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Low Carbon for the Long Term:

Essays on the Comparative Political Economy of Climate Change Policy

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DECLARATION

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For our future

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ABSTRACT

Long-term policy challenges – biodiversity loss, education and skills, infrastructure, and public debt – are everywhere, yet scholars are just beginning to examine their distinct political economy. In the context of these types of issues, politics is not only about who gets what, but who gets what and *when*. Climate change is the quintessential long-term policy problem. Why have some advanced capitalist democracies been more successful than others at addressing long-term problems like climate change? Surprisingly, political science has provided few answers to this substantively important question. This thesis tackles this question by focusing on the distributional politics of climate policy investment. It provides new arguments for how institutions and electoral incentives generate opportunities for governments to arrive at successful distributive bargains that impose short-term costs on social actors today for benefits that arrive in the future. Across countries, I show how electoral rules and interest group intermediation systematically structure the conditions needed for politicians to make long-term climate policy investments. Indeed, the complementarity between these institutions generate *varieties of decarbonization*, which push countries onto diverging policy trajectories. Building on these arguments, I look within countries over time and provide the first theoretical arguments and empirical evidence that links electoral competition to fossil fuel taxation. By influencing political risk, competition structures political incentives for imposing short-term costs on voters today for long-term benefits. It is only governments with a comfortable lead over rivals that can think past the next election to society's long-run aggregate welfare. I find support for my arguments using new cross-national data on shadow carbon prices, original datasets of historical gasoline taxation across high-income democracies and US states, and a case study of fossil fuel tax policy decisions by the German Social Democratic-Green coalition government. Beyond shedding light on the politics of long-term policymaking in the case of climate change, the thesis points to crucial mechanisms that plausibly account for the differential ability of governments to tackle a wider range of long-term challenges.

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Introduction:
The Comparative Political Economy of Climate Change Policy

"Through his [sic] worldwide industrial civilization, Man [sic] is unwittingly conducting a vast geophysical experiment. Within a few generations he [sic] is burning the fossil fuels that slowly accumulated in the earth over the past 500 million years... This may be sufficient to produce measurable and perhaps marked changes in climate…"

- "Report of The Environmental Pollution Panel", President's Science Advisory Committee (1965, 126-7)

Scientists have known the basics of climate change since the 1800s. In the early part of that century, Joseph Fourier and Claude Pouillet put forward the idea that the earth's climate was determined by the heat balance of incoming and outgoing solar radiation. In 1865, John Tyndall argued that the heat absorption of gases in the atmosphere, particularly water vapor and carbon dioxide (CO_2), regulate the earth's climate – a dynamic that would later be called the "greenhouse effect". By the end of the nineteenth century, Svante Arrhenius had calculated the expected change in the earth's surface temperature as a result of different concentrations of CO_2 in the atmosphere.[1]

While these discoveries were of general interest to atmospheric researchers, it was not until after World War II that the risks of a warming world were contemplated by governments. The 1965 report by US President Lyndon B. Johnson's Science Advisory Committee quoted above included a section titled "Carbon Dioxide from Fossil Fuels – The Invisible Pollutant", which warned of the hazards of increasing CO_2 emissions from burning fossil fuels (President's Science Advisory Committee, 1965). In 1974, the UN General Assembly called on the World Meteorological Organization (WMO) to undertake a study of climate change. In 1979, the WMO and the United Nations Environment Programme (UNEP) organized the First World Climate

[1] For a full history of climate science see Bolin (2007).

Conference. By 1980 the first international assessment of climate change was completed (Bolin 2007). The WMO and UNEP established the Intergovernmental Panel on Climate Change (IPCC) in 1988 and tasked it with providing governments at all levels with regular scientific assessments of climate change, its impacts and risks, and policy options for mitigation and adaptation. Since then, the IPCC has published five Assessment Reports, as well as numerous Special Reports. At the same time, scientists and government agencies across the world have published countless articles and reports on the causes and dangerous consequences of climate change. Indeed, governments today have a tremendous amount of scientific information at their fingertips.

Countries began negotiating a collective response to the climate challenge in the late 1970s. It featured as a major agenda item at the 1979 Group of Seven (G7) meeting in Tokyo (Kirton and Kokotsis 2016). In 1988, the World Conference on the Changing Atmosphere brought together policymakers from 46 countries in Toronto and called on governments to reduce pollution of the atmosphere. By 1992, countries had negotiated the first international climate change treaty, the United Nations Framework Convention on Climate Change (UNFCCC). Under its framework, governments have met every year since 1995 to assess global progress on combatting climate change. In 1997, countries negotiated the Kyoto Protocol, the world's first (and only) legally binding international agreement for emissions reductions. The most recent global climate treaty – the Paris Agreement – was negotiated by countries in 2015.

At the domestic level, research on policy instruments to mitigate climate change has a similarly long history. The 1965 report from the Science Advisory Committee mentioned above recommended that "special taxes" be levied against polluters. In 1977, William Nordhaus published a paper in the *American Economic Review* on "control strategies" for the "carbon dioxide problem" (Nordhaus 1977). Since then a huge literature has developed in economics around the most efficient policy responses to climate change, spawning the entire subfield of environmental economics (e.g., Stern 2007). Indeed, for decades governments have enjoyed an extensive policy design menu from which to choose, as well as myriad policy evaluation studies outlining the effectiveness and costs of each (e.g., Andersson 2019; Gillingham and Stock 2018; Stern 2007). What is more, from an engineering perspective, we have possessed the fundamental technical and industrial know-how to solve climate change since at least the turn of this century (Banuri et al. 2001; Pacala and Socolow 2004).

In sum, the basic science of climate change has been known for almost 200 years; its hazards have been known to governments for half a century; countries have been negotiating a collective response for four decades; policies to address it have been known for a similar amount of time; and we have had the technology to solve it for almost twenty years. Nevertheless, progress toward addressing the problem has been slow. Indeed, the existential risk of climate catastrophe is perhaps greater now than ever before. Why? It cannot simply be a matter of too little information for the same reason that it cannot be about a lack of technology or know-how.

The reason is politics. Beyond science, policy design, and technology, addressing climate change poses unique *political* challenges. It is individual politicians, political parties, and governments that are tasked with adopting, implementing, and maintaining climate change policy over decades. By stabilizing the climate, such policies increase aggregate social welfare over the long term. However, they also involve short-term costs. Efforts to increase energy efficiency, switch to clean energy, produce zero-carbon products, and halt deforestation impose costs today on social actors. If they did not, these actions would already be taking place. The crucial point is that policies to combat climate change engender a distribution of costs and benefits that is not uniform across social actors or through time. As a result, distributive conflict arises. Hence, climate change politics are distributional politics.

Politicians can incur serious political damage if they do not navigate the distributional politics with caution. To be sure, all one has to consider is the recent *gilets jaunes* protests in France to understand the political risks associated with climate policy. In November 2018, protesters took to the streets to oppose planned increases in the county's carbon tax, which would have increased the price of everyday goods like gasoline and diesel. By December, President Emmanuel Macron had responded by postponing any fuel increases and froze prices for natural gas and electricity. However, the protests did not end. Protesters continued to take to the streets every Saturday to oppose a wide range of government policy. The backlash in France was not the first. In 2001, motorists across Europe, especially truck drivers, blocked roads in response to rising fuel costs. They demanded governments cut taxes on fuel, which included climate and other environmentally-related levies. In 2011, Australians took to the streets in opposition to the recently adopted carbon tax. Similarly, mainstream parties and governments face increasing pressure from populist leaders and parties who tend to be

sceptical about climate change. Their recent surge across the high-incomes democracies portends greater political conflict on the issue.

Yet at times politicians have faced pressure in the opposite direction. Currently governments face mobilization campaigns demanding that they do *more* to address climate change. In November 2018, the group Extinction Rebellion blocked bridges across central London to call for increased action from the UK government. Five months later Britain's capital ground to halt as the same group blocked critical junctions for over a week. Similar actions were undertaken by affiliate organizations around the world. Similarly, "school strikes for climate" have ramped up globally as schoolchildren routinely take to the streets to demand that their governments take stronger action to ameliorate the climate emergency. The key point is that, from the perspective of politicians, risk is all around.

Since the late 1980s governments *have* acted to address to climate change. As I show in this thesis, there is substantial variation both across the high-income democracies and within them over time. The question is: Why do some countries do more to address climate change than others? This deceptively simple inquiry motivates this thesis. We know surprisingly little about the answers to it. Mainstream political science, including the subfield of comparative political economy (CPE), has virtually ignored it. Given the centrality of politics to climate change, providing an answer should be a central task for the discipline. It is the goal of this dissertation.

In an effort to achieve this, I focus on the role that institutions and electoral incentives play in systematically structuring the political risks and opportunities for climate change mitigation policy. I reconceptualize climate policy as a type of long-term "policy investment", and as such, argue that it is driven by a distinct political economy. Governments wishing to embark on climate change policymaking require certain necessary political conditions. I focus on two: electoral safety and the capacity to overcome organized opposition from cost-bearing groups, principally carbon- and energy-intensive industries (e.g., coal, oil, gas, steel, chemicals, and manufacturing). Electoral safety reduces the risk that any voter backlash in response to strong climate action removes the government from power, while capacity to overcome industry opposition reduces the risk that powerful economic actors counter-mobilize and block policy change.

Across countries, I argue that electoral rules and interest group intermediation systematically structure the nature of these risks, and by doing so moderate political

opportunities for governments to make successful long-term climate policy investments. Indeed, the complementarity between these institutions generate distinct *varieties of decarbonization*, which push countries onto diverging policy trajectories. Building on these arguments, I look within countries and US states over time and provide the first theoretical arguments and empirical evidence that links electoral competition to fossil fuel taxation. By influencing electoral safety, competition structures political incentives for imposing short-term costs on voters (via increased fuel taxation) for long-term benefits (a stable climate). It is only governments with a comfortable lead over rivals that can think past the next election to society's long-run aggregate welfare. Taken together, the arguments illuminate how climate policy investment emerges from the electorally and institutionally constrained choices of politicians. I test the arguments using new cross-national data on climate policy stringency, original datasets of gasoline taxation across high-income democracies (1978-2013) and US states (1919-2016), and a case study of fossil fuel tax policy decisions by the German Social Democratic-Green coalition government in the early 2000s.

By providing novel insights on the comparative political economy of climate change policy, this thesis sheds light on the more general question of how politicians address long-term challenges in the face of short-term political imperatives. By doing so, its findings offer insight on the politics of a wider range of long-term policy challenges, such as: biodiversity loss, education and skills, infrastructure, and public debt. Indeed, the thesis points to crucial mechanisms that plausibly account for the differential ability of entire societies to tackle long-term problems, building upon and contributing to important existing work in CPE (e.g., Birchfield and Crepaz 1998; Cusack, Iversen, and Soskice 2007; Crepaz 1996; Hall and Soskice 2001; Lindvall 2017; Martin 2015b).

1. The problem of climate change

The earth has already warmed around 0.87°C, on average, relative to the pre-industrial period (Hoegh-Guldberg et al. 2018). The IPCC has recently concluded that warming of 1.5°C is associated with widespread species loss, loss of terrestrial and ocean ecosystems, increased magnitude of floods and droughts, reduced crop yields, increased heat-related human mortality, and reductions in economic growth, for example (Hoegh-Guldberg et al. 2018). Indeed, if greenhouse gases (GHGs) emissions do not begin to

decrease soon, planetary thresholds could be crossed that set in motion potentially catastrophic and irreversible positive feedback loops: collapsing ice sheets, loss of arctic permafrost, and the conversion of the Amazon rainforest to savannah (Steffen et al. 2018). If such events were to pass, it is unclear how organized human life would survive on this alien "hothouse earth".

Climate change is caused by the increased concentration of GHGs in the atmosphere (IPCC 2104). There are seven primary gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). GHGs are emitted when humans undertake economic activities, such as using fossil-fuel based energy for electricity, heating, and transportation and changing land-use patterns (e.g., deforestation). Emissions are tied up with almost every aspect of modern economies. Those who emit GHGs are causing climate change and by doing so imposing costs on current and future generations. However, they do not themselves tend to directly bear the full costs of their actions, either through markets or in other ways, such as compensation to those who are negatively affected by climate change (Stern 2007, 27). If emitters do not face these costs, they have little or no economic incentive to reduce their emissions. What is more, a stable climate is a global public good *par excellence* (Arrow 2007, 3). It is non-excludable – those who pay for it cannot exclude those who do not from enjoying its benefits, and non-rivalrous – one person's enjoyment of a stable climate does not diminish the ability of others to enjoy it too. On their own, markets do not provide the right type and quantity of public goods because there are little or no returns to private investors for doing so. In this way, climate change is caused by the twin market failures of externalities and public goods. Indeed, climate change "must be regarded as market failure on the greatest scale the world has seen" (Stern 2007, 27). To correct it, government policy is required.

Governments have a wide range of policy options to reduce emissions and mitigate climate change. They can use fiscal instruments, such as carbon taxes that increase the price of fossil fuels (in order to internalize the negative externalities) or subsidies for wind and solar electricity in order to incentivize their adoption. Additionally, they can use emissions trading schemes to put a price on GHG emissions. Governments can also adopt regulations that mandate the use of clean technologies or specify minimum standards for carbon pollution output. For example, automakers can be required to produce cars that meet certain basic efficiency requirements. Public

funding for research and development into zero-carbon technologies can also be increased.

2. The political challenges of climate change

As mentioned, climate change is primarily a political problem. That is, it poses a unique set of *political*, rather than scientific or technological, challenges for politicians, especially those in democracies. First, climate change is global in its causes and consequences. The marginal damage of one additional tonne of GHG emissions is the same regardless of its country of origin. As a result, no country on its own can ameliorate the problem. Instead, some level of global collective action is required so that global public goods – a stable future climate – can be produced. Though, like other collective action problems, climate change can fall prey to issues of free-riding, which reduces incentives for counties to cooperate and can lead to a "tragedy of the commons" type outcome. A very large and important literature in International Relations considers the thorny issues of multilateral cooperation in the context of climate change (for a review see Bernauer 2013).

Second, combating climate change requires the radical transformation of economic production and consumption so as to make it significantly less emissions-intensive. This involves costs (Dietz et al. 2018; Gillingham and Stock 2018). For example, the power sector will have to move from generating electricity from fossil fuels to generating it from zero-carbon sources like wind and solar, while industry will have to increase energy efficiency and switch to cleaner fuels. Households will need to switch to electric vehicles. All of these changes cost more than the status quo. If they did not, economic actors would have already made them. All else equal, politicians will tend to be wary of increasing costs for their constituents, since doing so generates distributive conflict and attendant political risks.

Third, climate change is characterized by uncertainty. The precise type, timing, magnitude, and location of future impacts are difficult to predict. Similarly, policies to address climate change rely on far-reaching assumptions about the future and complex causal chains, which become less certain as time horizons lengthen. For example, the shape and rate of technological change, which is important for addressing climate change, cannot be precisely known ex-ante. The result is that no government can be certain that a costly policy implemented today will have the intended effect fifty or one

hundred years down the road. Politicians will tend to have little reason to adopt costly policies whose future benefits seem unlikely to emerge (Jacobs 2011).

Fourth, and relatedly, to be effective climate policies must be implemented consistently over time (Hovi, Sprinz, and Underdal 2009; Levin et al. 2012). They cannot be constantly changed or periodically repealed. Indeed, many policies, such as those aimed at keeping fossil fuels in the ground, will have to be implemented indefinitely. In democracies this is a difficult task. Politicians' policy preferences are prone to time-inconsistency due to changes in material conditions, shifting political priorities and coalitions, or simply turnover in office (Alesina and Tabellini 1988). Social actors have little reason to pay the costs of climate policy today if they doubt the government's commitment or ability to deliver its future benefits (Jacobs 2011).

Lastly, climate change requires that governments and voters focus on the future. However, high time discounting means that both actors often afford much greater weight to society's immediate interests and consumption. Voters tend to see long-term problems as less salient than short-term ones, generating incentives for politicians to do the same (Jacobs and Matthews 2012). What is more, political business cycles and retrospective voting can incentivize short-sighted government policy (Nordhaus 1975).

3. Variation in climate policy across high-income democracies

Yet despite the significant obstacles, many politicians *have* acted to address climate change and these actions occurred before *and* after countries joined international agreements. Indeed, serious efforts to adopt climate change policy have been attempted in *all* high-income democracies since the late 1980s. Some have succeeded, some have failed, and some have been reversed. Examples abound. In 1990, Finland was the first country in the world to adopt a carbon tax and Germany adopted a feed-in-tariff law to subsidize the generation of renewable energy. Subsequent carbon taxes were adopted in Norway (1991), Sweden (1991), Denmark (1992), Ireland (2008), Japan (2012), France (2014), and Canada (2018), while feed-in-tariffs were implemented in Switzerland (1991), Spain (1994), and Denmark (1993). In 2005 the European Union Emissions Trading Scheme (EU ETS) was launched. Switzerland and New Zealand adopted a similar scheme in 2008.

At the same time, carbon taxes have failed in the US (1993) and France (2009). US attempts to pass an emissions trading scheme failed in 2001, 2003, 2005, and 2008.

The most recent plan was abandoned in the Senate in 2010 after having passed the House. In 2001, Italy repealed its carbon tax. In 2011, Australia implemented a carbon price only to have it repealed by a new government three years later. In 2017, the newly-elected Trump Administration in the US initiated a process to repeal the Obama Administration's signature climate policy – the Clean Power Plan.

Internationally, all of the high-income democracies signed the United Nations Framework Convention on Climate Change in 1992 which committed them to an identical domestic emissions reduction goal. In 1997, all signed the Kyoto Protocol. However, the treaty was never ratified by the US, while Canada, Japan, and New Zealand withdrew from it in 2012. The most recent international treaty, the Paris Agreement, was signed by all advanced democracies in 2015. The US has already signalled its intention to withdraw from it.

Apart from policy adoption and treaty ratification, the content of climate policies varies considerably across countries and over time, particularly policy stringency. Some policies impose significant costs or provide significant subsidies to economic actors in an effort to change their behavior, while others are lax and do little to shift the status quo. For example, headline carbon tax rates are $139 per tonne of CO_2 in Sweden, $55 in France, $29 in Denmark, and $3 in Japan (World Bank and Ecofys 2018). Stringency is important because it is critical to hastening the decarbonization of national economies. Climate policies that impose few significant costs will be ineffective in addressing the problem. More importantly for my purposes, stringency matters because it determines the degree of distributive conflict that policies entail, and therefore the politics. Policies that impose few significant costs on any social actor will not be political. It is only when government make serious efforts to address climate change through stringent policy that political dynamics kick in.

4. Existing research

What explains the variation described above? Why do some advanced capitalist democracies do much to address climate change while others do so little? Most existing political science research has come from International Relations and focused on issues related to global collective action (see Bernauer 2013). Fewer studies have examined the domestic drivers of climate policy, and even fewer have undertaken cross-national comparative research and theory development (Cao et al. 2014; Purdon 2015; Rykkja,

Neby, and Hope 2014). Here I offer a quick overview of the literature. I will return to a detailed discussion of it later in the chapter.

One vein of existing research examines the balance of power between "green" (low-carbon) and "brown" (carbon-intensive) organized groups in shaping coalitions of climate policy proponents and opponents (Cheon and Urpelainen 2013; Hughes and Urpelainen 2015; Meckling 2011; Ward and Cao 2012; Harrison 2015). A closely related literature uses a dynamic framework to analyze how politicians strategically shape clean versus dirty coalitions, and the effect it has on climate politics over time via processes of positive feedback and path dependency (Aklin and Urpelainen 2013; Breetz, Mildenberger, and Stokes 2018; Meckling et al. 2015; Kelsey 2018). A second strand theorizes about the role of political parties, especially green and left parties (Dumas, Rising, and Urpelainen 2016; Jensen and Spoon 2011; Harrison and Sundstrom 2010; LaChappelle 2011; Mildenberger 2020); while a third focuses on electoral politics, especially the role of political competition (Aklin and Urpelainen 2013), electoral insulation (Lipscy 2019), accountability (Tvinnereim 2013), and electoral backlash (Stokes 2016). A final set of studies examines the role of institutions. Many focus on formal institutions: veto points (Madden 2014), federalism (Harrison and Sundstrom 2010), the European Union (Compston and Bailey 2008; Harrison and Sundstrom 2010; Tobin 2017), welfare states (Kono 2019; MacNeil 2015), bureaucratic capacity (Hughes and Urpelainen 2015; Meckling and Nahm 2018b, 2018a), electoral rules (Harrison and Sundstrom 2010; LaChappelle 2011; Lipscy 2019), and interest group intermediation (Karapin 2016; Meckling and Nahm 2018b; Mildenberger 2020; Tobin 2017). A number of studies have also investigated the role of informal institutions, particularly political trust and perceptions of corruption (Jo 2019; Povitkina 2018; Rafaty 2018).

