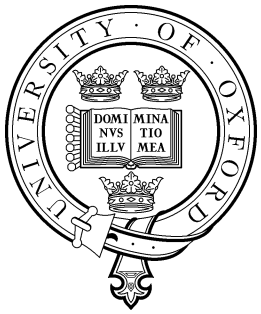
Splitting the Check: A Political Economy of Climate Change Policy



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Declaration

I hereby declare that except where specific reference is made to the work of others, the contents of this submission are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other University. This submission is the result of my own work and includes nothing which is the outcome of work done in collaboration. This submission contains less than 100,000 words including appendices, bibliography, footnotes, and tables.

Alexander Sayer Gard-Murray
Trinity 2019

Abstract

The literature on climate politics has often treated policy as being nationally uniform, obscuring the ways in which different groups in the economy face different costs from mitigation. Chapter 2 develops a formal model of climate change policymaking in which stringency can vary across sectors of the economy. I show that if capital-owners have some disproportionate influence over the government, it should affect which sectors get targeted with mitigation policy. Chapter 3 uses "shadow price" data developed by Althammer and Hille[1] to measure the stringency of climate policy on a sectoral level. Using multi-level modelling, I show that economic interests have an advantage over environmental ones, that producers have an advantage over consumers, and that capital receives more protection than labor. Chapter 4 examines the role of ideology, and shows that while most parties protect capital to some extent, right parties do so more than left ones. Chapter 5 tests whether broader political economy arrangements that protect labor enable or block stronger mitigation policy. I find that an enabling effect predominates: labor-intense sectors accept heavier policy burdens when labor-protective institutions and policies are stronger. Chapter 6 moves beyond shadow pricing data to look at public opinion. It offers the first many-country study to show that climate attitudes are shaped by individuals' sector of employment. Chapter 7 concludes with a review of the results and avenues for future research.

[1]Wilhelm Althammer and Erik Hille. "Measuring Climate Policy Stringency: A Shadow Price Approach". In: *International Tax and Public Finance* 23.4 (2016), pp. 607–639.

For Mom

Acknowledgements

A visitor to Maine, upon asking directions to a remote corner of the state, is liable to receive the unsettling response "you can't get there from here."[2] This captures the experience of writing a dissertation: a sense that the destination definitely exists but is mysteriously inaccessible from your current location. Many people helped me to escape this conundrum.

I am deeply grateful to Nancy Bermeo for her constant generosity and wisdom. Without her agreement to serve as my supervisor I wouldn't have started the journey, let alone reached its end. She supported me when I completely changed the direction of my work, jumping from civil wars to climate change. I often walked into her office full of doubts—stuck on some question, disappointed in my own progress, unsure of where to go next—but I always left with a renewed enthusiasm not only for my work but for the academic life. Her incisive questions were always asked with kindness, building the flickering flame of an idea without blowing it out. Nancy is the rare senior scholar who has not lost sight of what being a junior scholar is like.

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[2]Thanks to David Berliner for teaching me this useful phrase, among many other things.

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[3] Any institution that wants to build real community (and has the money to pay excellent cooks) should follow its example and start with free lunch for everyone involved.

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Oliver Gard-Murray and John Murray could not always be nearby, but we made the most of all the time we had together. Without them I would not have made it through. I eagerly await our next adventure.

Cheryl Gard was not alive to see this work started, let alone finished. But anything that is good in it and in me is ultimately owed to her. She was the strongest and smartest and funniest of us all. I dedicate this work to her.

I thank Lia Marcoux, my partner, from whom I have learned more than any research.

A.S.G.M.
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Abbreviations

Abbreviation	Full Name
CCES	Cooperative Congressional Election Study
CPDS	Comparative Politics Dataset
CMP	Comparative Manifesto Project
COP	Conference of the Parties (to the UNFCCC)
DPI	Database of Political Institutions
ESS	European Social Survey
ETS	Emissions Trading System
FCHH	Final Consumption by Households
IAM	Integrated Assessment Model
IEA	International Environmental Agreement
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
MAC	Marginal Abatement Cost
MWh	Megawatt Hour
NACE	Statistical Classification of Economic Activities in the European Community[4]
NDC	Nationally Determined Contribution
PAMS	International Energy Agency's Policies and Measures Databases
PR	Proportional Representation
SCC	Social Cost of Carbon
tCO_2	Metric Tons of CO_2
tCO_2e	Metric Tons of CO_2 Equivalents
toe	Metric Tons of Oil Equivalents
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollars
VA	Value-Added
WIOD	World Input-Output Database
WTP	Willingness-to-Pay
WTS	Willingness-to-Support

[4]The acronym NACE is derived from the French "Nomenclature générale des Activités économiques dans les Communautés Européennes"

Formal Notation

Symbol	Description
W^S	Social maximizer welfare
W	Political welfare
π^E	Environmentalist influence
π^K	Investor influence
π^L	Labor influence
π^D	Consumer influence
π^{KL}	Producer influence
π^{KLD}	Economic interest influence
$_i$	Sector subscript
b_i	Environmental benefits of regulation
c_i	Material costs of regulation
c_i^K	Capital-specific costs
c_i^L	Labor-specific costs
c_i^D	Consumer-specific costs
m_i	Emissions intensity
λ_i	Mitigation policy stringency
λ_i^*	Optimal mitigation policy stringency for government
θ_i	Consumer pass-through potential
ϕ_i	Labor pass-through potential

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Chapter 1

Introduction

> "Countries have adopted different approaches to climate change, both with respect to mitigation and adaptation, and we do not fully understand why. There is an intellectually vibrant comparative politics of economic policy and of human rights policy. There should be a comparative politics of climate change policy."
>
> Robert Keohane
> *The Global Politics of Climate Change: Challenge for Political Science*[1]

1.1 Towards a Comparative Politics of Climate Change Policy

Climate change is one of the most significant challenges facing governments today. If not mitigated, greenhouse gas-induced global warming will disrupt ecosystems, agriculture, sea levels, and weather patterns, and will threaten lives and livelihoods around the world. In response to this risk, many countries have actively adopted policies to reduce the emission of greenhouse gasses. These policies have taken a wide range of forms, including technology regulation, taxes on emissions,

[1] Robert O. Keohane. "The Global Politics of Climate Change: Challenge for Political Science". In: *Political Science & Politics* 48.1 (2015), pp. 19–26

tradable permits, subsidies, sanctions, mandatory targets, and funding for abatement projects or research. But many other countries have not made much effort at all. Why do some countries do more to confront climate change than others?

Any answer must account for the intense distributional issues involved in climate policymaking. Climate politics are inherently distributive politics. Groups are in conflict over who will bear the costs of environmental protection.[2] The conflicts involved exist along three broad dimensions: conflict between present and future generations, between different countries, and between different groups of people within countries. All three of these conflicts have received attention in the economics and environmental policy literatures. But as the quotation from Robert Keohane's address to the American Political Science Association suggests, the literature on the comparative politics of climate policy is still in a nascent stage.[3] As a result, this literature has largely overlooked the role of the third dimension—intra-country distributive conflicts—in the formation of climate policy.

The aim of this dissertation is to use comparative, quantitative methods to explore how distributive conflicts within countries affect the stringency of national mitigation policy outputs. Governments supply policy in response to demands from many competing interest groups. These conflicts take place not only between carbon-intense businesses and environmentalists, but between different kinds of businesses, between labor and capital, and between producers and consumers. While these conflicts have been analyzed in political case studies and the theoretical economics literature, they have yet to be fully incorporated into

[2]Any ambitious mitigation policy involves costs. These costs may be obvious and direct, as in the case of a carbon tax. Or these costs may be implicit and indirect, as in the case of caps on emissions, efficiency standards, or mandates to use particular technologies. These all impose costs, even if they do not carry an explicit price tag. In the rest of this dissertation, I will consider policies which impose higher levels of costs to be "stonger" or "more stringent."

[3]Keohane, "The Global Politics of Climate Change: Challenge for Political Science".

the quantitative analysis of policymaking across many countries, which generally focuses primarily on the conflict between businesses and environmentalists. It is time to paint a richer picture.

The core of this project is the theoretical and empirical disaggregation of climate policy and policymaking. Distributive conflict is hard to model or measure when domestic interests and policy are only represented by national aggregates. Instead, I go beneath the country level to analyze policy at the level of economic sectors. Sectors are statistical groupings of economic activities based on similar functions and technology: farming, plastics, construction, financial services, and healthcare are all examples of sectors.[4] By studying climate politics at the sector level, I am able to capture intra-country distributive variation in both interest demand and policy supply.

In doing so, I make three main contributions to the comparative study of climate politics.

First, I construct a theoretical model of mitigation policymaking that integrates multiple dimensions of distributive conflict. The model makes clear how firms, workers, investors, and consumers interests' interrelate, sometimes coinciding and sometimes conflicting. While other studies have examined these interests in isolation, this model represents the first combination of many groups and many sectors into a single theory of mitigation supply and demand. It links the observable distribution of mitigation policy stringency across different sectors to differences in group power. And it generates testable predictions about how economic structure will shape political outputs.

Second, I test the model using sector-level data on policy stringency recently developed by Althammer and Hille.[5] Their measure uses a "shadow price" ap-

[4]These classifications can themselves be more or less disaggregated. The sources and construction of the sectoral data are discussed in detail in chapter 3.

[5]Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

proach, estimating the total impact of all carbon regulation by tracking the differences between their actual and expected use of greenhouse gasses, given the prevailing prices of fossil fuels. These data cover twenty-eight developed and developing countries from 1995-2007, the crucial period in which many nations began to confront the issue of climate change. These data allow us to answer the new questions posed by the theoretical model, and also help resolve several outstanding questions in the literature. To my knowledge, this project is the first to employ a many-sector approach to the comparative statistical analysis of mitigation politics.

Third, I extend the theory and empirics to cover three of the areas in comparative climate politics that have the most to gain from a distributive approach. These correspond roughly to the classic "trinity" of comparative politics: institutions, ideas, and interests.[6] I look at the larger political economy context, to see how institutions which protect labor interact with the distributive interests analyzed earlier. I unpack the supply side of policymaking, showing how the effects of political ideology on mitigation are conditional on sector-level factors. And I test whether and how the interests of individuals' sectors of employment affects their attitudes towards climate change and its mitigation. The results validate the basic theoretical model, contribute to ongoing debates in these literatures, and suggest new directions for research.

Beyond climate politics, I also contribute to broader debates about inequality, legitimacy, and representation in modern democracies. There has been substantial interest in recent years in understanding the extent to which democratic politics have been captured by economic elites. There is no question that the

[6]Peter A. Hall. "The role of interests, institutions, and ideas in the comparative political economy of the industrialized nations". In: *Comparative Politics: Rationality, Culture, and Structure*. Ed. by Mark I. Lichbach and Alan S. Zuckerman. Cambridge University Press, 1997, pp. 174–207.

wealthy have more resources with which to influence governments. The question is: to what extent do they manage to successfully leverage these resources to do so? This question has been especially pressing in the United States,[7] but it has also caused serious concern in other advanced democracies.[8]

This is not a new concern: the idea that business elites possess a "privileged position" goes back to Lindblom[9] and earlier, and the idea that well-resourced small groups have an advantage in pursuing their interests is nothing new either.[10] But especially in the wake of the global financial crisis in 2008-2009, scholars have been increasingly concerned with whether elite influence has risen to the point that it is undermining democratic functioning and legitimacy.[11]

At its heart this issue can be characterized as a principal-agent problem.

[7] *Inequality and American Democracy: What We Know and What We Need to Learn*. Russell Sage Foundation, 2005; Larry M. Bartels. *Unequal Democracy: The Political Economy of the New Gilded Age*. New York and Princeton, NJ: Russell Sage Foundation and Princeton University Press; Jacob S. Hacker and Paul Pierson. *Winner-take-all politics: How Washington made the rich richer-and turned its back on the middle class*. Simon and Schuster, 2011, p. 368; Martin Gilens and Benjamin Page. "Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens". In: *Perspectives on Politics* 12.3 (2014), pp. 564–581; James N. Druckman and Lawrence R. Jacobs. *Who Governs? Presidents, Public Opinion, and Manipulation*. Chicago, 2015.

[8] H. Macartney. *The Debt Crisis and European Democratic Legitimacy*. Springer, 2013; Thomas Piketty. "Capital in the Twenty-First Century". In: (2013); Anthony B Atkinson. "After Piketty?" In: *The British Journal of Sociology* 65.4 (2014), pp. 619–638; Pepper D. Culpepper. "Structural power and political science in the post-crisis era". In: *Business and Politics* 17.3 (2015), pp. 391–409.

[9] Charles E. Lindblom. *Politics and markets: the world's political economic systems*. New York: Basic Books, 1977, p. 403.

[10] Mancur Olson. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press, 1965.

[11] This is an active area of debate, and others have pushed back against the idea of elite domination. Critics of (Gilens and Page, "Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens") argue that the interests of the middle-class people often coincide with those of elites (Peter K. Enns. "Relative Policy Support and Coincidental Representation". In: *Perspectives on Politics* 13.4 [2015], pp. 1053—1064) and that when they differ, non-elites win as often as elites (O.S. Bashir. "Testing Inferences about American Politics: A Review of the "Oligarchy" Result". In: *Research & Politics* [2015]). If true, the representation problem could be less severe than it first appears. In Europe, interest group representation may be robust enough to include non-elite perspectives (Justin Greenwood. "Organized Civil Society and Democratic Legitimacy in the European Union". In: *British Journal of Political Science* 37 [2007], pp. 333–357). Recent lapses in trust and perceptions of legitimacy may simply be normal fluctuations in political life (Kriesi2013. "Democratic legitimacy: Is there a legitimacy crisis in contemporary politics?" In: *Politische Vierteljahresschrift* 54.4 [2013], pp. 609–638).

In theory the "people" are the principals and policymakers their agents.[12] But policymakers have discretion to make policy choices that deviate from the popular interest, however conceived. Their latitude to do so is especially wide when the policy area in question is difficult for the public to monitor.

Climate change is an especially difficult issue in this regard. The primary benefits of mitigation are never felt directly: they are invisible and mostly occur in the future. Even if we succeed at mitigating climate change there will be no observable counter-factual. Even if citizens could see the future, the global nature of climate change means they cannot attribute aggregate changes directly to the actions of their principals. Even the immediate effects of mitigation policy are more difficult to observe, relative to normal taxes and transfers. The complexity and multiplicity of mechanisms implemented to mitigate climate change make it hard for any individual to understand everything their country is doing. They often operate through complex chains of cost-shifting[13] which no individual is likely to have the resources to track. This lack of clarity[14] inhibits citizens' ability to monitor the performance of their elected officials on this crucial issue.

Most pressingly for questions of inequality, the opacity of climate policymaking means that representatives have an especially wide window of opportunity to make distributive choices that are not immediately apparent to their constituents. The extent to which this leads to inequality and undermines democratic representation depends on whether policymakers use this opportunity to protect economic elites. This dissertation will seek to help unpack this question, by tracing how dif-

[12]Nadia Urbinati and Mark E. Warren. "The Concept of Representation in Contemporary Democratic Theory". In: *Annual Review of Political Science* 11 (2008), pp. 387–412.

[13]Don Fullerton and Erich Muehlegger. "Who Bears the Economic Costs of Environmental Regulations". NBER Working Paper Series. Cambridge, MA, 2017.

[14]G. Bingham Powell and Guy D. Whitten. "A Cross-National Analysis of Economic Voting: Taking Account of the Political Context". In: *American Journal of Political Science* 37.2 (1993), pp. 391–414; Sara Hobolt et al. "Clarity of responsibility: How government cohesion conditions performance voting". In: *European Journal of Political Research* 52.2 (2012).

ferent countries allocate their climate policy burdens across elites and non-elites.

The remainder of this chapter will proceed as follows. I begin by highlighting few key limitations in the current literature on climate change mitigation policy, ending with a discussion on why more attention to distributive interests is necessary. I use three brief case vignettes from Norway, the United Kingdom, and the United States to show how existing non-distributive approaches will fail to capture important phenomena. I then conclude with an outline of the dissertation and a summary of its main findings.

1.2 The Research Frontier

At the global level, mitigating climate change is the ultimate public goods problem, in which the benefits of action accrue to everyone on the planet irrespective of contributions. This global coordination challenge has been the focus of much of the climate politics literature. But there is a domestic level to the problem as well. And there is a growing sense among political scientists of the need for a more robust comparative politics of domestic climate policy.[15] Both Harrison and Sundstrom[16] and Victor[17] have called the domestic politics of climate change a "black box" that is too seldom opened.

[15]Kathryn Harrison and Lisa McIntosh Sundstrom. "The Comparative Politics of Climate Change". In: *Global Environmental Politics* 7.4 (Dec. 2007), pp. 1–17; Kathryn Harrison. "A Tale of Two Taxes: The Fate of Environmental Tax Reform in Canada". In: *Review of Policy Research* 29.3 (May 2012), pp. 383–407; David G. Victor. *Global Warming Gridlock : Creating More Effective Strategies for Protecting the Planet*. Cambridge University Press, 2011, p. 358; Paul F. Steinberg and Stacy D. VanDeveer. *Comparative Environmental Politics: Theory, Practice, and Prospects*. MIT Press, 2012, p. 424; Xun Cao. "Interest Groups, Partisan Politics, and the Development of Renewable Energy in the OECD Countries". 2014; Keohane, "The Global Politics of Climate Change: Challenge for Political Science"; Mark Purdon. "Advancing Comparative Climate Change Politics: Theory and Method". In: *Global Environmental Politics* 15.3 (Aug. 2015), pp. 1–26; Andreas Duit et al. "Greening Leviathan: the rise of the environmental state?" In: *Environmental Politics* 25.1 (Sept. 2016), pp. 1–23.

[16]Harrison and Sundstrom, "The Comparative Politics of Climate Change".

[17]Victor, *Global Warming Gridlock : Creating More Effective Strategies for Protecting the Planet*.

What is going on within that "black box"? Other contributors to the field have identified a range of ways that the study of climate politics needs to be deepened. This section will highlight three such calls for improvement, to which this dissertation seeks to respond. There is a need for more work that (1) uses large-N, comparative methods; (2) focuses on domestic policy stringency; and (3) offers a richer account of economic interests.

1.2.1 A Large-N Comparative Approach

There has been a dearth of comparative work on climate politics.[18] Environmental issues more generally have not been at the core of comparative politics. In a meta-analysis of 614 articles in *Comparative Politics* and *Comparative Political Studies* from 1990-2010, the period in which climate change first became politically salient, Steinberg and VanDeveer[19] find that less than 1% of them dealt with any environmental issue at all.

An earlier meta-analysis by Munck and Snyder[20] classifying 319 articles from those same journals and *World Politics* did not find enough pieces focused on the environment to justify noting it as a category. Nor is the problem confined to the comparativist side: Steinberg and VanDeveer also ask why "researchers in environmental politics and policy" are "paying so little attention to insights from comparative politics?" The solution, they argue, demands that both sides come together in a "doubly-engaged" research program that combines environmental

[18] Steinberg and VanDeveer, *Comparative Environmental Politics: Theory, Practice, and Prospects*; Cao, "Interest Groups, Partisan Politics, and the Development of Renewable Energy in the OECD Countries"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method"; Keohane, "The Global Politics of Climate Change: Challenge for Political Science".

[19] Paul F. Steinberg and Stacy D. VanDeveer. "Comparative Theory and Environmental Practice: Toward Doubly Engaged Social Science". In: *Comparative Environmental Politics: Theory, Practice, and Prospects*. Ed. by Paul F Steinberg and Stacy D VanDeveer. Cambridge, MA: MIT Press, 2012. Chap. 14.

[20] Gerardo L. Munck and Richard Snyder. "Debating the Direction of Comparative Politics: An Analysis of Leading Journals". In: *Comparative Political Studies* 40.1 (2007), pp. 5–31.

policy and comparative politics.

The lack of such a research program is especially critical in the case of climate change, given that the problem has implications for every country and has been the subject of highly diverse national responses. The quotation from Keohane at the head of this chapter underlined the absence of a "comparative politics of climate policy".[21] This sentiment is echoed by Purdon,[22] who notes that "the research effort to date in domestic climate change politics has largely been comprised of single case-studies and description."

This is not to say that there has been no comparative work. Many of these authors are writing in preface to their own contributions to a growing comparative literature, and there are others that I will review in the following chapters. But as Lachapelle and Paterson[23] state, "systematic 'second generation' comparative scholarship is in its relative infancy". The relatively recent emergence of this literature has left a number of questions under-examined. The focus on single cases and small-N comparisons has meant a few key countries (like the United States, the United Kingdom, or Germany) are frequently studied, while others receive far less attention. And many questions are difficult to answer without a large-N approach.

1.2.2 A Focus on Policy Stringency

Within the large-N literature that does exist, there has been insufficient attention paid to domestic mitigation policy.[24] The environmental economics and politics

[21] Keohane, "The Global Politics of Climate Change: Challenge for Political Science".

[22] Purdon, "Advancing Comparative Climate Change Politics: Theory and Method", p. 8.

[23] Erick Lachapelle and Matthew Paterson. "Drivers of national climate policy". In: *Climate Policy* 13.5 (Sept. 2013), pp. 547–571, p. 548.

[24] Klaus Jacob and Axel Volkery. "Modelling Capacities for Environmental Policymaking In Global Environmental Politics". In: *Environmental Governance in Global Perspective: New Approaches to Ecological Modernisation*. Ed. by Martin Jänicke and Klaus Jacob. Berlin: Freie Universität Berlin, 2006, pp. 67–94; Thomas Bernauer and Tobias Böhmelt. "Are Economically 'Kinder, Gentler Societies' also Greener?" In: *Environmental Science and Technology* 47.21

literatures on climate change initially focused on explaining differences in greenhouse gas emissions.[25] Then, as global efforts to coordinate a response ramped up, scholars paid increasing attention to explaining participation in international agreements.[26] But as Harrison and Sundstrom point out, international environmental agreements are ultimately dependent on national implementation:[27]

> "[W]hen international meetings conclude, actors invariably return home to their domestic constituents. Decisions whether or not to ratify international agreements and adopt national policies to mitigate climate change are in the end domestic political decisions, taken in the context of home-grown electoral interests, national discourses, and domestic political institutions."[28]

Until recently, however, the crucial role of national policy has not been matched by the empirical attention it has received. More than a decade ago, Jacob and Volkery[29] wrote that "comparative environmental policy analysis still lacks theoretical and empirical scrutiny in understanding the factors that influence the innovation behaviour of nation-states." In line with the general lack of comparative approaches, early work on national policy was "largely a matter of case studies or qualitative small-n studies".[30] More scholars have begun to examine mitigation policy, but the number of large-N, explanatory efforts remains

(2013), pp. 11993–12001; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[25]Martin Gassebner et al. "Determinants of pollution: what do we really know?" In: *Oxford Economic Papers* 63 (2011), pp. 568–595.

[26]Harrison and Sundstrom, "The Comparative Politics of Climate Change".

[27]Furthermore, in the wake of the failure of the Kyoto Protocol and the Copenhagen Accord to drive significant change, scholars have increasingly recognized that domestic policy may drive international agreement, rather than the other way around. (David G Victor et al. "Climate. A Madisonian approach to climate policy." In: *Science (New York, N.Y.)* 309.5742 [Sept. 2005], pp. 1820–1; Jonas Meckling et al. "Winning Coalitions for Climate Policy How Industrial Policy Builds Support for Carbon Regulation". In: *Science* 349.6256 [2015], p. 1170).

[28]Harrison and Sundstrom, "The Comparative Politics of Climate Change", p. 2.

[29]Jacob and Volkery, "Modelling Capacities for Environmental Policymaking In Global Environmental Politics".

[30]Ibid.

limited, inhibiting the field's ability to draw generalizable lessons about how such policy is made.[31]

Part of the problem has been the availability of necessary data. There are fundamental difficulties in making different types of environmental policies commensurate with each other,[32] and many potentially valid but non-overlapping conceptions of what constitutes climate policy stringency.[33] Climate policy is itself relatively new, only having appeared in the last three decades, so it took some time before countries had implemented enough policy to study.[34] This situation has improved since Jacob and Volkery were writing, but has not yet been fully overcome: "while large-N research would be helpful for greater understanding of domestic climate change politics, there is a dearth of data on climate policy outcomes appropriate for such analysis".[35]

In response, there has been a growing effort to create and analyze measures of domestic climate policy strength. These include expert surveys,[36] policy inventories,[37] indices based on manual coding of particular policies,[38] carbon price

[31] Bernauer and Böhmelt, "Are Economically 'Kinder, Gentler Societies' also Greener?"

[32] Claire Brunel and Arik Levinson. "Measuring the Stringency of Environmental Regulations". In: *Review of Environmental Economics and Policy* 10.1 (2016), pp. 47–67.

[33] Swenja Surminski and Andrew Williamson. "Policy Indexes as Tools for Decision Makers: The Case of Climate Policy". In: *Global Policy* 5.3 (Sept. 2014), pp. 275–285.

[34] Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[35] Ibid., p. 8.

[36] Jan Burck et al. *The Climate Change Performance Index Results 2018.* Bonn: Germanwatch, 2018; Franklin Steves and Alexander Teytelboym. "Political Economy of Climate Change Policy". In: *SSRN Electronic Journal* (Oct. 2013).

[37] Michal Nachmany et al. *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition.* Tech. rep. London: GLOBE International and the Grantham Research Institute, London School of Economics, 2014; Sam Fankhauser et al. "The political economy of passing climate change legislation: evidence from a survey". In: *Global Environmental Change* 35 (2015), pp. 52–61.

[38] Steves and Teytelboym, "Political Economy of Climate Change Policy"; Navroz K. Dubash et al. "Developments in national climate change mitigation legislation and strategy". In: *Climate Policy* 13.6 (2013), pp. 649–664; Nathan J. Madden. "Green means stop: veto players and their impact on climate-change policy outputs". In: *Environmental Politics* 23.4 (June 2014), pp. 570–589.

rates,[39] and econometric estimates of stringency.[40][41] There is also a burgeoning explanatory literature that has begun to use these measures to test the determinants of policy strength. I will review this literature and its lessons in more detail in the following chapters.

Here I will only mention one crucial limitation, which will help to motivate the rest of my project. Though comparative scholars have begun to unravel the domestic politics of climate policy, our theory and our large-N empirics have not been set up to capture distributional variation within countries.

1.2.3 Attention to Distribution

It has long been recognized that environmental policy creates distributional issues.[42] Though environmental policies "may seek to generate net social benefits, they inevitably generate winners and losers".[43] Case studies of climate policy are often sensitive to these effects. But the wider comparative literature seems to inherit from its international counterpart a focus on aggregate domestic interests. When interests are present in large-N analyses, they tend to be binary: a struggle between the advocates of environmental regulation and their industrial adversaries. There is a growing awareness that such treatments are insufficiently complex.[44]

[39] OECD. *Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems*. Paris: OECD Publishing, 2016, pp. 131–150; World Bank and Ecofys. *State and Trends of Carbon Pricing 2018*. Tech. rep. Washington, D.C.: World Bank, 2018.

[40] Misato Sato et al. "International and sectoral variation in energy: how does it relate to emissions policy stringency?" 2015; Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

[41] It is the last kind measure, by Althammer and Hille, that I use in my policy regressions.

[42] Graham Bennett. *Dilemmas: Coping with Environmental Problems*. London: Earthscan Publications, 1992, p. 252.

[43] Constanze Haug et al. "Navigating the dilemmas of climate policy in Europe: evidence from policy evaluation studies". In: *Climatic Change* 101 (2010), pp. 427–445.

[44] Jonas Meckling. *Carbon Coalitions: Business, Climate Politics, and the Rise of Emissions Trading*. Cambridge, Mass., 2011; Matto Mildenberger. "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking". PhD Dissertation. Yale University, 2015; Purdon, "Advancing Comparative Climate Change Politics:

Duit et al.[45] call for scholars to "populate the environmental state" by examining more closely "the relationship between state structures, policies, and governance styles on the one hand, and the people that are subjected to these regulatory efforts". Without this 'populating' effort, the divergent interests of different groups often remain implicit or abstract. Purdon strikes a similar note when he writes "the interests at play in climate change politics can be more complex than much of the international climate policy literature suggests".[46]

Haug et al.[47] conduct a meta-analysis of 262 European climate policy evaluation studies. Only 16% included some measure of distributional effects in their analysis. Many of them focus on the UK, examining the balance between firms, consumers, and the government. But one problem is that costs imposed on firms are sometimes, perhaps often, passed on to consumers. And most of these studies were also looking at carbon pricing policies: an important part of climate regulation but not the only tool that governments employ.

One of the clearest advocates for a deeper treatment of distributive interests is Mildenberger.[48] He criticizes earlier work on climate change for emphasizing "barriers to international climate cooperation and distortions in individual cognition - at the expense of more distributive accounts". And he cautions against simple models of industrial interests blocking all action: "[e]ven where distributive conflict is invoked, scholars may simply assert the capacity of corporate fossil fuel interests to control climate policymaking, rather than developing conditional accounts of the influence of different economic interest groups".

The roots of a non-distributional approach stretch to the beginning of the

Theory and Method"; Duit et al., "Greening Leviathan: the rise of the environmental state?"

[45]Duit et al., "Greening Leviathan: the rise of the environmental state?"

[46]Purdon, "Advancing Comparative Climate Change Politics: Theory and Method", p. 13.

[47]Haug et al., "Navigating the dilemmas of climate policy in Europe: evidence from policy evaluation studies", p. 436.

[48]Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking", p. 26-27.

field. For a good example, in an early and influential paper on the politics of environmental policy, Congleton[49] writes:

> "The political effects of economic interest groups are ignored in this paper. As a first approximation, the efforts of economic interest groups are assumed to offset each other as in the symmetric case characterized by Congleton (1989), leaving the median voter or authoritarian decisive."[50]

This assumption was reasonable as the literature was first developing. But though economic interests have received somewhat more attention in the decades since Congleton wrote, there is still a tendency to treat them as binary, a contest between two entities, business and environmentalists, over whether or not environmental regulation will be imposed by the state.[51] Business wants weaker policy, environmentalists want stronger policy. The focus is therefore on the strength of these two groups. In the case of environmentalists, this strength is measured by things like the number of environmental groups or activists. When business interests are considered more deeply, their interests are represented by national measures of emissions intensity, export dependence, or size of the industrial base.

This approach has its merits – it is simple, and captures one of the central lines of conflict. It corresponds to how many voters and activists understand the conflict over climate policy. But it is fundamentally incomplete.

The crucial missing piece is that climate policy, and therefore climate politics, has distributive implications. In the contest model, the costs of climate policy are aggregated across the whole economy: they're borne by "business" or "industry"

[49]Roger D. Congleton. "Political Institutions and Pollution Control". In: *Review of Economics and Statistics* 74.3 (1992), pp. 412–421.

[50]Ibid.

[51]I will discuss what I call the "political contest" model in more detail in chapter 2.

in a general sense. But this national aggregation masks important variation in how business and individuals within a country are affected by policy. Any climate policy regime, even a "uniform" policy like a carbon tax, is going to have different effects on different kinds of economic activities. The distribution of policy costs defies simple categorization based on emissions intensity or export intensity alone. And they affect the investors, workers, and consumers dependent on each sector in different ways as well. The substance of climate politics is about how to distribute those burdens.

But in the contest model, these differences do not matter. If climate politics is something that is fought between businesses and environmentalists, carbon-intense business should oppose climate policy, and environmentalists should support it. As reasonable as this sounds, the following three examples of actual political wrangling over climate policy will challenge this model. In order to avoid bringing in too many issues at once, all three are examples of conflicts about a similar kind of climate policy: carbon pricing. But the issues they raise crop up in many kinds of policy debates, and should push scholars to reconsider whether a binary contest model is sufficient for capturing the interests at stake in mitigation.

1.3 Distributive Case Vignettes

1.3.1 Strange Bedfellows: The Carbon Price Floor in the United Kingdom

In 2011, a coalition government between the center-right Conservatives and centrist Liberal Democrats in the United Kingdom announced that it would be instituting a carbon price floor from 2013. The UK is part of the European Union's Emissions Trading System (EU ETS), a cap-and-trade program that distributed

too many emissions permits, leading to perennially low prices. The low permit prices limit the EU ETS' effectiveness as an incentive to reduce emissions. The carbon price floor (CPF) was intended to supplement the EU ETS, guaranteeing a baseline cost for emissions. The CPF started at £16 ($25) per ton of CO_2 in 2013, and was scheduled to rise to £30 ($47) by 2020.[52]

As of late 2016, the carbon price floor is still in place, though it has been frozen at £18 ($27) since 2014. With the Conservative government now having a majority in Parliament under a new Prime Minister, one might expect business to be lobbying the government to cut the carbon price altogether. And indeed, the steel and manufacturing industries are pressing for it to be eliminated. But they face opposition not only from environmental groups, which generally favor a stronger carbon price, but utility companies.[53] According to the Financial Times:

> "UK Prime Minister Theresa May's commitment to tackling climate change faces a stiff test as energy companies launch a lobbying drive ahead of the Autumn Statement to protect a contentious carbon tax blamed for hurting the steel industry and other power-hungry businesses."[54]

On the face of it, this should be a surprising statement. First, the utility sector is the most emissions-intense industry in the United Kingdom. Some companies, including the ones leading the drive to protect the carbon price floor, continue to operate coal-fired power plants. Second, the fact that the Conservatives have a "commitment to tackling climate change" challenges traditional expectations that left parties should be the primary drivers of climate policy.

[52] Alex Bowen. *What is a carbon price and why do we need one?* Grantham Research Institute on Climate Change and the Enviroment `http://www.lse.ac.uk/GranthamInstitute/faqs/what-is-a-carbon-price-and-why-do-we-need-one/`. 2018.

[53] Pilita Clark. *UK climate pledge faces stiff test amid carbon tax drive.* London, Sept. 2016; Susanna Twidale. *Four British power firms call for carbon tax extension | Reuters.* London, Sept. 2016.

[54] Clark, *UK climate pledge faces stiff test amid carbon tax drive.*

This does not mean that U.K. utilities have an intrinsic desire for regulation. Okereke and Russel[55] survey senior business managers in the U.K.'s most carbon-intense businesses, and find that many see carbon pricing as a way to avoid more onerous regulations or as a tool to gain competitive advantages over other firms. Another part of the explanation is that once a carbon pricing policy is in place, businesses like utilities that make long-term capital investments based on the policy have an interest in retaining it:

> "SSE, the largest UK utility by market capitalisation, has warned the chancellor that energy companies need clarity on his approach to taxing carbon emissions if they are to invest in a new generation of gas-fired power stations. In a letter also signed by three other energy companies and an environmental group, SSE and its allies said a 'robust and strong carbon price' was the best way to meet government goals to combat climate change without further regulation and with fewer state subsidies."[56]

This case presents several challenges to binary, business vs. environment or left vs. right accounts. It suggests that policy impacts vary across sectors in ways that generate substantive conflict between businesses. The fact that carbon-intense businesses are championing a mitigation policy indicates that distributional impacts may not be driven solely by carbon intensity. The potential to pass costs on to consumers, inter-firm market dynamics, or the time horizons involved in investments may all be more relevant in some cases. Furthermore, coalitions are not static, and policy can change coalitions. Once firms have made

[55] Chukwumerije Okereke and Duncan Russel. "Regulatory Pressure and Competitive Dynamics: Carbon Management Strategies of UK Energy-Intensive Companies". In: *California Management Review* 52.4 (2010).

[56] Andrew Ward. *UK urged to renew carbon tax pledge.* `https://www.ft.com/content/9b43eba6-b70c-11e7-8c12-5661783e5589`. Oct. 2017.

investments under one policy regime, they may support that regime even if they may previously have been wary of it. And right parties can advocate for climate action.[57]

That said, one should be careful about carrying this evidence too far. Companies may publicly support mitigation while opposing individual measures in private.[58] The Conservatives may support some degree of climate action without being as committed than their rival parties. Unpacking the relationships between businesses, parties, and mitigation will require more detailed analysis than the anecdotal evidence above. But the case should still lead us to question models of climate policymaking that assume emissions-intense businesses and right-wing parties will always favor weakening policy.

This is not the only example of distributional politics complicating climate policy in unexpected ways: there have also been surprising conflicts at the subnational level in the United States.

1.3.2 Coalition-Splitting: The Carbon Tax Initiative in Washington State

In Washington State, a ballot initiative on introducing a carbon tax was held in November 2016. The tax would have begun at \$15 per ton of CO_2 in 2017, risen to \$25 in 2018, and then gone up by 3.5% (plus inflation) every year until it reached \$100. The revenue would have been returned to state residents through the combination of a 1% decrease in the sales tax, an additional \$1,500 supplement

[57]The case also serves as a useful reminder that climate policies are not "fire and forget" tools. They can be strengthened or watered down, frozen or eliminated. Climate politics, like regulatory politics more broadly, does not end with policy enactment (Kenneth Abbott and Duncan Snidal. "The governance triangle: regulatory standards institutions and the shadow of the state". In: *The Politics of Global Regulation*. Ed. by Walter Mattli and Ngaire Woods. Princeton University Press, 2009).

[58]Okereke and Russel, "Regulatory Pressure and Competitive Dynamics: Carbon Management Strategies of UK Energy-Intensive Companies", p. 108.

to the Earned Income Tax Credit for around half a million low-income households, and the near elimination of the Business and Occupation Tax.

The proposal sounded like a viable hybrid—a substantial and rising carbon price designed to be politically palatable to opponents of tax rises. And Washington seemed like fertile ground. The state was dominated by the center-left Democratic Party, having elected only Democratic governors since 1985. The current governor, Jay Inslee, had a 92% rating from the League of Conservation Voters during his time as a congressman.[59] But the measure failed. Even as Democratic presidential candidate Hillary Clinton won the state by 16 percentage points, the carbon tax was defeated by 20 points.

Not only were industries and conservatives against it, but the proposal was also undermined by opposition from environmentalists and other groups on the left. News coverage from the campaign for the initiative, labelled I-732, helps clarify the reasons:

> "I-732 is still being opposed by a variety of social justice groups, and more quietly opposed by some environmental groups. The stated reason is that I-732 doesn't do enough to help poor people in Washington, who would be disproportionately impacted by a carbon tax."[60]

A lack of support from environmental groups may not have been responsible for the initiative's failure (though it can hardly have helped), but it reveals something important about the intersection of distributional and environmental issues. The policy conformed to economists' general criteria for an efficient carbon mitigation policy. It included provisions for compensating low-income

[59] League of Conservation Voters. *2012 National Environmental Scorecard*. https://scorecard.lcv.org/sites/scorecard.lcv.org/files/LCV_Scorecard_12_FNLlo-2.pdf. 2012.

[60] Shi-Ling Hsu. "Environmentalists' Disdain for Washington's Carbon Tax". In: *Slate* (Oct. 2016). http://www.slate.com/articles/health_and_science/science/2016/10/environmentalists_are_against_i_732_washington_s_carbon_tax.html.

families (though since the compensation comes in the form of a supplement to a tax credit, it may only benefit households with employed members). It also used some of the revenue to reduce an unpopular tax. And yet it not only failed to muster support from green groups, it actually spurred their opposition. The problem was not carbon taxes in general: a large coalition of green and social justice groups that opposed I-732 were officially committed to developing a carbon tax proposal of their own for a future election.

The initiative floundered with environmental groups not for strictly environmental reasons, but for distributional ones. The failure of the backers of I-732 to secure support from the left in general and from environmental groups in particular cannot be understood without taking the distributional issues involved into account. The case of the Washington carbon tax is a useful reminder that support from the left for a given climate policy is not guaranteed. Nor does opposition from the left only come from concern about impact on industry and pushback from unions: it can come from the environmental left as well. The lesson is that distributional issues can divide people who agree about the urgency of mitigating climate change. Support for environmental policy is constrained by distributional impacts—even for environmentalists.

1.3.3 One Size Does Not Fit All: Rate Divergence in Norway

The first example was about maintaining a moderately stringent policy, and the second was about trying to introduce a new policy. The third example, from Norway, is about how distributional issues can undermine what appears to be a strong policy response.

Norway was among the first countries to introduce a carbon tax in 1991, under the social-democratic Labour Party. The tax covers around half of the country's

emissions, and the rate varies by sector, from as low as $3 per ton of CO_2 to as high as $52 (World Bank 2015). At its maximum levels, the rate is among the highest carbon prices in the world. Even if the tax rate is aggregated by taking an emissions-weighted average of the rates as they apply to individual sectors, the overall rate is still fairly high by international standards. And yet Norwegian emissions have not declined; instead, they have increased since 1990. Part of the problem may be the various exemptions offered to different sectors:

> "Norway's policymakers say they gave exemptions to some local industries because they feared the tax would damage economic growth and hurt employment. 'We had to find ways to spur environmental change without shooting ourselves in the foot,' say Gro Harlem Brundtland, who devised the tax when she was Norwegian prime minister in the 1990s."[61]

The result, according to an analysis by Statistics Norway, is that:

> "The tax does not work on the levied sources, and is exempted in sectors where it could have worked."[62]

A high average price conceals crucial variation. For example, metal processing, fishing, air and ocean transport, and cement manufacturing are all exempted from the tax, and paper and pulp industries get a 50% reduction. Sectors with high process emissions, "in which we expect the carbon tax to be most efficient in terms of downscaling of the production and reduced emission, are the same industries which are exempted from the carbon tax." In other words, industries with the greatest potential to make reductions were not asked to do so. According to

[61] Leila Abboud. "An Exhausting War on Emissions: Norway's Efforts to Contain Greenhouse Gases Move Forward - and Backfire". In: *Wall Street Journal* (Sept. 2008).

[62] Annegrete Bruvoll and Bodil Merethe Larsen. "Greenhouse gas emissions - do carbon taxes work?" Statistics Norway. 2002, p. 5.

Bruvoll and Larsen, the sectors on which the tax was levied saw only small drops in emissions due to the tax.

If this analysis is correct, the tax has not lived up to its potential as an environmental policy. But while the tax's environmental aims were undermined by the exemptions, those same exemptions may have been vital to getting the policy passed, by shielding potential opponents.[63] The Norwegian case demonstrates that distributional impacts can be salient in policymakers' minds when they are formulating climate policies. It also shows that distributionally-driven design considerations can have serious impacts on whether policy is effective, and that these effects are not necessarily discernible from looking at the headline rates or a weighted national average.

The exemptions in the Norwegian carbon tax do not apply to all carbon-intense sectors. Despite lobbying from the oil and gas industry, that sector was not exempted, while industries like fishing and paper production received heavy discounts. The tax has not prevented emissions from growing in the oil and gas sector: expansion in drilling increased emissions fourfold between 1990 and 2008. But the sector has invested in technology to reduce its emissions intensity, storing excess CO_2 produced during the refinement process underground instead of releasing it into the air, and the Norwegian flagship driller Statoil's emissions intensity is now less than 40% of the industry average.[64] This is another useful reminder that policy stringency cannot be measured from emissions growth alone. Furthermore, policy needs to be measured in a disaggregated fashion, because the

[63] That said, a distributional victory for some groups may be a distributional defeat for others. As Mildenberger recounts, "this policy imposed differentiated costs by economic sectors rather than applying a flat rate on each unit of carbon pollution across the entire Norwegian economy. While the tax exempted onshore industries, it imposed a concentrated burden on households and consumers." See Matto Mildenberger. "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking". PhD Dissertation. Yale University, 2015, p. 29.

[64] Abboud, "An Exhausting War on Emissions: Norway's Efforts to Contain Greenhouse Gases Move Forward - and Backfire".

impacts are dependent on how the burden is distributed.

1.3.4 Lessons from the Case Vignettes

These cases challenge expectation about climate politics that are embedded in the current comparative literature.

First, they demonstrate unexpected lines of conflict. Coalitions do not always match binary business vs. environmentalist expectations. Carbon-intense businesses can be in favor of climate policies and actively fight against other carbon-intense businesses to enact or preserve them. Environmentalists can be opposed to ambitious climate policies and actively fight other environmentalists to prevent their enactment, even at the risk of preserving the status quo. These unexpected conflicts are the result of underlying distributional issues not visible in a simple business/environmentalist dichotomy.

Second, parties do not always behave as expected. Right parties can be the ones to implement climate policies, even in the face of serious business opposition. This support is not necessarily conditional on being in a coalition with non-right parties. Left parties, conversely, can oppose climate policies. And they can be sensitive to concerns of business. The effect of party ideology should be analyzed in the context of their constituencies and the electoral incentives they face.

Third, policy impact cannot be fully understood without looking at the varying impacts across different groups of firms and individuals. Design choices matter; not all carbon taxes or emissions trading systems or renewable energy portfolios are created equal. Strong-seeming policies can be revealed as weaker when the pattern of their application is assessed. These impacts are at the core of debates about whether to implement carbon policies, and are salient in the minds of the people making the policies.

The core of these lessons is that climate politics cannot be fully understood

without taking distributional issues into account. The next chapter will go into more detail about what such an account looks like, but it is worth noting here what "distributional issues" means in this dissertation. Incorporating distributional issues means taking seriously the ways in which the impact of climate policy varies not only between countries but across different groups within countries. Specifically, it means paying attention to how climate policy costs flow from sectors of the economy to investors, workers, and consumers. Only when this is done do the previously puzzling cases outlined above start to make sense.

The support of energy intensive utility industries in the UK for continuing the carbon price floor makes sense when accounting for the fact that utility companies, unlike steel and manufacturing companies, can pass on the costs of regulation to a captive domestic market of energy consumers. Those costs have motivated utilities to make major investments in gas infrastructure whose continued viability depends on the floor. The fact of business support for carbon pricing helps resolve the paradox of right-wing governments enacting mitigation legislation.

The opposition of environmental and social justice groups to the carbon tax in Washington makes sense when considering how the left has to reconcile distributional and environmental concerns within its coalition. The issues are not separate, and the failure to build a coalition and policies that balance these concerns undermines the prospects for environmental action.

The failure of Norway to curb emissions even with a strong price signal makes sense once we pay attention to how fears of reduced employment and growth shape the design of policy. The imposition of costs on some emissions intense, export-dependent sectors like oil and gas but not on other sectors like fishing and paper production makes sense once we consider distributional politics and the result that different sectors may have different relationships to parties' coalitions.

A distributive account makes these cases tractable; a non-distributive account

leaves them mysterious. To make sense of them, political scientists must develop an account of interests that goes beneath the national level to examine the interest of different kinds of firms and different classes of people.

I am not the first to describe these distributional issues, nor to call for more large-N comparative work on domestic climate policy. The rich literature cited above attests to this. But this dissertation is, to my knowledge, breaking new ground by combining a large-N approach to domestic policy with a focus on inter-sectoral distributional conflicts.

1.4 Structure of the Project

The remainder of the dissertation will be structured as follows.

In chapter 2, I develop a basic theory of distributive climate politics that disaggregates interests among different economic sectors, factors of production, and consumers. I review the literature explaining climate policy outputs, and show that although detailed interest-based accounts appear in case studies, interests are almost universally reduced in the quantitative literature to binary "business vs. environmentalist" conflicts. Drawing on recent work in environmental economics, I demonstrate that a simple distributive model can capture some of the nuanced treatment of interests in case studies, while also being testable using quantitative methods. In doing so, I help bridge the gap between the qualitative and quantitative climate policy subfields, while also linking comparative climate politics more closely with the relevant areas in economics. I use this model to derive a number of hypotheses that will be tested in subsequent chapters.

My overarching prediction or "meta-hypothesis" is that variation in climate policy across sectors exists and is driven by sector-specific characteristics. I develop sub-hypotheses based on which groups I expect to have more influence over

policymakers. I expect that sectors that are more carbon-intense, more trade-exposed, more capital-intense, and which employ more high-skilled workers are all likely to receive weaker mitigation regulation.

In chapter 3, I test the model developed in the previous chapter using sector-level policy measures. I show that previous comparative work has relied on data that is not sectorally disaggregated, preventing scholars from examining within-country variation in stringency. I present the first comparative political study to use econometrically-estimated shadow prices from Althammer and Hille.[65] The results largely confirm the expectations of the theory, demonstrating that sector-specific characteristics do drive mitigation variation.

Having looked at the demand side of worker, investor, and consumer interests, in chapter 4 I explore the supply side of mitigation policy. There is a longstanding debate in the literature over the role of partisan ideology in climate politics, with many conflicting results. I argue that this instability is due to neglecting different parties' factoral constituencies. By showing that the effects of sectoral characteristics are partially conditional on politics, the results build confidence that the effects in the previous chapter are indeed politically-induced and not simply structural in nature. I find that left parties shield labor-intense sectors, and right parties shield capital-intense sectors.

In chapter 5, I explore the role of political economy institutions in shaping the distributive conflict over climate policy. Climate policy is not created in a vacuum: it is shaped by a wider political economy context. Some countries have institutions and organizations that include some economic interest groups in decision-making and protect them from some kinds of policy costs. Coordinated market economies, corporatism, unions, and social protection all change interest groups' calculations. The results help explain previously conflicting results in the

[65] Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

literature. In particular, I find that they weaken the risk to labor of accepting the imposition of climate policy, resulting in higher stringency for labor-intense sectors.

In chapter 6, I set aside sectoral policy outputs to look at individual public opinion. The theory I developed earlier could work through interest group lobbying, through politicians anticipating impacts on constituents, or through constituents themselves becoming aware of their interests. This chapter tests this last mechanism, asking whether individuals' climate attitudes are shaped by their sectoral interests. Despite the rich literature on public opinion and the climate, there has been little work exploring such a link cross-nationally. Using data from the European Social Survey,[66] I find that some sectoral interests are indeed incorporated into individual attitudes.

Finally, in chapter 7 I draw together the findings of the previous chapters. I discuss some of the implications for environmental justice. I make the case for more sector-level distributive work, both in climate politics but also other areas of political science, where sector-level analysis remains rare. I also discuss lessons, not only for academics but for policymakers, activists, and climate change communicators.

A quantitative, sector-level analysis of domestic policy stringency does not tell the whole story of climate politics. Actual emissions levels, though they are imperfect proxies for national effort, will ultimately determine the consequences that future generations face. International diplomacy still has the potential to enhance or derail mitigation efforts. And in-depth qualitative work is vitally necessary to understand how climate mitigation policy succeeds or fails.

The kind of intra-country, inter-sector distributional conflict upon which I focus is not the only kind of distributional conflict that matters. Conflict be-

[66] European Social Survey. *Round 8 Data edition 2.1.* 2016.

tween countries continues to play a large role. Conflict between groups about the impacts of climate change itself rather than the costs of mitigation policy will become increasingly important as the greenhouse effect accelerates.

But as the results in the following pages demonstrate, domestic distributional conflicts between different kinds of businesses, producers and consumers, capital and labor, play a crucial role in shaping our response to climate change. These conflicts are concealed if we confine ourselves to the national level. Without an account of how sectors and their associated interests interact to shape mitigation, our comparative politics of climate policy will be fundamentally incomplete.

Chapter 2

Bringing Interests In: A Distributive Model of Climate Policymaking

> "[A] great part of economic science is occupied with the diffusion throughout the community of economic changes which primarily affect some particular branch of production or consumption; and there is scarcely any economic principle which cannot be aptly illustrated by a discussion of the shifting of the effects of some tax"
>
> Alfred Marshall[1]

> "[W]here there is inequality of estates, there must be inequality of power"
>
> James Harrington[2]

[2]Alfred Marshall. "Book V: General Relations of Supply, Demand, and Value, Chapter IX". in: *Principles of Economics*. 8th ed. London: Macmillan, 1890, pp. 323–503, p. 413.

[2]James Harrington. "The Commonwealth of Oceana". In: *The Commonwealth of Oceana and A System of Politics*. Ed. by J.G.A. Pocock. Originally published 1656. Cambridge, UK: Cambridge University Press, 2005, p. 57.

2.1 Introduction

In this chapter I develop a distributive theory of climate policymaking. Following the distinction made by Stigler[3] and Keohane et al.,[4] this theory seeks to model domestic variation in both mitigation demand and supply. I examine how policy impacts can vary across firms, workers, investors, and consumers, affecting the intensity of their demand for weaker climate policy. And I model how policymakers can choose to vary the supply of mitigation policy stringency across these different groups. The goal is a theory that is sensitive to the heterogeneity of interest inputs and policy outputs, while also remaining empirically tractable.

In the last chapter, I identified the need for a "comparative turn" in the political economy of climate change.[5] Hall[6] distinguishes political economy from economics by its concern for three subjects: interests, institutions, and ideas.[7] All three have featured in the literature on environmental and climate politics, but I will focus my attention in this chapter on the first: interests. Interests have

[3]George J Stigler. "The Theory of Economic Regulation". In: *Bell Journal of Economics and Management Science* 2.1 (1971), pp. 3–21.

[4]Nathaniel O. Keohane et al. "The Choice of Regulatory Instruments in Environmental Policy". In: *Harvard Environmental Law Review* 22 (1998), pp. 313–367.

[5]Harrison and Sundstrom, "The Comparative Politics of Climate Change"; Victor, *Global Warming Gridlock : Creating More Effective Strategies for Protecting the Planet*; Xun Cao et al. "Research Frontiers in Comparative and International Environmental Politics: An Introduction". In: *Comparative Political Studies* 47.3 (2014), pp. 291–308; Keohane, "The Global Politics of Climate Change: Challenge for Political Science"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[6]Hall, "The role of interests, institutions, and ideas in the comparative political economy of the industrialized nations".

[7]There are other ways of subdividing the field. Drawing on the study of welfare states by Meadowcroft, Gough adds industrialization and international influences to the list of factors explaining the parallel emergence of "eco-states." Lichbach and Zuckerman emphasize the distinction between rationality, culture, and structure as explanations. But the classic triumvirate of interests, institutions, and ideas is the one that best fits my present purpose. See James Meadowcroft. "From Welfare State to Ecostate". In: *The State and the Global Ecological Crisis*. Ed. by J. Barry and Robyn Eckersley. Cambridge, MA: MIT Press, 2005. Chap. 4, pp. 3–23; Ian Gough. "Welfare states and environmental states: a comparative analysis". In: *Environmental Politics* (Aug. 2015), pp. 1–24; Mark Irving Lichbach and Alan S. Zuckerman, eds. *Comparative Politics: Rationality, Culture, and Structure*. 2nd ed. Cambridge: Cambridge University Press, 2009.

been under-represented in the literature: this chapter is an attempt to "bring interests back in" to comparative climate politics.

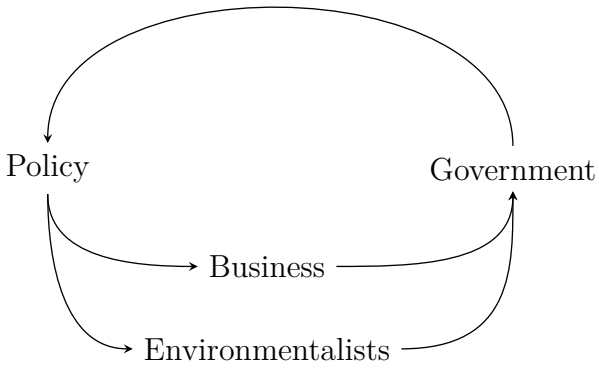
While there is ample economic and case study evidence that mitigation demand and supply vary substantially within countries, the quantitative, comparative work on the subject has mostly treated domestic interests as being locked in binary conflict. On the demand side, this approach manifests itself in a reduction of heterogeneous interests to two groups: often business versus environmentalists, but sometimes "dirty" versus "clean" industry. On the supply side, policy is often measured along a single, national spectrum of stringency. The implication is that policy can vary "vertically" in its level but not "horizontally" across different groups. Sometimes this reduction is an explicit theoretical choice, and at other times it is merely implicit in the empirical treatment. But either way, it limits how interests can be represented.

I call the existing approach a "political contest" model, to capture the idea that it involves two groups fighting over a single prize. A stylized version of this model is illustrated in section 2.1. Business and environmentalists both work to influence policymakers, who then choose a level of policy stringency that in turn affects the welfare of business and environmentalists.[8]

I am not claiming that it is never appropriate to simplify interests in this way. Depending on the subject of a given study, a binary model may well be a reasonable assumption. But as I will show, the political contest model conceals important variation in material interests within countries considering domestic mitigation policy.

To capture such variation, the core of this chapter will be devoted to develop-

[8]One could also draw a line from business to environmentalists, since the gains to environmentalists of policy are ultimately conditional on businesses reducing their emissions. But these gains are only realized over the long term: in the short term, environmentalists' gains come from perceptions of policy stringency. Because I treat environmentalists' demands as exogenous, the difference is not crucial to my theory.



ing a theoretical model of distributive climate policymaking. Grounded in work by Grossman and Helpman[9] and extensions by Fredriksson[10] and Aidt,[11] I call this a "political market" model of climate policymaking (following Keohane et al.[12]). This differs from the political contest model in two crucial ways.

First, this model disaggregates from the national level to consider policy supply and demand at the sectoral level. The model allows policymakers to choose different levels of regulatory stringency for different economic sectors. Instead of a pro-mitigation and anti-mitigation camp, each sector is its own interest group, concerned about its own sector-specific level of regulation.[13]. This follows the spirit of the original "Protection for Sale" tariff model of Grossman and Helpman.[14] But it represents a new approach for the existing comparative mitigation literature, which has not yet incorporated heterogeneity across many sectors into quantitative analysis.

[9]Gene M. Grossman and Elhanan Helpman. "Protection for Sale". In: *The American Economic Review* 84.4 (1994), pp. 833–850.

[10]Per G. Fredriksson. "The Political Economy of Pollution Taxes in a Small Open Economy". In: *Journal of Environmental Economics and Management* 33 (1997), pp. 44–58.

[11]Toke S. Aidt. "Political internalization of economic externalities and environmental policy". In: *Journal of Public Economics* 69 (1998), pp. 1–16.

[12]Keohane et al., "The Choice of Regulatory Instruments in Environmental Policy".

[13]Chapter 3 will discuss the possibility that sectors may also be concerned with the regulatory burden place on other sectors

[14]Grossman and Helpman, "Protection for Sale".

Second, this model considers how mitigation policy affects not only the immediate target of a policy, but other groups of people who are tied economically to that target. As the quotation from Marshall[15] at the head of this chapter indicates, regulation which is targeted at "some particular branch of production or consumption" is apt to diffuse "throughout the community." In this chapter I focus on business firms as targets of regulation, and on workers, investors, and consumers as the groups within the community to which the effects of regulation diffuse. Investors depend on firms for capital returns, workers for wages and salaries, and consumers for the goods which they purchase. The model I develop draws on recent work in environmental economics to show how these different capital, labor, and consumption effects can be disentangled.[16]

The results of taking both inter-sector "horizontal" differentiation and intra-sector "vertical" differentiation into account are illustrated in fig. 2.1. This diagram is only conceptual: the formalization will follow below. But this version is still useful for highlighting the key features of my approach. First, instead of setting one level of mitigation stringency for the whole economy, the government sets multiple sector-specific levels of stringency. Second, instead of thinking of policy costs as falling on 'business' broadly considered, the model separates burdens across capital, labor, and consumers.

This schematic model lacks important features of real-world politics, like international factors, institutions, or media influence. Its purpose is not to encompass the full political dynamics of climate policy, but to resolve specific issues with the prevailing contest model.

This rest of this chapter will proceed as follows.[17]

[15]Marshall, "Book V: General Relations of Supply, Demand, and Value, Chapter IX".

[16]Don Fullerton. "Six Distributional Effects of Environmental Policy". In: *Risk Analysis* 31.6 (June 2011), pp. 923–929.

[17]Before I continue, two notes on terminology will be helpful. First, there are two kinds of supply and demand at play in this dissertation. There is the economic kind, representing

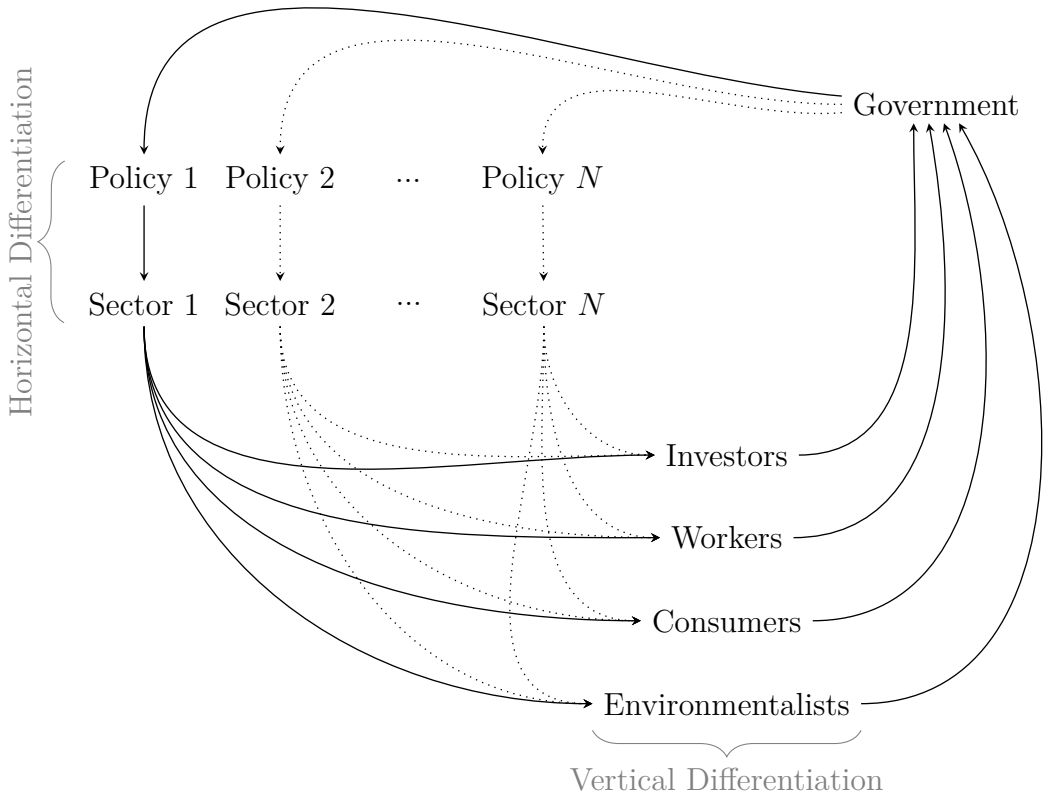


Figure 2.1: **Stylized Diagram of a Political Market Model with Horizontal and Vertical Differentiation.** The dotted lines are purely to aid readability: they do not indicate a substantive difference in relationships.

First, I briefly survey the relevant literature on climate economics, highlighting how mitigation policy's impacts can vary across different sectors and groups. Second, I give an overview of the literature on environmental and climate politics. I pay particular attention to how interests have been theorized in this body of work, and identify areas for improvement. I discuss the business and politics literature as well, to which my theory will also contribute. Third, I take care of some theoretical ground-clearing, marking out the boundaries of my argument and making my baseline assumptions clear. Fourth, I build the model itself. Fifth, I use the formal equations to derive a set of hypotheses that will be tested in subsequent chapters. Then I conclude by summarizing the ways in which my theory goes beyond existing work.

2.2 Distributive Interests in the Comparative Climate Literature

In the previous chapter, I outlined three limitations in the current literature on comparative climate politics. First, there has been too little large-N, cross-

producer and consumer behavior in the market for goods and services. There is also the political kind, where interests groups demand policy and policymakers supply it (James M. Buchanan. "A Behavioral Theory of Pollution". In: *Economic Inquiry* 6.5 [Dec. 1968], pp. 347–358). A firm might be a supplier of goods but also a demander of policy. Since both concepts are an important part of my theory, I cannot confine myself to discussing just one. Thus, when using these terms in their political sense, I will make this clear with language like "policy demand" or "mitigation supply." I will reserve the unqualified use of the terms for their economic meaning.

Second, in the climate politics literature, countries' mitigation activities are variously described as policy 'inputs,' 'outputs,' 'outcomes,' or 'performance,' depending on the preferences of authors and the purpose of their studies. Some authors make fine distinctions between these categories, but such distinctions are not universal. For clarity, I will specifically refer to policy outputs, policy outcomes, or just policy generally when discussing mitigation actions by governments, rather than using output or outcome in an unqualified sense. I will use the term "performance" along with "pollution" and "emissions" to refer to the greenhouse gas levels and flows that result from policy.

national work, as opposed to case studies of one or a few countries.[18][19] Second, in the extant quantitative literature, there has not been enough focus on policy stringency, as opposed to treaty commitments or emissions changes.[20] Third, there has been too little attention paid to distributional interests in comparative climate policymaking.[21]

The first two issues are primarily empirical: they can be solved by finding new data and analytical approaches to the subject. But the last one is not only an empirical issue, but a theoretical one. It concerns how we think about the costs of climate mitigation policy: who bears its costs, and how do those bearers of costs shape the prospects for future policy? Answering these questions requires addressing the role of interest groups.

Before I go further, I should clarify what I mean by an interest or an interest group. For some authors, the term "interest group" denotes formally constituted organizations like corporations, trade associations, unions, or membership-based advocacy groups.[22] Others think of interest groups in broader terms, encom-

[18]Steinberg and VanDeveer, *Comparative Environmental Politics: Theory, Practice, and Prospects*; Cao et al., "Research Frontiers in Comparative and International Environmental Politics: An Introduction"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method"; Keohane, "The Global Politics of Climate Change: Challenge for Political Science".

[19]This is not intended as a dismissal of case studies, either by myself or the authors cited. Many valuable lessons have been and are being learned from case studies of climate policy. Quantitative comparative work does not need to overcome qualitative work: it needs to catch up to it. For examples, see Guri Bang et al., eds. *The domestic politics of global climate change: key actors in international climate cooperation.* Edward Elgar, 2015; David Held et al., eds. *Climate governance in the developing world.* Polity, 2013, p. 272; Kathryn Harrison and Lisa McIntosh Sundstrom. *Global commons, domestic decisions : the comparative politics of climate change.* MIT Press, 2010, p. 312; Henrik Selin and Stacy D. VanDeveer. *Changing climates in North American politics: institutions, policymaking, and multilevel governance.* MIT Press, 2009, p. 338; Hugh Compston and Ian Bailey, eds. *Turning Down the Heat.* New York: Palgrave Macmillan, 2008.

[20]Jacob and Volkery, "Modelling Capacities for Environmental Policymaking In Global Environmental Politics"; Bernauer and Böhmelt, "Are Economically 'Kinder, Gentler Societies' also Greener?"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[21]Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[22]Frank R. Baumgartner and Beth L. Leech. *Basic Interests: The Importance of Groups in*

passing categories of individuals with some common trait, like occupation, sector of employment, income level, or other demographic characteristics.[23] I conform to the second, broader use. Unorganized interests can still exert influence on a government that fears "potential" groups may coalesce when sufficiently threatened.[24] In the model I build below, interest groups are defined by their position within the economy rather than an organizational grouping. Firms need not be in a trade association, or workers in a union, to count as an interest group for my purposes.

The theoretical importance of interest groups has not always been matched by empirical attention.[25] Baumgartner and Leech[26] characterize the study of interest groups between 1950 and 1995 as being dominated by formal theory at the expense of empirical work, leading to a state of "elegant irrelevance." In the last two decades, there has been a rise in the number of large-scale, comparative studies of interest groups, but there remains a disconnect between empirical and theoretical studies.[27] According to Klüver,[28] "understanding why some interest groups win and others lose is still an area of confusion."

This is true not only for political science in general, but for environmental poli-

Politics and in Political Science. Princeton: Princeton University Press, 1998, p. 223; Heike Klüver. "Lobbying as a collective enterprise: winners and losers of policy formulation in the European Union". In: *Journal of European Public Policy* 20.1 (2013), pp. 59–76.

[23]Gary S. Becker. "A Theory of Competition Among Pressure Groups for Political Influence". In: *The Quarterly Journal of Economics* 98.3 (1983), pp. 371–400, p. 388.

[24]David B. Truman. *The Governmental Process*. 2nd ed. New York: Alfred A. Knopf, 1971.

[25]Baumgartner and Leech, *Basic Interests: The Importance of Groups in Politics and in Political Science*; Christine Mahoney and Frank Baumgartner. "Converging Perspectives on Interest Group Research in Europe and America". In: *West European Politics* 31.6 (Nov. 2008), pp. 1253–1273; Frank R. Baumgartner. *Lobbying and policy change: Who wins, who loses, and why*. University of Chicago Press, 2009, p. 341; Klüver, "Lobbying as a collective enterprise: winners and losers of policy formulation in the European Union".

[26]Baumgartner and Leech, *Basic Interests: The Importance of Groups in Politics and in Political Science*.

[27]Marie Hojnacki et al. "Studying Organizational Advocacy and Influence: Reexamining Interest Group Research". In: *Annu. Rev. Polit. Sci* 15.921 (2012), pp. 1–9.

[28]Klüver, "Lobbying as a collective enterprise: winners and losers of policy formulation in the European Union".

tics in particular.[29] Purdon[30] claims that institutional analysis has predominated at the expense of work on interests in environmental politics. Mildenberger[31] highlights the lack of "conditional accounts of the influence of different economic interest groups" in climate policymaking. Duit et al.[32] call for scholars to deepen their understanding of how environmental regulation affects interest groups:

> "[T]here is a need to populate the environmental state—to understand better the relationship between state structures, policies, and governance styles on the one hand, and the people that are subjected to these regulatory efforts"

This is not a new problem in the field. Writing almost three decades ago, Hahn criticizes the "reduction of the diverse range of interest group perspectives on environmental policy into two distinct viewpoints" as "a gross oversimplification".[33]

I argue that carrying out this 'populating' effort has proven challenging for cross-national, quantitative analysis for two reasons. The first has to do with how we model the supply of policy, the second with how we model its demand.

2.2.1 Heterogeneous Policy Supply

In terms of policy supply, the quantitative and comparative policy literature tends to treat countries' mitigation efforts as if they had a uniform impact across the

[29]Purdon, "Advancing Comparative Climate Change Politics: Theory and Method"; Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking"; Duit et al., "Greening Leviathan: the rise of the environmental state?"

[30]Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[31]Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking".

[32]Duit et al., "Greening Leviathan: the rise of the environmental state?", p. 16.

[33]Robert W Hahn. "The political economy of environmental regulation: Towards a unifying framework". In: *Public Choice* 65 (1990), pp. 21–47, p. 26.

economy in which they are implemented. Most comparative efforts to characterize country's mitigation policy do so with a single number for the whole country.[34]

These aggregate measures provide valuable information. Aggregation is not only helpful but necessary for answering certain kinds of questions. When testing whether a country is living up to its treaty commitments, for example, how it allocates ambition across different sectors may be less analytically important than the overall level of ambition. If pollution performance is the outcome of interest, then national ambition is a reasonable explanatory variable. But if we want to know about how policy stringency distributes costs, then aggregated measures are insufficient.[35]

Climate policy regimes can apply heterogeneous levels of stringency within countries. Many climate policies are sector-specific.[36] Feed-in tariffs target the utility sector, fuel economy standards target the transportation sector, and efficiency mandates for new buildings target the construction sector. Though sectors can often pass on some of the costs to other sectors and consumers, the potential for pass-through is itself uneven.

Even when policy is cross-sectoral in nature, the costs for individual sectors can vary substantially.[37] It has long been recognized that environmental policies

[34]Dubash et al., "Developments in national climate change mitigation legislation and strategy"; Madden, "Green means stop: veto players and their impact on climate-change policy outputs"; Michal Nachmany et al. *Global trends in climate change legislation and litigation.* London: Grantham Research Institute on Climate Change and the Environment, 2017; Burck et al., *The Climate Change Performance Index Results 2018*, See, for example,

[35]At the other extreme, policy-level inventories like those from Nachmany et al.; Fankhauser et al. and the International Energy Agency are useful for gaining in-depth, qualitative information on particular actions. But quantitative cross-national comparison requires a higher level of aggregation than they can provide on their own. See Michal Nachmany et al. *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition.* Tech. rep. London: GLOBE International and the Grantham Research Institute, London School of Economics, 2014; Sam Fankhauser et al. "The political economy of passing climate change legislation: evidence from a survey". In: *Global Environmental Change* 35 (2015), pp. 52–61; International Energy Agency. *Policies and Measures Databases (PAMS).* `https://www.iea.org/policiesandmeasures/`. 2018.

[36]Productivity Commission. *Carbon Emission Policies in Key Economies.* Tech. rep. May. Canberra: Productivity Commission, 2011, p. 231, p. 18.

[37]Sato et al., "International and sectoral variation in energy: how does it relate to emissions

often have uneven effects across different industries.[38] A 'first-best' policy like a uniform carbon tax still produces varying effects across sectors, due to structural and technical heterogeneity. Industries that emit more greenhouse gasses, face higher costs to abate their emissions,[39] or that cannot pass on their costs to other groups[40] will all face a higher burden from an ostensibly 'uniform' tax.

Furthermore, policymakers have many options for adjusting the application of ostensibly cross-sectoral policies, leading to policy-driven heterogeneity. In the case of the European Union's Emissions Trading System, some countries exempt sectors covered by the ETS from their national carbon tax, while others do not. The scale of the inefficiencies created by sectoral differentiation is large: Kallbekken[41] estimates that they nearly doubled the cost of meeting the EU's Kyoto Protocol obligations.

For example, through its Climate Change Levy the United Kingdom imposes a carbon price floor that overlaps with the ETS. But the UK also negotiates Climate Change Agreements with individual sectors that reduce the rates they pay by between 65% and 90% in exchange for 'voluntary' commitments to reduce emissions and improve energy efficiency. This transforms what looks like a clear, uniform price signal into a patchwork of firm- and sector-specific actions.[42]

Germany's *Energiewende* ('Energy Transition') funds low-carbon sources through charges on energy users, but "energy intensive users actually pay a similar amount for electricity as their competitors in the USA (30–40 Euro per MWh) because

policy stringency?"

[38]Keohane et al., "The Choice of Regulatory Instruments in Environmental Policy"; Christian Downie. "Business actors, political resistance, and strategies for policymakers". In: *Energy Policy* 108 (2017), pp. 583–592.

[39]Per-Anders Enkvist et al. *Impact of the financial crisis on carbon economics: Version 2.1 of the global greenhouse gas abatement cost curve*. McKinsey & Company. 2010.

[40]Fullerton, "Six Distributional Effects of Environmental Policy".

[41]Steffen Kallbekken. "The cost of sectoral differentiation in the EU emissions trading scheme". In: *Climate Policy* 5.1 (Jan. 2005), pp. 47–60.

[42]David Pearce. "The political economy of an energy tax: The United Kingdom's Climate Change Levy". In: *Energy Economics* 28 (2006), pp. 149–158.

they enjoy exemptions from grid access fees, renewables support and EU ETS carbon costs".[43]

Sweden's carbon tax has the highest headline rate in the world, at over 100 euro per tonne of CO_2-equivalent fossil fuel emissions.[44] But from its inception in 1991 until the government began a process of rate convergence in 2011, the tax applied very different rates across emitters.[45] Households and services paid the full rate, while industry outside the ETS paid a quarter to a fifth of that, and industry within the ETS was exempted. The rates of households, services, and non-ETS industries did not converge until 2018.[46]

These examples demonstrate the difficulty of assessing the overall ambition of a countries' climate policies without taking into account the divergence of stringency across different sectors of the economy.

2.2.2 Heterogeneous Policy Demand

Interest groups that are affected by mitigation policy will not be neutral about how its burdens are distributed. If you value environmental quality, you will demand more stringent environmental policy. But if environmental policy imposes costs on you, *ceteris paribus* you are likely to demand less of it. This is not only a property of individuals but of interest groups. The level of positive or negative demand will vary a great deal across the different interest groups in a country.

So far I have focused on how aggregate measures fail to capture variation in the real world. But they have another limitation. Treating policy as national

[43] Misato Sato et al. "International and sectoral variation in industrial energy prices 1995–2015". In: *Energy Economics* 78 (2019), pp. 235–258; Felix Matthes et al. *EKI – Der Energiekostenindex für die deutsche Industrie*. Tech. rep. Berlin: Institute for Applied Ecology, 2017.

[44] Government Offices of Sweden. *Sweden's Carbon Tax*. `https://www.government.se/government-policy/taxes-and-tariffs/swedens-carbon-tax/`. 2019.

[45] Susanne Åkerfeldt and Henrik Hammar. "Le taxe carbone en Suède". In: *Revue Projet* (2015).

[46] Government Offices of Sweden, *Sweden's Carbon Tax*.

and uni-dimensional flattens our models of interest groups, making it difficult to capture distributive politics. A distributive account of climate policy requires not just understanding how policy burdens vary, but analyzing how those variations come about.

There is no shortage of qualitative or single-case accounts that attest to conflict between sectoral interest groups. Among others, sectoral conflict has been found in Australia,[47] Brazil,[48] Germany,[49] South Africa,[50] Norway,[51] the United Kingdom,[52] the United States,[53] and the European Union.[54] But when it comes to cross-national quantitative analysis of the political determinants of climate policy, sectoral differentiation is not part of the picture.

Most quantitative, cross-national studies of climate change policy implicitly or explicitly rely on the binary "political contest" model of policy demand. The identity of the policy demanders varies. Often the contest is between environmentalists and business, but sometimes the contestants are 'clean' businesses and 'dirty' businesses.[55] Sometimes there is no explicit treatment of policy demand

[47]Harriet Bulkeley. "No regrets? Economy and environment in Australia's domestic climate change policy process". In: *Global Environmental Change* (2001).

[48]Eduardo Viola and Matías Franchini. "Brazilian climate politics 2005-2012: ambivalence and paradox". In: *WIREs Climate Change* 5 (2014), pp. 677–688.

[49]Niels Anger et al. "The political economy of energy tax differentiation across industries: theory and empirical evidence". In: *Journal of Regulatory Economics* 47 (2015), pp. 78–98.

[50]Lucy Baker et al. "The Political Economy of Energy Transitions: The Case of South Africa". In: *New Political Economy* 19.6 (2014), pp. 791–818.

