robust determinant of carbon tax opposition. In countries where the environmental issue resembles a manifest cleavage, the media will remind news-consuming citizens about which industries and sectors that are the largest emitters.

Returning to the Norwegian example, it is apparent that emission intensity is a misguided predictor of perceived industry contributions to climate change. Total greenhouse gas emissions have slightly increased in Norway during the period 1990-2017 (Weyer, SSB 2019). In the same period, the economic production has more than doubled, halving the emission intensity of the Norwegian economy (ibid). The population and unemployment has not changed by a factor of two, so there is no reason to believe that emission intensity is an appropriate measure of 'scaled emissions' – it accounts for the size of the economy, not for the number of employees or the amount of public goods it produces. Conversely, dampened emission intensity has resulted in increased production and export of petroleum with a reduced carbon tax base (ibid).

This pattern is not limited to Norway. The emission intensity of power generation in the EU-27 fell by 51 percent from the baseline year 1990 until 2019 (European Environment Agency 2021). GHG emissions has only fallen 23 percent in the same period (EU 2019), which does portray a transition towards decoupling emissions from GDP, but simultaneously indicates that growth in less polluting sectors – via modernisation and the shift from production industry to the digital tech sector, for example – may have been just as important as emissions cuts.

Because green growth will not alleviate climate change unless it is paired with meaningful and substantial emission cuts, the industries which are the largest drivers of climate change arguably has a more significant role in climate change debates than the most carbon intensive. I employ a novel coding of industrial emissions to capture this: Absolute emissions from is divided by the sum of domestic industrial emissions, weighting respondents' industrial emissions as a percentage of the country total. While this is a less precise measure of the real emissions of a specific company, it picks up the *perceived* effect of respondents' workplace-related footprint.

This results in the following hypothesis:
H2: Higher emission percentages is a stronger predictor of carbon tax opposition than emission intensity.

2.3.5 Unemployment effects and economic risk

Individuals with entrenched emission interests depend on the continuation of releasing GHGs from their industry, as they fear carbon taxes can result in narrow profit margins that consequently drive lay-offs and wage cuts. This emission effect can be exacerbated among high-emitters who find it difficult to either (i) get a new job or (ii) survive on their current income. These are two distinct sources of worry, but their effects can be explained by the same conceptual logic as the emission-carbon tax opposition relationship, enabling economic risk to shape climate policy preferences. Conceptually, this makes high-emitters vulnerable to two factors: rising unemployment, which is the objective risk stemming from unemployment rates in the labour market; and subjective risk, which are self-reported feelings of economic anxiety.

A substantial part of the scholarship on economic risk connect the state of the economy to climate change attitudes, not the effect of employment rates on climate policy opinion specifically. The current state of this somewhat uncharted territory is presented in this section.

Almost fifty years ago, Downs argued that environmental concern would tail off when economic conditions were poorer (1972). In hard times, the public face more immediate material challenges than climate change, which must be covered first, according to Maslow's hierarchy of needs (1954). This is the central tenet of Inglehart's postmaterialist thesis: when a society meets material needs, the public will shift to seeking nonmaterial, value-based goals, such as environmental concern (1971, 1977). Scruggs and Benegal identify trends in environmental concern that peak at the peaks of economic cycles in 2001 and 2008, and find that declining climate change worry in the US and the EU-27 can be explained by heightened concerns about unemployment and the state of the economy (2012).

In addition, strands of the scholarship have identified economic determinants of direct policy attitudes. Support for climate policy measures drops in economic recessions (Drews and van den Bergh 2016, 864). In the US, state unemployment rates have been linked to declining climate policy support (Kahn and Kotchen 2011). Among Americans, a drop in both worry about climate change and support for mitigation measures coincided with the Great Recession in late 2007. A more recent study has attributed this to shifting political cues, not the economic downturn (Mildenberger and Leiserowitz 2017). In countries with high levels of political trust, the issue salience of climate change worry has been shown to be a prerequisite of policy support (Fairbrother, Sevä and Kulin 2019). Unemployment rates and economic conditions may drive the issue salience, but there are contrasting findings on whether policy support is affected directly (Kachi, Bernauer and Gampfer 2015).

Beyond public concern about the general economic condition, unemployment has several negative consequences. Information about unemployment rates can shape voting patterns, because it is a signifier of current economic conditions (Lewis-Beck and Stegmaier 2000). This economic voting effect can be biased by partisan factors, which influence access to, and assessment of, information about unemployment rates (Ansolabehere, Meredith and Snowberg 2008). Information about unemployment rates is sourced from the news media, but it can also be provided by a person's social network: family, friends and colleagues. Access to information about unemployment rates is a crucial first step for this latent rate to manifest itself into political behaviour.

The role of individuals' perceived economic situation has been associated with voting patterns, but is far less prominent in the climate policy support literature. One contribution found no effect on climate policy support (Kachi, Bernauer and Gampfer 2015). In addition to losing income, previously unemployed people are paid less when they again find work (Arulampalam and Notes 2001). Beyond the direct adverse consequences of unemployment, it can have spillover effects on political behaviour: unemployed people can be less politically active (Azzollini 2021). The dynamics of this 'scarring effect' can discourage unemployed voters from using their vote.

High unemployment reduce the likelihood of finding a similar job at another company or in another industry, by producing more competition on the supply-side of the labour market. High-emission workers can oppose the idea of taxing carbon emissions, not because they are climate skeptics, but because these taxes are perceived to inflate their economic risk in several ways: by exacerbating work conditions, wages and ultimately threatening their job. Carbon tax policies incurring producer costs may therefore meet substantial opposition in carbon-intensive sectors, despite the fact that most voters prefer that carbon taxes target industry over consumers. Unemployment rates has been linked to political behaviour earlier, including economic voting for incumbents (Fossati 2013). Abou-Chadi and Kourer has identified an effect of unemployment rates, both for one's own occupation and one's partner's occupation, on radical right voting (Abou-Chadi and Kourer 2021). While its association with climate worry and climate policy preferences has not been investigated before, there are reasons to believe it may drive carbon tax opposition. If industry emissions influence employees' climate policy attitudes via paycheck preferences, economic risk and anxiety can influence it as well. The mechanism that connects labour market risk to voting is similar to the mechanism that effect of industry emissions on policy opinion: they are both economic determinants of political behaviour.

If the effect of emissions on policy opposition don't run through economic risk, it is more plausible that other mechanisms govern this relationship. It can possibly be explained by the learnt attitudes and norms inside the workplace. Individuals may experience cognitive dissonance to justify one's work as important, despite climate concern. This dissonance wants to be resolved. Additionally, working in a high-emission sector may entail a belief in technology optimism: carbon taxes may minimise the surplus value that the company could otherwise allocate to clean transition research and development.

This produces the following hypothesis:
H3: Individuals with higher risk exposure in industries with higher emissions will be more skeptical of carbon taxes than other climate policies.

2.3.6 Effects on climate worry and other climate policies

Comparing the emission effect on carbon tax support with other climate-related outcomes, including climate worry and support for other climate policies, enables a qualified discussion about the conceptual logic that carries the statistical relationship. Policies are meant to solve problems; therefore, individuals would have to acknowledge climate change as a problem to support the policy solutions. Climate worry is associated with climate policy support (Smith and Leiserowitz 2013), and an emission effect on policies may in reality signal an individual's general distrust in climate change science. A significant relationship between emissions and climate worry would indicate that less cognitive dissonance is needed to hold opinions on climate policy that is aligned with the industry of work. This would weaken the task structure logic, which explain how different occupational styles produce different preferences for solving problems. It would therefore reinforce the case for other explanations, such as the conceptual logic of diffusion and self-interest that is outlined above.

Support for a range of climate policy instruments can vary with respect to policies' cost-concentration: when emission intensive sectors bear a substantial burden of carbon tax costs, high-emitters are likely to oppose such legislation (see Hughes and Urpelainen 2015; Gullberg 2008; Levy and Egan 2003). Conversely, renewable energy subsidies have diffuse costs and concentrated benefits: renewable power and low-emission sectors will be motivated to lobby for subsidies, and employees in these industries will have opinions aligned with their employers' attitudes, either through economic self-interest or learnt workplace norms. Carbon pricing has direct economic consequences for high-emitting companies. These consequences have less effect on subsidies for renewables and regulations on energy efficient appliances. This is an important reason why carbon pricing is popular among economists in the first place. What follows is that high-emission workers may be more tolerant of other policy instruments – subsidies and regulations – that do not target their company's bottom line.

There is a possibility that low-emitting companies have as much to gain from supporting carbon taxes as polluting firms have to lose. Low-emitting companies in e.g. production or transportation may gain competitive advantages from higher carbon prices. Opinion on renewable energy subsidies should not be as influenced by this as carbon pricing support, as it would only concern a very limited subset of clean energy producers. A similar logic applied to the high-emitting end of the spectrum could explain possible subsidy opposition: high-emitters may be concerned about what subsidies are paying for; how subsidies are a competitive threat to their profitability. Fairness concerns between industries can come into play.

This theoretical expectation produces a fourth hypothesis:
H4: Higher risk exposure in industries with higher emissions will be more strongly negatively associated with support for carbon taxes than climate worry and other climate policies.