These studies shed important light on a number of key processes that shape domestic climate politics. However, a gap remains regarding the construction of broader theory that can situate the myriad findings. Put simply, we know much more about individual processes than how they might fit together into a coherent theoretical framework of climate change politics. Furthermore, few studies have yet to take seriously the institutional diversity that underpins advanced capitalist countries. This thesis fills these gaps. To do so, it finds inspiration in comparative political economy. For decades, scholars in this field have been interested in the political determinants of economic policy outcomes across the advanced capitalist democracies (e.g., Crouch 1993; Hall and Soskice 2001; Martin and Swank 2012; Steinmo, Thelen, and Longstreth

1992). Yet its tools and analytical frameworks have been curiously absent in the analysis of climate policy by environmental politics researchers. This is a puzzling fact given that climate policy is simply another type of economic policy. For their part, CPE scholars have also paid virtually no attention to the looming threat of climate change. The arguments here also build on recent research on the politics of long-term policymaking (e.g., González-Ricoy and Gosseries 2016; Jacobs 2016; Jacobs and Matthews 2012, 2017; Lindvall 2017), particularly Alan Jacobs' (2011) book *Governing for the Long Term*. This thesis' focus on institutions and electoral incentives tests and extends existing theory of long-term policymaking, while the focus on climate change extends research into a new critical case. By building a theory of the comparative political economy of long-term climate change policy across the high-income democracies, the dissertation contributes to research on climate change politics, comparative political economy, and long-term policymaking.

5. The comparative political economy of long-term climate policy investment

Here I preview the arguments of this thesis. After offering a reconceptualization of climate change policy, I lay out a theoretical framework that focuses on the roles of domestic political institutions and electoral incentives in shaping policy stringency across countries and within them over time.

5.1. Climate policy as long-term policy investment

The theoretical starting point is a reconceptualization of climate change mitigation policies as long-term "policy investments", taking inspiration from Jacobs (2011). Climate change is the quintessential long-term problem. As such, the costs and benefits of policies to address it engender a distinct temporal structure. They extract resources today from the economy and invest them in the production of a slowly emerging consumption good – a stable future climate that is hospitable to human life. It is for this reason that they are "investments". They entail short-term pain for long-term gain. To date, researchers have tended to neglect the role of this fundamental non-simultaneity of costs and benefits in shaping the political economy of climate change.

Thinking about climate policy in this way recasts its attendant distributional conflict along two dimensions. The first is intertemporal. Governments have to decide

whether and how much of today's resources are to be invested. Conflict arises over the *level* of climate policy investment – the sum of short-term costs across the economy. It is compounded by the considerable uncertainty, complex causal chains, and very long time horizons that characterize both global warming and the effectiveness of policy responses, as well as the global public goods nature of the problem. Levels of climate policy investment can be measured by the stringency of a given country's policy portfolio. This continuous variable is the primary dependent variable of interest.

After deciding how much of today's resources are to be mobilized to reduce future warming, governments next need to decide which social actors are to bear these costs today. This is the second, or cross-sectional, dimension of the distributional politics. Conflict arises as governments decide which actors are to pay. There are two principal groups of actors. The first are *consumers*. In a democracy these are also voters. Second are *producers*, particularly firms engaged in emissions-intensive activities (e.g., oil and gas, coal, electricity, steel, cement, and chemicals).

These two dimensions of distributional conflict can be illustrated with an example. Consider a tax on carbon – the "first-best" policy solution from the economist's toolbox. The objective of such a tax is to increase the price of carbon-intensive goods and services across the economy (e.g., gasoline, diesel, heating fuels, fossil fuel inputs for industry, and electricity generated from fossil fuels) in order to reduce their consumption (and associated emissions) in an economically efficient way. The most important benefit of the tax is a stable climate over the coming centuries – a global and intergenerational public good. The cost of the tax will fall on economic actors today. As described above, the government needs to decide on two aspects of the policy. The first is the level of the tax. For example, should it be £30 per tonne of CO_2 emissions or £60? This is the measure of the policy's short-term costs, or stringency. Conceptually, it represents the level of policy investment, or the amount of today's resources that will be extracted from the economy to provide a future benefit. The second policy design feature is the distribution of these costs between actors today. Politicians can impose the same tax rate across the economy so that consumers and producers pay similar amounts (relative to their use of carbon-intensive goods and services). Although this is the economist's prescription, few countries have gone this route. A second option is for governments to impose a higher rate on industry *or* on consumers. As I will show, this is the more common route. For example, the UK has pushed costs toward producers, while Sweden primarily shifts them toward consumers.

The political economy of climate change will be driven by the political risks and opportunities of distributing costs along both of these dimensions. Politicians need to invest enough resources today so that future climate change is effectively mitigated and distribute the associated policy costs across economic actors in a way that is feasible and stable. Importantly, possibilities for the latter determine the opportunities for the former. That is, the level of overall climate policy investment will depend on the ability of governments to pursue a distributive strategy that allocates short-term costs cross-sectionally between consumers and producers. Crucially, there are political risks on both fronts. Increased costs for voters can produce electoral backlash that removes the governing party(ies) from power. Increased costs for industry can cause them to counter-mobilize and expand the scope of conflict in an effort to block policy change. Or they may simply divest and leave the country, taking jobs with them. Both scenarios represent significant political stumbling blocks to long-term climate policy investment.

5.2. Two causal channels of climate politics

With this framework in mind, we can now turn to the factors that shape distributive politics along both dimensions. This thesis examines two causal channels through which the politics of climate policymaking play out. They represent two arenas of distributive conflict. The first is electoral and connects politicians with voters. The second concerns the ability of politicians to overcome opposition from organized groups (i.e., industry) that stand to pay the costs of long-term policy investments.

5.2.1. Channel 1: Electoral politics

Policies that increase costs for voters run the risk of being unpopular. A risk that is compounded when: (1) the benefits associated with those costs are public goods that arrive in the future and (2) the benefits take the form of reduced losses relative to a counterfactual scenario of runaway climate change rather than additional, highly visible benefits relative to the status quo. As mentioned, the risk for politicians is simple: electoral punishment. If the costs of policy become politically salient, they could elicit a severe electoral backlash that removes the governing party from power at the next election. This should be especially likely when policy imposes direct and highly visible costs on voters, such as fossil fuel taxes. Prior work highlights that a key condition for

politicians to adopt long-term policy investments, especially those that seek structural economic change, is electoral safety (Garrett 1993; Jacobs 2011). Electoral safety insulates governments against decreases in vote shares for policies that are unpopular in the short-term but promise long-term benefits. I build on this reasoning. It is only governments that feel secure in office that engage in the long-terms politics of decarbonization and structural economic change. In this way, electoral safety is a crucial mechanism that shapes political risks and opportunities of long-term climate policy investments.

Two determinants of electoral safety are electoral competition and accountability. Electoral competition, or the expected probability of a change in government control at the next election as perceived by the governing party(ies), structures the governing party's strategic tradeoff between vote-seeking and policy-seeking preferences (Boyne 1998; Kayser and Lindstädt 2015; Strom 1990). When it is low, the governing party enjoys an advantage over its rivals, insulating it against any marginal losses in vote shares from unhappy voters and opening up political opportunities for pursuing its long-term policy preferences. However when competition is high, the governing party should instead rely on a short-term strategy of vote maximization in an effort to win the next contest. Adopting strong climate policies that impose direct costs on voters will simply be too politically risky.

Accountability means that voters can remove a government from office if they dislike its policies (Htun and Powell 2013). To do so, voters must be able to: (1) assign responsibility for a particularly unpopular policy to the government, and within the government to an identifiable actor or party, and (2) remove these actors or parties from office. Governing parties will experience less electoral safety to the extent that both of these conditions are satisfied.

Importantly, both electoral competition and accountability are shaped by the institutional context in which elections take place. I pay particular attention to the role of electoral rules. Proportional electoral rules (PR) tend to dampen electoral competition by decreasing seats-votes elasticities, or the marginal expected gains in a party's seat share in the national legislature for a given increase in the party's national vote total (Rogowski and Kayser 2002). Indeed, a number of studies highlight the link between electoral rules, competition, and consumer prices (Chang, Kayser, and Rogowski 2008; Chang et al. 2010; Linzer and Rogowski 2008). The insight is that whichever electoral system increases the impact of votes (via higher seats-votes

elasticities, and hence competition) will shift policy toward voters (i.e., consumers). In this way, PR dampens the electoral preferences of unhappy consumers while majoritarian rules amplify them, generating incentives for politicians to keep prices low. I extend these arguments to case of changes in consumer prices, particularly energy prices, as a result of climate policy investments.

PR rules also decrease clarity of responsibility, making it more difficult for voters to assign responsibility for policies they dislike, while majoritarian rules increase it (Powell and Whitten 1993). PR tends to generate coalition governments, while majoritarian rules usually result in single-party ones. All else equal, voters should find it easier to punish single-party governments, not least because coalition governments enable governing parties to shift blame for unpopular policies onto their coalition partners (Hobolt, Tilley, and Banducci 2013; Powell and Whitten 1993). Moreover, dynamics of coalitional bargaining under PR means that significant policy decisions tend to enjoy cross-party consensus. For example, in Denmark the Energy Agreement law of 2012, an ambitious and costly policy to increase clean energy generation, was supported by virtually all political parties (Toke and Nielsen 2015). Such broad consensus further blurs lines of responsibility for voters. PR rules also make it difficult to sanction governments because even if voters substantially reduce their support for a party, there is no guarantee that it will not end up in the governing coalition after the election; for example, as a result of coalition bargaining (Powell 2000, Ch 3). However, a substantial loss of support for a party under majoritarian rules will almost certainly remove it from power.

To sum up, electoral safety should be key for climate policy investments. It is driven in part by electoral competition and accountability, which themselves are shaped by electoral rules. National political institutions should systematically structure electoral safety, and therefore climate policy, across countries.

5.2.2. Channel 2: Organized interests

The second causal channel concerns the relationship between governments and cost-bearing organized interests. Powerful economic actors are critical to possibilities for long-term policy investment, since they often have the resources to disproportionately influence policymaking. The goal of climate policy is to push these actors to change their production processes so that they become less carbon-intensive. Doing so involves

short-term costs, but also long-term benefits. All else equal, I assume that industry prefers not bear these costs. Hence, to adopt long-term climate policy investments, governments require the capacity to overcome opposition from cost-bearing organized groups (Jacobs 2011). Indeed, as mentioned above, a key obstacle to climate policy that is hypothesized in the literature is the ability of business, especially carbon-intensive industries, to block policy change (Cheon and Urpelainen 2013; Hughes and Urpelainen 2015; Mildenberger 2020).

Institutions shape the relationship between government, firms, and workers; and by doing so, shape the ability of governments to defuse organized opposition. When undertaking significant reforms, especially those that entail major distributive conflict, governments have two general options for dealing with powerful cost-bearing groups: compensate them or ignore them (Lindvall 2017). Both options involve political costs. Ignoring powerful industries risks that they counter-mobilize, expand conflict to the public arena, block policy change, and cause electoral damage. While compensation promises the possibility of defusing organized opposition, it may take too much time and energy to negotiate (transaction costs), make the policy less effective (dilution costs), or make other important political actors, especially voters, react negatively (audience costs).

Crucially, institutions structure these costs. I pay particular attention to the role of corporatism, especially concertation. By granting highly organized, encompassing peak associations for capital and labor privileged access to government policymaking, concertation decreases the costs associated with compensating cost-bearing producers. For example, negotiations often take place within long-standing relationships of face-to-face repeated interaction and trust (e.g., Martin and Swank 2012) – two important ingredients for reducing transaction costs. What is more, corporatism helps to ensure that long-term climate policy investments and their attendant compensation are perceived as credible by industry. For example, by giving cost-bearing groups influence over the shape and rate of policy change. Credible commitment is particularly important for long-term policy investments since firms will have little reason to pay the short-term costs of climate policy if they believe the government will change course before the long-term benefits are fully realized. In this way, institutions that structure interactions between government and cost-bearing firms should play a crucial role shaping possibilities for governments to defuse organized opposition.

5.3. Institutional complementarities and varieties of decarbonization

Across the high-income democracies, electoral rules tend to go together with forms of interest group intermediation (Cusack, Iversen, and Soskice 2007; Iversen and Soskice 2009; Martin and Swank 2012). In the case of climate change policy, I theorize how the joint presence of these two institutions generates powerful complementarities that reinforce their independent effects, driving differences in the timing, stringency, and distributional profile of policy investments and giving rise to two distinct, ideal-type *varieties of decarbonization*.

The first are "negotiated" political economies with PR electoral rules and coporatist interest group intermediation. Countries toward this end of the spectrum also tend to have other consensus-based democratic institutions, such as inclusive parliamentary committees, and coordinated market economies (Hall and Soskice 2001; Lijphart 2012; Powell 2000). Archetypal negotiated political economies include Austria, Denmark, Germany, and Sweden, among others. In these countries the complementarity between PR rules and concertation simultaneously reduces the political risks of imposing costs on consumers *and* producers. Because PR rules increase electoral safety, they decrease risks associated with shifting costs toward voters, giving governments the option to do so. For this reason, governments are more likely to choose policies that directly increase consumer prices. Furthermore, this flexibility opens up critical room to maneuver when negotiating compensation with industry. Offering compensation to powerful cost-bearing organized groups reduces the likelihood that distributive conflict enters the public arena or that industry increases the salience of short-term costs for voters, making it less risky for governments to impose them. Hence, the complementarity between PR and corporatism changes the payoffs to industry of pursuing different strategies in response to government action. For example, it becomes less costly for industry to directly negotiate an agreement with the government than to launch a public campaign attempting to block policy change through sewing doubt about climate science. As a result, I argue corporatism reduces "climate scepticism" and open public conflict. In negotiated political economies policy stringency tends to increase incrementally over time through negotiation and bargaining, giving economic actors time to adjust. Interested actors also see policy as credible, since institutions diffuse power and give them influence over the shape and rate of policy change.

The second ideal-type are "competitive" political economies. Here majoritarian electoral rules are jointly present with interest group pluralism. Countries in this category also tend to have other majoritarian institutions, such legislative committees dominated by the government and liberal market economies. Archetypal competitive political economies include the UK, US, Canada, and Australia. Here majoritarian electoral rules decrease electoral safety, increasing the political risk of directly imposing visible costs on voters. Given the risks of the electoral channel, governments serious about climate policy investment instead opt for imposing short-term costs on industry. This makes political sense for two reasons. First, polluting industries lack institutionalized influence. Second, pro-climate governments rarely rely on polluters for political support, almost by definition. As a result, governments tend to ignore policy losers rather than compensate them. Such a distributive strategy can generate radical and stringent policy change, however it does not make powerful polluters go away. Lacking an inside channel, industry goes public in their attempt to influence policy design, hoping to sway voters. The fundamental problem is that a strategy of ignoring losers, which will be politically attractive in this institutional setting, does not reconcile distributive conflict, but instead amplifies it. Indeed, conflict tends to permeate climate politics in competitive political economies. The two main political parties are locked in fierce competition. One party is for climate action, while the other opposes it. Policy waxes and wanes depending on which is in power. Few veto points means that the anti-climate party can simply change course and reverse policy after winning an election, causing a boom and bust policy cycle and low levels of overall investment. Constant changes to policy also undermine the long-term credibility of government action, reducing trust and consumer and producer incentives to bear short-term costs.

The key point is that institutional complementarities systematically structure the contours of distributive conflict in each variety of decarbonization, offering markedly different expectations regarding: cross-party consensus, feasibility of distributing costs toward voters or industry, policy instrument choice, policy reversal, credible commitment, and public conflict over climate policy (including levels of climate change scepticism). Different institutional environments entail different political logics vis-à-vis long-term climate policy investment. In this way, my arguments offer an explanation for why some high-income democracies have done much to address climate change while others have done so little. Furthermore, they predict that, given their institutions, negotiated political economies should be better able to address a wide range of long-

term policy challenges; building upon and extending key works in CPE (Cusack, Iversen, and Soskice 2007; Lijphart 2012; Martin and Swank 2012; Rogowski and Kayser 2002).

6. Contribution to existing work

By paying special attention to institutional diversity across the advanced capitalist democracies, the arguments in this thesis help to situate and contextualize findings from a number of existing strands of climate change politics research.

6.1. Electoral rules and partisanship

Scholars have previously theorized a link between electoral rules and climate policy (e.g., Harrison and Sundstrom 2010; LaChappelle 2011). The mechanism is that PR rules open up possibilities for green parties to win parliamentary seats, participate in government, and enact climate policy. However, there is still little evidence that greens, whether in parliament or government, have a systematic effect on climate policy adoption (e.g., Madden 2014; Rafaty 2018). By highlighting the role of electoral incentives, particularly electoral safety, my arguments provide a complementary causal mechanism that links electoral rules and climate policy independent of partisanship. They complement forthcoming work by Lipscy (2019) who shows how electoral rules shape energy efficiency policies across countries by structuring electoral insulation.

Aklin and Urpelainen (2013) argue that pro-climate parties will strategically overinvest in climate policies while in office while anti-climate parties will underinvest. As a result, electorally-minded politicians shape pro-climate coalitions, influencing the future balance of power between low-carbon and high-carbon sectors. My arguments add that this effect should be most pronounced in competitive political economies where single party governments are empowered to change policy quickly and dramatically after an election. Conversely, in negotiated political economies we should expect cross-party consensus on climate change investments to emerge, reducing partisan swings.

This logic also explains the puzzling non-relationship between partisanship and climate policy. While scholars have predicted that the left-right orientation of the governing party(ies) matters (Dumas, Rising, and Urpelainen 2016; Harrison and

Sundstrom 2010; LaChappelle 2011), empirical tests have been mixed. Some find that left parties play an important role (Tobin 2017; Ward and Cao 2012), while others find little difference between the behaviour of left and right parties in government (Cheon and Urpelainen 2013; Fankhauser, Gennaioli, and Collins 2015b; Rafaty 2018). Mildenberger (2020) offers one explanation. By splitting pre-existing coalitions of labor and capital, the issue of climate change creates new cleavages within traditional left-right political camps. For example, both workers and business are internally split between carbon-intensive and clean sectors. As a result, there are opponents and proponents of climate policy in both left and right blocs. Because opponents in particular are double represented, policy adoption is difficult regardless of the party in power. My arguments offer a complementary explanation. The effect of partisanship should vary by institutional setting. In negotiated political economies, cross-party consensus on climate makes dramatic partisanship shifts unlikely. However, in competitive countries, such consensus is unlikely to emerge. Instead, policy should swing dramatically depending on which of the two main parties is in power.

6.2. Interest group intermediation

A number of national and cross-national studies have described a relationship between a general conception of corporatism and climate policy (e.g., Brand and Pawloff 2014; Hatch 1995; Kasa 2000; Tobin 2017). I extend this important line of work by providing a causal pathway that links one feature of corporatism – concertation – to higher levels of climate policy investment via compensation for cost-bearing groups. My arguments are most closely related to forthcoming work by Mildenberger (2020) who argues that institutions for interest group intermediation structure the way in which partisan preferences are articulated and lead to policy action or inaction. My arguments complement his by drawing attention to ways that national institutions shape the political risks and opportunities of climate policy. Yet they also diverge in important ways. Whereas Mildenberger argues that corporatism stabilizes the political influence of carbon-intensive policy losers, inhibiting ambitious policy, I argue that it opens up political possibilities for reaching stable distributive bargains with industry through bargaining and compensation.

The thesis' arguments about institutions for interest group intermediation also help to explain the especially Anglo-Saxon flavor of climate scepticism (Tranter and

Booth 2015). In these political economies powerful economic actors can expect little formal and stable influence over policy design. As a result, they are more likely to attempt to gain influence by shaping voters' climate policy preferences. One way they do this is by expanding the scope of distributive conflict and increasing the saliency of short-term costs. Furthermore, given the competitive incentives of a two-party system, the party opposed to strong action on climate change will be tempted to pick up on these frames and incorporate them into their own political communication. Doing so polarizes opinion on climate change sharply along partisan lines. Indeed, this is precisely what we observe in the US. While there is little difference between the climate change beliefs of Republicans and Democrats in the late 1980s (when the issue first appears), public opinion quickly polarizes in the 1990s as the two parties consolidate opposing positions (Egan and Mullin 2017). My arguments explain this outcome by endogenizing public opinion to the dynamic interactions between the party system and interest group intermediation.