[51]Annegrete Bruvoll and Bodil Merethe Larsen. "Greenhouse gas emissions in Norway: Do carbon taxes work?" In: *Energy Policy* 32.4 (2004), pp. 493–505.

[52]Matthew Lockwood. "The political sustainability of climate policy: The case of the UK Climate Change Act". In: *Global Environmental Change* 23.5 (Oct. 2013), pp. 1339–1348.

[53]Michael I Cragg et al. "Carbon Geography: The Political Economy of Congressional Support for Legislation Intended to Mitigate Greenhouse Gas Production". In: *Economic Inquiry* 51.2 (2013), pp. 1640–1650; Downie, "Business actors, political resistance, and strategies for policymakers".

[54]Paul Ekins and Stefan Speck. "Competitiveness and exemptions from environmental taxes in Europe". In: *Environmental and Resource Economics* 13.4 (1999), pp. 369–396; Peter Markussen and Gert Tinggaard Svendsen. "Industry lobbying and the political economy of GHG trade in the European Union". In: *Energy Policy* 33 (2005), pp. 245–255; Tora Skodvin et al. "Target-group influence and political feasibility: the case of climate policy design in Europe". In: *Journal of European Public Policy* 17.6 (2010), pp. 854–873.

[55]Michaël Aklin and Johannes Urpelainen. "Political Competition, Path Dependence, and

at all. Whenever policy is understood as national and unidimensional, analysts are constrained to treat policy conflict as a 'tug-of-war' between two groups, one which wants more policy and one which wants less.

Early work in environmental economics focused on the efficiency of different policy instruments, but there is also a tradition of work examining the distributive consequences of pollution regulation.[56] Fullerton[57] gives a useful account of how the cost of regulation flows through the economy. Policy costs do not 'stay put' but are shared among multiple groups, potentially affecting consumers, labor, and capital in different ways. The degree to which these groups are affected depends on the relative elasticities of supply and demand, both for whatever good is being sold and for the factors used in its production. These elasticities constrain the ability of each group to shift costs to the other groups.

To the extent that capital, labor, and consumers have different capacities for political organization and influence, the distributive impacts across them are likely to have policy implications. And yet their interaction in shaping climate policy has not been the focus of scholarly attention. The reason is partly one of data availability, which will be addressed in the next chapter. But their omission can also be traced to a gap in the theory, which I will address next.

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the Strategy of Sustainable Energy Transitions". In: *American Journal of Political Science* 57.3 (July 2013), pp. 643–658.

[56] William J. Baumol and Wallace E. Oates. *The Theory of Environmental Policy.* 2nd ed. New York: Cambridge University Press, 1988; Ian W.H. Parry et al. "The incidence of pollution control policies". In: *International Yearbook of Environmental and Resource Economics 2006/2007.* Ed. by H Folmer and T Tietenberg. Cheltenham, UK: Edward Elgar, 2006, pp. 1–42; Don Fullerton. "Distributional Effects of Environmental and Energy Policy: An Introduction". In: *Distributional Effects of Environmental and Energy Policy.* Ed. by Don Fullerton. Aldershot: Ashgate, 2009; Julie Anne Cronin et al. "Vertical and Horizontal Redistributions from a Carbon Tax and Rebate". In: *Journal of Environmental and Resource Economics* 6.S1 (2019), S169–S208.

[57] Fullerton, "Six Distributional Effects of Environmental Policy".

2.2.3 Modelling Interest Competition

I have made the case that we need to two kinds of disaggregation in our models. First we need disaggregation in policy supply, in order to see how the strength of policy varies across sectors. Second, we need disaggregation in policy demand, capturing how the impact of policy varies across groups within sectors and how that variation affects policy supply in the first place. To disaggregate both policy supply and demand, we need a theory about how they interact.

Existing theory takes us halfway there. The widespread "common agency" model of Grossman and Helpman[58] already allows for policy that varies across different parts of the economy. Originally developed for studying trade politics, this model and its extensions by Aidt[59] have become an essential foundation for work on environmental interest competition.

The common agency model builds on the "menu auction" framework of Bernheim and Whinston.[60] In this framework, an auctioneer has a portfolio of actions that can affect multiple bidders positively or negatively. Bidders offer lists of potential payments they promise to make in exchange for each potential combination of actions. The auctioneer chooses actions in order to maximize their payoffs. When combined with assumptions of perfect information, such a setup produces efficient outcomes, because each bidder is incentivized to contribute truthfully according to their prospective gains or losses. With sectors as bidders and the government as the auctioneer, the model captures the competition of many groups over an assortment of different policy choices. When policies diverge from an efficient outcome, it is because some groups have successfully organized to offer contributions while others have not (as in Olson[61]).

[58] Grossman and Helpman, "Protection for Sale".

[59] Aidt, "Political internalization of economic externalities and environmental policy".

[60] B. Douglas Bernheim and Michael D. Whinston. "Menu Auctions, Resource Allocation, and Economic Influence". In: *The Quarterly Journal of Economics* 101.1 (Feb. 1986), p. 1.

[61] Olson, *The Logic of Collective Action.*

The common agency model is commonly cited as theoretical justification for comparative work on environmental politics. But in a demonstration of the disconnect between theory and empirics,[62] the climate policy literature's reliance on whole-country measures has meant the sectoral differentiation implied by the common agency model has not been tested cross-nationally. Two decades after Grossman and Helpman,[63] Anger et al.[64] "constitutes the first quantitative assessment of the role of interest groups in energy (environmental) tax differentiation." They extend the common agency framework to consider differences in sectors' ability to reduce energy consumption, and validate their model with data from Germany. They find that sectors with inelastic energy demands receive protection in the form of lower energy tax rates. This finding highlights the necessity of a multi-sectoral approach for scholars who want to understand climate policymaking's distributive aspects. But more remains to be done.

There is yet to be a cross-national, quantitative study that disaggregates both policy supply and policy demand. Existing models do not reflect the distributional dynamics described by Fullerton.[65] Specifically, they do not incorporate how imposing climate mitigation regulation on a particular sector subsequently affects the consumers who buy its goods, the workers who perform its labor, and the investors who own it.

Models of whole-country policy are limited in what they can reveal about these groups, since their measures do not map out where costs are falling. But once we look at the burden by sector, it opens the door to examining the burden on investors, workers, and consumers. In the next section, I provide a model

[62]Hojnacki et al., "Studying Organizational Advocacy and Influence: Reexamining Interest Group Research".

[63]Grossman and Helpman, "Protection for Sale".

[64]Anger et al., "The political economy of energy tax differentiation across industries: theory and empirical evidence".

[65]Fullerton, "Six Distributional Effects of Environmental Policy".

which attempts to capture these distributive dynamics.

2.3 A Model of Distributive Climate Policymaking

2.3.1 Theoretical Boundaries

Before I begin describing the model's details, I will outline some of its boundaries and constraints. The model is relatively basic: its purpose is to make my account of sectoral interests precise.

Domestic Policy

The model in this chapter focuses on domestic policymaking by national governments. While international agreements play an important role in shaping climate action,[66] most international environmental commitments are ultimately dependent on national implementation.[67][68] Countries have wide latitude in deciding how to meet their commitments: neither the Kyoto Protocol nor the Paris Accords mandate particular policy instruments. Even in the European Union, the strongest example of transnational climate policy coordination, member states

[66] Per-Olof Busch et al. "The Global Diffusion of Regulatory Instruments: The Making of a New International Environmental Regime". In: *Annals of the American Academy of Political and Social Science* 598 (2005), pp. 146–167; Steven Bernstein and Benjamin Cashore. "Complex global governance and domestic policies: four pathways of influence". In: *International Affairs* 88.3 (2012), pp. 585–604.

[67] Meadowcroft, "From Welfare State to Ecostate"; Harrison and Sundstrom, "The Comparative Politics of Climate Change"; Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[68] For the first few decades of climate action the focus, both of political actors and academics, was on international coordination. Therefore analysis was usually centered on the actors with seats at the table: countries. International business interests and NGOs played secondary roles, with domestic interest groups in the background. Now that scholars and practitioners have turned more of their attention towards implementation at the national level, the need to bring domestic interests to the foreground has become more pressing (Purdon, "Advancing Comparative Climate Change Politics: Theory and Method").

exhibit significant diversity in climate policy implementation.[69]

That said, national governments are not the only policy-setters: sub-national governments can also take substantive action on the climate, especially in federal systems,[70] as can non-state actors.[71] The theory I develop could be extended to policymaking by non-national actors, but it would require modification to account for the national context.

Policy as Stringency

The model is primarily concerned with stringency, which I define as the extent to which policy makes the emission of greenhouse gasses more or less costly. This focus on stringency abstracts away from potentially important variation in instrument choice.[72] The key reason for this focus is that while different kinds of policies may have very different effects in their "pure" form, their implementation can make their effects quite similar.[73] For example, carbon taxes and emissions trading can be functionally equivalent or significantly different, depending on

[69]Tanja A. Borzel. "Why there is no 'southern problem'. On environmental leaders and laggards in the European Union". In: *Journal of European Public Policy* 7.1 (Jan. 2000), pp. 141–162; Lorenzo Pellegrini and Reyer Gerlagh. "Corruption and Environmental Policies: What Are the Implications for the Enlarged EU?". In: *European Environment* 16 (2006), pp. 139–154.

[70]Barry G. Rabe. "States on Steroids: The Intergovernmental Odyssey of American Climate Policy". In: *Review of Policy Research* 25.2 (Mar. 2008), pp. 105–128; B. Burke and M. Ferguson. "Going Alone or Moving Together: Canadian and American Middle Tier Strategies on Climate Change". In: *Publius: The Journal of Federalism* 40.3 (June 2010), pp. 436–459; Kirsten Jörgensen et al. "Multi-level climate governance and the role of the subnational level". In: *Journal of Integrative Environmental Sciences* 12.4 (Oct. 2015), pp. 235–245.

[71]Jessica F. Green. *Rethinking private authority : agents and entrepreneurs in global environmental governance*. Princeton University Press, 2013; Frank Biermann. "Beyond the intergovernmental regime: recent trends in global carbon governance". In: *Current Opinion in Environmental Sustainability* 2 (2010), pp. 284–288.

[72]Donald N. Dewees. "Instrument Choice in Environmental Policy". In: *Economic Inquiry* 21.1 (Jan. 1983), pp. 53–71; Keohane et al., "The Choice of Regulatory Instruments in Environmental Policy"; Llewelyn Hughes and Johannes Urpelainen. "Interests, institutions, and climate policy: Explaining the choice of policy instruments for the energy sector". In: *Environmental Science and Policy* 54 (2015), pp. 52–63.

[73]Joseph E. Aldy et al. "Designing Climate Mitigation Policy". In: *Journal of Economic Literatures* 48.4 (2010), pp. 903–934.

their design.

Stringency is not necessarily the same thing as policy effectiveness. Effectiveness must ultimately be measured in terms of emissions reduced and avoided. But it is possible to conceive of a policy which imposes costs on emitters but nevertheless fails to put a dent in emissions. If both the demand of and supply for a particular good are both inelastic, even a very costly policy could result in only small emissions changes.

Or consider a policy which does not impose costs, like a public information campaign or a product labelling scheme. Neither would be considered especially stringent, since they would be relatively cheap compared with technological mandates or carbon pricing. If they managed to change behavior, they would rate as effective. But the following model is focused on costly policy, because I am interested in how policy's creation is affected by the interests of those on whom costs are imposed.

Finally, stringent policies are not only those which impose a direct price on greenhouse gas emissions. Requirements that all cars meet a certain efficiency standard, quotas for the amount of emissions that factories can emit, mandates for firms to use a particular technology: all these are examples of policies which do not put a price on emissions but which nevertheless end up raising costs for those who emit greenhouse gasses. The concept of stringency used in the model below is neutral to how these costs are imposed.

Short-Run Effects

Finally, the model is focused on the short-run effects of policy. This focus keeps the model tractable. It also reflects a judgement that mitigation policy to date seems to have been constrained by a focus on near-term costs (both to firms and policymakers). Several subsidiary assumptions follow.

First, in line with my focus on short-run effects, I assume locally linear elasticities of supply and demand by producers and consumers. If dramatic year-on-year changes in policy stringency are unlikely to be politically feasible, linear elasticities are a reasonable approximation.

Second, I follow Grossman and Helpman[74] and Dixit[75] in ignoring cross-effects of prices between sectors. In other words, I do not model the potential benefits a sector might receive if the price of other sectors' goods go up (or the costs it might face if other sectors' prices go down). Doing so would be theoretically interesting, but is beyond the scope of this model. Similarly, the model ignores the potential for scarcity rents.[76]

Third, I employ a static, one-period model to represent dynamic, multi-period politics. In each year, policymakers look at the demands of interest groups and set a new policy in response, without considering the historical trajectory of policies. The model assumes the world is in an equilibrium state characterized by perfect competition within sectors. All profits are returned to factors, rather than being saved or re-invested in firms.

2.3.2 Policy Supply

Because the model is focused on the short-run and represents deviations from equilibrium, the existing price level and quantity of output are not included. Instead I focus directly on the environmental benefits from regulation b_i and the economic costs of regulation c_i. Both are sector-specific, with sectors represented by $i \in (1, 2, \ldots, I)$.

The variable b_i represents the present discounted value of the damages from

[74] Grossman and Helpman, "Protection for Sale".

[75] Avinash Dixit. "Special-Interest Lobbying and Endogenous Commodity Taxation". In: *Eastern Economic Journal* 22.4 (1996), pp. 375–388.

[76] I do not ignore this possibility in my empirical treatment. The regressions in the subsequent chapters include a control for fossil fuel income.

climate change that will be avoided as a result of policy-induced greenhouse gas gas reductions in this sector. This is equivalent to the "public goods" benefits of policy: it comes from the sector but the value is not captured by the sector, accruing instead to global society. The variable c_i represents the total economic costs borne by firms and their economic dependents from complying with mitigation policy.[77]

The distinction between 'environmental' benefits and 'economic' costs is somewhat arbitrary. Pollution reduction can create economic 'co-benefits' as well as costs. For example, a policy that limits particulate emissions can improve health outcomes, resulting in monetary savings on treatment. It could also induce technological innovation, leading to more economic growth in the long-run. If the net economic benefits are positive, the cost variable c_i would be negative.

But for this model, the distinction between environmental benefits and economic costs remains useful. In the case of climate change, there is a significant time asymmetry between costs and benefits: both environmental benefits and economic benefits take a long time to manifest, compared to costs which are often 'front-loaded'.

Furthermore, many of the largest benefits of climate regulation are public rather than private goods. So even if the net economic benefits are positive, they may not accrue directly to the people targeted by (and therefore incentivized to oppose) regulation. In the short-run, therefore, distinguishing between general environmental benefits (felt by environmentalists) and targeted economic costs (felt by investors, workers, and consumers) is a reasonable simplification.

[77]In this abstract, stylized account, costs are entirely material and economic, while benefits are non-material and non-economic (even if they are commensurable in terms of the equations). Another way to think of them is to see b as the long-term impacts and c as the short term impacts. In the case of climate change mitigation policies, b is often positive and c negative, at least for someone. An environmentalist in this "time" frame is someone who plays a higher value on future impacts than others.

λ_i represents the stringency of mitigation regulation applied to a given sector: more stringent regulation means it is costlier for a given sector to emit greenhouse gasses. Both the benefits and costs of regulation are differential functions of $\lambda_i \cdot m_i$, where m_i is sector-specific emissions intensity, and a vector of other sectoral characteristics Z_i:

$$b_i = b_i(\lambda_i \cdot m_i, Z_i); \quad \frac{\partial b_i}{\partial \lambda_i} > 0, \quad \frac{\partial^2 b_i}{\partial \lambda_i \lambda_i} < 0 \tag{2.1}$$

$$c_i = c_i(\lambda_i \cdot m_i, Z_i); \quad \frac{\partial c_i}{\partial \lambda_i} > 0, \quad \frac{\partial^2 c_i}{\partial \lambda_i \lambda_i} \geq 0 \tag{2.2}$$

I make several basic assumptions about the forms of these functions. The first is that as policy stringency increases, both the costs and benefits of regulation should increase as well. The second assumption is that there will be decreasing marginal benefits from stringency. As the total amount of emissions abated rises, further reductions avert relatively smaller and smaller amounts of warming. The third is that there are stable or increasing marginal costs from regulation. Sectors will presumably implement the lowest-cost solutions for reducing emissions first. But as mitigation stringency rises, some kinds of firms may no longer be profitable, leading to closures. This possibility means that dramatically intensifying regulation could lead to non-linear increases in regulatory cost.

I make minimal assumptions about the relative sizes of b_i and c_i. The size of b_i will be affected by the rate at which we discount the damages from unmitigated climate change (and thus the benefits from mitigating them). Even if we knew exactly what future damages would be, subjective differences about the proper discount rate can drastically alter the present perceived benefits from mitigation. This makes it fundamentally difficult to make a firm statement about the relationship of b_i to c_i. It will be useful for the rest of the model to make

some statement about how they will change relative to one another.

I can, however, make some simple assumptions about how they will change relative to each other.

First, I assume that c_i has two separable components, driven by the regulatory price which a sector pays for its emissions on an ongoing basis (λ_i) and an abatement price (a_i) which it pays for its reduction of emissions (in order to avoid the price). Abatement intensity is denoted by x_i:[78]

$$c_i = (m_i - x_i)\lambda_i + x_i a_i \tag{2.3}$$

I further assume that the price per unit of abatement is itself a function of both abatement intensity x_i and emissions intensity m_i:

$$a_i = a(x_i * m_i, Z_i); \quad \frac{\partial a}{\partial x_i} > 0; \quad \frac{\partial a}{\partial m_i} > 0; \quad \frac{\partial^2 a}{\partial m_i \partial x_i} > 0 \tag{2.4}$$

The reasoning here is that attempting to abate large amounts at the same time will be costlier than abating small amounts. Not all abatement options have the same cost, and firms will presumably pursue the least-costly options first (if permitted to do so). Therefore the greater the quantity of abatement that firms pursue at a given time, the more they will have to select higher-cost options. As for mitigation intensity, firms that depend heavily on emissions for their production (i.e. have a high emissions intensity) will probably find it more difficult to identify alternatives than firms which only require a small quantity of emissions, driving up the cost of abatement. They are multiplicative because each drives up the other: trying to abate large quantities of emissions while also being very emissions intense compounds the challenge that sector faces.

Now I find the optimal level of abatement for the sector by deriving with

[78] Output is normalized to unity, so that the other coefficients implicitly reference the sector's overall resources.

respect to x_i (using the product rule):

$$\frac{\partial c_i}{\partial x_i} = -\lambda_i + x_i m_i \frac{\partial a_i}{\partial x_i} + a_i(x_i m_i) \tag{2.5}$$

Setting the derivative to zero allows us to find the level of abatement when costs for the firm are minimized, which I denote by x_i^*

$$x_i^* = \frac{\lambda_i - a_i(x_i m_i)}{m_i \frac{\partial a_i}{\partial x_i}} \tag{2.6}$$

Note that (from the firm's perspective) optimal mitigation is increasing with respect to λ_i and strictly decreasing with respect to abatement cost a_i (because $\frac{\partial a}{\partial m_i} > 0$, the denominator rises with a_i). This makes sense, because firms will generally want to abate more when their abatement costs are low and abate more when they are high, relative to regulatory stringency. Finally, I also assume that benefits are proportional to the quantity of abatement, where r is some positive constant:

$$b_i = r x_i \tag{2.7}$$

If countries pursued really substantial mitigation, benefits would begin to decline. The results that follow do not depend on a constant value for r: they would hold if we assumed instead that r itself declines as total abatement across all countries and sectors rise. But over the space of politically-feasible mitigation options, this is a reasonable approximation.

2.3.3 Policy Demand

The costs of mitigation regulation can be further disaggregated below the sectoral level to different functionally-specified groups:

$$c_i = c_i^K + c_i^L + c_i^D \tag{2.8}$$

The superscript K denotes capital, L labor, and D demanders or consumers. This last category includes both firms that purchase sector i's output as intermediate inputs and final consumers like households. This equation does not specify the nature of these costs.[79]

By construction, the benefits b_i of mitigation policy accrue only to environmentalists. This does not mean there are sector-specific groups of environmentalists. But since the emissions from one sector are essentially interchangeable with those from another, we can consider environmentalists' benefits from sector-level reductions to be separable.

The sector-level benefits b_i and costs c_i of regulation are weighed by the government, which can adjust them by choosing different levels of λ_i. The next equation represents the welfare function of a social maximizer, denoted by W^S:

$$W^S = \sum_{i=1}^{I} b_i - c_i = \sum_{i=1}^{I} b_i - c_i^K - c_i^L - c_i^D \tag{2.9}$$

Note that in this equation the social maximizer is indifferent about where the costs of regulation fall. But real governments are not likely to be indifferent between groups. For all the models that follow, I will focus on the case of a government that places different values or weights on the interests of different groups, as in the "power-weighted social decision rule" of Boyce and Torras and Boyce.[80] These weights, denoted by π, represent the power or influence of a

[79]For labor, costs might come in the form of reduced wages, worse working conditions, retraining costs, or job losses. For capital-owners, costs might mean lower profit margins, weaker returns on investments, and falling stock prices. For consumers, costs might mean higher prices or smaller consumption surpluses. The pathways by which regulatory costs manifest themselves may be very important for the workers, investors, and consumers themselves. But they are beyond the scope of this model.

[80]James K. Boyce. "Inequality as a cause of environmental degradation". In: *Ecological Economics* 11.3 (Dec. 1994), pp. 169–178; Mariano Torras and James K Boyce. "Income,

given group over the government. The welfare function of an interest-weighting government is denoted by W:

$$W = \sum_{i=1}^{I} \pi^E b_i - \pi^K c_i^K - \pi^L c_i^L - \pi^D c_i^D \tag{2.10}$$

Following Oates and Portney,[81] I call this the "political equilibrium". π^E represents the power of environmentalists, π^K the power of capital-owners, π^L represents the power of labor, and π^D the power of consumers. These four interests—environmentalists, investors, workers, and consumers—will be the main focus of the following analysis.

In the real world, these groups are not composed of distinct individuals. People have multiple overlapping identities: the same person can own stocks, earn a wage, consume goods, and care about the environment. The division of people's interests into functionally-specialized groups (to borrow a term from Aidt[82]) is a matter of convenience. The same model could be described in individual terms by assuming that utility is separable across these categories.[83]

The model does not characterize the source of the groups' influence parameters. Influence is treated as an exogenous endowment of particular groups. But one simple way to think of influence is that it represents the inverse cost of collective organization. If it is easier to organize one kind of interest than another into an active lobby, then that interest will be relatively more able to affect the operations of government.

The model also abstracts away from the particular method by which groups

inequality, and pollution: a reassessment of the environmental Kuznets Curve". In: *Ecological Economics* 25 (1998), pp. 147–160.

[81] Wallace E. Oates and Paul R. Portney. "The Political Economy of Environmental Policy". In: *Handbook of Environmental Economics*. Ed. by Karl-Goran Mäler and Jeffrey R. Vincent. Elsevier Science, 2003. Chap. 8, pp. 327–354, p.334.

[82] Aidt, "Political internalization of economic externalities and environmental policy".

[83] Don Fullerton and Garth Heutel. "The general equilibrium incidence of environmental taxes". In: *Journal of Public Economics* 91 (2007), pp. 571–591.

influence policy. Groups may have different abilities to make campaign contributions, provide information, pay bribes, shape opinion, or deliver votes. Groups may try to elect sympathetic politicians or sway existing incumbents. Even policymakers who are not subject to election, like bureaucrats or autocrats, may still be more closely tied to some domestic constituencies than others. But the details of these connections are not specified in the model.

Recalling the insight about the power of "potential" groups in Truman,[84] I assume that all four influence parameters are positive. This means that the government is assumed to care about the welfare of all groups to at least some extent, even if some groups receive more consideration than others.[85]

$$\pi^E > 0,\ \pi^K > 0,\ \pi^L > 0,\ \pi^D > 0 \tag{2.11}$$

2.3.4 Influence Inequality

If all groups had equivalent influence, then the social maximizer's equilibrium would be the same as the political equilibrium.[86] The distribution of group burdens would then be unrelated to the design of climate policy. I assume, however, that groups' influence is unequal. In particular, capital-owners often seem to exert an influence out of proportion with their numbers. Based on this expectation, to be discussed further below, I propose the following:

[84] Truman, *The Governmental Process*.

[85] My analysis focuses on democracies, where this expectation is more likely to hold than autocracies. But even in autocracies, the government may derive at least some utility from the welfare of most groups, if only to reduce the risk of being overthrown.

[86] In formal terms, $\pi^E = \pi^K = \pi^L = \pi^D \implies W = W^*$. This matches the situation in Oates and Portney, where "if all agents have their interests represented accurately by an interest group, then the political equilibrium is socially efficient". See Wallace E. Oates and Paul R. Portney. "The Political Economy of Environmental Policy". In: *Handbook of Environmental Economics*. Ed. by Karl-Goran Mäler and Jeffrey R. Vincent. Elsevier Science, 2003. Chap. 8, pp. 327–354, p. 334.

Proposition 2.1 *The government will be more responsive to the interests of capital than to those of environmentalists, workers, or consumers.*

$$\pi^E < \pi^K$$

$$\pi^L < \pi^K$$

$$\pi^D < \pi^K$$

This assertion is the product of a long tradition in political economy that emphasizes the outsize power of capital-owners compared with other groups in society.[87] Some of the work in this tradition is about 'business', while other parts refer to the power of 'capital'. But insofar as large businesses are mostly owned by investors, in terms of political influence they are "in practice very often the same thing".[88] This power comes in both 'instrumental' and 'structural' forms.[89]

On the instrumental side, capital has an advantage in terms of resources. Capital wealth tends to be concentrated, so its holders have more resources to directly influence politicians and the public. This concentration should also make it

[87]Adam Przeworski and Michael Wallerstein. "Structural Dependence of the State on Capital". In: *American Political Science Review* 82.1 (1988), pp. 11–29; Stephen R. Gill and David Law. "Global Hegemony and the Structural Power of Capital". In: *International Studies Quarterly* 33.4 (1989), pp. 475–499; Duane Swank. "Politics and the Structural Dependence of the State in Democratic Capitalist Nations". In: *American Political Science Review* 86.1 (Mar. 1992), pp. 38–54; David M. Andrews. "Capital Mobility and State Autonomy: Toward a Structural Theory of International Monetary Relations". In: *International Studies Quarterly* 38.2 (June 1994), p. 193; Thomas Ferguson. *Golden rule: The investment theory of party competition and the logic of money-driven political systems*. University of Chicago Press, 1995, p. 432; Jeffrey A. Winters. *Power in Motion*. Ithaca, NY: Cornell University Press, 1996, See, among others,

[88]Culpepper, "Structural power and political science in the post-crisis era", p. 42.

[89]There is a thriving debate over the relationship and priority of instrumental and structural power for explaining government decision-making. Though theoretically distinct, they can be difficult to disentangle in practice (Stephen Bell. "The Power of Ideas: The Ideational Shaping of the Structural Power of Business". In: *International Studies Quarterly* 56.4 [2012], pp. 661–673; Andrew Hindmoor and Josh McGeechan. "Luck, Systematic Luck and Business Power: Lucky All the Way down or Trying Hard to get What it Wants without Trying?" In: *Political Studies* 61.4 [Dec. 2013], pp. 834–849). In many cases where business or capital 'wins', both forms of power are in evidence.

easier for capital-holders to solve the kinds of collective action problems described in Olson.[90]

Capital also possesses a structural advantage, rooted in "the dependence of the state on private investors".[91] As long as goods and financial markets are sufficiently open, capital-holders can shift their investments between jurisdictions. The relocation of business activity, or more properly the threat of such relocation, acts as a check on government regulation. Insofar as governments depend on business activity to maintain employment and growth, they will be especially sensitive to the concerns of capital-owners.[92][93]

Capital is not perfectly mobile: some investments can be shifted more easily than others. And workers and consumers are not immobile: it is possible for households to move in pursuit of a new job or a lower cost of living. But in general capital has more credible exit options. Workers and consumers could in theory threaten mass exit, but making or carrying out such a threat would require daunting levels of collective coordination. A single institutional investor or business can remove millions or billions of dollars out of a country unilaterally. Very few households can do the same, unless they are among the very wealthy, in which case they are likely to be part of the capital-holding interest group as well. As for environmentalists, if they are concerned about the global impact of climate change, there is no option to exit from the planet. These differences suggest that capital is more mobile than the other interest groups taken individually, giving it greater leverage.[94]

[90] Olson, *The Logic of Collective Action*.

[91] Culpepper, "Structural power and political science in the post-crisis era", p. 397.

[92] Jacob S. Hacker and Paul Pierson. "Business Power and Social Policy: Employers and the Formation of the American Welfare State". In: *Politics & Society* 30.2 (June 2002), pp. 277–325; Pepper D. Culpepper and Raphael Reinke. "Structural Power and Bank Bailouts in the United Kingdom and the United States". In: *Politics & Society* 42.4 (2014), pp. 427–454.

[93] The advantages of business may be even stronger in the environmental arena than in other sphere; see Gebhard Kirchgässner and Friedrich Schneider. "On the political economy of environmental policy". In: *Public Choice* 115 (2003), pp. 369–396, p. 379.

[94] Recent evidence from the United States highlights the significant influence that economic

So far I have not discussed the other groups in relation to each other. The expectations for them are less clear than in the capital case, but some general constraints can be derived from the idea of collective action problems. One of the most useful insights of Olson[95] is that the number of actors faced with a collective action problem generally increases the difficulty they have in solving it. Environmentalists, consumers, and labor are solving problems at different scales.

The collective action problem faced by environmentalists advocating for climate change mitigation is global. The collective action problem faced by consumers is national or regional. And the collective action problem faced by workers is firm- or industry-specific.

The benefits of mitigation accrue to everyone in the world regardless of their contributions, meaning that environmentalists face potentially global free-riding. Frictions in trade mean that the benefits of low prices can be at least partially limited to a country or region, reducing the scale of consumers' challenges. And the fact that workers are employed by specific firms and industries reduces the scope of their collective action problem further.

These are broad generalizations. Environmental groups still manage to form in spite of barriers to organization, and labor unions are not obviously dominant in many jurisdictions.[96] But these nested scales should, in general, mean lower barriers to collective action. I therefore expect that consumers will have at least

elites exert over politics there (Hacker and Pierson, *Winner-take-all politics: How Washington made the rich richer-and turned its back on the middle class*; Gilens and Page, "Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens"). In other countries it is not yet clear whether capital's power is enough to create "economic-elite dominance" or merely "biased pluralism" (to borrow terms from Gilens and Page). My model does not rely on a presumption of dominance: some bias or advantage is sufficient.

[95]Olson, *The Logic of Collective Action.*

[96]Note that the presence or absence of organized groups is not necessarily a good guide to the power of the constituency they represent. Consumers may not have as many active lobbying organizations as environmentalists. Consumers may simply be 'potential' groups whose active organization policymakers forestall by trying to limit price increases beyond acceptable levels. In this case, the proliferation of organized environmental groups could be a sign of the weakness of environmental interests rather than their strength.

as much influence as environmentalists, and the workers will have at least as much influence as consumers.[97]

This reasoning is summarized in the following proposition:

Proposition 2.2 *The government will be more responsive to capital interests than labor interests, no more responsive to environmental interests than consumer interests, and no more responsive to consumer interests than labor interests.*

$$\pi^E \leq \pi^D \leq \pi^L < \pi^K$$

The power imbalances described in proposition 2.1 and proposition 2.2 should affect how governments respond to different distributive tradeoffs.

Even if labor, consumer, and environmental interests are given equal weight, this proposition will still hold true as long as capital has some advantage over other groups. Governments may vary in the extent to which they favor capital, however, changing the magnitudes of these inequalities. To explore some potential sources of variation, I look at the role of governing party ideology in chapter 4 and political economy arrangements in chapter 5. But I assume that capital has at least some advantage, even if small, across all countries.

Note that these inequalities do not mean that economic interests will always dominate environmental ones, that producers will always dominate consumers, or that capital will always dominate labor. If the government weighs the interests of one group over another, this proposition does not imply that the favored group will be spared from any regulatory cost whatsoever. It only means that the government will be expected to apply relatively less regulatory stringency to favored groups than it would if it were indifferent between groups.

[97]It is useful to recall here that I define influence as a multiplier placed by the government on groups' utility. Having a higher influence does not mean that a group is a bigger force in a country's politics in an absolute sense, only that its utility carries relatively more or less weight with the gov than we would expect given its size.

Ultimately, the governments' choices about how much regulatory stringency to supply will depend not only on influence, but on the costs that each group can expect to face under regulation. These costs will be the focus of the next section.

2.3.5 Distributive Variables

The last step in building the model is to characterize how regulatory costs flow to different groups.[98] Instead of trying to obtain micro-foundations for these flows, I follow the sufficient statistics approach of Chetty[99] and introduce two variables to represent distributive dynamics. θ is the proportion of cost increases that are borne by consumers rather than producers. ϕ is the proportion of increases in producer costs that are borne by labor rather than capital.

Both are assumed to vary by sector, and to vary between 0 and 1 exclusively:

$$\theta_i \in (0,1),\ \phi_i \in (0,1) \tag{2.12}$$

These variables can now be used to define how the sector-level regulatory cost c_i is divided between capital, labor, and consumers:

$$c_i^K = (1-\theta_i)(1-\phi_i)c_i \tag{2.13}$$

$$c_i^L = (1-\theta_i)\phi_i c_i \tag{2.14}$$

$$c_i^D = \theta_i c_i \tag{2.15}$$

[98] As discussed in section 2.3.3, the benefits of climate regulation are felt only by environmentalists.

[99] Raj Chetty. "Sufficient Statistics for Welfare Analysis: A Bridge Between Structural and Reduced-Form Methods". In: *Annual Review of Economics* (2009).

θ_i captures the relative elasticity of supply and demand for a sector's output. This elasticity determines the extent to which producers can pass costs on to consumers. When demand is relatively less elastic than supply, θ_i will be high and firms will be able to pass more of the costs of regulation onto consumers. When demand is relatively more elastic than supply, θ_i will be low and firms will need to bear the cost themselves.

The portion of regulatory costs that is borne by firms will be distributed between the two factors of production, capital and labor. ϕ_i captures the extent to which the firms can pass those costs onto labor in the form of reduced wages, reduced hours, layoffs, or changes in working conditions. When ϕ is high, perhaps because the demand for labor in the sector is more elastic than its supply, labor will bear relatively more of the burden of regulation. When ϕ_i is low, firms are constrained in their ability to put costs on labor. When costs cannot be passed to labor or consumers, they will fall on capital in the form of reduced dividends or stock prices.

The "initial incidence" of regulation is less important than which actors are constrained by relative elasticities to bear the cost.[100] In the next chapter I will discuss different ways of operationalizing both θ_i and ϕ_i, but for now I will leave them as abstract variables.

Figure 2.2 illustrates how costs imposed on a given sector flow to different groups according to these variables.

2.3.6 Full Model

With both the influence parameters and distributive variables in hand, it is possible to specify the complete baseline model:

[100] Fullerton, "Six Distributional Effects of Environmental Policy".

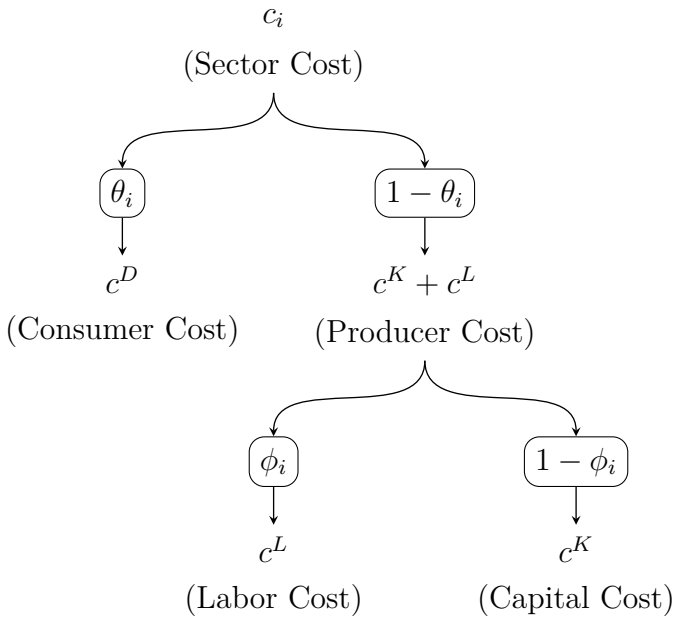


Figure 2.2: **A Diagram of the Cost Flow.**

$$W = \sum_{i=1}^{I} \Big(\pi^E b_i - \pi^K (1-\theta_i)(1-\phi_i) c_i - \pi^L (1-\theta_i)\phi_i c_i - \pi^D \theta_i c_i \Big) \tag{2.16}$$

Figure 2.3 displays the same model in graphic form, updating the stylized diagram (fig. 2.1) with the variables and parameters from the formalization. To maintain readability, the full pathway is only displayed for one sector.

At this stage it may also be helpful to summarize the model in words. To review: the government supplies a mitigation policy λ to each sector $i \in (1, 2, \ldots, I)$. That mitigation policy creates sector-specific environmental benefits b_i and sector-specific costs c_i. The environmental benefits are only felt by environmentalists ($b_i = b_i^E$). A sector-specific proportion θ_i of regulatory costs are borne by consumers (c^D). The rest are distributed between investors (c^K) and workers (c^L) according to ϕ_i, which represents the ability of firms to pass on costs to labor. All four groups demand that the government either reduce (in the case of investors,

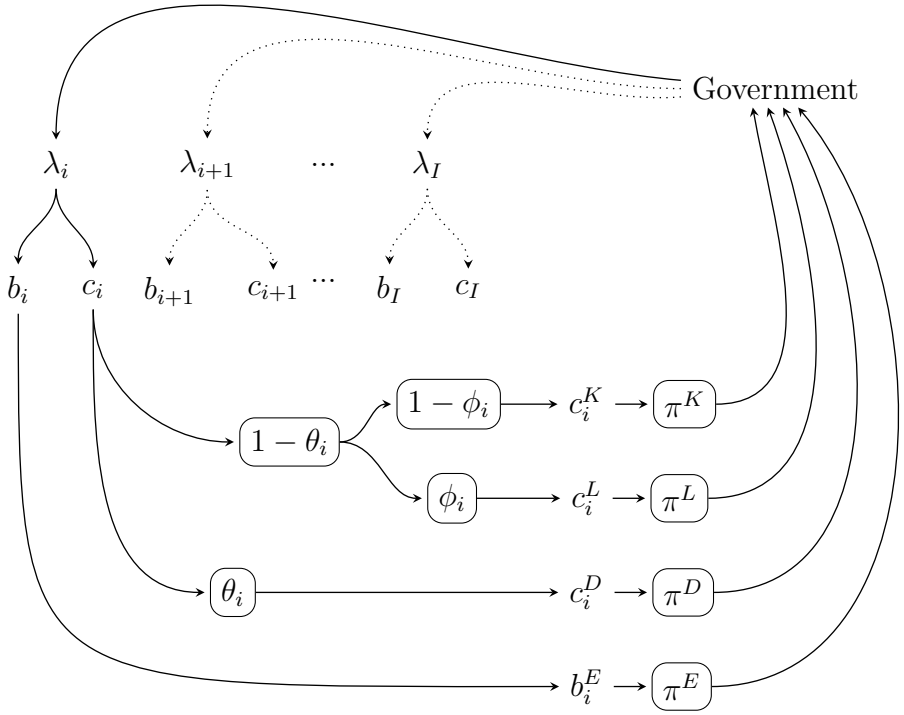


Figure 2.3: **A Diagram of the Formal Model with Labels.** To preserve readability, only the full diagram for sector 1 is featured. If drawn fully, sectors $\{i+1 \dots I\}$ would create their own costs and benefits which would also feed back into government decision-making. Outlined terms represent distributive variables and influence parameters.

workers, and consumers) or increase (in the case of environmentalists) the stringency of sectoral regulation, in proportion to the cost or benefit they face. The degree to which the government responds to these demands is conditioned by the influence (π) of each group.

I am primarily interested in when governments will raise or lower the stringency of mitigation policy in a particular sector. Taking the derivative of the government's welfare function W with respect to λ_i gives the following equation:

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial c_i}{\partial \lambda_i} \tag{2.17}$$

Though the sector subscripts remain, the model is now focused on a single sector i. Because the model is focused on short-term impacts and ignores the cross-price effects of regulation, other sectors fall out of the model.[101] The final model does not focus on interactions between sectors, but on the influence of sector-specific characteristics on sector-specific regulation. Without constraining b_i, c_i, and λ_i, it is possible for the government to be incentivized to set $\lambda_i < 0$. This would be equivalent to subsidizing emissive activity, which many governments do via fossil fuel production or consumption subsidies.

I am also interested in how the relationship between welfare and stringency changes as stringency increases, so I calculate the second derivative of welfare with respect to stringency:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \lambda_i} = \pi^E \frac{\partial^2 b_i}{\partial \lambda_i \lambda_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial^2 c_i}{\partial \lambda_i \lambda_i} \tag{2.18}$$

Based on the assumptions in eq. (2.1) and eq. (2.2) about the second derivatives of b_i and c_i with respect to λ_i, I can determine that the second derivative of W with respect to λ_i is negative:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \lambda_i} < 0 \tag{2.19}$$

Finally, I define λ_i^* as the level of stringency that maximizes W (i.e. that makes $\frac{\partial W}{\partial \lambda_i} = 0$):

[101] For the reasoning behind this choice, see section 2.3.1.

$$\underset{\lambda_i}{\operatorname{argmax}} W = \lambda_i^* \tag{2.20}$$

2.4 Three Hypotheses

With the model complete, it is now possible to derive several predictions about the relationship between power inequalities and governments' decisions about mitigation policy stringency.

2.4.1 Environmental Versus Economic Interests

By construction, the extent to which sectoral regulation has costs or benefits depends on the emissions intensity of that sector (see eq. (2.1) and eq. (2.2)). To figure out how emissions intensity relates to the government's choice of stringency, I start by re-stating eq. (2.17):

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial c_i}{\partial \lambda_i}$$

I use implicit differentiation to obtain the following relationship:

$$\frac{d\lambda_i^*}{dm_i} = -\frac{\dfrac{\partial^2 W}{\partial \lambda_i \partial m_i}}{\dfrac{\partial^2 W}{\partial \lambda_i \partial \lambda_i}} \tag{2.21}$$

The denominator is negative by assumption (see eq. (2.19)), so the sign of the whole equation matches the sign of the numerator. The mixed partial derivative $\frac{\partial^2 W}{\partial \lambda_i \partial m_i}$ represents how the emissions intensity of a particular sector affects the rate of change in the government's welfare function when regulation of that sector is

increased. Its sign indicates whether governments will supply stronger or weaker mitigation regulation to emissions-intense sectors. If it is positive (negative), then the government will apply more (less) stringent regulation to emissions-intense sectors. If it is zero, then emissions intensity will be unrelated to the government's choice of stringency.

To find this sign, I begin by deriving eq. (2.17) with respect to m_i:

$$\frac{\partial^2 W}{\partial \lambda_i \partial m_i} = \pi^E \frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial^2 c_i}{\partial \lambda_i \partial m_i} \quad (2.22)$$

This mixed second-order partial derivative will be negative under the following condition:

$$\pi^E \frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} < \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial^2 c_i}{\partial \lambda_i \partial m_i} \quad (2.23)$$

By proposition 2.1 and proposition 2.2, we know the following to be true:

$$\pi^E < \pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i \quad (2.24)$$

Therefore we know that the second-order partial derivative of interest will be negative as long as the following holds:[102]

$$\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} \leq \frac{\partial^2 c_i}{\partial \lambda_i \partial m_i} \quad (2.25)$$

How can we know whether this condition holds? The answer can be found in the abatement formula eq. (2.4) and the sectoral cost equation eq. (2.3). First,

[102]In fact eq. (2.25) is somewhat conservative: as long as capital retains a large enough advantage over environmentalists the same results would flow even if this condition were loosened

the sector's mixed partial derivative with respect to stringency and emissions intensity can be obtained by straightforward derivation from eq. (2.3):

$$\frac{\partial c_i}{\partial \lambda_i} = m_i - x_i a_i \tag{2.26}$$

Deriving again:

$$\frac{\partial^2 c_i}{\partial \lambda_i \partial m_i} = 1 \tag{2.27}$$

Therefore we know that $\frac{\partial^2 W}{\partial \lambda_i \partial m_i}$ will be negative as long as the following holds:

$$\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} < 1 \tag{2.28}$$

I re-state the formula for optimal sector mitigation from eq. (2.6)

$$x_i^* = \frac{\lambda_i - a_i(x_i m_i)}{m_i \dfrac{\partial a_i}{\partial x_i}}$$

Combining eq. (2.6) and eq. (2.7) gives:

$$b_i = r \frac{\lambda_i - a_i(x_i m_i)}{m_i \dfrac{\partial a_i}{\partial x_i}} \tag{2.29}$$

Deriving with respect to λ_i gives:

$$\frac{\partial b_i}{\partial \lambda_i} = \frac{r}{m_i \dfrac{\partial a_i}{\partial x_i}} \tag{2.30}$$

Deriving again with respect to m_i gives:

$$\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} = -\frac{r\left(m_i x_i \dfrac{\partial^2 a_i}{\partial x_i \partial m_i} + \dfrac{\partial a_i}{\partial m_i}\right)}{\left(m_i \dfrac{\partial a_i}{\partial x_i}\right)^2} \tag{2.31}$$

For $\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} \leq \frac{\partial^2 c_i}{\partial \lambda_i \partial m_i}$ to hold, the former must be less than or equal to one. The following re-states this condition:

$$-\frac{r\Big(m_i x_i \dfrac{\partial^2 a_i}{\partial x_i \partial m_i} + \dfrac{\partial a_i}{\partial m_i}\Big)}{\Big(m_i \dfrac{\partial a_i}{\partial x_i}\Big)^2} \leq 1 \tag{2.32}$$

Re-arranging (multiplying across the inequality sign is permissible because the denominator is squared and therefore positive):

$$-r\Big(m_i x_i \frac{\partial^2 a_i}{\partial x_i \partial m_i} + \frac{\partial a_i}{\partial m_i}\Big) \leq \Big(m_i \frac{\partial a_i}{\partial x_i}\Big)^2 \tag{2.33}$$

Re-arranging further:

$$0 \leq \Big(m_i \frac{\partial a_i}{\partial x_i}\Big)^2 + r\Big(m_i x_i \frac{\partial^2 a_i}{\partial x_i \partial m_i} + \frac{\partial a_i}{\partial m_i}\Big) \tag{2.34}$$

All of the components on the right are positive (see Equation 2.4), therefore this condition always holds. This has the following results:

$$\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} \leq 1 \tag{2.35}$$

From eq. (2.27) I obtain:

$$\frac{\partial^2 b_i}{\partial \lambda_i \partial m_i} \leq \frac{\partial^2 c_i}{\partial \lambda_i \partial m_i} \tag{2.36}$$

Combining this result with eq. (2.23) and eq. (2.24) gives:

$$\frac{\partial^2 W}{\partial \lambda_i \partial m_i} < 0 \tag{2.37}$$

And from eq. (2.21), I conclude that optimal level of stringency should decrease with respect to emissions intensity:

$$\frac{d\lambda_i^*}{dm_i} < 0 \tag{2.38}$$

This can be re-stated in the following hypothesis:

Hypothesis 2.1 (Mitigation Cost Effect) *Policymakers will impose less stringent mitigation regulation on emissions-intense sectors.*

This hypothesis matches the observation that carbon-intense businesses tend to lead opposition to mitigation regulation.

Larger values of carbon intensity m_i lead to larger climate policy costs for any given carbon price λ_i, and therefore encourage higher contributions. Regardless of how the cost is ultimately distributed among investors, workers, and consumers, higher carbon intensities for a given sector imply higher costs of regulation for somebody.[103]

In some cases, however, carbon-intense sectors mobilize in favor of some form of climate policy. The support from British energy firms for a carbon price, discussed in chapter 1, is one example. Such cases suggest that carbon intensity is not the only determinant of business' position on policy. But all else being equal, I still expect relatively carbon-intense sectors to be more predisposed to oppose climate regulation.

This hypothesis does not imply that there will be no policy action by the government. If the environmental benefits of mitigation substantially exceed its economic costs, then stringency could be positive even if environmentalists are politically weak. But if action declines with emissions intensity, it provides good evidence that economic concerns are carrying more weight the policymakers than environmental ones.

[103]This ignores for the time being the fact that some sectors may have cheaper mitigation options than others.

2.4.2 Producer Versus Consumer Interests

In this section, I set environmentalists aside to focus on the distributive conflict between producers and consumers. The key variable of interest here is the ability of a sector's producers to pass costs on to its consumers, denoted by θ_i. I begin by using implicit differentiation of eq. (2.17), treating $\frac{\partial W}{\partial \lambda_i}$ as a function of θ_i:

$$\frac{d\lambda_i^*}{d\theta_i} = -\frac{\frac{\partial^2 W}{\partial \lambda_i \partial \theta_i}}{\frac{\partial^2 W}{\partial \lambda_i \partial \lambda_i}} \tag{2.39}$$

Since the denominator is again negative, the sign of the whole formula is determined by the numerator. To obtain its sign, I begin by re-arranging eq. (2.17) to isolate θ_i:

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} - \frac{\partial c_i}{\partial \lambda_i}\Big(\pi^K - \pi^K\phi_i + \pi^L\phi_i + \big(\pi^D + \pi^K\phi_i - \pi^K - \pi^L\phi_i\big)\theta_i\Big) \tag{2.40}$$

I then derive with respect to θ_i:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \theta_i} = \frac{\partial c_i}{\partial \lambda_i}\Big(\pi^K + \pi^L\phi_i - \pi^K\phi_i - \pi^D\Big) \tag{2.41}$$

This equation (and thus the main derivative of interest) will be positive as long as the following condition holds:

$$\pi^K + \pi^L\phi_i - \pi^K\phi_i - \pi^D > 0 \tag{2.42}$$

I can re-arrange the condition thus:

$$\frac{\pi^K - \pi^D}{\pi^K - \pi^L} > \phi_i \tag{2.43}$$

By proposition 2.2, I know that $\pi^D \leq \pi^L$. Therefore, $\pi^K - \pi^D \geq \pi^K - \pi^L$, which means the left side of the equation should always be greater than or equal to 1. By assumption eq. (2.12), $\phi_i < 1$, which means that the condition should always hold, with the result that:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \theta_i} > 0 \tag{2.44}$$

In other words, I assume that some of the cost of regulation always flows to capital. Even if most of the cost is to consumers, capital will not be entirely indifferent to regulation. Because capital is argued to have a power advantage over consumers (and labor), capital's interest in minimizing its costs creates an advantage for producers more generally.

Stated mathematically, the marginal effect of consumer pass-through on regulation is positive:

$$\frac{d\lambda_i^*}{d\theta_i} > 0 \tag{2.45}$$

This forms the basis of my second hypothesis:

Hypothesis 2.2 (Consumer Cost Effect) *Policymakers will impose more stringent mitigation regulation on sectors which can pass costs through to consumers.*

The degree to which producers can pass on the costs of climate regulation to consumers of their goods plays an important role in the incentive they have to oppose mitigation action. If the costs of regulation can be largely passed on to consumers, then producers have only a marginal interest in lobbying against climate policy. But if producers are unable to pass on these costs, then fighting climate policy is likely to be a priority for them.

The ability of a sector to pass on its costs depends on the relative elasticity of supply and demand. When the elasticity of demand is large relative to the elasticity of supply, it means that more of the burden of regulation will fall on suppliers. When consumers can buy substitute goods from other sectors or the same good for foreign sources, producers cannot raise their prices much without seeing their market share diminish.

When demand is relatively inelastic, however, producers have a freer hand in raising prices in response to regulation. If a good has few substitutes or if there are barriers to trade, then consumers may be relatively unable to avoid paying higher prices. In these cases, producers can pass the cost of regulation onto consumers.

All these considerations are aggregated in the model's θ_i variable. The source of the pass-through potential is not crucial for the basic theory. Whatever the reason, when θ_i is high, it means costs can be passed through, weakening producer incentives to oppose regulation. When θ_i is low, it means a higher proportion of costs will be borne by producers, pushing them to oppose regulation more strongly.

Regardless of the source, if there is indeed some asymmetry in influence costs, I expect this asymmetry to be reflected in a positive relationship between pass-through potential and regulatory strength. The existence of such a relationship would not mean that policymakers are indifferent to concerns about consumer prices and rising living costs. But it would indicate that those concerns are at least marginally subordinate to producer priorities, at least in the field of climate change.

2.4.3 Labor Versus Capital Interests

In this final section, I focus on distributive conflicts between factors of production: labor and capital. Here the crucial variable is ϕ_i, the proportion of a sector's regulatory costs that are borne by workers rather than investors. I begin again with implicit differentiation, this time treating $\frac{\partial W}{\partial \lambda_i}$ as a function of $\lambda_i(\phi_i)$ and ϕ_i:

$$\frac{d\lambda_i^*}{d\phi_i} = -\frac{\frac{\partial^2 W}{\partial \lambda_i \partial \phi_i}}{\frac{\partial^2 W}{\partial \lambda_i \partial \lambda_i}} \tag{2.46}$$

As before, eq. (2.19) indicates that the denominator is negative. To get the numerator, I re-state eq. (2.17) to isolate ϕ_i:

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} + \Big(\phi_i(\pi^K - \pi^L)(1-\theta_i) - \pi^K(1-\theta_i) - \pi^D\theta_i\Big)\frac{\partial c_i}{\partial \lambda_i} \tag{2.47}$$

I then take this function's derivative with respect to ϕ_i:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \phi_i} = (\pi^K - \pi^L)(1-\theta_i)\frac{\partial c_i}{\partial \lambda_i} \tag{2.48}$$

I argued in proposition 2.2 that labor's political influence is relatively weaker than that of capital (i.e. $\pi^L < \pi^K$). This means that as a sector's ability to pass costs to labor increases, policymakers should be expected to place a relatively higher regulatory burden on that sector than they otherwise would. Because $\theta_i < 1$ (see eq. (2.12)) and $\frac{\partial c_i}{\partial \lambda_i} > 0$ (see eq. (2.2)), the whole equation is positive:

$$\frac{\partial^2 W}{\partial \lambda_i \partial \phi_i} > 0 \tag{2.49}$$

Combined with the implicit differentiation in eq. (2.46), that means that optimal stringency is rising with respect to labor pass-through:

$$\frac{d\lambda_i^*}{d\phi_i} > 0 \tag{2.50}$$

This is formalized in the third and final hypothesis:

Hypothesis 2.3 (Labor Cost Effect) *Policymakers will impose more stringent mitigation regulation on sectors which can pass relatively more of their costs to labor rather than capital.*

If labor and capital possess equal political power, then the distribution of costs among them should be irrelevant for predicting policy outcomes. But if capital is more powerful than labor, then the ability of sectors to pass costs onto workers rather than investors should shape the stringency of mitigation.

As with H2.2, this hypothesis presumes that sectors vary in their ability to pass regulatory costs onto their workers, and that this variation is captured in the ϕ_i variable.

In sectors where ϕ_i is high, capital owners can shield themselves from regulatory costs by measures such as reducing wages, increasing workloads, or laying people off and replacing them with new technology. These options mean owners have relatively less incentive to oppose regulation: they have less 'skin in the game'. In sectors where ϕ_i is low, capital owners are constrained to bear more of the burden of regulation, perhaps through reduced dividends or lower stock prices, strengthening their reasons to fight climate change mitigation efforts.

This does not mean that capital-owners will never oppose mitigation regulation when their pass-through potential is low. Nor does it mean that the government is unconcerned about costs to workers.

The hypothesis merely suggests that the rewards to capital-owners for opposing regulation is marginally decreasing as their ability to pass on costs to workers increases. In other words, pass-through to workers increases indifference

among investors. Because investors are thought to have outsize political influence compared to workers, this marginally increasing indifference leads to marginally increasing policy stringency.

2.5 Conclusion

Studying distributive politics requires giving some account of interest groups: they are both the objects of distributive forces and the subjects seeking to change outcomes. But the models implicit in existing quantitative, cross-national studies of mitigation policy have had the unintended effect of concealing interest group dynamics.

Without a sector-level model of policy, it is difficult to see where the burdens of climate policy are really falling and whether the allocation of these burdens follows consistent patterns. The model I construct in this chapter differentiates both between sectors (for policy supply) and within sectors (for policy impact and therefore demand).

Based on simple propositions about power inequality, I advance three basic hypotheses. First, because economic groups are more influential than environmental groups, governments will place weaker regulation on emissions-intense sectors. Second, because producers are more influential than consumers, governments will place stronger regulation on sectors that can pass costs on to consumers. Third, because capital is more influential than labor, governments will place stronger regulation on sectors that can pass costs on to workers.

In chapter 3, I put this baseline model to the test. I will discuss how to operationalize the hypotheses described here, show how econometric measures of the 'shadow price' of regulation can be used to evaluate them, and present the results of those tests.

In the rest of the substantive chapters, I expand on the model presented here and unpack its assumptions. The baseline model assumes that policy is supplied by an undifferentiated government actor: chapter 4 looks at how ruling party ideology changes which constituencies are favored. The baseline model treats climate policy as independent of other kinds of policy: chapter 5 examines how other political economy policies and institutions shapes where the burden of mitigation falls. Finally, the baseline model does not deal explicitly with public opinion: chapter 6 investigates whether individuals' sector of employment affects their climate attitudes.

Chapter 3

Unpacking Stringency: Analyzing Mitigation Policy at the Sector Level

> "[In] different stages of society, the proportions of the whole produce of the earth which will be allotted to each of these classes, under the names of rent, profit, and wages, will be essentially different; [...] To determine the laws which regulate this distribution is the principal problem in Political Economy"
>
> David Ricardo[1]

3.1 Introduction

In the previous chapter, I argued that the costs of climate policy will not be distributed equally across different parts of the economy. According to my model, the distribution of these costs will be driven by the political power of different groups and their ability to shift costs to one another. To test this theory, I need to compare climate policy stringency not only across different countries, but across different economic sectors within countries. While the last decade has seen growing interest in cross-country comparison of climate policies, there has

[1]David Ricardo. *The Principles of Political Economy and Taxation.* Originally published 1821. London: Dent, 1965, p. 1.

been little comparative work examining the distribution of climate policy burdens at the sectoral level.

The crucial problem has been that most measurements of climate policy employed have focused on differences between economies but not within them. The lack of sector-level measurements has limited the kinds of questions we can ask about climate politics. I move beyond this literature by using recently compiled data that disaggregate the burden of climate policy on different sectors. These data, developed by Althammer and Hille,[2] use econometric estimates of the "shadow price" of regulation. These estimates are based on comparing sectors' emissions patterns and fuel use to the prevailing prices of carbon-intense fuels. Sectors which emit less than we would expect based on the prices they face are thought to face a positive shadow price, while those which emit more enjoy a negative shadow price or a subsidy.

To my knowledge this dissertation represents the first time that highly disaggregated sector-level data have been used to study the political determinants of climate policy strength. These data are leveraged to test the model elaborated in chapter 2. The results show that the hypotheses generated there are broadly correct. Higher emissions intensity is associated with lower policy stringency. Sectors which can pass on costs to their consumers face lower policy stringency. And sectors which can pass on their costs to their employees also face higher policy stringency.

The structure of the chapter is as follows. Following the introduction, in the second section I review the existing comparative work that has developed over the last decade. I discuss the limitations of the country-level, whole-economy approach that has been employed in the literature thus far. I also show how the questions I raised in the previous chapter require a sectoral approach to be

[2]Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

answered. Third, I introduce the sector-level shadow price data and describe the general trends that we can observe in it. Fourth, I discuss the regression method and the sources of the data employed in the regressions. Fifth, I present the results of several series of multilevel regression models testing the hypotheses. Sixth and finally, I conclude by discussing the implications of the work for future research on climate policy and lay the foundation for the extensions in subsequent chapters.

3.2 Previous Approaches: Pollution, Promises, and Policies

There are two linked features of the quantitative, cross-national study of climate action that make distributive analysis difficult. The first is on the supply side, where the measures of climate action are almost uniformly national in scope. These measures tend not to provide comparable, disaggregated information on the costs of climate action, which would be necessary to assess where those costs are falling. The second issue is on the demand side, where economic interest groups are seldom the focus of analysis. When they are present, economic interests also tend to be aggregated to the national level, making it hard to explore potential inter-group conflicts.

These supply and demand issues give rise to what I called in the previous chapter the "political contest" model of policymaking, where domestic climate action is framed as the product of a binary struggle between one camp of proponents and one camp of opponents. This obscures the possibility that actions and burdens are distributed unevenly across different groups in society, inhibiting the distributive analysis of climate politics.

The comparative, quantitative study of climate action can be divided into

three areas: pollution, promises, and policies. All three have produced valuable insights, but all three feature the issues highlighted above.

3.2.1 Supply

Performance

The quantity of greenhouse gasses that countries emit is ultimately more important than the policy choices they make. The size and speed of climate change is physically determined by countries' total emissions, regardless of their source within the economy. As a result, the literature on climate "performance" has naturally focused on aggregate national emissions.[3]

Pollution measures are not necessarily representative of effort or cost burdens. All of Russia's Kyoto-mandated emissions reductions were achieved before the protocol went into force, due to de-industrialization after the fall of the Soviet Union.[4] Most of Germany's greenhouse gas reductions between 1990 and 2000 were similarly caused by industrial declines following unification, and not by policy change.[5] Calculating emissions levels related to gross domestic out-

[3]See Gassebner et al. for an overview of early studies of pollution determinants (Martin Gassebner et al. "Determinants of pollution: what do we really know?" In: *Oxford Economic Papers* 63 (2011), pp. 568–595) For more recent work, see Daniel J. Fiorino. "Explaining national environmental performance: approaches, evidence, and implications". In: *Policy Sciences* 44 (2011), pp. 367–389; Andrew K. Jorgenson and Brett Clark. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005". In: *American Journal of Sociology* 118.1 (July 2012), pp. 1–44; Laura Policardo. "Is Democracy Good for the Environment? Quasi-Experimental Evidence from Regime Transitions". In: *Environmental and Resource Economics* (Dec. 2014), pp. 1–26; George E. Halkos and Epameinondas A. Paizanos. "The channels of the effect of government expenditure on the environment: evidence using dynamic panel data". In: *Journal of Environmental Planning and Management* 60.1 (2017), pp. 135–157; Adam Mayer. "Will Democratization Save the Climate? An Entropy-Balanced, Random Slope Study". In: *International Journal of Sociology* 47.2 (2017), pp. 81–98.

[4]Sergey V. Paltsev. "The Kyoto Protocol: "Hot air" for Russia?" Working Paper 00–9. University of Colorado, Boulder. 2000; Christoph Böhringer et al. "Hot air for sale: A quantitative assessment of Russia's near-term climate policy options". In: *Environmental and Resource Economics* 38.4 (2007), pp. 545–572.

[5]Joachim Schleich et al. "Greenhouse Gas Reductions in Germany: Lucky Strike or Hard Work?" In: *Climate Policy* 1.3 (2001), pp. 363–380.

put or population does not change the fact that the levels "are usually affected by many intervening variables" besides environmental policy,[6] like fiscal policy,[7] input prices, or changes in economic composition.[8]

Furthermore, while the climate system is indifferent to emissions sources, different parts of the economy depend on emissions in different ways. From a physical standpoint a macro-level national measure of performance makes sense, but from a distributional standpoint it limits our analytical leverage. National emissions measures do not tell us who, if anyone, is bearing the costs of action.

Promises

As attention to the climate problem has increased, more studies have begun to analyze the commitments that countries make rather than the pollution they emit. I use the word "promises" to cover the broad literature that discusses international climate agreements and their accompanying climate targets. Such work became especially prominent in the wake of the Kyoto Protocol and its successor agreements.

This is a large literature. Some studies focus on the number of treaties signed.[9]

[6]Katharina Holzinger et al. "Is there convergence of national environmental policies? An analysis of policy outputs in 24 OECD countries". In: *Environmental Politics* 20.1 (Jan. 2011), pp. 20–41, p. 29.

[7]Ramón López and Amparo Palacios. "Why has Europe Become Environmentally Cleaner? Decomposing the Roles of Fiscal, Trade and Environmental Policies". In: *Environmental Resource Economics* 58 (2014), pp. 91–108.

[8]There are also some performance studies which look at results other than pollution, like growth in renewable energty. But these too are distinct from the stringency of the policy which drives them. See "How do Competing Interest Groups Influence Environmental Policy? The Case of Renewable Electricity in Industrialized Democracies, 1989–2007". In: *Political Studies* 61 (2013), pp. 874–897; Michaël Aklin and Johannes Urpelainen. "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions". In: *American Journal of Political Science* 57.3 (July 2013), pp. 643–658.

[9]Patrick Bernhagen. "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies". In: *Global Environmental Politics* 8.1 (Feb. 2008), pp. 78–110; Thomas Bernauer et al. "A comparison of international and domestic sources of global governance dynamics". In: *British Journal of Political Science* 40.3 (2010), pp. 509–538; Kai Schulze. "Do parties matter for international environmental cooperation? An analysis of environmental treaty participation by advanced

Others construct indices that combine ratification and compliance with the UNFCCC process (through things like paying dues and submitting reports on time).[10] Others examine participation in transnational governance schemes.[11]

These commitments represent the core of international attempts to coordinate a response to climate change. Without them, greenhouse gas emissions might have risen even further than they did over the last few decades. Measuring and explaining them is an important scholarly endeavour.

But when trying to examine distributional outcomes, promises have some of the same limitations as as performance. Treaties do not generally spur mitigation on their own: they tend to rely on implementation through domestic policy.[12] And neither treaty ratification nor targets tell us whether governments are actually pursuing stringent mitigation agendas at home.

Despite the theoretical participation of 192 countries, the impact of the Kyoto Protocol is heavily contested.[13] The Paris Accords of 2015 have re-oriented international climate coordination towards a system of voluntary national pledges.

industrialised democracies". In: *Environmental Politics* 23.1 (Dec. 2014), pp. 115–139.

[10]Nives Dolšak. "Climate change policy implementation: A cross-sectional analysis". In: *Review of Policy Research* 26.5 (2009), pp. 551–570; Thomas Bernauer and Tobias Böhmelt. "National climate policies in international comparison: The Climate Change Cooperation Index". In: *Environmental Science and Policy* 25 (2013), pp. 196–206; Tobias Böhmelt et al. "Democratic inclusiveness, climate policy outputs, and climate policy outcomes". In: *Democratization* 23.7 (2016), pp. 1272–1291.

[11]Charles Roger et al. "The Comparative Politics of Transnational Climate Governance". In: *International Interactions* 43.1 (2017), pp. 1–25.

[12]Harrison and Sundstrom, "The Comparative Politics of Climate Change".

[13]Helm claims that Kyoto "has had no noticeable impact on global carbon emissions", while Shishlov et al. says that many countries did end up achieving their goals. One clear lesson is that ratification is no guarantee of compliance. Canada signed and ratified the Kyoto Protocol, but failed to live up to its emissions commitments and withdrew in 2012. Canada's emissions had increased rather than decreased, with a gap of over 50 percentage points. New Zealand, which remained a party to the agreement but declined to sign up for a second commitment period, had a nearly 60 percentage point gap between its targets and reality. See Duncan Clark. "Has the Kyoto protocol made any difference to carbon emissions?" In: *Guardian* (Nov. 2012). `https://www.theguardian.com/environment/blog/2012/nov/26/kyoto-protocol-carbon-emissions`; Dieter Helm. "Climate policy: The Kyoto approach has failed". In: *Nature* 491.7426 (2012), pp. 663–665; Igor Shishlov et al. "Compliance of the Parties to the Kyoto Protocol in the first commitment period". In: *Climate Policy* 16.6 (2016), pp. 768–782.

This new system may catalyze stronger action than Kyoto's mandates did. But "pledge-and-review" is even more dependent on domestic willingness to bear mitigation costs.[14] In the words of Todd Stern, the United States' Special Envoy for Climate Change,

> "There is a role that international agreements have in addressing climate change [...] But you can't ever forget that the most important locus of action on climate change is at the national level."[15]

Even if we were measuring compliance perfectly, analysis of treaty participation would not tell us who within the country is bearing the costs of that compliance.

Policy

Policy is the "missing link" between promises and performance. Over the last decade or so there has been a growing literature focused directly on the actual policies that countries pass. The measures this literature has produced seem well-suited for studying cost burdens, since they track government actions directly. But while these measures have many strengths, they remain mostly national in scope, limiting their applicability for distributional analysis.

Providing a quantitative assessments of countries' mitigation efforts is difficult. The category of climate policies, like environmental policies generally, is an "open list".[16] Defining which policies count as climate-related involves non-trivial theoretical questions. A gas tax implemented prior to the advent

[14] Robert O. Keohane and Michael Oppenheimer. "Paris: Beyond the climate dead end through pledge and review?" In: *Politics and Governance* 4.3 (2016), pp. 142–151.

[15] Andrew Jordan and Dave Huitema. "Innovations in climate policy: the politics of invention, diffusion, and evaluation". In: *Environmental Politics* 23.5 (Aug. 2014), pp. 715–734, p. 1.

[16] Katharina Holzinger. "Methodological Pitfalls of Convergence Analysis". In: *European Union Politics* 7.2 (2006), pp. 271–287.

of climate change as a matter of public concern was clearly not intended as a mitigation measure, but it may exert crucial downward pressure on greenhouse gas emissions anyway. Many countries use a complex mix of policies to promote mitigation, blending carbon pricing, mandates, subsidies, and voluntary and information-based approaches.[17] Rendering these diverse instruments commensurable with each other is a challenge.[18] And while there are clear theoretical differences between some instruments (like carbon taxes versus cap-and-trade), these differences are often muddied or disappear altogether in implementation.[19]

The two most common kinds of policy measures used in the climate politics literature are inventories and indices. Inventories attempt to catalogue the different kinds of laws and programs that countries use to deal with climate change.[20] By describing policies rather than evaluating them, inventories avoid the problem of rendering various instruments commensurate with each other. These are excellent resources for studying general trends in policy adoption,[21] diffusion,[22] and instrument choice. But without information on stringency, it is difficult to use them as measures of cost allocation.

Madden[23] extends the inventory approach by coding particular policies as

[17]Nachmany et al., *Global trends in climate change legislation and litigation.*

[18]Swenja Surminski and Andrew Williamson. "Policy indexes – what do they tell us and what are their applications? The case of climate policy and business planning in emerging markets". Grantham Research Institute on Climate Change and the Environment, Working Paper No. 88, `http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/02/WP88-policy-indexes-climate-policy-business-planning.pdf`. 2012.

[19]Robert N. Stavins. *The Future of U.S. Carbon-Pricing Policy.* M-RCBG Faculty Working Paper Series, 2019-02. Cambridge, MA: Mossavar-Rahmani Center for Business & Government, Harvard Kennedy School, 2019.

[20]International Energy Agency, *Policies and Measures Databases (PAMS)*; Nachmany et al., *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition*; Dubash et al., "Developments in national climate change mitigation legislation and strategy"; Gabriela Iacobuta et al. "National climate change mitigation legislation, strategy and targets: a global update". In: *Climate Policy* 18.9 (2018), pp. 1114–1132.

[21]Iacobuta et al., "National climate change mitigation legislation, strategy and targets: a global update".

[22]Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey".

[23]Madden, "Green means stop: veto players and their impact on climate-change policy out-

major or minor, and as concentrated or diffuse in their allocation of cost. This represents a useful first step towards capturing policy stringency. But it is hard to recover much distributional information from a binary coding of strength (Madden[24] has other goals in his study, which focuses on the role of veto players).

The second approach is to aggregate different pieces of information into a composite index of effort. This can be done using expert surveys,[25] by rating the strength of a chosen set of policies,[26] or by evaluating the credibility of emissions targets.[27] The Climate Change Performance Index contains a survey-based measure of the strength of domestic policy, but this information is not publicly available separate from its inclusion in the larger index.[28] The expert evaluation sub-index has the theoretical advantage of encompassing all kinds of policy, but even if provided separately it would not describe the variation in policy strength within the country.

The Climate Laws, Institutions, and Measures Index[29] includes some sectoral differentiation, since they rate the strength of policy in some distinct sectors. But while any sectoral disaggregation is useful, in both measures the level of disaggregation (to six sectors) is somewhat low. Furthermore, the temporal coverage of both is limited to one year. Perhaps most pressingly, it is difficult to evaluate

puts".

[24]Madden, "Green means stop: veto players and their impact on climate-change policy outputs".

[25]Burck et al., *The Climate Change Performance Index Results 2018*.

[26]Steves and Teytelboym, "Political Economy of Climate Change Policy"; Nana Künkel et al. "Climate policies – (the feasibility of) a statistical analysis of their determinants". 2006.

[27]Climate Action Tracker. *Climate crisis demands more government action as emissions rise*. New Climate Institute and Climate Analytics, `https://climateactiontracker.org/documents/537/CAT_2019-06-19_SB50_CAT_Update.pdf`. 2019; Alina Averchenkova and Samuela Bassi. *Beyond the targets: assessing the political credibility of pledges for the Paris Agreement*. London: Grantham Research Institute on Climate Change and the Environment, 2016, p. 54.

[28]Though Tobin does employ it on its own by agreement with the authors. See Paul Tobin. "Leaders and Laggards: Climate Policy Ambition in Developed States". In: *Global Environmental Politics* 17.4 (2017), pp. 28–47.

[29]Steves and Teytelboym, "Political Economy of Climate Change Policy".

stringency across sectors, since both measures evaluate stringency relative to the strongest policy options currently employed in that sector.

Climate Action Tracker[30] and Averchenkova and Bassi[31] both assess the credibility of countries' climate pledges based on their current policy mix, which provides an implicit measure of policy. As a measure of countries' compliance with the Paris Accords these measures are quite useful. But since stringency is evaluated related to a country-specific target rather than some absolute standard, these measures are less applicable if we want to separate target-setting from policy-setting.

The final measure of policy involves directly measuring carbon price rates.[32] The OECD[33] measure has six-sector differentiation and multi-year coverage. The sector-level data have not been employed in a political study to my knowledge. While these data would be suitable for such an analysis, a higher level of disaggregation would be even more preferable.

All the policy measures discussed here have many applications in the study of climate politics. The issue I raise here is that they are not designed for distributional analysis. They do not focus on the costs facing particular groups.

3.2.2 Demand

Because measures of climate action have generally not been disaggregated within countries, it is unsurprising that the literature that seeks to explain the drivers of such action has also steered away from disaggregating interests. A comprehensive account of distributive issues in climate politics would need to study cost alloca-

[30] Climate Action Tracker, *Climate crisis demands more government action as emissions rise.*

[31] Averchenkova and Bassi, *Beyond the targets: assessing the political credibility of pledges for the Paris Agreement.*

[32] OECD, *Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems*; World Bank and Ecofys, *State and Trends of Carbon Pricing 2018.*

[33] OECD, *Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems.*

tion across different groups within countries. That would mean that sub-national groups would need to be the unit of analysis rather than whole countries. But in line with the nationally-aggregated measures of action, countries are the unit of analysis and interests are nationally-aggregated as well.

Performance

In studies of performance, the most common variable used to capture economic interests affected by mitigation is the proportion of GDP generated by manufacturing or industry.[34] On the other hand, some studies include no sectoral interest measures whatsoever (e.g. Jorgenson and Clark[35]).

Gassebner et al.[36] provide one of the rare studies to go beyond this measure in their extreme-bounds analysis of carbon dioxide determinants. They include the share of industry in GDP, but unlike earlier studies they also include the share of industry in employment. In their results, industry size does not have a strong effect, but the higher the share of workers employed in industry, the greater the amount of emissions. They suggest two reasons for this effect. First, a "higher industry share of total employment induces more political pressure against pro-environmental policies" Second, perhaps "a labour-intensive industrial sector is less efficient and therefore produces more waste".[37] This finding is a critical development in the study of pollution determinants: it indicates that the standard

[34]Of the sixteen studies of pollution in the 1990s and 2000s mentioned by Gassebner et al., half model emissions of CO_2. The association between manufacturing share and CO_2 in these studies is inconsistent: findings range from a positive and statistically significant relationship, to a positive but inconsistently significant relationship, to no statistically significant relationship at all (Cole and Neumayer). This suggests that the relationship between economic composition and emissions may not be as straightforward as expected. It also points to the limitation of using manufacturing as a catch-all variable for economic interests. See Martin Gassebner et al. "Determinants of pollution: what do we really know?" In: *Oxford Economic Papers* 63 (2011), pp. 568–595.

[35]Jorgenson and Clark, "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005".

[36]Gassebner et al., "Determinants of pollution: what do we really know?"

[37]Ibid., p. 582.

account based on industry size may not tell the whole story, and that the structure of employment may be even more important.

Some studies, such as that by Bättig and Bernauer,[38] use the production of fossil fuels in the country as a proxy for emissions-related interest groups. As with the manufacturing measure this only captures one sector and does not tell us about the impact of policy on the fossil fuel sector itself.[39]

Halkos and Paizanos[40] do not include a manufacturing measure, but uses the total level of private investment in the economy as a measure of capital stock, and finds that it is positively associated with carbon dioxide emissions per capita.

Even when other economic measures are included—such as the size of manufacturing in employment,[41] the level of private investment in the economy,[42] or inequality[43]—the fact that pollution is measured nationally rather than sectorally constrains these studies. Controlling for the size of a particular sector in a national pollution regression does not tell us whether that sector is reducing its emissions or not.[44]

[38]Michèle B. Bättig and Thomas Bernauer. "National Institutions and Global Public Goods: Are Democracies More Cooperative in Climate Change Policy?" In: *International Organization* 63 (2009), pp. 281–308.

[39]As the Norwegian example shows, strong climate policy generally does not necessarily involve lowering fossil fuel exports.