3. Data and methods

I use existing, publicly available survey data to shed light on the research question: '*What is the effect of high-emission employment and economic risk on carbon tax preferences?*'. For observational data on political opinion, I use the European Social Survey (ESS) round 8, which is a representative survey containing questions on carbon tax support, as well as other types of climate policies. The data also has information about respondents' industry, occupation and relevant control variables.

Three data sets from Eurostat are merged with ESS 8 to construct economic risk and industrial emissions as continuous variables assigned to ESS respondents. I employ a linear multilevel model with three-level nesting: respondents (level 1) are nested within the industry they work in (level 2), which are nested within countries (level 3).

3.1 Data structure

Cross-sectional survey data, including opinions on climate policies and climate change, are drawn from ESS 8. Fieldwork for this survey was conducted in 23 countries between August 2016 and December 2017 (Poortinga et al. 2018). This round is chosen because it is the only one with a climate module, containing a battery of climate-related questions. Of the 23 countries, 21 are EFTA countries with comparable emissions data in the Eurostat statistics (Austria, Belgium, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom). Israel and Russia are omitted, as they do not appear in the Eurostat data on emissions and unemployment.

3.2 Dependent variables: Support for climate policies

The climate module in ESS 8 includes three questions about climate policies, with five response categories ranging from 'strongly in favour' to 'strongly against': '*To what extent are you in favour or against the following policies in your country to reduce climate change?':* (i) *Increasing taxes on fossil fuels, such as oil, gas and coal;* (ii) *Using public money to subsidise renewable energy such as wind and solar power;* (iii) *A law banning the sale of the least energy efficient'.* These variables are in their true sense ordinal, but they will be evaluated as continuous normal outcomes so that no link function is required (Hedeker 2005). This makes it possible to compute averages, and they satisfy the interpretation assumption of linear mixed models. Distances between points on the five-point Likert scales are assumed to be identical, in line with a body of climate policy opinion research using this dataset (Pohjolainen et al. 2021; Umit and Schaffer 2020).

3.3 Operationalisations: Emissions and economic risk

The carbon intensity of an economic activity is captured by its emissions divided by output or value added, as reported in the Eurostat database (Eurostat 2020). The industry emissions variables are coded in three ways: (i) *emissions percentage*, the share of industry GHG emissions within each country; (ii) *emissions intensity by output*, measured in kg/euro, 2021 prices; and (iii) *emissions intensity by value added*, which is very similar to the former, but weighted differently, and is used as a robustness control. Data on absolute emissions and emission intensity from economic activities are grouped within the 21 countries, and the emission values that are assigned to respondents are modelled within a hierarchical industry-within-country-level.

3.3.1 Industry emissions: the EU classification of economic activities

The Statistical Classification of Economic Activities in the European Community – abbreviated to NACE, based on its French acronym – is the standard EU taxonomy for economic activities (Eurostat 2016). NACE revision 2 is the latest revision of the framework, and it was implemented on Jan 1st 2008 (Eurostat: NACE Rev. 2). It has four hierarchical levels, of which the top two can be coded for respondents in the ESS data. Level 1 has 21 groups, coded in letters (A-U), and level 2 has 88 sub-activities under these groups, coded in two-digit numbers (01-99) (Eurostat Ramon 2021). This analysis uses the level 2 industries where they correspond with Eurostat emissions data. NACE level 1 codes can be understood as sectors. Emissions values from the Eurostat data are assigned to each economic activity within each country. A few industries are collapsed into sectors (e.g. sector B: Mining and quarrying), due to absence of emissions data on lower industry levels. This artificially inflates the emission levels of some respondents' industries. This will not affect the conclusions, as it concerns few respondents.

3.3.2 Objective economic risk: Unemployment rates

High-emitters who find themselves in a difficult economic situation may worry about carbon taxes hurting company profits, in turn leading to pay cuts or lay-offs. The risk of losing one's job can be experienced as more severe and more likely if employer profit margins are reduced. This establishes a conceptual link between risk exposure to unemployment and the economic interests of high-emitters. Risk exposure stems from the unemployment rates in the occupations of individual respondents and their partners. The unemployment data comes from the EU Labour Force Survey, and is aggregated at ISCO level 1 categories (EU-LFS). An individual unemployment rate is contingent on three variables, capturing variation within 21 countries, ten occupation levels and two genders. Unemployment rates range from 0–15.6 percent.

The number of observations falls from about 35 000 to 14 100 for the unemployment rates of respondents' partners. Not everyone has a partner, which presumably explains this drop in response rate. To mitigate this problem, economic risk exposure within the household is recoded as the average of each individual's unemployment rate and their partner's unemployment rate. When the occupation values of respondents' partners are missing from the data, they are assigned an economic risk value equal to their unemployment rate. As unemployment risk has been shown to affect populist voting, but not run through other policy attitudes (Abou-Chadi and Kurer 2020, 22-23), I will test the effect of self-reported economic anxiety as well.

3.3.3 Subjective economic risk: Difficult income

Individuals may not be aware of the unemployment rates in their occupation, but they can still be worried about their personal financial situation. Therefore I include a survey variable that picks up subjective economic anxiety: '*Feeling about household's income nowadays*', ranging from 1-4 (Living comfortably; Coping; Difficult; Very difficult). The variable is named 'Difficult income'. This is a relatively simple operationalisation of self-reported economic anxiety.

3.4 Control variables

In line with expectations, climate change attitudes are a primer and one of the strongest predictors of climate policy support (Goldberg et al. 2020). Among these attitudes are climate change worry and risk perception, and belief that climate change is human-caused. This follows the lead of recent academic work on the predictors of climate policy support (Drews and van den Bergh 2015). I control for the belief that *climate change is human-caused*: «Do you think that climate change is caused by natural processes, human activity, or both?» with responses ranging from 1 («entirely by natural processes») to 5 («entirely by human activity»), 3 being «about equally». The response «I don't think climate change is happening» is recoded from 55 to 0, and represents the most extreme climate change denialism on this survey question.

Occupational groups may have correlated tax preferences, which are controlled for with this survey response variable. Preferences for traditional economic policy preferences, including opinions on the government's role for redistributing wealth and ensuring everyone has basic needs covered, should differ between a traditional divide between working-class people and wealthier groups. Income, including relative income, has been connected to environmental concern (Li and Chen 2018). Earlier research on their relationship to environmental policy support has produced contrasting results (Kahn and Matsusaka 1997; Thalmann 2004).

Higher income is associated with opposition to redistribution policies (Stegmueller et al. 2012), and carbon tax opposition may be correlated with opposition to all taxes due to ideological stances, as people generally prefer pull over push measures (Drews and van den Bergh 2015). If individuals with safe, stable jobs and moderate income already prefer more redistributive tax schemes, any effect on carbon tax support specifically may be explained by their general tax preferences. I control for preferences that *Government should reduce inequality* with the survey statement «government should take measures to reduce differences in income levels», with responses that are recoded so that 1 is «disagree strongly», 3 is «neither agree nor disagree» and 5 is «agree strongly».

Earlier studies indicate a relationship between left-wing ideology and carbon tax support (Thalmann 2004; Harring, Jagers and Matti 2019, 646) that is reinforced by political culture; specifically the Scandinavian political culture. Support for environmental taxes have been shown to correlate with left-wing ideology in countries with high quality of government (Davidovic, Harring and Jagers 2020; Drews and van den Bergh 2016).

3.5 Multilevel modeling

The data is nested due to the higher-level values of the explanatory variables, which introduces correlations that breach with the assumption of independent observations. Individuals are nested within industries, which are then further nested within countries. This hierarchical data structure is modelled with intercepts that are allowed to vary for these two higher levels in the hierarchy. Estimating models without accounting for this hierarchical structure would bias the parameter estimates and standard errors, as OLS regression relies on independent observations; breaking this assumption often produces spuriously significant results (Hox 2010, 5).

A more efficient estimator reduces the variance around the expected value of the population parameter. Because units are nested in a hierarchical structure, OLS or generalised linear models will provide inefficient parameter estimates and negatively biased standard errors (Christophersen 2018, 107), producing spuriously significant effects. Variance bias can be minimised by correcting the standard errors with multi-way clustering, but the parameter estimates are too large, making multilevel models «a much stronger form of correction» (Lago-Peñas and Lago-Peñas 2010).

All predictors of interests are modelled as fixed effects. Emissions effects may vary between countries, but I am interested in the average effect of emissions across countries. Because the fixed effect of emissions is the main variable of interest, «the appropriate random structure is desired to provide more accurate parameter estimations for fixed effects» (Yu, 2015). No variables are therefore assumed to have varying slopes. In contrast to a complete-pooling model fit with corrected or clustered standard errors, the multilevel model gives separate estimates for the intercepts of countries and industries, but assumes the same average effect on the dependent variable.

Units are nested within two grouping variables: industry ID number identification on level 2, and countries on level 3. There is no reason to nest countries within industries, because industry emissions are affected by country-level policy and economic characteristics; any between-industry effects that crosses over the country level are negligible. These higher levels are parametrised as varying-intercepts. This enables the models to estimate direct and contextual effects separately (Gelman 2006), allowing them to correct for unknown group-level factors, such as context-level characteristics within countries and industries – relevant examples are economic development, domestic emissions, climate and economic policies, and lobby power.