6.3. Trust

Recent studies have highlighted an intriguing relationship between trust in government and climate change policy (Jo 2019; Rafaty 2018; Povitkina 2018). While precise theoretical interpretations of the result vary, it has yet to be linked to theories about long-term policymaking. However, theories about long-term policymaking predict that trust should play a crucial role in increasing support for long-term policies amongst social actors (Jacobs and Matthews 2012, 2017; Jacobs 2016). Given the non-simultaneity of policy costs and benefits, voters and business need to trust that governments will keep policies in place long enough so that future benefits are able to materialize.

A key source of political trust is voters' perceptions of their government's capacity to make credible commitments (Levi and Stoker 2000). I argue that such a capacity depends in part on institutions. Indeed, because negotiated political economies enjoy higher levels of policy credibility given their institutional complementarities, my arguments predict that they should also have higher levels of political trust. In this way, trust is endogenous to institutions. Put differently, institutions are causally prior to trust, predicting both it and climate policy investment. At the same time, trust reinforces institutions over time, as institutions that require trust, such as negotiations between

business and the state, are further bolstered by the trust that they engender through repeated interactions over the course of decades.

6.4. Coalitional dynamics across countries

Scholars have focused on the balance of power between "green" (low-carbon) and "brown" (carbon-intensive) organized groups as a key driver of climate policy (Aklin and Urpelainen 2013; Cheon and Urpelainen 2013; Hughes and Urpelainen 2015; Ward and Cao 2012). The intuition is that where brown industries are larger, they should be able to exercise greater political influence to oppose climate policy. As a result, governments adopt less stringent policy. While studies illuminate and test causal processes that link producers to climate policy adoption, they often assume US-style pluralist institutions for interest group intermediation whereby all interests compete for influence and the state is open and non-partial. Yet we know from comparative political economy that state-business relationships vary across countries and over time. By taking these differences seriously, this thesis offers an entry point for theorizing about how institutions structure green and brown coalition formation in different ways across countries.

7. Structure of the thesis

This thesis is comprised of three essays, corresponding to Chapters 2, 3, and 4. While each speaks to the larger theoretical framework outlined above, they should at the same time be considered as self-contained pieces of work.

Chapter 2 picks up on the themes of this introduction and lays out a theory of climate change politics across the high-income democracies in detail. After offering a reconceptualization of climate policy as a form of long-term policy investment, it explains the two causal channels that shape the political economy of climate policy investment. One is electoral, the other concerns the role of industry. The essay then focuses on the way that two institutions – electoral rules and interest group intermediation – drive variation in climate policies across the high-income democracies by structuring the political conditions needed for such investments to occur. Proportional electoral rules increase electoral safety, allowing politicians to impose short-term costs on constituents. Institutionalized relationships between industry and

the state enable governments to compensate losers, defusing organized opposition to policy change. Moreover, their joint presence generates powerful institutional complementarities that push countries onto distinct *varieties of decarbonization*. On one end are negotiated political economies and on the other are competitive ones. I test these arguments using new data on "shadow" carbon prices to measure countries' overall levels of climate policy investment, as well as develop separate measures for the costs imposed on voters versus those imposed on industry. I show that countries with more proportional electoral rules indeed have higher levels of policy investment compared to majoritarian countries. Additionally, in countries with PR, governments shift costs toward voters and away from industry, while in majoritarian countries there is little difference in costs between the two groups. In the case of concertation, I show how climate policy investment is highest in those countries where industry enjoys privileged and routine access to policymaking. It is also in these countries that costs for industry are highest. Moreover, high levels of concertation are associated with higher costs for consumers, offering evidence that these institutional arrangements enable governments to compensate industry by shifting costs toward voters. Lastly, I leverage within-country variation in concertation over time to demonstrate that concertation has a larger effect on policy investment at low levels of electoral disproportionality, suggesting a complimentary relationship between PR and concertation. The analysis is the first to provide comprehensive theoretical arguments and detailed quantitative evidence that links institutions to the distributional politics of long-term climate change policymaking.

Chapter 3 focuses on the electoral channel of climate politics. It develops theory about the role that electoral competition plays in shaping policy outcomes, particularly fossil fuel taxation. The essay is motivated by a simple puzzle. For over 40 years, economists have advocated carbon taxes as the most efficient policy for addressing climate change. Yet few governments have substantially increased the price of fossil fuels. The reason, I argue, has to do with the political risks of imposing direct and visible costs on voters. Electoral competition moderates such risks. When it is low, the governing party enjoys an advantage over its rivals, insulating it against any marginal losses in vote shares from unhappy voters and opening up political opportunities for pursuing its long-term climate policy preferences. What is more, this effect depends on the personal costs that tax increases impose on voters. If a fossil fuel is not widely consumed, politicians can tax it more easily, even when competition is high. I test this

explanation using an original dataset on gasoline taxes and new data on electoral competition across high-income democracies between 1978 and 2013. Gasoline is an important test case because it is widely consumed by voters. Furthermore, its associated emissions in the transport sector constitute one of the largest sources of emissions in many high-income democracies. Governments will need to get a handle on gasoline consumption if climate change is to be mitigated, yet virtually no studies in political science have analyzed it. I find strong evidence of a negative relationship between levels of competition and levels of gasoline taxation. Tax rates are lowest when competition is high. Moreover, I show how this effect depends on the personal costs that tax increases impose on voters. When gasoline is widely consumed, increased competition has an even stronger negative influence on tax rates. This suggests that under highly competitive conditions governments refrain from increasing the price of widely consumed goods. Lastly, I show that gasoline taxes vary with electoral rules. They are highest in PR countries and lowest in countries with majoritarian rules. My arguments provide a mechanism, electoral competition, which drives this cross-national relationship. A case study of eco-tax reform in Germany across two sequential electoral periods demonstrates how changes in the electoral fortunes of the Social Democratic-Green coalition generated changes in fossil fuel tax policy in a negotiated political economy setting.

Chapter 4 keeps the focus on the electoral channel of long-term climate policy. It extends theoretical arguments in Chapter 3 to an examination of fossil fuel taxation over nearly a century. The goal is to look more generally at the relationship between electoral competition and politicians' decision-making about long-term policy investment. I again focus on gasoline taxation, this time in US states. I collect an original dataset of tax rates for each state going back to the first year of adoption (beginning in 1919). The data comprises virtually the entire universe of tax rate changes. These taxes are quintessential long-term policy investments. By immediately raising the price of fuel, they impose short-term costs on voters. However, in return they offer long-term benefits, especially transportation infrastructure, energy security, and climate change mitigation. Given this unique temporal distribution of costs and benefits, state-level gas taxes offer a useful case for analyzing the long-run relationship between electoral dynamics and long-term policymaking in an archetypal competitive political economy setting. In particular, they offer insight on the factors that moderate politicians' time horizons, making them more or less short-term oriented. I find strong

evidence of a robust negative relationship between levels of electoral competition and levels of taxation. Furthermore, underlying trends in competition matter. Increases in long-term average levels of competition have a larger influence on the tax rate than short-term fluctuations. In other words, successive highly competitive contests are associated with even lower tax rates than election-to-election changes. Second, dynamic analysis using error correction models suggests that the negative effect of electoral competition lasts years into the future. While the largest part of this effect occurs in the year following a shock to competition, it decays slowly over time. To address concerns of potential reverse causality from the tax rate to levels of electoral competition I use federal intervention in the US South as a result of the 1965 Voting Rights Act as a source of exogenous variation. The results suggest that the relationship between electoral competition and gasoline taxation is causal. Taken together, the results provide strong evidence that politicians' strategic concerns about electoral safety are an important driver of long-term policy investment.

Chapter 5 concludes the dissertation by summarizing the main findings, discussing broader implications, and outlining areas for future research.

CHAPTER 2

Institutions, Climate Change, and the Foundations of Long-Term Policymaking

Abstract: Many policy problems require taking costly action today for future benefits. Do institutions structure the ability of governments to address long-term challenges? Examining the case of climate change, this paper argues yes. It focuses on the ways that two institutions – electoral rules and interest group intermediation – drive variation in climate policies across the high-income democracies by structuring the political conditions needed for them to occur. Proportional electoral rules increase electoral safety, allowing politicians to impose short-term costs on constituents. Institutionalized relationships between industry and the state enable governments to compensate losers, defusing organized opposition to policy change. Moreover, their joint presence generates powerful institutional complementarities that push countries onto distinct "varieties of decarbonization". Tests using new data on shadow carbon prices provide empirical support for the arguments. This analysis is the first to provide comprehensive theoretical arguments that link institutions to the distributional politics of long-term climate change policymaking. By doing so it illuminates causal mechanisms that should structure policy responses to a more general set of long-term challenges.

1. Introduction

Long-term policy challenges – biodiversity loss, education and skills, infrastructure, and public debt – are everywhere, yet scholars are just beginning to examine their distinct political economy (Jacobs 2011, 2016). In the context of these types of issues, politics is not only about who gets what, but who gets what and *when* (Lasswell 1936). Three features characterize long-term problems: they last at least one human generation, they exhibit considerable uncertainty given their long time horizons, and they entail problems of public goods, both at the stage of problem generation and policy response (Sprinz 2014). Climate change is the quintessential long-term policy problem. If left unabated, its impacts will last for centuries; there is uncertainty regarding the exact timing, scale, and geographic distribution of future impacts; and it is caused by the twin market failures of public goods and externalities; while addressing the problem requires the collective provision of a stable climate – a global public good *par excellence* (Keohane and Victor 2016; Arrow 2007, 3). Why have some advanced capitalist democracies been more successful than others at addressing long-term problems like climate change? Surprisingly, political science has provided few answers to this substantively important question (Bernauer 2013; Keohane 2015; Purdon 2015).

Recent theoretical work argues that addressing such problems is challenging for politicians in democracies for three reasons: the difficulty of imposing short-term costs on voters for benefits that arrive in the future, uncertainty about whether future benefits will materialize, and overcoming opposition from cost-bearing organized groups (Jacobs 2011). Consequently, three necessary conditions are required for long-term "policy investments" to occur: electoral safety, expectations of long-term benefits, and capacity to overcome opposition from organized cost-bearing groups. While existing work has examined the role of cognitive biases, ideational factors, and veto points, we know less about how institutions systematically structure the necessary conditions for long-term policy investment (Jacobs 2011; Jacobs and Matthews 2012, 2017). Yet, we know from existing research, particularly in comparative political economy, that institutions play a major role in shaping policy outcomes across countries, including taxation, trade, social policy, corporate governance, and labor markets (e.g., Gourevitch and Shinn 2005; Hall and Soskice 2001; Katzenstein 1985; Martin and Swank 2012; Steinmo, Thelen, and Longstreth 1992). I argue that they play a similar role in the case of long-term policy.

By examining the political economy of climate change mitigation policy, this paper gives an account of the institutional foundations of long-term policymaking.[2] It focuses specifically on the way that two institutions – electoral rules and interest group intermediation – drive cross-national variation in long-term climate policy investments by structuring the political conditions needed for such investments to occur. I argue that proportional electoral (PR) rules increase electoral safety by decreasing electoral accountability and electoral competition, which in turn enables governments to impose short-term costs on their constituents. Corporatist institutions for interest group intermediation facilitate bargaining between the government and powerful economic actors over compensation for the losers of policy change, which helps governments overcome industry opposition. Lastly, I theorize how the joint presence of both institutions generates powerful complementarities that reinforce their independent effects. PR rules decrease risks associated with shifting costs toward voters, which opens up critical room to maneuver when negotiating compensation with cost-bearing groups. Moreover, these types of complementarities generate distinct *varieties of decarbonization* that drive differences in climate policy investments across the high-income democracies. On the one hand are negotiated political economies with consensus-based democratic institutions and coordinated market economies. On the other are competitive political economies with majoritarian democracies and liberal market economies. Each institutional environment entails a different political logic vis-à-vis climate change policy. Lastly, the arguments predict that negotiated political economies should be better able to address a wider range of long-term policy challenges.

I test the arguments using new cross-national data on climate policy stringency. A consistent picture emerges. Between countries, and within them over time, stringency is higher when electoral rules are more proportional and levels of concertation are high. Furthermore, the joint presence of these institutions is similarly associated with high levels of policy investment. To better identify their effect, I examine the influence of institutions on the distribution of policy costs between producers and consumers. As theorized, I find a distinct distributive profile underlying climate policy investment. PR rules and concertation are associated with higher costs for consumers relative to producers, and this distributional bargain drives higher overall policy stringency.

[2] I use climate change mitigation policy, climate change policy, and climate policy interchangeably. What I am referring to are policies that aim to reduce greenhouse gas (GHG) emissions.

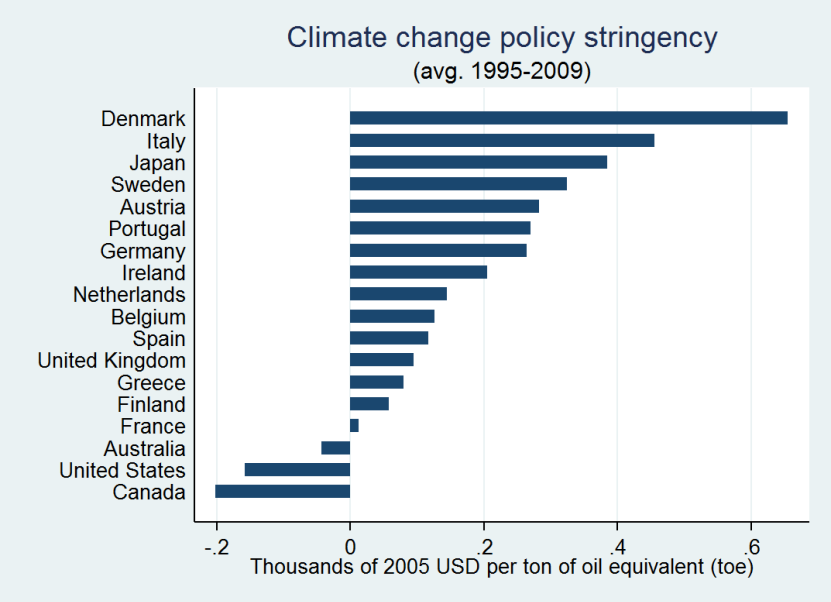
Conversely, majoritarian rules and interest group pluralism are associated with a more equal distribution of costs between the two groups, which results in comparatively lower levels of overall investment. This finding is important because it highlights how institutions structure the distributive politics of climate change policy, and by doing so, drive variation in governments' ability to do respond to the problem.

This paper makes a number of contributions. First, it provides a theoretical account of the micro-foundations that link institutions to long-term climate policy. We know surprisingly little, theoretically or empirically, about the political determinants of variation in climate policy stringency across the high-income democracies (Bernauer 2013; Keohane 2015; Purdon 2015). This paper seeks to contribute to filling this large gap by examining the role of political institutions – an area that has so far received scant attention (for recent examples see: Andersen 2019; Lipscy 2019; Mildenberger 2020). Moreover, it seeks to develop theory about how the joint presence of certain institutions creates complementarities that push countries onto distinct climate policy pathways and generate varieties of decarbonization. Secondly, the paper contributes to the growing literature on the politics of long-term policymaking (Jacobs 2011, 2016). By focusing specifically on the role of institutions it tests and extends existing theory. By focusing on climate change it extends empirical research into a new critical case of long-term policy problems. Lastly, the paper contributes to the climate policy debate by elucidating the ways that institutions structure opportunities for and constraints on climate policy adoption. Doing so helps to shed light on why some countries take strong action to address climate change, while others do not. Information that can enable the design of climate policy instruments that better take account of country-specific institutional settings, rather than relying on one-size-fits-all prescriptions.

2. The puzzle of climate change policy

Effectively responding to climate change poses many well-known political challenges for governments (Ch.1 this thesis; Bernauer 2013; Hovi, Sprinz, and Underdal 2009; Levin et al. 2012). However, despite the obstacles politicians *have* acted to address climate change and these actions occurred before *and* after countries joined international agreements. Indeed, serious efforts to adopt climate change policy have been attempted in *all* high-income democracies over the past three decades. The puzzle is that the stringency of policy portfolios varies considerably across countries (Figure 2.1). What

Figure 2.1. Climate change policy stringency across countries



Notes: This is a measure of the average "shadow" carbon price across the economy from Althammer and Hille (2016). It captures the extent to which government policy increases or decreases carbon-based energy prices relative to an undistorted market price. See Section 5.1 for further details.

explains this variation? Why have some countries done much to address climate change while others have done so little? A puzzling question considering that climate change arrived on the policy scene at virtually the same time for all high-income democracies – by the mid-1980s. Moreover, by 1992 each had signed the United Nations Framework Convention on Climate Change (UNFCCC), which committed them all to an identical domestic emissions reduction goal.[3] This of course includes countries that are now considered climate laggards, such as the US.[4] Yet from this relatively common starting point, countries quickly diverged along radically different policy trajectories. Why?

Surprisingly, political science has provided few answers (Keohane 2015). Existing research has explained why addressing climate change has been difficult for governments, however the domestic factors that drive cross-national variation in policy adoption are still under-researched (Bernauer 2013; Purdon 2015). A marked lack of theory development also characterizes the subfield in general and many previous studies in particular (Cao et al. 2014). Only a few scholars have attempted to provide a general

[3] Each country committed to reducing its emissions to 1990 levels by 2000. See Article 4 Section 2a of UN (1992). These goals were not just international, but backed up in each of the countries by national goals and strategies.

[4] For example, on Earth Day in 1993, then President Bill Clinton publicly affirmed the US's commitment to reduce its emissions in line with the international goal (Clinton 1993).

theory of climate policy adoption (Harrison 2015; Hughes and Urpelainen 2015; Mildenberger 2020). Perhaps for this reason, cross-national empirical studies have identified multiple variables that are correlated with climate policy, but a framework for how they might fit together is still missing (e.g., Fankhauser, Gennaioli, and Collins 2015a, 2015b; Fredriksson and Neumayer 2013, 2014; Harrison and Sundstrom 2010; Madden 2014; Rafaty 2018; Tobin 2017). This paper seeks to fill this large theoretical gap by examining the role of political institutions. It does so by drawing upon the rich toolkit of comparative political economy. CPE research highlights the ways in which institutions constitute the basis of democratic and capitalist diversity across the high-income countries and structure a range of policy outcomes (e.g., Iversen and Soskice 2006; Martin and Swank 2012; Rogowski and Kayser 2002). The case of climate change should be no different, yet only recently have a small handful of studies began to leverage CPE insights and explore the effects of institutions in this policy area (Lipscy 2019; Meckling and Nahm 2018b; Mildenberger 2020).[5] Moreover, we are still missing an account of climate policy adoption that takes seriously the institutional complementarities that underpin distinct patterns of democracy and varieties of capitalism. Lastly, we lack well-identified, robust large-N empirical evidence. Part of the reason has been the availability of data. This paper helps to address this issue by utilizing new data on climate policy stringency.

3. The politics of long-term climate policy investment: A theoretical framework

Climate change politics is distributive politics. In aggregate, government policies to reduce greenhouse gas emissions benefit society as a whole. However, like other types of long-term economic policy, the distribution of costs and benefits are not uniform across social actors or through time (Jacobs 2011). As a result, climate policy involves distributive conflict along two axes (see Figure 2.2). The first is intertemporal (vertical axis in Figure 2.2). Climate policy extracts economic resources today and invests them in the production of a slowly emerging consumption good – a stable climate that is hospitable to human life. Today's resources are invested via policies that, for example: increase prices for carbon-intensive goods and services (e.g., carbon taxes and emissions trading schemes), subsidize low-carbon technology (e.g., feed-in-tariffs for renewable

[5] Institutions have received more attention in studies of non-climate related environmental policies (e.g., Crepaz 1995; Jahn 2016; Scruggs 2003).