[40]Halkos and Paizanos, "The channels of the effect of government expenditure on the environment: evidence using dynamic panel data".

[41]Gassebner et al., "Determinants of pollution: what do we really know?"

[42]Halkos and Paizanos, "The channels of the effect of government expenditure on the environment: evidence using dynamic panel data".

[43]Policardo, "Is Democracy Good for the Environment? Quasi-Experimental Evidence from Regime Transitions".

[44]This issue extends to the literature on environmental performance more broadly, which is too large to discuss in detail here. Fiorino summarizes the explanations for environmental performance and identifies four causal factors: growth, democracy, institutional features like corporatism or federalism, and "institutional or societal capacities". The role of interest groups is not among them. Furthermore, having high levels of emissions is sometimes seen "as a proxy for environmental pressure" rather than as an indicator of dependence and therefore opposition: see Duncan Liefferink et al. "Leaders and laggards in environmental policy: a quantitative analysis of domestic policy outputs". In: *Journal of European Public Policy* 16.5 (2009), pp. 677–700, p. 692. See also Daniel J. Fiorino. "Explaining national environmental performance: approaches, evidence, and implications". In: *Policy Sciences* 44 (2011), pp. 367–389.

Promises

Interests are similarly peripheral in the literature on climate promises. As discussed in chapter 1, this is part of a larger issue in that work on international coordination tends to treat domestic climate politics as a "black box".[45] Domestic economic interests are not a focus of the international coordination literature, as attested by Marchiori et al.:[46]

> "Surprisingly, one critical dimension of the problem that has remained largely unexplored and is yet to be systematically analysed is the role that (domestic) politics play in shaping international environmental policy; in particular, how special-interest groups affect countries' decisions to cooperate for the protection of the global environment."

When interests do appear, they tend to be the same nationalized controls as seen in the pollution literature.[47] Since climate treaties seldom specify how the burdens of policy ought to be allocated within countries, it is understandable that work on international agreements and targets have not made allocation of costs among interests a major subject of research.[48] But the result is that "[e]mpirical

[45]Harrison and Sundstrom, "The Comparative Politics of Climate Change"; Victor, *Global Warming Gridlock : Creating More Effective Strategies for Protecting the Planet*.

[46]Carmen Marchiori et al. "Domestic politics and the formation of international environmental agreements". In: *Journal of Environmental Economics and Management* 81 (2016), pp. 115–131, p. 116.

[47]Per G. Fredriksson et al. "Kyoto Protocol cooperation: Does government corruption facilitate environmental lobbying?" In: *Public Choice* 133 (2007), pp. 231–251; Bernauer et al., "A comparison of international and domestic sources of global governance dynamics"; Bernauer and Böhmelt, "Are Economically 'Kinder, Gentler Societies' also Greener?"; Schulze, "Do parties matter for international environmental cooperation? An analysis of environmental treaty participation by advanced industrialised democracies"; Böhmelt et al., "Democratic inclusiveness, climate policy outputs, and climate policy outcomes".

[48]An exception is Bernhagen, who provides a particularly large range of domestic interest-related controls, including not only manufacturing share and trade dependence, but union strength, business' share of R&D spending, neo-corporatism, and the strength of environmental groups. This represents an ambitious attempt to cover a wide variety of interest factors, but all the measures are ultimately national in scope. See Patrick Bernhagen. "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies". In: *Global Environmental Politics* 8.1 (Feb. 2008), pp. 78–110.

studies offer interesting findings but little insight into the mechanisms that drive policy outcomes".[49]

Policy

As discussed above, policy is the dependent variable best-suited to distributional analysis. But even in policy studies, the role of interests has remained nationalized. At the national level, a few common variables have served to represent interests that might be negatively affected by mitigation.

Some studies use a variation of the manufacturing share variable. Jacob and Volkery[50] rank strength of four kinds of policies (CO_2 targets, CO_2 and energy taxes, renewable quotas, and feed-in tariffs). Their chief economic interest measure is the combined share of six "dirty industries" in GDP, which they find is negatively associated with policy strength. Steves and Teytelboym[51] employ the share of manufacturing in GDP, which they also find to be negatively associated with their CLIMI measure. Madden[52] focuses on the role of veto players and specifically highlights how business is well-placed to exploit veto points. He finds that the share of manufacturing in GDP has no significant relationship with the passage of "major" climate policies.

Other studies use fossil fuel use and exports as an interest control. Dolšak[53] makes a 5-point rating of countries' compliance with UNFCCC provisions, and her interest variables are fossil fuel dependence and fuel exports. Neither a linear nor a square term of fossil fuel use is significant in her regressions, but fossil fuel exports

[49] Leo Wangler et al. "The Political Economy of International Environmental Agreements: A Survey". In: *International Environmental Agreements* 13 (2013), pp. 387–403, p. 398.

[50] Jacob and Volkery, "Modelling Capacities for Environmental Policymaking In Global Environmental Politics".

[51] Steves and Teytelboym, "Political Economy of Climate Change Policy".

[52] Madden, "Green means stop: veto players and their impact on climate-change policy outputs".

[53] Dolšak, "Climate change policy implementation: A cross-sectional analysis".

have a statistically significant negative relationship with compliance. Lachapelle and Paterson[54] study the passage of particular kinds of policies and also use fossil fuel exports as their control. They find it only has a statistically significant association with one form of policy, reducing the likelihood that countries will use economic incentives to reduce emissions. Kammerer and Namhata[55] use the data from Nachmany et al.[56] to explore climate policy diffusion, and find fossil fuel consumption has a negative but statistically insignificant association with diffusion.

National CO_2 emissions per capita is sometimes used as an interest measure, though scholars recognize that it may have ambiguous effects.[57] On the one hand per capita CO_2 emissions indicate "the amount at stake for CO_2 emitters, and thus their lobbying incentives," but at the same time "higher levels of per capita CO_2 likely also imply lower marginal abatement costs".[58] Using the same CLIMI data, these studies have found conflicting results: Steves and Teytelboym[59] finds that the effect of CO_2 intensity is positive (though inconsistently significant) while Fredriksson and Neumayer[60] finds its effect is statistically significant and negative. Kammerer and Namhata[61] "expect that countries with higher levels of CO_2 emissions are more likely to introduce mitigation policies," but then find their effect to be negative. These conflicting expectations and results indicate

[54]Lachapelle and Paterson, "Drivers of national climate policy".

[55]Marlene Kammerer and Chandreyee Namhata. "What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion". In: *Policy Sciences* 51.4 (Dec. 2018), pp. 477–513.

[56]Nachmany et al., *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition.*

[57]Steves and Teytelboym, "Political Economy of Climate Change Policy"; Per G. Fredriksson and Eric Neumayer. "Democracy and climate change policies: Is history important?" In: *Ecological Economics* 95 (2013), pp. 11–19.

[58]Fredriksson and Neumayer, "Democracy and climate change policies: Is history important?", p. 14.

[59]Steves and Teytelboym, "Political Economy of Climate Change Policy".

[60]Fredriksson and Neumayer, "Democracy and climate change policies: Is history important?"

[61]Kammerer and Namhata, "What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion".

that at the national level this variable is a problematic proxy for interests, since it can theoretically encompass both positive and negative factors.

Still other studies use no clear interest variable at all. Fankhauser et al.[62] and Fankhauser et al.[63] study the count of climate laws using the GLOBE study,[64] and Tobin[65] use the expert policy evaluation data from the Climate Change Performance Index[66] to conduct a fuzzy set Qualitative Comparative Analysis. These studies explore a wide range of climate policy determinants, but the role of economic interests is not central to their analysis.[67]

No explanatory study of climate policy to date has used sub-national economic interests as the unit of analysis. When they appear, economic interests are treated primarily as control variables rather than key independent subjects of interest. No criticism of any particular study is implied by this: each has their own distinct empirical focus. But taken together the result is a literature which speaks often of the role economic interests, but where the actual impact of policy on those interests is not centered empirically.

The result is the "political contest" model introduced in the previous chapter, where a nationally-uniform level of policy stringency is the singular prize to be

[62]Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey".

[63]Sam Fankhauser et al. "Do international factors influence the passage of climate change legislation?" In: *Climate Policy* 16.3 (2016), pp. 318–331.

[64]Nachmany et al., *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition.*

[65]Tobin, "Leaders and Laggards: Climate Policy Ambition in Developed States".

[66]Burck et al., *The Climate Change Performance Index Results 2018.*

[67]A similar problem applies to studies of environmental policy strength more broadly, with studies using the ENVIPOLCON (Knill et al.; Holzinger et al.) and the OECD's Green Taxation data (Ward and Cao) also not including specific interest variables. See Christoph Knill et al. "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000". In: *European Journal of Political Research* 49.3 (2010), pp. 301–336; Katharina Holzinger et al. "Is there convergence of national environmental policies? An analysis of policy outputs in 24 OECD countries". In: *Environmental Politics* 20.1 (Jan. 2011), pp. 20–41; Hugh Ward and Xun Cao. "Domestic and International Influences on Green Taxation". In: *Comparative Political Studies* 45.9 (2012), pp. 1075–1103.

won.

3.3 Shadow Prices as a Measure of Mitigation Stringency

As I have shown, the existing quantitative literature on comparative climate politics is not well-suited to the analysis of distributional issues. The limitation is both on the supply side (in terms of measures) and demand side (in terms of modelling interests).[68] But the supply issue comes first, because hard to measure interests without a disaggregated outcome variable.

A distributional analysis requires a few ingredients. First, it requires some measure of stringency, that is, of the strength of mitigation policy and size of the burdens it imposes. Though this is clearly related to policy, it is difficult to obtain by looking at individual policies, because even policies of the same kind are not always easily commensurable.[69] Ideally a measure of stringency should be separate from the choice of instrument, since the same type of instrument can be designed to have widely varying effects and different types can be made functionally equivalent.[70]

Second, that measure of stringency needs to be capable of distinguishing burdens imposed on different parts of the economy. In other words, it needs to be disaggregated, ideally to the level of the firm or sector. The further the disaggregation, the more detailed the distributional analysis can be. This raises the empirical bar even further, because collecting policy information on a sector-by-sector basis is costly.

[68]The reasons why distributional analysis requires disaggregation of both policy supply and demand are discussed in chapter 2, in section 2.2.1 and section 2.2.2 respectively.

[69]Surminski and Williamson, "Policy indexes – what do they tell us and what are their applications? The case of climate policy and business planning in emerging markets"; Brunel and Levinson, "Measuring the Stringency of Environmental Regulations".

[70]Stavins, *The Future of U.S. Carbon-Pricing Policy.*

Third, the measure should ideally be available for a wide enough range of contexts to support robust cross-sectional and longitudinal comparison. That means including enough countries to be able to compare different kinds of national contexts, and enough years to see potential changes within countries.

No measure used in existing work analyzing comparative climate politics meets all three goals. To repeat a quotation from chapter 1, "while large-N research would be helpful for greater understanding of domestic climate change politics, there is a dearth of data on climate policy outcomes appropriate for such analysis."[71]

A recently developed technique known as "shadow pricing" offers a way to meet all three goals with one measure. Based on work by van Soest et al.,[72] Althammer and Hille[73] develop a sector-level measure of greenhouse gas mitigation stringency. The work of van Soest et al. is grounded in the idea "that country-wide measures are not good indicators in explaining variations in international competitiveness between sectors as differences in regulatory stringency exist both between countries and between sectors within one country".[74]

The intuition behind the shadow price approach is that in equilibrium, firms' choices about how much to pollute are driven by the market prices of polluting inputs. When stringent environmental policies are passed, they raise the cost of emitting. This increase in cost drives a "wedge" between the market price of polluting inputs and the effective price which firms face for using them. When this wedge is large, firms will emit much less pollution than they would be expected to given prevailing market prices. When the wedge is small, firms' emissions will generally match the prices they face. Wedges might even be negative, if policy

[71] Purdon, "Advancing Comparative Climate Change Politics: Theory and Method", p. 8.
[72] Daan P. van Soest et al. "Shadow prices, environmental stringency, and international competitiveness". In: *European Economic Review* 50.5 (2006), pp. 1151–1167.
[73] Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".
[74] Ibid., p. 632.

incentivizes the use of polluting inputs. This wedge, when denoted in monetary terms, is the shadow price of pollution.

Althammer and Hille estimate the magnitude and direction of shadow prices for 33 sectors in 28 countries from 1995 to 2009.[75] They do so by gathering data on fossil fuel consumption, energy use, and greenhouse gas emissions for individual economic sectors and combining them with national and global prices for energy inputs. They use this information to calculate whether a sector is using more emissions-relevant energy than it would be expected to do based on prevailing input prices. They compute the shadow price for each country-sector-year combination, obtaining a "cardinal measure of policy stringency" over this period.

Shadow prices are calculated as follows. The shadow price of a given input to production is defined as "the potential reduction in expenditures on other variable inputs that can be achieved by using an additional unit of the input under consideration (while maintaining the level of output)."[76] Firms are assumed to be cost-minimizing: they want to find ways to reduce their expenditure on inputs while maintaining output. Therefore, estimating shadow prices requires first modelling the cost function of firms. To do this Althammer and Hille use a generalized Leontief cost function (following "Tracing the effects of agricultural commodity prices on food processing costs" and van Soest et al.[77]). This cost function incorporates scale effects and different technological endowments at the country-sector level. The authors assume constant returns to scale over the long run.

[75] The generation of this data was funded by the German Federal Ministry for Education and Research through their project on "Climate Policy and the Growth Pattern of Nations".

[76] van Soest et al., "Shadow prices, environmental stringency, and international competitiveness", p. 1155.

[77] "Tracing the effects of agricultural commodity prices on food processing costs". In: *American Journal of Agricultural Economics* 85.3 (2003), pp. 633–646; van Soest et al., "Shadow prices, environmental stringency, and international competitiveness".

The cost functions for each country and sector include unobserved coefficients representing the shadow price Z of emissions-relevant energy use. These cost functions are then combined with a formula defining the shadow price: $Z = p + \lambda$, where p is the undistorted world price of the polluting input and λ is the wedge between the world price and the shadow price. Data on p are observed, but Z and λ must be estimated. The cost functions and the shadow price function are combined using a seemingly unrelated regression model, which estimates a common set of coefficients across multiple regressions. In effect, this procedure reconciles information about domestic scale, technology, and other input prices (in the country and sector cost functions) with information about the world prices of greenhouse gas-emitting inputs (in the shadow price function). The resulting Z and λ values are those that best explain the pattern of pollutant-use across country-sectors.[78]

I employ the wedge or λ values are as my measure of regulatory stringency rather than the full shadow price or Z values, because I am interested in the burden added by regulation independent of the underlying input prices.

The chief drawback of this method is that it relies on econometric estimates rather than direct evaluation of specific regulations.[79] If a policy does not change the cost of emitting greenhouse gasses then it will not be reflected in the shadow price.

But this is also a benefit for studying burden allocation. A shadow price only captures those policies which actually impose costs on polluting activity. While policies that do not impose costs on emitters (e.g. informational campaigns) could play an important role in driving action on climate change, they are distribution-

[78]Further details on the methodology can be obtained from Wilhelm Althammer and Erik Hille. "Measuring Climate Policy Stringency: A Shadow Price Approach". In: *International Tax and Public Finance* 23.4 (2016), pp. 607–639, pp. 615-618

[79]Brunel and Levinson, "Measuring the Stringency of Environmental Regulations".

ally neutral (or relatively near to being so). When conducting a distributional analysis it makes sense to focus on the policies with real costs.

That said, not all mitigation policies impose explicit costs. "Command and control" policies do not set a specific price for emissions but still create costs by mandating changes in production or consumption. The vehicle fuel economy standards implemented in both the United States and Europe impose burdens not only on transportation manufacturing sectors, but also all firms and households that need to purchase new vehicles. A renewable portfolio standard that compels utilities to provide a certain portion of their power from renewable sources affects both the utilities and their customers. Anyone who sought to estimate the stringency of each individual policy mechanism in each country and year would have an immense task ahead of them.

A shadow price deals neatly with the problem of commensurability. By estimating the total net effect of all policies, shadow prices abstract away from issues of instrument choice. If two policy mechanisms have overlapping functions, or if one is more effective than the other at reducing emissions-relevant energy use, this will be reflected in the shadow price. This is especially helpful when countries have policies like gas taxes or fuel standards that were implemented prior to the advent of climate change as an issue, but which nevertheless act as greenhouse gas mitigation policies.

Unlike many policy measures, a shadow price also captures "anti-mitigation" policies. Some policies that countries employ have the effect of encouraging greenhouse gas emissions, like tax breaks to fossil fuel companies or subsidies for purchasing gasoline. These tools can partially offset or even outweigh the effect of mitigation policies. When they are not taken into account, any assessment of climate policy strength is biased upwards. In the data by Althammer and Hille the net shadow price is often negative, suggesting that there are many policies of

this kind.

The second key requirement for a distributional climate policy measure is that it capture variation in stringency across different parts of the economy. As discussed in chapter 2, policy is heterogeneous in both supply and demand.[80] A single category for "industry" misses potentially important heterogeneity between industrial sectors.

The shadow price measure by Althammer and Hille provides a high level of sectoral disaggregation. Because their shadow price measures is computed for 33 individual sectors, it captures a much finer level of policy variation than any measure used in existing quantitative, comparative work on climate politics. This makes it well-suited for distributional analysis. It distinguishes not only between industrial sectors, but between primary and service sectors as well. The list of sectors for which shadow prices are calculated is available in table 3.1.

Finally, the data also meet the general need for a measure which is available over a sufficiently large range of countries and years to permit longitudinal analysis. The shadow prices are calculated for five three-year periods between 1995 and 2009. Though a longer time series would be preferable, their calculations are limited by the available emissions data. Starting in 1995 means that the data captures the early state of climate regulation prior to the Kyoto Protocol, and ending in 2009 means that the data avoids being overly influenced by the events of the financial crisis.

These data are calculated for 28 rich and middle-income countries from a range of regions. The countries included are listed in table 3.2.

The shadow prices themselves are denominated in dollars per metric ton of oil equivalent (toe). This represents the energy derived from burning one ton of oil,

[80]The reasons why distributional analysis requires disaggregation of both policy supply and demand are discussed in section 2.2.1 and section 2.2.2, respectively.

Table 3.1: List of Sectors and ISIC Revision 3 Codes

Code	Short Name	Official Name
A-B	Agriculture	Agriculture, Hunting, Forestry and Fishing
C	Mining	Mining and Quarrying
15-16	Food	Food, Beverages and Tobacco
17-18	Textiles	Textiles and Textile Products
19	Leather	Leather, Leather and Footwear
20	Wood	Wood and Products of Wood and Cork
21-22	Paper	Pulp, Paper, Printing and Publishing
23	Fuel	Coke, Refined Petroleum and Nuclear Fuel
24	Chemicals	Chemicals and Chemical Products
25	Plastics	Rubber and Plastics
26	Oth. Mineral	Other Non-Metallic Mineral
27-28	Metal	Basic Metals and Fabricated Metal
29	Oth. Machinery	Machinery, Not Elsewhere Classified
30-33	Elec. Eq.	Electrical and Optical Equipment
34-35	Trans. Eq.	Transport Equipment
36-37	Oth. Manuf.	Manufacturing, Not Elsewhere Classified; Recycling
E (40-41)	Utilites	Electricity, Gas and Water Supply
F (45)	Construction	Construction
50	Vehicle Sale	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
51	Wholesale	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
52	Retail	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
H (55)	Hospitality	Hotels and Restaurants
60	Land Trans.	Inland Transport
61	Water Trans.	Water Transport
63	Oth. Trans.	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
64	Telecoms	Post and Telecommunications
J (65-67)	Finance	Financial Intermediation
70	Real Estate	Real Estate Activities
71-74	Oth. Business	Renting of Movables and Equipment and Other Business Activities
L (75)	Public	Public Admin and Defence; Compulsory Social Security
M (80)	Education	Education
N (85)	Health	Health and Social Work
O (90-93)	Oth. Services	Other Community, Social and Personal Services

Table 3.2: List of Countries

Region	Countries
Asia and Oceania (4 countries)	Australia, Japan, Korea, Turkey
America (3 countries)	Canada, Mexico, USA
Eastern Europe (6 countries)	Czech Republic, Estonia, Hungary, Poland, Slovak Republic, Slovenia
European Union 1995 (15 countries)	Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden

Reproduced from Wilhelm Althammer and Erik Hille. "Measuring Climate Policy Stringency: A Shadow Price Approach". In: *International Tax and Public Finance* 23.4 (2016), pp. 607–639, p. 619.

and is equivalent to 11.63 Megawatt hours (MWh). The shadow price's original mean is \$107.59/toe or \$9.25/MWh, and its standard deviation is \$319.25/toe or \$27.45/MWh. The distribution of shadow price values is plotted in fig. 3.1: note that the net shadow price is negative in a non-trivial number of cases.[81]

To put these units in context, the European Union used approximately 3.2 toe or 37.2 MWh of energy per capita in 2015, while the United States used 6.8 toe or 79.1 MWh per capita.[82] So imposing the mean shadow price (across all countries, sectors, and years) would cost \$344.29 per person in the EU, and \$731.61 per person in America, based on their relative average energy consumption. This would represent a substantial expenditure in either jurisdiction.

These numbers suggest that shadow prices represent a significant portion of total energy costs. Figure 3.2 confirms this intuition, showing the distribution of sector-level shadow prices as a share of market prices for energy. The market price excludes the shadow price-portion of energy costs, and is also obtained

[81] A negative shadow price represents an effective subsidy to carbon emissions.

[82] The World Bank. "Energy use (kg of oil equivalent per capita)". In: *World Bank DataBank*. `https://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE`. 2019.

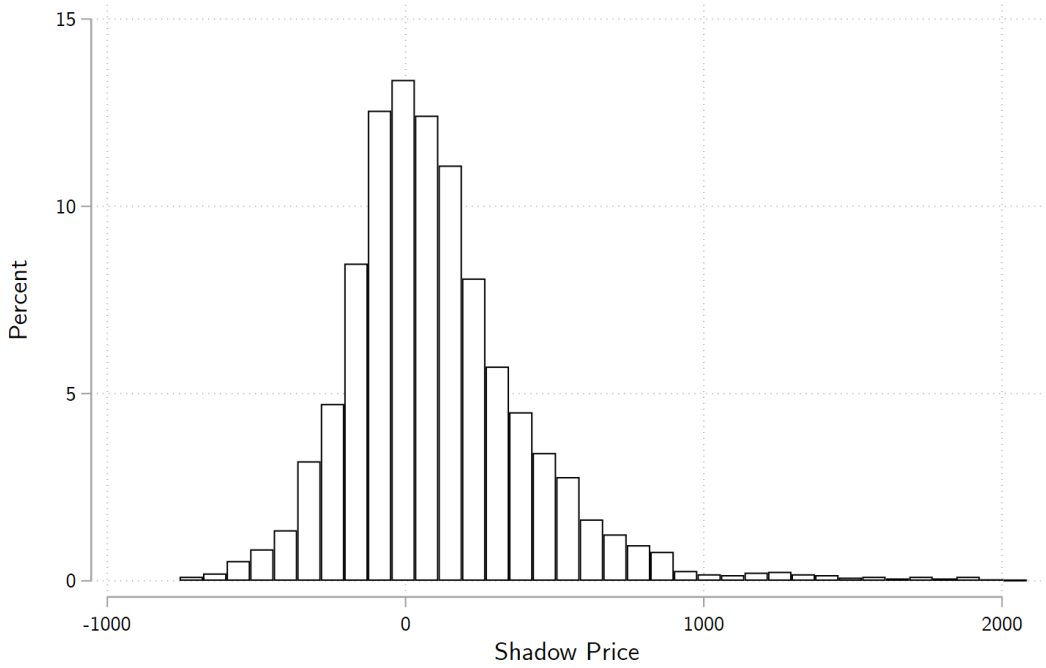


Figure 3.1: Shadow Price Histogram

from Althammer and Hille.[83] Note that the shadow price rarely exceeds the base market price, and is usually less than half its size.

Figure 3.3 shows the general relationship between shadow prices and sectors' emissions intensities.[84] The association between them is negative, as one might expect. But there is a good deal of variation around the linear trend line ($r = -0.26$), suggesting that there is more to the relationship than emissions-intense sectors being exempted from policy burdens.

To give some sense of the distribution of stringency and emissions intensity, I have plotted their relationship in four select sectors (fig. 3.4) and countries (fig. 3.5).[85] In the sector plots, note that there is a good deal of vertical spread in each sector: this suggests that countries can end up treating them same sector differently. The horizontal spread is generally wider in the country plots than in

[83] Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".
[84] The source of the emissions intensity data is described in the next section.
[85] The plots for all the sectors and countries are available in Appendix E.



Figure 3.2: Shadow Price and Base Price

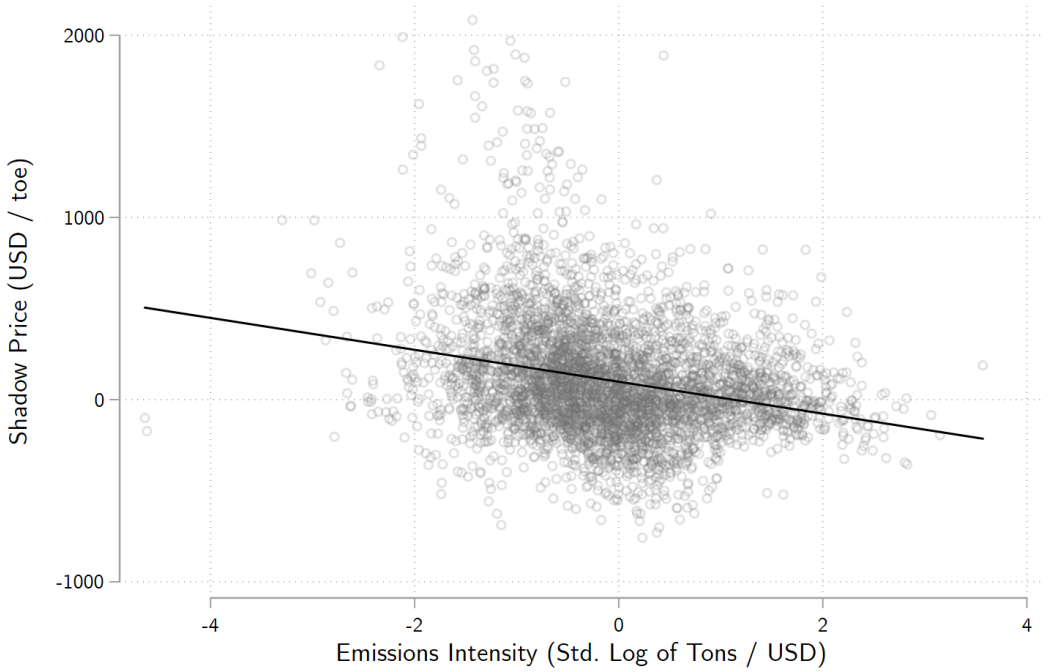
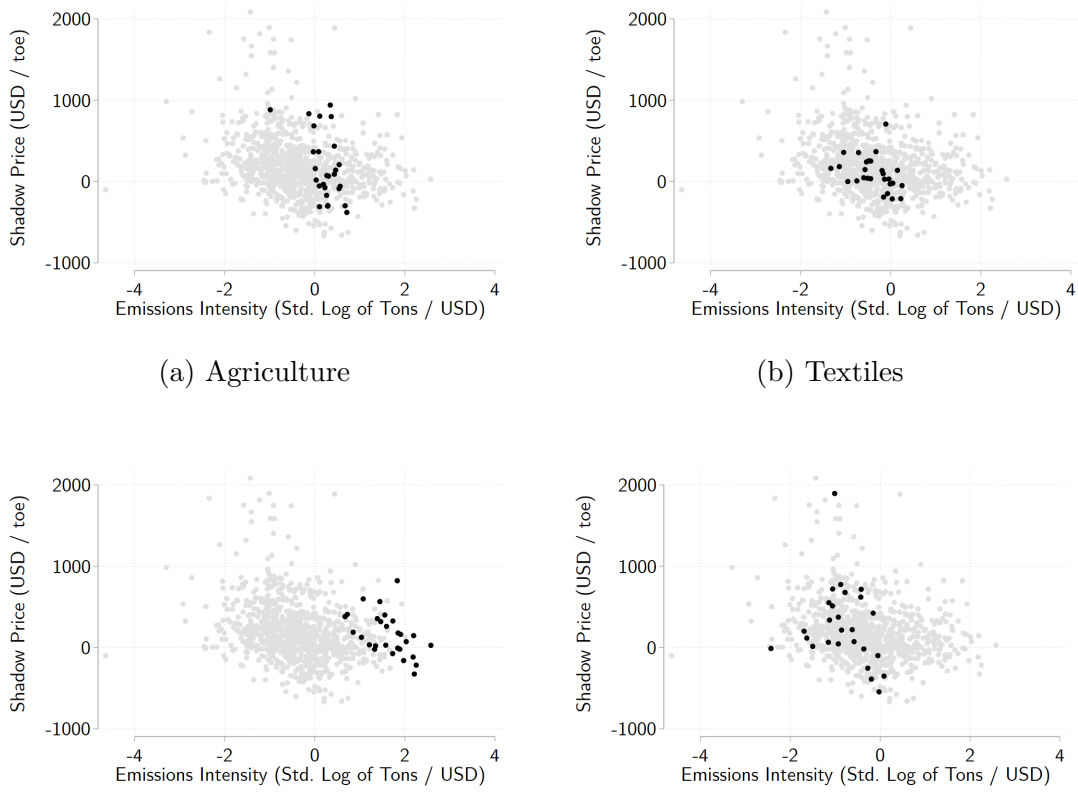


Figure 3.3: Shadow Price and Emissions Intensity

the sector plots, suggesting that there is more variation in emissions intensity between sectors within a country than within sectors between countries. Consistent with the general perception that the United States is a laggard in climate policy, its net stringency level for most of its sectors is negative. Germany and the United Kingdom have higher levels of policy stringency across the board. South Korea is an intermediate case, with some sectors receiving low to moderate shadow prices and others receiving negative shadow prices.



(a) Agriculture

(b) Textiles

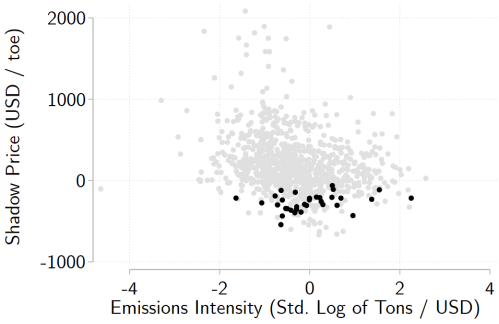
(c) Utilities

(d) Retail

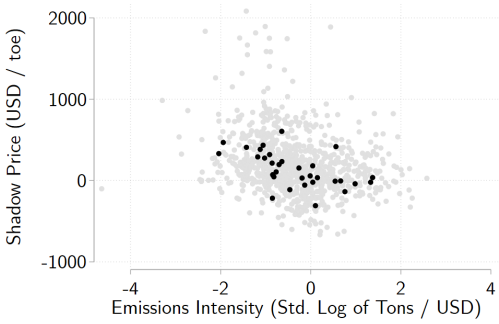
Figure 3.4: Shadow Price and Emissions Intensity for Selected Sectors

3.4 Data Sources and Regression Approach

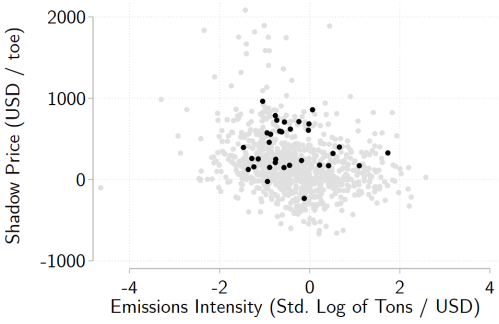
In this section I discuss the modelling strategy for the rest of the chapter and the sources of the data employed in the models. The hypotheses elaborated in



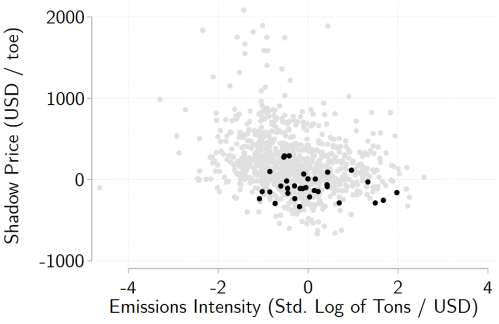
(a) United States of America



(b) United Kingdom



(c) Germany



(d) South Korea

Figure 3.5: Shadow Price and Emissions Intensity for Selected Countries

chapter 2 require operationalizing three key concepts: sectors' emissions intensity (m_i), the ability of producers to pass costs through to consumers (θ_i), and the ability of producers to pass costs on to their workforce (ϕ_i).[86] The operationalization of these variables is discussed in each regression subsection.

3.4.1 Variables

Many of the key variables are drawn from the World Input Output Database (WIOD),[87] the same source used to develop the shadow price data. The WIOD harmonizes data from 40 developed and large developing countries' national-level statistical agencies over the period 1995-2011. It contains information on production and consumption relationships at a highly disaggregated level, encompassing 35 different economic sectors ranging from agriculture to plastics to healthcare.[88]

The WIOD is made up of several systems of accounts. From the main National Input-Output Tables[89] (NIOT), I obtain each sectors' **Output**, which is comprised of sales to other domestic sectors, sales to final consumers, gross fixed capital formation, changes in inventory, and exports to other countries. This is logged and standardized.

m_i represents a sectors' emissions intensity, which can be computed by combining the WIOD's Environmental Accounts[90] with the NIOT. I calculate emissions intensities at both the sector and country levels. At the sector level, emis-

[86] See section 2.4.

[87] Marcel P. Timmer et al. "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production". In: *Review of International Economics* 23.3 (Aug. 2015), pp. 575–605.

[88] Of which two are dropped due to missing data on shadow prices: "Private Households with Employed Persons" and "Air Transport". The omission of the former is not especially concerning, since it represents homes with employees rather than firms and therefore would not fit the theory even if it had sufficient data. The latter omission is unfortunate but represents a small fraction of countries' output (.6% on average).

[89] Timmer et al., "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production".

[90] Aurélien Genty et al. *Final Database of Environmental Satellite Accounts: Technical Report on Their Compilation*. WIOD Deliverable 4.6, Documentation. 2012.

sions are divided by output. At the country level, emissions are divided by the sum of all sectors' outputs. These variables are also logged and standardized.

To supplement the sectoral data from WIOD, I add several more national-level controls. From the population and gross domestic product data in the Penn World Tables, I derive the logged **GDP per Capita** and the annual level of **GDP Growth**.[91] Aside from the level of development, the rate of change may also matter. It may be that the environment is a "sunshine issue" that only receives attention when economic times are good.[92] So I will also control for the annual growth rate of GDP.[93]

Though political variables will largely be reserved for chapter 4, I do include one institutional variable in these models as well: membership in the European Union. A "green myth" has been a core part of the EU's projected identity.[94] Several scholars have found that the union plays an important role in fostering mitigation policy ambition.[95] Policies like the Emissions Trading System create a certain baseline level of stringency for member nations. An EU membership dummy variable is included to reflect this. It is worth noting, however, that the EU does not induce policy homogeneity: there have still been significant differences in national environmental policies.[96] The EU's Emissions Trading System has had difficulty raising the cost of carbon emissions, and while some

[91]Robert C. Feenstra et al. "The Next Generation of the Penn World Table". In: *American Economic Review* 105.10 (2015), pp. 3150–3182.

[92]Russell J. Dalton and Robert Rohrschneider. "Environmental concerns during a time of duress: an introduction". In: *Environmental Politics* 24.4 (May 2015), pp. 523–529.

[93]Note, however, that Michallet et al. finds no evidence for such "business cycle" effects. See Benjamin Michallet et al. "Greening Up or Not? The Determinants of Political Parties Environmental Concern: An Empirical Analysis Based on European Data (1970-2008)". In: *Climate Change and Sustainable Development*. Mar. 2015.

[94]Andrea Lenschow and Carina Sprungk. "The Myth of a Green Europe". In: *Journal of Common Market Studies* 48.1 (Jan. 2009), pp. 133–154.

[95]Martin Jänicke. "Trend-setters in environmental policy: the character and role of pioneer countries". In: *European Environment* 15.2 (Mar. 2005), pp. 129–142; Liefferink et al., "Leaders and laggards in environmental policy: a quantitative analysis of domestic policy outputs".

[96]Pellegrini and Gerlagh, "Corruption and Environmental Policies: What Are the Implications for the Enlarged EU?".

states like the UK, Sweden, and Germany have pursued ambitious climate policies beyond the ETS, this has not been the case for all members. Madden[97] has even found evidence that EU countries actually pass more minor environmental policies, so some of the reputation of the union may be symbolic.

Finally, there is a difference between being dependent on greenhouse gas emissions and having reserves of fossil fuels. Technological alternatives can already replace many emissions-intense processes, even if some of them are expensive. But in the absence of technology that can efficiently remove large quantities of greenhouse gasses from the atmosphere, fossil fuel reserves will need to "stay in the ground" in order to avoid significant climate change. Countries with such reserves, therefore, have a special incentive to avoid regulating greenhouse gasses. Because many countries lack such assets, there are a large number of 0 observations. To avoid the bias that would come from a log-transformation of such zeros, I use an inverse hyperbolic sine transformation, which produces similar values to the log but is defined at zero.[98]

All variables, with the exception of the dummy for EU membership, are standardized prior to their use in the regression so that their means are 0 and their standard deviations are 1. Table 3.5 shows the correlations between the variables employed in the models below, and table 3.4 presents some descriptive statistics for those variables.

[97] Madden, "Green means stop".

[98] John B. Burbidge et al. "Alternative Transformations to Handle Extreme Values of the Dependent Variable". In: *Journal of the American Statistical Association* 83.401 (Mar. 1988), pp. 123–127.

[100] Wilhelm Althammer and Erik Hille. "Measuring Climate Policy Stringency: A Shadow Price Approach". In: *International Tax and Public Finance* 23.4 (2016), pp. 607–639.

[100] Stephen Haber and Victor Menaldo. "Do Natural Resources Fuel Authoritarianism? A Reappraisal of the Resource Curse Author". In: *The American Political Science Review* 105.1 (2011), pp. 1–26.

Table 3.3: Variables, Sources, and Units

Source	**Name**	**Unit**	**Level***
Althammer and Hille[99]	Shadow Price of Emissions	Log($/toe)	CSY
WIOD NIOT	Share of National Output	%	CSY
	Output	Log(M$)	CSY
	Export Intensity	Log(%)	CSY
	Import Penetration	Log(%)	CSY
	FCHH / Output	%	CSY
	FCHH / National FCHH	%	CSY
WIOD SEA	Labor Intensity	Ratio	CSY
	Log Compensation / Output	Log(Ratio)	CSY
	Log Employees / Output	Log(#/$)	CSY
	Labor Comp. / Nat. Labor Comp.	Log(Ratio)	CSY
WIOD EA	Emissions Intensity	Log(tCO_2/$)	CSY
	National Emissions Intensity	Log(tCO_2/$)	CY
PWT	GDP per Capita	Log($/Person)	CY
	GDP Growth	%	CY
Haber and Menaldo[100]	Fossil Fuel Income per Capita	IHS($/Person)	CY
Author	European Union Membership	0/1	CY

*CSY denotes variables measured at the country-sector-year level. CY denotes variables measures at the country-year level. All variables are standardized, with the exception of the European Union dummy.

Table 3.4: Summary Statistics

	Mean	S.D.	Min	Max	Count
Shadow Price	.0063	.98	-2.7	6.2	3555
CO_2 Intensity	-.078	.93	-4.3	3.9	3555
Export Intensity	-.0046	.98	-.88	2.7	3555
Import Penetration	.0038	.97	-.9	2.5	3555
Household% of C.	-.088	.91	-1.2	2.4	3555
% National FCHH	.03	.97	-.8	6.3	3555
Labor Intensity	-.044	.87	-1.5	3.8	3555
Ln. Labor Comp. / Output	-.015	.98	-7.1	3.3	3555
Employees / Output	-.25	.8	-3.6	2.9	3555
Labor Comp. / Nat. Labor Comp.	.039	.96	-.88	10	3555
Output	.2	.84	-3.4	2.6	3555
Nat. CO_2 Intensity	-.21	.79	-2.6	2.1	3555
GDP per Capita	.42	.61	-1	1.6	3555
GDP Growth	.0064	.67	-1.6	1.6	3555
Fossil Fuel Inc. P.C.	.097	1	-1.8	1.7	3555
E.U. Member	.59	.49	0	1	3555

Table 3.5: Correlations

		1	2	3	4	5	6	7	8
1	Shadow Price	1.00							
2	CO_2 Intensity	-0.24	1.00						
3	Export Intensity	-0.14	0.05	1.00					
4	Import Penetration	-0.11	0.09	0.84	1.00				
5	Household % of Cons.	-0.07	-0.12	-0.04	0.07	1.00			
6	% National FCHH	0.04	-0.27	-0.26	-0.29	0.53	1.00		
7	Labor Intensity	0.20	-0.19	-0.36	-0.32	-0.07	-0.12	1.00	
8	Ln. Lab. Comp. / Output	0.17	-0.17	-0.26	-0.21	-0.10	-0.24	0.87	1.00
9	Employees / Output	-0.13	-0.01	-0.21	-0.17	0.01	-0.12	0.49	0.59
10	Lab. Comp. / Nat. Lab. Comp.	0.17	-0.27	-0.36	-0.41	-0.24	0.13	0.62	0.51
11	Output	0.10	-0.15	-0.34	-0.45	-0.08	0.24	0.13	0.07
12	Nat. CO_2 Intensity	-0.38	0.21	-0.04	-0.03	-0.02	-0.00	-0.09	-0.08
13	GDP per Capita	0.25	-0.14	0.05	0.04	0.02	0.00	0.15	0.16
14	GDP Growth	-0.11	0.04	-0.01	0.00	0.03	-0.00	-0.00	-0.01
15	Fossil Fuel Inc. P.C.	-0.15	0.08	-0.02	-0.01	0.07	0.00	-0.00	0.00
16	E.U. Member	0.40	-0.23	0.15	0.15	0.01	0.00	0.08	0.08

		9	10	11	12	13	14	15	16
9	Employees / Output	1.00							
10	Lab. Comp. / Nat. Lab. Comp.	0.33	1.00						
11	Output	-0.29	0.33	1.00					
12	Nat. CO_2 Intensity	0.51	-0.02	-0.34	1.00				
13	GDP per Capita	-0.56	0.01	0.37	-0.71	1.00			
14	GDP Growth	0.09	-0.00	-0.13	0.12	-0.10	1.00		
15	Fossil Fuel Inc. P.C.	0.09	0.00	0.07	0.31	-0.01	0.06	1.00	
16	E.U. Member	-0.34	0.01	-0.02	-0.61	0.43	0.02	-0.27	1.00

3.4.2 Regression Method

I conduct my analysis using a hierarchical multilevel model. Treating observations as independent of each other would be inappropriate, as they are clustered by country and sector. The data are also longitudinal, as the same country-sector is observed multiple times.

The data are also cross-classified. That is, each observation is nested within both countries and sectors, and each sector type is present in each country. This naturally suggests the use of a cross-classified multi-level model. Cross-classified models, however, expand the number of parameters substantially. The Bayesian Deviance Information Criterion (or DIC) is the recommended measure for determining whether the increased complexity of a cross-classified model is worthwhile, trading off model complexity against model fit.[101] I ran both cross-classified and hierarchical multilevel models, and the hierarchical version consistently produced substantially lower DIC values (often by over 2000, well above the traditional threshold of 5 for substantial differences[102]). Given these DIC results, it is apparent that the extra complexity of a cross-classified model is not strictly necessary, and a hierarchical model provides a sufficiently good fit with fewer parameters.

Multilevel modelling has several advantages over competing techniques for analyzing data of this type. Ignoring the hierarchical structure in data risks underestimating the standard errors and inflating statistical significance, especially when some variables are only available at higher levels. When group-level variance is also of substantive interest, multilevel modelling allows us to see the relative sizes of group effects. Group-level dummies, as employed in fixed effects regression, would be confounded with group-level variables that are of substantive

[101] D.J. Spiegelhalter et al. "Bayesian Measures of Model Complexity and Fit". In: *Journal of the Royal Statistical Society B* 64 (2002), pp. 191–232.

[102] D.J. Lunn et al. *The BUGS Book: A Practical Introduction to Bayesian Analysis*. Boca Raton: Chapman & Hall/CRC, 2012.

interest.[103]

$$\begin{aligned}\lambda_{i,t+1} &= \beta_0 + \beta_1 x_{1i} \ldots \beta_n x_{ni} + v_k\text{cons} + u_{jk}\text{cons} + e_{ijk}\text{cons} \\ \Big[v_k\Big] &\sim \mathcal{N}(0,\, \Omega_v) \\ \Big[u_{jk}\Big] &\sim \mathcal{N}(0,\, \Omega_u) \\ \Big[e_{ijk}\Big] &\sim \mathcal{N}(0,\, \Omega_e)\end{aligned} \tag{3.1}$$

The basic unit of analysis is the country-sector-year, denoted by the subscript i. Observations are nested within sectors j, which are turn nested within countries k. The dependent variable is the shadow price of regulation in the next year, $\lambda_i, t+1$. β_0 is the intercept, and $\beta_1 x_1 \ldots \beta_n x_n$ represent n explanatory co-variates (x) and their coefficients (β).

The random effects terms for country, sector, and year are denoted by v_k, u_{jk}, and e_{ijk} respectively. They are assumed to be normally distributed, with means of zero and constant variances. Ω_v is the between-country variance, Ω_u is the between-sector variance, $\Omega)e$ is the residual between-year variance. They are multiplied by a vector of constants ("cons"). If a given variance is large relative to the other variances in a model, it suggests that a higher share of the overall variance in the dependent variable is driven by differences at that level.[104]

The models are implemented using the `runmlwin` command[105] in Stata 15.1, which interfaces with the multi-level modelling program MLwiN 3.02.[106] I employ

[103] Jon Rasbash et al. *A User's Guide to MLwiN, Version 3.01.* Bristol: Centre for Multilevel Modelling, University of Bristol, 2017.

[104] George Leckie and Chris Charlton. "runmlwin - A Program to Run the MLwiN Multilevel Modelling Software from within Stata". In: *Journal of Statistical Software* 52.11 (2013), pp. 1–40.

[105] Ibid.

[106] Chris Charlton et al. *MLwiN Version 3.02.* Center for Multilevel Modelling, University of Bristol. 2018.

Markov Chain Monte Carlo (MCMC) estimation.[107]

3.4.3 Alternative Specifications

Other modelling strategies are possible. To make sure my results are robust to model specification, I run a series of alternative models for every regression. These include:

1. Cross-Classified Mixed Effects: a multilevel model with crossed effects for country, sector, and year, conducted with Markov Chain Monte Carlo estimation.

2. Lagged Dependent Variable: a dynamic panel data model with a system generalized method of moments and a one-year lag of the dependent variable. This helps to address concerns that the dynamic, longitudinal structure of the data may not be fully accounted for in a random effects regression.

3. Panel-Corrected Standard Error Model: a linear regression with panel-corrected standard errors and a panel-specific AR1 autocorrelation structure. As with the lagged dependent variable, accounting for serial autocorrelation helps test whether dynamic effects are being adequately accounted for.

4. Country- and Sector-Fixed Effects: a linear regression with separate fixed effects for country and sector, with standard errors clustered by country-sector units.

[107] W.J. Browne. *MCMC Estimation in MLwiN v3.03.* Center for Multilevel Modelling, University of Bristol, `http://www.bristol.ac.uk/cmm/media/software/mlwin/downloads/manuals/3-03/mcmc-print.pdf`. Bristol, 2019.

5. Random Effects: a linear panel regression with random effects by country-sector and standard errors clustered by country and sector.

6. Fixed Effects: a linear panel regression with fixed effects by country-sector and standard errors clustered by country and sector.

The results of these alternative specifications are generally consistent with the results of the main hierarchical linear model. The main exceptions come from the fixed effects models. This is less concerning, however, because as discussed before the fixed effects models have the unfortunate side effect of confounding the group-level predictors that are an important part of many of the models below. More detail on their implementation is available in appendix A. Appendix A also includes graphical comparisons of their results with the key results from the hierarchical model. The full results for these alternative specifications are available in appendix B (for this chapter), appendix C (for chapter 4), and appendix D (for chapter 5).

The fact that the cross-classified model produces estimates consistent with the hierarchical model helps allay potential concern that ignoring the crossed structure of the data would bias the results (though given the DIC inequality this would have been unlikely). The fact that the lagged dependent variable model and the panel-corrected standard error models are consistent with the mixed models provides confidence that the dynamic, longitudinal nature of the data is being adequately accounted for and that the results in the mixed model are not being driven by autocorrelation.

3.5 Results

3.5.1 Mitigation Costs

Hypothesis 2.1 (Mitigation Cost Effect) *Policymakers will impose less stringent mitigation regulation on emissions-intense sectors.*

For any given level of regulatory stringency, some sectors face greater mitigation costs due to the emissions intensity of their production. This incentivizes economic interests tied to those sectors to oppose regulation more strenuously. At the same time, environmentalists will benefit far more from the regulation of emissions-intense 'dirty' sectors than 'clean' ones. If policymakers paid equal heed to economic and environmental interests, then the government would simply set policy stringency so that the costs and benefits were equal. Emissions intensity would not matter.

As I argued in chapter 2, however, I do not expect economic and environmental interests to carry the same weight with policymakers. When the economic costs and environmental benefits of regulating a particular sector are equal, policymakers will reduce the stringency of regulation to allay economic concerns. Therefore, I expect the relationship between sector-specific emissions intensity m_i and policy stringency λ_i to be negative.

Table 3.6: Mitigation Effect

	(1)	(2)	(3)
CO_2 Intensity	-0.190***	-0.115***	-0.112***
	(0.0233)	(0.0251)	(0.0228)
Output		0.200***	0.226***
		(0.0417)	(0.0388)
Nat. CO_2 Intensity		-0.237***	-0.392***
		(0.0430)	(0.0491)
GDP Growth		0.00541	0.0159
		(0.0140)	(0.0141)
Fossil Fuel Inc. P.C.		-0.271***	-0.332***
		(0.0720)	(0.0721)
E.U. Member		0.290***	0.282***
		(0.0380)	(0.0387)
GDP per Capita			-0.589***
			(0.0829)
Random Effect Variances			
Country	0.359***	0.347**	0.450**
	(0.106)	(0.115)	(0.147)
Sector	0.415***	0.415***	0.416***
	(0.0216)	(0.0215)	(0.0217)
Year	0.141***	0.130***	0.128***
	(0.00390)	(0.00365)	(0.00352)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
DIC	3967.49	3689.93	3618.48

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The regressions in table 3.6 put this hypothesis to the test. Across all three models, emissions intensity has a large negative association with mitigation policy stringency. In all models, this relationship is statistically significant at the $p<0.001$ level.

The first model demonstrates that the association between emissions intensity and stringency holds up in the absence of any co-variates. When controls for sector size and national emissions intensity, wealth, growth, fossil fuel income, and E.U. membership are added in the second model, the size of the intensity-stringency relationship diminishes only slightly. In this fuller model, a one standard deviation increase in emissions intensity is associated with a 0.12 standard deviation decrease in regulatory stringency. This is equivalent to approximately \$36/toe.[108]

The third model can be used to compare the effect of sector-level and national-level emissions intensities. National emissions intensity and national wealth are strongly correlated (r=-0.72). Since these variables are meant as controls and neither are strongly correlated with sector-level emissions intensity ($|r|<0.3$), this relationship does not substantively change the main effect of interest. But removing GDP per capita in this model reduces the potential for bias in the national intensity estimate. In this model, the effect of sector-level emissions intensity is more than a quarter that of national emissions intensity (-0.11 vs. -0.39). This result supports my contention that the politics of climate change mitigation are not wholly national, but sectoral as well.

These initial results are consistent with H2.1. Policymakers appear to apply less stringent regulation to emissions-intense sectors. If environmentalists were more influential than economic interests, I would expect to see the opposite

[108]This conversion is obtained by multiplying the coefficient by the standard deviation of the shadow price in dollars per ton of oil equivalent (\$319/toe).

relationship.

More broadly, this is the first empirical evidence presented in this dissertation that a sector-level analysis of regulation produces useful results. The fact that the effect of sector-level emissions intensity does not substantially diminish in the presence of a control for national emissions intensity is crucial. If national intensity wiped out sector intensity, it would suggest that the use of nationally-aggregated interest variables in earlier work was harmless. In such a case, a sectoral approach would add little value. But the results presented here indicate that at least one sector-level factor is having some impact on outcomes.

3.5.2 Consumer Costs

Hypothesis 2.2 (Consumer Cost Effect) *Policymakers will impose more stringent mitigation regulation on sectors which can pass costs through to consumers.*

The second hypothesis focuses on the ability of firms to shift the burden of regulation to the purchasers of their products. The theoretical model developed in the previous chapter represents this burden-shifting capacity with the sector-specific θ_i variable. Recall that when θ_i is high, most the burden of mitigation ends up on consumers. When θ_i is low, the burdens remain on firms' books. Because producers are thought to be more politically influential than consumers, the relationship between pass-through potential θ_i and regulatory stringency λ_i is expected to be positive. Since data on the relative elasticity of demand and supply are not available for the range of countries, sectors, and years in the model, I operationalize θ_i using measures of trade exposure and consumption by households.

Both exports and imports can affect firms' ability to shift costs to con-

sumers.[109] Firms that export large shares of their output face prices that are set on the world market. This constrains their ability to raise their export prices without incurring competition from other foreign suppliers. Firms whose domestic markets are heavily penetrated by foreign imports are similarly constrained. If foreign alternatives are easily available, then firms cannot raise their domestic prices either without consumers switching. I expect the tradability of a sector's good to be negatively associated with the stringency of mitigation regulation.[110]

The first trade variable is **Export Intensity**, the share of a domestic sector's output that is sold to foreign buyers. The second trade variable is **Import Penetration**, the share of domestic purchases of a given sector's good that is supplied by foreign rather than domestic firms. The two trade variables are highly correlated (0.83), which makes sense given that some kinds of goods are more easily traded across borders than others.

The second expectation concerns whether sectors sell to firms or households. H2.2 is based on the idea that producers will be more politically powerful than

[109]The extent to which environmental regulation actually reduces competitiveness is contested. The "Porter Hypothesis" suggests that environmental regulation actually induces improvements in international competitiveness (Porter and Van Der Linde; Esty). For an account of the mixed evidence in favor of the hypothesis, see Ambec et al. Vogel argues that economic integration itself can promote stronger regulation. But for my purposes, the real long-term severity of the trade problem is less important than whether firms perceive it as severe in the short-term (or are able to wield its severity effectively when lobbying). If the managers of trade-exposed firms feel they have more to lose from regulation, then they should be expected to lobby harder against it, regardless of how real the threat is. See Michael E Porter and Claas Van Der Linde. *Toward a New Conception of the Environment-Competitiveness Relationship*. Tech. rep. 4. 1995, pp. 97–118; Daniel C Esty. "Bridging the Trade-Environment Divide". In: *Journal of Economic Perspectives* 15.3 (2001), pp. 113–130; Stefan Ambec et al. "The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?" In: *Review of Environmental Economics and Policy* 7.1 (2013), pp. 2–22; David Vogel. "Environmental Regulation and Economic Integration". In: *Journal of International Economic Law* (2000), pp. 265–279.

[110]This will be truer for some kinds of goods than others. Commodity goods like iron ore or wheat bushels will by definition be more vulnerable to this kind of substitution. Cars are heavily traded goods, but some countries and companies may produce particular varieties of cars that cannot be easily substituted. In line with my focus on sector-level dynamics, I abstract away from potential variation across the goods that a sector produces. But to the extent that intra-sectoral differentiation does exist, it reduces consumers ability to substitute between goods from different firms and countries, biasing my coefficients downwards rather than upwards.

consumers. But the category of "consumers" includes both intermediate consumers (other firms) and final consumers (chiefly households). If all of a sector's output went to intermediate consumption, then both the selling firms and buying firms could have a similar political advantage.[111] But a customer base comprised mainly of households will have more difficulty coordinating opposition to price increases. The end result will be stronger regulation for sectors that sell final consumption goods and weaker for those that sell intermediate inputs.

Fortunately for the purposes of empirical verification, sectors vary in the degree to which they sell to households rather than firms. To capture this variation, I use the share of a sector's **Output sold for Final Consumption by Households (FCHH)**. Sectors which sell large portions of their output to households will have an easier time passing costs on to their consumers (i.e. a higher θ_i), weakening their incentive to oppose regulation.

This variable does not fully capture the relationship between firms and households, however. A firm might sell all of its output to households, but account for only a small component of overall household consumption. If household consumers were somehow more politically powerful than firms, then one might still expect them to focus their power on preventing cost pass-through from the sectors that make up large shares of household demand.[112] In this case, a sector's dependence on final consumers would not be a reliable test of the relative power of firms and households. To deal with this issue, I include the **Share of National Final Consumption by Households** that comes from a given sector. Because my own theory expects household consumers to be politically weaker than producers, I expect the relationship between this variable and stringency to be negative.

[111] There could still be a difference in political incentives between the selling and buying firms, however. The buying firm can pass on some cost increase to its own consumers in turn.

[112] This scenario would run contrary to my theory.

Table 3.7: Consumption Effect

	(1)	(2)	(3)	(4)
Export Intensity	-0.105***			
	(0.0207)			
Import Penetration		-0.0556*		
		(0.0223)		
FCHH % of Output			-0.00947	
			(0.0207)	
FCHH % of Nat. Consumption				0.0183
				(0.0225)
CO_2 Intensity	-0.118***	-0.117***	-0.118***	-0.113***
	(0.0226)	(0.0229)	(0.0232)	(0.0232)
Output	0.161***	0.174***	0.226***	0.212***
	(0.0407)	(0.0441)	(0.0399)	(0.0430)
Nat. CO_2 Intensity	-0.398***	-0.395***	-0.391***	-0.393***
	(0.0508)	(0.0507)	(0.0506)	(0.0505)
GDP per Capita	-0.581***	-0.571***	-0.576***	-0.574***
	(0.0939)	(0.0937)	(0.0932)	(0.0932)
GDP Growth	0.0156	0.0144	0.0140	0.0140
	(0.0143)	(0.0143)	(0.0142)	(0.0142)
Fossil Fuel Inc. P.C.	-0.294***	-0.288***	-0.286***	-0.287***
	(0.0671)	(0.0666)	(0.0664)	(0.0663)
E.U. Member	0.297***	0.289***	0.280***	0.282***
	(0.0394)	(0.0394)	(0.0393)	(0.0393)
Random Effect Variances				
Country	0.427**	0.414**	0.412**	0.411**
	(0.141)	(0.137)	(0.136)	(0.136)
Sector	0.390***	0.406***	0.417***	0.417***
	(0.0207)	(0.0213)	(0.0216)	(0.0215)
Year	0.129***	0.128***	0.128***	0.128***
	(0.00355)	(0.00353)	(0.00350)	(0.00350)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	3651.61	3636.76	3618.78	3619.06

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

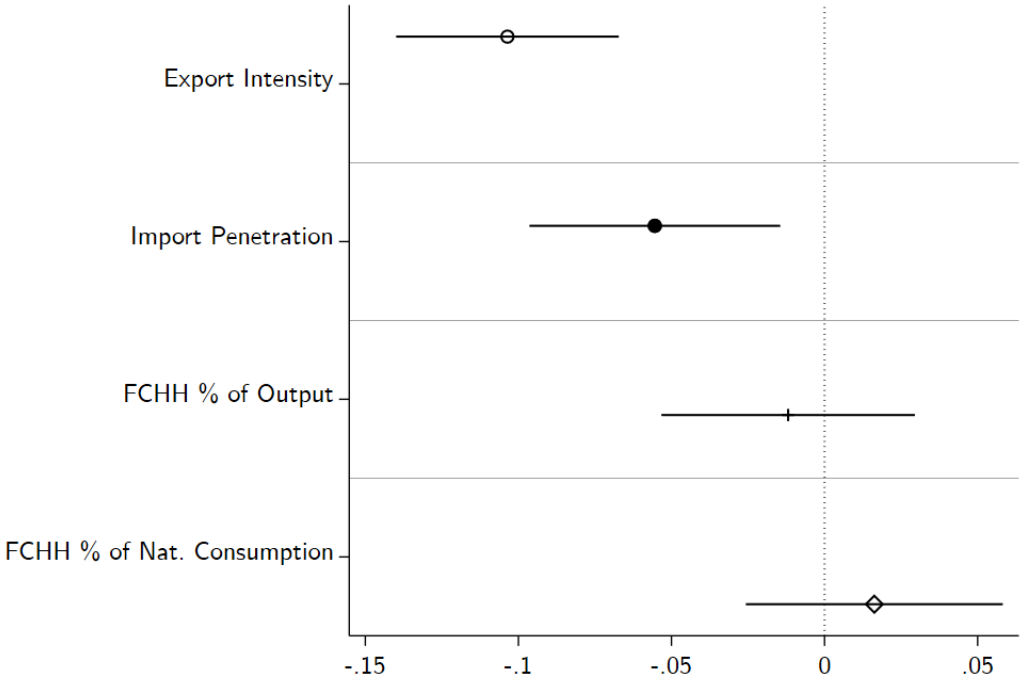


Figure 3.6: Coefficient Plots for Consumption Variables. Each line represents a different model.

Table 3.7 shows the regression results for the variables related to H2.2. They are also displayed in graphical form in fig. 3.6. The results for both trade measures match the behavior expected by the theory. A one standard deviation increase in export intensity is associated with a 0.105 standard deviation decrease in regulatory stringency ($p < 0.001$), equivalent to \$33/toe. A one standard deviation increase in import penetration is associated with a smaller but still statistically significant 0.06 standard deviation or \$18/toe decrease in the shadow price ($p < 0.05$). Turning to households, neither the share of a sector's output sold to households nor the share of national household consumption has a statistically significant effect on shadow prices. This is not what the theory predicts.

These results provide mixed support for H2.2. Sectors with greater export dependence or import penetration receive weaker policy burdens than they otherwise would. Sectors which account for a large portion of household consumption

receive higher regulatory costs. But the effect of sectors' sales households is not significant.

It appears that policymakers are sensitive to the trade-induced risks that face sectors, but that the identity of the domestic consumers does not enter into their calculation. One note: the fact that the coefficients for the household measures is itself significant, in that it suggests that policymakers are not going out of their way to protect households.

3.5.3 Labor Costs

Hypothesis 2.3 *Policymakers will impose more stringent mitigation regulation on sectors which can pass relatively more of their costs to labor rather than capital.*

The third hypothesis sets consumers aside to focus on the distribution of costs between two factors of production: labor and capital. H2.3 posits that the owners of firms will try to push cost of regulation on to their labor forces. Their ability to do so is represented by the variable ϕ_i. When ϕ_i is high, firms are more likely to respond to regulation by reducing wages, cutting hours, or laying off employees. When ϕ_i is low, regulation is more likely to cut into profits, dividends, and stock prices. Because capital is expected to have an advantage over labor in influencing policymakers, a higher ϕ_i is expected to lead to lower mitigation stringency λ_i.

I use four variables to represent the capacity of firms to pass costs on to their employees. In the absence of data on the elasticity of demand for labor across countries and sectors, I rely on the labor intensity of the sector instead. The WIOD's Socio-Economic Accounts[113] include information on the number of people employed in a sector and the amount of money spent on compensating labor and capital.

[113]Timmer et al., "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production".

I calculate **Labor Compensation as a Share of Output**, **Logged Labor Compensation as a Share of Output**, and the **Logged Number of Employees per Unit of Output**. These measure similar concepts but are not totally correlated. This helps ensure that the regression is not dependent on a particular specification of labor intensity. I also calculate a fourth measure: each sector's **Labor Compensation as a share of National Labor Compensation**. This captures the importance of the sector to national employment in a way that the other measures do not. I expect all four measures of labor intensity to be positively associated with mitigation stringency.[114]

This expectation follows the Stolper-Samuelson theorem from the economics of trade, which describes how changes in prices affect the returns to factors of production.[115] Consider a country with two sectors, each of which uses labor and capital in different proportions. One sector will be more labor-intense and the other more capital-intense. If trade makes one sector grow relative to the other, the returns to the factor used intensively in the growing sector will increase, as that factor becomes relatively scarce. Meanwhile, returns to the factor used intensively in the shrinking sector will decrease, as that factor becomes relatively abundant. Though the country overall may experience gains from trade, one factor can lose as others gain.

The underlying logic applies to regulation as well. If regulation drives down the producer prices for a given sector's goods, the sector will produce relatively less and owners of its abundant factor will suffer relatively more.[116] For sectors that are more labor-intense, the imposition of mitigation regulation threatens

[114]Running all the regressions with numbers of employees in the numerator instead of labor compensation produces similar results.

[115]Wolfgang F Stolper and Paul A. Samuelson. "Protection and Real Wages". In: *The Review of Economic Studies* 9.1 (1941), pp. 58–73.

[116]This assumes, as my model does, that firms are operating in a sufficiently competitive market prior to the introduction of regulation.

labor more than capital.[117] As a result, capital-owners in these sectors have relatively weaker incentives to oppose emissions regulation.

The third measure is the average compensation per employee, which represents the strength of labor demand relative to labor supply in each sector. When compensation is high in a competitive market, it means that firms have some reason they need to pay workers well. Perhaps production technology or consumer preferences require particular skills or training. Maybe regulation or union advocacy has raised wages or the number of employees needed. The labor market could simply be tight. Whatever the reason, if firms were able to pay lower wages and salaries they would. So when average compensation is high, it suggests that firms will be relatively less able to pass the costs of new mitigation regulations on to their workers. Since higher compensation implies greater costs for capital owners, I expect it to be negatively associated with regulatory stringency.

Table 3.8 presents the results for models testing H2.3. The key variables' coefficients are also reproduced in fig. 3.7. All four variables representing labor pass-through ϕ_i behave as expected. Sector-level labor intensity has a substantive effect on mitigation policy stringency: a one standard deviation increase in the ratio of compensation to output is associated with a 0.14 standard deviation increase in the shadow price. This is equivalent to \$44/toe. The effect of logged labor compensation as a share of output is about the same size. The effects of the logged employment per unit of output and sectoral labor compensation as a share of national compensation are a bit smaller, but still substantively meaningful. All of these relationships are statistically significant at the p=0.001 level.

These findings are consistent with H2.3, and they support the argument in chapter 2 that policymakers weigh costs to investors more heavily than costs to workers. When firms have more ability to pass on costs to labor, sectors end

[117] Fullerton, "Six Distributional Effects of Environmental Policy".

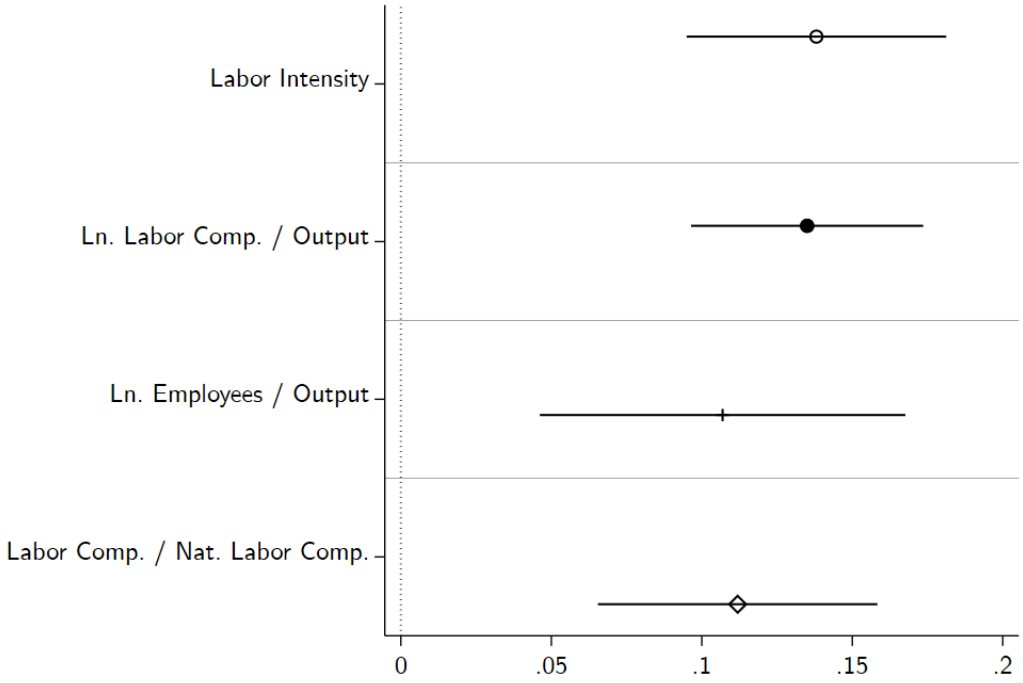


Figure 3.7: Coefficient Plots for Compensation Variables. Each line represents a different model.

up with substantively stronger mitigation policy burdens. When firms' ability to pass costs on to labor is constrained, their sectors' burdens appear lower.

Table 3.8: Compensation Effect

	(1)	(2)	(3)	(4)
Labor Intensity	0.137***			
	(0.0231)			
Ln. Labor Comp. / Output		0.135***		
		(0.0205)		
Ln. Employees / Output			0.107***	
			(0.0311)	
Labor Comp. / Nat. Labor Comp.				0.112***
				(0.0253)
CO_2 Intensity	-0.0995***	-0.0988***	-0.106***	-0.104***
	(0.0228)	(0.0229)	(0.0231)	(0.0227)
Output	0.228***	0.258***	0.255***	0.111*
	(0.0392)	(0.0396)	(0.0405)	(0.0454)
Nat. CO_2 Intensity	-0.388***	-0.385***	-0.415***	-0.410***
	(0.0505)	(0.0504)	(0.0513)	(0.0507)
GDP per Capita	-0.583***	-0.596***	-0.571***	-0.556***
	(0.0930)	(0.0929)	(0.0930)	(0.0936)
GDP Growth	0.0131	0.0122	0.0149	0.0139
	(0.0142)	(0.0142)	(0.0143)	(0.0143)
Fossil Fuel Inc. P.C.	-0.302***	-0.304***	-0.287***	-0.281***
	(0.0669)	(0.0667)	(0.0664)	(0.0664)
E.U. Member	0.290***	0.292***	0.294***	0.288***
	(0.0393)	(0.0391)	(0.0393)	(0.0393)
Random Effect Variances				
Country	0.416**	0.424**	0.432**	0.397**
	(0.137)	(0.140)	(0.142)	(0.132)
Sector	0.399***	0.403***	0.409***	0.403***
	(0.0208)	(0.0210)	(0.0212)	(0.0209)
Year	0.128***	0.127***	0.128***	0.128***
	(0.00351)	(0.00347)	(0.00351)	(0.00351)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	3616.37	3592.93	3622.69	3628.09

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.5.4 Combined Model

In the final set of models, I test the robustness of the results of the previous regressions in several ways.

In the first model, I combine the key variables from the previous regressions to see whether their effects persist once combined. The key variables all retain their expected effects: emissions intensity is negatively associated with stringency, while the export intensity and employee intensity variables are both positively associated with stringency.

The effects of all three are statistically significant at the p=0.001 level. Since these three variables are not strongly correlated with each other, their simultaneous statistical significance here suggests that the results in my earlier, more parsimonious models were not simply due to omitting variables my theory had deemed important. The effect of emissions intensity is \$32/toe, of export intensity \$23/toe, and that of labor intensity \$37/toe.

The second model drops national Carbon Dioxide intensity, to make sure that the results are not being driven by the inclusion of the national measure. The third model substitutes Greenhouse Gas measures for the Carbon Dioxide measures. The fourth model changes the time specification, replacing the time dummies with a time trend that is positive and statistically significant, indicating a general rise in stringency over the study period. In all four models, the results are substantively the same as in the previous models.

Table 3.9: Full Model

	(1)	(2)	(3)	(4)
CO_2 Intensity	-0.0996***	-0.106***		-0.111***
	(0.0222)	(0.0230)		(0.0244)
Export Intensity	-0.0713**	-0.0707**	-0.0718***	-0.0582**
	(0.0229)	(0.0215)	(0.0204)	(0.0222)
Labor Intensity	0.115***	0.116***	0.123***	0.102***
	(0.0234)	(0.0232)	(0.0242)	(0.0232)
GHG Intensity			-0.0471*	
			(0.0202)	
Output	0.190***	0.235***	0.230***	0.202***
	(0.0420)	(0.0417)	(0.0416)	(0.0454)
Nat. CO_2 Intensity	-0.391***			-0.535***
	(0.0517)			(0.0398)
GDP per Capita	-0.567***	-0.260***	-0.495***	-0.288***
	(0.0868)	(0.0786)	(0.0747)	(0.0656)
GDP Growth	0.0141	0.0162	0.0232	-0.0294**
	(0.0139)	(0.0144)	(0.0141)	(0.0113)
Fossil Fuel Inc. P.C.	-0.301***	-0.354***	-0.333***	-0.135*
	(0.0597)	(0.0666)	(0.0714)	(0.0625)
E.U. Member	0.300***	0.423***	0.368***	0.227***
	(0.0376)	(0.0367)	(0.0348)	(0.0383)
Nat. GHG Intensity			-0.475***	
			(0.0523)	
Random Effect Variances				
Country	0.414**	0.409**	0.438**	0.333**
	(0.136)	(0.133)	(0.146)	(0.102)
Sector	0.385***	0.386***	0.391***	0.390***
	(0.0204)	(0.0205)	(0.0207)	(0.0211)
Year	0.129***	0.131***	0.128***	0.132***
	(0.00363)	(0.00363)	(0.00360)	(0.00366)
Time Indicators	Yes	Yes	Yes	No
N	3555	3555	3531	3555
DIC	3638.42	3712.87	3602.22	3720.70

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Now that these final models have been specified, it is useful to comment on the random effect variances at the bottom of the tables. Their relative sizes of the communicate how much of the variance in the data is driven by differences across the group levels. In all models, the random effects are relatively large, indicating the the group differences are playing an important role. Of particular note is that the country and sector variances are about equally large. There is nearly as much variation between different sectors as there is between different countries. This is a key point for the sector-based, distributive approach for which this dissertation advocates. It suggests that only examining country-level data would miss important variation within countries, and only accounting for country-level effects in the statistical analysis would miss important structure in the data.

3.6 Conclusion

All three hypotheses developed in chapter 2 receive empirical support from the data analyzed in this chapter. All the variables but one behaved as expected. H2.1, which claimed that more carbon intense-sectors would receive weaker regulatory burdens, was confirmed in all the models. While this result is unsurprising, it provides a simple "sanity check" on the data. H2.2, the consumption effect, suggested that sectors that have difficulty passing their costs on to their consumers would receive weaker regulation. This received some empirical support from the export dependence, import penetration, and national household consumption share measures, but the share of output sold to households did not matter. Finally, H2.3 posited a compensation effect in which capital-intense sectors would be shielded in comparison to labor-intense sectors, a pattern which appeared to hold up in the data.

Taken together, the results suggest that the sector-level theory proposed in the previous chapter offers a useful lens for understanding climate mitigation policymaking. Basic intuitions about how political power is distributed across groups map neatly onto where the burdens of mitigation policy are targeted. Trade-exposed sectors are protected over domestic household consumers. Investors are protected over workers. High-resource workers are protected over low-resource ones.

This analysis would not be possible without the kind of sector-level stringency data that shadow pricing provides. While shadow prices are not a perfect climate policy measure, they make it possible to conduct cross-national tests of within-country differences in mitigation stringency. To my knowledge, this is the first such exercise in the comparative climate politics literature.

The following three chapters will delve into facets of climate policymaking that were ignored in these baseline models. It is crucial to establish whether effects seen are simply structural ones or political ones. Chapter 5 will look at the wider political economy context, to see how the pass-through of costs can be dampened or exacerbated depending on the distributive arrangements of each country. Chapter 4 will bring politics back in, looking at how parties interact with sectoral interests. Finally, chapter 6 will move beyond a policy-focused analysis to examine whether individual attitudes about climate policy are also shaped by sectoral factors.

Chapter 4

Opening the Black Box: Political Ideology and Conditional Representation

> "Until very recently, most political scientists who have studied climate change have done so from an international relations perspective, with a focus on explaining international agreements based on the interests or ideational orientations of states as unitary actors, without opening the 'black box' of domestic politics."
>
> Kathryn Harrison and Lisa Sundstrom[1]

4.1 Introduction

Parties of the left have a "greener" reputation than parties of the right. There is a persistent expectation that left-wing parties will be more friendly to green causes than right-wing ones,[2] and that this general tendency will extend to the

[1] Kathryn Harrison and Lisa McIntosh Sundstrom. "The Comparative Politics of Climate Change". In: *Global Environmental Politics* 7.4 (Dec. 2007), pp. 1–17.

[2] Riley E. Dunlap. "The Impact of Political Orientation On Environmental Attitudes and Actions". In: *Environment and Behavior* 7.4 (Dec. 1975), pp. 428–454; Susan Owens. "Environmental politics in Britain: new paradigm or placebo?" In: *Area* 18.3 (1986), pp. 195–201; Aaron M. McCright and Riley E. Dunlap. "The Politicization of Climate Change and Polar-

climate issue as well.[3] But this expectation has received weak and conflicting empirical support. Left parties may be trying to combat climate change more than right parties, but the literature has not found consistent evidence that they have succeeded in doing so.

The previous chapters focused on the "demand-side" of policy: the interests of the firms, workers, investors, and consumers who might bear the costs of climate mitigation. I concentrated on how sectoral variation creates distributive challenges for governments, but abstracted away the details of the actors within governments. In this chapter, I unpack the "supply-side" of the equation, examining the interests of policymakers themselves. By doing so, I open the "black box" of national policymaking, and show how political ideology interacts with the distributive logic of climate mitigation.