The nested structure produces a more complex model specification compared to an ordinary least squares (OLS) regression. Respondents are nested in j industries. These j groups are allowed to have varying-intercepts in the following one-predictor model:

$$\mathbf{y_i = \alpha_{j[i]} + \beta x_i + \varepsilon_i\ .}$$

The j intercept coefficients are given a model, and replace the intercepts α_j (Gelman and Hill 2006, 251). Let i, j, k indicate individual, industry and country. I estimate a linear mixed model of this form:

$$\mathbf{y_i = \beta_1 \text{ Emissions}_{ij} + \beta_2 \text{ Economic risk}_{ijk} + \beta_3 \text{ Difficult income}_k + \beta_i B + \varepsilon_i} ,$$

where B is the coefficient matrix for the control variables.

4. Results

There is considerable variation in the sizes of national economies, which inflate absolute emission levels based on their economic output. Large sectors will often contribute large emissions, even if the GHGs associated with their operation is moderate compared to the worst emitters, such as the burning of coal. This makes between-country comparisons of absolute emissions meaningless; a better signifier of an industry's «shade of grey» is the *share of emissions* that they contribute within each country. Another common operationalisation of industry emissions is *emission intensity* (Bechtel, Genovese and Scheve 2017; Gard-Murray 2019).

The descriptive analysis follows in two parts. First, I will briefly describe the current levels of support for climate policies in the sample, and then I will give an overview of the industries with the highest emissions within each country, before contrasting it with the most emission intensive industries. This comparison will shed light on the pros and cons of the two ways of conceptualising 'clean' and 'dirty' industries. This is crucial for the overall aim of untangling the emissions-policy support link. I will then move on to the multivariate analysis, by testing the stated research hypotheses using multilevel regression models.

4.1 Descriptive analysis

4.1.1 Dependent variables

There are four dependent variables: support for three types of climate policies, and self-reported climate worry, all measured on Likert scales ranging from 1 to 5, 5 being the highest level of support or worry. While subsidising renewables is generally warmly accepted in European publics (mean = 3.97, SD = 1.05), support for higher fossil fuel taxes is substantially weaker (mean = 2.79, SD = 1.24). Support for banning the least energy efficient household appliances, the third and final climate policy variable in ESS 8, has a mean in between the other two (mean = 3.54, SD = 1.17). Moving beyond climate policies, climate worry is included to identify whether the proposed effects of emissions and unemployment rates run through this variable, as earlier research indicate that worry about climate change is a primer of climate policy attitudes.

4.1.2 Explanatory variables

The following comparison is made to make a crucial point: comparing the two codings of industry emissions produces some counterintuitive results.

4.1.3 Emission percent

For high-emission occupations to shape policy, a substantial part of the European workforce would need to be employed in high-emission industries. If GHG pollution was constrained to a few companies and industries with small workforces, the political opinions of these employees would likely have little sway over political outcomes. Therefore, any policy implications from a robust multivariate relationship between emissions and policy opinion is contingent on a critical mass of voters being employed in polluting enterprises. While there is no conventional *a priori* cut-point for measuring when the number of voters reach critical mass, or what constitutes a high-emission industry, I operate with a cut-off percentage where the top three polluting industries can be discerned, and hold that the percentage of employees in these industries must surpass the lower single-digits for potential statistical relationships to result in political impact.

High-emitting workforce

Numerically, this translates to threshold values of 6 percent of domestic GHG emissions for an industry to be a high-emitter, with a share of the workforce in these industries larger than 5 percent. The latter cut-point is set somewhat arbitrarily, but it does equal the electoral threshold in many European countries (Troen 2019, 19), which would qualify 5 percent of a politically aligned electorate as a meaningful political force. The first is set empirically, based on the sample at hand: there are a minimum of three industries producing at least 6 percent of domestic emissions in all countries except Estonia, where there are only two meeting this criteria; the third industry sits at 4.3 percent. Lowering the threshold to 4.3 percent would include many additional industries in other countries, and this would be a diversion from the aim of this descriptive analysis: mapping a limited range of the most polluting industries, to identify which sectors can reasonably be framed as main drivers of climate change among European publics. It is important to note that there is no binary coding of pollutive sectors in later regression models; the overview using this threshold value is only useful for descriptive purposes, as the regression models are fit with predictors that make use of a full, continuous range of industry emissions.

How many are high-emitters? In the representative sample, 35181 respondents have given information about their industry of work. Of these, the majority of respondents are employed in sectors with low contributions to national GHG emissions. The table below displays the number of observations sorted by their share of domestic emissions; 3119 respondents in the sample of more than 35 000 are part of the high-emission workforce that produces more than 5 percent of domestic emissions, comprising 8.9 percent of the sample. This is considerable, and it is nearly twice the threshold value set at 5 percent. This is a necessary qualifier, before turning to multivariate models for testing the claim that working at a polluting firm can have a meaningful impact on environmental policy opinion. For a more detailed distribution of respondents, sorted by industry and country, see the external appendix.

≤ 1%	>1%–5%	>5%–10%	>10%–20%	>20%–30%	>30%–40%	>40%–50%	>50%
24314	7725	1328	984	499	222	54	32

Fig 1: Observations in emission groups in ESS8 within NACE industries – industry emissions are calculated as the percentage of total domestic industrial emissions.

High-emitting industries

Which industries do high-emitters work in? Here I will outline the pattern of polluting economic activities in Europe, briefly describing some of the national cases. The most polluting industries in each country are displayed in the horizontally stacked bar plot below. Industries producing more than 6 percent of domestic emissions are labelled with ID numbers, which will be explained in the following section.

Looking at the data unveils some industries with severe emission shares, which cannot be explained solely by their direct economic output. In the EU-27, the five economic activities with the highest emissions produce 60 percent of GHGs, but only 6.7 percent of the gross domestic product (GDP) (Eurostat 2021). Among these five, one is especially distinct in the barplot: 'Electricity, gas, steam and air conditioning supply' (number 24, in green) is among the three most polluting activities in 16 of the 21 countries. This activity alone contributed 20 % of total EU GHGs in 2019 (Eurostat 2021).

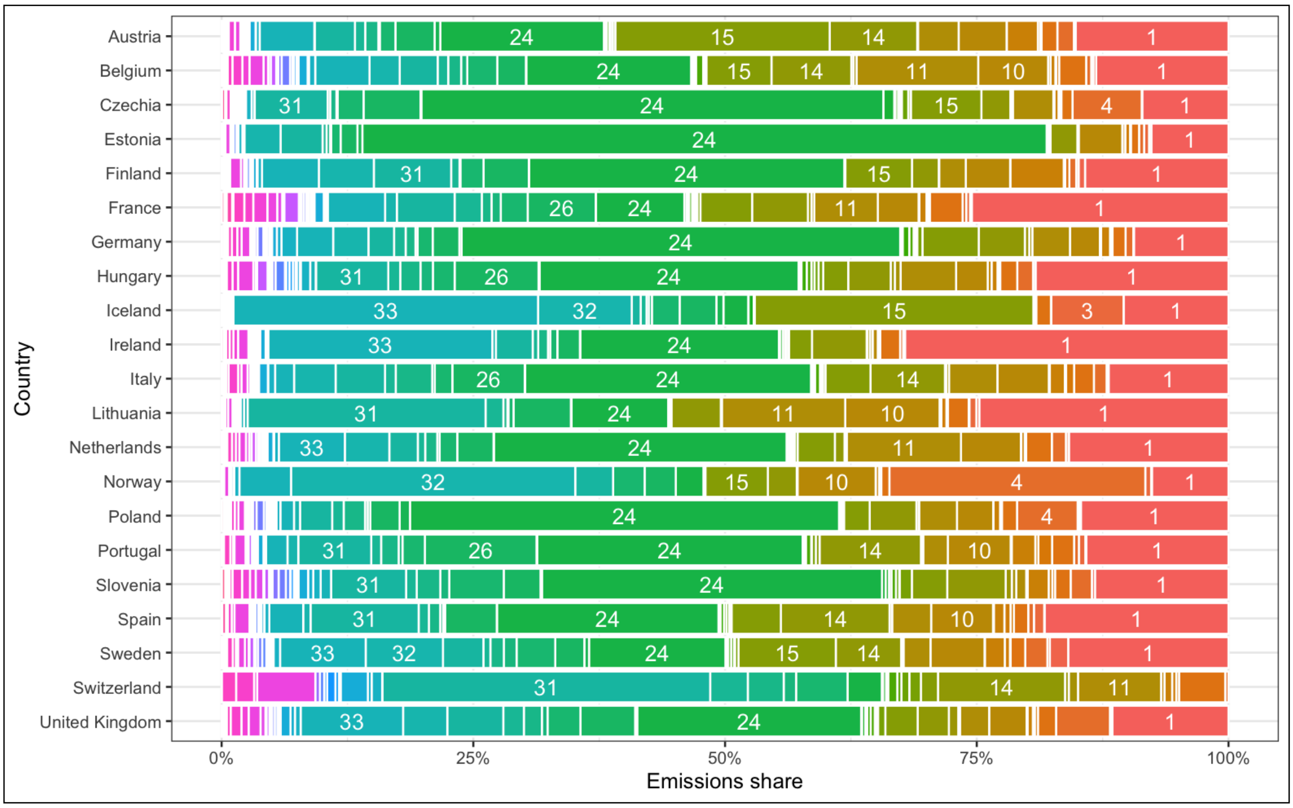


Fig 2: Emission share, by industry, within each country in the sample.