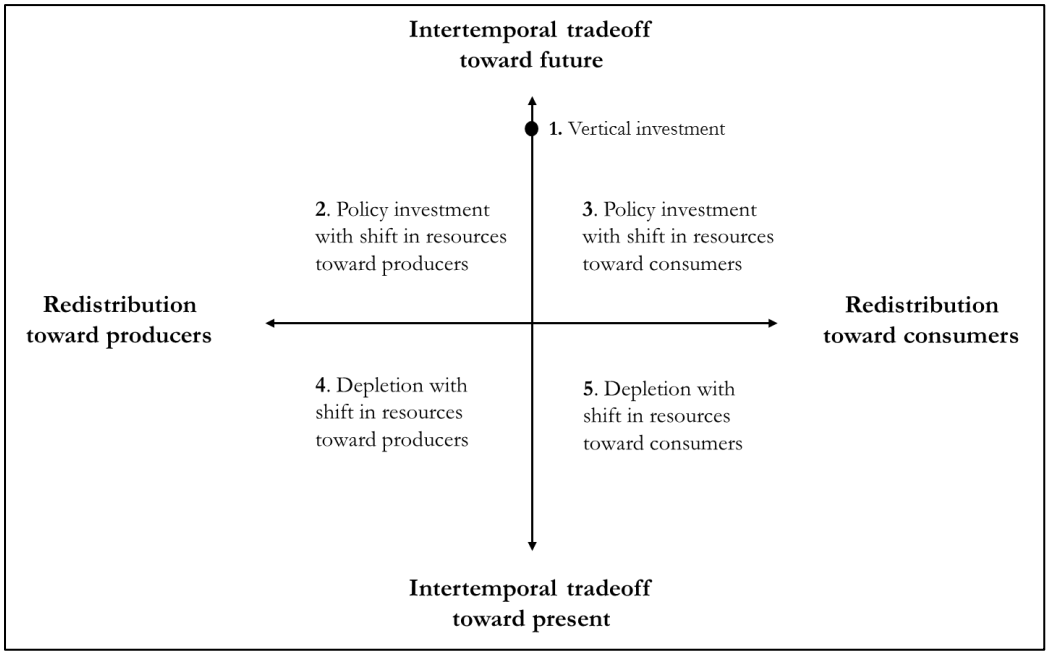
energy), compel firms to invest in cleaner production process (e.g., performance standards), and increase government R&D expenditure. Distributive conflict arises as governments decide whether and how much of today's resources to invest. The level of climate policy investment can be conceptualized as the overall stringency of a given country's policy portfolio and measured by the level of short-term costs imposed on economic actors.

The second dimension of distributive conflict is cross-sectional (horizontal axis in Figure 2.2). The short-term costs of long-term climate policy investments must be borne by economic actors today. Distributive conflict arises as governments decide which actors are to pay. For parsimony, there are two primary groups of actors. The first is *consumers*. These are private households that spend part of their budget on carbon-intensive goods and services, particularly fossil fuels for transportation (e.g., gasoline and diesel), natural gas for cooking and heating, and carbon-based electricity. Crucial to climate politics is the fact that in democracies consumers are also voters.

The second group is *producers*. These are industrial actors who produce carbon-intensive goods and services and will therefore bear the costs of policies that aim to reduce carbon pollution. A number of different types of firms fall into this category (Kelsey 2018). The first are producers of carbon itself – oil, natural gas, and coal companies. For them, climate policy is an existential threat. Second are "convertible" firms, such as automakers and utilities, which currently produce carbon-intensive goods but could feasibly switch manufacturing to non-polluting products (e.g., from coal-fired electricity to wind power). For them, climate policy primarily involves initial transition costs. Last are firms that use carbon-intensive inputs (e.g., steel companies) or emit carbon as part of the production process (e.g., cement and chemicals manufacturers). They cannot change what they produce (like convertible firms), but only how. For them, climate policy investments make production costlier. A final category are policy "winners". These are firms that produce low- or no-carbon goods and services (e.g., electric vehicle manufacturers). However, since they benefit from climate policy they can be expected to support policy investments, and therefore do not represent a cost-bearing group to be overcome.

For governments, the basic distributional choice is whether to impose short-

Figure 2.2. Possible distributional profiles of climate policy investment[6]



term costs *directly* on producers, consumers, or some combination of the two.[7] For example, when implementing a carbon tax politicians can decide to apply the same rate to both groups, impose a higher rate on industry (e.g., the UK Climate Change Levy), or impose a higher rate on consumers (e.g., the Swedish carbon tax until 2018).

Climate change policy offers a unique distributional profile that sets it apart from other long-term policy investments. Most importantly, it is not technically feasible to redistribute the future benefits of a stable climate (or the costs of an unstable one).[8] These are global public goods (or bads) and will therefore be enjoyed equally by all social actors. This contrasts it from other long-term policies, such as pensions policy, which offer actors the possibility of redistributing the future costs and benefits of policy change to one group over another (Jacobs 2011). This matters because it shapes the distributional strategies that actors pursue, particularly cost-bearing organized groups. Without the possibility for such groups to fully capture the future benefits of policy investment, the political economy of climate change should be driven primarily by cross-sectional distributive conflict. That is, by the opportunities for and constraints on

[6] Adapted from Jacobs (2011, 20).
[7] I am concerned with the political decision of distributing the direct costs of climate policy. I therefore leave aside a detailed discussion of the secondary question of cost incidence, which will depend on the price elasticity of supply and demand.
[8] This is a simplification in the interest of parsimony. To be sure, depending on the context, the relative gains from climate policy may not be the same across all actors or over time.

cross-sectional distribution today of the short-term costs of policy between producers and consumers.

Governments wanting to make long-term climate policy investments therefore need to be successful in pursuing a distributive strategy that charts a stable and credible allocation of short-term costs between industry and voters. There are risks on both fronts. Increased costs for voters may produce electoral backlash that removes the governing party(ies) from power. Increased costs for industry may cause them to counter-mobilize and block policy change, thwarting the government's policy agenda. It may also mean that they leave the country, taking jobs with them. An emerging body of research on long-term policymaking provides insight on the political economy of overcoming such risks (González-Ricoy and Gosseries 2016; Jacobs 2011, 2016; Jacobs and Matthews 2012, 2017; Jacobs and Weaver 2015; Lindvall 2017; Mackenzie 2016). First, politicians' willingness to impose short-term costs on voters should depend on the extent to which they enjoy some level of *electoral safety*, which can insulate them against potential electoral backlash. Secondly, in the case of producers, governments require the capacity to *overcome opposition from organized groups* that will bear the short-term costs of climate policy investment. Taken together, these two necessary conditions highlight two causal channels of climate change politics. The first is electoral, linking politicians to voters. The second concerns the role of organized interests. In the next section I theorize how institutions should systematically structure these necessary conditions, and by doing so, shape distributive politics along both channels and drive variation in climate policy investment across countries.

4. Institutions and long-term climate policy investment

4.1. Electoral rules and electoral safety

A number of strands of existing research point to why we should expect that voters will dislike bearing the short-term costs of climate change policy. First, individuals exhibit well-documented cognitive patterns that bias them against policy investment (Jacobs 2011, Ch.2). Negativity bias will tend to focus individuals' attention on negative information (short-term costs) rather than positive (long-term benefits), while a loss-aversion bias means they tend to weight potential losses more than prospective gains of equal size (Baumeister et al. 2001; Kahneman, Knetsch, and Thaler 1991). Second,

individuals tend to have relatively high discount rates, placing more value on consumption today relative to consumption in the future (Frederick, Loewenstein, and O'Donoghue 2002). Similarly, survey experiments show that individuals place more value on policy-related benefits that come about quickly versus those that arrive far in the future (Jacobs and Matthews 2012). Lastly, in countries diverse as Germany (Diekmann and Preisendörfer 2003), Switzerland (Tobler, Visschers, and Siegrist 2012), Sweden (Brannlund and Persson 2012; Jagers and Hammar 2009) and the US (Shwom et al. 2010) survey research consistently finds that individuals dislike environmental policies, including climate policies, in proportion to the personal costs they entail (for a review see Drews and Bergh (2015)). Taken together, these insights highlight the significant political risks of imposing short-term costs on voters, which politicians themselves should be keenly aware of. The extent to which they drive politicians' behaviour should vary, however, depending on electoral safety. When politicians perceive themselves to have a relatively low risk of losing office for imposing short-term costs associated with policy investments on constituents, they should be more likely to do so (Garrett 1993; Jacobs 2011; Tvinnereim 2013).

Institutions should systematically structure electoral safety across countries, particularly electoral rules. This should occur via two causal mechanisms. First, proportional (PR) electoral rules tend to dampen electoral competition, or the expected probability that the governing party (or largest party in the governing coalition) loses it seats plurality in the next election (Kayser and Lindstädt 2015). They do so by decreasing seats-votes elasticities, or the marginal expected gains in a party's seat share in the national legislature for a given increase in the party's national vote total (Rogowski and Kayser 2002). Lower electoral competition decreases the political risk of directly imposing costs on voters. Indeed, for this reason PR rules are associated with higher consumer prices (e.g., Chang et al. 2010; Rogowski and Kayser 2002).

Secondly, electoral rules shape accountability via their effect on clarity of responsibility and the ability of voters to sanction governments. PR rules tend to decrease clarity of responsibility, making it more difficult for voters to assign responsibility for policies they dislike, while majoritarian rules increase it (Powell and Whitten 1993). PR often generates coalition governments, while majoritarian rules usually result in single-party ones. All else equal, voters should find it easier to punish single-party governments (Hobolt, Tilley, and Banducci 2013; Powell and Whitten 1993). Not least because coalition governments enable governing parties to shift blame

for unpopular policies onto their coalition partners. Moreover, dynamics of coalition bargaining under PR means that significant policy decisions tend to enjoy cross-party consensus. Such broad support further blurs lines of responsibility for voters. PR rules also make it difficult to sanction governments because even if voters substantially reduce their support for a party, there is no guarantee that it will not end up in the governing coalition after the election; for example, as a result of coalition bargaining (Powell 2000, Ch 3). However, a substantial loss of support for the governing party under majoritarian rules will almost certainly remove it from power.

The overall result is that PR rules should better insulate politicians from marginal changes in the electoral preferences of unhappy consumers, which should reduce the political risk of imposing short-term costs on them. Conversely, under plurality rules, politicians from two major parties face highly competitive contests over the median voter, generating strong incentives to pay close attention to these voters' short-term preferences for low prices. This should be especially true for emissions-intensive goods and services (e.g., gasoline and electricity) since they tend to make up a large proportion of household budgets.It is important to note that my arguments diverge from previous work regarding the relationship between electoral rules and climate policy. Existing studies have emphasized a partisan effect, whereby PR rules open up possibilities for green parties to win parliamentary seats and influence policymaking (Harrison and Sundstrom 2010; LaChappelle 2011). My arguments on the other hand emphasize electoral incentives – a fundamental causal mechanism that should affect political decision-making independent of partisanship. Furthermore, they are consistent with a recent turn in climate politics research, which builds on long-standing work in comparative political economy about the relationship between electoral rules and consumer prices. For example, Lipscy (2019) shows how, in the case of energy efficiency policy, electoral rules systematically structure electoral insulation, which shapes the ability of politicians to impose diffuse costs on household energy consumers.

4.2. Interest group intermediation and organized opposition

Even if politicians experience electoral safety, they still require the capacity to overcome opposition from organized groups that will bear the short-term costs of policy investments (Jacobs 2011, Ch. 2). Indeed, one key obstacle to climate policy that is

often hypothesized in the literature is the ability of organized opponents, especially emissions-intensive industries such oil, gas, and coal-fired utilities, to block policy change (e.g., Hughes and Urpelainen 2015). To be sure, a number of factors will influence the ability of governments to overcome opposition from these groups and enact long-term policy investments into law; for example, institutional veto points, the centralization of policymaking, and their size relative to clean sectors (Cheon and Urpelainen 2013; Jacobs 2011). Here I explore another: institutions that structure interactions between cost-bearing organized groups and the government, particularly corporatism.

In its stylized form, corporatism is a coordinated and compromise-oriented arrangement for structuring interactions: (1) between firms and (2) between industry and government (Crouch 1993; Iversen and Soskice 2009; Schmitter 1974). It includes a number of dimensions. The focus here is on concertation, or the extent to which institutions grant relatively few encompassing, hierarchal, and monopolistic peak associations privileged access to pre-legislative government policymaking via long-standing linkages to political parties and the public administration. Conceptually, concertation constitutes institutionalized political exchange between privileged interest groups and the state (Crouch 1993; Öberg et al. 2011). Each actor controls resources that the other desires. Governments control legislation, public expenditure, and the ability to privilege selected organizations. Organized groups can shape the opinions of their members, which influences public support for government policy and votes for the governing coalition. Concertation involves industry exchanging political support for the government's agenda in return for influence over the shape and rate of policy change. Industry participates in such exchanges because firms have a material interest in maintaining a cooperative regulatory environment. Deviations could unsettle existing policy compromises across a range of other issues important to industry.

For governments wanting to take action on climate change, concertation should increase the likelihood of successful long-term policy investment because it increases the likelihood of credible compensation for cost-bearing organized groups. When undertaking significant reforms, especially those that entail major distributive conflict such as climate policy, governments have two general options for dealing with powerful cost-bearing groups: compensate them or ignore them (Lindvall 2017). In the case of climate policy, compensation can take a variety of forms: for example, select industries can be wholly or partially exempted from compliance costs or they can receive refunds

and subsidies. The challenge for governments is that compensation involves its own set of political costs. It may make the policy less effective (dilution costs), be expensive to administer (deadweight costs), take too much time and energy to negotiate (transaction costs), or make other important political actors, especially voters, react negatively (audience costs) (Lindvall, 2017, Ch.3).

Crucially, concertation should influence these costs. First, deliberation between the government and a limited number of highly organized peak associations, with the authority to decide on behalf of their members and bind them to the terms of any future agreement, should reduce the transaction costs of negotiating a stable and credible long-term distributive bargain. Moreover, corporatist networks are based on long-standing and frequent face-to-face interaction between industry, trade unions, and government, which promotes trust – a key ingredient for further reducing transaction costs (Lindvall 2017, Ch.3). Second, negotiations typically take place in private and outside of the legislative process (Martin 2013). Indeed, the threat of legislative action, which would exclude interest group preferences, is often used as a penalty for inaction. Holding negotiations in secret can reduce audience costs (Lindvall 2017, Ch.3). Lastly, corporatist networks are well-established in many democracies and have long been used to negotiate compensation for policy change (e.g., Martin 2015a). As a result, compensation in the case of climate policy should require little in the way of additional administrative resources and therefore few deadweight costs. Lastly, compensation agreements are credible. They are usually supported by all political parties, reducing the likelihood that they will be upended by a future government. At the same time, individual firms and unions are bound to them via their representative peak associations. For both sides, deviating from the agreement jeopardizes future cooperation.

Compensating, rather than ignoring, cost-bearing groups should lead to higher long-run climate policy investment (and therefore lower dilution costs) via three related causal pathways. The first channel regards the sequencing of costs for industry. By defusing organized opposition, compensation makes it more likely that governments have early success in enacting climate policy into law. To be sure, these early investments are likely to impose few costs on carbon-intensive industry. However, through ongoing negotiations we should expect incremental increases in stringency over time that gradually increase costs for polluters. Indeed, more stringent climate policy

often becomes possible only after the adoption of early, moderate, and politically feasible policy options (Kelsey 2018; Meckling et al. 2015).

Second is electoral politics. Remember that the government exchanges compensation in return for industry's support of their climate policy agenda. Powerful economic actors have the resources and capacity to shape public perceptions of government action on climate change. Eliciting business support means they should be less likely to mobilize public conflict. In particular, they should be less likely to attempt to influence voters' climate policy preferences by drawing attention to short-term policy costs. This works to reduce the political salience of such costs. Under these conditions, government should find it less risky to adopt policies that impose costs on voters, which in turn increases the level of overall policy investment.

Last is policy reversal. As mentioned, agreements regarding climate policy investments between government and cost-bearing groups will be long-term in nature and agreed to by all political parties and peak associations for capital and labor. Moreover, cooperative veto points are diffuse, offering all sides a say over future policy change (Birchfield and Crepaz 1998). Changes will therefore tend to be incremental and negotiated, rather than radical or unilaterally imposed by a new government after an election. The likelihood of wholesale policy reversal is low, which increases long-run average levels of policy investment.

Conversely, when governments lack institutionalized bargaining with cost-bearing organized groups, as is the case in majoritarian democracies with interest group pluralism, the political costs of negotiating compensation are likely to be high. Additionally, under these conditions governments will tend to be more insulated from such groups. First, groups lack institutionalized access to pre-legislative policymaking and will therefore find it difficult to exploit institutional veto points. Second, a governing party(ies) wishing to adopt stringent climate policy will tend not to rely on political support from carbon polluters, almost by definition. As a result, these governments are more likely to ignore such groups, all else equal.

This strategy should make it more politically attractive for governments to impose costs on industry. For this reason, radical, disruptive policy change is more likely under pluralist interest group institutions, since high costs can be imposed on carbon polluters shut out of policy design negotiations (Mildenberger 2020). However, counterintuitively, this distributive strategy is likely to result in comparatively lower long-run climate policy investment. First, it will tend to antagonize powerful economic

actors. Lacking pre-legislative influence over policy design, especially regarding compensation, these firms will tend to view any climate policy investment as a zero-sum distribution of resources away from them, and therefore as a threat. As a result, they will have few reasons to support it. Instead, in an effort to exercise influence during the legislative phase, they face strong incentives to counter-mobilize, expanding the scope of distributive conflict and turning climate change into "noisy politics" (Culpepper 2010). They are likely to employ two strategies: (1) intensely lobby individual legislators in an attempt to win particularistic policy concessions or block policy change outright and (2) influence voters' climate policy preferences via mass information campaigns that increase the salience of short-term costs or sew doubts about climate science. As a result, climate change is likely to become highly politicized and the focus of intense public conflict. With the costs of climate policy investments made highly salient for voters, governments will find it difficult to impose even moderate costs on them for fear of electoral backlash. Secondly, and perhaps more importantly, ignoring cost-bearing groups does not make them go away. Once their political allies regain control of government they are likely to reverse course and repeal climate policy. The overall result should be a boom-and-bust policy cycle and intense public conflict. It should also reduce policy credibility as social actors begin to anticipate policy reversal.

These arguments offer a causal mechanism – compensation – which links interest group intermediation to long-term climate policy investments. By doing so, they theoretically situate findings from manifold country case studies that highlight the role of peak associations and corporatist bargaining in climate policymaking in: Scandinavia (Daugbjerg and Pedersen 2004; Kasa 2000; Midttun and Hagen 1997; Mildenberger 2020), Austria (Brand and Pawloff 2014; Hermann, Hogl, and Pregernig 2016; Tobin 2017), the Netherlands (Hermann, Hogl, and Pregernig 2016; Kemp 2010) and Germany (Hatch 1995; Meckling and Nahm 2018b; Renn and Marshall 2016). They also explain why governments in countries such as Denmark, Germany, the Netherlands, and Switzerland have been more successful at negotiating voluntary climate change-related agreements with industry compared to the US and France (Baranzini and Thalmann 2004; Delmas and Terlaak 2002). Lastly, they are consistent with research that demonstrates a positive relationship between corporatism and environmental performance (Jahn 2016; Scruggs 2003).

While these previous cross-national studies have described a relationship between a general conception of corporatism and climate policy (e.g., Tobin 2017). My

arguments go further by providing a clear causal pathway that links one feature of corporatism – concertation – to higher levels of climate policy investment via compensation for cost-bearing groups. They are most closely related to forthcoming work by Mildenberger (2020). Though they diverge in important ways. Mildenberger argues that corporatism stabilizes the political influence of carbon-intensive policy losers, which inhibits disruptive, non-incremental policy change and locks in low policy stringency. That is, corporatism is associated with excessive policy dilution costs. This view implicitly assumes that costs for producers are *the* measure of policy stringency. While these costs are surely important, I contend that the overall stringency of a country's policy portfolio crucially depends on the distribution of short-term costs between both producers *and* consumers. Eliciting the political support of industry via compensation can enable governments to increase costs for voters and, over time, incrementally increase costs for industry. My arguments therefore predict comparatively higher levels of long-run climate policy investment in corporatist settings.

4.3. Institutional complementarities

I have argued that both electoral rules and concertation have independent effects on long-term climate policy investment. Here I theorize how their joint presence generates powerful complementarities that reinforce these effects. Across the high-income democracies, electoral rules tend to go together with forms of interest group intermediation. Indeed, they co-evolved for important historical reasons and constitute the institutional basis of democratic and capitalist diversity (Cusack, Iversen, and Soskice 2007; Hall and Soskice 2001; Iversen and Soskice 2009; Lijphart 2012; Martin and Swank 2012). In "consensus" democracies with coordinated market economies, PR rules co-occur with concertation. Conversely, in "majoritarian" democracies with liberal market economies, first-past-the-post electoral rules co-occur with interest group pluralism.

The complementarity between PR rules and corporatism should simultaneously reduce the political risks of imposing costs on consumers *and* producers. Because PR rules increase electoral safety, they decrease risks associated with shifting costs toward voters, giving governments the option to do so. This flexibility opens up critical room to maneuver when negotiating compensation with cost-bearing groups. By shifting short-term costs toward consumers, governments can offer policy exemptions to

industry and still retain the overall integrity of the policy investment. In this way, the institutional complementary between electoral rules and corporatism can prevent excessive dilution costs. At the same time, offering compensation to powerful cost-bearing organized groups reduces the likelihood that distributive conflict enters the public arena or that industry increases the salience of short-term costs for voters, which should make it easier for governments to impose such costs on them. To be sure, this type of policy investment, which distributes higher costs toward voters, is less stringent than one that imposes similarly high costs on both voters and industry. However, I have tried to show that, given its political risks, that type of distributive bargain is rarely feasible for governments, at least initially.