The scale of the problem means that climate change mitigation has the potential to be much more costly for a wider range of groups than most other environmental issues. Instead of focusing only on whether left or right parties "do more" across the board, I explore how party responses differ across economic sectors, depending on whether their constituencies are threatened. I extend the basic theory from earlier chapters to incorporate the idea of 'conditional representation.' In the first version of my theory, constituencies had different levels of influence over government, but I assumed that this influence was the same over all policymakers. Here I move beyond that assumption, and consider the fact that parties may have relatively stronger links to some constituencies than others. I assume that parties of the right are more likely to favor the interests of capital and producers generally, while parties of the left are more likely to favor

ization in the American Public's Views of Global Warming, 2001-2010". In: *The Sociological Quarterly* 52 (2011), pp. 155–194.

[3]Neil Carter et al. "Political parties and climate policy: A new approach to measuring parties' climate policy preferences". In: *Party Politics* (2017), pp. 1–12; Fay M. Farstad. "What explains variation in parties' climate change salience?" In: *Party Politics* (2017), pp. 1–10.

workers and consumers. These constituency links will have implications for the stringency of mitigation policy for individual sectors.

The analysis in this chapter has two purposes. The first is to add a new dimension to the literature on political ideology and environmental policy by considering constituency effects. The second is to validate the pathway through which the distributive outcomes observed in chapter 3 come to occur. I have already found evidence that sectoral characteristics are associated with the pattern of mitigation stringency. The theory outlined in chapter 2 suggests that these patterns are driven by policymakers' divergent responsiveness to different constituencies. But so far I have not analyzed the policymakers directly; their role in the process is implied but not proven. If the observed variation in stringency is at least in part politically-induced, rather than simply a result of structural economic relationships, then there should be some demonstrable relationship between policymaker characteristics, sector-level characteristics, and policy outcomes. This chapter tests this expectation.

In the next section I review previous work on partisan ideology and environmental policy and performance. I look at three ways of measuring environmentalism: party positions, pollution outcomes, and policy outputs. Work on party positions suggests a "green left," but neither outcome nor policy data provide consistent support for the idea that left parties are monolithically more green than right ones. I then develop the theory of conditional representation to help explain party behavior on the environment. I expect left parties to impose weaker mitigation regulation on workers and consumers and right parties to impose weaker regulation on capital. I validate this theory using data on partisan control of government, finding that the results closely match the theoretical expectations. I conclude with a discussion of possible extensions to this line of inquiry.

4.2 Partisan Ideology and the Environment

The literature on parties and the environment can be divided into two groups: work on positions and work on actions. The first, on the positions that parties take on environmental issues, has developed a dominant (though not uncontested) expectation that left parties will be greener than right parties. The second, on the effects of ideology on outcomes and policies, has produced more ambiguous and conflicting results, leaving the effect of partisanship—if it exists—in doubt. I will briefly review these works, showing that there is a conflict between clear expectations of left climate-friendliness and the muddier observed reality. I then develop my argument that sectoral differentiation can help resolve this conflict.

Which answer turns out to be correct has implications for many groups beyond academia. For activists and lobbyists, the findings could affect who they decide to support or target, and which lines of argument to use. For politicians, especially those in countries with more than two parties, the answer could affect which coalitions they form. And ultimately voters, perhaps the most likely of these groups to rely on broad party labels, want to know whether parties will live up to those labels.

Before delving into the literature on partisan environmental performance, it is important to acknowledge that "left" and "right" are imperfect categories.[4] Their meanings differ over time and across countries. Left parties in Western countries are often socially progressive, but in Eastern post-communist countries they can be more socially conservative than the economically right-wing or liberal parties. By some measures, center-right parties in many European countries are to the left of the Democratic Party in the United States. Some of the failure to find

[4]Detlef Jahn. "Conceptualizing Left and Right in comparative politics: Towards a deductive approach". In: *Party Politics* 17.6 (2010), pp. 745–765; Martin Mölder. "The validity of the RILE left–right index as a measure of party policy". In: *Party Politics* 22.1 (2016), pp. 37–48.

consistent effects of party ideology may simply be a result of the weakness of these categories cross-nationally.

I will, however, continue using "left" and "right" in my analysis. The first reason is that the literature to which I am responding is deeply concerned with the left-right distinction. Second, despite their variation, there are some characteristics which cross time and borders, which my theory tries to leverage.

In its early stages the environmental movement was not clearly aligned with existing political divisions. In Europe, prominent political environmentalists of the 1970s and 1980s explicitly rejected such alignment, proclaiming that "we are neither left nor right, we are out in front."[5] Parties on the left and right found it difficult to balance new environmental concerns with their existing economic bases. Proposed environmental regulations often united labor and business in opposition. Conservative and social democratic parties may have fought over how to slice the pie, but they had a shared interest in increasing its size, an interest which environmentalism appeared to threaten.[6] In the United States, environmentalism initially seemed like it might be a valence issue that both Republicans and Democrats could claim to champion.[7]

The initial lack of alignment led some scholars and activists to see environmentalism as part of a new dimension of political conflict, transcending existing class divisions to focus on non-economic concerns.[8] As green parties formed in many countries, this emerging second dimension seemed like it might permanently

[5]Jonathan Porritt, director of British Friends of the Earth and chair of the British Ecology Party (predecessor of the Green Party), and Petra Kelly, a founder of the German Green Party, both employed this slogan (Russell J. Dalton. "Economics, environmentalism and party alignments: A note on partisan change in advanced industrial democracies". In: *European Journal of Political Research* 48.2 [Mar. 2009], pp. 161–175).

[6]Ibid.

[7]Riley E. Dunlap and Aaron M. McCright. "Environment: Science and Policy for Sustainable Development A Widening Gap: Republican and Democratic Views on Climate Change". In: *Environment: Science and Policy for Sustainable Development* 50.5 (2008), pp. 26–35.

[8]Ronald Inglehart. *Culture shift in advanced industrial society*. Princeton University Press, 1990, p. 484.

reshape ideological conflict in developed countries.[9][10]

Other scholars have argued that environmentalism is gradually being incorporated into the left-right dimension, with left parties becoming more pro-environmental than right parties. Arguments for a left-green alignment emerged as early as the mid-1970s,[11] and have generally fallen into three categories: values, methods, and strategies.[12] In terms of values, environmentalism evokes altruistic principles—concern for the welfare of people in other places and times, as well as the welfare of non-humans—that dovetail with the left's own "collectivist spirit".[13] In a similar vein, the right tends to place more faith in business, which may make right parties more disposed to respond to the concerns of industry. In terms of methods, environmental regulation generally involves government intervention in the economy, which the left usually favors and the right is ideologically predisposed to oppose.[14] Furthermore, the fact that the environment is a relatively new issue means regulation requires more innovation, challenging the right's emphasis on conservatism and tradition.[15] In terms of strategy, even if left party leaders do not favor environmentalism for its own sake, they might be compelled to adopt more environmentally-friendly positions to fend off challenges

[9]Robert Pahlke. *Environmentalism and the Future of Progressive Politics*. New Haven: Yale University Press, 1989; Hanspeter Kriesi. "The transformation of cleavage politics". In: *European Journal of Political Research* 33.1967 (1998), pp. 165–185; Neil Carter. *The Politics of the Environment: Ideas, Activism, Policy*. Cambridge: Cambridge University Press, 2001; Liesbet Hooghe et al. "Does left/right structure party positions on european integration?" In: *Comparative Political Studies* 35.8 (2002), pp. 965–989.

[10]Hooghe et al. calls this new axis the GAL-TAN dimension, which stands for Green/Alternative/Libertarian vs. Traditional/Authoritarian/Nationalist. Note the prominence of green issues in this label, where they are placed at the same level as nationalism as a defining political force. See Liesbet Hooghe et al. "Does left/right structure party positions on european integration?" In: *Comparative Political Studies* 35.8 (2002), pp. 965–989.

[11]Dunlap, "The Impact of Political Orientation On Environmental Attitudes and Actions".

[12]Farstad, "What explains variation in parties' climate change salience?"

[13]Owens, "Environmental politics in Britain: new paradigm or placebo?", p. 197.

[14]McCright and Dunlap, "The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010", p. 160.

[15]Dunlap, "The Impact of Political Orientation On Environmental Attitudes and Actions"; Kelly S. Fielding et al. "Australian politicians' beliefs about climate change: political partisanship and political ideology". In: *Environmental Politics* 21.5 (Sept. 2012), pp. 712–733.

from left-leaning greens. Where green parties and voters cluster more on the left side of the spectrum, left parties face more pressure to incorporate their concerns to defuse electoral competition.[16]

These two competing expectations have set the stage for a large empirical literature investigating whether left parties are more pro-environmental than right parties. This literature can broadly be divided into work on party positions and actions. I will review each in turn, paying special attention to work that focuses on climate change. The evidence is mixed on whether left parties take more pro-environmental positions generally, but left parties do seem to take more specifically pro-climate positions. Whether parties "walk the talk" and translate these positions into more pro-climate actions, however, remains contested and ambiguous.

4.2.1 Party Positions

There are three main ways to measure party positions: public surveys, expert surveys, and coding of manifestos.[17] Difference in question wordings and limited coverage of issues makes it difficult to use public surveys to compare party environmentalism across many countries. Most of the work in this area, therefore, relies on the latter two methods.

Using two expert surveys from Laver and Hunt and Benoit and Laver,[18] Dalton[19] finds that the traditional left-right economic dimension and the new en-

[16]Robert Rohrschneider. "Environmental Belief Systems in Western Europe: A Hierarchical Model of Constraint". In: *Comparative Political Studies* 26.1 (1993), pp. 3–29; Jae-Jae Spoon et al. "Going green: Explaining issue competition on the environment". In: *European Journal of Political Research* 53 (2014), pp. 363–380.

[17]Dalton, "Economics, environmentalism and party alignments: A note on partisan change in advanced industrial democracies".

[18]Michael Laver and W. Ben Hunt. *Policy and Party Competition*. New York: Routledge, 1992; Kenneth Benoit and Michael Laver. *Party Policy in Modern Democracies*. New York: Routledge, 2006.

[19]Dalton, "Economics, environmentalism and party alignments: A note on partisan change in advanced industrial democracies".

vironmental dimension were already somewhat aligned by 1989, and that they increasingly converged over time. That said, this alignment was still incomplete by 2002-2003, with social-democratic and labor parties remaining closer to right-wing parties than green parties on the environmental dimension.

Neumayer,[20] Carter,[21] and Michallet et al.[22] analyze data from the Manifesto Project,[23] where sentences from party election manifestos are coded by position and topic, giving an overall measure of how salient different issues are to that party.[24] Examining data from between World War II and the late 1990s, Neumayer finds that left-wing ideology has a statistically significant bi-variate correlation with manifesto environmentalism, but that the magnitude of the correlation is not particularly high. Focusing on European countries between 1970 and 2008, Michallet finds that left wing parties devote significantly more space in their manifestos to environmental issues.[25] Carter[26] employs both expert survey[27] and manifesto data from the 2012 edition of the Manifesto Project. His expert survey results support the idea that left-wing parties take more pro-environmental policy stances, but in contrast to Michallet, Carter's analysis of the manifesto data finds "only marginal differences in issue salience" between left and right.

[20]Eric Neumayer. "The environment, left-wing political orientation and ecological economics". In: *Ecological Economics* 51.3-4 (Dec. 2004), pp. 167–175.

[21]Neil Carter. "Greening the mainstream: party politics and the environment". In: *Environmental Politics* (Feb. 2013).

[22]Michallet et al., "Greening Up or Not? The Determinants of Political Parties Environmental Concern: An Empirical Analysis Based on European Data (1970-2008)".

[23]Ian Budge and Hans-Dieter Klingemann. *Mapping Policy Preferences: Estimates for Parties, Electors, and Governments*. Oxford: Oxford University Press, 2001; Andrea Volkens et al. *The Manifesto Project Dataset - Codebook. Manifesto Project (MRG / CMP / MARPOR)*. Berlin, 2017.

[24]The Manifesto Project is the current home of work by the earlier Manifesto Research Group and the Comparative Manifestos Project.

[25]A control for the share of industry in national output is included, but never statistically significant, in Benjamin Michallet et al. "Greening Up or Not? The Determinants of Political Parties Environmental Concern: An Empirical Analysis Based on European Data (1970-2008)". In: *Climate Change and Sustainable Development*. Mar. 2015.

[26]Carter, "Greening the mainstream: party politics and the environment".

[27]Ryan Bakker et al. "Complexity in the European party space: Exploring dimensionality with experts". In: *European Union Politics* 13.2 (2012), pp. 219–245.

So far I have only discussed environmentalism generally, and not climate change in particular. This is partially because the concepts are closely related and measures of environmentalism could implicitly include positions on climate change mitigation. But there is also relatively less comparative data on party positions and climate change: neither the Chapel Hill Expert Survey nor the Comparative Manifesto Project include climate change as a distinct issue. A few recent works have tried to fill this gap.[28]

Both Farstad[29] and Carter et al.[30] extend manifesto coding data to include climate change. Farstad[31] analyzes 127 party manifestos in 18 OECD countries, using one election in each country from between 2009 and 2013. While she does not find any difference between left and right parties on the environment generally, she does show strong evidence that the climate change issue receives more attention in left-wing manifestos. Her results emphasize the importance of distinguishing the climate issue from environmentalism more generally. Carter et al.[32] applies a similar approach to a smaller set of countries over a longer period of time: 64 parties in Denmark, France, Germany, Ireland, Italy, and the U.K. from the mid-1990s through 2015. One-tailed t-tests suggest that left parties devote more space in their manifestos to climate change (though the difference is not especially large: 6.8% versus 5.4%).

Båtstrand[33] conducts case studies of nine conservative parties and finds that

[28]Carter et al., "Political parties and climate policy: A new approach to measuring parties' climate policy preferences"; Farstad, "What explains variation in parties' climate change salience?"; Sondre Båtstrand. "More than Markets: A Comparative Study of Nine Conservative Parties on Climate Change". In: *Politics & Policy* 43.4 (Aug. 2015), pp. 538–561.

[29]Farstad, "What explains variation in parties' climate change salience?"

[30]Carter et al., "Political parties and climate policy: A new approach to measuring parties' climate policy preferences".

[31]Farstad, "What explains variation in parties' climate change salience?"

[32]Carter et al., "Political parties and climate policy: A new approach to measuring parties' climate policy preferences".

[33]Båtstrand, "More than Markets: A Comparative Study of Nine Conservative Parties on Climate Change".

parties on the same ideological "side" can vary widely in their professed attitude to climate issues. While the Republican Party in the United States says that greenhouse gas regulations "will harm the nation's economy and threaten millions of jobs", the Christian Democratic Union in Germany proclaims that "climate change threatens the very foundations of our existence". The Liberal Party in Australia both acknowledges climate change as one of its "top policy priorities" while also attacking the country's carbon tax 29 times.

Combining Båtstrand's results with those of Farstad and Carter leaves us with a general expectation that the left will express more concern about climate change than the right, but that the right is not always against action. The manifesto and expert survey literatures cannot tell us, however, the degree to which party commitments translate into action. For that, we must turn to studies of outcomes.

4.2.2 Ideology and Emissions

Since the early 1990s, many studies have attempted to assess whether left parties actually produce better outcomes for the environment in general and climate change in particular. The results have again been mixed. Some authors find evidence that the left outperforms the right,[34] others that there is no difference,[35]

[34]R.F. King and A. Borchardt. "Red and green: air pollution levels and left party power in OECD countries". In: *Environment & Planning C: Government & Policy* 12.2 (1994), pp. 225–241; Detlef Jahn. "Environmental performance and policy regimes: Explaining variations in 18 OECD-countries". In: *Policy Sciences* 31 (1998), pp. 107–131; Ward and Cao, "Domestic and International Influences on Green Taxation"; Aklin and Urpelainen, "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions"; Sebastian Garmann. "Do government ideology and fragmentation matter for reducing CO2-emissions? Empirical evidence from OECD countries". In: *Ecological Economics* 105 (Sept. 2014), pp. 1–10.

[35]Markus M.L. Crepaz. "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making". In: *Environmental Politics* 4.3 (1995), pp. 391–414; Lyle A. Scruggs. "Institutions and Environmental Performance in Seventeen Western Democracies". In: *British Journal of Political Science* 29 (1999), pp. 1–31; Christian B. Jensen and Jae Jae Spoon. "Testing the 'Party Matters' Thesis: Explaining Progress towards Kyoto Protocol Targets". In: *Political Studies* 59.1 (2011), pp. 99–115; Schulze, "Do parties matter for international environmental cooperation? An analysis of environmental treaty participation by advanced industrialised democracies"; Xun Cao and Hugh Ward. "Winning Coalition Size, State Capacity, and Time Horizons: An Application of Mod-

and still others that the relationship is ambiguous.[36] As a result, it is difficult to get a clear picture of whether left-right ideology matters.

Early work in this area focused on pollution outcomes in the OECD, with conflicting results.[37] King and Borchardt[38] conduct the first many-country comparative study of party ideology and pollution. They test the effect of left parties' role in the cabinet and their electoral performance on five pollutants. Left parties' strength in the cabinet and the legislature (though not their vote share) have a statistically significant negative relationship with most pollutants, including carbon oxides (a category which includes CO_2). Jahn[39] employs a composite index that includes CO_2, and find it has a negative relationship with social democratic party strength. Unlike King and Jahn, Crepaz[40] includes a direct measure of CO_2; however, he finds no relationship between an index of left party dominance and CO_2 emissions. Scruggs[41] does not include any greenhouse gas measure, and while his models initially indicate a negative relationship between left party strength and pollution, this result disappears once the level of corporatism is added to

ified Selectorate Theory to Environmental Public Goods Provision". In: *International Studies Quarterly* 59.2 (June 2015), pp. 264–279.

[36]Eric Neumayer. "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries". In: *Ecological Economics* 45.2 (June 2003), pp. 203–220; Knill et al., "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000"; Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey"; Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking".

[37]King and Borchardt, "Red and green: air pollution levels and left party power in OECD countries"; Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making"; Jahn, "Environmental performance and policy regimes: Explaining variations in 18 OECD-countries"; Scruggs, "Institutions and Environmental Performance in Seventeen Western Democracies"; Neumayer, "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries".

[38]King and Borchardt, "Red and green: air pollution levels and left party power in OECD countries".

[39]Jahn, "Environmental performance and policy regimes: Explaining variations in 18 OECD-countries".

[40]Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making".

[41]Scruggs, "Institutions and Environmental Performance in Seventeen Western Democracies".

the model. Neumayer[42] adds more detailed controls for industrial characteristics, but also finds inconsistent results. In a fixed effects model, left-party seat share appears to reduce CO_2 emissions, but left party strength in the cabinet appears to increase it, and neither effect is robust to model selection.

More recent studies have the advantage of covering the period over which climate change became a significant political issue, but continue to produce differing results depending on the dependent variable chosen. Garmann[43] measures the growth rate of CO_2 intensity from 1992-2008, and finds that higher levels of left-wing dominance are associated with lower emissions increases. Jensen and Spoon[44] examines countries progress towards meeting their emissions targets under the Kyoto Protocol, but show that progress between 1998 and 2003 was not affected by the mean left-right position of national governments.

4.2.3 Ideology and Actions

As discussed in chapter 3, pollution levels are not the only or even necessarily the ideal measure of environmental activity. Other scholars have examined the relationship between partisanship and the level of green taxation,[45] the number of environmental treaties or policies,[46] and the growth of renewable energy.[47]

[42]Neumayer, "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries".

[43]Garmann, "Do government ideology and fragmentation matter for reducing CO2-emissions? Empirical evidence from OECD countries".

[44]Jensen and Spoon, "Testing the 'Party Matters' Thesis: Explaining Progress towards Kyoto Protocol Targets".

[45]Ward and Cao, "Domestic and International Influences on Green Taxation".

[46]Knill et al., "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000"; Schulze, "Do parties matter for international environmental cooperation? An analysis of environmental treaty participation by advanced industrialised democracies"; Kammerer and Namhata, "What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion".

[47]Aklin and Urpelainen, "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions"; Xun Cao. "An Interest Groups and Partisan Politics Model for Renewable Energies". 2012.

Ward and Cao[48] are interested in whether policies diffuse more easily between ideologically-similar governments. Looking at green taxation levels in the OECD from 1995-2004, they do not find much evidence of ideologically-based diffusion; however, it does appear that left-wing governments impose higher environmental taxes than right-wing ones. The taxation data is a useful reminder that climate-relevant policy is not limited to measures specifically targeting greenhouse gasses: Ward and Cao note that "revenue from taxes on petrol, diesel, and the sale and use of motor vehicles dwarfs that from other green taxes." But because the green taxation variable includes non-greenhouse gas taxes, it is not a perfect substitute for a climate-specific measure.

Though environmental agreements and policies are often too numerous and too heterogeneous to compare in a straightforward fashion over many countries, some scholars attempt to simplify the comparison by counting the absolute number of treaties signed[49] or policies passed.[50] Neither studies find that left-right differences affect these counts. It is worth noting that both find (as Ward and Cao do) that the degree to which the governing party's manifesto focuses on the environment does matter, increasing the number of environmental treaties and policies. But the negative finding for all environmental policies does not rule out the possibility that some parties pass more climate-specific policies, or that they pass fewer but stronger policies.

Aklin and Urpelainen,[51] while examining the share of renewables in electricity generation, test not only left-right differences but also the effect of changes in partisanship. They argue that investing in renewable energy creates new vested

[48]Ward and Cao, "Domestic and International Influences on Green Taxation".

[49]Schulze, "Do parties matter for international environmental cooperation? An analysis of environmental treaty participation by advanced industrialised democracies".

[50]Knill et al., "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000".

[51]Aklin and Urpelainen, "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions".

interests which will support green governments. They suggest that incumbent parties strategically over- or under-regulate the energy sector ahead of an election they are in danger of losing, in order to strengthen potential supporters during a period in opposition. Left-wing government has a positive sign, but is only statistically significant in a few of their models. However, the data from ideology-shifting elections is consistent with the hypothesis that left-wing governments prioritize renewables when their incumbency is threatened.

Cao[52] argues that neither left nor right parties have an intrinsic preference for "brown" or "green" industries. As the renewable sector grows, it has more money to lobby with, which leads to more pro-renewable policy, and more renewable growth. But partisanship still matters, because right-wing parties are more receptive to contributions from industry, and therefore will do more to help any industry that is able to pay. The result is that right-wing governments appear to be better than left-wing ones for the renewables sector.[53] Cao highlights a crucial point: the interaction of partisanship with industry structure. But there is room to improve on the use of national energy intensity as a gross measure of that structure.

Aklin and Urpelainen[54] and Cao[55] represent the start of a trend towards considering outcomes at the sector-level, albeit for only one sector. They suggest some themes which I will pick up on as well: the link between industry type and pre-existing groups of supporters, and the potential for left and right to be neutral with regards to climate change but differentially receptive to particular kinds of contributions.

[52]Cao, "An Interest Groups and Partisan Politics Model for Renewable Energies".

[53]Nikolaos Zahariadis. "State Aid and Partisan Government in the European Union". In: *Social Science Quarterly* 91.2 (June 2010), pp. 436–454, This matches findings that right parties provide more industrial subsidies than left ones. See.

[54]Aklin and Urpelainen, "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions".

[55]Cao, "An Interest Groups and Partisan Politics Model for Renewable Energies".

The number of scholars looking specifically at partisanship and climate change policy is relatively small. Most authors seem to have found that left parties are not systematically more committed to mitigation,[56] though Tobin[57] finds the opposite.

Following the policy-counting approach in Knill et al.,[58] Fankhauser et al.[59] focuses specifically on the number of climate-related policies, as measured by the GLOBE climate legislation study.[60] In their main models, they find no difference between left and right governments in the passage of climate legislation. The only exception is when they restrict their sample to Anglo-Saxon countries, in which case left parties appear to produce more climate policies. If the idea of a green left was disproportionately driven by the Anglo-Saxon experience, it could help explain why it has received inconsistent empirical support when measured elsewhere. Kammerer and Namhata[61] also use the GLOBE data, and no effect of partisanship on policy adoption.

Mildenberger[62] conducts the most in-depth study of partisanship and climate policy to date. His "logic of double representation" argues that the interests of greenhouse gas-emitting businesses are channeled through both right and left parties. Even though right parties are traditionally more pro-business, left parties

[56]Knill et al., "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000"; Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey"; Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking"; Kammerer and Namhata, "What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion".

[57]Tobin, "Leaders and Laggards: Climate Policy Ambition in Developed States".

[58]Knill et al., "Do parties matter in internationalised policy areas? The impact of political parties on environmental policy outputs in 18 OECD countries, 1970 2000".

[59]Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey".

[60]Nachmany et al., *The GLOBE Climate Legislation Study A Review of Climate Change Legislation in 66 Countries. Fourth Edition.*

[61]Kammerer and Namhata, "What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion".

[62]Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking".

also have an interest in protecting the employees of polluting firms. He traces this process in case studies of the United States, Australia, Norway, Germany, and Canada. His results show how both left and right parties can end up "privileging the influence of distributional losers on climate policy outcomes."

Mildenberger also emphasizes how the voice of polluters is mediated by political institutions.[63] When polluters have institutionalized access to decision-making (through corporatist arrangements, for example), only policy proposals that protect producer interests are proposed, and polluters need not mobilize against them (as in Norway). When polluters lack an institutionalized voice (as in pluralist countries), proposals may threaten their interests more intensely, stirring up mobilization and making climate change a politically contentious issue (as in the United States).

Contrasting with these non-findings for ideology, Tobin[64] conducts a fuzzy set Qualitative Comparative Analysis using left-wing government as one of the conditions. Policy is measured with the expert survey data from the CCPI.[65] The result is that "having a left-wing government is sufficient for ambitious climate policy."[66]

Surveying this literature, the relationship between partisanship and environmentalism appears to be very much in doubt. How should the mixed or negative findings be interpreted?

One could conclude that the relationship between the left and environmentalism is either nonexistent, or simply too weak to produce consistent results. On the climate issue, the disconnect between expectations and actions appears especially wide. While the findings of Farstad[67] and Carter et al.[68] indicate that

[63]This element in Mildenberger's work is discussed in more detail in chapter 5.
[64]Tobin, "Leaders and Laggards: Climate Policy Ambition in Developed States".
[65]Burck et al., *The Climate Change Performance Index Results 2018*.
[66]Tobin, "Leaders and Laggards: Climate Policy Ambition in Developed States", p. 39.
[67]Farstad, "What explains variation in parties' climate change salience?"
[68]Carter et al., "Political parties and climate policy: A new approach to measuring parties'

left parties "talk the talk" on climate, Mildenberger[69] and Fankhauser et al.[70] suggest that they do not consistently "walk the walk" in terms of policy. Despite the clear theoretical expectations shared by many scholars that the left will outperform the right on the environment, one should not discount the possibility that the theory may be wrong, or may not extend to every environmental issue.

The alternative is to consider how the effect of left-right partisanship may be conditional on factors which have not yet received substantive attention. I turn to this possibility in the next section.

4.3 Theory of Conditional Representation

4.3.1 Ideology and Sectoral Constituencies

I have reviewed a number of reasons why the left might be more concerned about climate change: ideology, methods, and strategy. Left parties may be more committed to values like altruism and collectivism, and so more concerned about the impact of climate change on vulnerable communities around the world. Left parties may be more comfortable with methods commonly proposed for mitigating climate change, like regulation, taxation, and subsidies. Or environmental voters may be more concentrated on the left, thus challenging left parties to cater to their interests or risk losing votes.

But these explanations, while important, leave out something crucial. With some exceptions,[71] the literature has focused on differences between left and right parties in their treatment of business generally, with less attention to how they

climate policy preferences".

[69]Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking".

[70]Fankhauser et al., "The political economy of passing climate change legislation: evidence from a survey".

[71]Cao, "An Interest Groups and Partisan Politics Model for Renewable Energies".

might treat different kinds of businesses differently.

In previous chapters, I looked at how economic constituencies—investors, workers, and consumers—affect the degree to which different sectors are targeted by climate policy. Sectors that can pass on costs to workers or consumers receive more of the burden of mitigation policy, and sectors which pass the costs on to investors receive less. I explain this by suggesting that producers wield more political influence than consumers, and investors have more political influence than workers.

In the baseline model in chapter 2, these power inequalities are independent of the government in power. But this may not generally be true. Here I argue that left and right parties have different levels of commitment to these constituencies. I expect these differences to shape how parties target mitigation policy.

Left and right carry many different meanings and these meaning vary across countries. But it is possible to make some broad generalizations. Jahn[72] draws on work by Bobbio,[73] who argues that the core difference between left and right is in their orientations to equality. Left parties, in Bobbio's conception, are fundamentally concerned with using the power of the state to promote equality among citizens. Right parties, on the other hand, are premised on the acceptance and justification of inequalities.

These categories should have implications for which constituencies parties favor. Because of their commitment to equality, left parties will prioritize the interests of the less well-off. In terms of my constituency categories, this should make left parties relatively more sympathetic to the demands of workers and consumers. Symmetrically, if right parties are more comfortable with inequality

[72]Jahn, "Conceptualizing Left and Right in comparative politics: Towards a deductive approach".

[73]Norberto Bobbio. *Left and Right: The Significance of a Political Distinction.* Cambridge: Polity Press, 1996.

they will be closer to well-off groups. This should lead right parties to be more attuned to the demands of investors and producers.

These are stylized accounts, and the relationships are intended to be relative rather than absolute. My argument is not premised on left and right parties being extremely polarized. In many countries and on many issues the difference between center-left and center-right parties may not be large. Nor is it important to my theory that all left and right parties have the same level of commitment to particular interest constituencies across countries.[74]

I am also not suggesting that party ideology will override the influence inequalities that underpinned my arguments in previous chapters. It may be the case that both left and right parties favor producers and investors over consumers and workers due to the structural power of business and capital. "New Labour" in Britain and the "New Democrats" in the United States both included attempts to widen the left's support among capital-owners in those countries. I see party ideology effects as mediating but not replacing the influence dynamics described earlier.

4.3.2 Formal Extension

In this section, I extend the baseline model from chapter 2 to include party ideology. Doing so does not require any major modifications of the original model. The only change I make to the original model is to assume that right parties pay more attention to the interests of capital-owners than left parties do.[75] This

[74] An avowedly socialist party with institutionalized ties to labor unions may be more sensitive to worker interests than a center-left party, for example. A populist right party may have weaker ties to financial elites and more open to some forms of government intervention. I will not investigate these intra-category differences here, though they may be fruitful subjects for future research.

[75] I could achieve the same result by assuming that left parties pay more attention to labor interests than right parties do. I could also assume that left and right parties each pay different amounts of attention to labor and capital, but that would add more model complexity for substantially similar results.

expectation is formalized in the following equation:[76]

$$\pi^K_{\text{Left}} < \pi^K_{\text{Right}} \tag{4.1}$$

In chapter 2, I show that the relationship between regulatory stringency λ_i and emissions intensity m_i, consumer pass-through θ_i, and labor pass-through ϕ_i are all proportional to the influence of capital:

$$\frac{\partial \lambda_i^*}{m_i} \propto \pi^K \tag{4.2}$$

$$\frac{\partial \lambda_i^*}{\theta_i} \propto \pi^K \tag{4.3}$$

$$\frac{\partial \lambda_i^*}{\phi_i} \propto \pi^K \tag{4.4}$$

If economic interests are stronger than environmental interests, the net effect of emissions intensity m_i on optimal stringency λ_i^* is negative (eq. (2.38)). If right parties favor capital more than left parties, this negative effect should be more intense under right parties than left ones:

$$\left.\frac{\partial \lambda_i^*}{m_i}\right|_{\pi^K_{\text{Left}}} > \left.\frac{\partial \lambda_i^*}{m_i}\right|_{\pi^K_{\text{Right}}} \tag{4.5}$$

If producer interests are stronger than consumer interests, higher consumer pass-through θ_i should be associated with higher optimal stringency λ_i^* (eq. (2.45)). If right parties favor capital more than left parties, producer interests should also be more empowered, increasing the size of this effect:

[76] I still assume that the original hierarchy of influence variables in proposition 2.2 holds regardless of party: $\pi^E \leq \pi^D \leq \pi^L < \pi^K$.

$$\left.\frac{\partial \lambda_i^*}{\theta_i}\right|_{\pi^K_{\text{Left}}} < \left.\frac{\partial \lambda_i^*}{\theta_i}\right|_{\pi^K_{\text{Right}}} \tag{4.6}$$

Finally, capital's power means that labor pass-through θ_i should also be positively associated with optimal stringency λ_i^* (eq. (2.50)). Straightforwardly, an increase in the power of capital under right parties will magnify the importance of labor pass-through:

$$\left.\frac{\partial \lambda_i^*}{\phi_i}\right|_{\pi^K_{\text{Left}}} < \left.\frac{\partial \lambda_i^*}{\phi_i}\right|_{\pi^K_{\text{Right}}} \tag{4.7}$$

I state these expectations as hypotheses in the next section. Note that in all three cases, the relationships are interactive. Party ideology does not affect sectoral stringency directly. Instead it indirectly raises or lowers stringency by raising or lowering the importance of other variables: emissions intensity, consumer pass-through, and labor-pass through.

The rest of this section describes three hypotheses about parties and sectors. These are based on a shared premise: parties will have different levels of sensitivity to the interests of different constituencies, and patterns of regulation will reflect these differences. Each hypothesis is specified as an interaction effect between the ideology of the national government and sectoral characteristics.

4.3.3 Hypotheses

Ideology and Emissions

As discussed above, the literature generally expects right parties to be less willing to apply stringent climate regulation because they are perceived as more friendly to business interests. But avoidance of climate regulation is more important for some businesses than others. Emissions-intense businesses, all else being equal,

have a stronger incentive to seek weaker climate regulation. So if right parties are more sympathetic to business concerns, then the effect of right government on climate policy should be strongest for emissions-intense sectors. This expectation is formalized in H4.1:[77]

Hypothesis 4.1 (Emissions Interaction Effect) *When right-wing parties govern, they will apply less stringent climate regulation to sectors with high emissions intensities.*

Ideology and Consumption

Along with a factoral effect, in chapter 3 I also found evidence for a consumption effect. The less firms can pass costs through to their consumers, the more pressure they will feel to oppose regulation in order to preserve profit margins. If right parties are more closely affiliated with producers than consumers, then they should provide relatively weaker regulation to sectors whose pass-through ability is limited.

Hypothesis 4.2 (Consumption Interaction Effect) *When right-wing parties govern, they will apply more stringent climate regulation to sectors which are able to pass costs through to their consumers.*

This hypothesis does not mean that right parties are unconcerned about impacts on consumers or that left parties are primarily focused on such impacts. But it does assume impacts on consumers affect left and right coalitions differently. If the left is more concerned with the impact on the poor, and the poor are disproportionately consumers of energy-intense goods, then one would ex-

[77] Each hypothesis is worded in terms of the effect of having a right-wing rather than a left-wing government, but the hypothesized effects are symmetrical and should apply with the reverse sign to left-wing governments.

pect left parties to be relatively more concerned with minimizing the impact on households.

Ideology and Factors of Production

As shown in chapter 3, there is substantial variation both within and between sectors in their relative labor and capital intensities. In that chapter, I also demonstrated that more capital-intense businesses receive lighter regulation, and more labor-intense businesses receive heavier regulation. I attributed this result to the greater power resources that capital-owners and investors have relative to the working class. But given my assumptions about factoral constituencies, I would also expect the effect of labor and capital intensity to vary depending on the party in power. If left parties are more sensitive to the concerns of labor constituencies than right parties are, this should be reflected in the relationship between labor intensity and government ideology:

Hypothesis 4.3 (Factor Interaction Effect) *When right-wing parties govern, they will apply more stringent climate regulation to sectors with high labor intensities.*

When left parties govern, I expect to see lighter regulation for labor-intense sectors. Symmetrically, when right parties govern I expect the burden on labor-intense sectors to be increased.[78] This effect can be interpreted as both ideological and strategic. It can be seen as an ideological effect, because left and right's ties to labor and capital can be seen as part of their underlying philosophical

[78]This contrasts with the approach of Mildenberger, who traces how the representation of labor interests in left parties and capital interests in right parties leads to a common privileging of producer interests. But where Mildenberger emphasizes similarity in producer representation across parties, I seek to explore how some producers may receive more favorable treatment from either left or right parties. See Matto Mildenberger. "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking". PhD Dissertation. Yale University, 2015.

commitments.[79] It can also be seen as strategic, as parties seek to economically strengthen groups they expect will support them in the future.[80]

4.4 Political Data

The new explanatory variable in this chapter is party ideology. To measure party ideology, I use data from the Manifesto Project.[81] As discussed earlier, the CMP is based on qualitative coding of the topics of individual sentences within party manifestos. The attention which party manifestos give to different topics is used to calculate their position on various issues.

I use the `rile` variable, which aggregates attention to a range of topics thought to be relevant to the left-right divide.[82]

This measure has several benefits. It is continuous: there are no arbitrary dividing lines between left, center, or right parties. It relies on a consistent set of criteria cross-nationally, focusing on policy issues rather than local party labels. This is especially useful when comparing countries from different regions of the world where the meaning of 'left' and 'right' may vary. It does not include a measure of environmentalism or party orientation towards climate change, so it is not endogenous to parties' environmental positions. Finally, it is commonly

[79] Jahn, "Conceptualizing Left and Right in comparative politics: Towards a deductive approach".

[80] Aklin and Urpelainen, "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions".

[81] Andrea Volkens et al. *The Manifesto Data Collection. Manifesto Project (MRG/CMP/MARPOR). Version 2016a.* Berlin: Wissenschaftszentrum Berlin für Sozialforschung, 2016.

[82] "Leftness" is based on positive references to anti-imperialism, peace, internationalism, democracy, market regulation, economic planning, protectionism, controlled economies, nationalization, welfare state expansion, education expansion, and labor groups, and negative references to the military. "Rightness" is based on positive references to the military, freedom and human rights, constitutionalism, political authority, free enterprise, incentives, economic orthodoxy, welfare state limitation, the national way of life, traditional morality, law and order, and social harmony, and negative references to protectionism. For the original measure, see M. J. Laver and Ian Budge. "Measuring Policy Distances and Modelling Coalition Formation". In: *Party Policy and Government Coalitions*. London: Palgrave Macmillan UK, 1992, pp. 15–40.

used in the literature on comparative environmental politics, making the results comparable to those of other authors.

The Manifesto Project data is available by party and election rather than by country and year. Seki and Williams[83] provide an annualized transformation of the manifesto data, which I employ, based on the parties in control of the executive and the lower house of the legislature in each year.[84] The right-left ideology variable for the executive and legislature or government are highly correlated (at 0.91). I report the measures for the government version of the variable, but the results are substantively the same if conducted with the executive variable instead.

For the sectoral characteristics I use the same variables as in chapter 3: for convenience I will briefly review them here. Emissions are measured by the logged tonnes of carbon dioxide emitted per dollar of output (recalling that all monetary variables are transformed using purchasing power parity). Consumption pass-through is measured using export intensity. Labor intensity is represented by the ratio of labor compensation to output. These data are all obtained from WIOD.[85]

In all models I include the same controls as in the previous chapter. To recall, these are sectoral emissions intensity, national emissions intensity, fossil fuel income per capita, annual GDP growth, GDP per capita, European Union membership, and a time trend. All of these variables except growth are consistently statistically significant.[86] I also add four new control variables not present in the previous chapter to represent the political environment in which policy-making is taking place: the presence of a green party in government, the number of veto

[83]Katsunori Seki and Laron K Williams. "Updating the Party Government data set". In: *Electoral Studies* 34 (2014), pp. 270–279.

[84]When different parties share control during a year, Seki and Williams weight their contribution to the annual variable based on the proportion of the year they were in power.

[85]Timmer et al., "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production".

[86]Excluding growth has no substantive impact on the results.

players, proportional representation, and federalism.

'Green' or 'ecological' parties are natural promoters of climate change action. Their seat share is generally small, but they have been present in governing coalitions in several countries. Rather than use a strict measure of seat share, which would be partly dependent on electoral institutions anyway, I include a binary measure of whether they are present in a country's cabinet.[87] The expectation is that their presence in the government should increase climate policy stringency. The data is drawn from ParlGov.[88][89]

Madden[90] finds that veto players are negatively associated with environmental policy creation. A system with more veto players provides more opportunities for entrenched interests to oppose new kinds of regulation. I expect a similar negative effect to apply to climate policy. My source for veto player coding is the "Checks & Balances" variable from the Database of Political Institutions (DPI).[91] The number of legislative chambers and the existence of a competitively elected chief executive increase the number of checks, but the number of parties in the

[87]Bernhagen and Neumayer use the same approach. See Patrick Bernhagen. "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies". In: *Global Environmental Politics* 8.1 (Feb. 2008), pp. 78–110; Eric Neumayer. "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries". In: *Ecological Economics* 45.2 (June 2003), pp. 203–220.

[88]Holger Döring and Philip Manow. *Parliaments and governments database (ParlGov): Information on parties, elections and cabinets in modern democracies*. 2016.

[89]There are three countries in my data that are not covered by ParlGov: the United States, South Korea, and Mexico. Green parties were not present in government during the study period in the U.S. or South Korea, so I fill these variables with a 0. Mexico is a somewhat unusual case, since many observers do not consider the "Ecological Green Party of Mexico" (PVEM) to be a true green party. One scholar labels it "a pseudo-environmentalist group that is more akin to a family business than a political organization" (Gustavo Flores-Macías. "Mexico's 2012 Elections: The Return of the PRI". in: *Journal of Democracy* 24.1 [2013], pp. 128–141, p. 131). They had limited participation in government during the study period, and so I run the models both including and excluding them as a green party. The results made no substantive difference; the reported models consider them not to be green.

[90]Madden, "Green means stop: veto players and their impact on climate-change policy outputs".

[91]Cesi Cruz et al. *The Database of Political Institutions 2017 (DPI2017)*. Tech. rep. Inter-American Development Bank, 2018.

governing coalition and their ideology relative to the dominant party can also increase the number of checks.[92]

The second institutional control is whether or not a country uses proportional representation to elect its legislature. By reducing the risk that voters who prefer smaller parties will waste their votes, proportional representation makes it easier for more parties to enter the legislature.[93] This could empower environmentalists, either allowing them to enter the legislature themselves or more credibly threaten existing parties with a challenge if they do not address environmental issues. To measure proportional representation, I use the binary `PR` variable from the DPI.[94][95]

The final institutional control is whether the country is federal or unitary. Federalism has the potential to both block and enable environmental ambition,[96] and which effect predominates has been the subject of much debate.[97] Some argue that federalism provides more avenues for minority interests to block action,[98] and

[92] A more detailed account of the procedure for generating the `CHECKS` variable is as follows. Countries without competitive elections have a value of 1 (only the executive is considered to wield a veto). In countries with competitive elections, the measure is increased by one for each of the following conditions: when the country has a chief executive, when that executive is competitively elected, and when a party opposed to that executive controls the legislature. In presidential systems, the measure is also increased by one for each chamber of the legislature (unless the president's party has a majority in the lower chamber and a closed-list system is in effect). In parliamentary systems, the variable is increased by one for every party in the governing coalition that is necessary to maintain a majority. If a closed rule system is in effect (that is, if amendments can only be made in committee and not in the legislature as a whole), the prime minister's party is not considered to be a separate check (because the executive is considered to control their own party). If there is a coalition government in either system, the number of checks is increased for each coalition partner whose ideology is closer to that of the main opposition party than it is to the executive's party.

[93] Torsten Persson et al. "Electoral Rules and Government Spending in Parliamentary Democracies". In: *Quarterly Journal of Political Science* 2.2 (2007), pp. 155–188.

[94] Cruz et al., *The Database of Political Institutions 2017 (DPI2017).*

[95] This variable is coded as 1 if "candidates are elected based on the percent of votes received by their party" or sources otherwise label the system as proportional. Non-competitive electoral systems are also coded as non-proportional.

[96] Wallace E. Oates. "A Reconsideration of Environmental Federalism". In: *Recent Advances in Environmental Economics.* New Horizons in Environmental Economics series. Edward Elgar, 2002.

[97] Daniel L. Millimet. "Environmental Federalism: A Survey of the Empirical Literature". In: *Case Western Reserve Law Review* 64.1669 (2014).

[98] William H Riker. *Federalism: Origin, Operation, Significance.* Boston: Little, Brown,

that trans-boundary environmental problems are more appropriately addressed at higher levels of government.[99] On the other hand, federalism can allow for sub-national policy ambition when the national government fails to act.[100] Fredriksson and Gaston[101] predict that federalism will have no impact on the overall level of environmental policy stringency, but that it shifts the burden of environmental policy towards labor. I include a binary measure of federalism from the DPI.[102][103]

The data on shadow prices and the main controls are the same as those in chapter 3. The results displayed are from multilevel mixed-effects linear regression, where the time-varying independent variables are lagged by one year. Summary statistics and correlations are displayed in table 4.1 and table 4.2.

4.5 Results

Country controls employed in chapter 3 behave similarly in the following regressions, and to preserve space they are not reported separately here. These include national emissions intensity, gross domestic product per capita, annual growth in gross domestic product, per capita fossil fuel income, and European Union membership.

The coefficients in the regression tables refer to standard deviations of the shadow price of energy use. In the accompanying descriptions, these coefficients

1964.

[99] Susan Rose-Ackerman. *Controlling environmental policy: The limits of public law in Germany and the United States*. Yale University Press, 1995.

[100] Rabe, "States on Steroids: The Intergovernmental Odyssey of American Climate Policy"; Lori M. Poloni-Staudinger. "Are consensus democracies more environmentally effective?" In: *Environmental Politics* 17.3 (2008), pp. 410–430; Elinor Ostrom. "A Polycentric Approach for Coping with Climate Change". In: *Annals of Economics and Finance* 15.1 (2014), pp. 97–134.

[101] Per G. Fredriksson and Noel Gaston. "Environmental Governance in Federal Systems : the Effects of Capital Competition and Lobby Groups". In: *Economic Inquiry* 38.3 (2000), pp. 501–514.

[102] Cruz et al., *The Database of Political Institutions 2017 (DPI2017)*.

[103] I use the `AUTHOR` variable, which is coded as 1 if "state/provinces have authority over taxing, spending, or legislating".

Table 4.1: Summary Statistics

	Mean	S.D.	Min	Max	Count
Shadow Price	.0063	.98	-2.7	6.2	3555
Right Govt. (CPDS)	-.047	1	-1	1.6	3159
Green Party in Gov.	.083	.28	0	1	3159
Veto Players	.031	.63	-1.1	2.5	3555
Proportional Rep.	.85	.36	0	1	3555
Federalism	.22	.42	0	1	3555
CO_2 Intensity	-.078	.93	-4.3	3.9	3555
Export Intensity	-.0046	.98	-.88	2.7	3555
Output	.2	.84	-3.4	2.6	3555
Nat. CO_2 Intensity	-.21	.79	-2.6	2.1	3555
GDP per Capita	.42	.61	-1	1.6	3555
GDP Growth	.0064	.67	-1.6	1.6	3555
Fossil Fuel Inc. P.C.	.097	1	-1.8	1.7	3555
E.U. Member	.59	.49	0	1	3555

are converted to a dollar value per ton of oil equivalent by multiplying the coefficients by \$319.24 / toe (the shadow price standard deviation). For more discussion of these units, see chapter 3.

4.5.1 Ideology and Emissions

Table 4.3 shows how party ideology affects sectoral shadow price strength. Model 1 shows the main effects of emissions intensity and right government on their own. Right government has a negative and statistically significant negative association with shadow prices. Models 2 and 3 add interactions between right-wing government and emissions intensity. In both cases the interaction term is negative and highly statistically significant. For a sector with emissions one standard deviation above the average, a one standard deviation difference in the right ideology of the government is associated with shadow prices that are lower by \$21/toe ($p<0.001$). When further political controls are added, the effect remains about the same at \$20/toe ($p<0.001$).

Table 4.2: Correlations

		1	2	3	4	5	6	7
1	Shadow Price	1.00						
2	Right% Gov.	0.00	1.00					
3	Green Party in Gov.	0.10	-0.15	1.00				
4	Veto Players	0.01	0.11	-0.12	1.00			
5	Proportional Rep.	0.22	0.06	0.11	0.07	1.00		
6	Federalism	-0.16	-0.04	0.12	0.05	-0.28	1.00	
7	CO_2 Intensity	-0.24	0.02	-0.01	0.02	-0.07	0.03	1.00
8	Export Intensity	-0.14	-0.05	-0.03	0.12	0.06	-0.04	0.05
9	Labor Intensity	0.20	-0.04	0.04	-0.01	-0.05	0.05	-0.19
10	Output	0.10	0.03	0.16	-0.08	-0.40	0.35	-0.15
11	Nat. CO_2 Intensity	-0.38	0.04	-0.08	0.03	0.15	-0.03	0.21
12	GDP per Capita	0.25	0.07	0.13	0.17	-0.33	0.34	-0.14
13	GDP Growth	-0.11	-0.11	0.05	0.13	0.04	-0.04	0.04
14	Fossil Fuel Inc. P.C.	-0.15	0.12	-0.17	0.28	-0.30	0.16	0.08
15	E.U. Member	0.40	-0.30	0.21	0.04	0.08	-0.10	-0.23

		8	9	10	11	12	13	14	15
8	Export Intensity	1.00							
9	Labor Intensity	-0.36	1.00						
10	Output	-0.34	0.13	1.00					
11	Nat. CO_2 Intensity	-0.04	-0.09	-0.34	1.00				
12	GDP per Capita	0.05	0.15	0.37	-0.71	1.00			
13	GDP Growth	-0.01	-0.00	-0.13	0.12	-0.10	1.00		
14	Fossil Fuel Inc. P.C.	-0.02	-0.00	0.07	0.31	-0.01	0.06	1.00	
15	E.U. Member	0.15	0.08	-0.02	-0.61	0.43	0.02	-0.27	1.00

Table 4.3: Party Ideology and Emissions Intensity

	(1)	(2)	(3)
CO_2 Intensity	-0.115***	-0.124***	-0.122***
	(0.0263)	(0.0247)	(0.0243)
Right % Gov.	-0.0347***	-0.0386***	-0.0120
	(0.00871)	(0.00875)	(0.00920)
CO_2 Intensity		-0.0654***	-0.0637***
× Right % Gov.		(0.00847)	(0.00884)
Output	0.243***	0.245***	0.264***
	(0.0505)	(0.0441)	(0.0457)
Green Party in Gov.			-0.0195
			(0.0331)
Veto Players			-0.0534**
			(0.0187)
Proportional Rep.			0.942***
			(0.271)
Federalism			-0.361
			(0.229)
Random Effect Variances			
Country	0.345**	0.328**	0.252**
	(0.118)	(0.110)	(0.0945)
Sector	0.436***	0.434***	0.450***
	(0.0239)	(0.0235)	(0.0254)
Year	0.120***	0.117***	0.113***
	(0.00350)	(0.00345)	(0.00335)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3026.94	2959.39	2728.92

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Having a green party in government has no statistically significant effect. The standardized number of veto players has a statistically significant negative association with shadow prices, consistent with the findings of.[104] The effect of proportional representation is strongly positive and statistically significant (at the $p < 0.01$ level). Federalism has a negative association with stringency whose magnitude is substantively large but whose confidence intervals are too wide for statistical significance. This suggests that the effect of federalism may not be especially consistent across countries.

4.5.2 Ideology and Consumption

To measure whether firms can pass on costs to their consumers, I again use the export intensity of a sectors' production. The results are displayed in table 4.4. As with the models in the previous section, the first model has only main effects, the second adds an interaction term, and the third adds further political controls. H4.3 predicts that sectors which have a greater ability to pass costs onto their consumers will receive lighter regulatory burdens from right-wing governments. As in chapter 3, the regressions use export intensity to represent pass-through potential.

In model 2, the interaction term is essentially 0 and not statistically significant. But in model 3, which adds more political controls, the relationship expected by H4.2 appears. In this model, when a right-wing government is in power a sector whose export intensity is one-standard deviation higher is expected to receive shadow prices that are lower by \$8/toe. This effect is statistically significant at the $p < 0.01$ level. While this result is less strong than that for emissions, it suggests that right governments pay at least some attention to protecting sectors

[104] Madden, "Green means stop: veto players and their impact on climate-change policy outputs".

Table 4.4: Party Ideology and Consumption

	(1)	(2)	(3)
Export Intensity	-0.125***	-0.125***	-0.123***
	(0.0209)	(0.0210)	(0.0232)
Right % Gov.	-0.0380***	-0.0375***	-0.00868
	(0.00890)	(0.00875)	(0.00938)
Export Intensity		0.000144	-0.0254**
× Right % Gov.		(0.00828)	(0.00856)
CO_2 Intensity	-0.114***	-0.115***	-0.119***
	(0.0247)	(0.0237)	(0.0265)
Output	0.167***	0.168***	0.181***
	(0.0456)	(0.0474)	(0.0513)
Green Party in Gov.			-0.0125
			(0.0342)
Veto Players			-0.0705***
			(0.0191)
Proportional Rep.			0.784**
			(0.293)
Federalism			-0.259
			(0.236)
Random Effect Variances			
Country	0.332**	0.331**	0.269**
	(0.110)	(0.112)	(0.0974)
Sector	0.404***	0.404***	0.421***
	(0.0225)	(0.0228)	(0.0239)
Year	0.121***	0.121***	0.116***
	(0.00360)	(0.00356)	(0.00344)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3058.71	3059.54	2804.88

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

from trade by shifting burdens from producers to consumers.

The political controls behave similarly to those in the previous regressions. Having more veto players is associated with weaker mitigation policy, and having proportional representation is associated with stronger policy. Green parties in government and federalism have no consistent association with stringency.

4.5.3 Ideology and Labor

H4.3 predicts that right parties will impose higher regulatory burdens than left parties on labor-intense sectors. The models in table 4.5 test this hypothesis. As discussed earlier, the measure of labor intensity used here is logged and standardized number of employees per unit of output.

As in chapter 3, labor intensity has a positive and statistically significant association with shadow price stringency across all three models. The term of interest here—the interaction between right-wing ideology and sectoral labor intensity—is also positive and statistically significant (at $p < 0.01$ in model 2 and $p < 0.001$ in model 3). Under a right-wing government, each standard deviation increase in a sector's labor intensity is associated with a shadow price that is higher by between \$10 and \$12/toe.

In the presence of the further controls, the main effect of right-wing ideology drops below standard thresholds for statistical significance. This suggests that the observed differences between left and right parties on climate change may be partially driven by differences in political institutions. That said, right parties seem relatively more willing to pass climate policy when the burden will be borne by labor rather than capital.

The main findings from these three previous sections are summarized graphically using a conditional marginal effects plot in fig. 4.1. This plot shows clearly how sectors receive weaker burdens from right governments as their emissions and

Table 4.5: Party Ideology and Compensation

	(1)	(2)	(3)
Labor Intensity	0.138***	0.137***	0.158***
	(0.0241)	(0.0240)	(0.0238)
Right % Gov.	-0.0367***	-0.0352***	-0.00662
	(0.00884)	(0.00869)	(0.00930)
Labor Intensity		0.0302**	0.0378***
× Right % Gov.		(0.00940)	(0.00973)
CO_2 Intensity	-0.0932***	-0.0957***	-0.0964***
	(0.0250)	(0.0241)	(0.0270)
Output	0.254***	0.255***	0.272***
	(0.0430)	(0.0461)	(0.0486)
Green Party in Gov.			-0.0206
			(0.0339)
Veto Players			-0.0658***
			(0.0188)
Proportional Rep.			0.837**
			(0.281)
Federalism			-0.305
			(0.230)
Random Effect Variances			
Country	0.337**	0.336**	0.250**
	(0.112)	(0.114)	(0.0915)
Sector	0.419***	0.419***	0.433***
	(0.0229)	(0.0232)	(0.0241)
Year	0.120***	0.119***	0.114***
	(0.00353)	(0.00350)	(0.00338)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3024.65	3012.58	2764.00

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

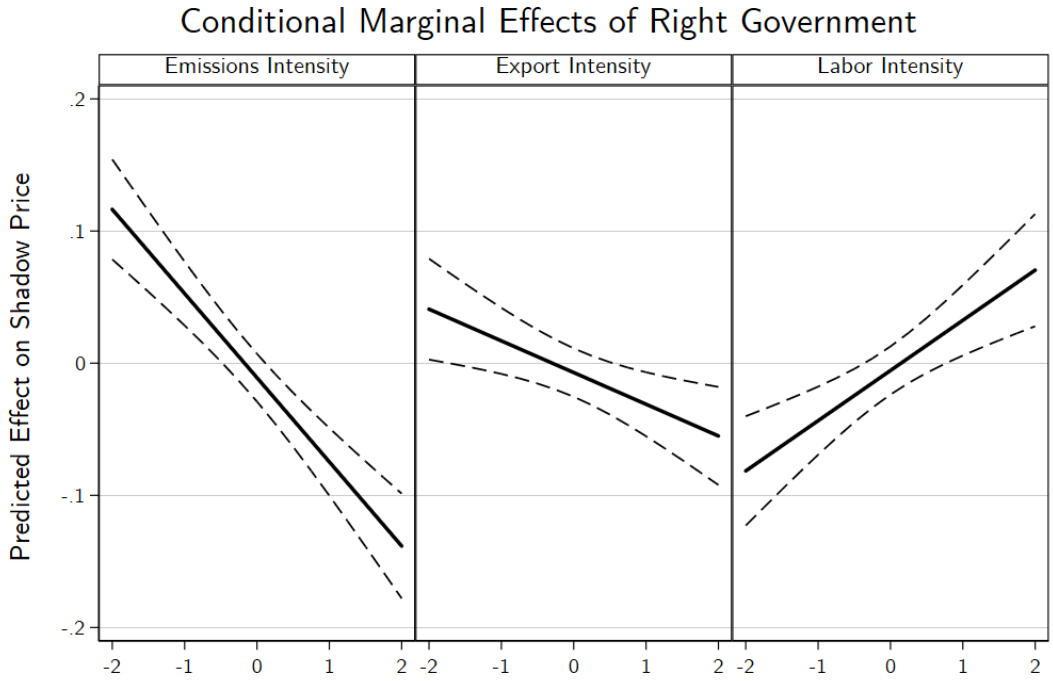


Figure 4.1: **Marginal effects of right-wing government, conditional on emissions, export, and labor intensity.** 95% confidence intervals.

exports rise, but also how right governments give higher burdens to labor-intense sectors.

4.6 Proportional Representation

Proportional representation (PR) has a large and statistically significant effect in all the models where it is included. Though it was initially included as a control variable, its consistent importance in the models raises a question: to what extent might the ideology effects observed here differ in PR and non-PR settings?

The focus of this chapter has been on the difference between right- and left-wing parties. There is a general consensus in the literature that right-wing parties have an advantage in majoritarian systems and a disadvantage in proportional ones.[105] There are several potential reasons for this. The preferences of the

[105]Holger Döring and Philip Manow. "Is Proportional Representation More Favourable to

middle class are more likely to be decisive in majoritarian electoral systems, empowering the right-wing parties that they trust not to tax them.[106] Since left-wing supporters tend to cluster more in cities, left parties waste more votes when electing representatives by district.[107]

A weaker electoral position may shift the environmental policymaking strategies that right parties employ. Proportional representation is thought to empower the median voter:[108] insofar as the median voter has less capital wealth than a rich voter, right parties may be pulled to be less capital-focused under PR. Schreurs and Tiberghien[109] explain the European Union's relatively high level of environmental prioritization on the predominance of PR in its member states. They also note that after Japan switched to a PR system for electing some seats in the 1990s, parties catered more to urban voters and NGOs, including environmental groups.

I thus perform several robustness checks for the results in this chapter by interacting government ideology with whether a country as a PR system or not. The checks for emissions intensity are displayed in table 4.6, for export intensity in table 4.7, and for labor intensity in table 4.8.[110]

In all models, I interact proportional representation with right-wing government to see if doing so diminishes the main effects of emissions intensity, export intensity, and labor intensity. These effects do not diminish, remaining substan-

the Left? Electoral Rules and Their Impact on Elections, Parliaments and the Formation of Cabinets". In: *British Journal of Political Science* 47.1 (2015), pp. 149–164.

[106]Torben Iversen and David Soskice. "Electoral Institutions and the Politics of Coalitions: Why Some Democracies Redistribute More than Others". In: *The American Political Science Review* 100.2 (2006), pp. 165–181.

[107]Jonathan Rodden. "The Geographic Distribution of Political Preferences". In: *Annual Review of Political Science* 13 (2010), pp. 321–40.

[108]Harrison and Sundstrom, "The Comparative Politics of Climate Change".

[109]Miranda A Schreurs and Yves Tiberghien. "Multi-level Reinforcement: Explaining European Union Leadership in Climate Change Mitigation". In: *Global Environmental Politics* 7.4 (2007).

[110]To make room for the interactions, the results for the country controls, sector controls, and political controls are collapsed. Their behavior is similar to that in the previous models.

Table 4.6: Proportional Representation, Ideology, and Emissions

	(1)	(2)	(3)
CO_2 Intensity	-0.117***	-0.130***	0.240**
	(0.0244)	(0.0262)	(0.0855)
Right % Gov.	-0.173***	-0.170***	-0.137***
	(0.0203)	(0.0202)	(0.0212)
Proportional Representation	0.969***	0.577*	0.607
	(0.289)	(0.259)	(0.371)
Proportional Representation	0.203***	0.195***	0.160***
× Right % Gov.	(0.0223)	(0.0220)	(0.0229)
CO_2 Intensity		-0.0598***	-0.0323
× Right % Gov.		(0.00867)	(0.0241)
Proportional Representation			-0.404***
× Emissions Intensity			(0.0876)
Proportional Representation			-0.0292
× Emissions Intensity × Right % Gov.			(0.0257)
Random Effect Variances			
Country	0.289**	0.257**	0.292*
	(0.111)	(0.0918)	(0.119)
Sector	0.454***	0.452***	0.458***
	(0.0257)	(0.0249)	(0.0258)
Year	0.111***	0.109***	0.108***
	(0.00330)	(0.00323)	(0.00328)
Time Indicators	Yes	Yes	Yes
Controls	Yes	Yes	Yes
N	3027	3027	3027
DIC	2679.95	2626.43	2586.65

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.7: Proportional Representation, Ideology, and Consumption

	(1)	(2)	(3)
Export Intensity	-0.122***	-0.125***	-0.0877
	(0.0233)	(0.0210)	(0.0606)
Right % Gov.	-0.177***	-0.177***	-0.177***
	(0.0205)	(0.0207)	(0.0202)
Proportional Representation	0.652**	0.639	0.804**
	(0.221)	(0.385)	(0.254)
Proportional Representation	0.205***	0.207***	0.207***
× Right % Gov.	(0.0226)	(0.0225)	(0.0224)
Export Intensity		-0.0263**	0.00679
× Right % Gov.		(0.00832)	(0.0197)
Proportional Representation			-0.0405
× Export Intensity			(0.0634)
PR × Right % Gov.			-0.0399
× Export Intensity			(0.0218)
Random Effect Variances			
Country	0.278**	0.279**	0.302*
	(0.0994)	(0.104)	(0.125)
Sector	0.422***	0.424***	0.422***
	(0.0238)	(0.0237)	(0.0242)
Year	0.112***	0.112***	0.112***
	(0.00333)	(0.00342)	(0.00337)
Time Indicators	Yes	Yes	Yes
Controls	Yes	Yes	Yes
N	3027	3027	3027
DIC	2705.03	2691.77	2690.68

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.8: Proportional Representation, Ideology, and Compensation

	(1)	(2)	(3)
Labor Intensity	0.156***	0.158***	-0.0218
	(0.0235)	(0.0247)	(0.0785)
Right % Gov.	-0.173***	-0.174***	-0.174***
	(0.0203)	(0.0205)	(0.0201)
Proportional Representation	0.722***	0.697	0.840***
	(0.212)	(0.370)	(0.246)
Proportional Representation	0.202***	0.205***	0.207***
× Right % Gov.	(0.0224)	(0.0223)	(0.0223)
Labor Intensity		0.0400***	-0.0212
× Right % Gov.		(0.00948)	(0.0238)
Proportional Representation			0.194*
× Labor Intensity			(0.0853)
PR × Right % Gov.			0.0720**
× Labor Intensity			(0.0260)
Random Effect Variances			
Country	0.254**	0.257**	0.278*
	(0.0917)	(0.0973)	(0.118)
Sector	0.435***	0.437***	0.432***
	(0.0242)	(0.0240)	(0.0245)
Year	0.111***	0.110***	0.110***
	(0.00328)	(0.00336)	(0.00330)
Time Indicators	Yes	Yes	Yes
Controls	Yes	Yes	Yes
N	3027	3027	3027
DIC	2672.61	2650.29	2643.31

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

tively and statistically significant in their expected directions. In all but one of the models (the second in table 4.7), proportional representation continues to have a substantively large and statistically significant association with shadow prices.

In all of these models, the main effect of right-wing government has a statistically significant negative association with the shadow price, but a statistically significant positive association under proportional representation. These negative and positive effects are roughly similar in size (though the interaction is a little larger). That is, right-wing governments impose weaker shadow prices across the economy in majoritarian countries than left-wing governments, but this difference narrows and possibly disappears in PR countries. This suggests that the "uphill battle" faced by right-wing parties in PR countries may indeed change their climate strategies.

In the second column of each table, I add in the two-way interactions from earlier in the chapter between right-wing government and (in turn) emissions, export, and labor intensity. These interactions are all statistically significant and have their expected signs. In these second columns, right-wing governments provide weaker regulation to emissions-intense and export-intense sectors, and impose stronger regulation on labor-intense sectors.

In the third model of each table, I add a three-way interaction between proportional representation, government ideology, and the emissions, export, and labor intensities. The models in columns 1 and 2 only tested whether right-parties made different climate policy decisions across the whole economy in PR countries. This three-way interaction helps to test whether right parties make different *distributive* decisions under PR. In tables table 4.6 and table 4.7, these interactions are not statistically significant. The relationship between party ideology and both emissions and export intensities does not appear to depend on

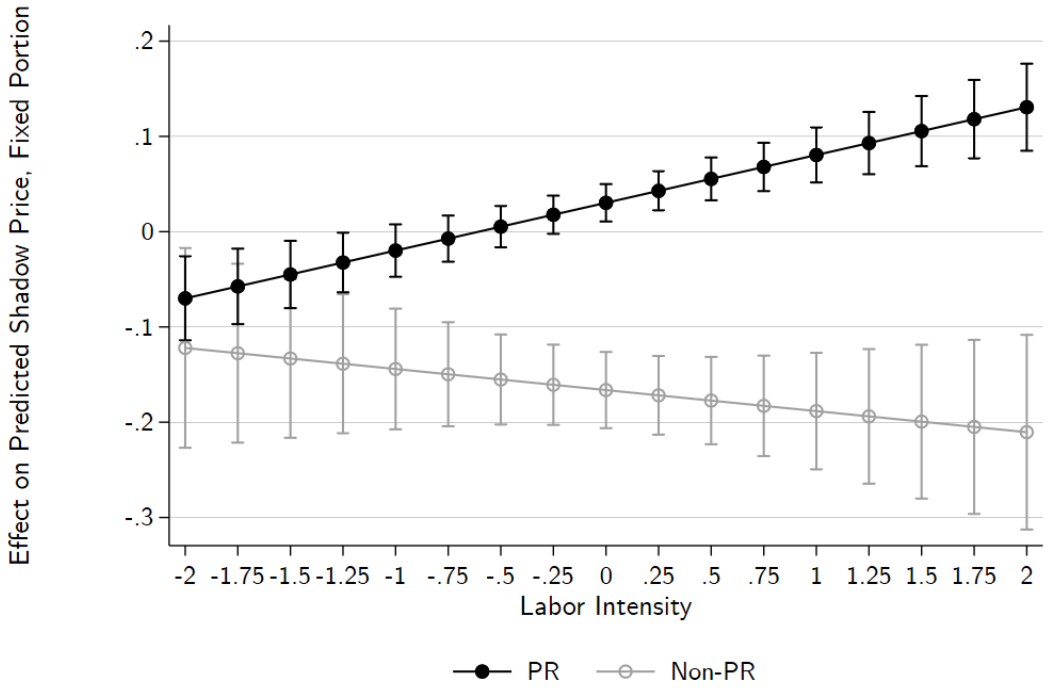


Figure 4.2: **Conditional Marginal Effects of Right-Wing Government on Predicted Shadow Prices**. 95% confidence intervals.

the presence or absence of proportional representation.

A different result is observed in table 4.8, where proportional representation is interacted with right-wing government and labor intensity. This three-way interaction is positive and statistically significant (at the $p < 0.01$ level). The interaction between PR and labor intensity is also positive and statistically significant (at the $p < 0.05$ level). The original interaction between labor intensity and right-wing government, however, is now statistically insignificant.

A marginal effects plot, displayed in fig. 4.2 can help illustrate these results more clearly. The lines represent the conditional marginal effects of having a right-wing government on predicted shadow prices for sectors with different levels of labor-intensity. Note that the confidence intervals of the gray line (which denotes non-PR countries) always overlap indicating that in non-PR countries right-wing parties give sectors similar levels of regulatory stringency regardless of their labor

intensity. On the black line (which represents PR countries), right-wing parties are predicted to give labor-intense sectors significantly higher levels of policy stringency.

How should these results for labor intensity be interpreted? The insignificance of the labor-right government interaction seems at first to challenge the theory presented earlier in the chapter. But taken together with the rest of the coefficients, the results still support the idea that right parties favor capital over labor, but this favoritism takes different forms in PR and non-PR settings.

When PR is absent, right parties can help capital simply by imposing weaker climate policy across all sectors (hence the statistically significant negative coefficient on right government's main effect). Because they are imposing a weaker climate policy burden overall, possibly by weakening policy from previous governments, there are fewer costs to shift from capital to other groups. When PR is present, however, right parties seem to impose a similar average policy burden as left parties (perhaps driven by stiffer competition for the votes of greens or middle class citizens). But they do not distribute this burden evenly. Insofar as climate policy costs are now higher, the need to protect capital becomes commensurately higher as well. Therefore right parties have a stronger incentive to shift costs to labor under PR.

The initial theory that right parties favor capital, and that this preference is reflected in their climate policy choices, is still supported. But this cost-shifting appears to be conditional on being in a PR setting (and therefore having more incentives to strengthen climate policy generally).

4.7 Conclusion

The results of the empirical analyses in this chapter provide new insight into old questions about the roles of parties in environmental policymaking. They also suggest other areas of research that might be fruitful.

The existing literature on parties and the environment has been conflicted. A widening gap has opened between the theoretical expectation that left parties should be more green than right parties and the empirical evidence for this proposition. The findings here help bridge this gap, by moving away from focusing on whether parties matter, to looking at when they matter.

I provide a novel explanation for why party effects have been hard to pin down: party behavior is contingent on sector-level constituency effects that had not yet been studied in depth. This challenges the approach taken by the existing literature, by showing how a full account of party effects is not possible at the national level alone.

When interacted with relevant constituencies—labor intensity, average compensation, and export intensity—the main effect of right-wing ideology diminishes into insignificance. This suggests that part of right parties' weak reputation on environmental issues is driven by the sector-level factors that this dissertation highlights.

The shadow price approach employed here may not capture all the important differences between political parties on climate. For example, right parties may be more inclined to use market mechanisms to implement mitigation standards than left parties. Parties might have different approaches to international environmental commitments. Parties might still vary in their response to non-climate environmental issues, or to the subject of adaptation. Future work should examine whether sectoral constituencies affect the nature of parties' climate policy

choices on dimensions beyond stringency.

Another potentially important extension would be to examine the behavior of individual legislators. In countries where legislators represent specific geographical districts, it is possible to gather data on the sectoral mix present in individual constituencies. These data could be used to test the influence of home-district industries on climate policy voting. Similarly, countries that make campaign finance data available in a form that can be matched to industry type could be used for similar purposes. The influence of sectors need not occur only at the level of the whole country: country-level sector influence may be matched or even outweighed by district-level influence.

In addition to examining policy-based variables, the determinants of political climate discourse also deserve more attention. New methods of text analysis make it possible to pick out patterns and trends from large numbers of documents. As climate change and its mitigation is now a prominent issue in legislative discussions and the media, the literature ought to explore whether there are sectoral dimensions to this discourse. For example, when opponents of mitigation speak of economic risks, which industries do they focus on? Are the costs of regulation framed in terms of lost jobs, lost investments, or rising prices? Similarly, for advocates of mitigation, what sectors do they frame as benefiting from proposed policy? While the sectoral data already at our disposal gives insight into the interests at stake in mitigation debates, a focus on actual discourse would enrich our understanding of these interests. It would also provide a further test of the hypotheses advanced here, by seeing whether the predicted concerns of different parties are reflected in their public statements.

Parties in the same ideological family may differ considerably. The willingness of the CDU in Germany to adopt mitigation policy does not mean the Republican Party in the United States will do so. More work remains to be done to pick apart

the relationship of parties with ostensibly similar ideologies to different sectoral constituencies. Beyond tracking their general ideology, I have not dealt with the role of individual leaders, who have often played a crucial role in advancing particular climate policies. In other words, there remain many party-related factors that ought to be examined alongside sectoral factors in order to explain climate outcomes.

This chapter does, however, provide validation of this dissertation's core assertion that climate politics are distributive politics. Though my theory in chapter 2 was based on distributive conflict among interest groups, my analysis in chapter 3 offered no evidence that the relationships observed were determined by policymakers responding to those groups. By showing how sector-level policy stringency is affected by party ideology, the results here provide evidence for this proposition.

Chapter 5

Mitigating Mitigation: The Role of Protection and Coordination

> "We only have this one earth, not several of them. We should all be aware of that. There is no contradiction between a reduction of CO_2 and secure jobs. They both go together."
>
> Uwe Hück
> Chairman of the Central Works Council, Porsche[1]

> "[I]t is difficult for progressive unionists to put climate change on their unions' agenda when workers say, 'I will die quicker from not having a job than from climate change."'
>
> Dimitris Stevis, David Uzzell, Nora Räthzel[2]

5.1 Introduction

Climate policy does not exist in a vacuum. It always sits in a wider context of non-climate policy regimes, which have the potential to change where the

[2]IG Metall. *IG Metall's demands with regard to European regulation of CO2 levels for cars for the period after 2020.* Tech. rep. 2014.

[2]Dimitris Stevis et al. "The labour-nature relationship: varieties of labour environmentalism". In: *Globalizations* 15.4 (2018), pp. 439–453.

burden of mitigation policy ultimately falls. This is especially true for policies affecting redistribution, social protection, and state-market coordination, which may intensify or ameliorate the costs of mitigation. The purpose of this chapter is to ask how these broader political economy arrangements affect the targeting of climate policy.

Previous literature has already examined how political economy institutions shape countries' environmental performance. But the focus has generally been on levels of pollution across the economy as a whole, and not on the distribution of policy burdens within the economy. Accounts of the role that factors like corporatism, union strength, and welfare policies play in climate politics are incomplete without examining how they affect burden allocations among different economic groups.

In this chapter I look at how the protective and coordinating elements in the state-market relationship affect the allocation of climate policy burdens between labor and capital. There are too broad possibilities suggested by the political economy literature. I briefly summarize them here, before discussing them in more detail below. The first is that there is an antagonistic relationship between protective, coordinating arrangements and climate policy, as such arrangements indicate stronger interest groups better able to block robust climate action. The second is that there is a complementary relationship, in which protection and coordination help insulate groups from the full burden of climate policy, reducing their opposition to mitigation.

I will present evidence that the second relationship dominates, with the result that more institutions of protection and coordination mean more burden is assigned to labor-intense, dirty sectors. The findings are based on three components of labor coordination and protection: institutions, organizations, and policies. To track these concepts, I use data on corporatism, varieties of capi-

talism, union density, union centralization, employment protection, active labor market programs, and general redistribution. Collectively, these data support the hypothesis that labor bears more of the burden of climate policy when this burden can be softened by other protective arrangements.

This chapter will be structured as follows. First, I survey how the wider political economy context has been incorporated into the study of climate politics so far. Second, I modify the expectations of this literature to focus on distributional factors. Third, I describe my empirical strategy and data. Fourth, I discuss the results, with a special focus on three-way interactions between protective arrangements, emissions intensity, and factor intensity. Fourth, I conclude with a discussion of what the findings mean for efforts to promote climate policy is non-coordinated economies, as well as other ways my argument could be tested in future work.

5.2 Coordination, Protection, and the Climate Policy Literature

The environment is a relatively new subject for state concern, having only come to prominence in the 1960s and 1970s. Climate change is even newer, with concerted interest among politicians and the public only developing in the 1990s. This newness means that climate politics has always been situated within earlier institutions and policies. In the words of Duit et al.,[3] "the new environmental mandates and programmes were 'layered' on top of pre-existing societal arrangements, creating tensions with more deeply embedded state imperatives." These pre-existing political economy arrangements and their effect on climate policy are my focus below.

[3]Duit et al., "Greening Leviathan: the rise of the environmental state?"

Differences in national political economy arrangements have not been fully incorporated into the study of climate politics.[4] Purdon[5] identifies "variation in the relationship between the state, markets, and society" as one of the three main "[c]omparative politics themes that continue to have underexplored links to climate change and broader environmental issues". Similarly, in their discussion of environmental political economy and climate change, Mikler and Harrison[6] note the "surprising dearth of scholarship from a comparative political economy perspective" and claim that "the relevance of the vast comparative capitalism literature has remained largely unchartered waters." These concerns dovetail with the argument of Steinberg and VanDeveer[7] that environmental politics generally has not drawn enough on the methods and knowledge of comparative politics.