In several European countries, including Estonia, Poland and Germany, the dominance of coal-based power generation result in very high pollution levels from electricity production. In Estonia, this economic activity emits 68 percent of industrial GHG; its dominance contributes to there being only two industries who meet the 6 percent threshold criteria. The third most pollutive industry ('manufacture of coke and refined petroleum products') contributes 4.3 percent of emissions, as refined petroleum amounted to nearly 6 percent of exports and more than 8 percent of imports in 2017 (OEC 2021), making it a key commodity in the diversified Baltic economy (Connolly 2012). Despite the pivotal role this industry plays in the Estonian economy, the relative carbon contribution is lower than for key sectors in other countries.

'Crop and animal production' (number 1, in red) is among the top two emitting activities in several countries, including France, Hungary, Ireland, Italy, Lithuania, the UK, Poland and Spain. The amount of CO2 emissions from this activity is surpassed by emissions of other, more potent greenhouse gases, namely methane and nitrogen dioxide (Eurostat 2021), the latter having an additional environmental impact as the main driver behind acid rain. This contributes to make agriculture a top emitter in all countries in the sample, except Switzerland, where this emission data is missing. Agriculture, like electricity and gas generation, is a low-GVA, high-GHG production activity. What becomes clear is that top emitting industries are not necessarily key economic sectors; ranking top polluters does not require any adjustment for economic output.

Some high-emitting industries are country-specific. In Iceland, for example, the magnitude of ‘air transport’ (33, in blue) reflect the importance of flight for tourism and business travel to the isolated island, giving Iceland by far the highest per capita emissions from aviation in Europe (Hopkinson and Cairns 2020, 29). Sizeable GHG emissions from ‘basic metals manufacturing’ (15, in green/ brown) reflect the key role that export of raw aluminium plays in the national economy (OEC 2021), followed by ‘fishing and aquaculture’ (3, in orange) – making Iceland the only country in which fisheries contribute >>1 percent of emissions, as a direct consequence of the fuel use during harvesting (Byrne, Agnarsson and Davidsdottir 2021).

A similar pattern can be seen in Norway, where the petroleum sector (number 4, in orange) is the culprit, producing 25 percent of domestic industrial emissions. On the Norwegian continental shelf sits the largest petroleum reserves in Europe, which has situated Norway as the fifth largest exporter of crude oil in the world (Climate Action Tracker: Norway 2020), and the third largest gas producer (Mildenberger 2020, 67). As the largest petroleum producer in the 21-country sample, the absolute number of respondents in the mining and quarrying sector, which includes the petroleum industry, is higher than for any of the other 20 countries.

4.1.2 Emission intensity

Basic economic interests can explain why emission intensity can possibly affect policy opinion: Because carbon taxes are a price distortion that directly reduces the profitability of emitting carbon dioxide, emission intensive industries will be more severely hurt by carbon taxes than cleaner sectors, and workers in these industries may therefore worry about their salary. The main difference between coding emissions as intensity or percent, is a matter of which industries fall on the polluting side of the spectrum. The stacked bar plot below indicates which industries this is, by displaying production activities by their emission intensity within each of the 21 countries. Only industries with emission intensity >1 kg/euro (2021 prices) are labelled with ID numbers, to identify the most carbon intensive industries.

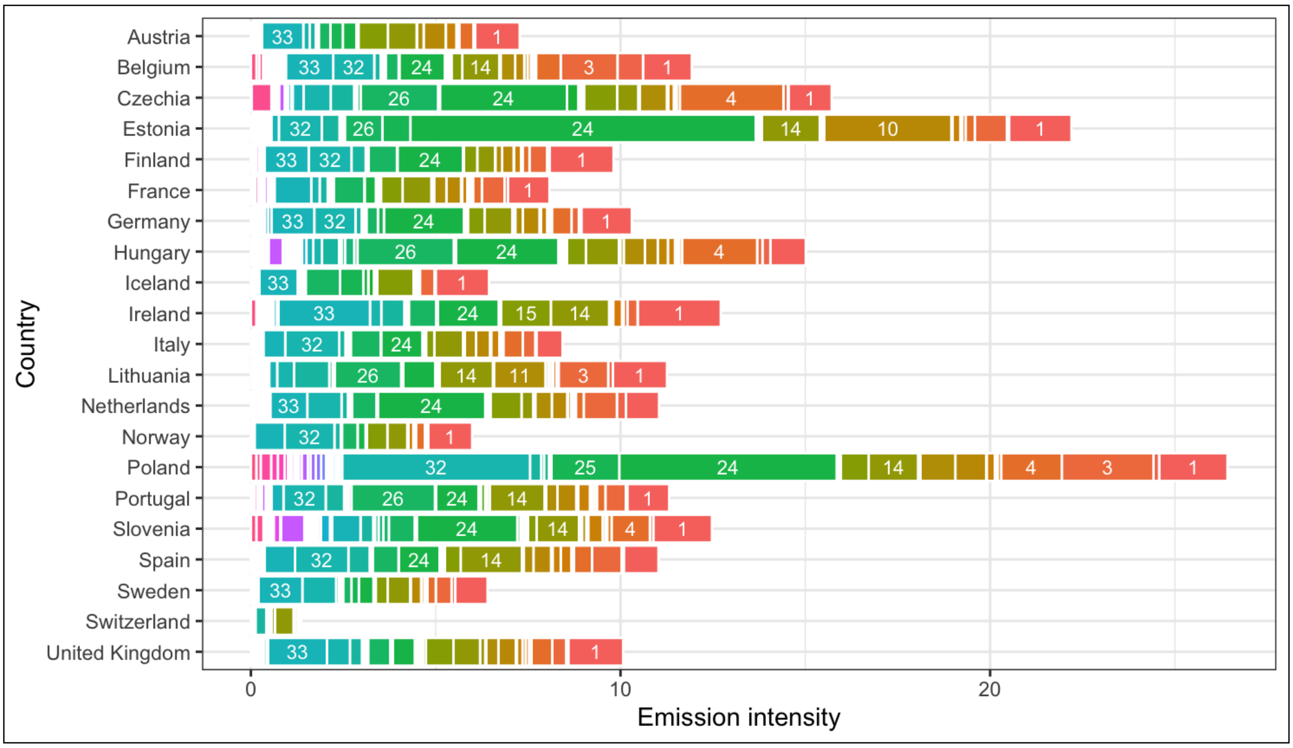


Fig 3: Emission intensity, by industry, within each country in the sample.

A clear pattern emerges from this overview. Activities 32 and 33 (water and air transport, respectively; in blue) are among the most emission intensive in almost all countries. Number 24 (electricity, gas, steam and air conditioning supply, in green) is very dirty in Estonia and Poland, and appears in the majority of other countries as well – in line with the previous emission percent bar plot. Due to its low economic output, industry 26 (sewerage and waste management, in green) is comparatively larger than under the emission percent coding above.

On the high-revenue end of the GDP spectrum, industry 4 (mining, in orange) is relatively carbon intensive in several Eastern European countries, but it is not visible in Norway, where the petroleum sector is the largest emitter. As oil and gas revenues are very high, this diminishes the emission intensity of the sector to a marginal level. This sector has vested interests in less intrusive carbon tax rates and coverages. If there is a positive emission-policy opposition correlation, one would assume that workers in very carbon intensive industries are not as consistent in their policy opposition as workers in high-emitting industries that are not adjusted for economic output.

Another discrepancy between the codings can be seen when returning to the example of Iceland: Because the Icelandic electricity grid is powered almost entirely by renewable energy (Logadóttir

2015), aluminium manufacturing is less emission intense than in many other countries. Still, the metals manufacturing industry emit more GHGs than any other industry besides air travel. By looking at emission intensity, the relative emissions from this important and large sector are relatively low. By looking at emission percent, they are higher than from other industries. But in relation to carbon taxes, which apply a relative economic competitive edge on less polluting sectors, they will have to pay a larger share than nearly all other industries. Being less emission intensive entails higher revenues per kg of CO2 that is released – but revenues and profitability are not correlated; profit margins for singular companies can be slim despite high revenues.

This comparison indicates some pivotal points where the two codings produce different sortings of emitting industries. The Pearson correlation between them is high, at 83 percent, but low enough to indicate that they are not measuring the identical latent concept. The emission percentage coding produce a different order of polluting industries, as economic output is not taken into account. Beyond the low-income, high-emission sectors mentioned above – such as agriculture, and the electricity and gas sector in countries with a carbon-dependent power grid – there are several country-specific industries with high emissions and low emission intensity. Because of these divergent paths, the emission percentage coding produces a more conventional sorting of polluting industries. While sectors that are dominant in specific countries contribute substantially to the national carbon output, their dominant contribution to GDP may give way to entrenched opposition to a higher price on carbon. A large workforce in a pivotal industry can lead to incumbent non-will to decarbonise; notions of an industry that is too important for the economy to be strangled by policy whims. But profitability does not make an industry clean.