The complementarity between plurality electoral rules and interest group pluralism has a different logic. First-past-the-post rules decrease electoral safety and thereby increase the political risk of imposing costs on voters, which will tend to take this distributive channel off the table. For governments serious about climate policy investment, the only other available channel is to impose costs on industry. But because they lack institutionalized pre-legislative bargaining with cost-bearing groups and parties in these governments will rarely rely on the political support of carbon-intensive firms, government will tend to ignore policy losers. Moreover, this strategy prevents excessive dilution costs. Since governments will be reticent to impose costs on voters, they have to impose substantial costs on industry or the policy investment will have little stringency. Additionally, by imposing costs on industry, especially intermediaries such as electricity and fuel suppliers, the link between consumers' short-term losses and the policy that produced them can be obscured, hiding the costs of policy investments and decreasing electoral accountability. However, as described above, the risk is that, in an effort to influence policy design from the outside in, industry counter-mobilizes and expands the scope of conflict. The fundamental problem is that a strategy of ignoring losers, which will be politically attractive in this institutional setting, does not reconcile distributive conflict, but instead amplifies and expands it. The overall result should be a deeply adversarial and conflict-ridden policy process that produces lower levels of long-run climate policy investment.

These arguments predict that consensus democracies are more likely to implement and sustain climate policy. Climate policy is a type of long-term policy investment and institutions in consensus democracies are more likely to provide governments the necessary conditions for making such investments. Indeed, in making

the case that consensus democracy is "kinder and gentler", Lijphart (2012, 291) himself provides evidence that consensus democracy is associated with higher environmental performance, though additional studies have found mixed results (Bernauer and Böhmelt 2013; Ozymy and Rey 2013; Poloni-Staudinger 2008). Moreover, a number of studies have hinted that these types of political economies are better able to address a wide range of long-term policy challenges (e.g., Birchfield and Crepaz 1998; Cusack, Iversen, and Soskice 2007; Crepaz 1996; Hall and Soskice 2001; Lindvall 2017; Martin 2015b). My arguments build on this work by offering a set of causal mechanisms that link the institutions of consensus democracies to long-term policy outcomes.

4.4. Observable implications

The arguments above offer a number of observable implications regarding the effects of institutions:

- *Electoral rules:*
    - Proportional electoral rules are associated with:
        - higher levels of overall climate policy investment
        - higher policy costs for consumers relative to producers
- *Interest group intermediation:*
    - Concertation is associated with:
        - higher levels of overall climate policy investment
        - higher costs for producers
        - higher costs for consumers relative to producers
- *Institutional complementarities:*
    - Levels of climate policy investment will be highest (lowest) in countries where PR rules and concertation are jointly present (absent)

5. Empirical analysis

5.1. Research design

I am interested in explaining why some advanced capitalist democracies do more than others to address climate change. I therefore employ a comparative, cross-national research design that examines between-country differences in climate policy

investments, as well as within-country differences over time when data allows. The first step is to collect a valid cross-national measure of long-term climate policy investment. Conceptually, climate policy investment is the amount of today's resources that are devoted to the provision of a stable future climate. This "amount" can be measured by policy stringency, or the short-term costs that policy imposes on economic actors. More stringent policies are more costly and therefore represent a larger investment of today's resources. To measure policy stringency I utilize new data from Althammer and Hille (2016) who estimate the "shadow price" of carbon-based energy for 33 sectors (all primary, secondary, and tertiary sectors) between 1995 and 2009.[9] Government policy drives a wedge λ_E between an economic actor's shadow price Z_E for an additional input of carbon-intensive energy E (energy from electricity, coal, natural gas, diesel, gasoline, heavy fuel oil, and light fuel oil) and the energy source's "undistorted" world market price p_E, so that:

$$Z_E = p_E + \lambda_E \tag{1}$$

The wedge λ_E is then a measure of all government policy that changes the price of carbon-intensive energy inputs. A positive wedge indicates that policy raises the price above its "undistorted" market price, while a negative wedge indicates that policy subsidizes usage of the energy source. The benefit of this approach is that it captures all policies that affect the price of carbon-intensive energy inputs (e.g., taxes, subsidies, regulations, and cap-and-trade schemes) and summarizes the stringency of a country's climate policy portfolio across the economy regardless of its multidimensionality. Because I am first interested in a single economy-wide measure of policy investment I calculate the average wedge λ_E across all sectors *s* in country *i* in year *t*. Throughout the paper I refer to this measure as "overall climate policy investment".

A further benefit of the data is that it is disaggregated by sector. Most important for my purposes are the separate stringency estimates for industrial and service sectors. Because the industrial estimates rely on industrial energy prices and the services estimates on household prices, I use each as a proxy for the distinct short-term costs imposed on industry ("costs for producers") and voters ("costs for consumers"), respectively.[10] Lastly, I calculate the difference between them to measure the

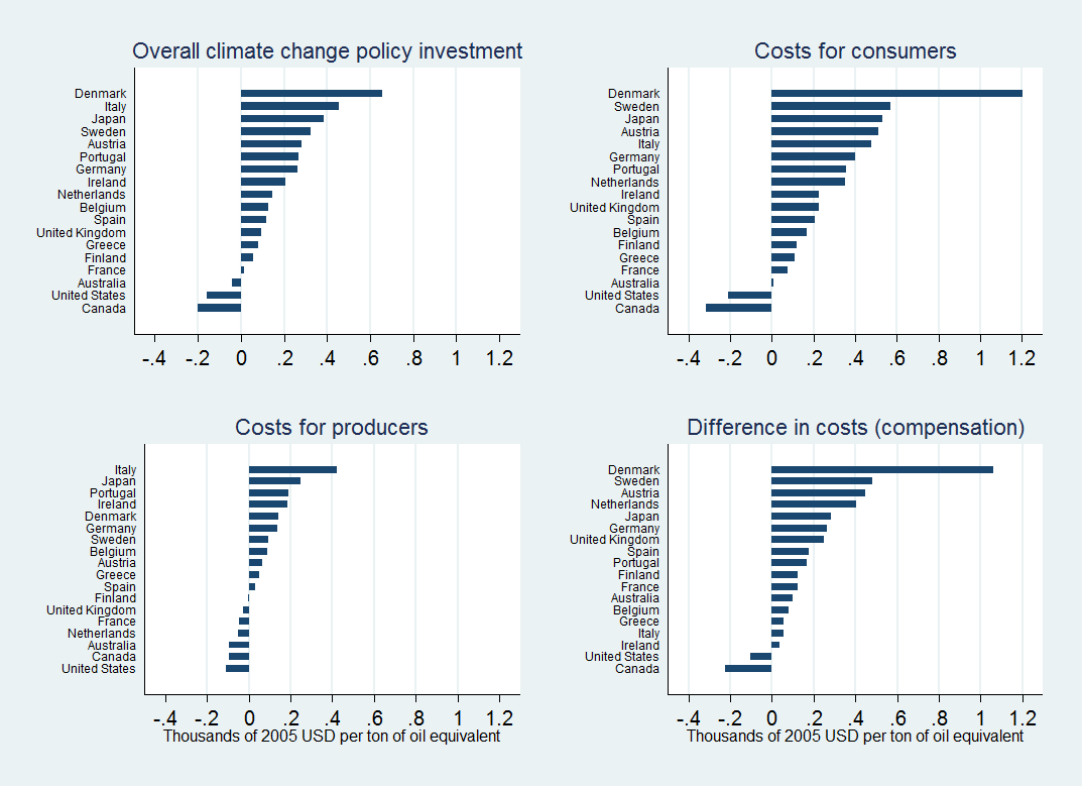
[9] Thank you to Erik Hille for making the data available to me.
[10] For a full list of sectors see Appendix A1.

distribution of costs between consumers and producers ("difference in costs"). When this measure is zero, equal costs on are imposed on both groups. However, higher values indicate higher costs for consumers relative to producers. Conceptually, it provides a measure for the level of compensation enjoyed by producers.

To my knowledge, this paper is the first to use this data. A key limitation of previous quantitative cross-national studies is the measurement of climate policy, whether as a count of climate-related laws (Fankhauser, Gennaioli, and Collins 2015b), a subjective score of policy stringency (Madden 2014; Fredriksson and Neumayer 2013), or a measure of general environmental policy stringency (Rafaty 2018). By relying on objective and comparable sector-level energy price data, the shadow price approach overcomes these previous barriers. To date, it is the most detailed measure available of climate policy stringency. Though one drawback is that it does not capture policies that have no effect on the price of carbon-intensive energy inputs, such as voluntary measures undertaken by firms. Nor does it measure policies that target greenhouse gases apart from carbon dioxide.

Figure 2.3 shows the average level of overall climate policy investment across countries between 1995 and 2009 (top left quadrant). Government policy in almost all countries increases the price of carbon-based energy above its market price. However, the amount to which it does so varies considerably, from an average of 655 USD (2005 dollars) per ton of oil equivalent (toe) in Denmark to 13 USD per toe in France. In Australia, Canada, and the US, government policy acts as a subsidy. That is, rather than being an investment (an intertemporal tradeoff toward the future), policy generates an intertemporal tradeoff toward the present, depleting the future resource of a stable climate. Examining the distribution of costs between consumers and producers reveals that almost all countries distribute some costs toward consumers, except Canada and the US where again policy subsidizes the use of carbon-based energy for voters (top right quadrant). The case for producers is mixed. In some countries policy imposes costs on industry, while in others it acts as a subsidy (bottom left quadrant). Lastly, we see that in almost all countries consumers pay more of the short-term costs of climate policy investment, except for Canada and US where producers pay more than consumers (bottom right quadrant).

Figure 2.3. Climate change policy investment across countries (avg.1995-2009)



5.2. Electoral rules and climate policy investment

To test the relationship between electoral rules and climate policy investment, I plot electoral proportionality against overall policy stringency. To measure the proportionality of electoral rules I use data from Lijphart (2012) on average long-run electoral disproportionality from 1981-2010. We see a negative relationship, as expected (Figure 2.4). Countries with more (less) proportional rules have higher (lower) levels of overall climate policy investment. To better identify the effect of electoral rules, let us examine their impact on the distribution of costs between consumers and producers. My arguments predict that PR rules are associated with higher costs for consumers, but not necessarily producers. Similarly, as rules become more disproportional politicians should distribute short-term costs more evenly between the two groups. Plotting electoral rules separately against costs for producers and consumers we find evidence for these arguments (Figure 2.5). Electoral rules have a differential relationship to costs for consumers versus those for producers. When rules are more proportional voters pay more than industry. However, this difference shrinks as rules become more disproportional.

Figure 2.4. Electoral rules and climate policy investment (with 95% CIs) (avg 1995-2009)

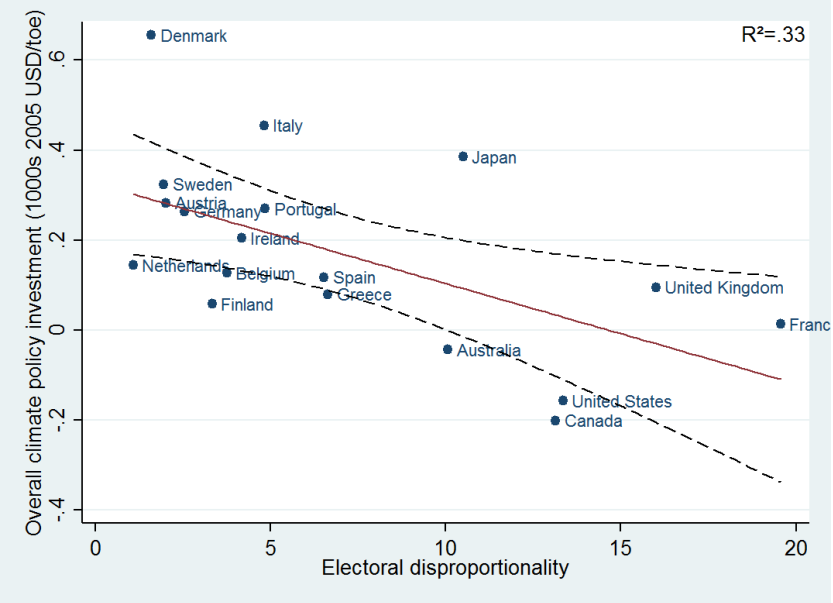
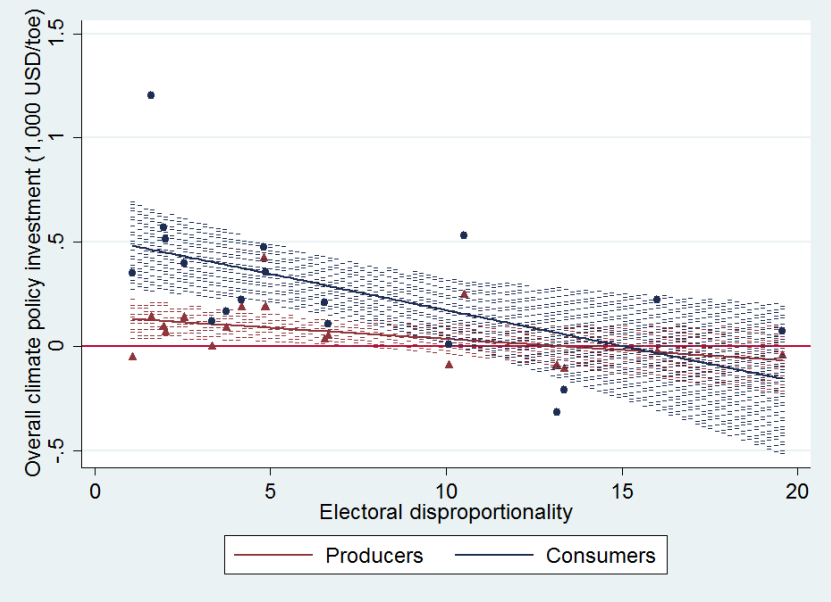


Figure 2.5. Electoral rules and distribution of costs (with 95% CIs) (avg 1995-2009)



Electoral proportionality is only substantively meaningful across countries, since few countries change electoral rules over time.[11] This fact limits possibilities for more sophisticated analysis. However, I test the robustness of the identified relationships using OLS models to regress averages for the four measures of climate policy

[11] Japan and Italy changed electoral rules during the sample period. In the case of Japan, it occurred in 1996. In the case Italy, it was 2005. Having only two countries with few years either before or after the change prevents any meaningful estimate of its effect.

investments over the sample period on average electoral disproportionality and a set of controls. The drawback of this approach is that it leaves only 18 observations (one for each country), which limits the model's degrees of freedom and statistical power. I therefore choose a parsimonious and theoretically motivated set of controls.

A key potential confounder in my analysis is membership in the European Union (EU). The EU has been active in promoting climate change policy in its member states, especially after 2000.[12] However, recent studies find an ambiguous relationship between the EU and domestic policy (Avrami and Sprinz 2019). Moreover, it is unclear to what extent EU decisions are exogenous to the domestic politics of the member states. Indeed, the EU's policy agenda is set by the European Council, which is comprised of the heads of member states, and policy proposals require its approval to become EU law. A second set of confounders are institutional veto points, especially those that constitute competitive veto points which can enable climate policy opponents to block policy change (Birchfield and Crepaz 1998; Harrison and Sundstrom 2010; Karapin 2016; Madden 2014). These include federalism, strong bicameralism, and presidentialism. To control for these institutional features while maintaining parsimony, I generate an additive index using data from Armingeon et al. (2016a). The green policy preferences of governments may also matter. I control for the "greenness" of governments using a new measure from Jahn (2016), who estimates the extent to which governing party(ies) are green- versus growth-oriented based on data from the Comparative Manifestos Project. In addition to capturing green policy preferences, the measure should provide a proxy for underlying voter preferences regarding the environment – if we assume that party preferences track voter preferences. A valid cross-national measure of public opinion for the time period under analysis is not available.[13] A country's production of fossil fuels may influence the government's decision to increase the price of carbon-based energy (Harrison 2015; Hughes and Urpelainen 2015). I therefore control for domestic fossil fuel (coal, oil, and natural gas) production per capita. Lastly, I control for the politics of "economy versus environment", as well as general economic conditions, by including real GDP growth.[14]

Table 2.1 presents the results. The estimates confirm findings from the scatter plot. Countries with more disproportional rules (i.e., majoritarian rules) have lower

[12] Most importantly, the EU has adopted the Renewable Electricity Directive in 2001, ratified the Kyoto Protocol in 2002, and launched the EU Emissions Trading Scheme in 2005.
[13] See Appendix A7 for an analysis of available measures of public opinion.
[14] For descriptions of each variable and summary statistics see Appendix A2.

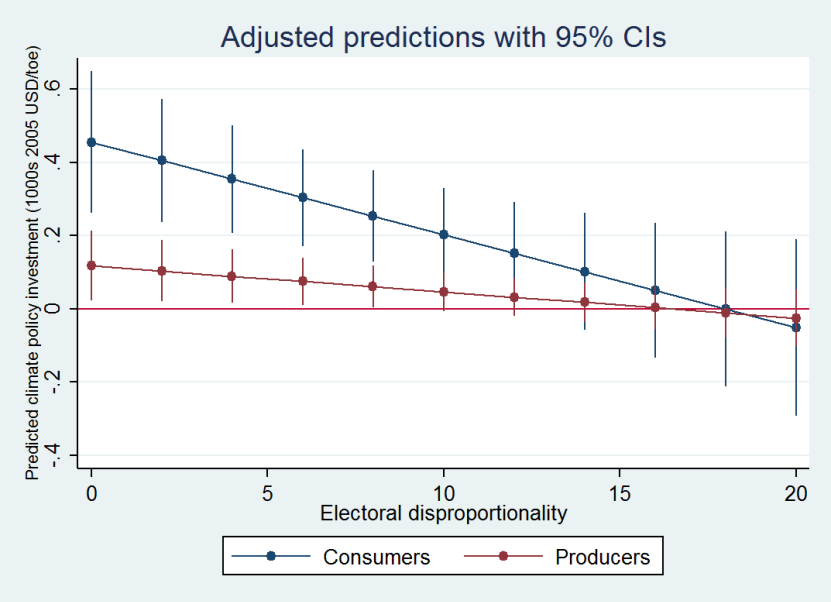
overall climate policy investment, all else equal (Model 1). Additionally, electoral rules have a differential impact on costs for consumers versus producers. A one-unit increase in average disproportionality is associated with a much larger decrease in costs for consumers ($25 per toe - Model 2), compared to those for producers ($7 per toe - Model 3), all else equal. Plotting the coefficients reveals the relationship more clearly (Figure 2.6). When rules are more proportional, costs for voters are predicted to be more than for industry, and this difference shrinks as rules become more disproportional. Indeed, at levels of disproportionality over ten there is no statistical difference between costs for consumers and producers. Lastly, we see that more proportional rules are associated with a larger difference in the distribution of costs between consumers and producers (Model 4). Taken together, the evidence offers support for the argument that electoral rules shape climate policy investments by structuring levels of electoral safety across countries. More specifically, the evidence suggests that electoral rules influence the extent to which policy investments are, in the language of Jacobs (2011), "vertical" (Option 1 in Figure 2.2) or generate simultaneous cross-sectional and intertemporal shifts in resources (Options 2 and 3).