In spite of these criticisms, a cursory review of the extant literature on environmental and climate politics will find no shortage of books and articles incorporating comparative political economy elements. So why are scholars like Meadowcroft, Purdon, Mikler, Harrison, and Steinberg unsatisfied? The problem is that while comparative political economy themes are not unknown in the environmental politics literature, there remain persistent gaps. For my purposes, the most notable such gap is the relative lack of attention to how political economy arrangements affect the distributive calculations involved in making climate policy. A further issue is that most work at the intersection of political economy and the environment focuses on performance or instrument choice, and not on policy stringency.

[4]Purdon, "Advancing Comparative Climate Change Politics: Theory and Method"; John Mikler and Neil Harrison. "Varieties of Capitalism and Technological Innovation for Climate Change Mitigation". In: *New Political Economy* 17.2 (2012), pp. 179–208; Steinberg and VanDeveer, *Comparative Environmental Politics: Theory, Practice, and Prospects*.

[5]Purdon, "Advancing Comparative Climate Change Politics: Theory and Method".

[6]Mikler and Harrison, "Varieties of Capitalism and Technological Innovation for Climate Change Mitigation".

[7]Steinberg and VanDeveer, *Comparative Environmental Politics: Theory, Practice, and Prospects*.

In the following section, I will review this literature with these issues in mind. When environmental and climate studies have drawn on comparative political economy, it has usually been woven into one of three strands of work. The first strand focuses on broad differences in political economy institutions, starting with the literature on corporatism and pluralism in the 1990s and early 2000s, and shifting to the varieties of capitalism approach in the 2000s and 2010s. The second strand investigates the role that labor unions play in supporting or opposing climate policy. The third strand examines the role of economic protections and social policies.

5.2.1 Coordinating Institutions: Are Environmental Interests Being Included?

There is a long tradition of dividing state-market relationships in capitalist countries into two or more camps. Early work on economic institutions and the environment focused on the differences between corporatist and pluralist countries,[8] while more recent work has tended to rely on the varieties of capitalism framework.[9] Though the concepts are distinct, they both tell us something important about whether labor has institutionalized access to state decisions.

Crepaz[10] defines corporatism as "a system of interest representation in which a small number of strategic actors (usually representatives of capital and labour), organised in peak associations, represent large parts of the population in an encompassing fashion." There are several reasons one might expect corporatist systems to provide stronger environmental protections than pluralist ones. In-

[8]Philippe C Schmitter. *Still the Century of Corporatism?* Tech. rep. 1. 1974, pp. 85–131; Arend Lijphart. *Patterns of Democracy: Government Forms and Performance in Thirty Six Countries*. New Haven: Yale University Press, 1999.

[9]Peter A. Hall and David Soskice. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press, 2001.

[10]Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making".

clusive peak organizations incentivize advocating for national rather than particularistic interests,[11] and pursuit of consensus makes it easier for new kinds of interests to gain access.[12] Repeated interaction builds trust, making monitoring and information-sharing easier.[13] The willingness of corporatist governments to intervene in the economy means they are more likely to "compensate losers," and firms are readier to accept negotiated solutions to forestall stronger regulation later.[14]

Despite these advantages, corporatism may not be inherently better for the environment than pluralism.[15] By formally entrenching the power of a few peak organizations, they may make it more difficult for non-traditional interests to gain access.[16] If they do gain access, guaranteed inclusion may ultimately undermine the environmental movement by removing the need to build membership or public consciousness.[17] Critics of corporatism also argue that it enshrines a "materialist logic of economic growth" that is incompatible with a "postmaterialism that favors ecological concerns" (these views are summarized but not endorsed by Crepaz[18]).

[11]Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making"; Scruggs, "Institutions and Environmental Performance in Seventeen Western Democracies".

[12]Martin Jänicke. "Conditions for Environmental Policy Success: An International Comparison". In: *The Environmentalist* 12.1 (1992), pp. 47–58.

[13]Jenny Stewart. "Corporatism, Pluralism and Political Learning: A Systems Approach". In: *Journal of Public Policy* 12.03 (July 1992), p. 243; Bernhagen, "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies".

[14]Scruggs, "Institutions and Environmental Performance in Seventeen Western Democracies".

[15]Janne Hukkinen. "Corporatism as an impediment to ecological sustenance: the case of Finnish waste management". In: *Ecological Economics* 15.1 (Oct. 1995), pp. 59–75; Neumayer, "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries".

[16]Hukkinen, "Corporatism as an impediment to ecological sustenance: the case of Finnish waste management"; Christian Hunold and John S Dryzek. "Green Political Theory and the State: Context is Everything". In: *Global Environmental Politics* 2.3 (2002), pp. 17–39.

[17]Hunold and Dryzek, "Green Political Theory and the State: Context is Everything".

[18]Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making".

Early studies based on an expert survey by Lijphart and Crepaz[19] found positive relationships between corporatism and environmental performance,[20] including carbon dioxide reductions.[21] Using a more theoretically-grounded index by Siaroff,[22] however, Neumayer[23] finds no consistent relationship between corporatism and pollution. Bernhagen[24] finds some evidence of a relationship between corporatism and greenhouse gas reductions, but it is sensitive to controls for the size of green groups and unions, suggesting the effect of corporatism may be dependent on other factors.

Since the early 2000s, corporatism and pluralism have been largely supplanted by another categorization scheme known as "varieties of capitalism" that distinguishes between liberal market economies (LMEs) and coordinated market economies (CMEs).[25] LMEs are characterized by competition in labor markets, employment bargaining at the firm-level, and a hands-off approach by government to economic regulation. CMEs involve power-sharing in firms between labor and management, collective bargaining across industries, and higher levels of government involvement in the economy. CMEs are expected to treat the environment better "principally because of the cooperative pattern of relations between states and business, which enables the state to coordinate policy and transform the interests and practices of business".[26]

[19] Arend Lijphart and Markus M.L. Crepaz. "Corporatism and Consensus Democracy in Eighteen Countries: Conceptual and Empirical Linkages". In: *British Journal of Political Science* 21.2 (Apr. 1991), pp. 235–246.

[20] Jänicke, "Conditions for Environmental Policy Success: An International Comparison"; Scruggs, "Institutions and Environmental Performance in Seventeen Western Democracies".

[21] Crepaz, "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-Making".

[22] Alan Siaroff. "Corporatism in 24 industrial democracies: Meaning and measurement". In: *European Journal of Political Research* 36 (1999), pp. 175–205.

[23] Neumayer, "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries".

[24] Bernhagen, "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies".

[25] Hall and Soskice, *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*.

[26] Erick Lachapelle et al. "The political economy of decarbonisation: from green energy 'race'

There is growing evidence that coordinated market economies are indeed doing more about climate change, especially in the area of renewable energy. Coordinated market economies appear to be better at both developing and deploying renewable energy than liberal market economies.[27] But the evidence is not all straightforward. LMEs provide more funding for research and development,[28] while CMES are surprisingly more likely to implement the kind of "market-based" mitigation policies one would expect to see in LMEs.[29] In federal countries like the U.S. (which often stands in for LMEs), national inaction may conceal subnational ambition.[30] Lachapelle et al.[31] conclude that "the standard analytical traditions in political economy struggle to make sense of the patterns we see."

5.2.2 Unions: "Swords of Justice" or "Vested Interests"?

The second strand of literature concerns the relationship between labor unions and environmental policy. Unions are "caught" between representing the narrow interests of their members and advocating for a wider community beyond the workplace.[32] The principle of "social unionism" holds that unions have a responsibility to represent the interests of the working class and society at large.[33] While the present interests of members can hardly be ignored, the idea of being

to green 'division of labour'". In: *New Political Economy* 22.3 (2017), pp. 311–327.

[27]Mikler and Harrison, "Varieties of Capitalism and Technological Innovation for Climate Change Mitigation"; Stefan Ćetković and Aron Buzogány. "Varieties of capitalism and clean energy transitions in the European Union: When renewable energy hits different economic logics". In: *Climate Policy* 16.5 (2016), pp. 642–657.

[28]Lachapelle and Paterson, "Drivers of national climate policy".

[29]Lachapelle and Paterson, "Drivers of national climate policy"; Robert MacNeil. "Death and Environmental Taxes: Why Market Environmentalism Fails in Liberal Market Economies". In: *Global Environmental Politics* 16.1 (2016), pp. 21–37.

[30]Barry G. Rabe. *Statehouse and Greenhouse*. Brookings Institution Press, 2004.

[31]Lachapelle et al., "The political economy of decarbonisation: from green energy 'race' to green 'division of labour'", p. 324.

[32]Darryn Snell and Peter Fairbrother. "Toward a Theory of Union Environmental Politics: Unions and Climate Action in Australia". In: *Labor Studies Journal* 36.1 (2011), pp. 83–103.

[33]Derek Hrynyshyn and Stephanie Ross. "Canadian Autoworkers, the Climate Crisis, and the Contradictions of Social Unionism". In: *Labor Studies Journal* 36.1 (2011), pp. 5–36.

a "sword of justice" instead of another "vested interest" has long been important to their self-conception and messaging..[34] Yet at the dawn of the green movement in the 1960s, many trade unionists were skeptical, seeing the environment either as a luxury for the rich or a source of resources to be exploited.[35]

Though this internal conflict is longstanding, climate change presents a new and pressing arena in which it plays out, simultaneously threatening jobs in some industries while also threatening broader social well-being. Unions might oppose mitigation policy if they see it as endangering members' livelihoods. This seems particularly likely for unions whose members are directly involved in fossil fuel extraction and carbon-intense production. As Bernauer and Koubi[36] note, "[i]n many countries worldwide labor unions have in the past often been vocal opponents, for instance, of closures or modernization of pollution intensive traditional industries." On the other hand, unions might support climate change action if they are committed to a social unionist vision of their role and see mitigation as important for humanity's future. Workers are not exempt from the harmful consequence of climate change. Furthermore, some unions might see material benefits for their members in climate change policy action.

Compared to the literature on political economy institutions and firm strategies on climate change, the relationship between labor and the environment has received "limited attention".[37] Räthzel and Uzzell[38] argues that this reflects a gap in two fields: "[e]nvironmental studies have largely ignored labour issues, while

[34]Allan D. Flanders. *Management and unions: the theory and reform of industrial relations,* London: Faber, 1970, p. 317, p. 15-16.

[35]Victor Silverman. "Sustainable Alliances: The Origins of International Labor Environmentalism". In: *International Labor and Working-Class History* 66 (2004), pp. 118–135, p. 120.

[36]Thomas Bernauer and Vally Koubi. "Effects of Political Institutions on Air Quality". In: *Ecological Economics* 68.5 (Jan. 2009), pp. 1355–1365.

[37]Dimitris Stevis and Romain Felli. "Global labour unions and just transition to a green economy". In: *International Environmental Agreements* 15 (2015), pp. 29–43.

[38]Nora Räthzel and David Uzzell. "Trade unions and climate change: The jobs versus environment dilemma". In: *Global Environmental Change* 21 (2011), pp. 1215–1223, p. 1215.

labour studies have paid little attention to climate change issues." The analysis of social unionism in Hyman[39] makes no mention of environmental concern, and the account of labor environmentalism in Silverman[40] does not include climate change. The situation has improved somewhat in recent years, as the field of "environmental labour studies" has grown.[41]

There is a growing literature documenting unions adopting proactive stances on climate change mitigation and forming alliances with green groups.[42] Many unions advocate for a "just transition" that moves away from fossil fuels while still protecting jobs.[43] Many union officials in both developed and developing countries see their members' interests as compatible with climate change mitigation, though the degree to which they do see a conflict varies by union and sector.[44] Bernhagen[45] finds that countries with higher proportions of workers covered by collective bargaining also have lower greenhouse gas emissions.

But these trends do not indicate that all unions are committed to fighting climate change; Stevis et al.[46] cautions scholars to study the issue "without assuming that social unions are a priori socially just or care for the way in which nature

[39]Richard Hyman. *Understanding European trade unionism: Between market, class and society*. London: Sage Publications, 2001, p. 196.

[40]Silverman, "Sustainable Alliances: The Origins of International Labor Environmentalism".

[41]Nora Räthzel and David L. Uzzell. *Trade unions in the green economy : working for the environment*. Routledge, 2013, p. 266.

[42]Räthzel and Uzzell, "Trade unions and climate change: The jobs versus environment dilemma"; Nora Räthzel and David L. Uzzell. *Trade unions in the green economy : working for the environment*. Routledge, 2012, p. 266; Thomas Farnhill. "The Characteristics of UK Unions' Environmental Activism and the Agenda's Utility as a Vehicle for Union Renewal". In: *Global Labour Journal* 7.3 (2016), pp. 257–278; Paul Hampton. "Trade unions and climate politics: prisoners of neoliberalism or swords of climate justice?" In: *Globalizations* 15.4 (2018), pp. 470–486.

[43]Stevis and Felli, "Global labour unions and just transition to a green economy"; Darryn Snell. "'Just transition'? Conceptual challenges meet stark reality in a 'transitioning' coal region in Australia". In: *Globalizations* 15.4 (June 2018), pp. 550–564.

[44]Räthzel and Uzzell, "Trade unions and climate change: The jobs versus environment dilemma".

[45]Bernhagen, "Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies".

[46]Stevis et al., "The labour-nature relationship: varieties of labour environmentalism".

is used and abused." Unions have been on both sides of the fight over climate change policy in the United States, from the Lieberman-Warner cap-and-trade bill[47] to Obama's Clean Power Plan.[48] Nor is opposition confined to unions in pluralist countries. While most unions supported Germany's Renewable Energy Law, the Mining, Chemical, and Energy Industrial Union (IG BCE) opposed it.[49] The Norwegian Confederation of Trade Unions (LO) actually allied with the Confederation of Norwegian Enterprise (NHO) to promote carbon-intensive electricity generation.[50]

So what do we know after a decade of rising interest in unions and climate policy? There is definite evidence that many unions are comfortable with and active in fighting for climate mitigation policy. But there is also evidence from a range of national contexts that unions have often "stood in for the interests of their affiliated capital".[51] But it remains unclear how unions are shaping policy outcomes across countries, and how much the burden of policy actually ends up falling on labor.

5.2.3 Social Policy: Tension or Protection?

The third strand of political economy work I weave into my theory concerns the broader social policy environment, particularly policies around employment protection. This is the most recent of the three strands, with the least work conducted to date. The work that has been done has focused on environmental policy generally, rather than climate change specifically. But the arguments are

[47] Janelle Knox-Hayes. "Negotiating climate legislation: Policy path dependence and coalition stabilization". In: *Regulation and Governance* 6 (2012), pp. 545–567.

[48] Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking".

[49] Frank N Laird et al. "The diverging paths of German and United States policies for renewable energy: Sources of difference". In: (2009).

[50] Mildenberger, "Fiddling While the World Burns: The Double Representation of Carbon Polluters in Comparative Climate Policymaking", pp. 418-419.

[51] Ibid.

applicable to greenhouse gas mitigation as well.

Environmental policies develop in the context of existing welfare states and social policy decisions, many of them put in place long before climate change became an issue.[52] Climate change, by creating new burdens and challenging existing economic models, has the potential to strain existing social policies. There is a risk of a "double injustice" if people who are already poor end up bearing the brunt of climate change policy burdens in the form of job losses and rising prices. A growing number of scholars have suggested ways that countries could re-design both their environmental and welfare state policies to avoid this injustice.[53] While this work tends to be prescriptive rather than descriptive, it highlights the importance of interactions between the old welfare state and the emerging environmental state. If not resolved, the "tension with more deeply embedded state imperatives"[54] risks preventing the creation of strong climate policy.

While environmental policy might put new pressure on social policies, it may also be the case that strong welfare states enable stronger environmental policy. There is not yet much quantitative work on how social policy has affected environmental stringency: reviewing the field, Kerret and Shvartzvald[55] find that "study of social policy effects is absent in the research literature." Fitzpatrick[56] has called for scholars "to turn environmentalism and social policy from distant

[52]Meadowcroft, "From Welfare State to Ecostate".

[53]Steve Pye et al. *Addressing the social dimensions of environmental policy.* Tech. rep. July. European Commission Directorate-General "Employment, Social Affairs, Equal Opportunities" Unit E1 - Social, and Demographic Analysis, 2008, pp. 1–9; Tony Fitzpatrick. *Understanding the environment and social policy.* Bristol: Bristol University Press, 2011, p. 384; Gordon P. Walker. *Environmental justice.* Routledge, 2012, p. 256; Gough, "Welfare states and environmental states: a comparative analysis".

[54]Duit et al., "Greening Leviathan: the rise of the environmental state?"

[55]Dorit Kerret and Renana Shvartzvald. "Explaining Differences in the Environmental Performance of Countries: A Comparative Study". In: *Environmental Science and Technology* 46.22 (2012), pp. 12329–12336, p. 12329.

[56]Fitzpatrick, *Understanding the environment and social policy.*

acquaintances into firm friends." Kerret and Shvartzvald conduct their own study using aggregate indices of social policy[57] and environmental performance.[58] They find that countries with stronger social policy perform better on several subsets of the performance data.

Bernauer and Böhmelt[59] review the study, suggesting three potential reasons for this apparent regularity. First, there might be a sociotropic spillover effect in which welfare states make societies "kindler and gentler" over time, socializing citizens into being more other-regarding. Second, higher provision of public goods creates more human capital, liberating citizens to be more concerned with post-materialist problems like environmental quality. Third, the relationship may simply be a correlation, if countries that are richer or more democratic tend to provide both economic and environmental protection to their citizens, for example. In their re-analysis of the data from Kerret and Shvartzvald,[60] Bernauer and Böhmelt settle on the last explanation as the most convincing, finding "only weak and inconsistent support" for a link between social and environmental policy. They also criticize the use of aggregate indices of many kinds of pollution, arguing that "more disaggregated analyses are in need as beneficial effects could well exist in some environmental domains, but not in others."

5.3 A Theory of Mitigation Offsetting

The three strands of work discussed above demonstrate a growing attention to the intersection of political economy and environmental policy. Yet despite this

[57] Jaya Krishnakumar and Juan M Tellez Minnig. "Social Policy Index: A model-based approach". 2009.

[58] Jay Emerson et al. *2010 Environmental Performance Index*. New Haven: Yale Center for Environmental Law and Policy, 2010.

[59] Bernauer and Böhmelt, "Are Economically 'Kinder, Gentler Societies' also Greener?"

[60] Kerret and Shvartzvald, "Explaining Differences in the Environmental Performance of Countries: A Comparative Study".

attention, it is hard to identify clear conclusions. Expectations that coordination, unionization, and social protection will enable stronger environmental and climate change policy receive inconsistent support, with positive findings mixed with a number of counter-examples and negative findings. In the face of these ambiguous results, scholars should be prepared to recognize that perhaps the true effect of political economy arrangements is simply weak or ambivalent. But another possibility is that analysis of these arrangements needs to be further developed to identify their full impact.

While they deal with distributive institutions, most of the quantitative studies cited here do not really provide distributive accounts of their effect on mitigation policy. Consistent with the climate policy literature more broadly, the focus is on explaining how much pollution is emitted or how much action is taken, and not on where the burdens of such actions fall.

In the study of coordinating institutions, distributive concerns are explicit in the idea that "losers" from policy are more willing to be burdened when they know they will be protected. But if losers are not distributed evenly across the economy, disaggregated data are needed in order to tell whether corporatism and coordinated market economies are having their predicted effect.

In the study of labor unions, there is repeated evidence that unions can be both supporters and opponents of climate action within the same country. A carbon tax clearly has different distributive implications for industrial and service unions. But since the dependent variables are economy-wide, we cannot see whether some sectors are ending up with more or less regulation. On the explanatory side, measures of union strength in these studies are always national rather than sectoral, preventing us from seeing whether better-represented sectors receive higher or lower burdens.

In the study of social policy, existing theories about welfare states and en-

vironmental states are clearly distributional. But the theory is predominantly future-oriented, concerned with avoiding double injustice and providing a framework for doing so. There is less attention paid to how existing welfare states have already shaped climate change action, the limited quantitative work having focused on environmental performance generally.

I focus on the balance of power between capital and labor, weaving together themes from all three strands of the political economy literature. I proceed from the broad assumption that capital generally has a 'privileged' position and is rarely denied a voice in policymaking.[61] Business is rarely, if ever, denied a voice in policymaking. Whether a country is corporatist and a coordinated market economy or pluralist and a liberal market economy, capital owners generally have access to the policymaking process through formal or informal channels of influence (at least in the kind of democratic, industrialized countries covered in this dissertation).

To what extent is labor also protected? Although coordinating institutions, union strength, and social policy are all distinct phenomena, they all indicate something about how much labor can expect to be shielded from the costs of policy change. If labor is formally included in policymaking, has strong organizational representation, or is already safeguarded through existing laws, it suggests that workers' interests are more likely to be protected.

None of these factors tells the whole story on its own, and no single indicator of labor protection is perfect. Corporatism may not always include labor groups in its consultations: for example, Japan is thought by some to be a case of "corporatism without labor".[62] Low levels of union membership do not mean

[61] Lindblom, *Politics and markets: the world's political economic systems*; Przeworski and Wallerstein, "Structural Dependence of the State on Capital"; Ferguson, *Golden rule: The investment theory of party competition and the logic of money-driven political systems.*

[62] T.J. Pempel and Keiichi Tsunekawa. "Corporatism without Labor? The Japanese Anomaly". In: *Trends toward Corporatist Intermediation.* Ed. by Philippe C Schmitter and

that unions are necessarily weak: France has low unionization rates but unions have legally-protected roles in management and almost all French workers are covered by collective bargaining.[63] Strong welfare policies could indicate that labor was powerful in the past, without guaranteeing that it remains powerful today. But while no single measure is perfect, combining data from all three areas helps patch potential gaps between them, and gives us a general sense of whether labor has access to and influence over policymakers.

The question for my analysis is how the protection of labor affects the prospects for climate protection. In other words, when labor is empowered, how does it use its power? I identify two competing hypotheses that integrate arguments from across the three strands of literature. First, protection may mean lower regulation, because workers have more power to block mitigation policy. Second, coordination may mean higher regulation, because workers' costs from mitigation policy will be offset.

Both hypotheses will be specified in terms of interactions between emissions intensity, labor intensity, and indicators of labor protection. I do this to capture how labor protection changes (or fails to change) the burden on emissions-intense, labor-intense sectors. I expect conflict to be most salient in emissions-intense sectors, since that is where increases in the cost of emitting greenhouse gasses will have the greatest effect on jobs, all else being equal. I expect the effects to be concentrated in sectors where labor is a major input and there are more jobs at stake.

This interactive approach is crucial for isolating the distributive effect of labor protection. In existing studies, hypotheses about political economy factors are constrained by the fact that while they posit distributive effects, only aggregate

Gerhard Lehmbruch. Beverly Hills: Sage, 1979.

[63] Sebastian Schulze-Marmeling et al. *Working Life in France*. Tech. rep. European Foundation for the Improvement of Living and Working Conditions, 2017.

changes in policy stringency are visible. This approach seems unsatisfactory when the variables of interest should be expected to affect some sectors more strongly than others. For example, in the case of unions, why expect labor to fight equally in labor-heavy and labor-light sectors? If policymakers were constrained to set one level of stringency for all sectors, this would be an appropriate assumption. But preceding chapters have already shown that neither emissions intensity, labor intensity, nor policy stringency is homogeneous across sectors. By leveraging this heterogeneity, I can make a more sensitive test of political economy effects than the literature has managed so far.

5.3.1 Formal Model

Before stating my hypotheses qualitatively, I frame them in terms of an extension to the baseline model from chapter 2. For convenience, I reproduce the base model's first derivative here:[64]

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(1-\theta_i)\phi_i + \pi^D\theta_i\Big)\frac{\partial c_i}{\partial \lambda_i} \tag{2.17}$$

To this model I add a new variable g, which represents the overall level of government-provided protection for labor. I focus on its relationship with two key terms from the baseline model that affect labor's regulatory burdens: workers' political influence π^L and the share of producer costs that get passed to workers ϕ_i.[65]

First, I assume that labor power is a rising function of g. Higher levels of

[64] Recall that W is government welfare, π are influence parameters, and b_i and c_i are regulatory benefits and costs, respectively.

[65] The consumer pass-through variable θ_i also affects labor's ultimate share of costs, but has a less clear relationship with labor protection.

labor protection provide workers with more avenues to influence government:

$$\pi^L = \pi^L(g);\ \frac{\partial \pi^L}{\partial g} > 0 \tag{5.1}$$

Second, I assume that labor protection introduces a difference between the share of costs that the firm tries to place on labor ϕ_i and the share of costs which labor actually receives, which I denote here by ϕ^L.

$$\phi_i^L < \phi_i \tag{5.2}$$

$$\phi_i^L = \phi_i^L(g);\ \frac{\partial \phi_i^L}{\partial g} < 0 \tag{5.3}$$

Now I substitute in the definitions from eq. (5.1) and eq. (5.3) into eq. (2.17):

$$\frac{\partial W}{\partial \lambda_i} = \pi^E \frac{\partial b_i}{\partial \lambda_i} - \Big(\pi^K(1-\theta_i)(1-\phi_i) + \pi^L(g)\cdot(1-\theta_i)\cdot\phi_i^L(g) + \pi^D\theta_i\Big)\frac{\partial c_i}{\partial \lambda_i} \tag{5.4}$$

In order to see how g affects the optimal level of stringency, I implicitly differentiate with respect to g:

$$\frac{d\lambda_i^*}{dg} = -\frac{\dfrac{\partial^2 W}{\partial \lambda_i \partial g}}{\dfrac{\partial^2 W}{\partial \lambda_i \partial \lambda_i}} \tag{5.5}$$

As shown in eq. (2.19), the denominator is negative. This cancels out the main negative sign, which means the numerator's sign determines that of the whole equation. I derive eq. (5.4) with respect to g using the product rule:

$$\frac{\partial^2 W}{\partial \lambda_i \partial g} = -\Big(\frac{\partial \pi^L}{\partial g}\phi_i^L + \pi^L\frac{\partial \phi_i^L}{\partial g}\Big)(1-\theta_i)\frac{\partial c_i}{\partial \lambda_i} \tag{5.6}$$

Keeping in mind that $\frac{\partial \phi_i^L}{\partial g} < 0$, this equation shows that there are two cross-cutting effects at play. Protection is increasing labor power, reducing stringency in proportion to the burden that falls on labor. At the same time, protection is reducing the burden that falls on labor, increasing stringency in proportion to labor power. Which effect predominates is not clear without further assumptions, making the sign of the whole equation indeterminate:

$$\frac{\partial \lambda_i^*}{\partial g} \begin{cases} < 0 \text{ if } \frac{\partial \pi^L}{\partial g}\phi_i^L > -\pi^L \frac{\partial \phi_i^L}{\partial g} \\ = 0 \text{ if } \frac{\partial \pi^L}{\partial g}\phi_i^L = -\pi^L \frac{\partial \phi_i^L}{\partial g} \\ > 0 \text{ if } \frac{\partial \pi^L}{\partial g}\phi_i^L < -\pi^L \frac{\partial \phi_i^L}{\partial g} \end{cases} \tag{5.7}$$

I consider the scenario in which the effects are equal to be an edge case, and treat it as the null hypothesis in the following analysis. The negative and positive cases correspond to my first and second hypotheses, elaborated below. Each of them depends on which of the cross-cutting effects predominates.

5.3.2 Protection Blocks Stringency

My first hypothesis is that increased labor protection will block climate mitigation stringency in dirty, labor-intense sectors. If environmental policy forces industrial restructuring, and labor is threatened by industrial restructuring, then more powerful labor interests should join with business and capital in a producer coalition against mitigation. Emissions-intense, labor-intense sectors will be on the front lines of this conflict, and will receive lower levels of climate policy:

Hypothesis 5.1 (Labor Protection Blocks Mitigation) *When labor is bet-*

ter protected by political economy arrangements, sectors which are labor-intense and emissions-intense will receive lower climate policy burdens.

If a country has a corporatist or coordinated market economy system and labor is formally included in policy consultation, then labor can use this privileged access to head off proposals which would affect members' interests. If a country has strong unions, they can use their resources to lobby the government or mobilize their members against policies which affect jobs in dirty sectors, as the "vested interest" concept of unions trumps the "sword of justice" vision. Strong welfare policies could be a proxy for a strong labor movement, indicating that labor has enough influence to obtain favorable treatment from government. Alternatively, strong welfare policies could be seen as putting the government "on the hook" for job losses in affected sectors, straining budgets and making it more costly to policymakers to induce such losses through regulation.

5.3.3 Protection Enables Stringency

My second hypothesis lays out the opposite position, arguing that when labor's interests are better protected it will be willing to accept higher levels of climate policy stringency. The central idea here is that coordinating institutions, strong unions, and strong social policies collectively serve as a form of insurance for labor. When labor knows it has a seat at the table, when it has sufficient resources to shape policy, and when it has pre-existing protective guarantees, the prospect of stringent climate regulation becomes less threatening. In these cases, labor can reasonably trust that any burden the government imposes will be offset in other ways, leading them to accept to stronger regulation:

Hypothesis 5.2 (Labor Protection Offsets Mitigation Costs) *When labor*

is better protected by political economy arrangements, sectors which are labor-intense and emissions-intense will receive higher climate policy burdens.

The potential for offsetting does not mean that labor will never oppose climate mitigation policy in countries where it is protected. But on the margin this opposition may be less intense, since there is comparatively less at stake for labor than in countries where such protection is far from assured. In countries with coordinating institutions, labor is more likely to have a direct role in the policy-making process, shaping mitigation strategies so that they are less threatening. Even if labor representatives are initially opposed to climate policy, there will be more room within coordinating institutions to fashion a bargain that protects both labor's interests and environmental goals. The end result will be stronger mitigation policy.

Strong labor unions from emissions-intense sectors may still oppose climate policy. But a strong union from a dirty industry can be more confident that even if climate policy passes, it will be able to secure side-payments or protective regulation. Strong unions with large membership also have a broader perspective: losses in one member's industry may be compensated for by gains in other members' industries.

Finally, policies protect employee welfare and ensure redistribution help dilute the negative impact of climate mitigation. If rules make it difficult to fire employees or provide generous benefits to the unemployed, job losses become either less likely or less frightening. Redistribution more generally lowers the risks attached to drops in income. Countries with "kindler, gentler" policy environments effectively promise to "file the sharp edges" off of climate policy-induced costs.

5.4 Data and Results

As the discussion earlier in this chapter revealed, there is good reason to believe that the wider political economy context shapes the impact of mitigation policy on labor. If coordinating institutions, powerful unions, and strong employment protections are evidence of higher levels of influence for workers, then one should expect to see lower mitigation stringency for labor-intense sectors when those factors are present. This can be thought of as a "first-order" effect of labor strength: stronger labor means lower stringency. At the same time, if labor is sufficiently influential, or at least sufficiently sure of its protected status, then it may have less to fear from the imposition of stringent regulation. This would be a "second-order" effect of labor strength: if labor is strong enough, it can afford to take the long view on mitigation regulation. Both could conceivably operate at the same time, which could help explain the conflicting results sometimes observed in the literature.

The statistical models below are intended to test whether the second-order effect exists, and if so, whether it dominates the first-order effect. That is, I want to know whether carbon-intense, labor-intense sectors face higher or lower regulation in countries with strong institutions of coordination and protection. The answer, consistent across all of my regressions, is yes: coordination is associated with more regulation for labor-intense, dirty sectors.[66]

The regressions are conducted using the same multi-level modelling approach described in chapter 3. To test the effects of the state-market relationship, I use measures of corporatism[67] and varieties of capitalism.[68] To test the effects of

[66]Performing the analyses with capital intensity instead of labor intensity gave symmetrical results, which are omitted for reasons of space.

[67]Siaroff, "Corporatism in 24 industrial democracies: Meaning and measurement".

[68]Peter A. Hall and Daniel W. Gingerich. "Varieties of Capitalism and Institutional Complementarities in the Political Economy: An Empirical Analysis". In: *British Journal of Political Science* 39 (2009), pp. 449–482.

Table 5.1: Summary Statistics

	Mean	S.D.	Min	Max	Count
Shadow Price	.0063	.98	-2.7	6.2	3555
Labor Intensity	-.044	.87	-1.5	3.8	3555
Corporatism	-.031	1	-1.1	1.9	2444
Coord. Market Economy	.58	.29	0	1	2227
Labor Coordination	.53	.3	0	1	2227
Union Density	-.02	1	-1.4	2.3	2444
Union Cent.	.35	.22	0	1	2444
Wage Coordination	.51	.32	0	1	2444
Employment Protection	-.067	.95	-1.8	1.7	2359
Active Labor Mkt. Policy	-.0014	.99	-1.2	2.8	3383
Redistribution	-.073	1	-3.3	2.1	2444
CO_2 Intensity	-.078	.93	-4.3	3.9	3555
Output	.2	.84	-3.4	2.6	3555
Nat. CO_2 Intensity	-.21	.79	-2.6	2.1	3555
GDP per Capita	.42	.61	-1	1.6	3555
GDP Growth	.0064	.67	-1.6	1.6	3555
Fossil Fuel Inc. P.C.	.097	1	-1.8	1.7	3555
E.U. Member	.59	.49	0	1	3555

labor organization, I use measures of union density and union centralization.[69] And to test the effects of the policy environment, I use employment protection legislation,[70] active labor market programs,[71] and overall redistribution.[72] I will describe the measures in more detail as I discuss the regressions below. The relevant summary statistics and correlation matrix are presented in table 5.1 and table 5.2, respectively.

[69]Jelle Visser. *ICTWSS: Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, Version 5.1.* `http://www.uva-aias.net/en/ictwss`. Amsterdam, 2016.

[70]OECD. *Employment and Labour Market Statistics*. Organization for Economic Cooperation and Development, `https://www.oecd-ilibrary.org/employment/data/oecd-employment-and-labour-market-statistics_lfs-data-en`. Paris, 2017.

[71]OECD. *Social Expenditure Database*. Organization for Economic Cooperation and Development, `http://www.oecd.org/social/expenditure.htm`. Paris, 2016.

[72]Frederick Solt. "The Standardized World Income Inequality Database". In: *Social Science Quarterly* 97.5 (Nov. 2016), pp. 1267–1281.

Table 5.2: Correlations

		1	2	3	4	5	6	7	8	9
1	Shadow Price	1.00								
2	Labor Intensity	0.20	1.00							
3	Corporatism	0.28	0.03	1.00						
4	Coord. Market Econ.	0.38	0.02	0.50	1.00					
5	Labor Coordination	0.38	0.03	0.55	0.98	1.00				
6	Union Density	0.24	-0.01	0.59	0.14	0.14	1.00			
7	Union Cent.	0.22	-0.02	0.58	0.52	0.47	0.48	1.00		
8	Wage Coordination	0.36	-0.02	0.63	0.67	0.67	0.52	0.56	1.00	
9	Empl. Protection	0.14	-0.01	0.03	0.73	0.62	-0.04	0.32	0.30	1.00
10	Active Lab. Mkt. Pol.	0.36	0.10	0.57	0.35	0.30	0.54	0.32	0.50	0.24
11	Redistribution	0.16	0.01	0.71	0.28	0.28	0.61	0.35	0.45	-0.02
12	CO_2 Intensity	-0.24	-0.19	-0.11	-0.15	-0.15	-0.09	-0.13	-0.14	-0.12
13	Output	0.10	0.13	-0.22	-0.15	-0.09	-0.42	-0.38	-0.21	-0.29
14	Nat. CO_2 Intensity	-0.38	-0.09	-0.37	-0.36	-0.37	-0.08	-0.18	-0.30	-0.12
15	GDP per Capita	0.25	0.15	0.26	-0.43	-0.34	0.05	-0.15	-0.12	-0.75
16	GDP Growth	-0.11	-0.00	-0.06	-0.20	-0.21	0.06	0.01	-0.04	-0.02
17	Fossil Fuel Inc. P.C.	-0.15	-0.00	-0.20	-0.47	-0.44	-0.37	-0.31	-0.55	-0.52
18	E.U. Member	0.40	0.08	0.33	0.47	0.37	0.34	0.33	0.40	0.60

		10	11	12	13	14	15	16	17	18
10	Active Lab. Mkt. Pol.	1.00								
11	Redistribution	0.68	1.00							
12	CO_2 Intensity	-0.13	-0.08	1.00						
13	Output	0.06	-0.17	-0.15	1.00					
14	Nat. CO_2 Intensity	-0.41	-0.28	0.21	-0.34	1.00				
15	GDP per Capita	0.43	0.26	-0.14	0.37	-0.71	1.00			
16	GDP Growth	-0.01	-0.11	0.04	-0.13	0.12	-0.10	1.00		
17	Fossil Fuel Inc. P.C.	-0.26	-0.13	0.08	0.07	0.31	-0.01	0.06	1.00	
18	E.U. Member	0.60	0.32	-0.23	-0.02	-0.61	0.43	0.02	-0.27	1.00

5.4.1 State-Market Relationships

I begin by presenting the results of testing the effects of political economy institutions: the level of corporatism and the variety of capitalism present in a country. Corporatism is measured using an index by Siaroff,[73] which consists of three sub-concepts: "social partnership," "industry-level co-ordination," and "overall national policy-making patterns."[74] Higher values represent more corporatist arrangements.

The varieties of capitalism variable is derived from Hall and Gingerich.[75] They break down the idea of a "coordinated market economy" into two separate concepts—coordination in corporate governance and coordination in labor relations. Using factor analysis, they show that both concepts are highly correlated and match the traditional varieties of capitalism classifications.[76] The original measures in Hall and Gingerich[77] range from 0 to 1. I combine the corporate governance and labor relations measures into a joint index by adding them and dividing by 2, so it still varies from 0 to 1. Because I am particularly focused on the representation of labor in policymaking, I also test the impact of coordination in labor relations on its own. Using these continuous measures has the benefit of accommodating differences in the degree to which individual countries conform

[73]Siaroff, "Corporatism in 24 industrial democracies: Meaning and measurement".

[74]"Social partnership" is high when unions avoid striking, pursue reformist strategies, and receive support from the state. "Industry-level co-ordination" is high when firms are focused on long-term innovation, training, and skill-building and give their employees rights of co-determination. "National policymaking patterns" are corporatist when states bargain with actors rather than impose policy unilaterally, when there is a "dense web of interactions" between a small number of peak actors, and when policymaking is characterized by consensus.

[75]Hall and Gingerich, "Varieties of Capitalism and Institutional Complementarities in the Political Economy: An Empirical Analysis".

[76]Coordination in corporate governance is measured by the power of a small set of dominant shareholders. Their power is argued to be high when protections for ordinary shareholders are low, when dispersion of ownership is low, and when the size of the stock market is small. Coordination in labor relations is high when firms and unions work together strategically to coordinate wages, when wage-bargaining happens at the national rather than firm level, and when workers rarely move between firms.

[77]Ibid.

to the ideal types of CMEs and LMEs.

The results are displayed in table 5.3. In the uninteracted regressions in models 1, 3, and 5, neither corporatism nor having a coordinated economy has a statistically significant association with stringency. This suggests that the national state-market relationship is not consistently associated with either an increase or decrease in policy stringency across all sectors.

In models 2 and 6, however, the interaction terms with labor intensity are positive and statistically significant. A one standard deviation increase in the level of corporatism makes the positive effect of labor intensity on stringency stronger by \$44/toe ($p < 0.001$).[78] In a country with coordinated labor relations, the same increase in labor intensity is associated with shadow prices that are higher by \$70/toe relative to a country with uncoordinated relations ($p < 0.05$). The coordinated market economy interaction has the expected sign and is substantively large, but is not statistically significant.

Taken together, the results in table 5.3 offer some support to the coordination offsetting hypothesis (H5.2). Countries that have strong ties between the state, business, and labor seem more likely to impose stringent mitigation policies on labor-intense sectors. Conversely, countries with pluralist institutions and liberal market economies seem less likely to place regulatory burdens on labor-intense sectors in this way.

These results are also displayed in graphical form in fig. 5.1.

5.4.2 Labor Organization

To study the effects of labor organization, I employ three variables: union density, the level of union centralization, and the level of wage-setting centralization.

[78]The dollar values are obtained by multiplying the coefficients by the standard deviation of the unstandardized shadow price (\$319).

Table 5.3: State-Market Relationships

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.122***	0.143***	0.132***	0.0195	0.131***	0.00532
	(0.0284)	(0.0282)	(0.0327)	(0.0780)	(0.0327)	(0.0691)
Corporatism	0.122	0.0949				
	(0.107)	(0.172)				
Labor Intensity		0.137***				
× Corporatism		(0.0268)				
Coord. Market Economy			0.716	0.405		
			(0.781)	(0.401)		
Labor Intensity				0.177		
× Coord. Mkt. Econ.				(0.118)		
Labor Coordination					0.696	0.473
					(0.687)	(0.372)
Labor Intensity						0.220*
× Labor Coordination						(0.111)
CO_2 Intensity	-0.107***	-0.107***	-0.119***	-0.122***	-0.119***	-0.122***
	(0.0304)	(0.0296)	(0.0309)	(0.0345)	(0.0309)	(0.0344)
Output	0.413***	0.389***	0.439***	0.431***	0.439***	0.428***
	(0.0546)	(0.0536)	(0.0599)	(0.0618)	(0.0599)	(0.0616)
Random Effect Variances						
Country	0.446*	0.473*	0.507*	0.502*	0.495*	0.489*
	(0.188)	(0.214)	(0.224)	(0.222)	(0.216)	(0.217)
Sector	0.448***	0.421***	0.473***	0.466***	0.473***	0.463***
	(0.0278)	(0.0258)	(0.0305)	(0.0312)	(0.0305)	(0.0310)
Year	0.111***	0.112***	0.116***	0.117***	0.116***	0.117***
	(0.00368)	(0.00368)	(0.00404)	(0.00406)	(0.00404)	(0.00406)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
DIC	2151.85	2165.59	2055.66	2068.00	2055.76	2069.58

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

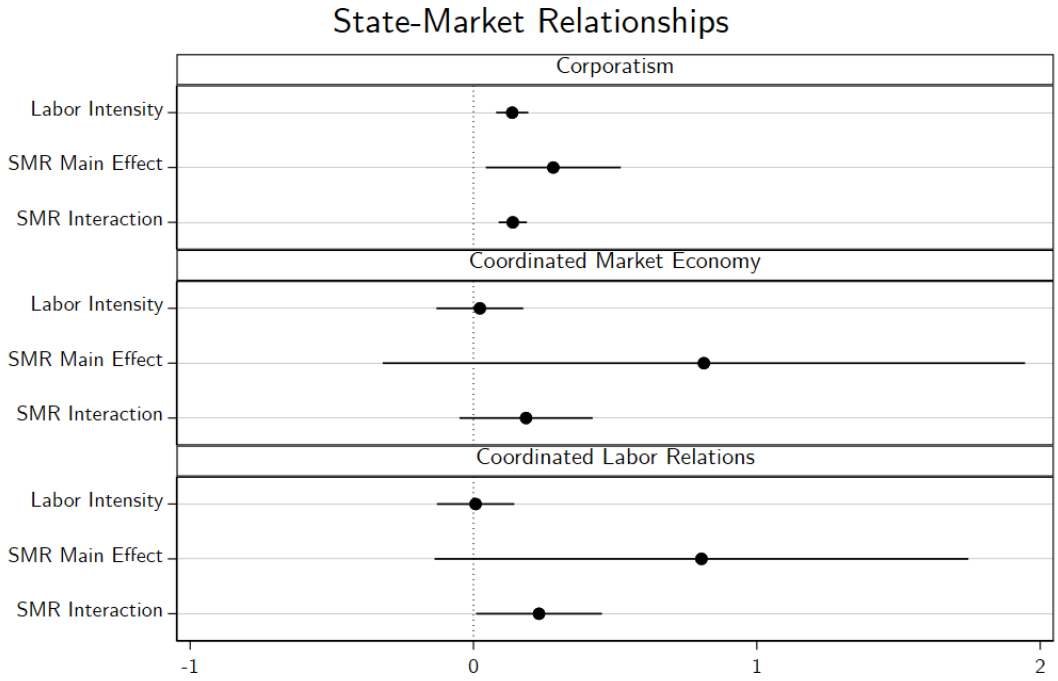


Figure 5.1: Coefficient Plots for State-Market Relationship Interactions with Labor Intensity

These data come from the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) database.

Union density represents the proportion of workers who are union members.[79] Union centralization represents the extent to which peak union organizations have power over local affiliates.[80] Centralized unions are likely to be more powerful since they are larger and better coordinated, but also have more "encompassing" interests since they cover a wider range of industries. In some countries, unions are strong even though they lack large membership bases. This can happen when unions play an institutionalized role in a national wage-bargaining process, as in the French case mentioned earlier.[81] Thus my third measure of union strength is

[79]The original variable is a percentage between 0 and 100. I standardize this variable prior to entering it in the regressions.

[80]The original variable is an eight-point index, whose components include confederal control over local leadership selection, control over local strike decisions, involvement in local wage agreements, and the presence of a joint strike fund. It has been recoded to vary from 0 to 1.

[81]Schulze-Marmeling et al., *Working Life in France*.

the degree to which wage-bargaining is coordinated at the national rather than firm level.[82]

The results of regressions with these variables are presented in table 5.4. As in the previous table, models 1, 3, and 5 show the variables of interest without interactions. In these models union density and centralization both appear to have a strong and statistically significant negative effect on mitigation stringency, while wage coordination appears to have no consistent effect.

Models 2, 4, and 6 show the interactions between the union strength variables and sector-level labor intensity. In all three models, there is a positive and statistically significant interaction between labor power and labor intensity.

For each standard deviation increase in union density, the effect of labor intensity on stringency intensifies by \$31/toe (model 2). Moving from decentralized unions to centralized unions strengthens the effect of labor intensity on stringency by about \$94/toe (model 4). Finally, a one standard deviation increase in labor intensity is associated with a \$75/toe increase in stringency in a centralized wage-bargaining system, compared to a fragmented system (model 6). The first and last relationships are statistically significant at the $p < 0.001$ level, while the middle one is significant at the $p < 0.01$ level.

The consistent positive interaction terms are also visible in the coefficient plot in fig. 5.2.

Taken together, these results suggest when unions are stronger, the mitigation policy that gets applied to labor-intense sectors is also stronger. This supports H5.2 rather than H5.1. While one might expect that stronger unions would shift mitigation costs away from labor-intense sectors, the opposite appears to be

[82]The original variable is a five-point index, where 1 indicates "fragmented" bargaining at the firm or plant level and 5 indicates bargaining across the whole economy between peak unions and employer associations or government imposed wage schedules. Like the union centralization index, it has been recoded to vary from 0 to 1.

Table 5.4: Unions

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.123***	0.138***	0.145***	0.0480	0.122***	0.0112
	(0.0283)	(0.0283)	(0.0280)	(0.0455)	(0.0284)	(0.0407)
Union Density	-0.288**	-0.310*				
	(0.0918)	(0.121)				
Labor Intensity		0.0970***				
× Union Density		(0.0280)				
Union Cent.			-4.081***	-4.207***		
			(0.258)	(0.252)		
Labor Intensity				0.294**		
× Union Cent.				(0.108)		
Wage Coordination					-0.0251	-0.0345
					(0.0771)	(0.0796)
Labor Intensity						0.234***
× Wage Coordination						(0.0622)
CO_2 Intensity	-0.107***	-0.104***	-0.112***	-0.112***	-0.108***	-0.105***
	(0.0302)	(0.0299)	(0.0298)	(0.0295)	(0.0304)	(0.0300)
Output	0.408***	0.398***	0.376***	0.362***	0.412***	0.399***
	(0.0549)	(0.0544)	(0.0542)	(0.0537)	(0.0545)	(0.0543)
Random Effect Variances						
Country	0.709*	0.783*	2.252*	2.412*	0.463*	0.490*
	(0.312)	(0.374)	(0.898)	(0.972)	(0.195)	(0.215)
Sector	0.448***	0.427***	0.448***	0.435***	0.448***	0.431***
	(0.0278)	(0.0264)	(0.0275)	(0.0261)	(0.0278)	(0.0263)
Year	0.110***	0.111***	0.0979***	0.0983***	0.111***	0.111***
	(0.00365)	(0.00368)	(0.00324)	(0.00324)	(0.00368)	(0.00368)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
DIC	2137.27	2154.98	1850.40	1861.88	2153.76	2162.96

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

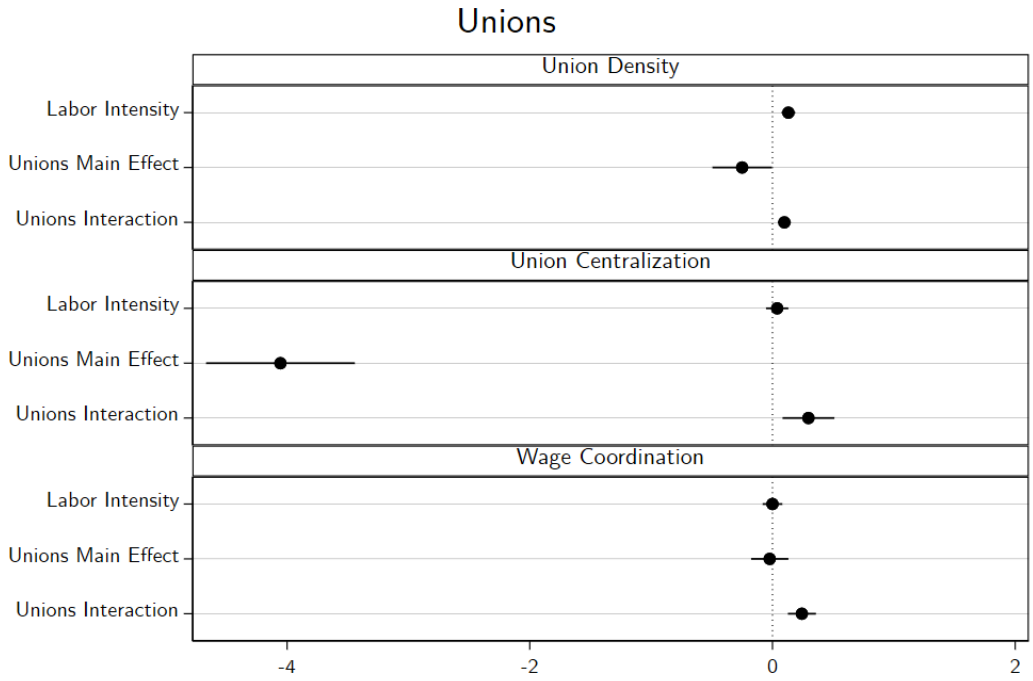


Figure 5.2: Coefficient Plots for Union Interactions with Labor Intensity

occurring. The explanation advanced earlier was that a stronger labor movement may have secured (or be able to secure) policy from government that offsets the cost of mitigation policy. The next section explores this possibility.

5.4.3 Policies

For the final set of regressions, I focus on the kinds of rules and policies that are implied—but not measured—by the foregoing institutional and organization-based variables. I examine policies in three areas: the level of employment protection, the extensiveness of active labor market programs, and the amount of redistribution. Together they are meant to represent the extent to which workers are shielded from the costs of regulation.

The first policy variable is an index of employment protection legislation, drawn from the OECD's Employment and Labour Force Statistics database.[83]

[83]OECD, *Employment and Labour Market Statistics*.

The OECD tracks regulations that govern how employees can be dismissed, such as notice periods, severance pay, grounds for dismissal, appeals processes. It also includes information about restrictions on hiring temporary employees, including restrictions on hours, contract lengths, and monitoring requirements. I take the average of these variables.[84]

The second policy variable is the size of active labor market programs (ALMP), drawn from the OECD's Social Expenditure Database.[85] It measures the percentage of Gross Domestic Product spent by the government on helping jobless people re-enter work, through mechanisms like training programs, subsidized apprenticeships, job-search assistance, and employment incentives. Countries with more generous active labor market programs make it to find a job, shifting the transition costs imposed by stringent mitigation policy from workers to the government.

The final policy-related variable is the overall level of economic redistribution in a country. The other variables specifically measure interventions in the labor market. But more redistribution also reduces the risk workers face from regulation, acting like another kind of insurance for income losses.[86] I use the measure of relative redistribution from the Standardized World Income Inequality Database (SWIID) by Solt.[87] This is calculated as the market (pre-tax-and-transfer) level of inequality, minus the net (post-tax-and-transfer) level of inequality, divided by the market level of inequality. Inequality is measured with Gini coefficients. Higher values represent proportionally larger levels of redistribution.

[84] While the index in theory varies from 0 to 6, in the data the range is 0.21 to 3.85. In other words, no country's policy is near the maximum strictness possible in all areas. The detailed methodology for the construction of the EPL index is available at `http://www.oecd.org/els/emp/EPL-Methodology.pdf`.

[85] OECD, *Social Expenditure Database*.

[86] Karl Ove Moene and Michael Wallerstein. "Inequality, Social Insurance, and Redistribution". In: *The American Political Science Review* 95.4 (2001), pp. 859–874.

[87] Solt, "The Standardized World Income Inequality Database".

Table 5.5: Policies

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.129***	0.134***	0.129***	0.140***	0.119***	0.137***
	(0.0296)	(0.0283)	(0.0244)	(0.0248)	(0.0284)	(0.0283)
Employment Prot.	-0.553***	-0.557***				
	(0.0384)	(0.0364)				
Labor Intensity		-0.0205				
× Employment Prot.		(0.0237)				
Act. Lab. Mkt. Pol.			0.00899	0.00310		
			(0.0312)	(0.0318)		
Labor Intensity				0.105***		
× Act. Lab. Mkt. Pol.				(0.0211)		
Redistribution					0.0498**	0.0476*
					(0.0185)	(0.0188)
Labor Intensity						0.0933***
× Redistribution						(0.0174)
CO_2 Intensity	-0.115***	-0.114***	-0.101***	-0.0941***	-0.111***	-0.110***
	(0.0300)	(0.0305)	(0.0267)	(0.0237)	(0.0304)	(0.0299)
Output	0.401***	0.410***	0.238***	0.214***	0.409***	0.396***
	(0.0560)	(0.0601)	(0.0433)	(0.0448)	(0.0544)	(0.0541)
Random Effect Variances						
Country	0.714*	0.778*	0.468**	0.471**	0.438*	0.459*
	(0.279)	(0.311)	(0.158)	(0.162)	(0.181)	(0.196)
Sector	0.455***	0.457***	0.411***	0.386***	0.448***	0.430***
	(0.0288)	(0.0289)	(0.0217)	(0.0212)	(0.0278)	(0.0264)
Year	0.0992***	0.0993***	0.127***	0.129***	0.111***	0.110***
	(0.00328)	(0.00330)	(0.00364)	(0.00364)	(0.00367)	(0.00363)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
DIC	1811.98	1814.02	3441.85	3469.74	2144.95	2135.28

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

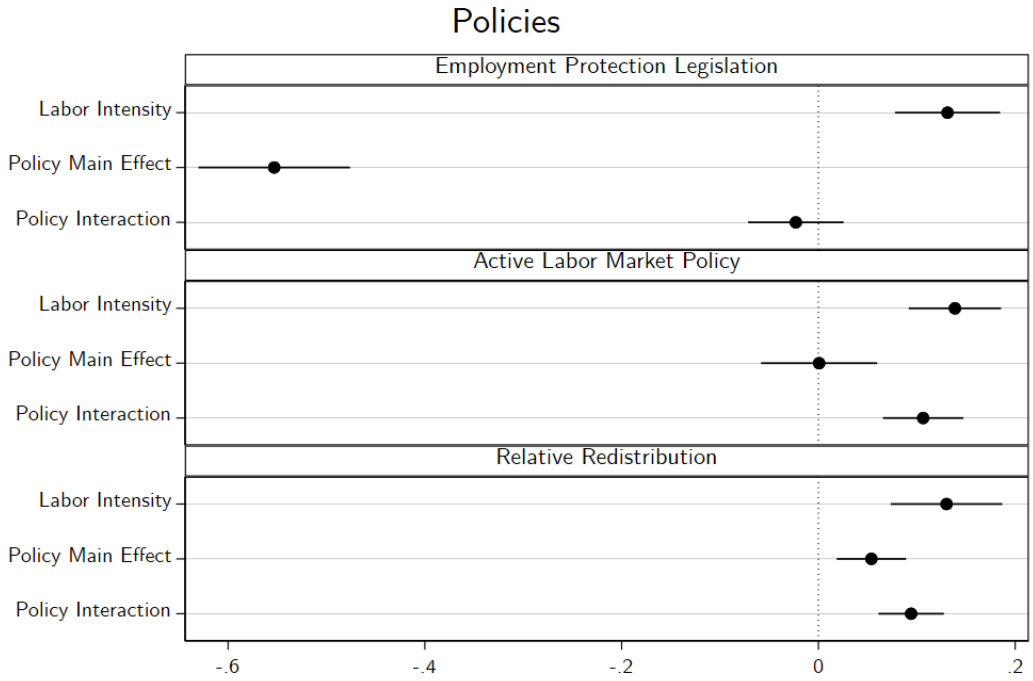


Figure 5.3: Coefficient Plots for Policy Interactions with Labor Intensity

The results for all three variables are displayed in table 5.3. The main effects of the policy variables are roughly the same across the uninteracted (1, 2, and 3) and interacted (2, 4, and 6) models. Employment protection legislation has a large, negative, and statistically significant association with mitigation policy stringency ($p < 0.001$). Active labor market policy has no statistically significant association with stringency. Relative redistribution has a moderate but significant positive association with stringency in both models ($p < 0.01$).

The interactions of labor intensity with active labor market policy and redistribution are statistically significant at the $p < 0.001$ level. For each standard deviation increase in the percentage of GDP spent on active labor market policies, the association between labor intensity and mitigation stringency rises by \$33/toe. For each standard deviation increase in the relative scale of redistribution, labor intensity's effect on shadow prices strengthens by \$30/toe. Both of these effects support the offsetting effect suggested by H5.2.

Employment protection legislation, however, shows no statistically significant interaction with labor intensity. Of all the variables explored in this chapter, this is the only one not to be consistent with H5.2. This null finding suggests that extra caution is in order before drawing conclusions from the results.

I have also graphed these results in a coefficient plot in fig. 5.3, where the contrast between Employment Protection Legislation and the other measures is more clearly visible.

One potential explanation for this null finding is that employment protection shifts costs in a different way than the other two policies. Active labor market policies are funded by the government (recall that the variable is measured as a percentage of GDP), so they offset costs on labor by distributing them across the tax base. Similarly, redistribution also shifts costs to the whole tax base. Employment protection legislation, on the other hand, puts costs directly on the employer by constraining their ability to dismiss workers.[88]

This means that when employment protection legislation is strong, the lower risk to a firm's labor force could be counter-balanced by a higher risk to management and investors. The offsetting effect from H5.2 could still be in operation: labor may still be less concerned about mitigation costs when their jobs are safer. But since costs are not spread out across the economy but concentrated on the firm, management and capital's potential costs are rising as labor's are falling.

This could also explain why there is such a strong negative effect of employment protection legislation on stringency generally. If employment protection reduces the ability of all firms to shift costs to their workforces, then it represents the inverse of pass-through potential ϕ_i. If this is the case, then it should not be surprising that employment protection has no consistent interaction with labor intensity.

[88] At least in a first-order sense.

Though the explanation for the null finding for employment protection is inevitably *post hoc*, it does offer plausible grounds to temper its impact on findings (given the otherwise consistent results).

5.5 Conclusion

Climate change is not only a "second-order" concern for many people and countries: it is also a "second-mover" issue, one that is always constrained and shaped by organizations and policy frameworks that were established long before it became an issue. These frameworks are not always favorable to the development of climate policy. I have shown how certain kinds of arrangements can help strengthen mitigation, but I have also shown that such arrangements can end up concentrating the cost in particular ways.

Collectively, the results of the rules and policy variables tell a similar story. Institutions of coordination, the strength of unions, and the level of government intervention in labor markets all have the potential to shape whether labor-intense sectors receive higher regulatory burdens or lower ones.

It is important to remember that the main effects of the variables of interest are mainly national in scope (with the exception of sector-level union density, which is not statistically significant). So while they tell us about the effect of these variables on mitigation policy in general, only the interactions with sector-level variables can tell us about how they affect the distribution of policy burdens.

The patterns visible in these interactions help clear up some of the conflicting outcomes in the existing literature. Instead of looking for a pure positive or negative relationship between corporatism or labor strength and environmental action, it is more helpful to think about how these factors change the strategic situation facing interest groups, particularly labor.

Countries with consensual, coordinated state-market relationships, strong and centralized unions, and social policies that help workers find new work and redistribute wealth progressively tend to place more of the burden of climate mitigation policy on labor-intense sectors. With the exception of employment protection, the results are all consistent with H5.2, the "offsetting effect."

Future work should follow up on the mixed findings for protective policies. Rather than treating all kinds of government offsetting as equivalent, a deeper model would examine how the costs of offsetting itself are distributed. Such a model would require a budget constraint for government and some representation of tax burdens on different groups. This is beyond the scope of the present chapter. But testing whether some kinds of protective policies make mitigation easier to pass while others make it harder could be useful for green groups seeking to ally with labor.

Further work should also test whether the burden offsetting implied by the theory and findings here is actually taking place. In what form is such offsetting being provided? Is labor receiving the kind of retraining help or trade protection or subsidies that will insulate labor interests? Do we see new policies being passed, or more reliance on existing ones? Are there explicit deals we can observe? For example, in 2018 the German metalworkers' union IG Metall successfully negotiated a 28-hour workweek, along with substantial annual pay rises. At the same time, the union has endorsed higher carbon dioxide standards for cars. To what extent are these linked? Michael Brecht, Chairman of the Central Works Council (*Betriebsrat*) at Daimler, explicitly highlights the importance of workers beings able to trust that they will be protected in order to accept environmental regulation:

> "Employees in the automotive industry are relying on technological and societal change in the direction of sustainable mobility opening

> up future opportunities for them. They must be able to believe and trust in the assurance that structural change associated with all this will not put them at risk. That is why it is crucial for environmental, economic and social issues to be put in a healthy balance along these lines."[89]

The results here help point the way forward for integrating welfare states and environmental states in a "healthy balance." Authors like Gough[90] and Fitzpatrick[91] have provided visions about how environmental policy can be integrated with the welfare state. Instead of simply "layering" environmental policy on top of existing frameworks, Gough argues for "linkage" in which the economy is more radically transformed through new "eco-social" policies. Though the empirical findings in this chapter do not establish whether such policies are desirable, they do suggest that social and environmental protection are indeed compatible. Another fruitful area for future work would be to test whether increasing climate policy strength is driving the kind of fundamental re-thinking of social arrangements for which Gough advocates, or if conventional "layering" continues to predominate.

[89] IG Metall, *IG Metall's demands with regard to European regulation of CO2 levels for cars for the period after 2020*, p. 23.
[90] Gough, "Welfare states and environmental states: a comparative analysis".
[91] Fitzpatrick, *Understanding the environment and social policy.*

Chapter 6

Paycheck Preferences: How Sector of Employment Affects Support for Climate Policy

> "It is difficult to get a man to understand something, when his salary depends upon his not understanding it!"
>
> Upton Sinclair[1]

6.1 Introduction

In this chapter, I investigate the role of economic self-interest in shaping individual attitudes towards climate change mitigation. In line with the approach taken in the rest of the dissertation, I focus specifically on the emissions intensity of people's sector of employment. To what extent do job-related emissions influence people's support for costly climate action?

There is a robust body of work describing climate attitudes, but the number of studies explaining such attitudes is relatively smaller.[2] This explanatory

[1] Upton Sinclair. *I, Candidate for Governor: And How I Got Licked*. Ed. by James Gregory. Berkeley: University of California Press, 1994, p. 109.

[2] So Young Kim and Yael Wolinsky-Nahmias. "Cross-National Public Opinion on Climate

literature has generally focused on three broad categories of determinants: demographic factors (like age, sex, education, and income), value-based and ideological factors (like and political orientations), and climate-specific factors (such as weather experiences, local vulnerability to climate change, and communication effects).

While some work has also incorporated national affluence and emissions intensity as proxies for economic interests, individual measures of economic interests are scarce. Only a couple of studies have taken a disaggregated approach and examined how sector of employment affects attitudes.[3] This chapter builds on these nascent efforts in several ways. I employ a larger sample of people and countries to test whether their findings are generalizable. I distinguish general concern about climate change from support for potentially costly domestic action. And I show how sector of employment mediates the effect of other prominent explanations for attitudes, including income, education, and ideology.

Shifting attention to public opinion serves as an important test for the dissertation's sector-focused approach. Having developed a distributive account of climate policy in chapter 2, I have focused on testing it using the econometric estimates of regulatory stringency developed by.[4] But if climate policy has a distributive component, and this component is driven in part by sector-level dynamics, then we should expect to see sector-level factors matter beyond shadow prices. To really be confident that sector-level characteristics matter for climate politics, I must show that they have observable implications beyond a single dataset. This chapter attempts to do that, by testing for sector-level distributive

Change: The Effects of Affluence and Vulnerability". In: *Global Environmental Politics* 14.1 (Feb. 2014), pp. 79–106.

[3]Michael M. Bechtel et al. "Interests, Norms and Support for the Provision of Global Public Goods: The Case of Climate Co-operation". In: *British Journal of Political Science* (2017), pp. 1–23; Endre Tvinnereim and Elisabeth Ivarsflaten. "Fossil fuels, employment, and support for climate policies". In: *Energy Policy* 96 (2016), pp. 364–371.

[4]Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

impacts in an area beyond policy.

Focusing on public opinion also serves as a test of potential mechanisms for the findings observed earlier in the dissertation. Probing the mechanisms of sectoral influence in depth is beyond the scope of this project (though it is a rich subject for future work). But one key question is whether this influence can only travel through elite-level interactions, or whether mass politics might play a role as well. It seems reasonable to assume that firm leaders' and investors' preferences about regulation will be influenced by the potential impact of regulation on their assets, since they have access to the information necessary to assess that impact. But for the mass public, it is not clear whether information about sector-level costs of potential regulation is easily accesssible. If mass opinion does or could play a role in shaping the sector-level allocation of policy burdens, we would first want to know whether that opinion was itself shaped by sector-level exposure to regulation.

The chapter is structured as follows. I begin by discussing the literature on the determinants of climate attitudes. I show that, despite the wide range of factors analyzed in this literature, the role of sectoral interests have not received much attention. This omission may be caused by (or may be causing) a lack of sectorally-disaggregated questions in many climate opinion surveys.

I then make three claims about how sector-level interests are likely to affect individual attitudes. First, I argue that individuals working in sectors with high emissions intensities will be less motivated to act on climate change. Second, I distinguish between concern about climate change and support for mitigation action, and contend that the latter will be more affected by sector of employment than the former. Third, I predict that the importance of non-sectoral determinants of climate attitudes will be mediated by emissions intensity. Factors like demographics and values will carry less weight with people in polluting sectors.

I test these claims using opinion data from the most recent round of the European Social Survey, in combination with economic data from the World Input-Output Database. The sample includes more than 19,000 observations from 14 countries. The results show that the relationships predicted by the theory largely hold. I conclude with a discussion of the implications of the results for both academics and the wider policy community.

6.2 The Role of Emissions in the Climate Attitudes Literature

The field of climate opinion research is young enough that only a few years ago, one review could still assert that "few studies seek to explain cross-national variation in climate opinions".[5] The number of studies seeking to explain rather than simply describe attitudes has grown since then. But there remain potentially important explanatory considerations which have been under-studied. In this section, I will show how one such factor—emissions—has received inconsistent attention and produced inconclusive findings. At the end I will discuss two works that point the way forward, by considering emissions intensity at the sectoral rather than national level.[6]

Studies that seek to explain levels of concern about climate change have sometimes included measures of national emissions, but with weak results. In one of the earlier efforts, an online poll of 46 developed and developing countries, Sandvik[7] finds a negative relationship between CO_2 per capita and concern about

[5]Kim and Wolinsky-Nahmias, "Cross-National Public Opinion on Climate Change: The Effects of Affluence and Vulnerability", p. 81.

[6]Bechtel et al., "Interests, Norms and Support for the Provision of Global Public Goods: The Case of Climate Co-operation"; Tvinnereim and Ivarsflaten, "Fossil fuels, employment, and support for climate policies".

[7]Hanno Sandvik. "Public concern over global warming correlates negatively with national wealth". In: *Climatic Change* 90 (2008), pp. 333–341.

global warming. But the relationship is only marginally significant (at the $p<0.10$ level). In an analysis of the 2005-2009 World Values Survey, Kvaløy et al.[8] finds a positively signed but statistically insignificant relationship between national emissions intensity and concern. Lee et al.[9] apply a novel statistical method to the results of a Gallup World Poll of 119 countries in 2007-2008. Using conditional inference trees to identify the most important factors on a country-by-country basis, they find that most national-level indices are poor predictors of concern, including carbon emissions per capita. Lo and Chow[10] distinguish between perceived importance and perceived risk, and find that CO_2 emissions per capita are not significantly associated with perceived importance and only marginally associated with perceived risk.

In the wake of these weak findings, many recent works have eschewed the use of carbon emissions measures altogether. Kim and Wolinsky-Nahmias[11] gather data from twelve different multi-national surveys between 2005 and 2009 with the explicit goal of examining "key national factors" at play, but carbon emissions are not among those factors. Knight,[12] in his analysis of the 2007–2008 and 2010 Gallup World Polls, similarly chooses to omit an emissions variable from his regressions.

Of course, concern about climate change is not the same as supporting action to prevent it. As Leiserowitz[13] notes, "stating that a problem is "very serious"

[8]Berit Kvaløy et al. "The publics' concern for global warming: A cross-national study of 47 countries". In: *Journal of Peace Research* 49.1 (Jan. 2012), pp. 11–22.

[9]Tien Ming Lee et al. "Predictors of public climate change awareness and risk perception around the world". In: *Nature Climate Change* 5 (2015), pp. 1014–1024.

[10]Alex Y. Lo and Alex T. Chow. "The relationship between climate change concern and national wealth". In: *Climatic Change* 131.2 (2015), pp. 335–348.

[11]Kim and Wolinsky-Nahmias, "Cross-National Public Opinion on Climate Change: The Effects of Affluence and Vulnerability".

[12]Kyle W. Knight. "Public awareness and perception of climate change: a quantitative cross-national study". In: *Environmental Sociology* 2.1 (2016), pp. 101–113.

[13]Anthony A. Leiserowitz. *International public opinion, perception, and understanding of global climate change*. Tech. rep. Human Development Report Office, 2007, p. 6.

is not the same as stating that it is an urgent or high priority". Support for climate policy proposals drops when questions explicitly mention costs.[14] For a given level of policy stringency, the costs should be expected to fall more heavily on emissions-intense industries. So one would expect the emissions intensity of individuals' industry of employment to shape their willingness to pay for or support climate action.[15] Yet emissions intensity is absent from many studies of action preferences.

In addition to looking at concern, Kim and Wolinsky-Nahmias[16] also track responses to six survey questions about support for specific policies and four questions about willingness-to-pay, but as before the focus is on GDP per capita and vulnerability to climate change, not carbon emissions. Dienes[17] uses data from the Life in Transition II survey, conducted in 35 countries in 2010. National CO_2 emissions are not included, presumably subsumed within country-level dummy variables.

Broader reviews of the policy support field also show that carbon emissions have either not been a major focus of investigation or have not proven significant. Johnson and Nemet[18] review estimates from twenty-seven studies of people's

[14]Michael M. Bechtel and Kenneth F. Scheve. "Mass support for global climate agreements depends on institutional design". In: *Proceedings of the National Academy of Sciences* 110.34 (2013), pp. 13763–13768; Robert Gampfer et al. "Obtaining public support for North-South climate funding: Evidence from conjoint experiments in donor countries". In: *Global Environmental Change* 29 (2014), pp. 118–126; Thomas Bernauer and Liam F. McGrath. "Simple reframing unlikely to boost public support for climate policy". In: *Nature Climate Change* 6.7 (July 2016), pp. 680–683; Zorzeta Bakaki and Thomas Bernauer. "Citizens show strong support for climate policy, but are they also willing to pay?" In: *Climatic Change* (Sept. 2017), pp. 1–12.

[15]Bakaki and Bernauer emphasize the distinction between "willingness to support" policy and "willingness to pay" for it. While this distinction is important, for my purposes I am bundling these concepts together. Support for increasing fossil fuel taxation implicitly involves willingness to pay for it, especially if one is working in an emissions-intense industry.

[16]Kim and Wolinsky-Nahmias, "Cross-National Public Opinion on Climate Change: The Effects of Affluence and Vulnerability".

[17]Christian Dienes. "Actions and intentions to pay for climate change mitigation: Environmental concern and the role of economic factors". In: *Ecological Economics* 109 (2015), pp. 122–129.

[18]Evan Johnson and Gregory F. Nemet. "Willingness to pay for climate policy: a review of

"willingness-to-pay" (WTP) for climate change action. They find eight "common and statistically significant variables," but personal energy use or carbon emissions are not among them.[19] Six years later, Drews and Bergh[20] review forty-nine survey and experimental studies of willingness-to-pay and willingness-to-support (WTS). They find three categories of explanations: socio-psychological, climate policy perceptions, and contextual factors. The category of contextual factors includes "wider economic elements," but CO_2 is not mentioned among them: the main economic variables discussed are economic wealth, growth, and unemployment. There is also an especially rich literature on climate public opinion within the United States,[21] but emissions have not been a focus of this body of work either.

The simplest conclusion from this literature is that carbon emissions just do not have a substantial impact on individual climate opinions. Lo and Chow[22] expresses doubt that individuals even understand their CO_2 emissions: "it is hard to draw a link between personal CO_2 emissions, as a proxy for present responsibility, and the low concern about climate change. Most people do not have or never seek information on the total amount of CO_2 emissions they produce from their everyday activities." But even if people do not have a good sense of their personal emissions, there are reasons to suspect that they may be influenced

estimates". La Follette School Working Paper Series No. 2010-011, University of Wisconsin-Madison. Madison, WI, 2010.

[19]These variables are personal environmental behavior, environmental values, education level, judgements about policy effectiveness, ideology, belief in climate change, expectations about future changes, and perceived reciprocity.

[20]Stefan Drews and Jeroen C.J.M. van den Bergh. "What explains public support for climate policies? A review of empirical and experimental studies". In: *Climate Policy* 16.7 (2016), pp. 855–876.

[21]Leiserowitz, *International public opinion, perception, and understanding of global climate change*; McCright and Dunlap, "The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010"; Patrick J. Egan and Megan Mullin. "Climate Change: US Public Opinion". In: *Annual Review of Political Science* 20 (2017), pp. 209–227.

[22]Lo and Chow, "The relationship between climate change concern and national wealth", p. 339.

by the emissions at their place of work. Two recent studies have followed up this line of inquiry.

In a study of Norway, Tvinnereim and Ivarsflaten[23] offer the first published analysis that uses individuals' sector of employment to represent their economic dependence on fossil fuels. Their data comes from the 2013-2014 Norwegian Citizen Panel, and depending on the question their sample size varies from 513 to 5190. They ask respondents whether they work in the oil and gas sector or a related field. This sector employs a high proportion of Norwegians (more than 10% of their sample) and is also clearly vulnerable to mitigation regulation. Respondents are also asked about support for a range of policies, which are then categorized by the authors into two groups: those that impose concentrated costs on fossil fuel production (an oil tax, reduction in drilling areas and production levels), and those whose costs are more diffuse (tightening the national CO_2 cap and investing in fossil fuel alternatives). The authors find that working in the oil and gas sector is associated with substantive and statistically significant reductions in support for the concentrated cost policies, but no significant differences for the diffuse policies.

Bechtel et al.[24] conduct a similar study in four other rich, developed countries: the United Kingdom, the United States, France, and Germany. The data come from a YouGov-administered survey with an overall sample size of 8,500 respondents, of which 4,009 identified their sector of work. Respondents are asked about three kinds of environmental attitudes: their support for global climate cooperation, the importance of CO_2 reductions, and their willingness to pay for environmental protection in general. Instead of focusing on a single sector, Bechtel et al. distinguish between low-emissions and high-emissions sectors.[25] The

[23]Tvinnereim and Ivarsflaten, "Fossil fuels, employment, and support for climate policies".

[24]Bechtel et al., "Interests, Norms and Support for the Provision of Global Public Goods: The Case of Climate Co-operation".

[25]Robustness checks include continuous measures of emissions, with substantively similar

results of the surveys indicate that people working in high-emissions sectors are less likely to support climate co-operation, less likely to believe in the importance of CO_2 reduction, and are less willing to pay for environmental protection.

These two studies offer important evidence that emissions linked to sector of employment can affect climate attitudes. That said, this area of inquiry is still new and there remains a good deal of work to be done. Bechtel et al. do not include an explicit question about domestic climate policy, since their focus is more on global co-ordination and reciprocity. Their study also only includes a few very rich countries. Tvinnereim and Ivarsflaten is more squarely focused on domestic policy, with several distinct questions on the subject, but the study is limited to one industry and one country.

In the rest of this chapter I will expand on this promising initial work. Like Tvinnereim and Ivarsflaten, I focus specifically on support for domestic policy action. I build on Bechtel et al. by comparing multiple countries, but expand on their work by employing a much larger sample of countries and respondents to test how far the results generalize. This larger sample also allows me to test whether the results for sector of employment are robust to controls for national wealth and carbon intensity. And for the first time, I theorize and test how sectoral carbon intensity changes the impact of other individual-level determinants of climate attitudes.

6.3 Theory of Sectoral Opinion Formation

To what extent do workers in high-emissions industries think differently about stringent mitigation policy than workers in low-emissions industries? In this section, I will make three claims about the kinds of differences I expect to find.

results.

First, in line with the findings of Tvinnereim and Ivarsflaten; Bechtel et al., I argue that higher carbon intensity in an individual's sector of employment will reduce their support for costly mitigation policy. Second, I emphasize that this effect will apply more strongly to people's support for action than their concern about climate change generally. Third, I claim that carbon intensity will dampen the effect of other key variables like income, education, and ideology.

6.3.1 Carbon Intensity

Some economic sectors are more vulnerable to climate mitigation policy than others. The most basic source of vulnerability is emissions intensity. As discussed in previous chapters, there are other sources of vulnerability, such as export intensity, elasticities of supply and demand, and the cost of mitigation opportunities. But emissions intensity is the most straightforward and general, and therefore more likely to be perceived and internalized by workers.