This descriptive analysis suggest sorting industries by emission intensity – a correction for economic output – arranges them in an order that is at odds with what one may term a ‘pollution scale’, or a spectrum of clean and dirty industries. Assuming that individual policy opposition is linked to their industrial pollution contributions, the pollution scale that most closely resembles what publics perceive as clean and dirty will likely have the highest correlation with policy preference distribution in the multivariate analysis in the following section. The share of emissions from a production activity is a measure that is simpler to understand, and therefore more likely to be information that is publicly accessible. It is likely that the emission share of an industry will have a larger imprint on public debates – and opinion – than the more complex system of emission intensive industries.

4.2 Multivariate analysis

What is the effect of industry emissions and economic risk on carbon tax preferences? This research question has produced four hypotheses, which I test with three sets of regression models. The models include some or all of the following control variables: four basic socio-economic control variables (age, gender, education and income), and three variables that measure political opinions (ideology, support for redistribution and belief that human activity cause climate change). The first set of models tests two alternative codings of industry emissions with the limited set of socio-economic covariates (hypothesis 1 and 2); the second set includes all control variables, and is used to test the effects of emissions and economic risk, both separately and as a combined interaction term (hypothesis 3); while the third and last set include four dependent variables, to test whether the effect on carbon tax support is stronger than the emission effect on other climate policies and climate change worry (hypothesis 4).

In the summary at the end of this chapter, I analyse the predicted effect of emissions on carbon tax support. Then I discuss why emissions would influence carbon tax support in light of the empirical findings, looking at which of the three mechanisms that supply the most credible explanation.

4.2.1 Model structure

To test the four hypotheses, I run three sets of linear multilevel models. The multilevel specification is as follows: individuals are nested within 65 industries, which are nested within within 21 countries, producing 1192 groups after missing emission values are excluded. Each group is allowed to have its own random intercept. These function as grouping variables; their random effects are of no interest. All other predictors are modelled as fixed effects. Design weights are added to all models to account for different sampling probabilities (ESS 2014).

4.2.2 H1 and H2: The effect of emissions on carbon tax support

There are two partly overlapping sets of assumptions about how emissions influence policy preferences: carbon intensity can be a strong predictor on company level, but within-industry variation of firms' carbon intensity and economic interests makes it difficult to distinguish on industry level. Instead, the share of emissions that the industry contributes to the national total is a measure that is more widely accessible to individual employees. Emissions can be operationalised in two different ways: emission intensity or emission share (measured in percent). I start by running regression models that compare the effect of these two codings of industry emissions.

The effect of emission intensity on carbon tax support has been tested before. In his 2019 working paper, Alexander Gard-Murray identifies a significant effect of emission intensity on individuals' support for carbon taxes (2019). He merges ESS 8 data with emissions statistics in the World Input-Output Database, divided into 35 economic activities based on an earlier version of the NACE framework. By employing logistic regression with two-way clustered standard errors on industry and country, he reports that higher emission intensity from these industries is negatively associated with support for costly climate policies, and he identifies negative interactions of emission intensity on income, education and ideology. This statistical relationship is not robust when tested with linear mixed models on a larger and more granular dataset of industries in the regression models below. I use Eurostat data containing information on emission intensity from 65 economic activities, computed as intensity by output, and these results are robust when emission intensity is instead computed by gross value added (GVA).

I first test two hypotheses by fitting regression models with four control variables:
H1: Emissions have a negative effect on carbon tax support.
H2: Higher emission percentages is a stronger predictor of carbon tax opposition than emission intensity.

I find support for both H1 and H2 in models 2 and 3 in the regression table. Emission intensity is significant at the five percent level when the model only includes a very limited set of control variables: gender, age, education and income. All variables in the three models are Z-transformed, to make comparisons between coefficients more easy to interpret. Emission intensity spans from 0 to 9.343, but is firmly centred with an sd < 0.5 around the mean = 0.146. Emission percent ranges from 0 to 67.961, but its distribution is densest in the single percentage range, where it varies with an sd = 5.259 around the mean = 2.013.

The effect of emission intensity disappears when controlling for ideology (model 2), while the effect of the emission percent coding is robust ($p < 0.01$) to the inclusion of this control (model 3). The emission percent coding has a larger coefficient (-0.027**) than emission intensity (-0.015) when the same covariates are included. The coefficients for the control variables are almost identical when comparing these two codings of industry emissions in model 2 and model 3. This supports both H1 and H2. Additionally, the coefficient of emissions (percent) is similar in magnitude to the age variable. This indicates that there is a strong and substantial effect of emissions on carbon tax support.

Effect of emissions on carbon tax support

	Dependent variable:		
	Carbon tax support		
	(1)	(2)	(3)
Emission intensity	-0.017*	-0.015	
	(0.008)	(0.008)	
Emissions (percent)			-0.027**
			(0.008)
Right-wing		-0.108***	-0.109***
		(0.007)	(0.007)
Female	0.029***	0.028***	0.026***
	(0.007)	(0.008)	(0.008)
Age	-0.028***	-0.023**	-0.023**
	(0.008)	(0.008)	(0.008)
Education (years)	0.149***	0.143***	0.141***
	(0.008)	(0.009)	(0.008)
Income (decile)	0.082***	0.091***	0.093***
	(0.008)	(0.008)	(0.008)
Constant	2.799***	2.811***	2.811***
	(0.065)	(0.066)	(0.066)
Observations	28,718	26,426	26,687
Log Likelihood	-45,628.960	-41,866.210	-42,277.610
Akaike Inf. Crit.	91,275.910	83,752.410	84,575.210
Bayesian Inf. Crit.	91,350.300	83,834.240	84,657.130
Note:	*p<0.05; **p<0.01; ***p<0.001		
	All covariates are Z-transformed		

Fig: Multilevel regression models testing hypothesis 1 and 2, comparing the relationship of two codings of industrial emissions – emission intensity and emission percentage – on carbon tax support. All independent variables are Z-transformed.

4.2.3 H3: The exacerbating effect of economic risk on carbon tax support

An exacerbating effect of economic risk, modelled as the interaction between economic risk and emissions, would suggest that industry emissions shape policy preferences because of economic concerns. Two economic risk variables are added to the three models below. The first is 'economic risk', which captures latent, objective risk. This risk is proxied by occupational-level unemployment rates in the household, measured on the level of respondent and partner. Averages are computed over the two unemployment rate values to produce a 'mean risk' value. If a respondent does not have a partner, only their own unemployment rate is used. This allows for a far higher number of observations, as many respondents do not have a partner or do not provide information about their occupation.

The second is 'difficult income': economic anxiety measured as self-reported feeling about one's income. Both this and the former variable are included, with the aim of capturing both the perceived anxiety and latent unemployment rate risk. One can have an effect without the other: high-income employees will not say that they are 'coping on present income', but they can still be worried about lower wages or unemployment, and they may believe that a higher carbon price has these effects. Avoiding long-term unemployment is not the only motivation for individuals to keep their job – many people may be fond of their job, colleagues and tasks.

In addition, two more control variables are added to these models: 'Govt should reduce inequality', which controls for general tax preferences and the preferred role of the state for reducing inequality; and 'CC is human-caused', CC meaning 'climate change'.

The following models are used to test *H3: There is a negative interaction between higher economic risk and higher industry emissions on carbon tax support.*

There are no interactions included in model 1. No variables are Z-transformed here; this makes the coefficients easier to interpret. Carbon taxes have little effect on the least polluting industries; they only adversely affect emitting companies. Therefore, the effects of the two economic risk variables are not of interest by themselves. Model 1 provides a simple baseline: the economic risk coefficient is significant ($p < 0.05$) and positive. Difficult income has a coefficient that is highly significant (p

< 0.001) and negatively signed, meaning that respondents with more 'difficult income' are less likely to support carbon taxation. The effect of emissions is practically unaffected by the addition of these covariates in model 1; it is still negative and significant at the 0.01 level. It ranges from 0 to about 20 percent in most countries, and the maximum level is 68 percent. A maximum change in this value produces a substantial change (-0.34**) in the dependent variable, which further validates hypothesis 1: higher emissions have a negative effect on carbon tax support. The coefficients of covariates that were included in the previous models are not significantly changed. The two control variables that are added in this model have positively signed coefficients and are highly significant in all three models. The effect of belief in climate change science is especially strong.

Models 2 and 3 include interaction effects of the two economic risk variables with emissions Surprisingly, there is no significant interaction on 'Economic risk' (model 2). The interaction on 'Difficult income' (model 3) reaches the significance threshold ($p < 0.05$), but it is sensitive to different model specifications, and the significance disappears when design weights are replaced with post-stratification weights, in contrast to the emission coefficient, which remains significant under several robustness tests. This provides weak support for the interaction hypothesis, and suggests that economic self-interest is an unconvincing driver of the emission effect. Alternatively, individuals may not be aware of their occupational unemployment rates – or variation in this variable may be cancelled out by coarse occupational groupings.