Table 2.1. Electoral rules and climate policy investment: Cross-sectional OLS models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Electoral disproportionality	-0.0160***	-0.0253***	-0.00715**	-0.0182**
	(0.00448)	(0.00807)	(0.00310)	(0.00812)
EU Membership	0.0297	0.174	-0.107*	0.282
	(0.0980)	(0.173)	(0.0537)	(0.160)
Institutional constraints	-0.0261	-0.0350	-0.0176	-0.0174
	(0.0189)	(0.0333)	(0.00990)	(0.0304)
Green policy preferences	0.00759	0.0153*	0.000305	0.0150*
	(0.00478)	(0.00778)	(0.00325)	(0.00694)
Real GDP growth	-0.0738	-0.126*	-0.0240	-0.102*
	(0.0500)	(0.0687)	(0.0408)	(0.0517)
Fossil fuel production	-0.00877	0.00728	-0.0239**	0.0312
	(0.0162)	(0.0274)	(0.00834)	(0.0235)
Constant	0.533***	0.693**	0.380***	0.313
	(0.149)	(0.264)	(0.0884)	(0.248)
R^2	0.684	0.653	0.541	0.524
N	18	18	18	18

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2.6. Electoral rules and distribution of policy costs



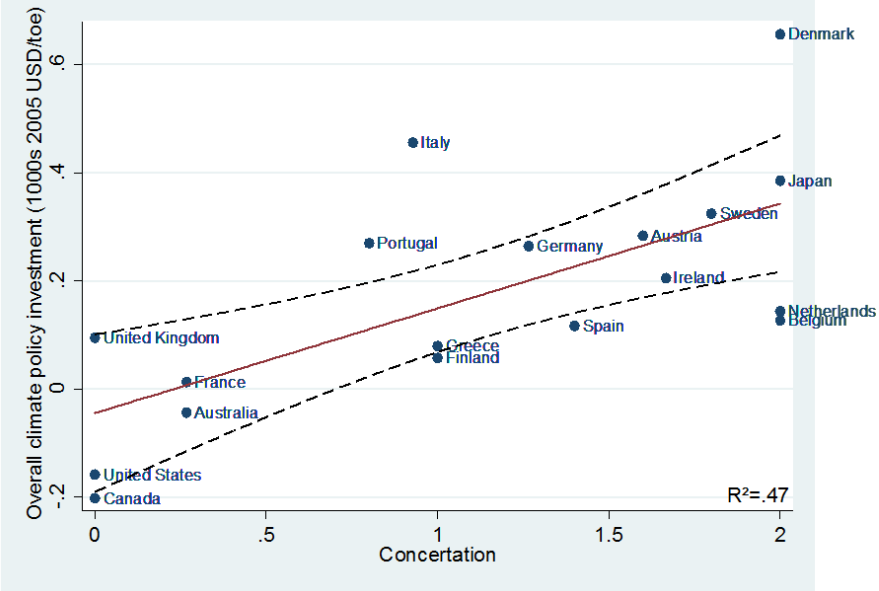
5.3. Interest group intermediation and climate policy investment

I turn next to testing arguments concerning the relationship between interest group intermediation and climate policy investment. To do so, I first collect data on the degree of concertation between the government and economic actors from Visser (2015). The variable ranges from 0-2 and measures the routine involvement of employers and labor unions in policymaking. Conceptually, it should provide a valid measure of the degree to which organized groups enjoy privileged access to climate policymaking – my primary variable of interest. Before using the data, I make one change. Visser (2015) codes Japan as zero for all years of the sample. This is due to the country's unique system of "corporatism without labor" (Lehmbruch 1984). However, a variety of case studies have shown the close relationship between highly organized industry associations and the government, especially the Ministry of Economy, Trade and Industry (METI) (e.g., Lipscy 2019; Mildenberger 2020). Because this is the phenomenon I am looking to measure, rather than whether employers *and* labor unions are routinely involved in policymaking, I recode Japan as two.[15]

I first plot the cross-national relationship between policy stringency and concertation (Figure 2.7). As expected, we observe a positive relationship. In countries where organized interests are routinely involved in policymaking, overall climate policy

[15] However, the results do not significantly change when Visser's (2015) coding is used. See Appendix A3.

Figure 2.7. Concertation and climate policy investment (with 95% CIs) (avg 1995-2009)



is more stringent. Unlike electoral rules, levels of concertation vary in substantively meaningful ways both between countries and within them over time, which enables more rigorous empirical analysis.[16] To do so, I estimate a series of "between-within", or hybrid, regression models of the form (Bell and Jones 2015):

$$y_{it} = \beta_0 + \beta_1(x_{it} - \bar{x}_i) + \beta_2\bar{x}_i + \beta_3 z_i + (u_i + e_{it}) \quad (2)$$

where y_{it} is a measure of climate policy investment, x_{it} is a series of time-variant independent variables measured at the occasion level (i.e., country-year), and z_i is a series of time-invariant variables measured at the country level. β_1 is the within-unit effect (relying on variation within countries over time) and β_2 is the between-unit effect (relying on cross-sectional variation across countries) for each time-variant variable x_{it}. β_3 is the between-country effect of each time-invariant variable z_i. The "random" part of the model is in brackets and consists of u_i, the higher-level error term for each country *i*, and e_{it}, the occasion-level error term for each country *i* in year *t*. I include the

[16] Concertation varies over time in 9 of 18 countries in the sample: Australia, Austria, France, Germany, Ireland, Italy, Portugal, Spain, and Sweden. This should be kept in mind when interpreting the results.

same controls as above and estimate the model within the random effects framework using the approach described by Schunck (2013).[17]

The advantage of hybrid models is that they simultaneously estimate both between- and within-country effects. Indeed, the estimates of "within" effects are very similar to those obtained by fixed effects models. These estimates control for all time-invariant factors at the country level that may affect climate policy, such as other institutions (e.g., EU membership, institutional veto points, and electoral rules), as well as slow-moving variables like generalized trust and culture. I also include year fixed effects to control for all time-varying factors that affect all countries equally, such as international climate change negotiations, increasing global public awareness regarding climate change, and common energy and economic shocks. Lastly, I use robust standard errors clustered at the country level to correct for serial correlation and heteroscedasticity.[18]

Table 2.2 presents the results. Both between countries and within them over time, concertation is associated with higher overall policy investment (Model 1). Furthermore, the institution influences short-term costs for consumers and producers in distinct ways. Both between and within countries, concertation has a much larger and statistically significant effect on costs for consumers compared to producers (Models 2 and 3). This distributive effect can be seen clearly in Figure 2.8. At low levels of concertation, there is a smaller difference between costs imposed on consumers relative to producers. However, this difference increases with levels of concertation. This finding is confirmed by Model 4, which shows that concertation is significantly associated with a larger difference between the costs imposed on households versus industry. Put differently, concertation is associated with higher levels of compensation for industry, as predicted. The results are robust to the use of a more general composite measure of corporatism, a variety of additional controls, and additional specifications (cross-sectional OLS and country fixed effects).[19]

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[17] Random effects models are often criticized for not meeting their key identifying assumption that the residuals are independent of the covariates. Hybrid models overcome this issue (Bell and Jones 2015). Because they fully account for both within and between effects, no additional variance is absorbed by the error terms u_i and e_{it}, so they cannot be correlated with the covariates.

[18] There is an ongoing methodological debate regarding the number of units that is needed for valid inference when clustering standard errors, however there still no consensus on what that number is (see Cameron and Miller 2015, 341). Given my interest in the high-income democracies and availability of data for the dependent variable, my sample is naturally fixed at 18 countries.

[19] See Appendix A4.

Table 2.2. Concertation and climate policy investment: Hybrid models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Between-country effects				
Concertation	0.141**	0.264***	0.0254	0.238***
	(0.0565)	(0.0910)	(0.0377)	(0.0792)
EU Membership	0.108	0.309*	-0.0818	0.391***
	(0.0966)	(0.158)	(0.0542)	(0.132)
Institutional constraints	-0.0208	-0.0203	-0.0214*	0.00112
	(0.0156)	(0.0247)	(0.0114)	(0.0219)
Green policy preferences	0.00808	0.0174**	-0.000661	0.0180***
	(0.00492)	(0.00759)	(0.00307)	(0.00586)
Fossil fuel production	0.00363	0.0311	-0.0222***	0.0534**
	(0.0171)	(0.0285)	(0.00857)	(0.0237)
Real GDP growth	-0.0713**	-0.123***	-0.0229	-0.0996***
	(0.0361)	(0.0432)	(0.0349)	(0.0302)
Within-country effects				
Concertation	0.0460**	0.0740***	0.0197	0.0543***
	(0.0202)	(0.0283)	(0.0142)	(0.0185)
Green policy preferences	0.00239	0.00244	0.00235	0.000114
	(0.00191)	(0.00238)	(0.00182)	(0.00178)
Fossil fuel production	0.00480	0.0123	-0.00229	0.0145
	(0.0142)	(0.0191)	(0.0113)	(0.0126)
Real GDP growth	-0.00491	-0.00986	-0.000242	-0.00962
	(0.00463)	(0.00859)	(0.00287)	(0.00862)
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.368	0.384	0.277	0.273
R^2 – between	0.725	0.758	0.490	0.691
R^2 – overall	0.673	0.716	0.451	0.668
Countries	18	18	18	18
N	268	268	268	268

Notes: Robust standard errors in parentheses clustered at the country level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. EU membership and institutional constraints are excluded from the within-country part of the model because they do not vary over time within countries.

Contrary to expectations, I find that concertation has a positive, but not statistically significant, effect on costs for producers. One reason may be the widespread use of negotiated agreements in corporatist countries. Since the early 1990s, governments in countries such as Denmark, the Netherlands, and Germany have relied on voluntary commitments by industry to reduce CO_2 emissions instead of implementing policy, such as fossil fuel taxes (Baranzini and Thalmann 2004; Delmas and Terlaak 2002). As mentioned, one drawback of the policy stringency data is that it does not capture these types of government actions. Still, plotting industrial policy

Figure 2.8. Concertation and distribution of costs between consumers and producers

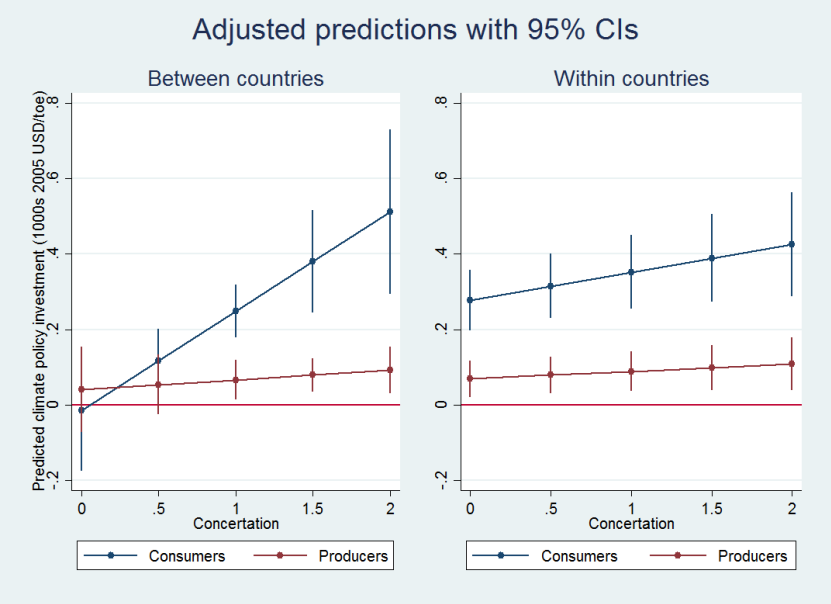
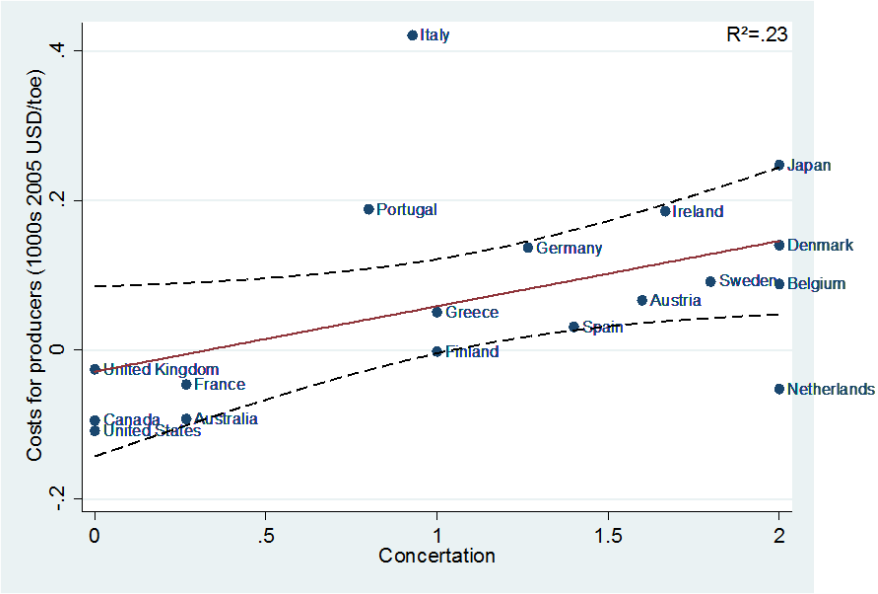


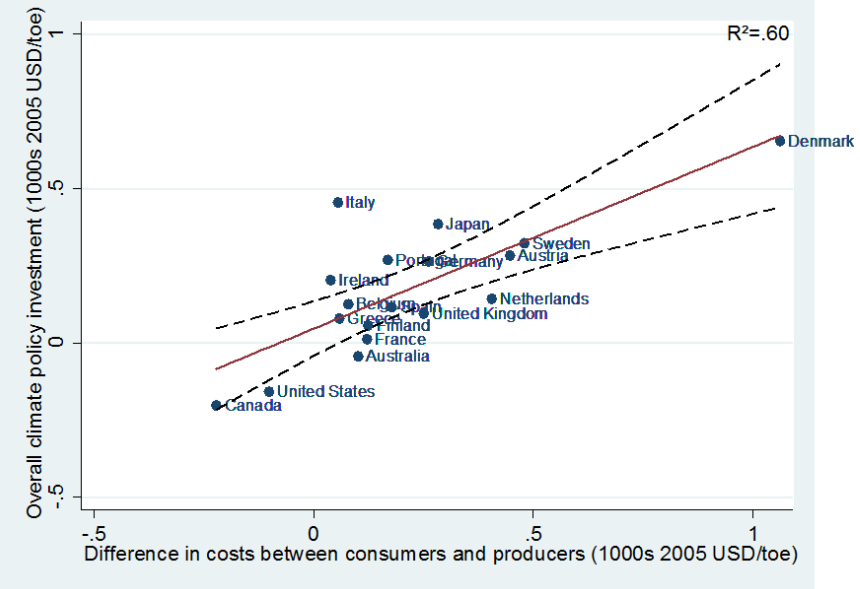
Figure 2.9. Concertation and costs for producers (with 95% CIs) (avg 1995-2009)



stringency against concertation we observe a generally positive relationship, albeit with two outliers: Italy and Netherlands (Figure 2.9).

Overall, the results lend support to the argument that institutions for interest group intermediation affect climate policy investment. Concertation increases overall levels of climate policy stringency both between countries and within them over time. Furthermore, a distinct distributive profile underlies these investments. The short-term costs of policy are shifted toward consumers and away from producers. These policy

Figure 2.10. Distribution of costs and overall policy investment (with 95% CIs) (avg 1995-2009)



concessions constitute compensation for producers. In return, industry supports the governments' climate policy agenda, leading to higher overall levels of climate policy investment, achieved primarily through increased costs for voters. This can be seen clearly in Figure 2.10. It is precisely those countries that offer compensation to producers, by distributing higher costs toward voters, which have the highest overall levels of climate policy investment. Denmark is the extreme example. It has the highest average overall stringency in the sample. Consumers there paid on average 1,000 USD more per unit of carbon-based energy than producers over the sample period. We see then that close and institutionalized relationships between industry and government facilitate climate policy. This finding runs counter to conventional thinking that polluters always oppose climate policy (e.g., Hughes and Urpelainen 2015); highlighting instead the crucial role that institutions play in structuring the incentives of these actors to cooperate with government.

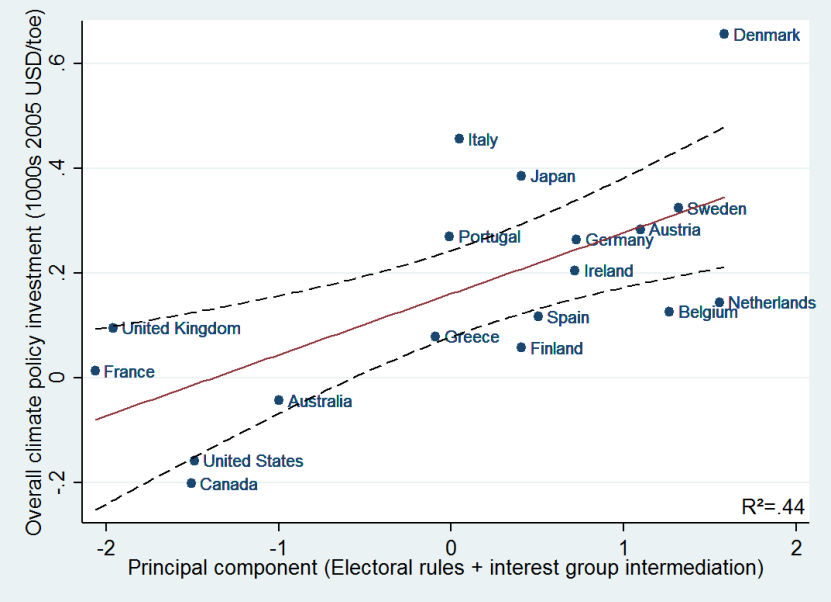
5.4. Institutional complementarities

Lastly, I test how the joint presence of electoral rules and interest group intermediation affect climate policy investments. As a first step, I extract the first principal component of electoral disproportionality and concertation. The resulting variable measures countries along a spectrum ranging from the joint presence of PR rules and

concertation to the joint presence of plurality rules and interest group pluralism. The measure is highly correlated with Lijphart's measure of consensus democracy (0.85), which is unsurprising since electoral rules and interest group intermediation constitute the institutional basis of his conceptualization. Plotting the new variable against overall climate policy investment reveals a positive relationship (Figure 2.11). Consensus democracies with both PR rules and concertation have higher levels of investment compared to majoritarian ones with first-past-the-post rules and interest group pluralism. Cross-sectional OLS models with controls confirm the robustness of this result.[20]

To investigate the relationship further, I again exploit within-country variation in concertation to estimate its effect at different levels of electoral disproportionality using fixed effects models. My arguments predict that the positive effect of concertation is strongest under PR rules. Table 2.3 presents the results and Figure 2.12 presents the marginal effects of four models. As expected, concertation has the largest and most statistically significant positive effect on climate policy investment when electoral rules are more proportional, all else equal (Figure 2.12 – top left). The result is similar when predicting costs for consumers (Figure 2.12 – top right), producers (Figure 2.12 – bottom left), and the difference in costs (Figure 2.12 – bottom right). Overall, the

Figure 2.11. Institutional complementarities and overall policy investment (with 95% CIs) (avg 1995-2009)



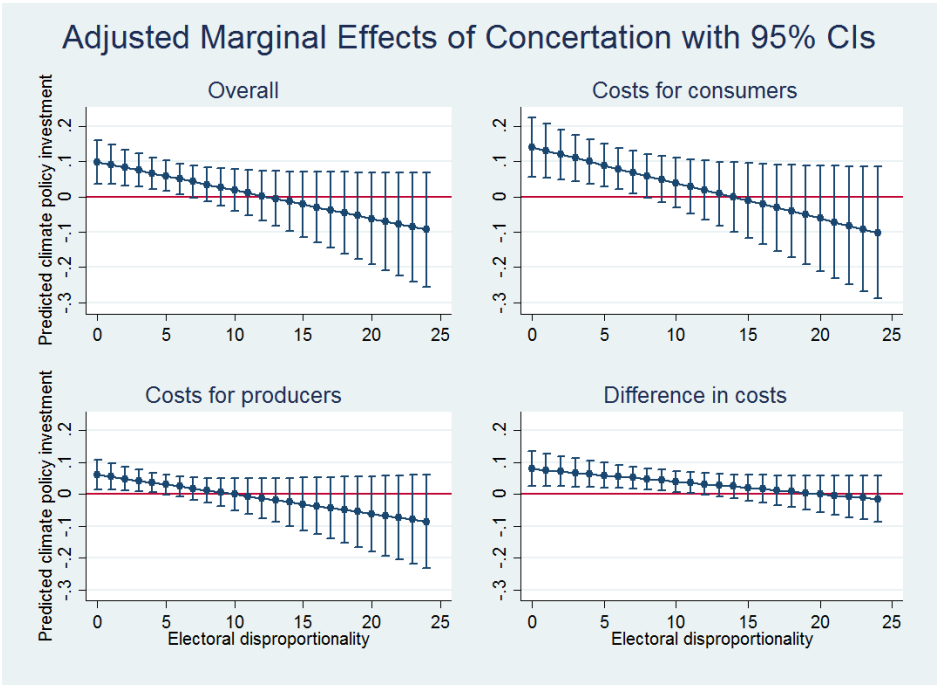
[20] See Appendix A5.