Workers are unlikely to know the precise amount of greenhouse gasses that are emitted by their employers (even managers are unlikely to know this, unless their firm is already subject to emissions regulation or has made a special effort to calculate emissions). But even without precise knowledge, many workers will still be able to classify their industries as relatively "clean" or "dirty." If a worker drives a truck, goes to work in a factory with smokestacks, mines fossil fuels, or operates heavy machinery, they have opportunities to observe emissive activity first-hand.

If a worker perceives their work as emissions-intense, they have a "pocketbook" incentive to oppose regulation of those emissions. Any policy that threatens to raise production costs for firms on the basis of their emissions could spark resistance among workers in those firms. Such measures could include market mechanisms like taxes or cap-and-trade programs, or command-and-control reg-

ulations like forbidding or phasing out particular industrial activities. Workers may fear that regulatory costs will reduce demand for their labor, dampening their wages and leading to layoffs.[26]

It may not matter whether the ultimate costs to workers will in fact be substantial. As discussed in chapter 2, not all the costs of regulation are passed to workers: some may go to consumers or investors instead. Some carbon tax designs, like the tax implemented in British Columbia and the plan proposed in Washington State, rebate money collected to businesses and households through other tax reductions. Policy design details are crucial in determining who actually ends up bearing the cost of regulation. But in terms of determining attitudes, detailed economic projections of distributional impacts may be outweighed by more vivid and pressing fears of job losses or wage freezes.

Even if workers do not independently perceive emissions-intensity, they may be subject to elite cueing from management. Hertel-Fernandez[27] presents evidence that firm managers attempt to use employees to achieve political goals, with 46% of the 513 managers they interviewed saying their firms "engaged in at least one form of worker mobilization." Babenko and Zhang[28] find that executives influence their employees' political contributions and turnout rates "in a manner consistent with firm value maximization." Whether workers are directly influenced by the emissions-intensity of their jobs or indirectly by management lobbying, the end result will be similar. Workers in high-emissions industries will be less supportive of mitigation policies that they think will threaten their jobs.

[26]This hypothesis and the ones that follow do not assume that mitigation regulation actually involves big risks to employees in high-emissions sectors, only that people in such industries are more likely to perceive such regulation as threatening their jobs.

[27]Alexander Hertel-Fernandez. "How Employers Recruit Their Workers into Politics—And Why Political Scientists Should Care". In: *Perspectives on Politics* 14.2 (2016), pp. 410–421, p. 415.

[28]Ilona Babenko and Song Zhang. "Do CEOs Affect Employee Political Choices?" In: *SSRN Electronic Journal* (2016).

Hypothesis 6.1 (Sectoral Intensity Effect) *Working in a sector with a higher emissions intensity will reduce individuals' support for costly mitigation policy.*

6.3.2 Cost Concentration

Climate change has created an "apparent contradiction in public attitudes":[29] there are many people around the world who express concern about climate change but do not support mitigation action to prevent it.[30] As Leiserowitz[31] points out, "stating that a problem is 'very serious' is not the same as stating that it is an urgent or high priority."[32]

The simplest explanation for this divergence is that people can be worried about a problem without wanting to bear the costs of solving it. When people are allowed to freely describe their reasons for supporting or opposing climate policy, cost considerations dominate other responses.[33][34] Framing experiments with surveys show that cost references generally reduce support for climate action.[35]

[29]Sonia Akter and Jeff Bennett. "Household perceptions of climate change and preferences for mitigation action: the case of the Carbon Pollution Reduction Scheme in Australia". In: *Climatic Change* 109.109 (2011), p. 737.

[30]Kim and Wolinsky-Nahmias, "Cross-National Public Opinion on Climate Change: The Effects of Affluence and Vulnerability".

[31]Leiserowitz, *International public opinion, perception, and understanding of global climate change*, p. 6.

[32]Questions about "worry" and "concern" are often represented as expressing similar concepts, but they can elicit different reactions in surveys, with "worry" being a more significant and active sentiment than "concern" (ibid.). I use the terms interchangeably, but as discussed earlier the particular measure I employ is based on a survey question with "worry" language.

[33]Rachael L. Shwom et al. "Understanding U.S. public support for domestic climate change policies". In: *Global Environmental Change* 20 (2010), pp. 472–482.

[34]Shwom et al. code free-text responses from surveys in Virginia and Michigan that ask people to explain their stance on climate policies. Generic language about costs is by far the most common response ("Consideration of costs in general or to themselves and their family"). More specific economic impact language related to the effect of policies on "job creation and destruction", "national/regional economy", and "a specific industry or businesses in general" is also common. Industry-specific language is mentioned by 6.9% of respondents, more than the number who mention skepticism about climate change, concern for future generations, health impacts, or religion as driving their policy stances. See Rachael L. Shwom et al. "Understanding U.S. public support for domestic climate change policies". In: *Global Environmental Change* 20 (2010), pp. 472–482.

[35]Gampfer et al., "Obtaining public support for North-South climate funding: Evidence from conjoint experiments in donor countries"; Bechtel and Scheve, "Mass support for global

Tobler et al.[36] finds that "perceived costs" are one of the two most important predictors of support for different climate change approaches (the other being perceived benefits). Perception may be misleading: people are especially likely to associate taxation-based policies with higher burdens,[37] even though other forms of regulation may impose similar costs indirectly. When respondents are presented with explicit price tags for policies, differences in support levels are markedly reduced.[38]

The relationship between sectoral emissions and opinion is theorized as being driven by fears of increased personal costs. The literature discussed above suggests that some climate attitude questions prompt cost concerns more strongly than others. Therefore, the effect of emissions on attitudes should depend on the extent to which a climate question emphasizes higher costs for people in emissions-intense sectors. General questions about concern should not prompt as much resistance from employees in emissions-intense sectors as policy questions, and non-taxation policies should prompt less resistance than taxation.

Hypothesis 6.2 (Cost Concentration Effect) *Working in a sector with a higher emissions intensity will have a greater effect on support for costly mitigation policy than on support for non-costly policy or general concern about climate change.*

climate agreements depends on institutional design"; Bernauer and McGrath, "Simple reframing unlikely to boost public support for climate policy".

[36]Christina Tobler et al. "Addressing climate change: Determinants of consumers' willingness to act and to support policy measures". In: *Journal of Environmental Psychology* 32.3 (2012), pp. 197–207.

[37]Sverker C Jagers and Henrik Hammar. "Environmental taxation for good and for bad: the efficiency and legitimacy of Sweden's carbon tax". In: *Environmental Politics* 18.2 (2009), pp. 218–237; Runar Brannlund and Lars Persson. "To tax, or not to tax: Preferences for climate policy attributes". In: *Climate Policy* 12.6 (2012), pp. 704–721.

[38]Matthew J. Kotchen et al. "Willingness-to-pay and policy-instrument choice for climate-change policy in the United States". In: *Energy Policy* 55 (2013), pp. 617–625.

6.3.3 Dampening Effects

The comparative literature on climate attitudes has identified several individual-level factors which affect support for climate action. Income, education, and ideology are among the most prominent. But their impact is contested. And since these variables have rarely been analyzed alongside sector-level CO_2, it is not yet known how their effects might change in the presence of emissions measures.

Stern[39] observes that "psychological variables such as attitudes and personal norms appear to have more effect on relatively inexpensive, easy-to-perform energy-saving actions." This suggests that personal characteristics and the costs of actions do not influence behavior independently, but interactively: rising costs change which factors influence people's environmental behavior. When costs are low, non-cost considerations govern action. When perceived costs are high, the importance of non-cost considerations for predicting action diminish. I propose that employment-related emissions may have a similar "crowding-out" effect on support for climate change policy, dampening the importance of factors beyond costs.

For workers in low-emissions sectors, questions about emissions regulation do not involve a threat to their livelihoods. They are thus free to interpret the problem through other lenses. Can they weather marginal increases in consumer prices? Can they understand how the regulation will help the climate problem? How do they feel about government regulation generally? How worried are they about climate change?

For workers in high-emissions sectors, however, emissions regulation could represent a personal risk. Asking someone whether they are willing to hazard job losses in general is very different from asking if they're willing to risk their

[39]Paul C. Stern. "Psychological Dimensions Of Global Environmental Change". In: *Annual Review of Psychology* 43.1 (2002), pp. 269–302, p. 285.

own job. If you think your livelihood is at stake, other considerations may well become less salient.

Hypothesis 6.3 (Dampening Effect) *Working in a sector with a higher emissions intensity will reduce the effect of other key variables on support for costly mitigation policy.*

Specifically, I argue that the effect of income, education, and ideology will diminish as sector-level carbon intensity increases. I will discuss each of these briefly in turn, starting with income.

Income

There is an active and ongoing debate over whether personal income increase support for climate change action. Some studies find that people with higher incomes are more supportive of mitigation.[40] This fits with the post-materialist values hypothesis, which suggests that prosperity relieves people from worrying about their basic needs, freeing them to prioritize things like environmental quality.[41] It also fits the pattern that rich people spend smaller proportions of their income on emissions-intense goods like electricity and fuel, and are more likely to be able to afford goods like electric cars or solar panels that reduce their dependence on emissions.[42]

[40] Malcolm Fairbrother. "Rich People, Poor People, and Environmental Concern: Evidence across Nations and Time". In: *European Sociological Review* 29.5 (2013), pp. 910–922; Fredrik Carlsson et al. "Paying for Mitigation: A Multiple Country Study". In: *Land Economics* 88.2 (2015), pp. 326–340; Dienes, "Actions and intentions to pay for climate change mitigation: Environmental concern and the role of economic factors".

[41] Ronald Inglehart. *Modernization and postmodernization : cultural, economic, and political change in 43 societies*. Princeton University Press, 1997, p. 453; Axel Franzen and Reto Meyer. "Environmental Attitudes in Cross-National Perspective: A Multilevel Analysis of the ISSP 1993 and 2000". In: *European Sociological Review* 26.2 (Apr. 2010), pp. 219–234.

[42] S. West and Williams R. "Estimates from a consumer demand system: Implications for the incidence of environmental taxes". In: *Journal of Environmental Economics and Management* 47.3 (2004), pp. 535–558; D. Fullerton and G. Heutel. "Analytical general equilibrium effects of energy policy on output and factor prices". In: *B.E. Journal of Economic Analysis & Policy* 10.2 (2010).

There are also a range of studies that find higher incomes are not associated with greater support for climate action.[43] Poorer people are more likely to face the problems of climate change, and have fewer investments that might be threatened by mitigation action. These effects might counter-act the positive role of income. In the study by Kachi et al.[44] of Germany and the US, "income is not statistically significant in any specifications." Income shows no significant relationship with either WTP or WTS in Brazil.[45] Mildenberger and Leiserowitz[46] find that drops in income are actually associated with more support for climate action in the US. How to resolve this conflict?

By analyzing income without taking into account people's sector of employment, these studies are effectively assuming that the source of one's income does not matter. They are assuming that rising income for a chef or nurse will have the same effect as rising income for a coal miner or a factory worker. But if a worker perceives regulation as threatening their job, their income itself is at risk. This risk could undermine or eliminate the positive association between income and environmentalism. Instead of a high income providing insulation from the threat of regulation, it becomes a source of potential opposition. The positive relationship between income and support for regulation should only be expected to hold as long as that income itself is not threatened by regulation.

Hypothesis 6.3a (Income-Dampening Effect) *Working in sectors with higher carbon dioxide intensities will reduce the effect of income on support for costly*

[43] Aya Kachi et al. "Climate policy in hard times: Are the pessimists right?" In: *Ecological Economics* 114 (2015), pp. 227–241; Bakaki and Bernauer, "Citizens show strong support for climate policy, but are they also willing to pay?"; Matto Mildenberger and Anthony A. Leiserowitz. "Public opinion on climate change: Is there an economy–environment tradeoff?" In: *Environmental Politics* (2017).

[44] Kachi et al., "Climate policy in hard times: Are the pessimists right?"

[45] Bakaki and Bernauer, "Citizens show strong support for climate policy, but are they also willing to pay?"

[46] Mildenberger and Leiserowitz, "Public opinion on climate change: Is there an economy–environment tradeoff?"

mitigation policy.

Education

Education is another common factor explored in the literature, included in most studies either as an independent variable of interest or as a control. But its importance, and indeed the direction of its effects, are contested.

Some find a strong positive relationship between education and concern or knowledge about climate change.[47] Lee et al.[48] goes so far as to say that "educational attainment is the single strongest predictor of climate change awareness." But others[49] find a negative relationship between education and climate concern.[50]

Moving from concern to willingness to support or pay for policy action, education plays a statistically significant role in more than half of the studies reviewed by Johnson and Nemet.[51] Many scholars have found positive relationships between education and willingness-to-pay, in countries such as Australia,[52] the

[47]Emilia Tjernström and Thomas Tietenberg. "Do differences in attitudes explain differences in national climate change policies?" In: *Ecological Economics* 65 (2007), pp. 315–324; Kvaløy et al., "The publics' concern for global warming: A cross-national study of 47 countries"; Lee et al., "Predictors of public climate change awareness and risk perception around the world".

[48]Lee et al., "Predictors of public climate change awareness and risk perception around the world".

[49]B. Dan Wood and Arnold Vedlitz. "Issue Definition, Information Processing, and the Politics of Global Warming". In: *American Journal of Political Science* 51.3 (July 2007), pp. 552–568; Ariel Malka et al. "The Association of Knowledge with Concern About Global Warming: Trusted Information Sources Shape Public Thinking". In: *Risk Analysis* 29.5 (2009); Aaron M. McCright. "The effects of gender on climate change knowledge and concern in the American public". In: *Population and Environment* 32 (2010), pp. 66–87.

[50]Education is also of interest to the literature on environmental concern, and the relationship between the two appears to be more consistently positive (Sandra T. Marquart-Pyatt. "Contextual influences on environmental concerns cross-nationally: A multilevel investigation". In: *Social Science Research* 41.5 [2012], pp. 1085–1099).

[51]Johnson and Nemet, "Willingness to pay for climate policy: a review of estimates".

[52]Akter and Bennett, "Household perceptions of climate change and preferences for mitigation action: the case of the Carbon Pollution Reduction Scheme in Australia".

United States,[53] Sweden and China.[54] Dienes[55] finds a positive effect of education on intention to pay for climate change mitigation across 35 countries from the Life in Transition Survey. But findings in the US indicate the relationship may not always be positive: Carlsson et al.[56] finds no statistically significant relationship between education and willingness-to-pay there.[57]

Scholars in the United States have also found increasing evidence that the effect of education is conditional on ideology and partisan affiliation, with higher education actually making conservatives and Republicans less concerned about climate change.[58] The finding that "[e]ducation no longer has a simple positive effect on concern"[59] is important, because it suggests that the role of education is dependent on other individual factors. Ideology seems to be one such factor. But why should material interests, represented by sector of employment, not play a similar role?

More educated people are likely to be better informed[60] and have greater cognitive resources,[61] helping them to understand the problem of climate change. They are also more likely to understand how mitigation policies work, and how to

[53]Robert E. O'Connor et al. "Risk perceptions, general environmental beliefs, and willingness to address climate change". In: *Risk Analysis* 19.3 (1999), pp. 461–471; Kotchen et al., "Willingness-to-pay and policy-instrument choice for climate-change policy in the United States".

[54]Carlsson et al., "Paying for Mitigation: A Multiple Country Study".

[55]Dienes, "Actions and intentions to pay for climate change mitigation: Environmental concern and the role of economic factors".

[56]Carlsson et al., "Paying for Mitigation: A Multiple Country Study".

[57]Alberto Longo et al. "Willingness to Pay for Ancillary Benefits of Climate Change Mitigation". In: *Environ Resource Econ* 51 (2012), pp. 119–140, For a review of similarly mixed findings on willingness to pay for environmental protection generally, see.

[58]Lawrence C. Hamilton. "Education, politics and opinions about climate change evidence for interaction effects". In: *Climatic Change* 104.104 (2011); McCright and Dunlap, "The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010".

[59]Hamilton, "Education, politics and opinions about climate change evidence for interaction effects", p. 233.

[60]Tjernström and Tietenberg, "Do differences in attitudes explain differences in national climate change policies?"

[61]Kvaløy et al., "The publics' concern for global warming: A cross-national study of 47 countries".

take advantage of programs like subsidies that reward knowledge and preparation.

However, if people are predisposed to think of mitigation regulation as personally costly, education may end up reinforcing that belief. Even if Lo and Chow[62] are right to say that "[m]ost people do not have or never seek information on the total amount of CO_2 emissions they produce," education should plausibly increase the chance that people have a relative sense of the carbon intensity of their work. Educated people may be better able to draw the connection between mitigation policies and risks to their jobs. Once that connection is drawn, education may also help people rationalize and find information channels to support their opposition. I argue that these cost-attribution and rationalization effects will be stronger for people who are both educated and working in emissions-intense sectors.

Hypothesis 6.3b (Education-Dampening Effect) *Working in sectors with higher carbon dioxide intensities will reduce the effect of education on support for costly mitigation policy.*

Ideology

In the previous hypothesis, I discussed political ideology and partisanship as an intervening factor that can change the impact of education. But political beliefs also appear to have an effect on their own.

Right-wing ideology is generally thought to be skeptical of government intervention in the economy. Right parties tend to be more sympathetic to the concerns of business, and more worried about the economic cost of policies. It seems natural, therefore, to expect that people opposed to government regulation and worried about costs to businesses would be more likely to oppose climate regulation as well.

[62]Lo and Chow, "The relationship between climate change concern and national wealth".

Empirically, holding conservative or right-wing political views[63] is associated with weaker concern about climate change and less support for mitigation policy.[64] In the study by Running,[65] "[o]f all of the factors considered, political ideology appears to have the strongest effect on attitudes about global warming" and Tobler et al.[66] writes that "[a]mong the sociodemographic variables, political affiliation was the most influential determinant" of policy support. This effect might be due to explicit political cues from elites,[67] or it could come from broader worldviews that are slowly shaped by ideology.[68] But either way, the relationship appears across many different national contexts.[69]

There is no conflict between the idea that conservatives and people employed in emissions-intense sectors will both be more likely to oppose climate change

[63]For the purpose of this chapter I will use the terms "conservative" and "right-wing" interchangeably.

[64]McCright and Dunlap, "The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010"; Katrina Running. "Examining Environmental Concern in Developed, Transitioning and Developing Countries". In: *World Values Research* 5 (2012), pp. 1–27; Kvaløy et al., "The publics' concern for global warming: A cross-national study of 47 countries"; Tobler et al., "Addressing climate change: Determinants of consumers' willingness to act and to support policy measures"; Sandra T. Marquart-Pyatt et al. "Politics eclipses climate extremes for climate change perceptions". In: *Global Environmental Change* (2014); Aaron M. McCright et al. "Political ideology and views about climate change in the European Union". In: *Environmental Politics* 25.2 (2016), pp. 338–358. arXiv: `arXiv:1011.1669v3`.

[65]Running, "Examining Environmental Concern in Developed, Transitioning and Developing Countries", p. 12.

[66]Tobler et al., "Addressing climate change: Determinants of consumers' willingness to act and to support policy measures".

[67]Matto Mildenberger and Anthony A. Leiserowitz. "Public opinion on climate change: Is there an economy–environment tradeoff?" In: *Environmental Politics* (2017).

[68]Thomas Dietz et al. "Support for Climate Change Policy: Social Psychological and Social Structural Influences". In: *Rural Sociology* 72.2 (June 2007), pp. 185–214; Nicholas Smith and Anthony A. Leiserowitz. "American evangelicals and global warming". In: *Global Environmental Change* 23 (2013), pp. 1009–1017.

[69]There is evidence for a similar relationship with environmental concern Hamilton; Franzen and Vogl, though Nawrotzki finds that right-wing views are actually associated with more concern in developing countries (which may be partially due to differences in the meaning of left and right outside Western nations). See Lawrence C. Hamilton. "Education, politics and opinions about climate change evidence for interaction effects". In: *Climatic Change* 104.104 (2011); Axel Franzen and Dominikus Vogl. "Two decades of measuring environmental attitudes: A comparative analysis of 33 countries". In: *Global Environmental Change* 23.5 (Oct. 2013), pp. 1001–1008; Raphael J. Nawrotzki. "The Politics of Environmental Concern: A Cross-National Analysis". In: *Organization & Environment* 25.3 (Aug. 2012), pp. 286–307.

mitigation. But the two effects may overlap with each other, creating a ceiling on mitigation opposition. If someone is working in an emissions-intense sector, regardless of their political ideology, they have more incentive to think in stereotypically "right-wing" terms about regulation that threatens them. If someone is normally left-wing, this may represent a departure from how they normally feel about regulation. But if they are usually conservative, then there may be less room for them to become more skeptical. Thus, for people working in emissions-intense sectors, a ceiling effect may dampen the relationship between political ideology and policy support.

Hypothesis 6.3c (Ideology-Dampening Effect) *Working in sectors with higher carbon dioxide intensities will reduce the effect of ideology on support for costly mitigation policy.*

6.4 Data and Methods

6.4.1 Data

The key difficulty in studying the influence of sectoral characteristics on climate opinion is that many opinion datasets do not include information on respondents' sector of employment. Without such information, one can make inferences about the effect of national sectoral composition on opinion, but it is not possible to assess individual-level relationships. Datasets that include occupational information contain some sectoral information: people coded as farmers are almost certainly working in agriculture, for example. But for other occupations, like 'manual laborer' or 'manager', the sector of employment is unclear. And datasets that do include occupational information do not necessarily include the necessary questions about climate opinion.

Tvinnereim and Ivarsflaten added custom questions to the Norwegian Citizen Panel, and Bechtel et al. commissioned their own four-country survey. These methods guarantee the inclusion of relevant questions, but they become very costly when trying to cover many countries. Fortunately, the latest round of the European Social Survey (ESS) includes both climate-focused questions and disaggregated information on respondents' sector of employment. I will employ it to test my hypotheses.

The eighth round of the ESS covers 47,594 respondents from 23 countries.[70] The survey was administered via face-to-face interviews in late 2016. The mean country sample size was 2,069, with a standard deviation of 550. The target population includes "all persons aged 15 and over (no upper age limit) resident within private households in each country, regardless of their nationality, citizenship or language." This round was chosen because, beyond being the most recent version of the survey, it also contained a module on climate change and energy-related topics.

Respondents' sector of employment was recorded using codes from the second revision of NACE, the Statistical Classification of Economic Activities in the European Community.[71] 39,945 of the respondents have a NACE code recorded (approximately 84%). There are 88 industry categories represented in the data. I aggregated these codes to match them with the 35 industries codes in the WIOD data, which are based on the first version of NACE.

To measure the emissions-intensity of individuals' sectors of employment, I use the same measure of carbon intensity included in the previous chapters: logged and standardized carbon dioxide (measured in tons) emitted per unit of output

[70]The countries include Austria, Belgium, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

[71]The acronym "NACE" comes from the French "Nomenclature générale des Activités économiques dans les Communautés Européennes."

(converted to dollars using purchasing-power parity). The standardization was done prior to merging, so that it is consistent with the earlier analysis and not affected by the number of individuals sampled from each industry in the ESS.

To measure income, I use the decile of the household's total income net of taxes and government payments.[72] To measure education, I use the highest level of education completed, based on the International Standard Classification of Education (ranging from less than lower secondary to higher tertiary). To measure political ideology, I use self-placement on an 11-point scale from "Left" to "Right". These variables have all been centered so the mean is 0. I also include standardized age, gender, and whether the respondent belongs to a religious denomination or a trade union as control variables.

In some models, I also employ national-level measures of GDP per capita and carbon intensity per unit of GDP, drawn from WIOD[73] and the Penn World Tables.[74] As with the sector variables, both measures are logged and standardized at the national level prior to merging.

The ESS data include several questions about support for climate mitigation policy. Respondents are asked "To what extent are you in favour or against the following policies in [country] to reduce climate change?" and then presented with three policy options: "Increasing taxes on fossil fuels, such as oil, gas and coal," "Using public money to subsidise renewable energy such as wind and solar power," and "A law banning the sale of the least energy efficient household appliances." Possible answers include "strongly in favour," "somewhat in favour," "neither in favour nor against," "somewhat against," "strongly against," "don't know," and a code for refusal to answer. I construct a dichotomous variable that is 1 if

[72]Respondents select their from a card indicating the income ranges appropriate to their country.

[73]Timmer et al., "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production".

[74]Feenstra et al., "The Next Generation of the Penn World Table".

a respondent is "strongly" or "somewhat in favour" and 0 otherwise, dropping "don't know" and non-responses.

To represent support for costly climate mitigation policy, I rely on the question about fossil fuel taxation. Taxation language is much more clearly cost-oriented than subsidies for renewable energy or appliance efficiency regulation. As Tvinnereim and Ivarsflaten[75] find, policies with concentrated costs are more likely to threaten workers in emissions-intense industries than policies with diffuse costs spread across the whole tax base.

The ESS also includes measures of respondents' concern and knowledge about climate change, both of which I re-coded to be dichotomous. For concern, respondents are asked "How worried are you about climate change?" and I coded responses as 1 if they replied that they were "very" or "extremely" worried. For knowledge, respondents are asked whether they "think that climate change is caused by natural processes, human activity, or both?" I coded responses as 1 if they said climate change was caused "mainly" or "entirely by human activity."

For robustness checks, I also included a series of control variables related to respondents' news consumption, values, and climate change awareness. To measure news consumption, I use the log of the number of minutes respondents claim to spend "watching, reading or listening to news about politics and current affairs" on a "typical day".

To measure values, I include support for redistribution, support for environmentalism, and a general measure of egalitarianism. For redistribution, I use agreement on a five-point Likert scale with the statement "The government should take measures to reduce differences in income levels." For environmentalism and egalitarianism, I use six-point measures expressing whether the respondent considers themselves similar to other people based on their values. For environmen-

[75]Tvinnereim and Ivarsflaten, "Fossil fuels, employment, and support for climate policies".

talism, I use the person described thus: "He strongly believes that people should care for nature. Looking after the environment is important to him". For egalitarianism: 'She thinks it is important that every person in the world should be treated equally. She believes everyone should have equal opportunities in life." In the survey, the genders match the respondent's. I re-scale all three variables so higher values indicate greater support for redistribution, environmentalism, and egalitarianism.

To measure climate change awareness, I included whether respondents say they think about climate change a lot, whether they think climate change is bad for the world, and their response to the human causation question. For thinking about climate change, I used the question "How much have you thought about climate change before today?" and coded responses as 1 if they replied "A lot" or "A great deal". For an estimate of climate change's effects, I used the question "How good or bad do you think the impact of climate change will be on people across the world?" Respondents select a number on an eleven-point scale ranging from 0 ("extremely bad") to 10 ("extremely good"), which I re-scaled so higher numbers indicate bad effects.

Table 6.1 and table 6.2 present the summary statistics and the correlations.

6.4.2 Regression Approach

Classical logistic regression does not account for data that is divided into many cross-cutting groups. In the ESS data, standard regression methods would only permit clustering by country or sector, but not both. This is a problem, given that the main explanatory variable of interest is only available at a group level (sectoral emissions intensity). Based on work by Cameron et al.,[76] Petersen et

[76] A. Colin Cameron et al. "Robust Inference with Multi-way Clustering". Technical Working Paper Series, National Bureau of Economic Research. Cambridge, MA, 2006.

Table 6.1: Summary Statistics

	Mean	S.D.	Min	Max	Count
Support Fossil Fuel Taxation	.33	.47	0	1	24288
Support Inefficient Appliance Ban	.59	.49	0	1	24403
Support Renewable Subsidies	.76	.43	0	1	24515
Worried About CC	.72	.45	0	1	24184
Sectoral Carbon Intensity	-.68	.78	-4.5	2.6	24998
National Carbon Intensity	-.87	.9	-1.9	1.1	24998
GDP per Capita	.008	1	-1.8	1.3	24998
Income	-.12	2.7	-4.5	4.5	21615
Right Ideology	.14	2.1	-5	5	22424
Education	.18	1.8	-3	3	24911
Union Member	.18	.38	0	1	24929
Age	.066	.95	-1.8	2.7	24934
Male	.48	.5	0	1	24998
Religious	.52	.5	0	1	24871
Pro-Egalitarian	4.8	1.1	1	6	24812
Pro-Redistribution	3.8	1	1	5	24704
Pro-Environmentalism	4.8	1	1	6	24838
CC Human Caused	3.4	.84	0	5	24092
CC Bad for World	6.6	2.1	0	10	23546
Thought About CC	3	1.1	1	5	24462
News Consumption	-.065	.95	-4.1	3.4	23683

Table 6.2: Correlations

		1	2	3	4	5	6	7	8	9	10
1	Support Fossil Fuel Tax	1.00									
2	Supp. Ineff. Appl. Ban	0.18	1.00								
3	Supp. R.E. Subsidies	0.19	0.24	1.00							
4	Worried About CC	0.14	0.17	0.15	1.00						
5	Sectoral CO_2 Intensity	-0.09	-0.04	-0.06	-0.07	1.00					
6	National CO_2 Intensity	-0.11	-0.08	-0.08	-0.11	0.32	1.00				
7	GDP per Capita	0.14	0.07	0.07	0.12	-0.31	-0.92	1.00			
8	Income	0.13	0.06	0.09	0.07	-0.07	-0.01	0.03	1.00		
9	Right Ideology	-0.06	-0.05	-0.06	-0.09	0.03	0.04	-0.05	0.07	1.00	
10	Education	0.15	0.06	0.07	0.09	-0.11	0.12	-0.08	0.38	-0.02	1.00
11	Union Member	0.10	0.04	0.06	0.05	-0.09	-0.14	0.16	0.17	-0.04	0.13
12	Age	-0.06	0.02	-0.04	-0.05	0.06	-0.05	0.04	-0.23	0.04	-0.19
13	Male	0.01	-0.04	-0.02	-0.06	0.17	-0.03	0.03	0.08	0.04	-0.04
14	Religious	-0.06	0.01	0.01	0.03	0.03	-0.05	0.03	-0.05	0.11	-0.05
15	Pro-Egalitarian	0.10	0.09	0.12	0.13	-0.08	-0.16	0.14	-0.01	-0.13	0.02
16	Pro-Redistribution	0.03	0.08	0.07	0.08	0.00	-0.01	-0.01	-0.17	-0.19	-0.10
17	Pro-Environmentalism	0.11	0.15	0.14	0.19	-0.01	0.01	-0.01	-0.02	-0.04	0.05
18	CC Human Caused	0.15	0.14	0.15	0.26	-0.08	-0.14	0.13	0.07	-0.09	0.07
19	CC Bad for World	0.11	0.12	0.12	0.21	-0.03	-0.05	0.02	0.05	-0.12	0.11
20	Thought About CC	0.19	0.17	0.16	0.41	-0.12	-0.19	0.18	0.14	-0.12	0.21
21	News Consumption	0.01	-0.02	-0.03	-0.01	0.04	0.07	-0.06	-0.06	0.01	0.01

		11	12	13	14	15	16	17	18	19	20
11	Union Member	1.00									
12	Age	-0.06	1.00								
13	Male	0.02	-0.03	1.00							
14	Religious	0.00	0.15	-0.07	1.00						
15	Pro-Egalitarian	0.05	0.01	-0.07	0.05	1.00					
16	Pro-Redistribution	0.05	0.09	-0.05	0.04	0.16	1.00				
17	Pro-Environmentalism	0.04	0.16	-0.06	0.06	0.29	0.11	1.00			
18	CC Human Caused	0.06	-0.11	-0.01	-0.01	0.09	0.03	0.09	1.00		
19	CC Bad for World	0.02	-0.08	-0.00	-0.01	0.12	0.06	0.14	0.26	1.00	
20	Thought About CC	0.08	-0.04	0.00	-0.03	0.16	0.02	0.24	0.24	0.25	1.00
21	News Consumption	-0.05	0.29	0.06	0.01	0.01	0.02	0.06	-0.07	-0.04	0.03

al.[77] have developed method of conducting logistic regressions with an arbitrary number of clustering variables. I employ their methods in the regressions below.[78]

The Petersen et al. implementation of logistic regression only allows for binary and not ordinal variables, which means that the dependent variables must be dichotomized.[79] I employ post-stratification weights, which adjust the data based on age, gender, and education to better reflect the distribution of these variables by region.

6.5 Results

6.5.1 Support for Fossil Fuel Taxation

In the first series of models, displayed in table 6.3, I test whether the carbon intensity of individuals' sector of employment affects their support for costly mitigation policy. As discussed above, costly mitigation policy is represented by increasing taxes on fossil fuels in order to combat climate change.

The results appear consistent with H6.1, which predicted that workers in carbon-intense sectors would be less supportive of costly mitigation. These results are also consistent with those in Tvinnereim and Ivarsflaten and Bechtel et al., confirming that the relationships they found in a few countries are present across Europe. Coefficients in logistic regression represent the log of the odds of the dependent variable being 1, so to interpret the coefficients it is necessary to

[77] Mitchell Petersen et al. *cgmlogit: Logit regressions with multi-way clustered standard errors, version 2.3.2.* 2014.

[78] In earlier chapters I employed a multilevel mixed-effects linear regression with crossed effects to account for this structure. But this model did not converge on estimates when using the ESS data, perhaps because of the large number of observations.

[79] An alternative model by Guan and Petersen implements ordinal logistic regression with multi-way clustered standard errors, but this method unfortunately does not allow for the necessary weighting of observations. See Jingling Guan and Mitchell Petersen. *logit2.* `https://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm`. 2008; European Social Survey. *Weighting European Social Survey Data.* Tech. rep. 2014.

exponentiate them. In the fully-specified third model, a one-standard deviation increase in the logged carbon intensity of a respondents' sector of employment is associated with a 10% lower chance of them supporting fossil fuel taxation.[80]

The first model demonstrates that the negative relationship between intensity and policy support is not driven by control variables. The second model adds a number of controls based on previous literature, which behave largely as expected. Right-wing ideology and belonging to a religious denomination are associated with weaker support for mitigation. Higher levels of income, education, and belonging to a union are associated with higher support. Being male also appears to have a positive effect on support, which is surprising given previous findings, but the effect is only marginally statistically significant and is not robust across later regressions.

The third and fourth models add national-level control variables: carbon intensity per unit of GDP and GDP per capita. Their inclusion reduces the size of the effect of sectoral carbon intensity, but it remains both substantively and statistically significant. National carbon intensity does not appear to be statistically significant. GDP per capita appears to have a large and statistically significant positive association with support for fossil fuel taxation in the countries sampled.

[80]The reduction appears larger in the first and second models (24% and 18% respectively) but I focus on the third model since it includes national-level covariates. Since the effect of carbon intensity is smallest in this model, it also represents a more conservative estimate of its importance.

Table 6.3: Support for Fossil Fuel Taxation

	(1)	(2)	(3)	(4)
CO_2 Intensity	-0.27***	-0.20***	-0.11***	-0.09***
	(0.08)	(0.07)	(0.03)	(0.03)
Right-Wing Ideology		-0.06***	-0.06***	-0.06***
		(0.02)	(0.02)	(0.02)
Income Decile		0.06***	0.06***	0.05***
		(0.01)	(0.01)	(0.02)
Education Level		0.13***	0.14***	0.15***
		(0.02)	(0.01)	(0.02)
Union Member		0.41***	0.33***	0.30***
		(0.12)	(0.10)	(0.10)
Religion		-0.16*	-0.20**	-0.20***
		(0.09)	(0.08)	(0.07)
Male		0.08*	0.05	0.04
		(0.05)	(0.04)	(0.04)
Age		-0.05	-0.05	-0.06
		(0.03)	(0.03)	(0.03)
National CO_2 Intensity			-0.33***	
			(0.13)	
GDP per Capita				0.84***
				(0.14)
Constant	-0.91***	-0.89***	-1.09***	-1.40***
	(0.14)	(0.15)	(0.12)	(0.12)
N	24,288	19,228	19,228	19,228
Pseudo R^2	0.01	0.04	0.05	0.06

Logistic Regression with Multi-Way Clustering

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

6.5.2 Cost-Concentration

In the second set of models, displayed in table 6.4, I test whether the effect of carbon intensity is stronger for fossil fuel taxation compared with other less "costly" opinions. The results appear consistent with H6.2, which predicts that CO_2 would have its greatest impact on support for costly mitigation policy and weaker impacts on less expensive, less targeted options. I performed the models with both a GDP per capita control and a national emissions control, with substantively similar results.

Models 1 and 2 test the effect of sectoral emissions on respondents' general concern and knowledge about climate change, respectively. Though the relationship is negatively signed, sectoral emissions have no statistically significant effect on respondents' concern about climate change or their understanding of it as human-caused. This helps deal with a potential concern about selection bias. It is possible that people who are more concerned or knowledgeable about climate change would be less likely to look for jobs in emissions-intense sectors. But if this were driving the results, one would expect emissions-intensity of employment to predict concern or knowledge, which is not the case.

Models 3 and 4 test the impact of sectoral emissions on support for two policy options that are less targeted at emissions-intense sectors than fossil fuel taxation: appliance efficiency mandates and renewable energy subsidies. These models add a control for concern about climate change (the dependent variable in Model 1).

Model 3 finds no statistically significant relationship between sectoral emissions and support for appliance mandates. This policy option does not involve costs targeted at people in most high-emissions industries, so it makes sense that there is no strong relationship here. Model 4 finds a statistically significant negative relationship between sectoral emissions and support for renewable subsidies,

but the relationship is somewhat smaller than that for fossil fuel taxation. Government renewable subsidies spread the costs of their policy across the tax base, so their impact on emissions-intense sectors is less strong. The effect is still substantively large, however, which might be explained by emissions-intense sectors also being energy-intense, and therefore concerned about rising energy prices.[81]

In line with H6.2, sectoral emissions have their strongest effect on support for the emissions policy with the strongest cost-concentration, fossil fuel taxes. The negative relationship between sectoral emissions and support for taxation persists when a control for concern is added to the model. This suggests that the emissions-opinion relationship is driven by cost considerations and not selection effects. If working in an emissions-intense sector reduce support for costly policy by making workers skeptical about climate change generally, then the concern measure would be expected to reduce the effect of the emissions measure.

[81] This would be a worthwhile subject for future research.

Table 6.4: Cost Targeting

	(1) Worry	(2) Anthropogenic	(3) Appliances	(4) Renewables	(5) Taxes
CO_2 Intensity	-0.02	-0.05	0.01	-0.08**	-0.10***
	(0.05)	(0.03)	(0.02)	(0.04)	(0.03)
Right-Wing Ideology	-0.09***	-0.09***	-0.03**	-0.05**	-0.03**
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Income Decile	0.04***	0.03**	0.04***	0.05***	0.05***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Education Level	0.05***	0.05**	0.04***	0.03	0.14***
	(0.02)	(0.02)	(0.01)	(0.03)	(0.02)
Climate Ch. Concern			0.44***	0.42***	0.42***
			(0.04)	(0.05)	(0.06)
Union Member	0.01	0.12	0.02	0.23*	0.31***
	(0.12)	(0.08)	(0.07)	(0.14)	(0.12)
Religion	0.25**	0.06	0.04	0.10	-0.23***
	(0.10)	(0.07)	(0.08)	(0.12)	(0.07)
Male	-0.30***	0.04	-0.14***	-0.05	0.10**
	(0.06)	(0.05)	(0.03)	(0.10)	(0.05)
Age	-0.09**	-0.26***	0.16***	-0.05	-0.03
	(0.04)	(0.04)	(0.03)	(0.07)	(0.04)
GDP per Capita	0.61***	0.47***	0.11	0.19	0.75***
	(0.22)	(0.18)	(0.17)	(0.26)	(0.13)
Constant	0.62***	-0.68***	-0.91***	-0.15	-2.65***
	(0.18)	(0.09)	(0.20)	(0.27)	(0.25)
N	19,076	18,928	18,865	18,918	18,794
Pseudo R^2	0.03	0.03	0.04	0.04	0.08

Logistic Regression with Multi-Way Clustering

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

6.5.3 Dampening Effects

In the third set of regressions, I test whether sector-level carbon emissions moderate the effects of other variables of interest in the literature. The results of the multi-way clustered logistic regressions are presented in table 6.5.

Models 1, 2, and 3 test the interaction between carbon emissions and income, education, and right-wing ideology, respectively. Recall that these variables have been centered, so a value of 0 represents being in the middle of the income distribution, having completed secondary education, and identifying with the political center.

The results are consistent with H6.3 and its three sub-hypotheses. In each model, the interaction effect moderates the impact of income, education, or ideology. In all three interacted models, the main effect of CO_2 retains its size and statistical significance. The main effects for income and education remain positive and statistically significant, and the main effect for right-wing ideology remains negative and statistically significant.

A more intuitive way of displaying these results is through marginal effects plots. For technical reasons the plots displayed below are based on a standard logistic regression rather than the one with multi-way clustered standard errors. But this has no material impact on the coefficients or the conclusions.[82]

[82]The Petersen et al. implementation of logistic regression with multi-way clustering in Stata does not support factor-based interaction terms, which are required for calculating marginal effects. Fortunately, a standard logistic regression clustered on sectors produces the same coefficient sizes at similar levels of statistical significance (the only noticeable difference being that the interaction between income and CO_2 is significant at the $p<0.05$ level rather than $p<0.01$. See Mitchell Petersen et al. *cgmlogit: Logit regressions with multi-way clustered standard errors, version 2.3.2.* 2014.

Table 6.5: Moderating Effects

	(1)	(2)	(3)
CO_2 Intensity	-0.09***	-0.09***	-0.10***
	(0.03)	(0.03)	(0.04)
CO_2 Intensity × Income	-0.02***		
	(0.01)		
CO_2 Intensity × Education		-0.05***	
		(0.01)	
CO_2 Intensity × Right Ideology			0.03***
			(0.01)
Right-Wing Ideology	-0.06***	-0.06***	-0.03*
	(0.02)	(0.02)	(0.02)
Income Decile	0.04**	0.05***	0.05***
	(0.02)	(0.02)	(0.02)
Education Level	0.15***	0.11***	0.15***
	(0.02)	(0.02)	(0.02)
Union Member	0.30***	0.29***	0.30***
	(0.10)	(0.10)	(0.10)
Religion	-0.20***	-0.20***	-0.20***
	(0.07)	(0.07)	(0.07)
Male	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)
Age	-0.06*	-0.06*	-0.05
	(0.03)	(0.03)	(0.04)
GDP per Capita	0.85***	0.84***	0.84***
	(0.14)	(0.14)	(0.14)
Constant	-1.40***	-1.40***	-1.41***
	(0.12)	(0.12)	(0.12)
N	19,228	19,228	19,228
Pseudo R^2	0.06	0.06	0.06

Logistic Regression with Multi-Way Clustering

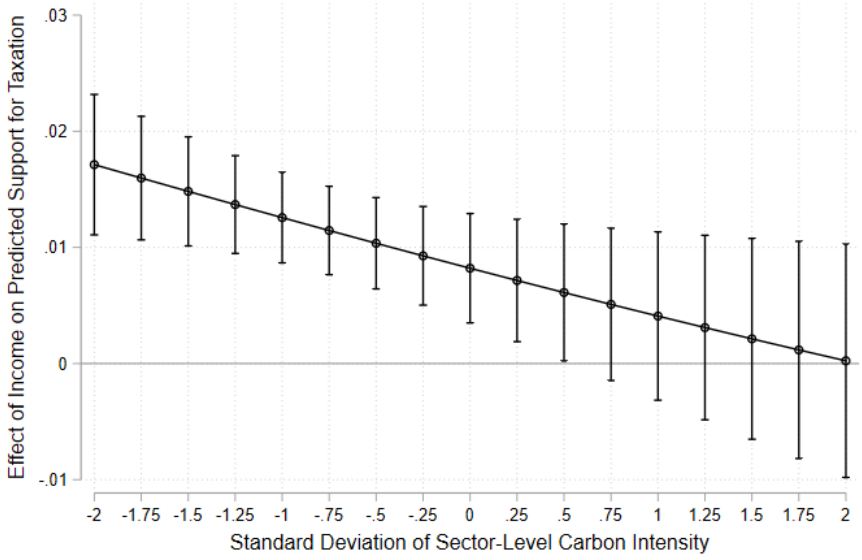
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

In all three marginal effects plots, the interaction of carbon intensity can be seen to moderate the impact of the other variables. In describing these interactions, I will calculate the predicted probabilities of two workers in the same sector supporting fossil fuel taxation. I will consider how this predicted support differs depending on whether they are employed in a low-emissions sector, with CO_2 intensity one standard deviation below the mean, or a high-emissions sector, with CO_2 intensity one standard deviation above the mean. In all cases the values of the other control variables are held at their means.

fig. 6.1 shows how the effect of income varies at different levels of carbon intensity. Consider two workers, one with a household income in the bottom 10% and one in the top 10%, who are employed in the same sector. If they work in a low emissions sector, the predicted probability that the low-income worker supports taxation is 28%, but the probability that the high-income worker supports it is predicted to be 39%. If they are employed in a sector with emissions one standard deviation above the mean, however, then there is no statistically significant difference in their likelihood of supporting taxation (28% versus 31%). This is consistent with hypothesis 6.3a, which argued that income will be less influential for people who work in high-emissions sectors.

A similar relationship is observed between education and emissions in fig. 6.2. In a low emissions sector, a worker whose highest level of education is secondary school has a 33% predicted probability of supporting taxation. A worker in the same sector with a tertiary education (equivalent to a bachelor's degree in the United Kingdom) is predicted to have a 40% chance of supporting taxation. Again, were both of them working in a high-emissions sector, the difference between them (29% versus 32%) is not statistically significant. This is consistent with hypothesis 6.3b, which suggested that the effect of income on support for taxation will weaken for people in emissions-intense industries.

Figure 6.1: Marginal Effects of Income, 95% CIs



Finally, in fig. 6.3 the relationship between political views and support for fossil fuel taxation is plotted. Consider two workers in the same industry, one of whom has right-wing views (8 on a scale of 0 to 10) and one who has left-wing views (2 on the same scale). If they work in a low emissions sector, the left-wing person is predicted to be 9 percentage points more likely to support fossil fuel taxation than their right-wing counterpart (39% versus 30%). But if they are employed in a high-emission sector, there is no predicted difference in their likelihood of supporting taxation (29% for both). This is consistent with hypothesis 6.3c, which claimed that ideology would be less salient for workers in high-emissions sectors.

6.5.4 Alternative Variables

In the next set of models, displayed in table 6.6, I test the robustness of the main result to the inclusion of other sets of variables thought to be important in explaining climate opinion. These fall into three categories: values, awareness, and news consumption.

Figure 6.2: Marginal Effects of Education, 95% CIs

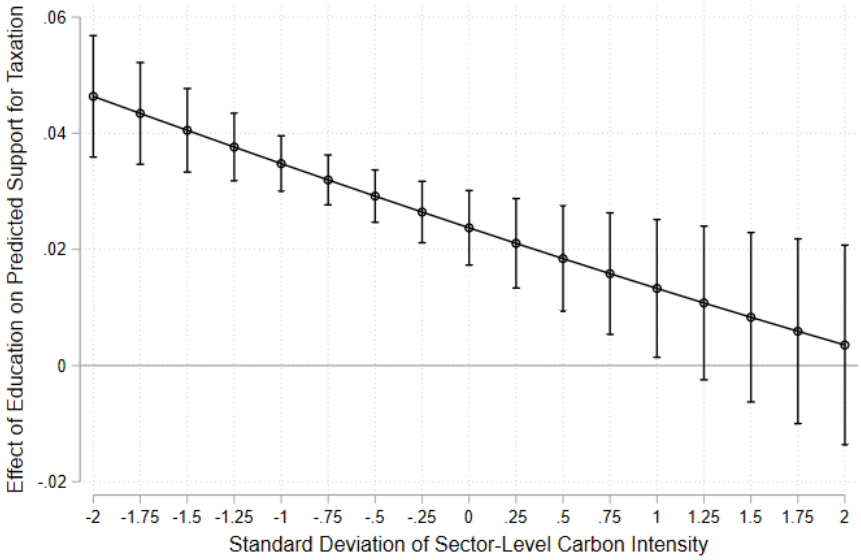
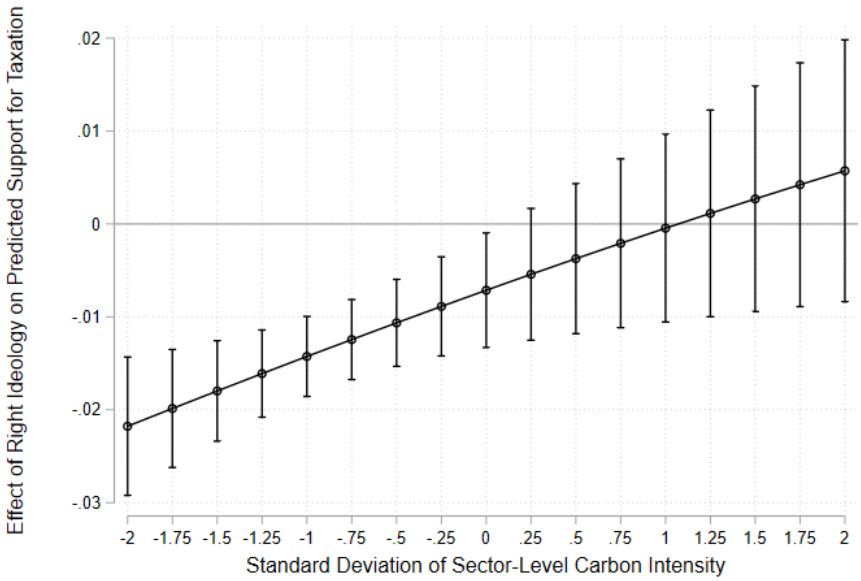


Figure 6.3: Marginal Effects of Right-Wing Ideology, 95% CIs



Values are a prominent explanation for climate opinion, and are featured in model 1. As with concern above, it is possible to imagine that people's values influence the sectors they choose to work in, or that working in a given sector could shape values over time. I use three kinds of potentially relevant values measures. The first is support for environmental protection in general, which should intuitively increase support for climate action. The second is support for redistribution: those who are in favor of more government intervention to equalize incomes are more likely to support intervention to mitigate climate change. The third is a more general measure of egalitarianism: those who believe in the importance of equality may be more concerned about the lives of people impacted by climate change.

It is also possible that some people are simply not aware of climate change or do not consider it to be a significant threat. As with values, it is possible that people who have less knowledge about climate change are more likely to go into emissions-intense work. In model 2, I include three measures of climate awareness. The first is whether respondents think about climate change a lot, since those who have not considered the issue may not have well-formed preferences on policy. Second, I include whether they consider climate change to be primarily caused by human activity. If one doubts that human emissions are causing change then there is little reason to support emissions reduction. Third, I include whether respondents consider the effects of climate change to be bad for the world. Why reduce emissions if climate change is good?

Finally, in model 3 I examine the effect of media consumption. In the theoretical discussion above, I suggested that one explanation for the link between sectoral emissions and taxation support may be cueing from management. But there are other more obvious sources of cues, namely the media. So in this model I add the amount of daily news consumption in minutes (standardized and logged).

As expected, all of the new variables have a statistically significant positive association with support for fossil fuel taxation. People who support redistribution, environmentalism, and egalitarianism are more likely to support costly mitigation policy. People who are more aware of the climate change problem are more likely to support mitigation policy, as are people who spend more time consuming news media. In model 4, all these effects are combined and still retain their positive signs and statistical significance.

Across all four specifications, the effect of sectoral carbon intensity retains its negative and statistically significant relationship with support for costly climate mitigation policy. This suggests that the effect of emissions is not driven by self-selection into industries based on values or climate awareness. Without panel data it is difficult to be certain that some underlying set of personal characteristics do not drive both sector of employment and climate attitudes. But the fact that emissions intensity continues to have a strong effect even when controlling for values and awareness and media consumption provides some measure of confidence that it is an independent effect.

Table 6.6: Alternative Variables

	(1)	(2)	(3)	(4)
CO_2 Intensity	-0.08***	-0.08***	-0.10***	-0.08***
	(0.03)	(0.03)	(0.03)	(0.03)
Right-Wing Ideology	-0.04***	-0.03**	-0.06***	-0.02
	(0.01)	(0.01)	(0.02)	(0.01)
Income Decile	0.06***	0.04***	0.05***	0.05***
	(0.02)	(0.01)	(0.02)	(0.01)
Education Level	0.14***	0.12***	0.14***	0.12***
	(0.02)	(0.02)	(0.02)	(0.02)
Union Member	0.27**	0.29***	0.30***	0.27**
	(0.11)	(0.11)	(0.10)	(0.11)
Religion	-0.24***	-0.21***	-0.20***	-0.23***
	(0.08)	(0.06)	(0.07)	(0.07)
Male	0.07*	0.04	0.02	0.05
	(0.04)	(0.04)	(0.04)	(0.04)
Age	-0.10***	-0.01	-0.09**	-0.08
	(0.04)	(0.04)	(0.04)	(0.05)
Support for Redistribution	0.07***			0.06***
	(0.02)			(0.02)
Support for Environmentalism	0.25***			0.17***
	(0.03)			(0.03)
Egalitarian Values	0.08***			0.06**
	(0.03)			(0.03)
Thought About Climate Change a Lot		0.23***		0.17***
		(0.04)		(0.04)
Climate Change Mostly Human-Caused		0.43***		0.42***
		(0.06)		(0.06)
Climate Change Bad for the World		0.05***		0.04***
		(0.01)		(0.01)
News Consumption			0.12***	0.11***
			(0.04)	(0.03)
GDP per Capita	0.85***	0.73***	0.85***	0.76***
	(0.14)	(0.12)	(0.15)	(0.13)
Constant	-3.21***	-2.52***	-1.40***	-3.60***
	(0.32)	(0.21)	(0.12)	(0.35)
N	19,032	18,387	19,140	18,153
Pseudo R^2	0.07	0.08	0.06	0.08

Logistic Regression with Multi-Way Clustering

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

6.5.5 Policy Feedback

So far I have focused on how sectoral carbon intensity affects opinion. But this does not account for the possibility of policy feedback. If people's climate opinions are shaped by the emissions profile of their sector, they may also be affected by the level of policy stringency applied to their sector. As we have seen in previous chapters, policy stringency is distinct from emissions intensity. So it is possible that it has some independent effect on support for strong climate action. People working in sectors with high levels of mitigation stringency may be less favorable disposed to further increases in stringency, if they feel they are already "bearing the burden."

To test for this possibility, I conduct two additional regressions, displayed in table 6.7. In both, I include as a new predictor the standardized shadow price in the sector in the last year for which data are available (2009). In the second, I also include an interaction between the shadow price and sectoral emissions intensity.

In neither regression is the coefficient for existing stringency statistically significant. The interaction effect in the second regression is not significant either. This suggests that sector-specific policy may noy play an important role in shaping climate preferences. Further measure of policy stringency would be necessary to robustly test this outcome, ideally more closely located in time to the survey. But the first indication is that there is an asymmetry at play. People's opinions on climate policy are shaped by the emissions intensity of their sector of employment. Yet they do not seem to take into account the level of emissions regulation already applied to them.

Table 6.7: Policy Feedback

	(1)	(2)
Sectoral Carbon Intensity	-0.108**	-0.105**
	(0.0361)	(0.0399)
Shadow Price	-0.0205	-0.0123
	(0.0923)	(0.0781)
Sectoral Carbon Intensity × Shadow Price		0.00944
		(0.0295)
Income	0.0511***	0.0511***
	(0.0155)	(0.0155)
Right Ideology	-0.0572**	-0.0571**
	(0.0175)	(0.0175)
Education	0.148***	0.148***
	(0.0179)	(0.0179)
Union Member	0.289**	0.289**
	(0.108)	(0.109)
Age	-0.0516	-0.0517
	(0.0341)	(0.0342)
Male	0.0523	0.0522
	(0.0417)	(0.0417)
Religious	-0.223**	-0.223**
	(0.0751)	(0.0753)
GDP per Capita	0.918***	0.917***
	(0.201)	(0.200)
Constant	-1.469***	-1.465***
	(0.156)	(0.153)
N	18188	18188
Pseudo-R2	0.0541	0.0541

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.6 Conclusion

At the outset of this chapter I asked whether individual workers' opinions about climate policy were affected by the emissions intensity of their sector of employment. All the findings in this chapter suggest that they are.

The analysis in this chapter has found that the effect of greenhouse gas emissions on climate attitudes cannot fully be accounted for using national measures. The emissions intensity of peoples' sector of employment has a substantial and statistically significant effect on their predicted likelihood of supporting costly climate change mitigation policy. This finding is not only robust to the inclusion of standard controls, but also to other prominent explanations of climate attitudes like concern, values, and awareness.

The results show that the findings of Tvinnereim and Ivarsflaten[83] and Bechtel et al.[84] are not confined to a few countries, but are applicable across a range of national contexts. The results also show that the effect of sectoral emissions is specific for support for costly policy action. This reinforces the lesson that concern about climate change and support for mitigation policy have distinct determinants. It also provides more evidence that policies which use cost language may provoke more opposition than those whose costs appear more diffuse.

Perhaps the most striking finding is that sectoral carbon emissions appear to moderate the effect of other variables previously found to be important. Income, education, and ideology have all received frequent attention from scholars and are thought to be important predictors of climate attitudes. But their effects may be reduced or even eliminated by working in emissions-intense industries.

What broader lessons can be drawn from these results?

[83]Tvinnereim and Ivarsflaten, "Fossil fuels, employment, and support for climate policies".

[84]Bechtel et al., "Interests, Norms and Support for the Provision of Global Public Goods: The Case of Climate Co-operation".

The first is that the debate about material interests in climate attitudes needs to move beyond general measures of wealth or pollution. The role of material interests in climate opinion is more specific and disaggregated than national measures can capture. As the rest of this dissertation has shown, more sectoral work is needed. Future work should explore how people in different sectors respond differently to climate change communication efforts. More should also be done to compare the "production" emissions explored in this chapter with "consumption" emissions that people in all sectors depend on.

Second, for those trying to influence public opinion on climate change, whether politicians or lobbyists or activists, the results of this chapter suggest that there may be value in sectorally-targeted outreach. If workers in emissions-intense industries are aware of their vulnerability, then policymakers may need to put more emphasis on policies that explicitly protect workers from the costs of transition.

This chapter helps fill an important gap in the dissertation. I have shown in previous chapters that sector-level interests help shape policy outputs, and that sectors with higher emissions intensities receive weaker regulation. These results could have been driven solely by elite-level phenomena: it seems reasonable to assume that sectoral interests can be transmitted to policymakers through lobbying by firms and investors.[85] But as this chapter has shown, mass opinion is also directly shaped by sectoral interests.

[85]Policymakers might also anticipate impacts on constituents without those constituents being aware of the impacts themselves; this would be another elite-level mechanism to explain the distributional outcomes.

Chapter 7

Conclusion

> "[T]he Green New Deal is precisely a project to reverse the rise of inequality under neoliberalism while also preventing ecological catastrophe."
>
> Robert Pollin[1]

> "The elites talk about the end of the world while we're talking about the end of the month."
>
> *Gilets jaunes* slogan[2]

7.1 The Distributional Turn

Greenhouse gasses are so deeply embedded in our economies that mitigating climate change was always going to involve serious distributional challenges. Distributional issues have not always been at the forefront of academic political studies

[2]Jonas Elvander. *We Need a Green New Deal to Defeat Fascism and Reverse Inequality.* 2019

[2]Raphaëlle Rérolle. ""Gilets jaunes": "Les élites parlent de fin du monde, quand nous, on parle de fin du mois"". In: (Nov. 2018). https://www.lemonde.fr/politique/article/2018/11/24/gilets-jaunes-les-elites-parlent-de-fin-du-monde-quand-nous-on-parle-de-fin-du-mois_5387968_823448.html

of climate politics or of the mainstream discourse around mitigation. But they have become increasingly prominent in recent years.

In France, the *gilets jaunes* ("yellow vests") protest movement was sparked not by skepticism about climate change, but opposition to the impact of a carbon tax on fuel.[3] In the United States, the "Green New Deal" recently proposed in Congress seeks to combat climate change and reduce inequality at the same time, explicitly fusing environmental and redistributive goals. Both movements are concerned not only with whether we confront climate change, but who will pay the costs of doing so. These conflicts include not only a "vertical" struggle between elites and masses, but also "horizontal" struggles between different regions, occupations, and industries.[4]

This dissertation is not the first piece of political science to deal with distributional issues linked to climate mitigation, nor does it attempt to tackle all such issues. But it does unpack distributional dynamics that have not yet received as much attention as they merit. It focuses on the uneven allocation of mitigation policy costs across different groups in society, and how inequalities in political power drive this allocation.

In the next section, I summarize the theoretical and empirical results of the previous chapters. After that, I suggest some promising lines of inquiry for future work. I then discuss potential applications of the results for academics and practitioners. In the final section, I offer some brief thoughts about the implications of the project for future policymaking.

[3]Mathilde Bouyé and Yamide Dagnet. *The Yellow Vests Movement Isn't Anti-Climate Action; It's Pro-Social Justice.* World Resources Institute, `https://www.wri.org/blog/2018/12/yellow-vests-movement-isn-t-anti-climate-action-it-s-pro-social-justice`. Dec. 2018.

[4]For a comparison of these two varieties of redistribution, see Julie Anne Cronin et al. "Vertical and Horizontal Redistributions from a Carbon Tax and Rebate". In: *Journal of Environmental and Resource Economics* 6.S1 (2019), S169–S208.

7.2 Summary of Results

The results help us understand why countries consistently take economically sub-optimal approaches to climate change mitigation. If they followed the consensus of economists, nations would simply implement uniform carbon taxes and let price signals take care of the transition. The revenue could be used to compensate groups suffering disproportionate harms.

But this is not what has happened. Instead, countries have implemented patchworks of policies that affect different parts of the economy unevenly. This reduces the impact of policy on emissions and increases the inequality that flows from these impacts.

This dissertation helps us understand why countries take this messier route to cleaning up their acts. It shows how targeting of different sectors is driven, at least in part, by the burdens that flow from these sectors to different groups.

Chapter 2 constructs a distributive theoretical model of climate policymaking. The model weaves together elements of earlier work in regulatory and environmental political modelling. As in Grossman and Helpman,[5] the supply of policy is disaggregated to the level of the economic sector. As in Aidt,[6] the demand for policy is disaggregated to functionally specialized interest groups: environmentalists, investors, workers, and consumers. And drawing on the power-weighted social decision rule of Boyce,[7] differences in power across interest groups shape policymakers' willingness to impose costs on sectors. The resulting "political market" model[8] generates predictions about how sectoral characteristics should affect the distribution of regulatory stringency across the economy.

Because of the privileged position of capital, policymakers are expected to

[5]Grossman and Helpman, "Protection for Sale".
[6]Aidt, "Political internalization of economic externalities and environmental policy".
[7]Boyce, "Inequality as a cause of environmental degradation".
[8]Keohane et al., "The Choice of Regulatory Instruments in Environmental Policy".

shift burdens away from investors. As emissions intensity rises, the potential costs firms face from mitigating their emissions also goes up, and regulatory stringency should decrease. But as sectors' ability to pass costs on to their consumers or their workers increases, the risks faced by investors diminish, and regulatory stringency should also increase.

These expectations are tested in chapter 3. To my knowledge, this chapter offers the first quantitative, cross-national political science study of climate change mitigation to use a distributive, disaggregated approach. Employing data by Althammer and Hille,[9] this chapter demonstrates the viability of using shadow pricing to study climate politics at the sector level. The results are consistent with the theoretical framework developed in chapter 2, showing that differences in group power play an important role in shaping mitigation stringency. Economic interests have an edge over environmental interests. Producers have an edge over consumers. And capital has an edge over labor.

In the first set of models, the government is an undifferentiated actor. Chapter 4 deepens the supply side of the model by examining how party ideology shapes policy outcomes. The literature on ideology and environmental policy has generated conflicting expectations, with some finding that right-wing parties are less stringent, and others finding that ideology has no consistent cross-national effect. This chapter helps move the debate forward, by showing how the effect of ideology on regulation depends on the constituencies that are at risk from regulation. The advantage of economic over environmental interests is stronger under right parties than left ones. When labor is at risk, left parties reduce regulatory stringency. When capital is at risk, right parties do the same. These results show that ideology's impact on climate policy is sector-dependent, helping to explain why national studies of ideology and the environment have produced inconsistent

[9] Althammer and Hille, "Measuring Climate Policy Stringency: A Shadow Price Approach".

results.

Chapter 5 focuses on one of the strongest and most striking relationships from earlier chapters: the positive association between labor intensity and mitigation stringency. The chapter examines how this relationship is affected by the broader political economy context. Some countries provide more protection for labor in general than others. But the literature is divided on whether this protection reduces policy burdens on labor (because labor is politically strong) or increases them (because labor knows the burdens will be offset by government intervention). The results of this chapter show that the net effect of labor protection on mitigation is positive: by insulating labor, protection enables stronger policy.

The previous empirical chapters have all focused on sector-level policy demand and supply. Chapter 6 moves beneath the level of sectors, to test whether the kinds of distributional dynamics observed there penetrate to individual-level opinions. Specifically, it focuses on whether a sector's emissions intensity affects the climate attitudes of the workers in that sector. Based on data from the European Social Survey,[10] I find that working in an emissions-intense sector is associated with weaker support for costly climate change mitigation policy. Emissions-intensity in a person's sector of employment also dampens the importance of income, education, and ideology on policy support. Whether these effects are conscious or unconscious, they show that the distributive effects observed in earlier chapters are not merely technical considerations accessible only to experts, but factors that shape mass opinion as well.

While these chapters have each explored different hypotheses, they are unified by the fact that they could not have been fully tested without a sectoral approach.

[10]European Social Survey, *Weighting European Social Survey Data.*

7.3 Potential Extensions

This dissertation does not cover all the distributive aspect of climate mitigation. In this section, I will discuss a few directions for future research that may be particularly worthwhile.

As discussed in chapter 3, this dissertation focuses on policy outcomes rather than pollution. This focus makes sense for the task at hand, which is understanding how policymakers allocate burdens across different parts of the economy. But the ultimate determinant of climate change mitigation success will be determined by physical reductions in emissions, regardless of policy stringency. Enough time has now passed to test whether the the sector-level policies studied here have managed to bear fruit. And examining where these policies have succeeded or failed would also be a valuable subject of distributional analysis. Bringing pollution in requires emissions data on the sectoral level, however, which tends to lag behind other kinds of data in availability.[11]

In future work, more information can be extracted from the kind of input-output data on which this dissertation's empirical foundation was built. To keep my model tractable and parsimonious, I confined inter-sectoral effects to the balance between sectors and their consumers, distinguishing between firm and non-firm consumers using measures of household sales. But now that this model has been built and tested, future expansions could include more complicated forms of inter-sectoral dependence and competition. The input-output data from WIOD and other sources contain rich information on these relationships which have yet to be exploited. Also, there is at present only limited sector-level data on cross-price elasticities, but if such data become available in the future it could

[11] While the World Input-Output Database published updated National Input-Output Tables and Socio-Economic Accounts in 2016, no new version of the emissions data has been released since 2013.

be a valuable source for examining inter-sectoral dynamics.

The chapters on political institutions are centered on the role of parties and political economy arrangements. These areas have clear conflicts within their respective literatures that a sectoral approach helps resolve. But there are other political-institutional elements that may be worth exploring. For example, I use the number of veto players and the use of proportional representation as controls in my party models. But these may have their own independent interactions with sectoral characteristics. While these institutional features are unlikely to change in the short term, a disaggregated analysis may suggest different advocacy strategies depending on the institutional context.

Future work could also disaggregate the supply side of politics further, by looking at individual legislators. Parties are not always unified entities. For example, Speaker of the U.S. House of Representatives Nancy Pelosi has characterized the Green New Deal proposed by her fellow Democrats as an unrealistic "Green Dream".[12] Some countries have data on political donations that can be matched to economic sectors, as well as data on economic sectors that can be mapped to legislative districts. These data could be combined with information on legislators' votes on climate-relevant bills or the language they use when speaking about climate. Doing so would help us understand the mechanisms by which sectors influence policymakers.

The foundation of my disaggregated approach has been the economic sector. I made the assumption in my model that sectors are homogeneous within countries. This assumption allowed me to keep the model relatively simple and produced results that were consistent with my theory. But there are other forms of disaggregation worth investigating.

[12]Heather Caygle et al. "'Too hot to handle': Pelosi predicts GOP won't trigger another shutdown". In: *Politico* (Feb. 2019).

Sectors vary in their spatial locations within countries. Some, like retail businesses, will be located throughout a country. Others, like certain kinds of manufacturing, may be geographically concentrated. This spatial variation could have potential political implications. The eruption of the *gilets jaunes* shows how climate change disagreements can map onto existing divides between cores and peripheries. But it is also possible the climate change could cross-cut traditional core-periphery divides, depending on the geographical locations of industries. Spatial data would make it possible to explore both possibilities. Some countries have data on the size of sectors in sub-national jurisdictions, which could be combined with new, spatially-assigned emissions data. Bringing them together would also build connections between the climate politics literature and political geography.

A more ambitious step would be to go beneath the sectoral level to look at the firms which comprise them. The stringency data necessary for the analysis I conduct here are not available at the firm level. But other hypotheses could productively be tested using firm data. Such data would be especially useful for testing the mechanisms behind some of the relationships I find in this dissertation. For example, if labor intensity and sales to households shape firms' interests on climate change, one might expect them to predict firm-level lobbying, political contributions, and coalition membership.

7.4 Applications

The dissertation contributes to the emerging "comparative politics of climate change policy" called for by Keohane.[13] It helps to bridge the gap between qualitative accounts that testify to the importance of individual sectors and quantita-

[13]Keohane, "The Global Politics of Climate Change: Challenge for Political Science".

tive accounts that rarely incorporate sector-level differentiation. The theory and empirical approaches show that sector-level disaggregation is both possible and fruitful.

But there are other areas of academic literature that might find something useful in the results. For scholars studying the power of business, this dissertation presents a new way of studying the operation of structural power. Culpepper[14] urges scholars to move beyond thinking of business in monolithic terms, and to explore "how the structure of capitalism creates opportunities for some companies (but not others) vis-á-vis the state". Going beneath the national level to look at sectors helps us do just this. Breaking down impacts among investors, workers, and consumers helps us trace who is actually being protected when business is privileged.

For international relations scholars studying attempts to coordinate action on climate, the results help open the "black boxes" of national policymaking.[15] Instead of seeing national climate policy as a unified entity, the results here show how stringency varies not only between countries but within them. When considering the role of domestic interest groups in shaping international action, scholars should take more fully into account the possibility that some groups may be able to shift the burden of regulation to others.[16]

Economists have also been calling for more attention to the distributive impacts of climate policy.[17] While many economic studies examine the costs and benefits of environmental policies, "[f]ewer studies address the question of who

[14]Culpepper, "Structural power and political science in the post-crisis era".

[15]Victor, *Global Warming Gridlock : Creating More Effective Strategies for Protecting the Planet.*

[16]Meckling, *Carbon Coalitions: Business, Climate Politics, and the Rise of Emissions Trading.*

[17]Marshall Burke et al. "Opportunities for advances in climate change economics". In: *Science* 352.6283 (2016), pp. 292–293; J Doyne Farmer et al. "A Third Wave in the Economics of Climate Change". In: *Environ Resource Econ* 62 (2015), pp. 329–357.

bears those costs or receives those benefits".[18] This is a pressing problem, as mitigation policy may induce as much or even more "horizontal redistribution" between people at similar income levels than "vertical redistribution" between different income levels.[19] By showing that sector characteristics drive differences in policy outcomes, this dissertation reinforces the need for more economic research into how mitigation policy impacts vary across the economy.

This lesson also applies more broadly to political economy. Much of the research in political economy focuses on vertical redistribution between rich and poor. But as this dissertation shows, inter-class redistribution is entangled with inter-sectoral differences. A sectoral approach helps us to disentangle these effects.

Beyond academia, this dissertation has lessons for those actively trying to change policy. It serves as a reminder to think about climate politics in sectoral terms. Activists have often have limited resources and need to be strategic about whom they target and what messages they send. It is not only fossil fuel companies who have an incentive to oppose mitigation. But some emissions-intense companies have weaker incentives to oppose mitigation than others. These differences can suggest which companies or unions might be more amenable to joining climate alliances. When picking legislators to lobby or challenge, looking at the sectoral composition of their district may suggest new lines of argument. For right-wing parties that seem generally opposed to climate action, offering proposals that protect the interests of their constituencies may overcome some of that opposition.

The results may also have implications for the broader strategic design of climate policy, which I will discuss in the final section.

[18] Fullerton, "Six Distributional Effects of Environmental Policy".
[19] Cronin et al., "Vertical and Horizontal Redistributions from a Carbon Tax and Rebate".

7.5 The Future of Mitigation

The lead sponsor of the Green New Deal in the United States Senate, Ed Markey, says of solving climate change: "it's not a technological problem, it's a political problem."[20] Physical scientists have supplied the models necessary to understand how our climate is changing. Engineers have supplied the technology necessary to mitigate most greenhouse gas emissions. Economists and policy designers have supplied the tools necessary to accomplish mitigation efficiently while limiting regressive impacts. If the remaining obstacle is political, what should political scientists do to chart a path forward?

Over the past few decades countries have implemented a diverse range of climate mitigation policies.[21] Some countries and sub-national actors have managed to pull ahead of the rest and implement policies that are relatively ambitious. Even the most ambitious actors, however, have generally fallen short of achieving the scale and speed necessary to avert climate change.[22] The Climate Action Tracker compares countries' emissions trajectories and pledged reductions against the reductions necessary to limit temperature growth below the 1.5°C goal of the Paris Agreement. The tracker's ratings have found only two countries' plans to be "compatible" with meeting that goal, and none are rated as "role models" whose actions would keep temperatures significantly below that threshold.[23] GermanWatch, which ranks countries' climate change performance along multiple dimensions, has not granted any country a top-three ranking, reflecting their judgement that "[n]o country is doing enough to prevent dangerous

[20]Remarks by Sen. Markey at an event promoting the Green New Deal on Sunday, May 5th, 2019 in Cambridge, Massachusetts.

[21]See International Energy Agency and Nachmany et al. for a good sense of that diversity.

[22]Climate Action Tracker, *Climate crisis demands more government action as emissions rise*; Burck et al., *The Climate Change Performance Index Results 2018*.

[23]Countries are rated against an estimate of their "fair share" of global emissions reductions. The two countries' whose planned reductions are rated "compatible" with the 1.5°C goal are Morocco and the Gambia.

climate change".[24]

Climate change is like an immense knot, and our failure to untie it is over-determined. Greenhouse gas emissions are embedded in so many parts of our lives. A wide gap in time separates present costs from future benefits.[25] The perennial difficulties of coordinating action among diverse actors with diverging interests are rearing their head at a global scale. And the direct costs and benefits of both action and inaction are unevenly distributed. With so many tangled threads, it is perhaps less surprising that we have not done enough to mitigate climate change, and more surprising that we have managed to act at all.

The goal of this dissertation has been to pull on one of these threads—distributional conflicts between different parts of the economy—in the hope that it can help unravel the problem. The results have been consistent with the idea that the distributional policy choices around mitigation have favored one group—owners of capital—over others. If this is true, what does it mean for the future?

Those who advocate stronger action to mitigate climate change have three broad options for dealing with the power of capital to block or alter those actions.

They could take a 'challenger' approach, by trying to overcome the entrenched power of capital interests while also pursuing an ambitious mitigation strategy. This could involve, for example, reforming political systems to reduce the influence of capital, raising protections on labor, or increasing redistribution in order to limit capital's ability to effectively shift costs onto other groups. In doing so, advocates could bypass the dynamics that have dominated this dissertation. The Green New Deal in the United States and the Extinction Rebellion movement could both be described as pursuing strategies of this type.

[24]Burck et al., *The Climate Change Performance Index Results 2018*, p. 11.

[25]This is not to say that there are no near-term benefits to mitigating climate change, only that a large portion of the benefits are only realized through avoided warming over the long term.

This is a risky strategy, because groups that have blocked or weakened less ambitious climate policies in the past are likely to resist a more ambitious program as well. This resistance would only be intensified if not only capital's climate-specific interests but also its wider influence over politics were challenged.

A second option is to take an 'accommodative' approach. Instead of trying to fight the resistance of entrenched interests, proponents of mitigation could look for compromise solutions that limit investors' losses. Compensating owners of fossil fuel-dependent assets in exchange for accepting stringent mitigation policy or ambitious investment programs could potentially transform resistance into support.

This is also a risky strategy. Depending on how such an approach is implemented, it could end up being deeply unfair. If insufficient concessions are tied to the compensation, this approach could be both less effective and more costly than current approaches. It could also alienate some environmentalists, as well as the consumer and labor groups who would presumably bear more of the burden of the resulting compromise policy. This could end up fracturing the pro-mitigation coalition while failing to build enough support from current opponents of action to achieve meaningful policy change.[26]

The third option is to continue 'muddling through', to borrow a phrase from Lindblom.[27] This would mean neither trying to shift the balance of power away from capital or trying to compromise with it. These alternatives could be distractions which end up delaying action rather than hastening it, and the climate might be better served by focusing on pushing existing approaches further. The falling costs of many clean energy sources could help tip energy investment onto a better pathway, regardless of policy choices. The Paris Agreement's pledge-

[26]The battle over the first carbon tax referendum in Washington State, discussed in chapter 1, could be an example of this.

[27]Charles E Lindblom. "The Science of "Muddling Through"". In: 19.2 (1959), pp. 79–88.

and-review paradigm could end up stimulating more action than the older model of collectively-negotiated targets. Yet this too is a risky strategy.[28] Fossil fuel interests need not prevent any and all climate action to preserve their assets: they need only delay it in enough markets to continue extracting value from their reserves. In the meantime, emissions continue to rise.