Effect of emissions and economic risk on carbon tax support			
	Dependent variable:		
	Carbon tax support		
	(1)	(2)	(3)
Emissions (percent)	-0.005**	-0.012**	-0.002
	(0.002)	(0.004)	(0.003)
Economic risk	0.005*		0.006*
	(0.002)		(0.003)
Difficult income	-0.155***	-0.161***	
	(0.012)	(0.012)	
Govt should reduce inequality	0.064***	0.064***	0.057***
	(0.008)	(0.008)	(0.008)
CC is human-caused	0.203***	0.202***	0.202***
	(0.010)	(0.009)	(0.010)
Right-wing	-0.042***	-0.042***	-0.040***
	(0.003)	(0.003)	(0.003)
Female	0.041**	0.047**	0.039*
	(0.015)	(0.015)	(0.015)
Age	-0.001*	-0.001*	-0.0005
	(0.0005)	(0.0004)	(0.0005)
Education (years)	0.032***	0.032***	0.034***
	(0.002)	(0.002)	(0.002)
Income (decile)	0.013***	0.013***	0.033***
	(0.003)	(0.003)	(0.003)
Emissions x Difficult income		0.004*	
		(0.002)	
Emissions x Economic risk			-0.0005
			(0.0005)
Constant	1.892***	1.938***	1.466***
	(0.096)	(0.096)	(0.095)
Observations	25,693	25,942	25,711
Log Likelihood	-40,914.650	-41,318.540	-41,039.290
Akaike Inf. Crit.	81,857.290	82,665.090	82,106.590
Bayesian Inf. Crit.	81,971.450	82,779.380	82,220.750
Note:			*p<0.05; **p<0.01; ***p<0.001

Fig: Models testing testing hypothesis 3: the interaction effect of emissions with (i) objective and (ii) subjective measures of economic risk (the latter termed 'Difficult income').

4.2.4 H3: Effects on other climate policies and climate worry

The last set of regression models test the effect on other climate policies. These models are run to strengthen the conceptual logic behind the emissions-carbon tax support relationship; no interactions are included here. The table below summarises the results from testing the last hypothesis: *H4: Higher emissions will have a stronger effect on carbon taxes than other climate policies.*

For comparison, model 1 from the previous section is repeated as model 1 here; it juxtaposes the emissions-policy effect identified above, showing a significant ($p < 0.01$) effect of emissions on carbon tax support as the dependent variable. Economic risk variables are not of interest; they are included for model comparison only. The 'Emission (percent)' variable is not significant when the dependent variable is 'Ban least energy-efficient appliances' (model 3), as expected. In isolation, this finding strengthens the economic interest mechanism which was termed unconvincing in the interaction models above. Surprisingly, the emission coefficient when the outcome is 'Subsidise', subsidising renewables, (model 2) is highly significant ($p < 0.01$). The emissions effect is also marginally stronger on subsidy support than in the carbon tax support model (1). This is striking, as the issue of subsidising renewables was expected to be less polarising due to its less cost-intrusive nature; subsidies benefit certain companies, but not necessarily certain industries in full. Subsidies can be beneficial to sectors that are dominated by 'clean' enterprises. The median company in a coal-dominated power sector, for example, would not demand subsidies for renewables, as that would enable competing firms to take market shares. This unexpected effect on the industry level suggest that linking subsidy preferences to competitive concern is common; it is not limited to workers in certain high- and low-emitting companies. Instead, it is a widespread motivation for workers on the emission continuum to oppose subsidies.

Climate worry is not significantly affected by emissions (model 4). Because risk perception of climate change is an important precursor of policy support, a non-significant climate worry relationship indicates that high-emitters experience cognitive dissonance: compared to the rest of the population, employees with high industry emissions have similar risk perceptions of climate change. Supporting a carbon tax would mean an acknowledgment of their contribution to a negative social and environmental external cost for society, but high-emitters instead react hesitantly when confronted with economic policy proposals to mitigate climate change. The implication is that the economic interests of the company spreads to individual employees, supporting the diffusion mechanism.

Support for climate policies and worry about climate change

	Dependent variable:			
	Carbon tax support	Subsidise	Ban appliances	Climate worry
	(1)	(2)	(3)	(4)
Emissions (percent)	-0.005**	-0.006***	-0.0005	-0.0004
	(0.002)	(0.001)	(0.001)	(0.001)
Economic risk	0.005*	0.002	-0.00005	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Difficult income	-0.155***	-0.019	-0.016	0.048***
	(0.012)	(0.010)	(0.011)	(0.008)
Govt should reduce inequality	0.064***	0.088***	0.100***	0.057***
	(0.008)	(0.006)	(0.007)	(0.005)
CC is human-caused	0.203***	0.177***	0.199***	0.338***
	(0.010)	(0.008)	(0.009)	(0.007)
Right-wing	-0.042***	-0.025***	-0.022***	-0.027***
	(0.003)	(0.003)	(0.003)	(0.002)
Female	0.041**	0.038**	0.099***	0.103***
	(0.015)	(0.013)	(0.015)	(0.011)
Age	-0.001*	-0.002***	0.003***	-0.0001
	(0.0005)	(0.0004)	(0.0004)	(0.0003)
Education (years)	0.032***	0.018***	0.016***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)
Income (decile)	0.013***	0.013***	0.020***	0.008***
	(0.003)	(0.003)	(0.003)	(0.002)
Constant	1.892***	3.007***	2.127***	1.431***
	(0.096)	(0.081)	(0.086)	(0.068)
Observations	25,693	25,879	25,808	25,981
Log Likelihood	-40,914.650	-36,460.330	-40,277.470	-32,423.700
Akaike Inf. Crit.	81,857.290	72,948.660	80,582.950	64,875.400
Bayesian Inf. Crit.	81,971.450	73,062.920	80,697.160	64,989.710
Note:				*p<0.05; **p<0.01; ***p<0.001

Fig: Models testing hypothesis 4: the effect of emissions and risk on all climate policies and climate worry.

4.3 Summary: Drivers and implications

These findings indicate that there is a strong and robust effect of emissions on carbon tax support. A striking finding is that emissions shape demand for renewable subsidies as well. I have outlined three distinct mechanisms that explain how: occupational task structures, diffusion mechanisms and economic self-interest. The comparison of emission codings shows that policy opposition is not closely correlated with carbon intensity on industry level; this suggests that employees' carbon tax opinion is not strongly affected by the tax burden on their industry. I proposed that top-down diffusion effects could occur within a company – significant between-company variation can explain why emission percent is a better predictor of opposition than emission intensity. Because emissions are measured on the industry level, it is difficult to discern whether the cleanest companies in an industry actually lose or gain a competitive advantage from higher carbon taxes. Earlier research indicates that the cleanest companies in a sector lobby for more stringent environmental policy, either as an expression of 'hedging' even more intrusive regulations, or based on economic concerns: when the cleanest company embraces more regulation, dirtier companies that compete in the same market will be more disadvantaged (Meckling 2015). Future research should address this unresolved question by measuring emissions on the company level, and thereby test the diffusion mechanism, which remains plausible. The findings of this thesis suggest that value diffusion within polluting companies can shape employees' policy preferences.

Occupational task structures was another proposed driver of the emission effect. It is not tested explicitly, as there are no test instruments present in the available data. Class and occupation explanations can still be valid drivers of the emission effect. Occupational task structure theory relates political behaviour to learnt problem-solving mechanisms. The general assumption is that a manager with disposable resources at hand can throw money at a problem, while a blue-collar worker would choose a different strategy. This can produce different policy demands.

Higher economic risk was expected to reinforce the effect of higher emissions. A non-significant interaction with economic risk, and a mild interaction with economic anxiety, implies that the emissions effect is not contingent on economic self-interest.

4.3.1 The entrenched emitter effect

An emission effect on carbon tax opposition was expected, but the effect on subsidies was not. The high-emitting workforce can get defensive about their emissions, motivated by industrial interests, and oppose economic measures that can make the economy less carbon-dependent, despite not being less worried about climate change than low-emitters. This produces an entrenchment of emissions: high-emission industries drive individual opposition to economic measures that are supposed to decarbonise both the dirtiest industries and make the cleanest alternatives competitive. They are not motivated by economic considerations. These beliefs will likely not change when the economic conditions change; they may be long-term.

Unfortunately, the cross-sectional data does not allow for drawing inferences about how climate policy opinions change when workers switch jobs. Future research should address this. High-emitters may be hesitant about taking a new job in cleaner industries that receive subsidies, and they may even be skeptical of switching to cleaner energy. Does this mean that geologists and petroleum engineers are somewhat less inclined to move into renewable energy sectors? They oppose subsidies for renewables, but do they oppose renewable energy industry as well? Opinions on climate change may be clustered with attitudes towards energy security, prioritising that economic growth prevails unhindered, and reasoning that defends the 'importance' of fossil fuels for the economy. They may say that change will come; market forces will make way for new technologies when they mature and costs fall. If they keep these opinions after switching jobs, this can be a barrier to technological change; a brain drain from dirty to clean sectors is needed, but the entrenched emitter effect can hinder it.

Under neutral coverage that exempted no polluters from paying, high-emission industries would have to pay the highest carbon tax dividends. When they shape voter preferences, they have influence over policy. The consequence is that the entrenchment effect hinders decarbonisation on two levels: if both subsidies and carbon taxes are low, high-emitters can avoid changing their operations, and clean competition will be kept out of the market for longer. Renewable technology in early development phases have steep cost curves; electric vehicles, for example, still require subsidies to be cost-competitive in many countries (Santos and Rembalski 2021).