Table 2.3. Institutional complementarity and climate policy investment: Fixed effects models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Concertation	0.0990***	0.140***	0.0607**	0.0792**
	(0.0315)	(0.0428)	(0.0240)	(0.0277)
Electoral disproportionality	0.000512	0.00209	-0.000975	0.00307
	(0.00222)	(0.00393)	(0.00111)	(0.00357)
Concertation * Electoral dis.	-0.00803*	-0.0101*	-0.00612	-0.00395
	(0.00429)	(0.00502)	(0.00381)	(0.00230)
Green policy preferences	0.00214	0.00216	0.00213	0.0000240
	(0.00149)	(0.00191)	(0.00157)	(0.00180)
Fossil fuel production	0.00414	0.00906	-0.000485	0.00954
	(0.0119)	(0.0157)	(0.0114)	(0.0133)
Real GDP growth	-0.00533	-0.0102	-0.000746	-0.00946
	(0.00470)	(0.00842)	(0.00324)	(0.00842)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.421	0.427	0.336	0.286
R^2 – between	0.325	0.436	0.046	0.406
R^2 – overall	0.312	0.361	0.105	0.292
Countries	18	18	18	18
N	269	269	269	269

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 2.12. Institutional complementarities and policy investment: Marginal effects



evidence lends support to the key arguments. Electoral rules and interest group intermediation complement one another. Governments are able to achieve higher levels of climate policy investment when both institutions are jointly present. For this reason, we also observe a positive and significant relationship between consensus democracy more generally and climate change policy.[21]

6. Varieties of decarbonization

I have theorized how institutions drive cross-national variation in long-term climate policy investment and provided evidence to support of my arguments. I show that countries with PR rules and corporatism have the highest levels of climate policy investment. Here I build on my findings to offer broader theorizing about how institutional diversity generates two ideal-type political-economic models – negotiated and competitive, which in turn produce distinct *varieties of decarbonization*.[22] Comparing climate policy investments over time across these two types of countries we see a clear pattern (Figure 2.13). Policy investments are much higher in negotiated political economies, as are costs for consumers and producers. In addition, stringency for both groups began increasing around 2003, while it has remained flat in competitive political economies. Below I offer an account of a broader set of mechanisms that should drive this variation. Though it is beyond the scope of this paper to provide rigorous empirical tests of each.

6.1. The negotiated model

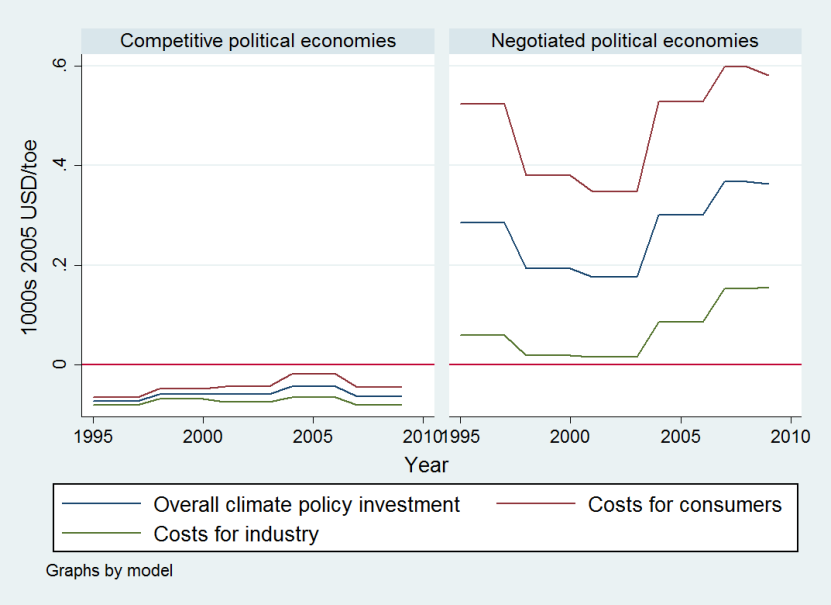
The negotiated model is characterized by inclusiveness, representation, bargaining, and compromise (Huber and Powell 1994, 298; Lijphart 2012, 2). Institutions aim to broaden participation in government and incentivize actors to achieve agreement on the policies that the government should pursue (Lijphart 2012, 2). In "inclusive negotiations" social actors "act toward collective instead of individualistic interests, think about long-term impacts on future generations, and focus on substantive rather than political goals" (Martin 2015b, 23). It is important to note that consensus does not mean the absence of disagreement between powerful actors. Rather, it refers to

[21] See Appendix A6.
[22] Thank you to David Soskice for suggesting this vocabulary.

generalized political exchange at an institutional level (Crouch 1993, 53). Consensus democracies accept and take for granted "a mass of conflicts, but [process] them in such a way that, unless something goes drastically wrong with the balance, the likelihood of recourse to open conflict is reduced, and actors [are] enabled to trade gains in one arena for losses in another" (Crouch 1993, 53-54). Archetypal negotiated political economies include the consensus-based coordinated market economies of Austria, Belgium, Germany, the Netherlands, Scandinavia, and Switzerland.

Given the centripetal political incentives generated by the need for coalition bargaining and inclusive legislative institutions, we should expect early cross-party party consensus on the problem of climate change and the need for action. Furthermore, these political economies should tend to rely on nonpartisan, expert legislative commissions to gather information and propose policies (Martin 2015b). For example, it was within the framework of the landmark "Inquiry Commission on Preventive Measures to Protect the Atmosphere",[23] that beginning in 1987 the first policy responses to climate change were formulated in Germany (Hatch 1995, 426; Michaelowa 2003, 32; Weidner and Mez 2008, 362). The commission brought together scientific experts, industry associations, and prominent politicians (representative of the

Figure 2.13. Varieties of decarbonization and climate change policy investment over time[24]



[23] Enquete-Kommission des Bundestags "Vorsorge zum Schutz der Erdatmosphäre"

[24] Included archetypal competitive political economies are: Australia, Canada, France, the UK, and the US. Included archetypal negotiated political economies are: Austria, Belgium, Denmark, Finland, Germany, Netherlands, and Sweden.

parties in parliament and chosen for their ties to important social groups and policy expertise) to deliberate and bargain, and "out of this process emerged a broad consensus for political action" (Hatch 1995, 426). Similar expert commissions have been used extensively in Denmark, Norway, and Sweden (e.g., Daugbjerg and Pedersen 2004; Toke and Nielsen 2015).

As detailed in this paper, we should expect a distinct distributive bargain to underpin climate policy investments, facilitated by the complementary between PR and corporatism. The costs of policy change are initially pushed toward consumers and away from producers. For this reason, governments will tend to rely on policy instruments that directly affect consumer prices, such as taxes and fees, rather than those that target industry, such as efficiency standards. Indeed, this is precisely the way that Scandinavian countries have become forerunners in climate policy (Daugbjerg and Pedersen 2004; Kasa 2000; Midttun and Hagen 1997; Mildenberger 2020). Through negotiation and bargaining, politicians and cost-bearing organized groups reached agreement in the early 1990s on carbon taxation that entailed significant exemptions for energy-intensive industries and shifted costs onto consumers. In return, producers supported government efforts to address climate change and little public conflict ensued. Crucially, the complementarity between PR and corporatism changes the payoffs to industry of pursuing different strategies in response to government action. It makes it less costly for industry to directly negotiate an agreement with the government than to launch a public campaign attempting to block policy change. In this way, privileged access also reduces "climate scepticism". In Austria, for example, obstruction and public climate change denial by industry is not necessary because peak associations for employers and labour can pre-screen and filter policy change through their privileged access to policymaking (Brand and Pawloff 2014, 791).

The adoption of early, moderate policy should enable governments to incrementally ratchet up policy stringency for producers over time. There is evidence that this is already underway. For example, after years of industry enjoying a much lower carbon tax rate than households, the Swedish government equalized tax rates across both groups in 2018 (Government of Sweden, 2019). Moreover, we see that after a period of low, stable costs for producers, costs begin to increase for industry around 2003 (Figure 2.13). These arguments stand in contrast to those made by a number of scholars who propose that close links between powerful economic actors and government enable industry to "capture" the climate policymaking process and prevent

significant action (e.g., Brand and Pawloff 2014; Meckling and Nahm 2018; Mildenberger 2020; Tobin 2017). I find little evidence of this. From a comparative perspective, these types of political economies have the *highest* overall levels of policy stringency, as well as the *highest* costs for industry.

Climate policy should also be more credible in these countries, which should increase certainty among social actors that its associated long-term benefits will actually accrue – further providing the necessary conditions for long-term policy investment (Jacobs 2011). Inclusive legislative committee rules decentralize the policymaking process, offering representation to both governing *and* opposition parties (Fortunato, Martin, and Vanberg 2017; Martin and Vanberg 2011; Mattson and Strom 1995; Powell 2000). This increases the number of cooperative veto points, making it less likely that a new government is able to deviate from a previous agreement without securing the buy-in of opposition parties and their allied interest groups.[25] At the same time, because individual firms are organized into peak associations that have the authority to commit to policy on behalf of their members and sanction non-compliance, it is difficult and costly for rogue firms to upend the collective agreement by either free-riding on the efforts of other firms or publicly challenging the agreement. Furthermore, repeated interactions through established corporatist channels fosters trust on both sides, which serves to further attenuate perceptions of risk about unexpected policy reversal or non-compliance. The result should be *interlocking* credibility. All groups can enter into long-term agreements with the confidence that the bargain will be upheld. Policy variance and regulatory uncertainty should be reduced, which incentivizes firms to undertake risky and expensive long-term investments in less carbon-intensive production processes. What is more, the process can be self-reinforcing. Interested actors make decisions based on the credibility and stability of policy, which generates incentives to preserve those policy commitments, so as to reap the long-term benefits. As a result, climate policy reversals should be rare as positive feedback effects and path dependency take over.

Lastly, we should expect climate policy investment to stall in times of heightened electoral competition, since these conditions will reduce electoral safety and make it more risky for politicians to impose additional costs on loss-averse voters. Policy investment should also stall if cross-party consensus breaks down, which may occur if populist or extreme parties that openly question climate change win substantial

[25] For a description of the Danish case see Toke and Nielsen (2015).

legislative seats – a phenomenon that is picking up steam across negotiated political economies given their proportional electoral rules. Lastly, policy should he hindered if large and unanticipated losses emerge for industry, as they should be expected to use their privileged access to bargain for reduced policy stringency (Jacobs and Weaver 2015). Conversely, if policy stringency can be incrementally increased, we should expect these political economies to lead on innovation in clean technologies, since we know from the environmental economics literature that policy stringency is a major driver of such innovation (Aghion et al. 2016; Calel and Dechezleprêtre 2016).

6.2. The competitive model

The competitive model is exclusive and adversarial (Lijphart 2012, 1). Elections are designed to produce "strong, single-party governments that are essentially unconstrained by other parties in the policy-making process" (Huber and Powell 1994, 291). Here "distributive bargaining" entails "zero-sum exchanges and particularistic pay-offs, exclude[s] the interests of those not represented at the table, and neglect[s] long-term consequences" (Martin 2015b, 23). Archetypal competitive political economies include the majoritarian liberal market economies of Australia, Canada, the UK, and the US.

Majoritarian electoral rules mean that two, typically patronage rather than programmatic, political parties are locked in fierce electoral competition over marginal votes, while exclusive legislative committees enable the governing party to dominate policymaking (Powell 2000). To influence policy, the only hope for the opposition party is to win the next election. In an effort to do so, it will face strong incentives to turn climate into a partisan issue and compete with the governing party on it. Under such conditions, the two main parties will have few incentives to cultivate and sustain cross-party consensus on long-term climate policy investments, leading to conflict and gridlock. For this reason, we should not expect these countries to be early policy adopters. Indeed, they were not. It was not until 2000, when the UK Labour government passed the Renewables Obligation, that a competitive political economy adopted a significant climate change policy.

Given the power of the governing party, partisanship should be the key driver of climate policy investment. Investment should wax and wane dramatically depending on which of the two parties is in power. However, if and when cross-party consensus

on climate does emerge, it should be a key driver of policy investment. For example, it was during an "extraordinary moment" of cross-party consensus from 2006 to 2008 that climate change became a valence issue in the UK, enabling the Labour government to adopt the country's flagship Climate Change Act (Carter 2014; Carter and Clements 2015; Lockwood 2013).[26] Because it increases electoral safety, reduced electoral competition should also increase the likelihood of policy investment, as would enabling politicians to push the short-term costs of investment into the future, beyond the next election. For example, under the UK's Climate Change Act parliamentarians set policy targets twelve years in advance. Such an approach helps to relieve the short-term pressures of electoral accountability. It is unique across the advanced economies.

When climate policy investments do occur, they will tend to be underpinned by a distributive profile that directs short-term costs toward producers and away from consumers, as detailed in this paper. The result is that politicians will tend to utilize policy instruments that hide the costs of policy change from voters, such as subsidies, tax credits, research and development spending, and other public investments financed through general revenues rather than through directly increasing consumer prices. They should also rely on supply-side policies aimed at changing the production processes of carbon-intensive firms, such as efficiency standards (e.g., for automobiles and power plants) and renewable energy quotas for utilities, for example. These arguments help to explain the considerable aversion that scholars have noted amongst politicians in Australia, Canada, the UK and the US to imposing short-term costs on voters, as well as the high political saliency of climate policy costs (Lockwood 2016; MacNeil 2015; Rabe 2010). Furthermore, they explain why major climate policy investments in these countries have tended to push significant costs toward industry, including: the Climate Change Levy in the UK, the Carbon Pricing Mechanism in Australia, and the Clean Power Plan in the US (Jotzo 2012; Pearce 2006).

However, the problem is that, due to interest group pluralism, politicians lack the capacity to negotiate credible compensation for organized cost-bearing groups. Rather than encompassing organizations, industry is loosely organized into associations of interests that compete for political influence and policy concessions. Under these conditions, the government and cost-bearing groups will find negotiation and

[26] However, some suggest that this consensus quickly broke down after the 2010 election as the right wing of the Conservative Party became hostile toward climate policy, especially "green taxes", returning climate to its previous status as a partisan issue (Carter 2014, 429; Carter and Clements 2015, 215-217; Gillard 2016).

bargaining difficult to sustain. For example, the US Environmental Protection Agency received 1,762 public comments from companies and organizations on proposed rules for emissions standards under the Clean Power Plan (EPA 2018). Strikingly, there was no common position among individual utilities or industry associations on how the rules should look (Downie 2017). Similarly, in 1993 President Clinton's plans to implement a broad-based energy tax in an effort to combat climate change fell apart as a multitude of companies and interest groups competed to secure particularistic advantages rather than negotiate a broad-based agreement (Erlandson 1994, 183; Wines 1993).

Ignoring cost-bearing organized groups should enable governments in these countries to adopt more radical policy change. However, the strategy will also antagonize industry, who, by being shut out of private negotiations, will tend to respond by expanding the scope of distributive conflict to the public square. Indeed, this mechanism helps to explain the particularly Anglo-Saxon flavor of climate scepticism (Tranter and Booth 2015). Industry should also be likely to resort to the courts to block policy change. In the US for example, firms are accustomed to highly adversarial relations with government institutions and expect to engage in extensive lobbying and frequent litigation, rather than deliberation, to influence climate policy in their preferred direction (Brewer 2014, 61). That said, we should expect industry buy-in when governments and industry are able to re-create corporatist style bargaining and negotiation over compensation for short-term costs. For example, in the UK in 2000, bargaining between the Labour government and industry associations secured industry buy-in for the Climate Change Agreements (Bailey and Rupp 2006).[27]

Long-term climate policy investments should also enjoy less credibility. Single-party governments and government-dominated legislative committees reduce the number of veto points in the policymaking process, as does the lack of corporatist linkages between peak associations and the policymaking process. New governments are empowered to change policy quickly and dramatically after an election. From the perspective of firms, these conditions create considerable regulatory uncertainty, reducing incentives to make expensive long-term investments in less carbon-intensive production processes. For example, since its creation in 1992, consecutive US governments have allowed the Production Tax Credit (PTC) (a tax exemption for

[27] In exchange for entering into these legally binding emission reductions agreements, firms in energy-intensive sectors receive reduction in their liabilities under the Climate Change Levy (a tax on carbon-based energy use).

renewable electricity generation) to expire and be extended six times, creating a boom-and-bust cycle in renewable energy investment and development, especially wind power (Barradale 2010; UCS 2017). In the UK, constant changes to renewable energy and carbon pricing policy, caused by party disagreements, are blamed for generating policy uncertainty amongst investors (Ares and Delebarre 2016, 18; Lockwood 2013, 1346; Wood and Dow 2011, 2239).

Rather than engage in deliberative bargaining, having few veto points incentivizes an anti-climate opposition party and its allied interest groups to oppose, delay, and block climate policy investment until their side comes to power, at which point they can reverse course. For this reason, competitive political economies are likely to be characterized by frequent policy reversals and a general lack of self-reinforcing policies. In Australia, for example, the centre-left Labor government implemented a carbon price in 2011 only to have it repealed once the new centre-right Liberal/National government came to power three years later (MacNeil 2015, 29-31; Rootes 2014). In 2015, the Democratic US President Barack Obama signed the Paris Climate Agreement and adopted the Clean Power Plan (the country's only major climate policy investment). Two years later however, the new Republican President Donald Trump announced the country's withdrawal from the Paris Climate Agreement and his intention to eliminate the Clean Power Plan. Precisely because credible commitment will be particularly difficult, politicians wanting to address climate change should be more likely to create institutions that bind the hands of future governments, such as long-term statutory reduction targets and delegation to independent advisory and/or regulatory bodies – two strategies used in the UK.

7. Conclusion

This paper offers a theoretical framework rooted in domestic institutions that explains the wide variation in climate policy investment across the advanced capitalist democracies. Institutions matter because they influence the necessary conditions for policy investment to occur. Most importantly, they shape electoral safety and structure the ability of governments to overcome opposition from organized cost-bearing groups. PR rules increase electoral safety by decreasing electoral accountability and electoral competition, which in turn enables governments to impose short-term costs on their constituents. Concertation facilitates bargaining between the government and powerful

economic actors over compensation for the losers of policy change, which helps governments overcome industry opposition. What is more, the joint presence of both institutions generates powerful complementarities that reinforce their independent effects. PR rules decrease risks associated with shifting costs toward voters, which opens up critical room to maneuver when negotiating compensation with cost-bearing groups.

By structuring the distributive politics of climate change, institutional complementarities generate distinct *varieties of decarbonization* that should drive differences in climate policy investments across these countries. On the one hand are negotiated political economies with consensus-based democratic institutions and coordinated market economies. Here climate policy should tend to enjoy relative cross-party consensus, support from cost-bearing industry, and low public conflict. Moreover, policy change is likely to be incremental rather than radical and offer compensation to losers. On the other hand are competitive political economies with majoritarian democracies and liberal market economies. Here climate policy investments are likely to enjoy little cross-party support or support from cost-bearing producers. Policy change is more likely to be radical and ignore losers. As a result, public conflict will tend to be high and policy reversals more frequent.

These arguments bring together two important streams in the emerging literature on the comparative political economy of climate policy related to electoral insulation (e.g., Lipscy 2019; Tvinnereim 2013) and the role of corporatism (e.g., Mildenberger 2020). My arguments seek to elucidate the complementarity between the two and shed light on how packages of institutions work together to shape climate policy investment across the advanced capitalist democracies. By doing so, the paper contributes to filling large theoretical gaps in the climate change politics literature. It also highlights a number of areas for future research. First, the arguments require additional tests. For example, future work could examine the hypotheses outlined here regarding the link between electoral rules and climate policy credibility, electoral rules and party positions on climate change, and corporatism and climate change scepticism. Second, research is needed that examines the effect of other complementarity institutions, especially legislative committees, corporate governance structures, and welfare states, as well as possible international complementarities between different varieties of decarbonization. Lastly, additional measures of climate policy investment,

especially time series data that reach back into the 1980s, are needed to analyze the effect of institutions over longer time horizons.

The results are also broadly consistent with Jacobs' (2011) theoretical arguments. Countries are able to achieve higher levels of climate policy investment when politicians have a low risk of losing office and can overcome opposition from cost-bearing organized groups. Moreover, the paper extends the long-term politics literature to climate change – a long-term problem whose future costs and benefits cannot be redistributed. Under these conditions, I find that the opportunities for and constraints on short-term cross-sectional distribution are crucial. Those countries that distribute short-term policy costs toward voters and away from industry (i.e., simultaneous cross-sectional and intertemporal redistribution) are also those that have higher overall levels of climate policy investment. In contrast, those that impose similar short-term costs on both groups (i.e., pursue vertical investment) have lower levels of overall investment. This suggests a relationship between types of policy investment and overall levels of investment.

Lastly, the analysis illuminates causal mechanisms that should enable consensus democracies to better address a wide range of long-term policy challenges apart from climate change. Previous scholars have suggested this hypothesis (e.g., Birchfield and Crepaz 1998; Crepaz 1996; Lindvall 2017; Martin 2015b). This paper links institutions present in these political economies to one type of long-term policy investment. Additional research is needed to further test the relationship across a variety of policy areas.