No approach is free from danger. Failure is perfectly possible: there is no reason why humans must inevitably succeed in meeting the challenge of climate change. Barring a technological *deus ex machina*, the window for taking relatively cost-effective action is narrowing.[29] By the time we know whether our collectively chosen approach has succeeded or failed, it will be even harder to change course.

Even as our physical models become progressively more certain, our social models remain uncertain in many ways. One thing that we can be reasonably confident about, though, is that climate politics are distributional politics. We ignore that to our peril.

[28] M Granger Morgan. "Opinion: Climate policy needs more than muddling." In: *Proceedings of the National Academy of Sciences of the United States of America* 113.9 (Mar. 2016), pp. 2322–4, For further criticism of this strategy, see.

[29] IPCC. "Summary for Policymakers". In: *Global Warming of 1.5 degrees C. An IPCC Special Report on the impacts of global warming of 1.5 degrees C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* Ed. by Myles Allen et al. In Press, 2018, pp. 1–21.

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Appendices

Appendix A

Comparing Alternative Modelling Strategies

This appendix provides a graphical representation of the key results from chapters 3-5, plotted alongside the matching coefficients from six alternative modelling strategies. All models include fixed effects for year and were run in Stata/MP 15.1 (except where noted).

1. Mixed Effects: a hierarchical linear model with nested random effects for country, sector, and year. This is the main model for the dissertation. Implemented with the user-written command `runmlwin`[1] and the external program `MLwiN`,[2] with Markov Chain Monte Carlo estimation.[3]

2. Cross-Classified Mixed Effects: a multilevel model with crossed effects for country, sector, and year. This was the first model chosen for the dissertation, because country and sector classifications are not nested within each other. Post-estimation examination of the Deviance Information Criterion, however, indicated that a cross-classified specification was not necessary to capture the variance across the levels. The hierarchical linear model had substantially lower D.I.C. values and was substituted in its favor. Like the main mixed effects model, this was also implemented with `runmlwin`, `MLwiN`, and MCMC estimation.

3. Lagged Dependent Variable: a dynamic panel data model with a system generalized method of moments and a one-year lag of the dependent

[1] Leckie and Charlton, "runmlwin - A Program to Run the MLwiN Multilevel Modelling Software from within Stata".

[2] Charlton et al., *MLwiN Version 3.02*.

[3] Browne, *MCMC Estimation in MLwiN v3.03*.

variable. Implemented with the user-written command `xtabond2`.[4]

4. Panel-Corrected Standard Error Model: a linear regression with panel-corrected standard errors and a panel-specific AR1 autocorrelation structure, where disturbances were assumed to be independent across panels. Implemented with the user-written command `xtpcse`.[5]

5. Country- and Sector-Fixed Effects: a linear regression with manually-added fixed effects for country, sector, with standard errors clustered by country-sector units. Implemented using `xtreg`.

6. Random Effects: a linear panel regression with random effects and standard errors clustered by country and sector. Implemented using `xtreg`.

7. Fixed Effects: a linear panel regression with fixed effects for each country-sector unit and standard errors clustered by country and sector. Implemented using `xtreg`.

The full results for all the alternative specifications for chapters 4, 5, and 6 are displayed in appendix B, appendix C, and appendix D, respectively.
Here, I show the main results in the form of coefficient plots. To maintain legibility, all control variables have been omitted. For models with interactions, the main interaction coefficient has been plotted at the bottom of the figure. When I discuss the "key results", I am referring specifically to the bottom coefficients, which are the ones featured most heavily in the analysis across the dissertation. Throughout, most of the coefficients for these key results are similar in magnitude and sign across most specifications.
The only consistent outlier is the basic fixed effects model. In the models of state-market relationships (fig. A.7, fig. A.8, and fig. A.9) the interaction term takes a sign opposite to those of the other models. This is not a cause for concern: the state-market relationship measures are constant over the regression period and therefore their main effects are omitted from the regressions, biasing the interaction term. The fixed effects model is again an outlier in the union density (fig. A.10), union centralization (fig. A.11) and active labor market policy (fig. A.14) models. But since fixed effects models eliminate between-group variation, it is not surprising that they behave differently. Since much of the focus of this dissertation is on the differences between groups (both countries and sectors), zeroing out this variation is not the optimal modelling strategy.

[4] M. Arellano and O. Bover. "Another look at the instrumental variable estimation of error-components models". In: *Journal of Econometrics* 68 (1995), pp. 29–51; R. Blundell and S. Bond. "Initial conditions and moment restrictions in dynamic panel data models". In: *Journal of Econometrics* 87 (1995), pp. 115–143; David Roodman. "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata". In: *Stata Journal* 9.1 (2009), pp. 86–136.

[5] W.H. Greene. *Econometric Analysis*. 8th ed. New York: Pearson, 2018.

The high level of agreement between the rest of the models suggests that the results are not driven by the choice of regression strategy, but by underlying patterns in the data.

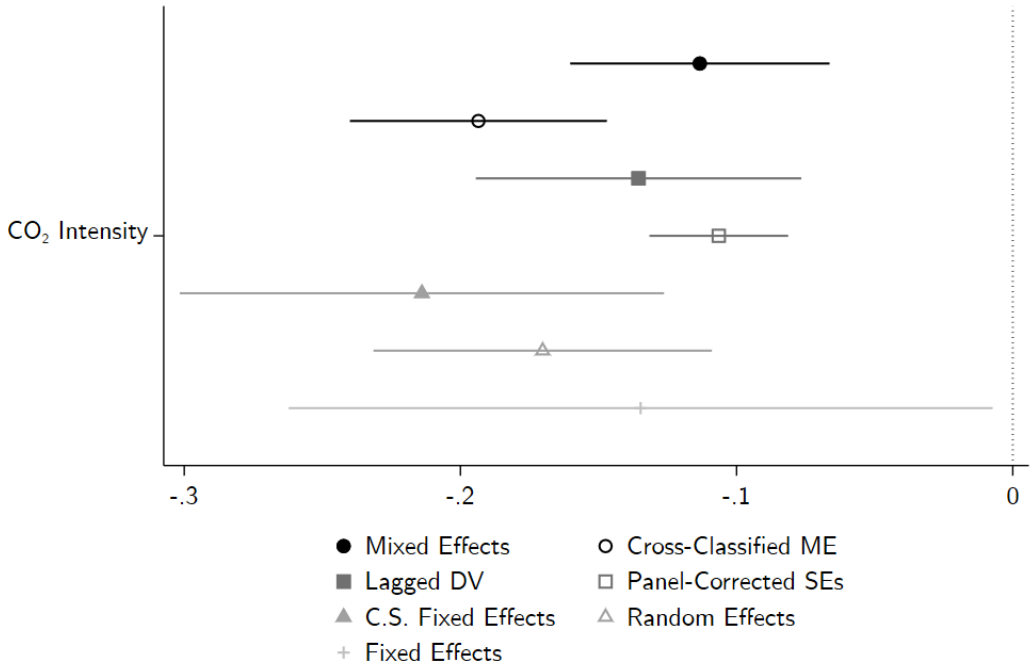


Figure A.1: Coefficient Plot of Alternatives to Table 3.6

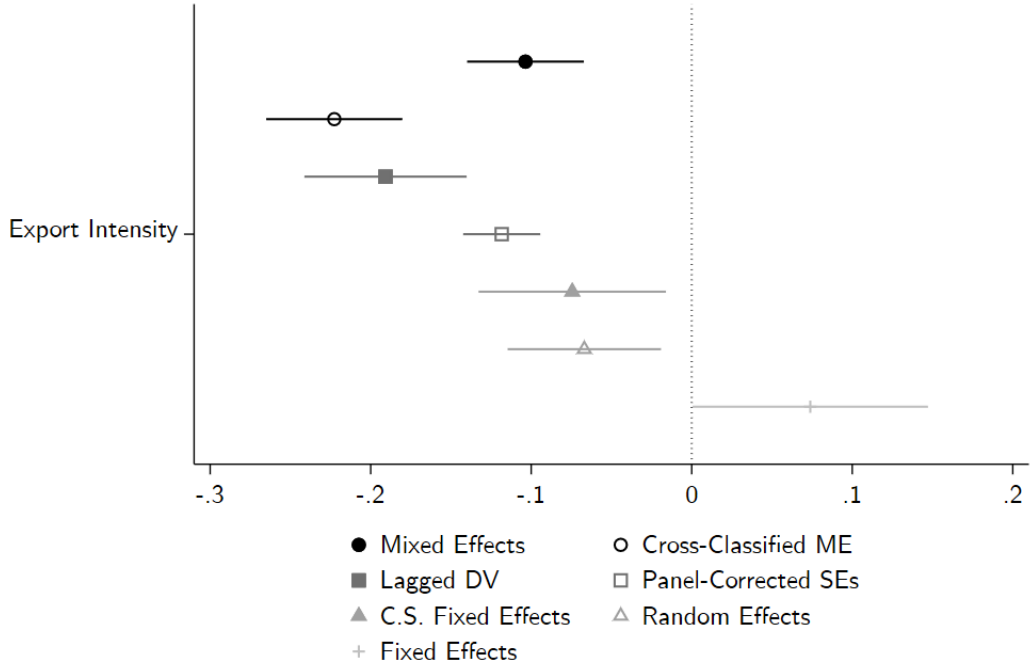


Figure A.2: Coefficient Plot of Alternatives to Table 3.7

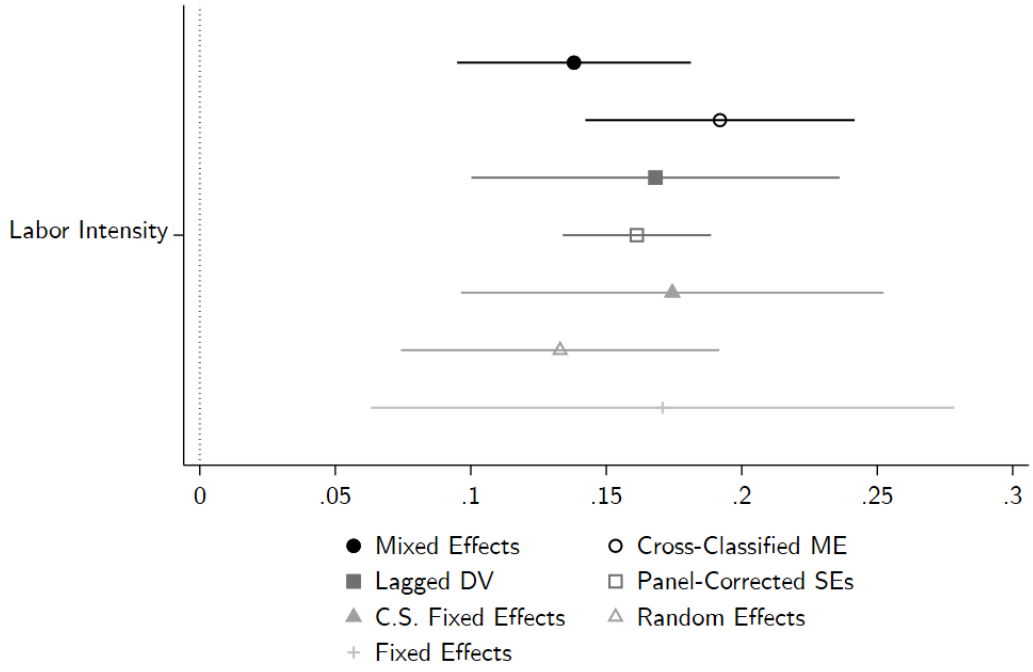


Figure A.3: Coefficient Plot of Alternatives to Table 3.8

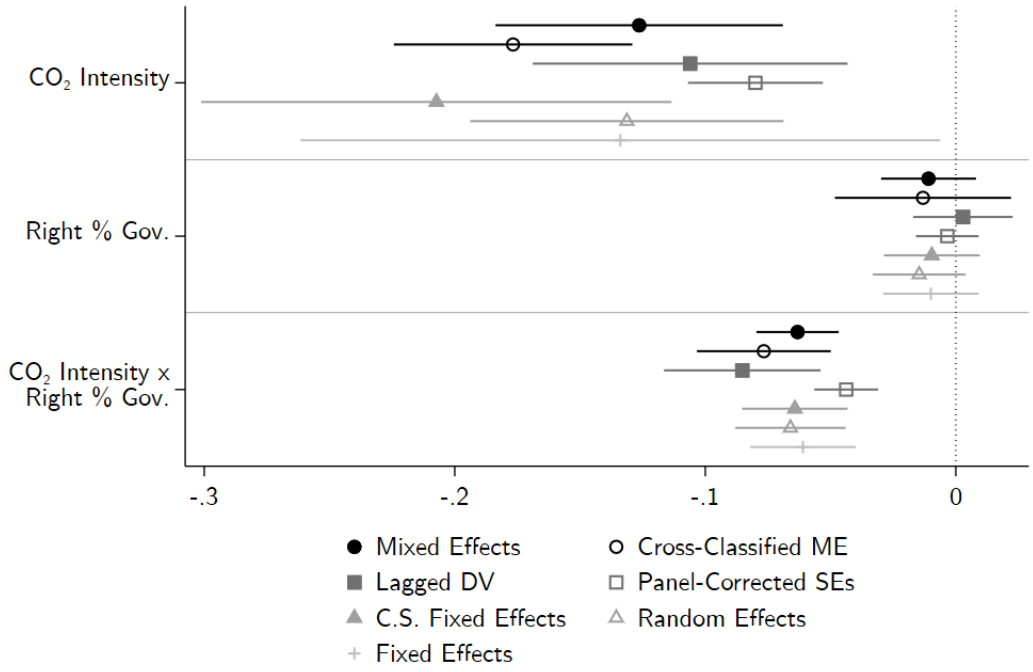


Figure A.4: Coefficient Plot of Alternatives to Full Interaction Model from Table 4.3

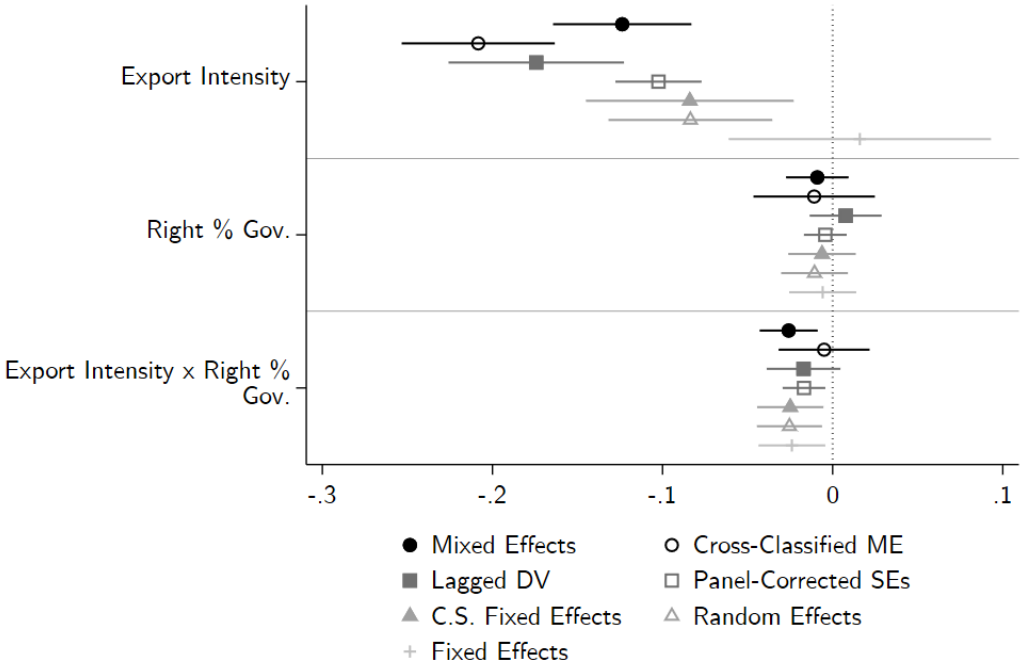


Figure A.5: Coefficient Plot of Alternatives to Full Interaction Model from Table 4.4

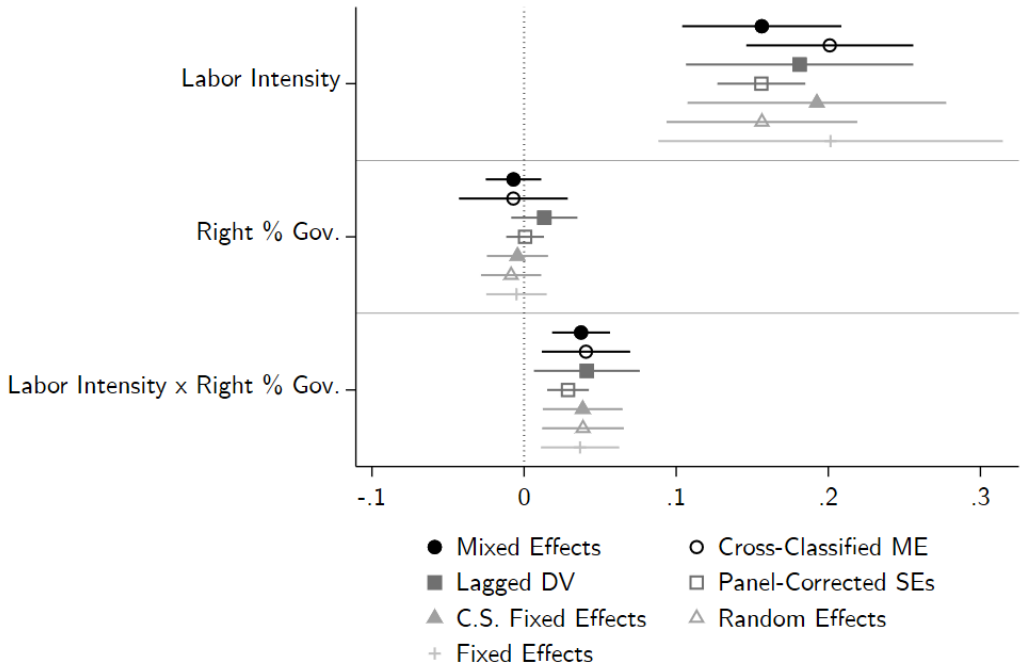


Figure A.6: Coefficient Plot of Alternatives to Full Interaction Model from Table 4.5

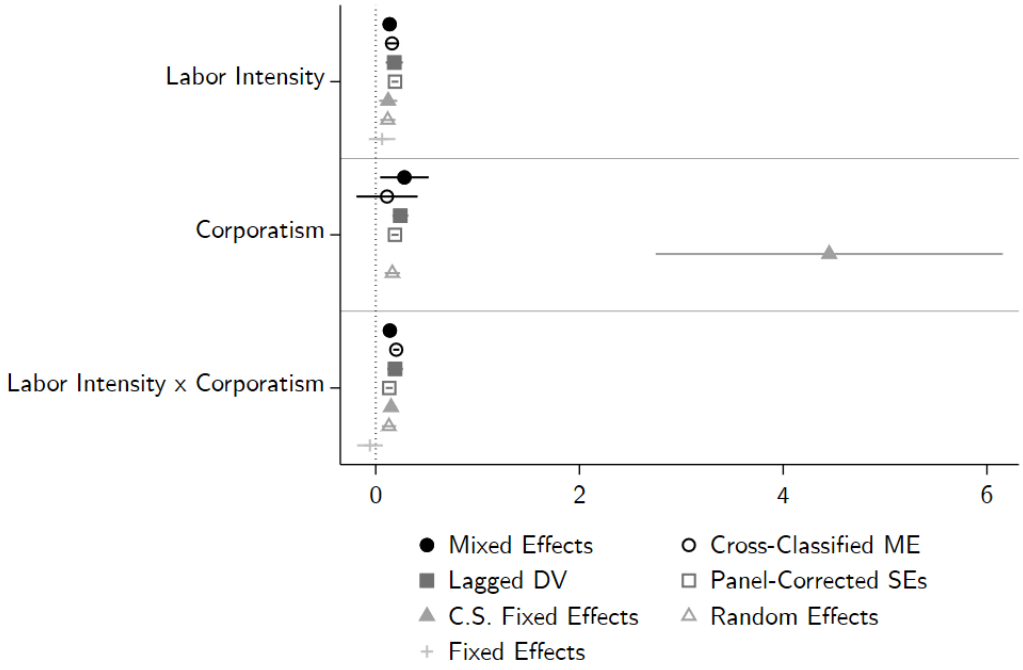


Figure A.7: Coefficient Plot of Alternatives to Corporatism Interaction Model from Table 5.3

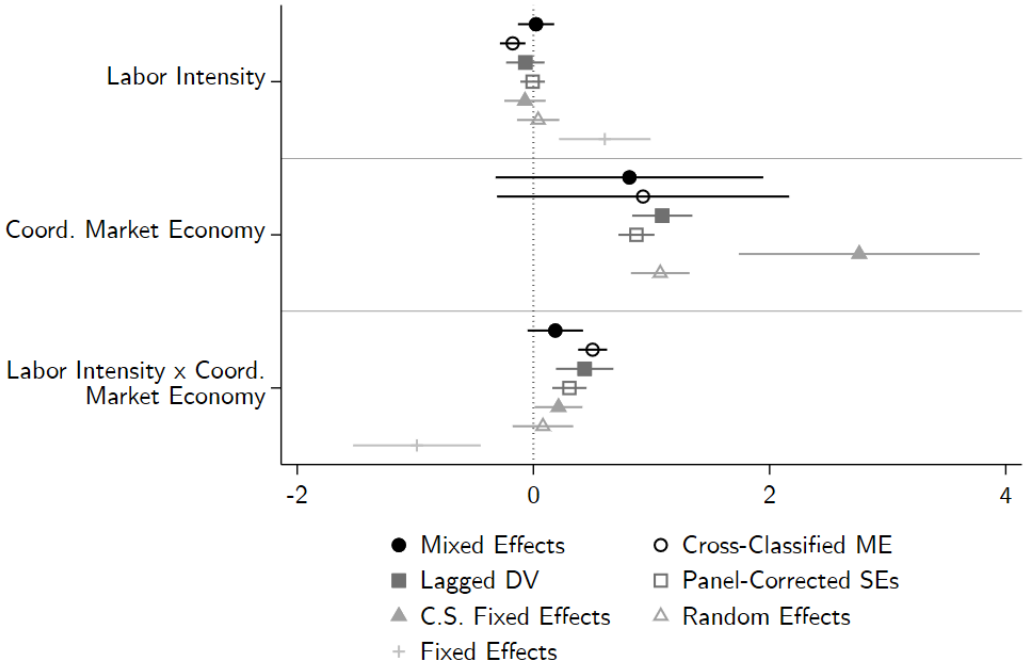


Figure A.8: Coefficient Plot of Alternatives to Coordinated Market Interaction Economy Model from Table 5.3

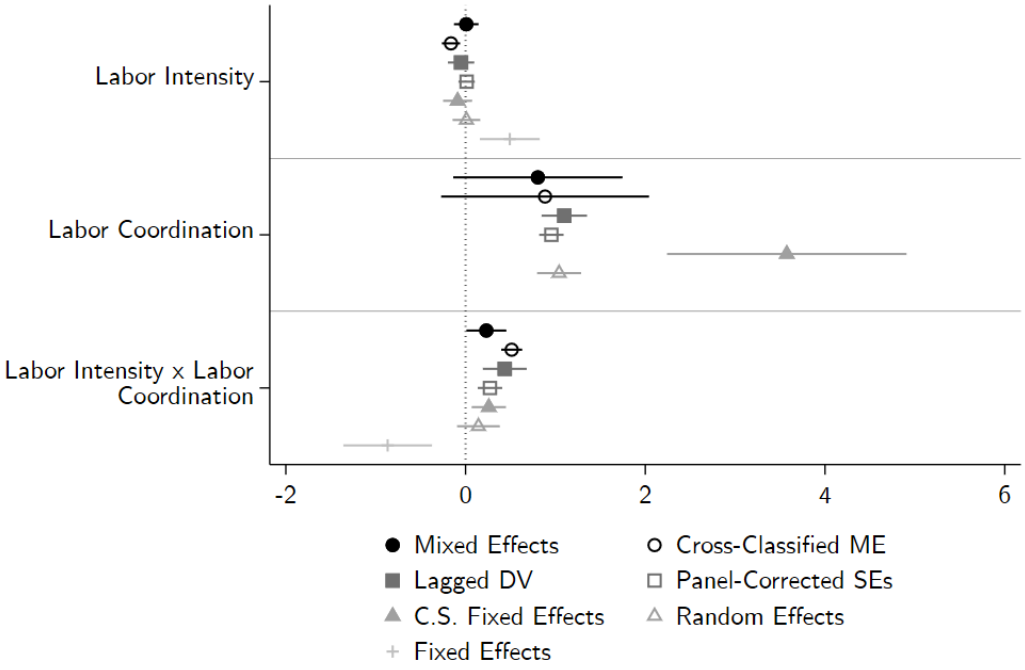


Figure A.9: Coefficient Plot of Alternatives to Labor Relations Interaction Model from Table 5.3

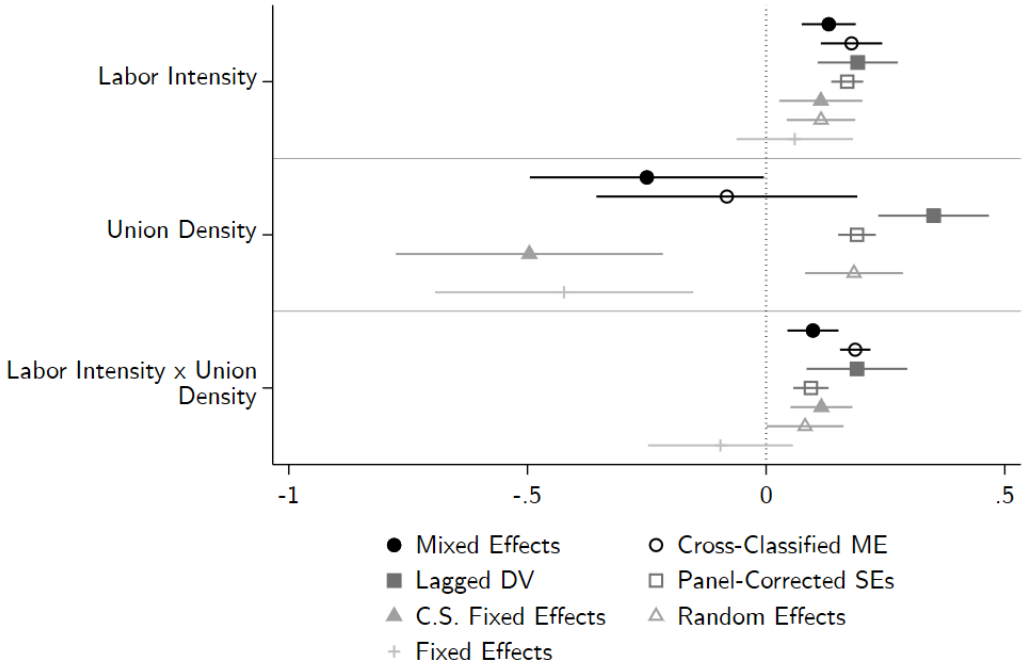


Figure A.10: Coefficient Plot of Alternatives to Union Density Interaction Model from Table 5.4

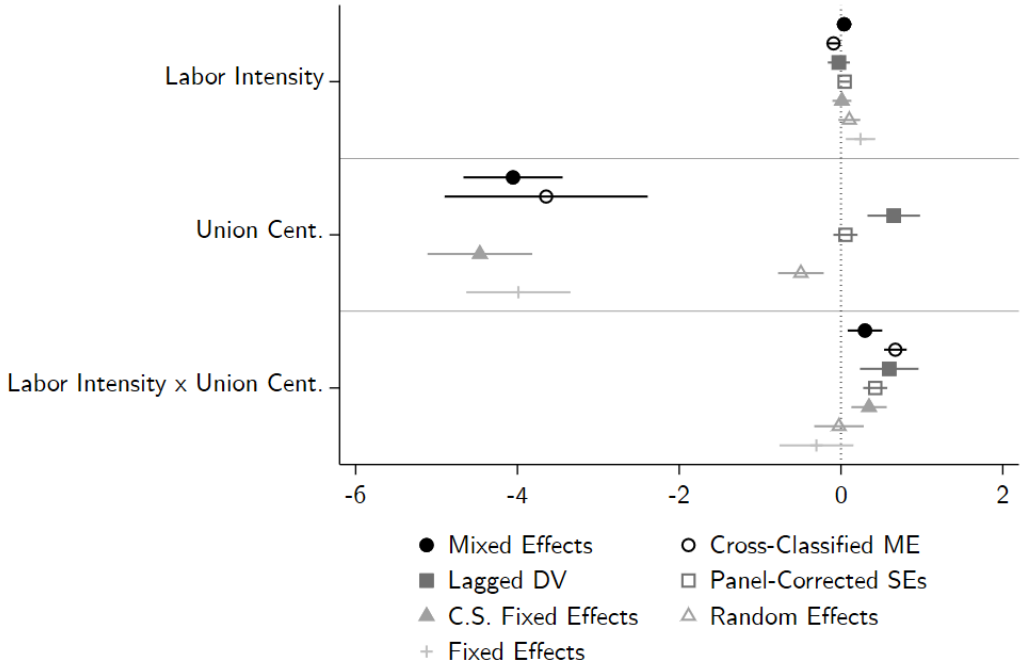


Figure A.11: Coefficient Plot of Alternatives to Union Centralization Interaction Model from Table 5.4

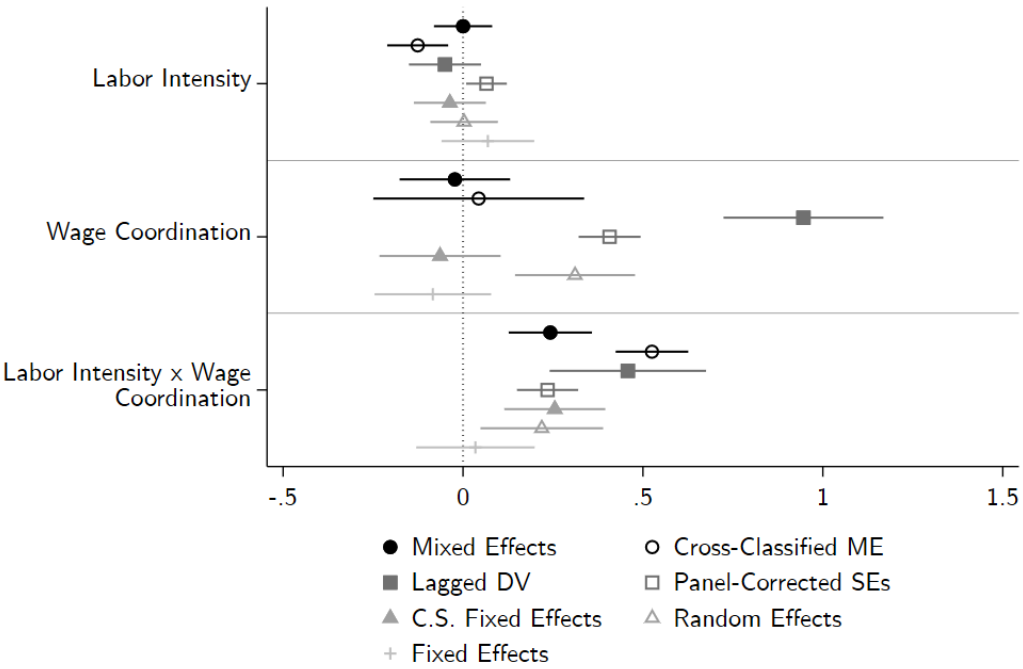


Figure A.12: Coefficient Plot of Alternatives to Wage Coordination Interaction Model from Table 5.4

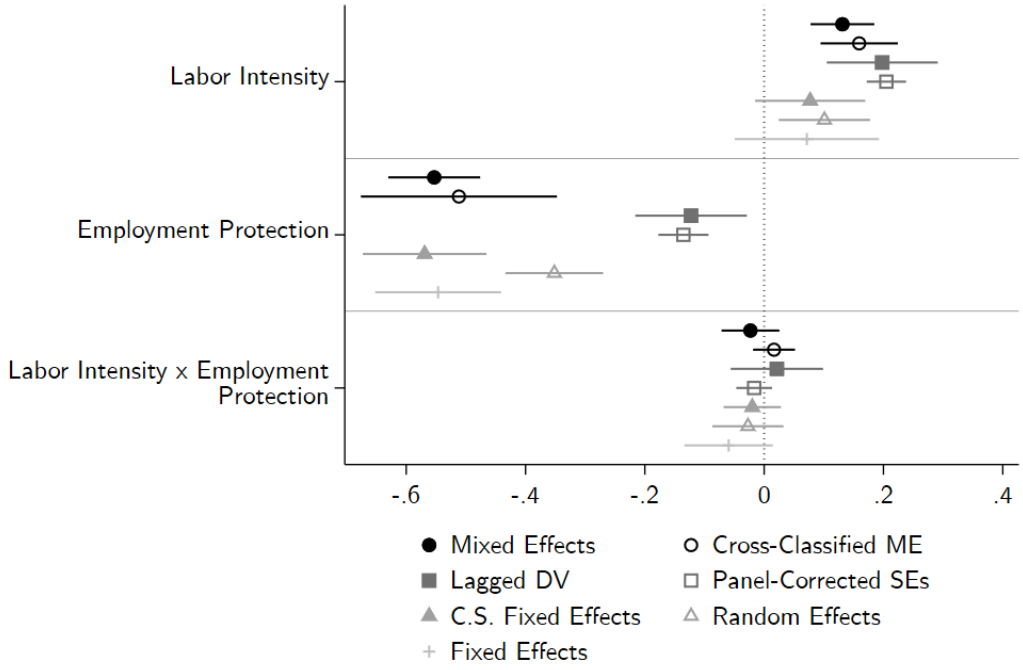


Figure A.13: Coefficient Plot of Alternatives to Employment Protection Legislation Interaction Model from Table 5.5

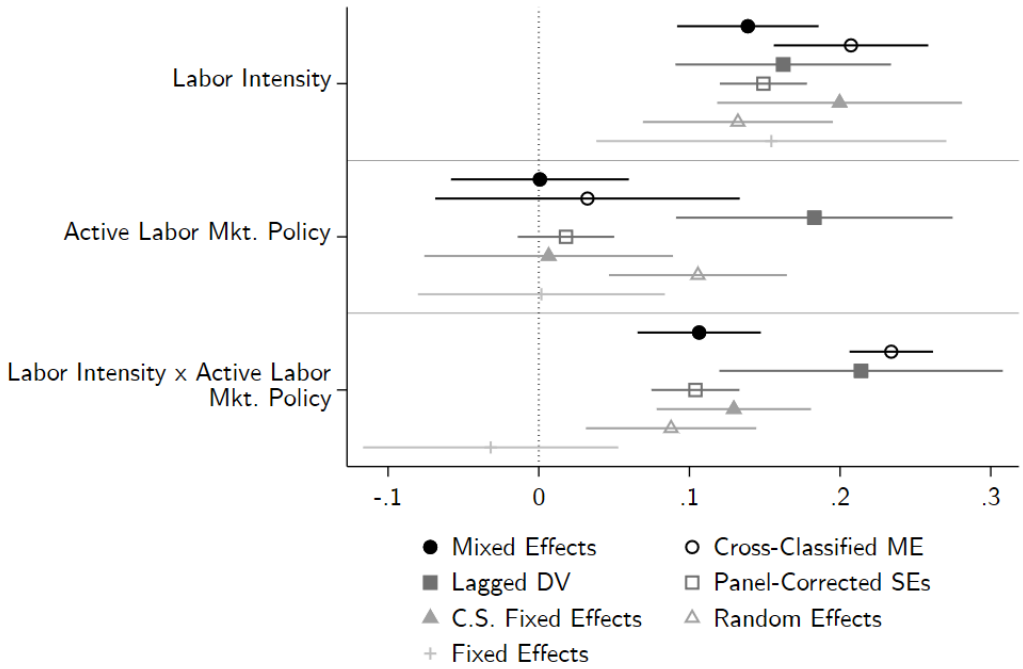


Figure A.14: Coefficient Plot of Alternatives to Active Labor Market Policies Interaction Model from Table 5.5

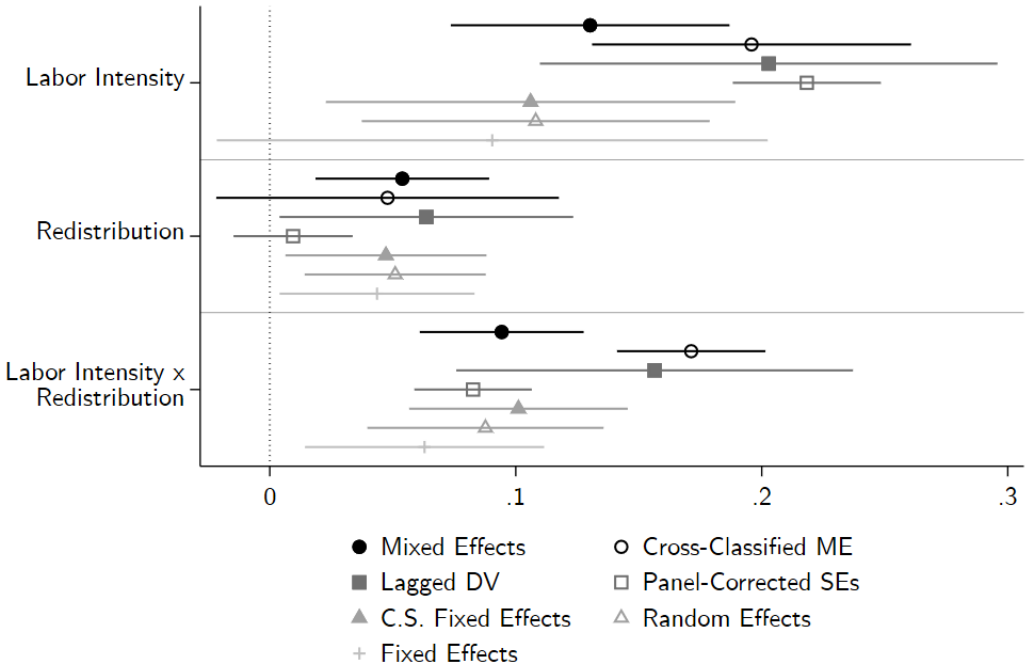


Figure A.15: Coefficient Plot of Alternatives to Relative Redistribution Interaction Model from Table 5.5

Appendix B

Alternative Regression Results for Chapter 3

B.1 Mitigation Effect

Table B.1: Mitigation Effect

	(1)	(2)	(3)
CO_2 Intensity	-0.190***	-0.115***	-0.112***
	(0.0233)	(0.0251)	(0.0228)
Output		0.200***	0.226***
		(0.0417)	(0.0388)
Nat. CO_2 Intensity		-0.237***	-0.392***
		(0.0430)	(0.0491)
GDP Growth		0.00541	0.0159
		(0.0140)	(0.0141)
Fossil Fuel Inc. P.C.		-0.271***	-0.332***
		(0.0720)	(0.0721)
E.U. Member		0.290***	0.282***
		(0.0380)	(0.0387)
GDP per Capita			-0.589***
			(0.0829)
Random Effect Variances			
Country	0.359***	0.347**	0.450**
	(0.106)	(0.115)	(0.147)
Sector	0.415***	0.415***	0.416***
	(0.0216)	(0.0215)	(0.0217)
Year	0.141***	0.130***	0.128***
	(0.00390)	(0.00365)	(0.00352)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
DIC	3967.49	3689.93	3618.48

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.2: Mitigation Effect (Cross-Classified)

	(1)	(2)	(3)
CO_2 Intensity	-0.204***	-0.193***	-0.193***
	(0.0237)	(0.0240)	(0.0231)
Output		-0.00504	-0.000389
		(0.0390)	(0.0427)
Nat. CO_2 Intensity		-0.219***	-0.337***
		(0.0640)	(0.0843)
GDP Growth		0.00140	0.00539
		(0.0261)	(0.0264)
Fossil Fuel Inc. P.C.		-0.160	-0.162
		(0.0888)	(0.0912)
E.U. Member		0.320***	0.316***
		(0.0699)	(0.0723)
GDP per Capita			-0.345*
			(0.141)
Random Effect Variances			
Country	0.367***	0.285**	0.318**
	(0.109)	(0.0917)	(0.102)
Sector	0.0935***	0.0939***	0.0933***
	(0.0261)	(0.0271)	(0.0263)
Year	0.463***	0.456***	0.455***
	(0.0108)	(0.0110)	(0.0109)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
DIC	7412.83	7363.95	7356.84

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.3: Mitigation Effect (Lagged Dependent Variable)

	(1)	(2)	(3)
CO_2 Intensity	-0.230***	-0.136***	-0.135***
	(0.0322)	(0.0300)	(0.0301)
Output		0.0318	0.0398
		(0.0332)	(0.0334)
Nat. CO_2 Intensity		-0.187***	-0.243***
		(0.0381)	(0.0505)
GDP Growth		-0.0584***	-0.0648***
		(0.0141)	(0.0141)
Fossil Fuel Inc. P.C.		-0.0215	-0.00721
		(0.0319)	(0.0310)
E.U. Member		0.533***	0.542***
		(0.0630)	(0.0623)
GDP per Capita			-0.0986
			(0.0545)
Constant	-0.144***	-0.404***	-0.368***
	(0.0262)	(0.0419)	(0.0472)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.4: Mitigation Effect (Panel-Corrected Standard Errors)

	(1)	(2)	(3)
CO_2 Intensity	-0.204***	-0.112***	-0.106***
	(0.0148)	(0.0131)	(0.0128)
Output		0.0770***	0.0829***
		(0.0162)	(0.0160)
Nat. CO_2 Intensity		-0.256***	-0.306***
		(0.0197)	(0.0245)
GDP Growth		-0.00884	-0.00992
		(0.00925)	(0.00931)
Fossil Fuel Inc. P.C.		-0.105***	-0.0858***
		(0.0130)	(0.0129)
E.U. Member		0.303***	0.311***
		(0.0231)	(0.0229)
GDP per Capita			-0.0914***
			(0.0266)
Constant	0.209***	-0.291***	-0.117***
	(0.0177)	(0.0208)	(0.0214)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
R^2	0.172	0.337	0.342

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.5: Mitigation Effect (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.320***	-0.217***	-0.214***
	(0.0469)	(0.0452)	(0.0447)
Output		0.188*	0.219*
		(0.0905)	(0.0900)
Nat. CO_2 Intensity		-0.216***	-0.387***
		(0.0567)	(0.0647)
GDP Growth		0.0112	0.0223
		(0.0117)	(0.0124)
Fossil Fuel Inc. P.C.		-0.388***	-0.437***
		(0.0956)	(0.0974)
E.U. Member		0.278***	0.268***
		(0.0496)	(0.0501)
GDP per Capita			-0.656***
			(0.123)
Constant	-0.435**	-0.544*	0.289
	(0.136)	(0.245)	(0.291)
Time Indicators	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes
N	3555	3555	3555
Within R^2	0.252	0.307	0.322
Between R^2	0.570	0.567	0.565
Overall R^2	0.526	0.532	0.533

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.6: Mitigation Effect (Random Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.293***	-0.172***	-0.170***
	(0.0336)	(0.0314)	(0.0313)
Output		0.0718*	0.0932**
		(0.0347)	(0.0345)
Nat. CO_2 Intensity		-0.237***	-0.342***
		(0.0370)	(0.0469)
GDP Growth		-0.00941	-0.00941
		(0.0119)	(0.0117)
Fossil Fuel Inc. P.C.		-0.0720*	-0.0528
		(0.0317)	(0.0315)
E.U. Member		0.339***	0.336***
		(0.0437)	(0.0437)
GDP per Capita			-0.240***
			(0.0578)
Constant	0.198***	-0.188***	-0.120**
	(0.0358)	(0.0437)	(0.0441)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
Within R^2	0.251	0.298	0.306
Between R^2	0.051	0.186	0.179
Overall R^2	0.080	0.207	0.201

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.7: Mitigation Effect (Fixed Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.472***	-0.152*	-0.135*
	(0.0756)	(0.0668)	(0.0649)
Output		0.597***	0.678***
		(0.129)	(0.126)
Nat. CO_2 Intensity		-0.160**	-0.344***
		(0.0563)	(0.0642)
GDP Growth		0.00844	0.0202
		(0.0116)	(0.0122)
Fossil Fuel Inc. P.C.		-0.366***	-0.418***
		(0.0932)	(0.0954)
E.U. Member		0.255***	0.242***
		(0.0493)	(0.0496)
GDP per Capita			-0.716***
			(0.123)
Constant	-0.152***	-0.227***	0.0448
	(0.0120)	(0.0345)	(0.0558)
Time Indicators	Yes	Yes	Yes
N	3555	3555	3555
Within R^2	0.255	0.312	0.328
Between R^2	0.051	0.081	0.046
Overall R^2	0.074	0.105	0.068

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.2 Consumption Effect

Table B.8: Consumption Effect

	(1)	(2)	(3)	(4)
Export Intensity	-0.105***			
	(0.0207)			
Import Penetration		-0.0556*		
		(0.0223)		
FCHH % of Output			-0.00947	
			(0.0207)	
FCHH % of Nat. Consumption				0.0183
				(0.0225)
CO_2 Intensity	-0.118***	-0.117***	-0.118***	-0.113***
	(0.0226)	(0.0229)	(0.0232)	(0.0232)
Output	0.161***	0.174***	0.226***	0.212***
	(0.0407)	(0.0441)	(0.0399)	(0.0430)
Nat. CO_2 Intensity	-0.398***	-0.395***	-0.391***	-0.393***
	(0.0508)	(0.0507)	(0.0506)	(0.0505)
GDP per Capita	-0.581***	-0.571***	-0.576***	-0.574***
	(0.0939)	(0.0937)	(0.0932)	(0.0932)
GDP Growth	0.0156	0.0144	0.0140	0.0140
	(0.0143)	(0.0143)	(0.0142)	(0.0142)
Fossil Fuel Inc. P.C.	-0.294***	-0.288***	-0.286***	-0.287***
	(0.0671)	(0.0666)	(0.0664)	(0.0663)
E.U. Member	0.297***	0.289***	0.280***	0.282***
	(0.0394)	(0.0394)	(0.0393)	(0.0393)
Random Effect Variances				
Country	0.427**	0.414**	0.412**	0.411**
	(0.141)	(0.137)	(0.136)	(0.136)
Sector	0.390***	0.406***	0.417***	0.417***
	(0.0207)	(0.0213)	(0.0216)	(0.0215)
Year	0.129***	0.128***	0.128***	0.128***
	(0.00355)	(0.00353)	(0.00350)	(0.00350)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	3651.61	3636.76	3618.78	3619.06

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.9: Consumption Effect (Cross-Classified)

	(1)	(2)	(3)	(4)
Export Intensity	-0.223***			
	(0.0212)			
Import Penetration		-0.0761**		
		(0.0244)		
FCHH % of Output			0.0400	
			(0.0253)	
FCHH % of Nat. Consumption				0.0903***
				(0.0247)
CO_2 Intensity	-0.190***	-0.188***	-0.191***	-0.188***
	(0.0233)	(0.0235)	(0.0237)	(0.0238)
Output	0.0322	-0.0478	0.00506	-0.0490
	(0.0409)	(0.0447)	(0.0416)	(0.0441)
Nat. CO_2 Intensity	-0.301***	-0.334***	-0.332***	-0.340***
	(0.0869)	(0.0877)	(0.0875)	(0.0876)
GDP per Capita	-0.372*	-0.344*	-0.358*	-0.345*
	(0.153)	(0.152)	(0.152)	(0.151)
GDP Growth	0.00960	0.00615	0.00587	0.00594
	(0.0259)	(0.0262)	(0.0262)	(0.0262)
Fossil Fuel Inc. P.C.	-0.187*	-0.162	-0.167	-0.161
	(0.0948)	(0.0930)	(0.0929)	(0.0928)
E.U. Member	0.350***	0.325***	0.314***	0.315***
	(0.0715)	(0.0724)	(0.0723)	(0.0722)
Random Effect Variances				
Country	0.353**	0.327**	0.328**	0.327**
	(0.124)	(0.114)	(0.113)	(0.113)
Sector	0.0700***	0.0791***	0.0948***	0.101***
	(0.0198)	(0.0223)	(0.0262)	(0.0281)
Year	0.442***	0.455***	0.455***	0.453***
	(0.0106)	(0.0109)	(0.0109)	(0.0108)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	7255.52	7354.08	7355.72	7342.24

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.10: Consumption Effect (Lagged Dependent Variable)

	(1)	(2)	(3)	(4)
Export Intensity	-0.191***			
	(0.0258)			
Import Penetration		-0.159***		
		(0.0293)		
FCHH % of Output			-0.00816	
			(0.0302)	
FCHH % of Nat. Consumption				0.0243
				(0.0333)
CO_2 Intensity	-0.128***	-0.126***	-0.137***	-0.129***
	(0.0288)	(0.0290)	(0.0303)	(0.0300)
Output	-0.0518	-0.0584	0.0416	0.0324
	(0.0375)	(0.0402)	(0.0343)	(0.0354)
Nat. CO_2 Intensity	-0.255***	-0.262***	-0.244***	-0.246***
	(0.0511)	(0.0515)	(0.0504)	(0.0508)
GDP per Capita	-0.0580	-0.0608	-0.100	-0.0963
	(0.0564)	(0.0568)	(0.0548)	(0.0547)
GDP Growth	-0.0712***	-0.0704***	-0.0642***	-0.0653***
	(0.0145)	(0.0146)	(0.0141)	(0.0142)
Fossil Fuel Inc. P.C.	-0.000684	0.00224	-0.00673	-0.00686
	(0.0300)	(0.0308)	(0.0308)	(0.0310)
E.U. Member	0.566***	0.553***	0.541***	0.540***
	(0.0624)	(0.0623)	(0.0623)	(0.0624)
Constant	-0.387***	-0.377***	-0.368***	-0.368***
	(0.0478)	(0.0482)	(0.0471)	(0.0473)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.11: Consumption Effect (Panel-Corrected Standard Errors)

	(1)	(2)	(3)	(4)
Export Intensity	-0.118***			
	(0.0123)			
Import Penetration		-0.0969***		
		(0.0130)		
FCHH % of Output			-0.0239	
			(0.0127)	
FCHH % of Nat. Consumption				-0.000163
				(0.0132)
CO_2 Intensity	-0.110***	-0.111***	-0.110***	-0.107***
	(0.0127)	(0.0128)	(0.0130)	(0.0129)
Output	0.0155	0.00878	0.0882***	0.0836***
	(0.0171)	(0.0184)	(0.0163)	(0.0167)
Nat. CO_2 Intensity	-0.322***	-0.317***	-0.308***	-0.306***
	(0.0240)	(0.0242)	(0.0246)	(0.0246)
GDP per Capita	-0.0645*	-0.0545*	-0.0991***	-0.0932***
	(0.0265)	(0.0261)	(0.0270)	(0.0266)
GDP Growth	-0.0120	-0.0126	-0.00896	-0.0104
	(0.00951)	(0.00950)	(0.00933)	(0.00931)
Fossil Fuel Inc. P.C.	-0.0793***	-0.0803***	-0.0854***	-0.0869***
	(0.0128)	(0.0129)	(0.0129)	(0.0130)
E.U. Member	0.319***	0.317***	0.308***	0.314***
	(0.0235)	(0.0230)	(0.0230)	(0.0228)
Constant	-0.141***	-0.127***	-0.117***	-0.120***
	(0.0210)	(0.0211)	(0.0215)	(0.0214)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
R^2	0.384	0.372	0.342	0.347

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.12: Consumption Effect (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)	(4)
Export Intensity	-0.0744*			
	(0.0298)			
Import Penetration		0.0517		
		(0.0354)		
FCHH % of Output			0.000616	
			(0.0327)	
FCHH % of Nat. Consumption				0.0804
				(0.0435)
CO_2 Intensity	-0.217***	-0.213***	-0.214***	-0.213***
	(0.0444)	(0.0448)	(0.0447)	(0.0443)
Output	0.219*	0.252**	0.219*	0.171
	(0.0890)	(0.0909)	(0.0902)	(0.0955)
Nat. CO_2 Intensity	-0.384***	-0.385***	-0.387***	-0.393***
	(0.0646)	(0.0643)	(0.0648)	(0.0651)
GDP per Capita	-0.668***	-0.656***	-0.656***	-0.651***
	(0.124)	(0.123)	(0.123)	(0.123)
GDP Growth	0.0235	0.0218	0.0223	0.0226
	(0.0124)	(0.0124)	(0.0124)	(0.0124)
Fossil Fuel Inc. P.C.	-0.444***	-0.433***	-0.437***	-0.439***
	(0.0975)	(0.0972)	(0.0970)	(0.0969)
E.U. Member	0.277***	0.261***	0.268***	0.272***
	(0.0503)	(0.0498)	(0.0503)	(0.0502)
Constant	0.253	0.253	0.289	0.365
	(0.290)	(0.292)	(0.292)	(0.294)
Time Indicators	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.319	0.324	0.322	0.322
Between R^2	0.573	0.563	0.565	0.567
Overall R^2	0.541	0.531	0.533	0.535

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.13: Consumption Effect (Random Effects)

	(1)	(2)	(3)	(4)
Export Intensity	-0.0669**			
	(0.0244)			
Import Penetration		-0.0397		
		(0.0279)		
FCHH % of Output			-0.0382	
			(0.0266)	
FCHH % of Nat. Consumption				0.0386
				(0.0319)
CO_2 Intensity	-0.170***	-0.168***	-0.174***	-0.161***
	(0.0308)	(0.0308)	(0.0315)	(0.0310)
Output	0.0586	0.0668	0.100**	0.0811*
	(0.0374)	(0.0372)	(0.0348)	(0.0367)
Nat. CO_2 Intensity	-0.345***	-0.345***	-0.344***	-0.346***
	(0.0466)	(0.0468)	(0.0468)	(0.0470)
GDP per Capita	-0.224***	-0.228***	-0.245***	-0.237***
	(0.0579)	(0.0589)	(0.0579)	(0.0580)
GDP Growth	-0.0101	-0.00999	-0.00915	-0.00951
	(0.0117)	(0.0117)	(0.0117)	(0.0117)
Fossil Fuel Inc. P.C.	-0.0488	-0.0496	-0.0506	-0.0522
	(0.0311)	(0.0315)	(0.0314)	(0.0315)
E.U. Member	0.348***	0.342***	0.334***	0.336***
	(0.0439)	(0.0437)	(0.0438)	(0.0437)
Constant	-0.123**	-0.120**	-0.125**	-0.119**
	(0.0440)	(0.0442)	(0.0442)	(0.0442)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.301	0.303	0.307	0.306
Between R^2	0.202	0.191	0.179	0.180
Overall R^2	0.221	0.211	0.201	0.202

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.14: Consumption Effect (Fixed Effects)

	(1)	(2)	(3)	(4)
Export Intensity	0.0739*			
	(0.0374)			
Import Penetration		0.119*		
		(0.0482)		
FCHH % of Output			-0.0264	
			(0.0429)	
FCHH % of Nat. Consumption				0.0443
				(0.0650)
CO_2 Intensity	-0.127	-0.129*	-0.136*	-0.135*
	(0.0652)	(0.0652)	(0.0650)	(0.0649)
Output	0.694***	0.748***	0.676***	0.648***
	(0.128)	(0.130)	(0.126)	(0.135)
Nat. CO_2 Intensity	-0.341***	-0.338***	-0.344***	-0.348***
	(0.0646)	(0.0637)	(0.0643)	(0.0645)
GDP per Capita	-0.704***	-0.713***	-0.713***	-0.713***
	(0.123)	(0.122)	(0.123)	(0.123)
GDP Growth	0.0191	0.0191	0.0201	0.0204
	(0.0122)	(0.0121)	(0.0122)	(0.0122)
Fossil Fuel Inc. P.C.	-0.410***	-0.409***	-0.415***	-0.419***
	(0.0950)	(0.0956)	(0.0951)	(0.0953)
E.U. Member	0.233***	0.227***	0.241***	0.244***
	(0.0497)	(0.0492)	(0.0498)	(0.0497)
Constant	0.0404	0.0356	0.0416	0.0468
	(0.0561)	(0.0561)	(0.0558)	(0.0558)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.329	0.330	0.328	0.328
Between R^2	0.041	0.039	0.047	0.048
Overall R^2	0.062	0.060	0.069	0.070

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.3 Compensation Effect

Table B.15: Compensation Effect

	(1)	(2)	(3)	(4)
Labor Intensity	0.137***			
	(0.0231)			
Ln. Labor Comp. / Output		0.135***		
		(0.0205)		
Ln. Employees / Output			0.107***	
			(0.0311)	
Labor Comp. / Nat. Labor Comp.				0.112***
				(0.0253)
CO_2 Intensity	-0.0995***	-0.0988***	-0.106***	-0.104***
	(0.0228)	(0.0229)	(0.0231)	(0.0227)
Output	0.228***	0.258***	0.255***	0.111*
	(0.0392)	(0.0396)	(0.0405)	(0.0454)
Nat. CO_2 Intensity	-0.388***	-0.385***	-0.415***	-0.410***
	(0.0505)	(0.0504)	(0.0513)	(0.0507)
GDP per Capita	-0.583***	-0.596***	-0.571***	-0.556***
	(0.0930)	(0.0929)	(0.0930)	(0.0936)
GDP Growth	0.0131	0.0122	0.0149	0.0139
	(0.0142)	(0.0142)	(0.0143)	(0.0143)
Fossil Fuel Inc. P.C.	-0.302***	-0.304***	-0.287***	-0.281***
	(0.0669)	(0.0667)	(0.0664)	(0.0664)
E.U. Member	0.290***	0.292***	0.294***	0.288***
	(0.0393)	(0.0391)	(0.0393)	(0.0393)
Random Effect Variances				
Country	0.416**	0.424**	0.432**	0.397**
	(0.137)	(0.140)	(0.142)	(0.132)
Sector	0.399***	0.403***	0.409***	0.403***
	(0.0208)	(0.0210)	(0.0212)	(0.0209)
Year	0.128***	0.127***	0.128***	0.128***
	(0.00351)	(0.00347)	(0.00351)	(0.00351)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	3616.37	3592.93	3622.69	3628.09

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.16: Compensation Effect (Cross-Classified)

	(1)	(2)	(3)	(4)
Labor Intensity	0.191***			
	(0.0250)			
Ln. Labor Comp. / Output		0.168***		
		(0.0226)		
Ln. Employees / Output			0.332***	
			(0.0373)	
Labor Comp. / Nat. Labor Comp.				0.0894***
				(0.0226)
CO_2 Intensity	-0.189***	-0.190***	-0.208***	-0.188***
	(0.0237)	(0.0238)	(0.0241)	(0.0236)
Output	0.0643	0.0952*	0.127**	-0.0742
	(0.0418)	(0.0432)	(0.0442)	(0.0458)
Nat. CO_2 Intensity	-0.321***	-0.317***	-0.381***	-0.349***
	(0.0869)	(0.0871)	(0.0874)	(0.0874)
GDP per Capita	-0.388**	-0.403**	-0.314*	-0.342*
	(0.149)	(0.149)	(0.157)	(0.152)
GDP Growth	0.00452	0.00388	0.00908	0.00576
	(0.0260)	(0.0260)	(0.0259)	(0.0262)
Fossil Fuel Inc. P.C.	-0.175	-0.177	-0.172	-0.158
	(0.0924)	(0.0926)	(0.0938)	(0.0929)
E.U. Member	0.322***	0.322***	0.351***	0.313***
	(0.0718)	(0.0718)	(0.0715)	(0.0723)
Random Effect Variances				
Country	0.318**	0.325**	0.360**	0.328**
	(0.110)	(0.112)	(0.125)	(0.113)
Sector	0.0830***	0.0881***	0.118***	0.0816***
	(0.0234)	(0.0248)	(0.0337)	(0.0230)
Year	0.448***	0.448***	0.443***	0.454***
	(0.0107)	(0.0107)	(0.0106)	(0.0108)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
DIC	7302.69	7304.37	7265.83	7346.55

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.17: Compensation Effect (Lagged Dependent Variable)

	(1)	(2)	(3)	(4)
Labor Intensity	0.168***			
	(0.0347)			
Ln. Labor Comp. / Output		0.117***		
		(0.0258)		
Ln. Employees / Output			0.109**	
			(0.0370)	
Labor Comp. / Nat. Labor Comp.				0.144***
				(0.0370)
CO_2 Intensity	-0.108***	-0.117***	-0.122***	-0.100**
	(0.0299)	(0.0301)	(0.0310)	(0.0306)
Output	0.0277	0.0407	0.0538	-0.0218
	(0.0336)	(0.0333)	(0.0338)	(0.0364)
Nat. CO_2 Intensity	-0.255***	-0.251***	-0.254***	-0.268***
	(0.0503)	(0.0503)	(0.0512)	(0.0513)
GDP per Capita	-0.137*	-0.136*	-0.0417	-0.0798
	(0.0550)	(0.0551)	(0.0577)	(0.0547)
GDP Growth	-0.0653***	-0.0646***	-0.0644***	-0.0683***
	(0.0140)	(0.0139)	(0.0141)	(0.0142)
Fossil Fuel Inc. P.C.	-0.00633	-0.00818	-0.0118	-0.00313
	(0.0300)	(0.0303)	(0.0305)	(0.0305)
E.U. Member	0.536***	0.540***	0.559***	0.523***
	(0.0611)	(0.0615)	(0.0628)	(0.0619)
Constant	-0.342***	-0.277***	-0.391***	-0.363***
	(0.0473)	(0.0395)	(0.0477)	(0.0477)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.18: Compensation Effect (Panel-Corrected Standard Errors)

	(1)	(2)	(3)	(4)
Labor Intensity	0.161***			
	(0.0140)			
Ln. Labor Comp. / Output		0.125***		
		(0.0117)		
Ln. Employees / Output			0.0918***	
			(0.0173)	
Labor Comp. / Nat. Labor Comp.				0.133***
				(0.0150)
CO_2 Intensity	-0.0989***	-0.0979***	-0.105***	-0.0886***
	(0.0132)	(0.0133)	(0.0134)	(0.0131)
Output	0.0692***	0.0843***	0.0955***	0.0310
	(0.0154)	(0.0155)	(0.0163)	(0.0168)
Nat. CO_2 Intensity	-0.317***	-0.316***	-0.321***	-0.322***
	(0.0239)	(0.0241)	(0.0244)	(0.0248)
GDP per Capita	-0.136***	-0.138***	-0.0413	-0.0778**
	(0.0275)	(0.0277)	(0.0281)	(0.0268)
GDP Growth	-0.0126	-0.0131	-0.00962	-0.0139
	(0.00925)	(0.00920)	(0.00933)	(0.00932)
Fossil Fuel Inc. P.C.	-0.0812***	-0.0821***	-0.0868***	-0.0787***
	(0.0127)	(0.0128)	(0.0131)	(0.0129)
E.U. Member	0.298***	0.303***	0.313***	0.307***
	(0.0227)	(0.0228)	(0.0232)	(0.0226)
Constant	-0.257***	-0.262***	-0.119***	-0.271***
	(0.0208)	(0.0208)	(0.0214)	(0.0210)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
R^2	0.379	0.369	0.347	0.378

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.19: Compensation Effect (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)	(4)
Labor Intensity	0.174***			
	(0.0398)			
Ln. Labor Comp. / Output		0.217***		
		(0.0335)		
Ln. Employees / Output			0.250***	
			(0.0619)	
Labor Comp. / Nat. Labor Comp.				0.0588
				(0.0421)
CO_2 Intensity	-0.221***	-0.224***	-0.238***	-0.215***
	(0.0445)	(0.0440)	(0.0436)	(0.0446)
Output	0.302***	0.389***	0.361***	0.172
	(0.0911)	(0.0889)	(0.0907)	(0.0993)
Nat. CO_2 Intensity	-0.366***	-0.351***	-0.422***	-0.394***
	(0.0644)	(0.0639)	(0.0677)	(0.0656)
GDP per Capita	-0.672***	-0.693***	-0.658***	-0.651***
	(0.123)	(0.122)	(0.122)	(0.123)
GDP Growth	0.0211	0.0190	0.0238	0.0225
	(0.0123)	(0.0122)	(0.0123)	(0.0124)
Fossil Fuel Inc. P.C.	-0.461***	-0.463***	-0.423***	-0.437***
	(0.0982)	(0.0975)	(0.0967)	(0.0972)
E.U. Member	0.274***	0.276***	0.291***	0.271***
	(0.0499)	(0.0491)	(0.0501)	(0.0502)
Constant	0.0603	-0.0976	0.0388	0.327
	(0.292)	(0.293)	(0.289)	(0.292)
Time Indicators	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.325	0.332	0.322	0.322
Between R^2	0.572	0.570	0.576	0.566
Overall R^2	0.540	0.539	0.542	0.534

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.20: Compensation Effect (Random Effects)

	(1)	(2)	(3)	(4)
Labor Intensity	0.133***			
	(0.0300)			
Ln. Labor Comp. / Output		0.126***		
		(0.0237)		
Ln. Employees / Output			0.0277	
			(0.0391)	
Labor Comp. / Nat. Labor Comp.				0.121***
				(0.0321)
CO_2 Intensity	-0.158***	-0.161***	-0.169***	-0.145***
	(0.0309)	(0.0310)	(0.0316)	(0.0311)
Output	0.0926**	0.107**	0.0986**	0.0417
	(0.0344)	(0.0345)	(0.0347)	(0.0371)
Nat. CO_2 Intensity	-0.343***	-0.342***	-0.347***	-0.357***
	(0.0468)	(0.0468)	(0.0477)	(0.0479)
GDP per Capita	-0.263***	-0.275***	-0.229***	-0.225***
	(0.0574)	(0.0577)	(0.0601)	(0.0572)
GDP Growth	-0.0103	-0.0106	-0.00931	-0.0102
	(0.0116)	(0.0116)	(0.0117)	(0.0117)
Fossil Fuel Inc. P.C.	-0.0539	-0.0565	-0.0532	-0.0482
	(0.0308)	(0.0309)	(0.0314)	(0.0312)
E.U. Member	0.343***	0.344***	0.340***	0.336***
	(0.0436)	(0.0434)	(0.0435)	(0.0437)
Constant	-0.0943*	-0.0941*	-0.119**	-0.119**
	(0.0446)	(0.0446)	(0.0445)	(0.0436)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.306	0.310	0.306	0.306
Between R^2	0.203	0.194	0.181	0.199
Overall R^2	0.222	0.215	0.203	0.218

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.21: Compensation Effect (Fixed Effects)

	(1)	(2)	(3)	(4)
Labor Intensity	0.171**			
	(0.0549)			
Ln. Labor Comp. / Output		0.268***		
		(0.0485)		
Ln. Employees / Output			0.214*	
			(0.109)	
Labor Comp. / Nat. Labor Comp.				0.0410
				(0.0835)
CO_2 Intensity	-0.142*	-0.149*	-0.158*	-0.135*
	(0.0646)	(0.0640)	(0.0648)	(0.0649)
Output	0.776***	0.921***	0.848***	0.649***
	(0.133)	(0.137)	(0.154)	(0.137)
Nat. CO_2 Intensity	-0.321***	-0.293***	-0.368***	-0.348***
	(0.0644)	(0.0640)	(0.0666)	(0.0649)
GDP per Capita	-0.733***	-0.767***	-0.725***	-0.713***
	(0.122)	(0.121)	(0.122)	(0.123)
GDP Growth	0.0190	0.0160	0.0213	0.0203
	(0.0121)	(0.0120)	(0.0121)	(0.0122)
Fossil Fuel Inc. P.C.	-0.441***	-0.452***	-0.406***	-0.419***
	(0.0965)	(0.0958)	(0.0945)	(0.0953)
E.U. Member	0.246***	0.250***	0.258***	0.243***
	(0.0493)	(0.0484)	(0.0490)	(0.0496)
Constant	0.0429	0.0248	0.0561	0.0462
	(0.0560)	(0.0564)	(0.0562)	(0.0561)
Time Indicators	Yes	Yes	Yes	Yes
N	3555	3555	3555	3555
Within R^2	0.331	0.339	0.330	0.328
Between R^2	0.055	0.051	0.040	0.050
Overall R^2	0.076	0.071	0.060	0.072

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix C

Alternative Regression Results for Chapter 4

C.1 Party Ideology and Emissions Intensity

Table C.1: Party Ideology and Emissions Intensity

	(1)	(2)	(3)
CO_2 Intensity	-0.115***	-0.124***	-0.122***
	(0.0263)	(0.0247)	(0.0243)
Right % Gov.	-0.0347***	-0.0386***	-0.0120
	(0.00871)	(0.00875)	(0.00920)
CO_2 Intensity		-0.0654***	-0.0637***
× Right % Gov.		(0.00847)	(0.00884)
Output	0.243***	0.245***	0.264***
	(0.0505)	(0.0441)	(0.0457)
Green Party in Gov.			-0.0195
			(0.0331)
Veto Players			-0.0534**
			(0.0187)
Proportional Rep.			0.942***
			(0.271)
Federalism			-0.361
			(0.229)
Random Effect Variances			
Country	0.345**	0.328**	0.252**
	(0.118)	(0.110)	(0.0945)
Sector	0.436***	0.434***	0.450***
	(0.0239)	(0.0235)	(0.0254)
Year	0.120***	0.117***	0.113***
	(0.00350)	(0.00345)	(0.00335)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3026.94	2959.39	2728.92

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.2: Party Ideology and Emissions Intensity (Cross-Classified)

	(1)	(2)	(3)
CO_2 Intensity	-0.181***	-0.192***	-0.177***
	(0.0250)	(0.0249)	(0.0256)
Right % Gov.	-0.0368*	-0.0388*	-0.0135
	(0.0171)	(0.0171)	(0.0185)
CO_2 Intensity		-0.0760***	-0.0762***
× Right % Gov.		(0.0130)	(0.0136)
Output	-0.0380	-0.0448	-0.00844
	(0.0438)	(0.0415)	(0.0458)
Green Party in Gov.			-0.00872
			(0.0664)
Veto Players			-0.0472
			(0.0364)
Proportional Rep.			0.721*
			(0.338)
Federalism			-0.00863
			(0.270)
Random Effect Variances			
Country	0.304**	0.308**	0.284**
	(0.102)	(0.105)	(0.110)
Sector	0.104***	0.105***	0.110***
	(0.0295)	(0.0293)	(0.0318)
Year	0.457***	0.452***	0.456***
	(0.0115)	(0.0116)	(0.0119)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	6557.93	6525.42	6281.87

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.3: Party Ideology and Emissions Intensity (Lagged Dependent Variable)

	(1)	(2)	(3)
CO_2 Intensity	-0.143***	-0.152***	-0.106***
	(0.0327)	(0.0333)	(0.0321)
Right % Gov.	0.0235	0.0182	0.00288
	(0.0130)	(0.0122)	(0.0101)
CO_2 Intensity		-0.0842***	-0.0852***
× Right % Gov.		(0.0163)	(0.0159)
Output	0.0466	0.0460	0.230***
	(0.0360)	(0.0359)	(0.0410)
Green Party in Gov.			0.114**
			(0.0347)
Veto Players			-0.00718
			(0.0209)
Proportional Rep.			0.903***
			(0.0769)
Federalism			-0.379***
			(0.0653)
Constant	-0.313***	-0.306***	-1.042***
	(0.0726)	(0.0713)	(0.0901)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.4: Party Ideology and Emissions Intensity (Panel-Corrected Standard Errors)

	(1)	(2)	(3)
CO_2 Intensity	-0.108***	-0.114***	-0.0800***
	(0.0121)	(0.0124)	(0.0137)
Right % Gov.	-0.00508	-0.00658	-0.00337
	(0.00631)	(0.00619)	(0.00638)
CO_2 Intensity		-0.0466***	-0.0437***
× Right % Gov.		(0.00637)	(0.00650)
Output	0.0840***	0.0788***	0.241***
	(0.0154)	(0.0153)	(0.0193)
Green Party in Gov.			0.00115
			(0.0227)
Veto Players			-0.0488***
			(0.0126)
Proportional Rep.			0.766***
			(0.0447)
Federalism			-0.445***
			(0.0366)
Constant	-0.209***	-0.210***	-0.803***
	(0.0252)	(0.0250)	(0.0450)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
R^2	0.418	0.415	0.446

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.5: Party Ideology and Emissions Intensity (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.192***	-0.212***	-0.207***
	(0.0484)	(0.0470)	(0.0479)
Right % Gov.	-0.0344**	-0.0371***	-0.00956
	(0.0111)	(0.0106)	(0.00978)
CO_2 Intensity		-0.0661***	-0.0642***
× Right % Gov.		(0.0114)	(0.0107)
Output	0.233*	0.225*	0.211*
	(0.101)	(0.0969)	(0.101)
Green Party in Gov.			-0.0138
			(0.0211)
Veto Players			-0.0557**
			(0.0183)
Proportional Rep.			0.476**
			(0.151)
Federalism			-0.295
			(0.260)
Constant	-0.423	-0.407	0.0817
	(0.311)	(0.304)	(0.319)
Time Indicators	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.377	0.391	0.428
Between R^2	0.570	0.574	0.567
Overall R^2	0.547	0.552	0.551

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.6: Party Ideology and Emissions Intensity (Random Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.168***	-0.181***	-0.131***
	(0.0339)	(0.0337)	(0.0319)
Right % Gov.	-0.0302**	-0.0333**	-0.0146
	(0.0110)	(0.0104)	(0.00948)
CO_2 Intensity		-0.0672***	-0.0660***
× Right % Gov.		(0.0118)	(0.0112)
Output	0.105**	0.103**	0.283***
	(0.0363)	(0.0361)	(0.0423)
Green Party in Gov.			-0.00661
			(0.0182)
Veto Players			-0.0461**
			(0.0161)
Proportional Rep.			0.918***
			(0.0790)
Federalism			-0.388***
			(0.0664)
Constant	0.0138	0.0134	-0.723***
	(0.0523)	(0.0528)	(0.0913)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.370	0.385	0.422
Between R^2	0.177	0.183	0.279
Overall R^2	0.208	0.215	0.307

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.7: Party Ideology and Emissions Intensity (Fixed Effects)

	(1)	(2)	(3)
CO_2 Intensity	-0.0707	-0.110	-0.134*
	(0.0663)	(0.0642)	(0.0650)
Right % Gov.	-0.0335**	-0.0359***	-0.00994
	(0.0109)	(0.0104)	(0.00967)
CO_2 Intensity		-0.0629***	-0.0610***
× Right % Gov.		(0.0114)	(0.0107)
Output	0.784***	0.749***	0.660***
	(0.133)	(0.127)	(0.129)
Green Party in Gov.			-0.0154
			(0.0210)
Veto Players			-0.0582**
			(0.0181)
Proportional Rep.			
Federalism			
Constant	0.0354	0.0285	0.132
	(0.0747)	(0.0737)	(0.0694)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.385	0.398	0.433
Between R^2	0.046	0.052	0.068
Overall R^2	0.077	0.086	0.111

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C.2 Party Ideology and Consumption

Table C.8: Party Ideology and Consumption

	(1)	(2)	(3)
Export Intensity	-0.125***	-0.125***	-0.123***
	(0.0209)	(0.0210)	(0.0232)
Right % Gov.	-0.0380***	-0.0375***	-0.00868
	(0.00890)	(0.00875)	(0.00938)
Export Intensity		0.000144	-0.0254**
× Right % Gov.		(0.00828)	(0.00856)
CO_2 Intensity	-0.114***	-0.115***	-0.119***
	(0.0247)	(0.0237)	(0.0265)
Output	0.167***	0.168***	0.181***
	(0.0456)	(0.0474)	(0.0513)
Green Party in Gov.			-0.0125
			(0.0342)
Veto Players			-0.0705***
			(0.0191)
Proportional Rep.			0.784**
			(0.293)
Federalism			-0.259
			(0.236)
Random Effect Variances			
Country	0.332**	0.331**	0.269**
	(0.110)	(0.112)	(0.0974)
Sector	0.404***	0.404***	0.421***
	(0.0225)	(0.0228)	(0.0239)
Year	0.121***	0.121***	0.116***
	(0.00360)	(0.00356)	(0.00344)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3058.71	3059.54	2804.88

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.9: Party Ideology and Consumption (Cross-Classified)

	(1)	(2)	(3)
Export Intensity	-0.223***	-0.221***	-0.210***
	(0.0225)	(0.0221)	(0.0227)
Right % Gov.	-0.0387*	-0.0394*	-0.0112
	(0.0170)	(0.0170)	(0.0184)
Export Intensity		0.0130	-0.00497
× Right % Gov.		(0.0130)	(0.0135)
CO_2 Intensity	-0.179***	-0.179***	-0.167***
	(0.0243)	(0.0242)	(0.0246)
Output	-0.0000702	0.000440	0.0307
	(0.0401)	(0.0430)	(0.0446)
Green Party in Gov.			-0.00847
			(0.0656)
Veto Players			-0.0599
			(0.0370)
Proportional Rep.			0.629*
			(0.297)
Federalism			-0.238
			(0.328)
Random Effect Variances			
Country	0.325**	0.326**	0.293*
	(0.111)	(0.107)	(0.118)
Sector	0.0679***	0.0676***	0.0715***
	(0.0194)	(0.0194)	(0.0211)
Year	0.445***	0.445***	0.451***
	(0.0114)	(0.0114)	(0.0118)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	6472.24	6472.79	6247.14

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.10: Party Ideology and Consumption (Lagged Dependent Variable)