4.4 Robustness and validity

These results are robust to several changes in model specifications: (i) running regressions on partitions of the dataset, split into only high-emitters and low-emitters (with a cut-off point at 6 percent of emissions); (ii) including an energy producer dummy for energy-producing industries (not significant); and (iii) adding post-stratification weights instead of design weights. They all have negligible effects on the parameter estimates and would not change the conclusions.

The dependent variables come from the same round of questions. When a researcher asks a respondent to subsequently rate elements on a specific theme in order several times, respondents tend to adjust their answers to display consistency. This general problem of nondifferentiation between survey questions can bias the validity of the data (Krosnick 1999). In this case, the dependent variable of interest – carbon tax support – result from the first question in this battery; any validity problems that this response effect introduces will likely only affect the other variables, and not the main results. The effect of emissions on ban/regulative climate policy is insignificant, so if this has introduced any bias it is negligible and will likely not affect the conclusions.

What are the dependent variables measuring? Preferences for fossil fuel taxes were measured with a general question that did not point towards industry emissions specifically; earlier research uses this specific variable in the same way (Hughes and Urpelainen 2015). I use the term carbon taxes throughout, even though the question asks strictly about fossil fuel taxes, which are energy taxes. Carbon pricing is an intricate web of excise duties, general taxes and cap-and trade regimes. The wording of the survey question asks whether respondents are in favour of '*increasing taxes on fossil fuels, such as oil, gas and coal*', which in theory could be limited to direct excise taxes on specific fossil fuels. Using the Norwegian case as an example, this would mean that the road usage tax on engine fuel ('*veibruksavgiften*'), which is levied on several fuels including biodiesel, would be only partially considered a fossil fuel tax, despite its implementation relying on the «polluter pays»-principle (Regjeringen 2020). Biofuels are not fossil fuels, despite producing emissions, and a consistent 'fossil fuel tax' would exempt petroleum-based mineral oils for other purposes than direct combustion, which are levied differently (Skatteetaten 2021). Beyond specific fossil fuels, the question could be further limited to direct taxes, excluding those sectors whose emissions are only subject to permit prices under the EU ETS, which covers a range of sectors and fuels in Norway, and works in tandem with national carbon pricing mechanisms (OECD 2019). More broadly, individuals can interpret fossil fuel taxes as a price hike on personal consumption of gasoline and diesel. Tax costs targeting consumers instead of producers are unpopular, and the question does not distinguish between these two. This could be a source of bias, especially in relation to income, as higher fuel prices at the pump would disproportionately affect the least affluent.

While all of these understandings can be present in the European population, I assume that individuals conflate fossil fuel taxes with fees, emissions allowances and similar market-based pricing instruments. This makes it possible to link occupational characteristics, including emissions and unemployment rates, to policy support. Because there is a significant emission-carbon tax opposition effect, industry emissions do drive skepticism about carbon taxation, which would be harder to explain if respondents understood carbon taxes as a policy that did not affect their own salary. In sum, the validity concerns do not alter the conclusions. Future research can address this by constructing a survey battery that differentiates between carbon taxes that target industry and individuals. If anything, the results are expected to be reinforced by more appropriate survey design.

Concerning the operational validity of the independent variables, there are some caveats which have been mentioned already. Emissions are measured on industry level, not on company level; identifying company-specific effects is more difficult as a result. Unemployment rates were assigned to respondents based on their occupation and gender; whether respondents are aware of especially high or low unemployment in their occupation is not clear. Considering that this variable did have mildly significant coefficients as a fixed (non-interaction) effect, there seems to be a real statistical association, which diminishes this concern.

A challenge with interpreting the economic risk variable appears in the following range of cases: If an individual and their partner both work in occupations with high unemployment, the resulting risk of losing a job is not moderated to the average value, it is exacerbated. Because of this, the household effect was also tested with a different coding, 'economic risk product': the exacerbating effect of household risk. The two unemployment values are multiplied, because job loss risk is a more severe problem when one's partner is exposed to high unemployment risk. This alternate coding accounts for cases where both jobs are at higher risk. If either of the unemployment rates is 0, they are summed instead of multiplied, to avoid reducing the risk product value to 0. The risk product coding resembles a simple interaction term between unemployment rates, which was the variable of interest in the paper by Abou-Chadi and Kurer (2020) that inspired this conception of household risk exposure. The economic risk product was somewhat significant in certain parametrisations of the models, similar to the mean economic risk presented in the models. Results are robust when exchanging the variables.

4.5 Limitations, implications and the path ahead

Shifting the perspective from industry to company level can be useful. Companies in both winning and losing industries will likely exhibit similar patterns of policy opposition on average, but all companies in a in industry do not have identical interests. Studies on lobbying at the firm level reveal that there can be significant variation within industries. This is a confounding factor. Earlier research on US lobbying indicate that the cleanest companies in an industry lobby for environmental regulation, believing that it will give them a competitive advantage (Delmas, Lim and Nairn-Birch 2015). This adds context to how policy opinion can vary with industry emissions, and consequently, how the winner/loser framing produce hypotheses that future research should aim to test.

There is significant interest variation among firms, beyond the immediate winner/loser framework that was used to illustrate the expected interests of companies, and how they align with employee policy opinion. Not all companies are directly affected by carbon taxes, and consequently do not belong to either a winner or loser group. But companies in their supply chain may be polluters, and carbon taxes can skew the prices of input resources such as energy or materials. This enables industry-inflicted policy opposition to exist beyond the directly carbon-dependent industries. The majority of corporate opposition to climate policy in the US «comes from outside the highest-emitting industries» according to research by Cory, Lerner and Osgood (2020). Companies opposing climate action have carbon-intensive upstream suppliers and sell to downstream emitters; these supply chain linkages produce an «extended carbon coalition» that have vested interests in maintaining carbon prices at a low level. While this provides nuance to the simple notion that some companies are winners and some are losers, it does not muddle the logic that relates emissions to policy opposition. The supply chain can be malleable – pollutive inputs can be replaced, and therefore, the 'opposition elasticity' of a company supply chain should be higher than the within-company policy interests, which are expected to be more consolidated. Dirty supply chains is not expected to influence long-term carbon tax opposition among individual employees in the same way winner and loser companies shape their employees.

Without experimental studies, causal inference from these findings is not possible. The cross-sectional observational ESS data does neither allow for analysing change over time. Consequentially, any statistical inference from these findings can not explain an eventual change in climate policy attitudes, if a steel worker in Poland, for example, were to quit their job and work as a shop clerk – an industry with far lower operational emissions. Future research should employ research methods that aim to identify if this link is causal. This can establish whether this statistical relationship holds under experimental conditions.

4.6 Discussion

Assuming the median individual is not well-traversed in the tax rates on different industries, a viable route to strengthen this argument would be by testing whether climate policy support is associated with the tax burden on the specific industries, which was beyond the scope of this paper.

What will happen in the future? After a successful green transition, renewables dominate the electricity mix. If most industries manages to eliminate their carbon footprint, the sectors that are truly dependent on carbon – either stemming from locked-in emissions or processes that cannot be made clean, such as cement and iron production – will produce a larger share of the within-country emissions relative to the rest. This could lead to polarisation on climate policies in the workforce: 'grey' outsiders will have stronger motivations for opposing costly carbon pricing, and 'green' insiders will have stronger reasons to support renewable subsidies, as they could benefit their economic baseline. This is fertile ground for further research.

New data is essential for scientists to explain the driving forces behind current political issues (Kittilson 2007, 893), and much has happened since 2016, when the survey data was collected. The significance of this study is somewhat limited by events that have happened since: in 2018, the yellow vests movement in France was catalysed by a proposed increase in fuel taxes; climate change has been termed a climate crisis, climate protesters have taken to the streets in droves, and recent reports from the IEA and IPCC have underlined what many have feared: there is no room for more petroleum exploration if the world is able to limit warming to 1.5 °C. Climate change has taken on a new meaning for many in the aftermath of these developments. Whether this have split the electorate on the issue of carbon taxation, or motivated those with vested interests in the fossil-fuel status quo to cross the aisle and let go of their economic privilege, remains to be seen. The field of climate policy support research has much to accomplish in a short timespan.

5. Conclusion

As time goes on and climate change grows in salience, it is crucial to understand the factors that shape support for and opposition to climate policy. Whenever this research field has been focused on the effects of carbon emissions and high-emission industries, it has mostly been limited to investigating effects on country-level. While the climate policy support literature is large, very few studies exist on how industries influence individual carbon tax support. It is puzzling that this void exists, because the influence of business interests in politics, and organisational effects on individuals, have been widely examined. Carbon taxes are the most promising instruments for mitigating climate change, but public support is missing, and business opposition water down policy proposals. Conveniently, there is more favourable public support for taxing producers than for taxing consumers. But the findings in this thesis unveils that there is a substantial amount of high-emitters, and they have oppose both carbon taxes and subsidies significantly more than others. Earlier sectoral groupings are coarse, and cannot tell us much about the real opinion variation. This thesis finds support for an emissions-policy support effect that is robust on the whole continuum of emitting industries, even when splitting the data and re-running the regressions with only high-emitters (>6 percent of emission share) and low-emitters (<6 percent).