	(1)	(2)	(3)
Export Intensity	-0.200***	-0.200***	-0.174***
	(0.0266)	(0.0271)	(0.0263)
Right % Gov.	0.0177	0.0176	0.00764
	(0.0126)	(0.0124)	(0.0108)
Export Intensity		-0.00626	-0.0171
× Right % Gov.		(0.0115)	(0.0111)
CO_2 Intensity	-0.134***	-0.134***	-0.0907**
	(0.0312)	(0.0312)	(0.0307)
Output	-0.0533	-0.0534	0.134**
	(0.0413)	(0.0413)	(0.0452)
Green Party in Gov.			0.132***
			(0.0330)
Veto Players			0.00500
			(0.0209)
Proportional Rep.			0.842***
			(0.0744)
Federalism			-0.347***
			(0.0627)
Constant	-0.330***	-0.331***	-1.020***
	(0.0733)	(0.0735)	(0.0890)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.11: Party Ideology and Consumption (Panel-Corrected Standard Errors)

	(1)	(2)	(3)
Export Intensity	-0.125***	-0.125***	-0.102***
	(0.0119)	(0.0118)	(0.0129)
Right % Gov.	-0.00806	-0.00811	-0.00432
	(0.00642)	(0.00644)	(0.00642)
Export Intensity		-0.00255	-0.0169**
× Right % Gov.		(0.00663)	(0.00641)
CO_2 Intensity	-0.0935***	-0.0940***	-0.0629***
	(0.0127)	(0.0127)	(0.0149)
Output	0.00894	0.00768	0.183***
	(0.0171)	(0.0171)	(0.0201)
Green Party in Gov.			0.0112
			(0.0233)
Veto Players			-0.0529***
			(0.0126)
Proportional Rep.			0.712***
			(0.0424)
Federalism			-0.392***
			(0.0342)
Constant	-0.229***	-0.231***	-0.579***
	(0.0257)	(0.0258)	(0.0482)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
R^2	0.433	0.434	0.433

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.12: Party Ideology and Consumption (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)
Export Intensity	-0.0944**	-0.0944**	-0.0840**
	(0.0307)	(0.0307)	(0.0312)
Right % Gov.	-0.0356**	-0.0355**	-0.00625
	(0.0111)	(0.0109)	(0.0101)
Export Intensity		0.000639	-0.0249*
× Right % Gov.		(0.0101)	(0.00994)
CO_2 Intensity	-0.197***	-0.197***	-0.196***
	(0.0479)	(0.0481)	(0.0488)
Output	0.238*	0.238*	0.216*
	(0.0995)	(0.0999)	(0.103)
Green Party in Gov.			-0.00944
			(0.0223)
Veto Players			-0.0734***
			(0.0202)
Proportional Rep.			0.411**
			(0.152)
Federalism			-0.272
			(0.265)
Constant	-0.478	-0.477	0.0566
	(0.309)	(0.310)	(0.323)
Time Indicators	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.375	0.375	0.416
Between R^2	0.580	0.580	0.571
Overall R^2	0.556	0.556	0.553

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.13: Party Ideology and Consumption (Random Effects)

	(1)	(2)	(3)
Export Intensity	-0.0979***	-0.0980***	-0.0836***
	(0.0247)	(0.0250)	(0.0246)
Right % Gov.	-0.0318**	-0.0319**	-0.0107
	(0.0109)	(0.0108)	(0.0100)
Export Intensity		-0.00153	-0.0254**
× Right % Gov.		(0.0100)	(0.00977)
CO_2 Intensity	-0.167***	-0.168***	-0.121***
	(0.0332)	(0.0334)	(0.0321)
Output	0.0545	0.0544	0.236***
	(0.0394)	(0.0395)	(0.0459)
Green Party in Gov.			0.000149
			(0.0188)
Veto Players			-0.0597***
			(0.0174)
Proportional Rep.			0.897***
			(0.0774)
Federalism			-0.376***
			(0.0658)
Constant	0.0154	0.0151	-0.710***
	(0.0521)	(0.0521)	(0.0899)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.366	0.366	0.409
Between R^2	0.209	0.209	0.293
Overall R^2	0.235	0.235	0.317

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.14: Party Ideology and Consumption (Fixed Effects)

	(1)	(2)	(3)
Export Intensity	0.0284	0.0285	0.0160
	(0.0389)	(0.0389)	(0.0393)
Right % Gov.	-0.0331**	-0.0330**	-0.00585
	(0.0109)	(0.0107)	(0.0100)
Export Intensity		0.00261	-0.0240*
× Right % Gov.		(0.0103)	(0.0100)
CO_2 Intensity	-0.0669	-0.0655	-0.108
	(0.0665)	(0.0667)	(0.0675)
Output	0.791***	0.794***	0.669***
	(0.135)	(0.135)	(0.136)
Green Party in Gov.			-0.0141
			(0.0216)
Veto Players			-0.0754***
			(0.0198)
Proportional Rep.			
Federalism			
Constant	0.0325	0.0338	0.132
	(0.0751)	(0.0754)	(0.0706)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.385	0.385	0.423
Between R^2	0.043	0.043	0.061
Overall R^2	0.073	0.073	0.102

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C.3 Party Ideology and Compensation

Table C.15: Party Ideology and Compensation

	(1)	(2)	(3)
Labor Intensity	0.138***	0.137***	0.158***
	(0.0241)	(0.0240)	(0.0238)
Right % Gov.	-0.0367***	-0.0352***	-0.00662
	(0.00884)	(0.00869)	(0.00930)
Labor Intensity		0.0302**	0.0378***
× Right % Gov.		(0.00940)	(0.00973)
CO_2 Intensity	-0.0932***	-0.0957***	-0.0964***
	(0.0250)	(0.0241)	(0.0270)
Output	0.254***	0.255***	0.272***
	(0.0430)	(0.0461)	(0.0486)
Green Party in Gov.			-0.0206
			(0.0339)
Veto Players			-0.0658***
			(0.0188)
Proportional Rep.			0.837**
			(0.281)
Federalism			-0.305
			(0.230)
Random Effect Variances			
Country	0.337**	0.336**	0.250**
	(0.112)	(0.114)	(0.0915)
Sector	0.419***	0.419***	0.433***
	(0.0229)	(0.0232)	(0.0241)
Year	0.120***	0.119***	0.114***
	(0.00353)	(0.00350)	(0.00338)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	3024.65	3012.58	2764.00

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.16: Party Ideology and Compensation (Cross-Classified)

	(1)	(2)	(3)
Labor Intensity	0.173***	0.174***	0.200***
	(0.0277)	(0.0266)	(0.0275)
Right % Gov.	-0.0362*	-0.0363*	-0.00738
	(0.0171)	(0.0171)	(0.0185)
Labor Intensity		0.0322*	0.0406**
× Right % Gov.		(0.0141)	(0.0146)
CO_2 Intensity	-0.176***	-0.177***	-0.161***
	(0.0250)	(0.0248)	(0.0250)
Output	0.0202	0.0218	0.0686
	(0.0421)	(0.0443)	(0.0466)
Green Party in Gov.			-0.0148
			(0.0657)
Veto Players			-0.0598
			(0.0369)
Proportional Rep.			0.661*
			(0.285)
Federalism			-0.254
			(0.308)
Random Effect Variances			
Country	0.306**	0.305**	0.261*
	(0.104)	(0.0998)	(0.104)
Sector	0.0880***	0.0878***	0.0927***
	(0.0248)	(0.0249)	(0.0271)
Year	0.452***	0.451***	0.454***
	(0.0116)	(0.0116)	(0.0119)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
DIC	6524.23	6520.47	6264.30

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.17: Party Ideology and Compensation (Lagged Dependent Variable)

	(1)	(2)	(3)
Labor Intensity	0.165***	0.167***	0.181***
	(0.0392)	(0.0394)	(0.0381)
Right % Gov.	0.0244	0.0253	0.0133
	(0.0130)	(0.0131)	(0.0111)
Labor Intensity		0.0373*	0.0413*
× Right % Gov.		(0.0188)	(0.0178)
CO_2 Intensity	-0.115***	-0.115***	-0.0664*
	(0.0325)	(0.0326)	(0.0316)
Output	0.0338	0.0339	0.217***
	(0.0365)	(0.0365)	(0.0410)
Green Party in Gov.			0.122***
			(0.0332)
Veto Players			-0.00129
			(0.0207)
Proportional Rep.			0.885***
			(0.0757)
Federalism			-0.382***
			(0.0639)
Constant	-0.302***	-0.304***	-1.027***
	(0.0717)	(0.0715)	(0.0890)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.18: Party Ideology and Compensation (Panel-Corrected Standard Errors)

	(1)	(2)	(3)
Labor Intensity	0.157***	0.158***	0.156***
	(0.0143)	(0.0127)	(0.0147)
Right % Gov.	-0.00474	-0.00492	0.000677
	(0.00633)	(0.00634)	(0.00633)
Labor Intensity		0.0231**	0.0289***
× Right % Gov.		(0.00724)	(0.00699)
CO_2 Intensity	-0.0878***	-0.0878***	-0.0530***
	(0.0123)	(0.0125)	(0.0153)
Output	0.0673***	0.0687***	0.237***
	(0.0148)	(0.0149)	(0.0191)
Green Party in Gov.			0.000789
			(0.0228)
Veto Players			-0.0465***
			(0.0125)
Proportional Rep.			0.706***
			(0.0489)
Federalism			-0.435***
			(0.0360)
Constant	-0.204***	0.0281	-0.754***
	(0.0252)	(0.0256)	(0.0496)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
R^2	0.450	0.448	0.455

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.19: Party Ideology and Compensation (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)
Labor Intensity	0.172***	0.171***	0.192***
	(0.0434)	(0.0426)	(0.0434)
Right % Gov.	-0.0347**	-0.0338**	-0.00434
	(0.0111)	(0.0112)	(0.0103)
Labor Intensity		0.0310*	0.0385**
× Right % Gov.		(0.0142)	(0.0134)
CO_2 Intensity	-0.198***	-0.201***	-0.197***
	(0.0482)	(0.0482)	(0.0489)
Output	0.322**	0.320**	0.318**
	(0.102)	(0.101)	(0.105)
Green Party in Gov.			-0.0154
			(0.0222)
Veto Players			-0.0687***
			(0.0194)
Proportional Rep.			0.487**
			(0.152)
Federalism			-0.126
			(0.265)
Constant	-0.638*	-0.652*	-0.223
	(0.316)	(0.315)	(0.327)
Time Indicators	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.381	0.384	0.423
Between R^2	0.575	0.575	0.570
Overall R^2	0.552	0.553	0.554

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.20: Party Ideology and Compensation (Random Effects)

	(1)	(2)	(3)
Labor Intensity	0.130***	0.130***	0.156***
	(0.0329)	(0.0327)	(0.0320)
Right % Gov.	-0.0305**	-0.0295**	-0.00852
	(0.0110)	(0.0111)	(0.0101)
Labor Intensity		0.0311*	0.0387**
× Right % Gov.		(0.0146)	(0.0137)
CO_2 Intensity	-0.155***	-0.157***	-0.104**
	(0.0336)	(0.0337)	(0.0322)
Output	0.103**	0.103**	0.284***
	(0.0364)	(0.0363)	(0.0425)
Green Party in Gov.			-0.00888
			(0.0185)
Veto Players			-0.0555**
			(0.0170)
Proportional Rep.			0.923***
			(0.0786)
Federalism			-0.397***
			(0.0660)
Constant	0.0330	0.0282	-0.708***
	(0.0523)	(0.0526)	(0.0907)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.371	0.373	0.415
Between R^2	0.197	0.197	0.296
Overall R^2	0.225	0.226	0.321

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.21: Party Ideology and Compensation (Fixed Effects)

	(1)	(2)	(3)
Labor Intensity	0.191**	0.188**	0.201***
	(0.0580)	(0.0574)	(0.0577)
Right % Gov.	-0.0337**	-0.0328**	-0.00498
	(0.0109)	(0.0110)	(0.0101)
Labor Intensity		0.0289*	0.0368**
× Right % Gov.		(0.0139)	(0.0131)
CO_2 Intensity	-0.0806	-0.0892	-0.118
	(0.0661)	(0.0664)	(0.0671)
Output	0.894***	0.883***	0.795***
	(0.139)	(0.138)	(0.139)
Green Party in Gov.			-0.0173
			(0.0219)
Veto Players			-0.0706***
			(0.0191)
Proportional Rep.			
Federalism			
Constant	0.0367	0.0278	0.141*
	(0.0749)	(0.0752)	(0.0704)
Time Indicators	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes
N	3159	3159	3027
Within R^2	0.389	0.391	0.429
Between R^2	0.053	0.055	0.076
Overall R^2	0.082	0.083	0.114

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix D

Alternative Regression Results for Chapter 5

D.1 State-Market Relationships

Table D.1: State-Market Relationships

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.122***	0.143***	0.132***	0.0195	0.131***	0.00532
	(0.0284)	(0.0282)	(0.0327)	(0.0780)	(0.0327)	(0.0691)
Corporatism	0.122	0.0949				
	(0.107)	(0.172)				
Labor Intensity		0.137***				
× Corporatism		(0.0268)				
Coord. Market Economy			0.716	0.405		
			(0.781)	(0.401)		
Labor Intensity				0.177		
× Coord. Mkt. Econ.				(0.118)		
Labor Coordination					0.696	0.473
					(0.687)	(0.372)
Labor Intensity						0.220*
× Labor Coordination						(0.111)
CO_2 Intensity	-0.107***	-0.107***	-0.119***	-0.122***	-0.119***	-0.122***
	(0.0304)	(0.0296)	(0.0309)	(0.0345)	(0.0309)	(0.0344)
Output	0.413***	0.389***	0.439***	0.431***	0.439***	0.428***
	(0.0546)	(0.0536)	(0.0599)	(0.0618)	(0.0599)	(0.0616)
Random Effect Variances						
Country	0.446*	0.473*	0.507*	0.502*	0.495*	0.489*
	(0.188)	(0.214)	(0.224)	(0.222)	(0.216)	(0.217)
Sector	0.448***	0.421***	0.473***	0.466***	0.473***	0.463***
	(0.0278)	(0.0258)	(0.0305)	(0.0312)	(0.0305)	(0.0310)
Year	0.111***	0.112***	0.116***	0.117***	0.116***	0.117***
	(0.00368)	(0.00368)	(0.00404)	(0.00406)	(0.00404)	(0.00406)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
DIC	2151.85	2165.59	2055.66	2068.00	2055.76	2069.58

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.2: State-Market Relationships (Cross-Classified)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.158***	0.159***	0.159***	-0.178**	0.159***	-0.165**
	(0.0328)	(0.0325)	(0.0378)	(0.0586)	(0.0379)	(0.0551)
Corporatism	0.108	0.0895				
	(0.163)	(0.169)				
Labor Intensity		0.201***				
× Corporatism		(0.0153)				
Coord. Market Economy			0.944	0.747		
			(0.747)	(0.588)		
Labor Intensity				0.502***		
× Coord. Mkt. Econ.				(0.0653)		
Labor Coordination					0.932	0.776
					(0.660)	(0.538)
Labor Intensity						0.514***
× Labor Coordination						(0.0620)
CO_2 Intensity	-0.206***	-0.217***	-0.265***	-0.251***	-0.265***	-0.254***
	(0.0316)	(0.0297)	(0.0364)	(0.0348)	(0.0364)	(0.0347)
Output	-0.0286	-0.0522	-0.0124	-0.0307	-0.0131	-0.0343
	(0.0564)	(0.0556)	(0.0662)	(0.0619)	(0.0661)	(0.0619)
Random Effect Variances						
Country	0.421*	0.433*	0.380*	0.371*	0.367*	0.358*
	(0.175)	(0.182)	(0.170)	(0.174)	(0.164)	(0.167)
Sector	0.118***	0.128***	0.133***	0.135***	0.133***	0.137***
	(0.0339)	(0.0363)	(0.0397)	(0.0385)	(0.0397)	(0.0391)
Year	0.452***	0.422***	0.473***	0.460***	0.473***	0.458***
	(0.0133)	(0.0122)	(0.0143)	(0.0141)	(0.0143)	(0.0140)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
DIC	5051.07	4882.87	4707.55	4648.40	4707.59	4638.43

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.3: State-Market Relationships (Lagged Dependent Variable)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.179***	0.182***	0.201***	-0.0683	0.196***	-0.0502
	(0.0425)	(0.0430)	(0.0481)	(0.0831)	(0.0470)	(0.0749)
Corporatism	0.256***	0.242***				
	(0.0411)	(0.0397)				
Labor Intensity		0.190***				
× Corporatism		(0.0393)				
Coord. Market Economy			1.145***	1.091***		
			(0.129)	(0.130)		
Labor Intensity				0.434***		
× Coord. Mkt. Econ.				(0.124)		
Labor Coordination					1.154***	1.099***
					(0.128)	(0.129)
Labor Intensity						0.436***
× Labor Coordination						(0.125)
CO_2 Intensity	-0.158***	-0.160***	-0.191***	-0.192***	-0.188***	-0.190***
	(0.0379)	(0.0377)	(0.0441)	(0.0440)	(0.0437)	(0.0437)
Output	0.118**	0.115**	0.0297	0.0317	0.0284	0.0307
	(0.0405)	(0.0402)	(0.0498)	(0.0489)	(0.0498)	(0.0488)
Constant	0.131	0.109	-1.150***	-1.108***	-0.897***	-0.862***
	(0.154)	(0.152)	(0.171)	(0.169)	(0.163)	(0.160)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.4: State-Market Relationships (Panel-Corrected Standard Errors)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.160***	0.190***	0.198***	-0.00656	0.179***	0.0119
	(0.0155)	(0.0169)	(0.0167)	(0.0529)	(0.0164)	(0.0465)
Corporatism	0.235***	0.189***				
	(0.0177)	(0.0183)				
Labor Intensity		0.133***				
× Corporatism		(0.0171)				
Coord. Market Economy			0.906***	0.873***		
			(0.0694)	(0.0779)		
Labor Intensity				0.305***		
× Coord. Mkt. Econ.				(0.0740)		
Labor Coordination					0.982***	0.955***
					(0.0623)	(0.0693)
Labor Intensity						0.272***
× Labor Coordination						(0.0695)
CO_2 Intensity	-0.130***	-0.125***	-0.170***	-0.173***	-0.158***	-0.163***
	(0.0151)	(0.0156)	(0.0171)	(0.0176)	(0.0169)	(0.0172)
Output	0.192***	0.174***	0.0982***	0.0819***	0.0795***	0.0666**
	(0.0196)	(0.0189)	(0.0234)	(0.0246)	(0.0232)	(0.0240)
Constant	0.0489	-0.000952	-0.823***	-0.791***	-0.719***	-0.668***
	(0.0649)	(0.0638)	(0.0762)	(0.0789)	(0.0847)	(0.0852)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
R^2	0.391	0.379	0.384	0.378	0.390	0.384

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.5: State-Market Relationships (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0868*	0.122**	0.0631	-0.0712	0.0631	-0.0886
	(0.0434)	(0.0454)	(0.0573)	(0.0893)	(0.0573)	(0.0824)
Corporatism	4.681***	4.452***				
	(0.894)	(0.869)				
Labor Intensity		0.150***				
× Corporatism		(0.0269)				
Coord. Market Economy			2.859***	2.759***		
			(0.530)	(0.520)		
Labor Intensity				0.213*		
× Coord. Mkt. Econ.				(0.103)		
Labor Coordination					3.747***	3.575***
					(0.694)	(0.680)
Labor Intensity						0.259**
× Labor Coordination						(0.0973)
CO_2 Intensity	-0.166**	-0.171***	-0.198**	-0.194**	-0.198**	-0.194**
	(0.0529)	(0.0513)	(0.0633)	(0.0630)	(0.0633)	(0.0628)
Output	0.365***	0.336***	0.429***	0.405***	0.429***	0.397***
	(0.0987)	(0.0985)	(0.115)	(0.115)	(0.115)	(0.115)
Constant	3.601***	3.294***	-1.431**	-1.415**	-1.431**	-1.416**
	(0.752)	(0.730)	(0.552)	(0.549)	(0.552)	(0.548)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
Within R^2	0.311	0.305	0.295	0.291	0.295	0.290
Between R^2	0.594	0.626	0.608	0.618	0.608	0.621
Overall R^2	0.563	0.592	0.574	0.582	0.574	0.585

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.6: State-Market Relationships (Random Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0972**	0.118**	0.0890*	0.0406	0.0875*	0.00942
	(0.0355)	(0.0380)	(0.0434)	(0.0913)	(0.0430)	(0.0787)
Corporatism	0.171***	0.163***				
	(0.0393)	(0.0380)				
Labor Intensity		0.130***				
× Corporatism		(0.0355)				
Coord. Market Economy			1.083***	1.074***		
			(0.126)	(0.127)		
Labor Intensity				0.0807		
× Coord. Mkt. Econ.				(0.131)		
Labor Coordination					1.057***	1.041***
					(0.125)	(0.125)
Labor Intensity						0.143
× Labor Coordination						(0.121)
CO_2 Intensity	-0.163***	-0.161***	-0.201***	-0.200***	-0.200***	-0.199***
	(0.0393)	(0.0389)	(0.0460)	(0.0460)	(0.0459)	(0.0458)
Output	0.283***	0.271***	0.208***	0.207***	0.203***	0.201***
	(0.0400)	(0.0399)	(0.0466)	(0.0464)	(0.0468)	(0.0465)
Constant	-0.539***	-0.519***	-1.384***	-1.375***	-1.328***	-1.311***
	(0.156)	(0.154)	(0.193)	(0.193)	(0.190)	(0.190)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
Within R^2	0.302	0.298	0.281	0.279	0.280	0.278
Between R^2	0.197	0.227	0.246	0.249	0.257	0.263
Overall R^2	0.208	0.235	0.249	0.252	0.259	0.265

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.7: State-Market Relationships (Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0852	0.0627	0.0285	0.604**	0.0285	0.492**
	(0.0564)	(0.0666)	(0.0823)	(0.197)	(0.0823)	(0.169)
Corporatism						
Labor Intensity × Corporatism		-0.0565				
		(0.0646)				
Coord. Market Economy						
Labor Intensity × Coord. Mkt. Econ.				-0.986***		
				(0.275)		
Labor Coordination						
Labor Intensity × Labor Coordination						-0.867***
						(0.251)
CO_2 Intensity	0.0399	0.0371	0.0550	0.0479	0.0550	0.0477
	(0.0727)	(0.0732)	(0.0813)	(0.0812)	(0.0813)	(0.0813)
Output	1.071***	1.067***	1.133***	1.227***	1.133***	1.219***
	(0.149)	(0.149)	(0.167)	(0.172)	(0.167)	(0.172)
Constant	-0.337*	-0.329	-0.505**	-0.554**	-0.505**	-0.540**
	(0.171)	(0.171)	(0.190)	(0.190)	(0.190)	(0.190)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2227	2227	2227	2227
Within R^2	0.325	0.325	0.308	0.317	0.308	0.315
Between R^2	0.005	0.004	0.001	0.000	0.001	0.000
Overall R^2	0.010	0.008	0.004	0.001	0.004	0.001

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

D.2 Unions

Table D.8: Unions

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.123***	0.138***	0.145***	0.0480	0.122***	0.0112
	(0.0283)	(0.0283)	(0.0280)	(0.0455)	(0.0284)	(0.0407)
Union Density	-0.288**	-0.310*				
	(0.0918)	(0.121)				
Labor Intensity		0.0970***				
× Union Density		(0.0280)				
Union Cent.			-4.081***	-4.207***		
			(0.258)	(0.252)		
Labor Intensity				0.294**		
× Union Cent.				(0.108)		
Wage Coordination					-0.0251	-0.0345
					(0.0771)	(0.0796)
Labor Intensity						0.234***
× Wage Coordination						(0.0622)
CO_2 Intensity	-0.107***	-0.104***	-0.112***	-0.112***	-0.108***	-0.105***
	(0.0302)	(0.0299)	(0.0298)	(0.0295)	(0.0304)	(0.0300)
Output	0.408***	0.398***	0.376***	0.362***	0.412***	0.399***
	(0.0549)	(0.0544)	(0.0542)	(0.0537)	(0.0545)	(0.0543)
Random Effect Variances						
Country	0.709*	0.783*	2.252*	2.412*	0.463*	0.490*
	(0.312)	(0.374)	(0.898)	(0.972)	(0.195)	(0.215)
Sector	0.448***	0.427***	0.448***	0.435***	0.448***	0.431***
	(0.0278)	(0.0264)	(0.0275)	(0.0261)	(0.0278)	(0.0263)
Year	0.110***	0.111***	0.0979***	0.0983***	0.111***	0.111***
	(0.00365)	(0.00368)	(0.00324)	(0.00324)	(0.00368)	(0.00368)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
DIC	2137.27	2154.98	1850.40	1861.88	2153.76	2162.96

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.9: Unions (Cross-Classified)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.158***	0.178***	0.160***	-0.0935*	0.159***	-0.127**
	(0.0328)	(0.0324)	(0.0328)	(0.0426)	(0.0329)	(0.0432)
Union Density	-0.0468	-0.0748				
	(0.156)	(0.129)				
Labor Intensity		0.186***				
× Union Density		(0.0161)				
Union Cent.			-3.260***	-3.572***		
			(0.558)	(0.629)		
Labor Intensity				0.672***		
× Union Cent.				(0.0711)		
Wage Coordination					0.0695	0.0472
					(0.157)	(0.156)
Labor Intensity						0.525***
× Wage Coordination						(0.0515)
CO_2 Intensity	-0.207***	-0.186***	-0.209***	-0.202***	-0.206***	-0.182***
	(0.0315)	(0.0299)	(0.0315)	(0.0299)	(0.0315)	(0.0299)
Output	-0.0318	-0.00793	-0.0539	-0.0732	-0.0301	-0.0241
	(0.0566)	(0.0559)	(0.0570)	(0.0566)	(0.0566)	(0.0561)
Random Effect Variances						
Country	0.450*	0.457*	1.233*	1.453*	0.398*	0.406*
	(0.195)	(0.201)	(0.527)	(0.712)	(0.169)	(0.170)
Sector	0.119***	0.118***	0.122***	0.126***	0.119***	0.118***
	(0.0341)	(0.0335)	(0.0349)	(0.0360)	(0.0340)	(0.0338)
Year	0.451***	0.428***	0.442***	0.426***	0.452***	0.434***
	(0.0133)	(0.0124)	(0.0130)	(0.0124)	(0.0133)	(0.0126)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
DIC	5050.86	4921.01	4999.59	4911.13	5053.03	4952.63

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.10: Unions (Lagged Dependent Variable)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.183***	0.192***	0.189***	-0.0265	0.191***	-0.0501
	(0.0419)	(0.0428)	(0.0445)	(0.0699)	(0.0417)	(0.0511)
Union Density	0.356***	0.351***				
	(0.0639)	(0.0592)				
Labor Intensity		0.190***				
× Union Density		(0.0539)				
Union Cent.			0.753***	0.653***		
			(0.171)	(0.166)		
Labor Intensity				0.597**		
× Union Cent.				(0.185)		
Wage Coordination					0.981***	0.946***
					(0.117)	(0.113)
Labor Intensity						0.458***
× Wage Coordination						(0.111)
CO_2 Intensity	-0.143***	-0.136***	-0.150***	-0.150***	-0.152***	-0.148***
	(0.0362)	(0.0352)	(0.0375)	(0.0377)	(0.0372)	(0.0370)
Output	0.200***	0.204***	0.161***	0.160***	0.0973*	0.0967*
	(0.0424)	(0.0421)	(0.0412)	(0.0404)	(0.0386)	(0.0377)
Constant	0.301	0.296	-0.714***	-0.689***	-0.502***	-0.503***
	(0.172)	(0.170)	(0.179)	(0.176)	(0.145)	(0.142)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.11: Unions (Panel-Corrected Standard Errors)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.190***	0.170***	0.188***	0.0456	0.199***	0.0652*
	(0.0151)	(0.0171)	(0.0165)	(0.0318)	(0.0152)	(0.0288)
Union Density	0.202***	0.190***				
	(0.0192)	(0.0201)				
Labor Intensity		0.0939***				
× Union Density		(0.0188)				
Union Cent.			0.246***	0.0554		
			(0.0728)	(0.0762)		
Labor Intensity				0.423***		
× Union Cent.				(0.0760)		
Wage Coordination					0.363***	0.407***
					(0.0440)	(0.0440)
Labor Intensity						0.235***
× Wage Coordination						(0.0434)
CO_2 Intensity	-0.133***	-0.108***	-0.141***	-0.142***	-0.0883***	-0.108***
	(0.0140)	(0.0137)	(0.0153)	(0.0151)	(0.0153)	(0.0150)
Output	0.250***	0.220***	0.184***	0.190***	0.183***	0.172***
	(0.0188)	(0.0190)	(0.0203)	(0.0206)	(0.0196)	(0.0192)
Constant	0.0953	-0.0703	-0.214**	-0.134*	-0.412***	-0.487***
	(0.0708)	(0.0599)	(0.0691)	(0.0683)	(0.0623)	(0.0609)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
R^2	0.437	0.357	0.345	0.360	0.349	0.379

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.12: Unions (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0886*	0.115**	0.131**	0.0116	0.0863*	-0.0365
	(0.0432)	(0.0445)	(0.0436)	(0.0598)	(0.0434)	(0.0511)
Union Density	-0.462**	-0.496***				
	(0.141)	(0.143)				
Labor Intensity		0.116***				
× Union Density		(0.0331)				
Union Cent.			-4.307***	-4.465***		
			(0.328)	(0.330)		
Labor Intensity				0.347**		
× Union Cent.				(0.111)		
Wage Coordination					-0.0543	-0.0638
					(0.0835)	(0.0859)
Labor Intensity						0.255***
× Wage Coordination						(0.0716)
CO_2 Intensity	-0.164**	-0.157**	-0.184***	-0.180***	-0.166**	-0.156**
	(0.0538)	(0.0518)	(0.0518)	(0.0516)	(0.0526)	(0.0510)
Output	0.361***	0.364***	0.298**	0.283**	0.367***	0.354***
	(0.0985)	(0.0961)	(0.0934)	(0.0935)	(0.0992)	(0.0988)
Constant	-1.354**	-1.405**	0.740	0.758	-1.180*	-1.182*
	(0.489)	(0.492)	(0.478)	(0.477)	(0.491)	(0.492)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
Within R^2	0.317	0.311	0.392	0.388	0.312	0.308
Between R^2	0.594	0.617	0.598	0.612	0.594	0.610
Overall R^2	0.564	0.584	0.577	0.589	0.563	0.578

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.13: Unions (Random Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.104**	0.115**	0.0939*	0.103	0.109**	0.00301
	(0.0355)	(0.0365)	(0.0369)	(0.0689)	(0.0360)	(0.0479)
Union Density	0.185***	0.184***				
	(0.0540)	(0.0523)				
Labor Intensity		0.0817*				
× Union Density		(0.0412)				
Union Cent.			-0.519***	-0.496***		
			(0.148)	(0.144)		
Labor Intensity				-0.0245		
× Union Cent.				(0.156)		
Wage Coordination					0.314***	0.311***
					(0.0848)	(0.0850)
Labor Intensity						0.219*
× Wage Coordination						(0.0870)
CO_2 Intensity	-0.157***	-0.154***	-0.184***	-0.184***	-0.166***	-0.161***
	(0.0377)	(0.0374)	(0.0413)	(0.0413)	(0.0393)	(0.0389)
Output	0.315***	0.312***	0.237***	0.236***	0.245***	0.240***
	(0.0426)	(0.0422)	(0.0427)	(0.0426)	(0.0390)	(0.0387)
Constant	-0.636***	-0.618***	-0.568***	-0.573***	-0.813***	-0.804***
	(0.150)	(0.150)	(0.168)	(0.166)	(0.153)	(0.151)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
Within R^2	0.298	0.293	0.321	0.321	0.294	0.292
Between R^2	0.213	0.233	0.129	0.130	0.214	0.233
Overall R^2	0.222	0.240	0.148	0.149	0.223	0.240

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.14: Unions (Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0878	0.0600	0.146**	0.242**	0.0842	0.0691
	(0.0562)	(0.0622)	(0.0542)	(0.0926)	(0.0564)	(0.0656)
Union Density	-0.452**	-0.423**				
	(0.140)	(0.138)				
Labor Intensity		-0.0956				
× Union Density		(0.0773)				
Union Cent.			-4.127***	-3.989***		
			(0.331)	(0.328)		
Labor Intensity				-0.303		
× Union Cent.				(0.233)		
Wage Coordination					-0.0826	-0.0839
					(0.0822)	(0.0825)
Labor Intensity						0.0345
× Wage Coordination						(0.0838)
CO_2 Intensity	0.0419	0.0388	-0.0337	-0.0390	0.0385	0.0398
	(0.0746)	(0.0750)	(0.0704)	(0.0711)	(0.0720)	(0.0718)
Output	1.062***	1.044***	0.852***	0.851***	1.079***	1.079***
	(0.148)	(0.150)	(0.131)	(0.132)	(0.150)	(0.150)
Constant	-0.200	-0.206	1.723***	1.664***	-0.296	-0.296
	(0.178)	(0.177)	(0.243)	(0.244)	(0.190)	(0.190)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2444	2444	2444	2444	2444	2444
Within R^2	0.330	0.331	0.400	0.401	0.325	0.325
Between R^2	0.001	0.001	0.000	0.000	0.004	0.004
Overall R^2	0.000	0.000	0.000	0.000	0.009	0.009

Standard errors in parentheses

Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

D.3 Policies

Table D.15: Policies

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.129***	0.134***	0.129***	0.140***	0.119***	0.137***
	(0.0296)	(0.0283)	(0.0244)	(0.0248)	(0.0284)	(0.0283)
Employment Prot.	-0.553***	-0.557***				
	(0.0384)	(0.0364)				
Labor Intensity		-0.0205				
× Employment Prot.		(0.0237)				
Act. Lab. Mkt. Pol.			0.00899	0.00310		
			(0.0312)	(0.0318)		
Labor Intensity				0.105***		
× Act. Lab. Mkt. Pol.				(0.0211)		
Redistribution					0.0498**	0.0476*
					(0.0185)	(0.0188)
Labor Intensity						0.0933***
× Redistribution						(0.0174)
CO_2 Intensity	-0.115***	-0.114***	-0.101***	-0.0941***	-0.111***	-0.110***
	(0.0300)	(0.0305)	(0.0267)	(0.0237)	(0.0304)	(0.0299)
Output	0.401***	0.410***	0.238***	0.214***	0.409***	0.396***
	(0.0560)	(0.0601)	(0.0433)	(0.0448)	(0.0544)	(0.0541)
Random Effect Variances						
Country	0.714*	0.778*	0.468**	0.471**	0.438*	0.459*
	(0.279)	(0.311)	(0.158)	(0.162)	(0.181)	(0.196)
Sector	0.455***	0.457***	0.411***	0.386***	0.448***	0.430***
	(0.0288)	(0.0289)	(0.0217)	(0.0212)	(0.0278)	(0.0264)
Year	0.0992***	0.0993***	0.127***	0.129***	0.111***	0.110***
	(0.00328)	(0.00330)	(0.00364)	(0.00364)	(0.00367)	(0.00363)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
DIC	1811.98	1814.02	3441.85	3469.74	2144.95	2135.28

Standard errors in parentheses

Mixed-effects linear regression with country, sector, and year effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.16: Policies (Cross-Classified)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.164***	0.160***	0.194***	0.206***	0.157***	0.195***
	(0.0330)	(0.0339)	(0.0263)	(0.0253)	(0.0329)	(0.0327)
Employment Prot.	-0.524***	-0.528***				
	(0.0751)	(0.0733)				
Labor Intensity		0.0173				
× Employment Prot.		(0.0181)				
Act. Lab. Mkt. Pol.			0.0411	0.0291		
			(0.0540)	(0.0488)		
Labor Intensity				0.234***		
× Act. Lab. Mkt. Pol.				(0.0140)		
Redistribution					0.0545	0.0490
					(0.0367)	(0.0358)
Labor Intensity						0.171***
× Redistribution						(0.0152)
CO_2 Intensity	-0.199***	-0.198***	-0.199***	-0.184***	-0.207***	-0.201***
	(0.0315)	(0.0318)	(0.0240)	(0.0230)	(0.0315)	(0.0298)
Output	-0.0220	-0.0281	0.0726	0.0526	-0.0308	-0.0206
	(0.0604)	(0.0618)	(0.0444)	(0.0418)	(0.0567)	(0.0553)
Random Effect Variances						
Country	0.650*	0.676*	0.304**	0.308**	0.410*	0.418*
	(0.274)	(0.292)	(0.105)	(0.108)	(0.169)	(0.171)
Sector	0.119***	0.120***	0.0862***	0.0927***	0.119***	0.121***
	(0.0350)	(0.0349)	(0.0250)	(0.0257)	(0.0341)	(0.0344)
Year	0.447***	0.447***	0.456***	0.420***	0.451***	0.430***
	(0.0134)	(0.0131)	(0.0111)	(0.0103)	(0.0133)	(0.0125)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
DIC	4851.93	4852.40	7007.91	6734.09	5050.57	4928.67

Standard errors in parentheses

Mixed-effects linear regression with cross-classified effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.17: Policies (Lagged Dependent Variable)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.199***	0.198***	0.158***	0.162***	0.185***	0.203***
	(0.0465)	(0.0475)	(0.0365)	(0.0365)	(0.0452)	(0.0475)
Employment Prot.	-0.121*	-0.123*				
	(0.0482)	(0.0477)				
Labor Intensity		0.0214				
× Employment Prot.		(0.0395)				
Act. Lab. Mkt. Pol.			0.197***	0.183***		
			(0.0521)	(0.0468)		
Labor Intensity				0.214***		
× Act. Lab. Mkt. Pol.				(0.0480)		
Redistribution					0.0676*	0.0637*
					(0.0315)	(0.0305)
Labor Intensity						0.156***
× Redistribution						(0.0411)
CO_2 Intensity	-0.187***	-0.187***	-0.114***	-0.104***	-0.172***	-0.169***
	(0.0415)	(0.0415)	(0.0302)	(0.0295)	(0.0394)	(0.0389)
Output	0.0497	0.0503	0.0362	0.0274	0.0928*	0.0908*
	(0.0481)	(0.0480)	(0.0348)	(0.0344)	(0.0415)	(0.0412)
Constant	-0.322*	-0.321*	-0.166**	-0.216***	-0.254	-0.254
	(0.157)	(0.158)	(0.0521)	(0.0497)	(0.153)	(0.151)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444

Standard errors in parentheses

Dynamic panel data model with system GMM

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.18: Policies (Panel-Corrected Standard Errors)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.200***	0.205***	0.145***	0.149***	0.183***	0.218***
	(0.0160)	(0.0168)	(0.0139)	(0.0148)	(0.0168)	(0.0154)
Employment Prot.	-0.134***	-0.135***				
	(0.0214)	(0.0214)				
Labor Intensity		-0.0167				
× Employment Prot.		(0.0153)				
Act. Lab. Mkt. Pol.			0.0250	0.0181		
			(0.0168)	(0.0163)		
Labor Intensity				0.104***		
× Act. Lab. Mkt. Pol.				(0.0149)		
Redistribution					0.0216	0.00948
					(0.0126)	(0.0124)
Labor Intensity						0.0826***
× Redistribution						(0.0122)
CO_2 Intensity	-0.169***	-0.170***	-0.0984***	-0.0847***	-0.156***	-0.139***
	(0.0137)	(0.0138)	(0.0140)	(0.0129)	(0.0151)	(0.0145)
Output	0.148***	0.151***	0.0773***	0.0780***	0.162***	0.163***
	(0.0199)	(0.0200)	(0.0163)	(0.0164)	(0.0186)	(0.0181)
Constant	0.0135	-0.220***	-0.0338	-0.0520	-0.0464	-0.0461
	(0.0696)	(0.0571)	(0.0270)	(0.0271)	(0.0711)	(0.0702)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
R^2	0.388	0.387	0.394	0.392	0.334	0.384

Standard errors in parentheses

Linear regression with panel-corrected standard errors and autocorrelation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.19: Policies (Country- and Sector-Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0721	0.0771	0.170***	0.200***	0.0802	0.106*
	(0.0456)	(0.0471)	(0.0416)	(0.0415)	(0.0432)	(0.0425)
Employment Prot.	-0.570***	-0.569***				
	(0.0525)	(0.0529)				
Labor Intensity		-0.0199				
× Employment Prot.		(0.0245)				
Act. Lab. Mkt. Pol.			0.0128	0.00658		
			(0.0420)	(0.0421)		
Labor Intensity				0.129***		
× Act. Lab. Mkt. Pol.				(0.0261)		
Redistribution					0.0498*	0.0472*
					(0.0215)	(0.0208)
Labor Intensity						0.101***
× Redistribution						(0.0227)
CO_2 Intensity	-0.163**	-0.165**	-0.236***	-0.227***	-0.172**	-0.173***
	(0.0543)	(0.0545)	(0.0460)	(0.0444)	(0.0523)	(0.0513)
Output	0.333**	0.340**	0.311**	0.290**	0.357***	0.344***
	(0.103)	(0.104)	(0.0963)	(0.0930)	(0.0987)	(0.0964)
Constant	-2.933***	-2.942***	0.0646	0.0582	-1.207*	-1.198*
	(0.468)	(0.469)	(0.325)	(0.321)	(0.485)	(0.481)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
Within R^2	0.384	0.385	0.346	0.338	0.314	0.316
Between R^2	0.606	0.605	0.574	0.610	0.594	0.614
Overall R^2	0.581	0.580	0.546	0.575	0.564	0.582

Standard errors in parentheses

Linear regression with country- and sector-fixed effects, unit-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.20: Policies (Random Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0984**	0.101**	0.119***	0.132***	0.0933**	0.108**
	(0.0375)	(0.0390)	(0.0311)	(0.0322)	(0.0359)	(0.0361)
Employment Prot.	-0.353***	-0.352***				
	(0.0413)	(0.0417)				
Labor Intensity		-0.0272				
× Employment Prot.		(0.0304)				
Act. Lab. Mkt. Pol.			0.106***	0.106***		
			(0.0309)	(0.0301)		
Labor Intensity				0.0878**		
× Act. Lab. Mkt. Pol.				(0.0288)		
Redistribution					0.0533**	0.0510**
					(0.0194)	(0.0188)
Labor Intensity						0.0877***
× Redistribution						(0.0245)
CO_2 Intensity	-0.194***	-0.194***	-0.166***	-0.158***	-0.175***	-0.173***
	(0.0442)	(0.0442)	(0.0313)	(0.0311)	(0.0402)	(0.0401)
Output	0.240***	0.241***	0.0893*	0.0811*	0.267***	0.261***
	(0.0483)	(0.0485)	(0.0357)	(0.0353)	(0.0409)	(0.0407)
Constant	-1.064***	-1.067***	-0.0251	-0.0354	-0.680***	-0.675***
	(0.151)	(0.151)	(0.0550)	(0.0540)	(0.148)	(0.145)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
Within R^2	0.364	0.365	0.324	0.319	0.307	0.310
Between R^2	0.137	0.136	0.236	0.264	0.168	0.186
Overall R^2	0.157	0.156	0.254	0.278	0.183	0.200

Standard errors in parentheses

Linear regression with random effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.21: Policies (Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Intensity	0.0556	0.0717	0.166**	0.154**	0.0755	0.0904
	(0.0593)	(0.0615)	(0.0565)	(0.0592)	(0.0561)	(0.0570)
Employment Prot.	-0.549***	-0.546***				
	(0.0529)	(0.0537)				
Labor Intensity		-0.0596				
× Employment Prot.		(0.0378)				
Act. Lab. Mkt. Pol.			0.000275	0.00176		
			(0.0417)	(0.0417)		
Labor Intensity				-0.0319		
× Act. Lab. Mkt. Pol.				(0.0431)		
Redistribution					0.0451*	0.0436*
					(0.0210)	(0.0202)
Labor Intensity						0.0629*
× Redistribution						(0.0248)
CO_2 Intensity	-0.00829	-0.0109	-0.165*	-0.167*	0.0265	0.0239
	(0.0738)	(0.0737)	(0.0661)	(0.0660)	(0.0724)	(0.0720)
Output	0.868***	0.892***	0.765***	0.763***	1.051***	1.045***
	(0.157)	(0.160)	(0.137)	(0.137)	(0.149)	(0.149)
Constant	-0.742***	-0.754***	0.00896	0.0131	-0.354*	-0.361*
	(0.157)	(0.159)	(0.0595)	(0.0598)	(0.172)	(0.171)
Time Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	2359	2359	3383	3383	2444	2444
Within R^2	0.392	0.393	0.352	0.352	0.327	0.331
Between R^2	0.002	0.002	0.069	0.066	0.006	0.008
Overall R^2	0.000	0.000	0.092	0.089	0.011	0.014

Standard errors in parentheses

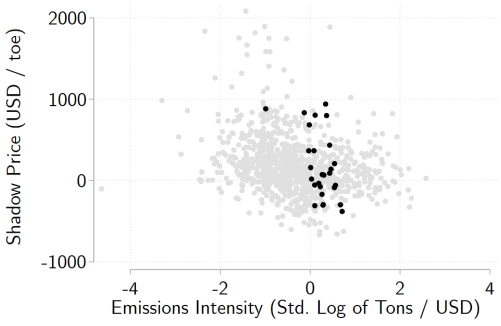
Linear regression with fixed effects, country- and sector-clustered SEs

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

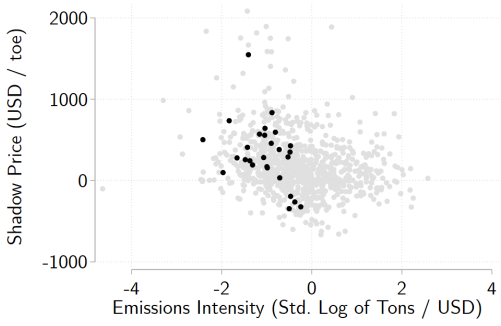
Appendix E

Shadow Prices and Emissions Plots

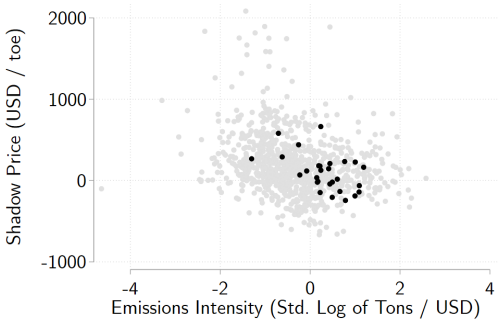
E.1 Plots by Sector



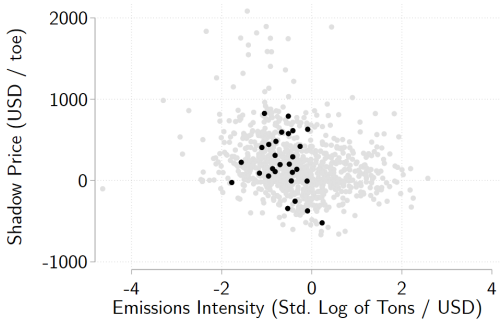
(a) Agriculture



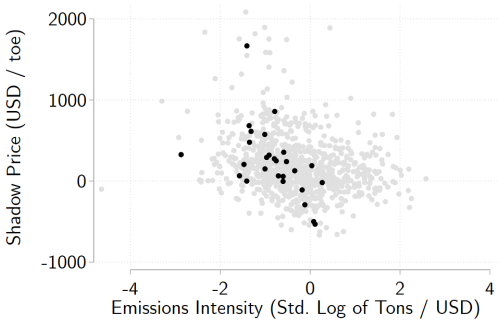
(b) Business



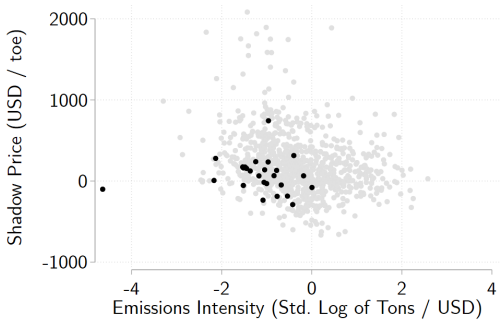
(c) Chemicals



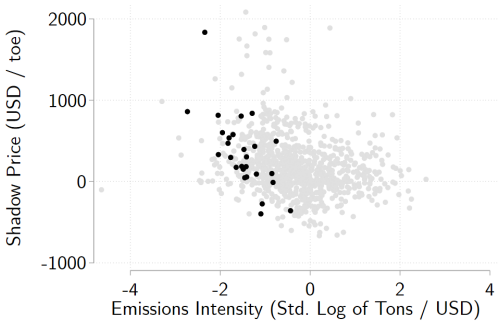
(d) Construction



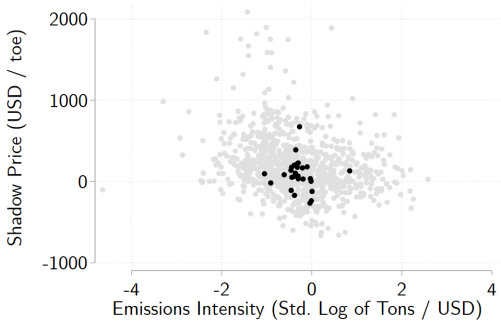
(a) Education



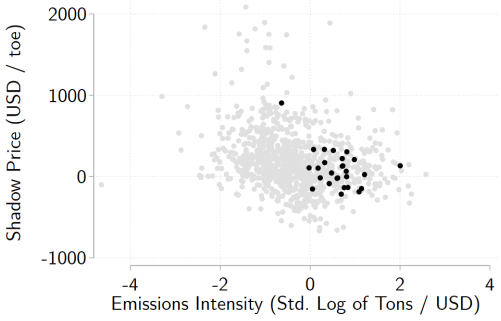
(b) Electrical Equipment



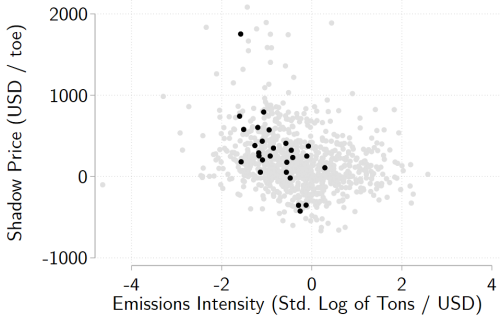
(c) Finance



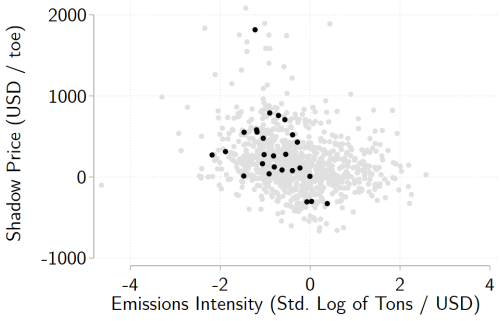
(d) Food



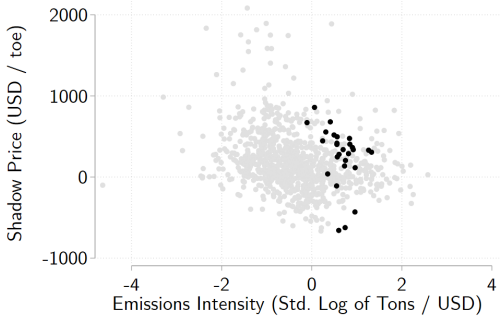
(e) Fuel



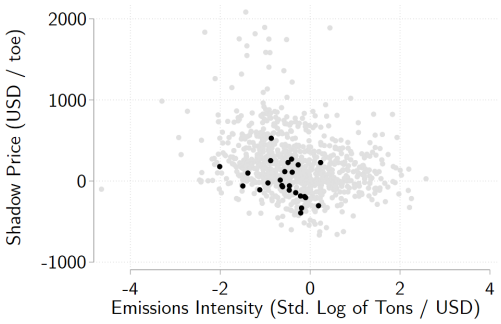
(f) Health



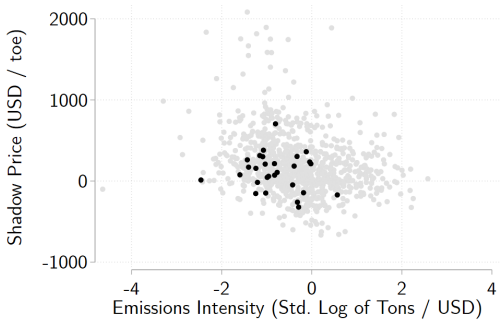
(g) Hospitality



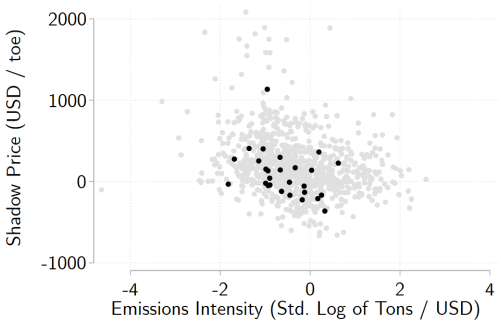
(h) Land Transport



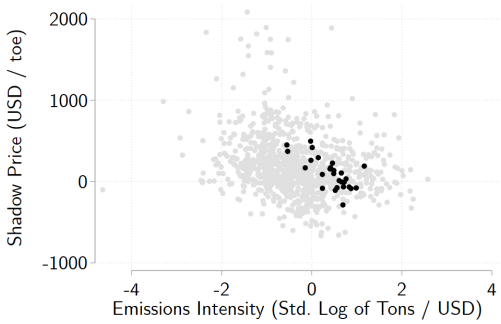
(a) Leather



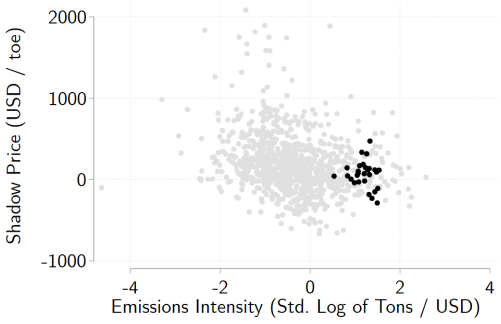
(b) Machinery



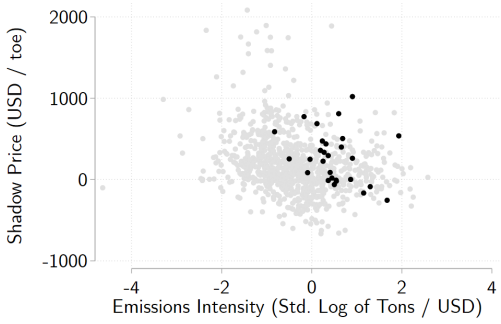
(c) Manufacturing



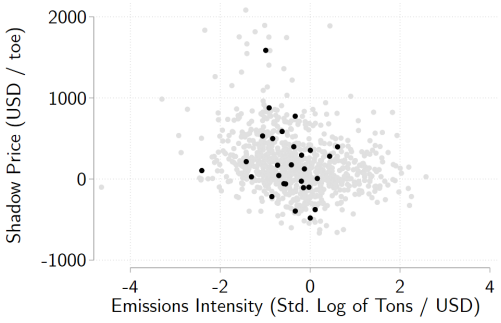
(d) Metal



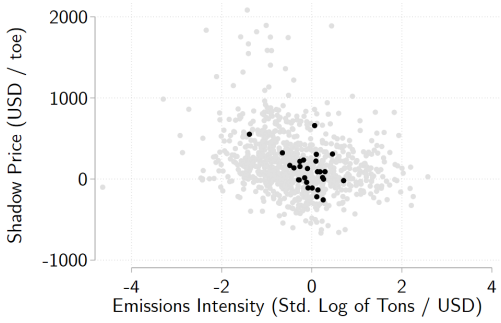
(e) Minerals



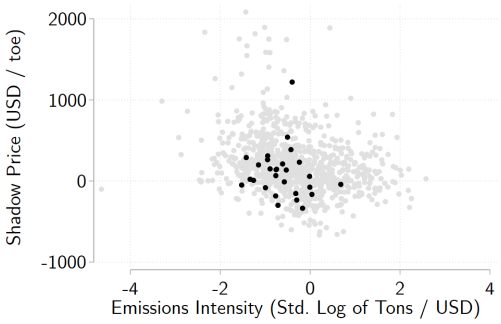
(f) Mining



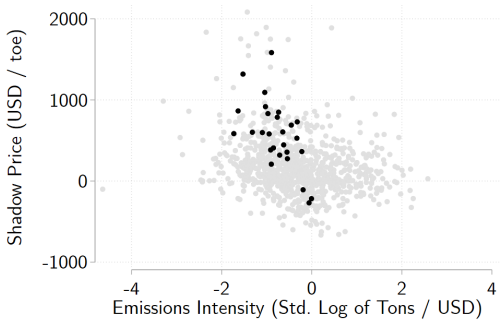
(g) Other Services



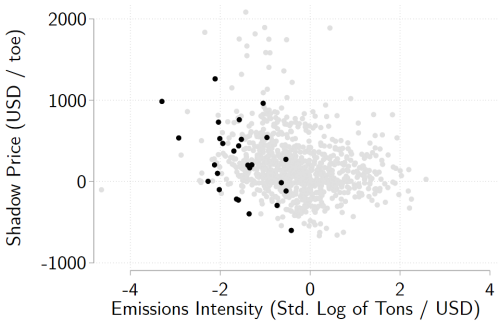
(h) Paper



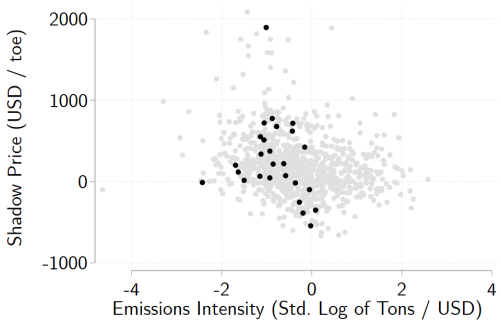
(a) Plastic



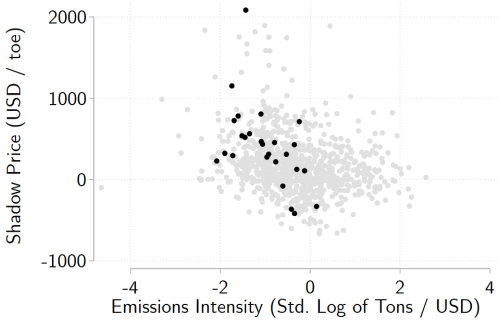
(b) Public



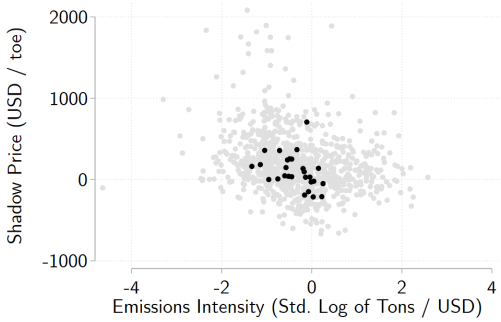
(c) Real Estate



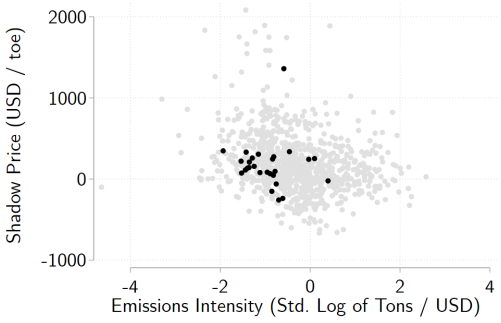
(d) Retail



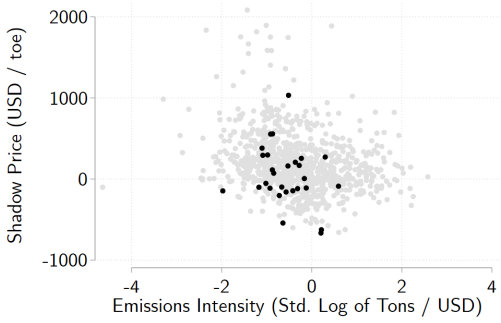
(e) Telecoms



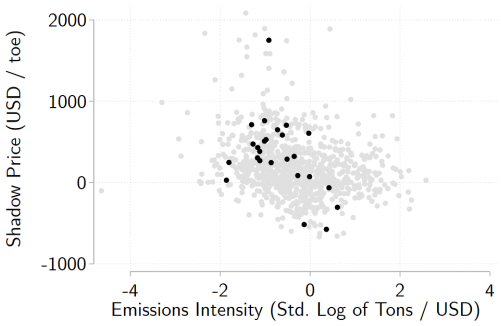
(f) Textiles



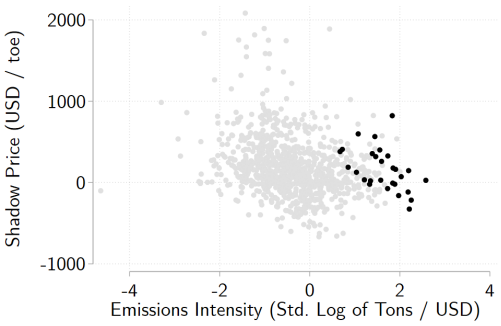
(g) Transport Equipment



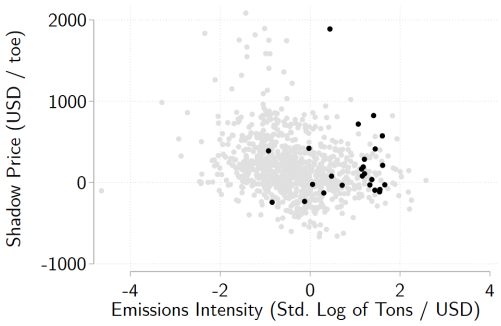
(h) Transport Sale



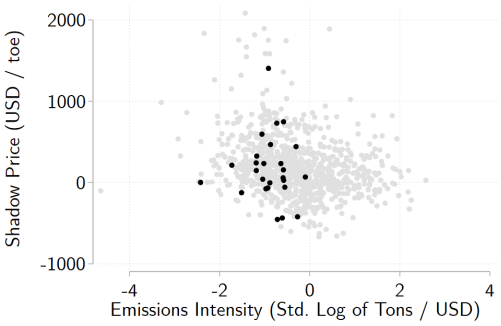
(a) Transport Support



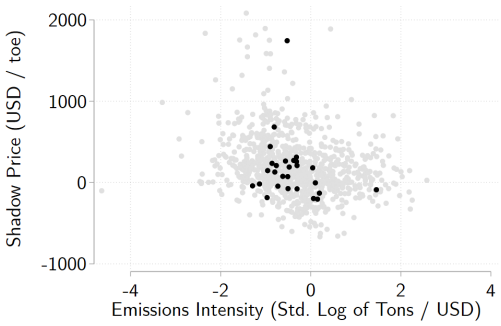
(b) Utilities



(c) Water Transport

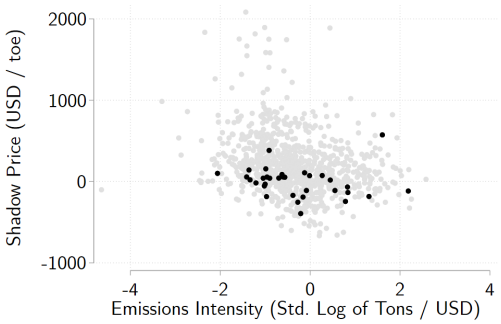


(d) Wholesale

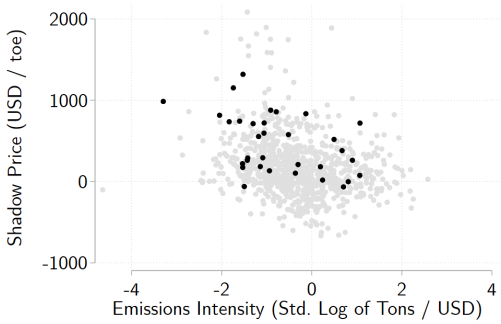


(e) Wood

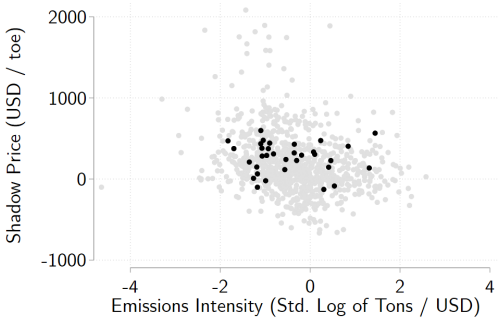
E.2 Plots by Country



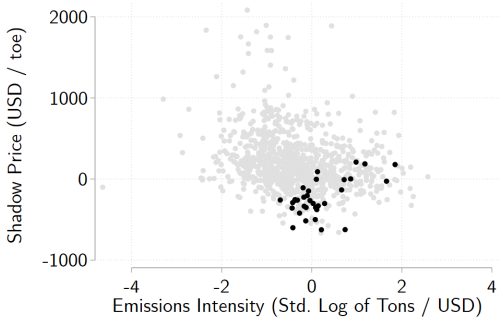
(a) Australia



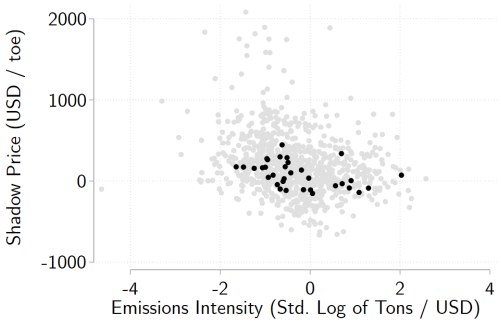
(b) Austria



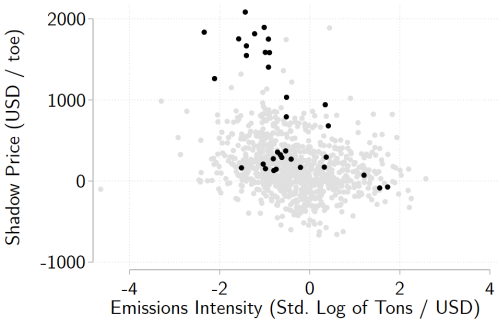
(c) Belgium



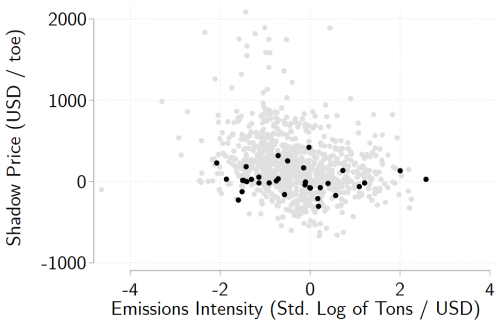
(d) Canada



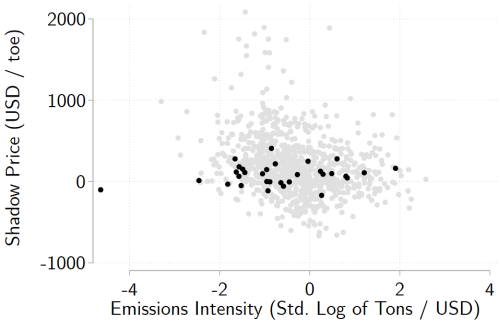
(a) Czech Republic



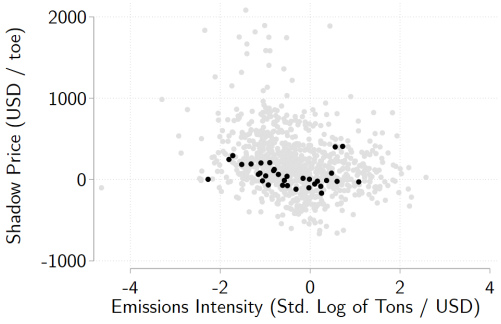
(b) Denmark



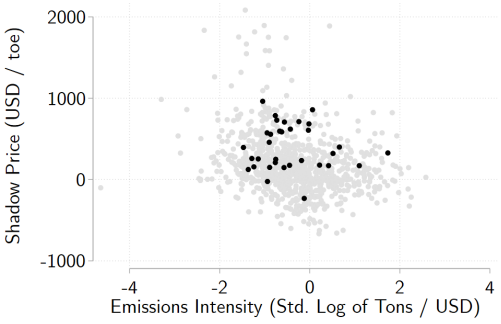
(c) Estonia



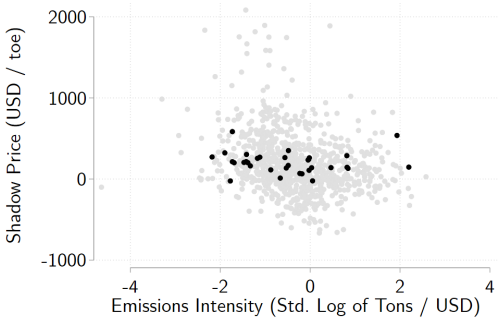
(d) Finland



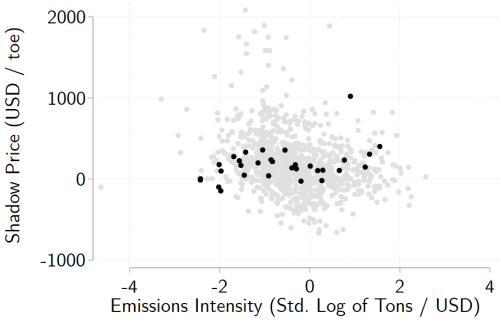
(e) France



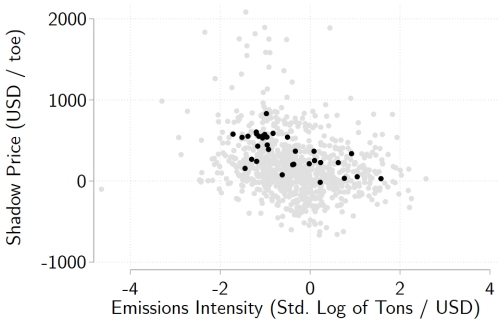
(f) Germany



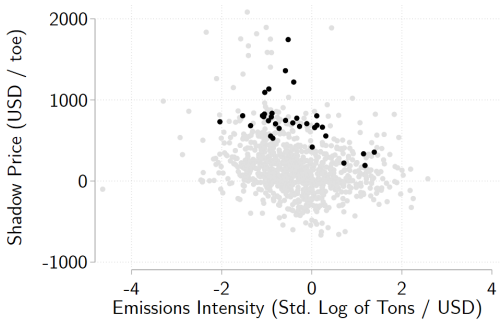
(g) Greece



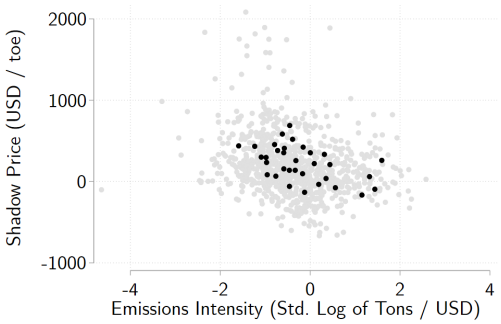
(h) Hungary



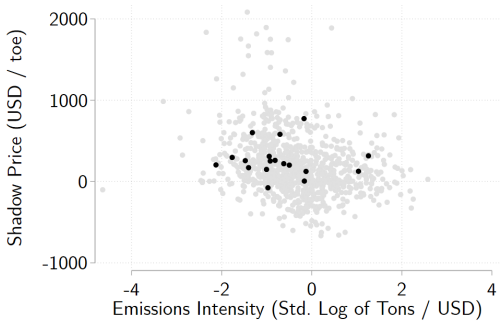
(a) Ireland



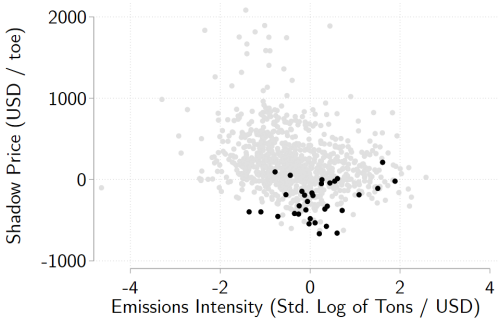
(b) Italy



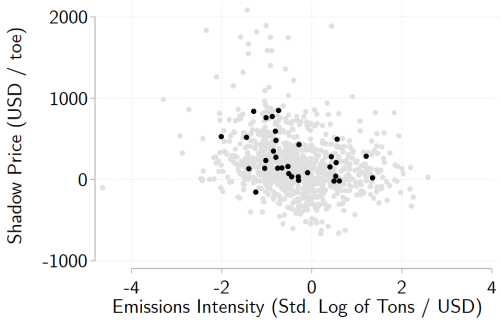
(c) Japan



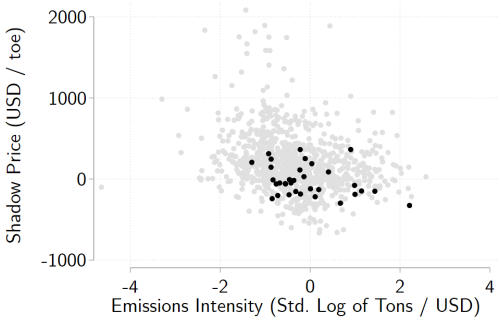
(d) Luxembourg



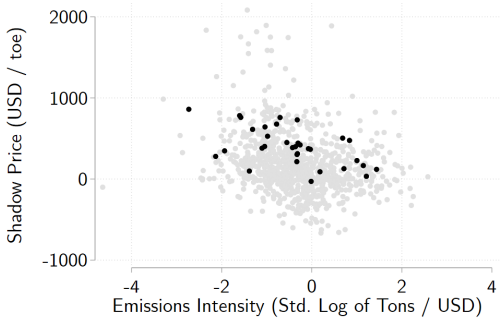
(e) Mexico



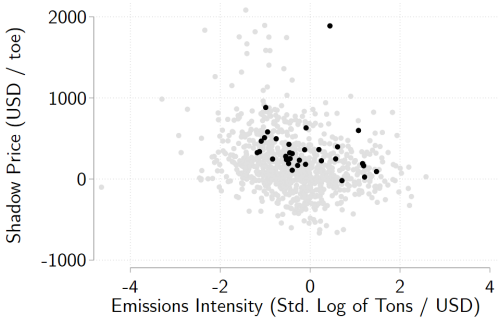
(f) Netherlands



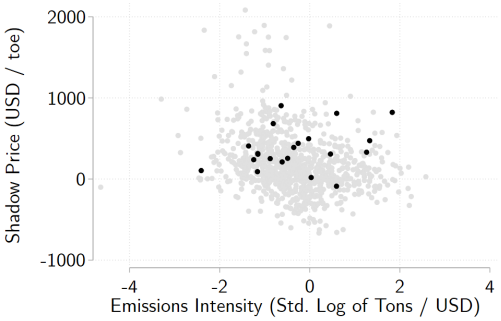
(g) Poland



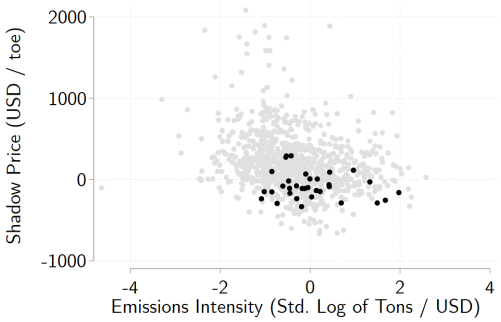
(h) Portugal



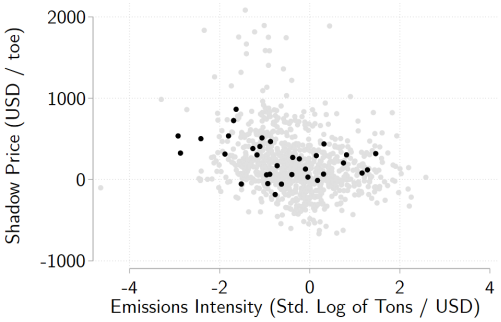
(a) Slovakia



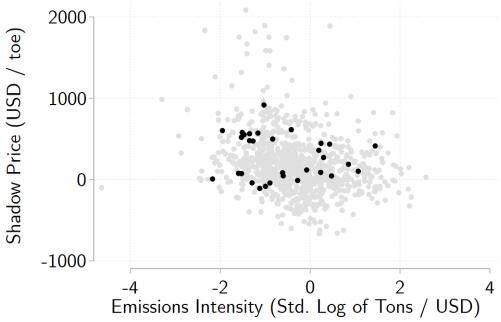
(b) Slovenia



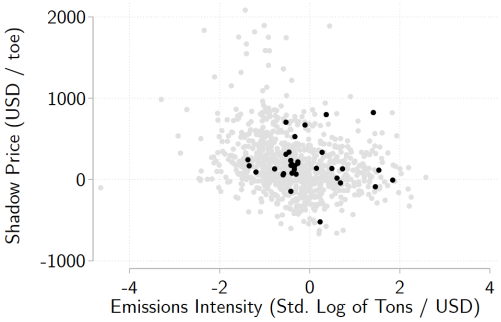
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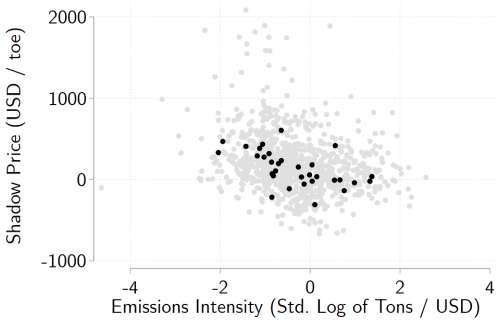
(d) Spain



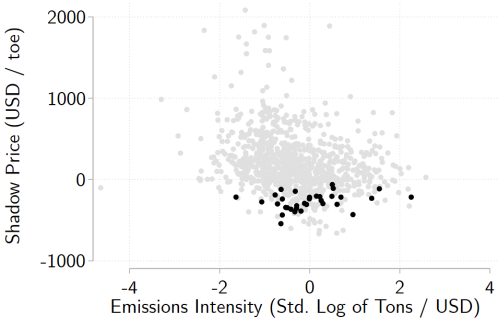
(e) Sweden



(f) Turkey



(g) United Kingdom



(h) United States