The primary contribution of this thesis is the identification of a robust effect of emissions on carbon tax opposition, equally substantial to the effects of age and gender. The thesis presents three distinct explanations for the emission effect: economic self-interest, within-company diffusion and occupational task structures. The interaction effects between emissions and either of the two economic risk variables were not significant, indicating that economic self-interest is not the driver of the emission effect, contrary to earlier research. Researching this mechanism is beyond the scope of this thesis; there are no attempts to create falsifiable hypotheses about the specific mechanism that governs the emission effect, because the available data is not suited to this task. Rather, these three frameworks can guide future research.

A second contribution is the surprising finding that there is a nearly identical emission effect on subsidies for renewables. This emission entrenchment effect suggests that high-emitters see subsidies as a competitive advantage for competing firms. A worrying consequence of this effect is that opposition produce policy inaction, and that this blocks the impetus for polluting and clean industry alike to decarbonise. Another worrying consequence is that policy opposition is long-term, because it is not directly driven by economic concerns. If high-emitter attitudes mirror the preferences of carbon-dependent coalitions, this alignment can manifest itself as cleavage line that defines domestic climate policymaking processes. When the low-carbon transition gradually moves jobs out of high-emission sectors, voter behaviour could be polarised between many low-emitters and workers in a few sectors that produce a vast share of domestic emissions. Vested interests among employers can manifest themselves as entrenched emitter effects in the workforce.

A third contribution concerns the operationalisation of emissions. Both the descriptive and multivariate results point to a widespread issue of conceptualising industry emissions, which has been overlooked in earlier research. Decoupling emissions from growth is a useful framing of sustainable development, but decoupling can produce unexpected results when the aim is to analyse effects of 'dirty' sectors. Among others, the petroleum sector of Norway, the largest oil and gas exporter in the sample, illustrated this point. GDP is not a proper correction of industry size when estimating emission effects on climate policy preferences. A better way of accounting for industry size could be by dividing by workforce magnitude, because the units of interest in policy preference research are individual citizens.

Meaningful climate reforms can bring about deep decarbonisation – the green transition to economies with net zero carbon emissions. The greatest impediment for deep decarbonisation is sustaining broad public support for climate reforms (Wiseman, Edwards and Luckins 2013). Policymakers can mediate public policy opposition by softening climate policies' effects on competition, e.g. through green jobs programs that complement market-based climate mitigation strategies. These programs can provide a softer transition for many high-emission workers, and a path out of emission entrenchment.

Appendix

Variables

Latent variables are operationalised with the following variables from ESS and Eurostat:

Dependent variables:

inctxff: Favour increase taxes on fossil fuels to reduce climate change (1-5)

sbsrnen: Favour subsidise renewable energy to reduce climate change (1-5)

banhhap: Favour ban sale of least energy efficient household appliances (1-5)

wrclmch: Climate change worry (1-5)

Industry emissions:

nacer2: 'What does/did the firm/organisation you work/worked for mainly make or do?' Economic activities, «industries», NACE Rev. 2.

Eurostat data set of GHG emissions per NACE industry per country (appendix).

Eurostat data set of emissions intensity per NACE industry, clustered by country (appendix).

Objective economic risk:

EU Labour Force Survey data on unemployment rates in ISCO level 1 categories: EU-LFS Unemployment rates are aggregated within three variables: 21 countries, ten occupation levels and two genders, and ranges from 0–15.6 percent.

Subjective economic anxiety:

hincfel: Feeling about household's income nowadays (coded 'difficultincome')

Economic control variable (control for general tax preferences):

gincdif: Government should reduce differences in income levels

Control variables:

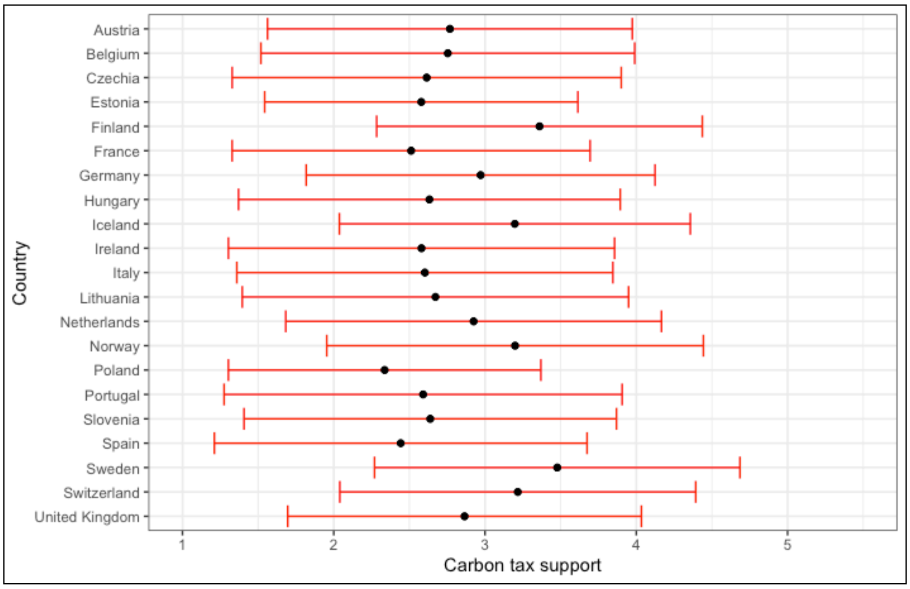
agea: Age

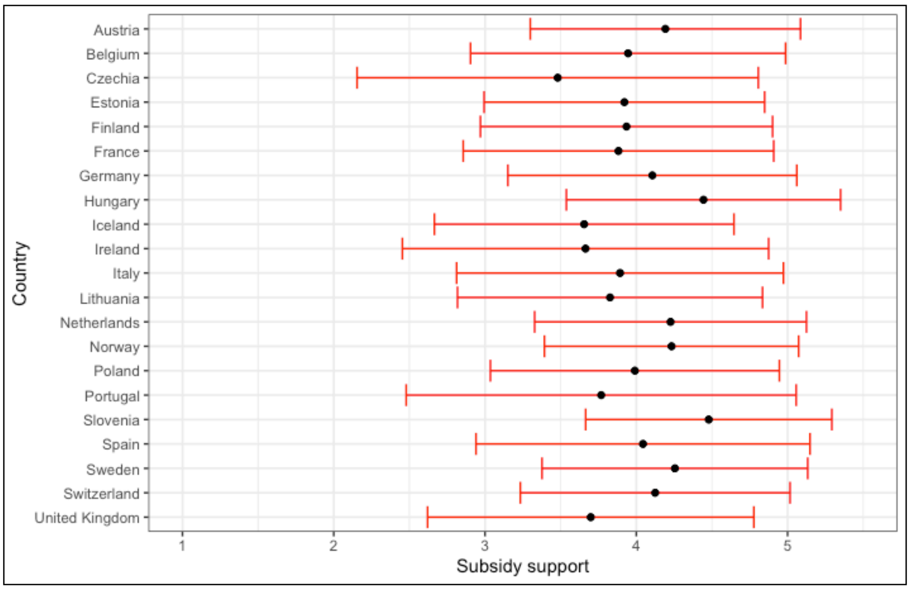
gndr: Gender (Male, Female)

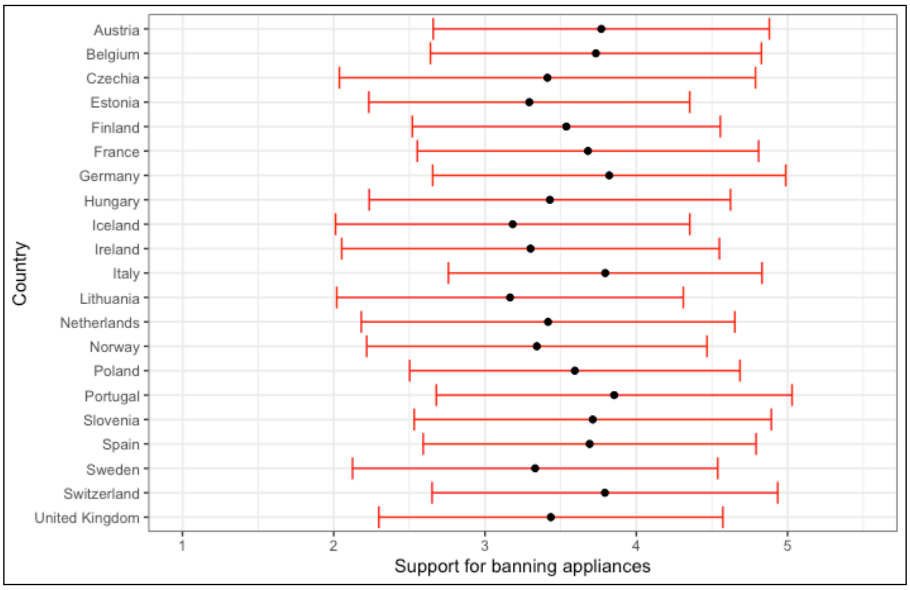
eduyrs: Years of full-time education completed (max. answer: 54)

lrscale: Placement on left right scale (1-10) hinctnta: Household's total net income, all sources (deciles)

Variable distributions within the 21 countries, mean and 1 sd







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