APPENDIX A

A1. List of sectors included in shadow carbon price data from Althammer and Hille (2016)

Table A1. List of sectors and coding

Sector	ISIC Rev 3.1 Classification	Coding
Agriculture, Hunting, Forestry and Fishing	A to B	Producer
Mining and Quarrying	C	Producer
Food, Beverages and Tobacco	D: 15 to 16	Producer
Textiles and Textile Products	D: 17 to 18	Producer
Leather, Leather and Footwear	D: 19	Producer
Wood and Products of Wood and Cork	D: 20	Producer
Pulp, Paper, Paper , Printing and Publishing	D: 21 to 22	Producer
Coke, Refined Petroleum and Nuclear Fuel	D: 23	Producer
Chemicals and Chemical Products	D: 24	Producer
Rubber and Plastics	D: 25	Producer
Other Non-Metallic Mineral	D: 26	Producer
Basic Metals and Fabricated Metal	D: 27 to 28	Producer
Machinery, Nec	D: 29	Producer
Electrical and Optical Equipment	D: 30 to 33	Producer
Transport Equipment	D: 34 to 35	Producer
Manufacturing, Nec; Recycling	D: 36 to 37	Producer
Electricity, Gas and Water Supply	E	Producer
Construction	F	Consumer
Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	G: 50	Consumer
Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	G: 51	Consumer
Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	G: 52	Consumer
Hotels and Restaurants	H	Consumer
Inland Transport	I: 60	Consumer
Water Transport	I: 61	Consumer
Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	I: 63	Consumer
Post and Telecommunications	I: 64	Consumer
Financial Intermediation	J	Consumer
Real Estate Activities	K: 70	Consumer
Renting of M&Eq and Other Business Activities	K: 71 to 74	Consumer
Public Admin and Defence; Compulsory Social Security	L	Consumer
Education	M	Consumer
Health and Social Work	N	Consumer
Other Community, Social and Personal Services	O	Consumer

A2. Summary statistics

Table A2. Summary statistics

Variable	Source	Obs	Mean	Std. Dev.	Min	Max
Overall climate policy investment (2005 USD per toe)	Althammer and Hille (2016)	269	0.169	0.224	-0.269	0.814
Costs for consumers (2005 USD per toe)	Althammer and Hille (2016)	270	0.279	0.345	-0.375	1.437
Costs for producers (2005 USD per toe)	Althammer and Hille (2016)	270	0.634	0.140	0.453	0.978
Difference in costs (2005 USD per toe)	Althammer and Hille (2016)	270	0.211	0.280	-0.271	1.264
Average electoral disproportionality	Lijphart (2012)	18	6.996	5.501	1.080	19.56
Electoral disproportionality	Armingeon et al. (2016a)	269	7.021	5.911	0.350	24.61
Routine involvement of employers and labor unions in policymaking	Visser (2015)	269	1	0.801	0	2
Routine involvement of employers and labor unions in policymaking	Author's recoding based on Visser (2015)	269	1.112	0.793	0	2
EU membership	Armingeon et al. (2016a)	270	0.778	0.417	0	1
Institutional constraints	Armingeon et al. (2016a)	269	3.781	2.208	1	10
Green preferences of governments	Jahn (2016)	269	2.779	7.072	-16.794	23.152
Fossil fuel production per capita (toe per capita)	IEA (2018)	269	2.324	3.383	0	12.885
Real GDP growth rate	Armingeon et al. (2016a)	269	2.385	2.594	-8.270	11.27
Consensus democracy (Lijphart's first dimension) (1981-2010)	Lijphart (2012)	270	0.202	0.912	-1.480	1.480
Left-right position of government	Jahn (2016)	269	2.293	5.220	-12.788	21.497
Unemployment rate	Armingeon et al. (2016a)	269	7.438	2.849	3.100	20.700
Real GDP per capita ($10,000s)	OECD (2018)	269	3.091	0.533	1.810	4.535
Industry value added (as % of GDP)	World Bank (2019)	255	27.587	4.215	17.126	39.654

Carbon intensity of total primary energy supply (TPES)	IEA (2018)	269	54.655	13.064	20.680	80.600
Political constraints (POLCON III)	Henisz (2002)	269	0.490	0.094	0.225	0.718
Perception of corruption	Standaert (2015)	270	25.060	10.774	7.460	52.494

A3. Concertation coding

The main results (Table 2.2) use a modified version of Visser's (2015) measure of concertation (described in main text). Here I re-run the estimates using Visser's original measure. They are not substantially different from the main results.

Table A3. Concertation and climate policy investment: Hybrid models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Between-country effects				
Concertation	0.156***	0.288***	0.0321	0.256***
	(0.0562)	(0.0995)	(0.0342)	(0.0949)
EU Membership	-0.0798	-0.0379	-0.119*	0.0813
	(0.0712)	(0.130)	(0.0625)	(0.143)
Institutional constraints	-0.0313**	-0.0401*	-0.0229**	-0.0172
	(0.0137)	(0.0226)	(0.00939)	(0.0203)
Green policy preferences	0.00977**	0.0204***	-0.000198	0.0206***
	(0.00496)	(0.00742)	(0.00329)	(0.00554)
Fossil fuel production	-0.0108	0.00419	-0.0248***	0.0290*
	(0.0124)	(0.0206)	(0.00689)	(0.0173)
Real GDP growth	-0.0856**	-0.149***	-0.0260	-0.123***
	(0.0421)	(0.0558)	(0.0353)	(0.0389)
Within-country effects				
Concertation	0.0460**	0.0740***	0.0197	0.0543***
	(0.0202)	(0.0283)	(0.0142)	(0.0185)
Green policy preferences	0.00239	0.00244	0.00235	0.000112
	(0.00191)	(0.00238)	(0.00182)	(0.00178)
Fossil fuel production	0.00481	0.0123	-0.00228	0.0145
	(0.0142)	(0.0191)	(0.0113)	(0.0126)
Real GDP growth	-0.00491	-0.00986	-0.000242	-0.00962
	(0.00464)	(0.00860)	(0.00287)	(0.00862)
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.368	0.384	0.277	0.273
R^2 – between	0.715	0.738	0.492	0.660
R^2 – overall	0.663	0.698	0.452	0.641
Countries	18	18	18	18
N	268	268	268	268

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. EU membership and institutional constraints are excluded from the within-country part of the model because they do not vary over time.

A4. Concertation and climate policy investment: Robustness tests

Below are additional tests of the relationship between concertation and climate change policy investment.

- Table A4 presents results from a basic cross-sectional OLS regression. Consistent with my arguments, concertation is associated with higher overall policy investment (Model 1), higher costs for consumers (Model 2), and a larger difference in costs between consumers and producers (Model 4).
- Table A5 estimates a series of OLS models with country and year fixed effects. The goal is test the robustness of the within-unit effects estimated by the hybrid models in the main text. The coefficients are similar to those in the main results in terms of sign, size, and statistical significance.
- Table A6 re-estimates the fixed effects models from Table A5 with an additional set of controls. I include the left-right ideological position of the government from Jahn (2016) to further control for the effect of partisan preferences. The unemployment rate and real GDP per capita are added to further control for the state of the national economy, as well as income effects. To control for structural economic changes over time I include value added of industry as a percentage of GDP. I also include the carbon intensity of countries' total primary energy supply (TPES). Countries with less carbon-intensive energy may find it more feasible to adopt stringent climate policy. Henisz's (2002) measure of political constraints is included to control for veto points. Lastly, to control for political trust, I include the Baysian Corruption Index from Standaert (2015) to measure citizens' perception of government corruption. Previous cross-national studies suggest a link between trust and climate policy (Povitkina 2018; Rafaty 2018). The results do not substantively change once these additional are added.
- Table A7 re-estimates the main results from hybrid models in Table 2.2 with the additional controls listed above. The inclusion of these additional controls does not substantively alter the results.

Table A4. Concertation and climate policy investment: Cross-sectional OLS models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Concertation	0.141*	0.264**	0.0268	0.238**
	(0.0669)	(0.108)	(0.0436)	(0.0935)
EU Membership	0.107	0.308	-0.0829	0.391**
	(0.114)	(0.188)	(0.0634)	(0.156)
Institutional constraints	-0.0207	-0.0202	-0.0211	0.000940
	(0.0185)	(0.0293)	(0.0133)	(0.0259)
Green policy preferences	0.00809	0.0174*	-0.000645	0.0180**
	(0.00582)	(0.00899)	(0.00358)	(0.00696)
Fossil fuel production	0.00367	0.0312	-0.0221*	0.0533*
	(0.0202)	(0.0338)	(0.0100)	(0.0280)
Real GDP growth	-0.0709	-0.122**	-0.0218	-0.100**
	(0.0425)	(0.0510)	(0.0401)	(0.0354)
Constant	0.147	-0.00796	0.288	-0.295
	(0.229)	(0.335)	(0.171)	(0.266)
R^2	0.727	0.758	0.501	0.695
N	18	18	18	18

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5. Concertation and climate policy investment: Fixed effects models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Concertation	0.0463**	0.0743**	0.0200	0.0543***
	(0.0196)	(0.0275)	(0.0140)	(0.0181)
Green policy preferences	0.00264	0.00267	0.00262	0.0000532
	(0.00195)	(0.00238)	(0.00191)	(0.00181)
Fossil fuel production	0.000718	0.00539	-0.00368	0.00907
	(0.0125)	(0.0169)	(0.0113)	(0.0141)
Real GDP growth	-0.00439	-0.00914	0.0000831	-0.00922
	(0.00458)	(0.00852)	(0.00278)	(0.00854)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.367	0.382	0.278	0.269
R^2 – between	0.554	0.544	0.330	0.355
R^2 – overall	0.337	0.327	0.251	0.250
Countries	18	18	18	18
N	268	269	269	269

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6. Concertation and climate policy investment: Fixed effects models with additional controls

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Concertation	0.0315*	0.0644**	0.000445	0.0640***
	(0.0175)	(0.0264)	(0.0109)	(0.0190)
Green policy preferences	0.00472**	0.00665**	0.00291	0.00374*
	(0.00197)	(0.00259)	(0.00171)	(0.00187)
Fossil fuel production	0.00914	0.0207	-0.00175	0.0225
	(0.0140)	(0.0186)	(0.0144)	(0.0178)
Real GDP growth	-0.00362	-0.00499	-0.00233	-0.00266
	(0.00535)	(0.00760)	(0.00407)	(0.00564)
Left-right position of gov	-0.00349	-0.00535	-0.00174	-0.00361*
	(0.00251)	(0.00314)	(0.00217)	(0.00191)
Unemployment rate	-0.00366	0.00225	-0.00923	0.0115*
	(0.00813)	(0.00978)	(0.00753)	(0.00620)
GDP per capita	0.0463	0.124	-0.0265	0.150
	(0.122)	(0.156)	(0.107)	(0.104)
Industry value added	-0.00908	-0.0168	-0.00183	-0.0150
	(0.00998)	(0.0147)	(0.00727)	(0.0113)
Carbon intensity	-0.00810	-0.00654	-0.00956**	0.00301
	(0.00497)	(0.00658)	(0.00432)	(0.00486)
Political constraints	-0.0630	-0.0725	-0.0541	-0.0185
	(0.126)	(0.160)	(0.102)	(0.0897)
Perceptions of corruption	0.0288**	0.0257*	0.0317***	-0.00603
	(0.0115)	(0.0130)	(0.0108)	(0.00569)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.504	0.484	0.507	0.412
R^2 – between	0.021	0.122	0.113	0.056
R^2 – overall	0.004	0.054	0.124	0.126
Countries	18	18	18	18
N	255	255	255	255

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7. Concertation and climate policy investment: Hybrid models with additional controls

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Between-country effects				
Concertation	0.158**	0.299***	0.0241	0.275***
	(0.0741)	(0.0950)	(0.0589)	(0.0516)
EU Membership	0.317**	0.457**	0.184*	0.274***
	(0.138)	(0.178)	(0.107)	(0.0921)
Institutional constraints	0.00409	0.0174	-0.00842	0.0258**
	(0.0170)	(0.0191)	(0.0164)	(0.0103)
Green policy preferences	-0.00000704	0.00457	-0.00432	0.00889
	(0.00705)	(0.00990)	(0.00492)	(0.00644)
Fossil fuel production	0.00677	0.00927	0.00442	0.00486
	(0.0168)	(0.0219)	(0.0128)	(0.0116)
Real GDP growth	-0.0794***	-0.121***	-0.0397**	-0.0817***
	(0.0215)	(0.0282)	(0.0187)	(0.0201)
Left-right position of gov	0.0215*	0.0318**	0.0118	0.0200*
	(0.0114)	(0.0155)	(0.00969)	(0.0117)
Unemployment rate	-0.0326**	-0.0424**	-0.0233*	-0.0191
	(0.0144)	(0.0186)	(0.0129)	(0.0135)
GDP per capita	-0.00354	-0.0475	0.0378	-0.0853
	(0.0927)	(0.115)	(0.0797)	(0.0661)
Industry value added	0.0216*	0.0132	0.0294***	-0.0163**
	(0.0114)	(0.0143)	(0.00906)	(0.00635)
Carbon intensity	0.00339	0.00611*	0.000828	0.00528***
	(0.00279)	(0.00353)	(0.00224)	(0.00180)
Political constraints	-0.850	-1.380*	-0.351	-1.028*
	(0.592)	(0.820)	(0.428)	(0.528)
Perceptions of corruption	0.00381	-0.00446	0.0116***	-0.0160***
	(0.00532)	(0.00689)	(0.00410)	(0.00368)
Within-country effects				
Concertation	0.0418**	0.0828***	0.00325	0.0796***
	(0.0194)	(0.0306)	(0.0110)	(0.0236)
Green policy preferences	0.00433**	0.00583*	0.00292*	0.00291
	(0.00217)	(0.00303)	(0.00172)	(0.00224)
Fossil fuel production	0.0133	0.0217	0.00533	0.0164
	(0.0139)	(0.0164)	(0.0152)	(0.0148)
Real GDP growth	-0.00454	-0.00640	-0.00279	-0.00361
	(0.00590)	(0.00797)	(0.00486)	(0.00571)
Left-right position of gov	-0.00314	-0.00409	-0.00225	-0.00184
	(0.00286)	(0.00356)	(0.00244)	(0.00203)
Unemployment rate	-0.00546	-0.00145	-0.00924	0.00778
	(0.00894)	(0.0106)	(0.00812)	(0.00584)
GDP per capita	0.0100	0.0472	-0.0250	0.0722
	(0.136)	(0.181)	(0.111)	(0.119)
Industry value added	-0.0112	-0.0177	-0.00517	-0.0125
	(0.00895)	(0.0132)	(0.00718)	(0.0111)

Carbon intensity	-0.00819*	-0.00705	-0.00926**	0.00220
	(0.00439)	(0.00585)	(0.00387)	(0.00448)
Political constraints	-0.00955	0.0415	-0.0576	0.0992
	(0.157)	(0.212)	(0.117)	(0.130)
Perceptions of corruption	0.0180	0.000545	0.0344***	-0.0339**
	(0.0150)	(0.0211)	(0.0117)	(0.0156)
Year FE	Yes	Yes	Yes	Yes
R^2 – within	0.492	0.457	0.485	0.342
R^2 – between	0.873	0.910	0.811	0.948
R^2 – overall	0.795	0.840	0.745	0.892
Countries	18	18	18	18
N	254	254	254	254

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. EU membership and institutional constraints are excluded from the within-country part of the model because they do not vary over time.

A5. Institutional complementarities and climate policy investment

Table A8 provides evidence that the relationship in Figure 2.11 of the main text is robust to the inclusion of controls.

Table A8. Institutional complementarities and climate policy investment: Cross-sectional OLS models

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
First principal component	0.0842**	0.151**	0.0218	0.129**
	(0.0331)	(0.0582)	(0.0205)	(0.0553)
EU Membership	0.0618	0.224	-0.0920	0.316*
	(0.0947)	(0.160)	(0.0602)	(0.146)
Institutional constraints	-0.0225	-0.0250	-0.0200	-0.00507
	(0.0175)	(0.0289)	(0.0113)	(0.0257)
Green policy preferences	0.00833	0.0175*	-0.000264	0.0177**
	(0.00531)	(0.00797)	(0.00345)	(0.00597)
Real GDP growth	-0.0714	-0.123*	-0.0221	-0.101**
	(0.0468)	(0.0603)	(0.0406)	(0.0424)
Fossil fuel production	-0.00286	0.0183	-0.0228**	0.0411
	(0.0172)	(0.0285)	(0.00890)	(0.0236)
Constant	0.354**	0.388	0.320**	0.0685
	(0.144)	(0.220)	(0.105)	(0.184)
R^2	0.720	0.731	0.512	0.642
N	18	18	18	18

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A6. Consensus democracy and long-term climate policy investment

This section provides evidence of the general relationship between consensus democracy and climate policy investment. The scatterplot shows a strong correlation between overall policy investment and Lijphart's (2012) first dimension of consensus versus majoritarian democracy (Figure A1). The robustness of the relationship is confirmed by cross-sectional OLS models (Table A9).

Figure A1. Consensus democracy and long-term climate policy investment (with 95% CIs) (avg. 1995-2009)

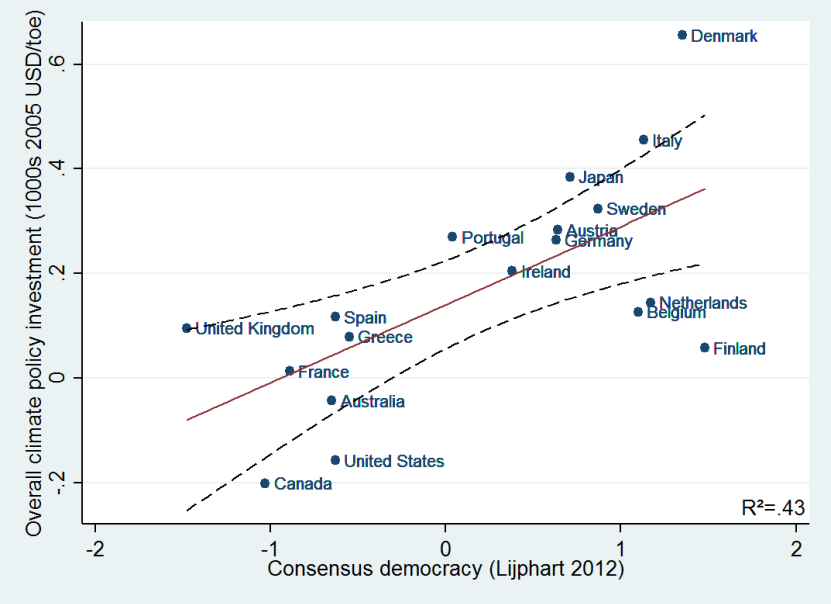


Table A9. Consensus democracy and long-term climate policy investment

	(1) Overall climate policy investment	(2) Costs for consumers	(3) Costs for producers	(4) Difference in costs
Consensus democracy	0.110*	0.180**	0.0427	0.137*
	(0.0499)	(0.0798)	(0.0332)	(0.0688)
EU Membership	0.105	0.296	-0.0758	0.372**
	(0.107)	(0.179)	(0.0670)	(0.159)
Institutional constraints	-0.0200	-0.0241	-0.0163	-0.00778
	(0.0149)	(0.0255)	(0.0101)	(0.0241)
Green policy preferences	0.0114**	0.0218**	0.00156	0.0203**
	(0.00476)	(0.00786)	(0.00350)	(0.00740)
Fossil fuel production	-0.0000607	0.0217	-0.0206**	0.0423
	(0.0175)	(0.0295)	(0.00906)	(0.0253)
Real GDP growth	-0.0587	-0.101	-0.0177	-0.0836*
	(0.0427)	(0.0566)	(0.0379)	(0.0440)
Constant	0.250	0.233	0.266**	-0.0324
	(0.149)	(0.237)	(0.0913)	(0.193)
R^2	0.715	0.695	0.539	0.571
N	18	18	18	18

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A7. Public opinion and climate policy investment

The series of plots below compare three different measures of public opinion with overall climate policy investment. The measure "Environmental concern" is a score calculated by Franzen and Vogl (2013) based on responses to environmental-related question in three waves of International Social Survey Programme (ISSP) surveys: 1993, 2000, and 2010. The measure "Willing to pay higher taxes to protect the environment" is taken from ISSP data for the question "…how willing would you be to pay much higher taxes in order to protect the environment?" (ISSP Research Group 1995, 2003, 2019). It is the sum of those that responded either "very willing" or "fairly willing". It is averaged across three waves: 1993, 2000, and 2010. The measure "Climate change is a personal threat" is taken from a 2007-08 Gallup survey data (Gallup 2009).

The figures provide little evidence of a cross-national relationship between public opinion and climate change policy. Indeed, in Figures A3 and A4 the relationship runs counter to expectations.

Figure A2. Environmental concern and overall climate policy investment (with 95% CIs)

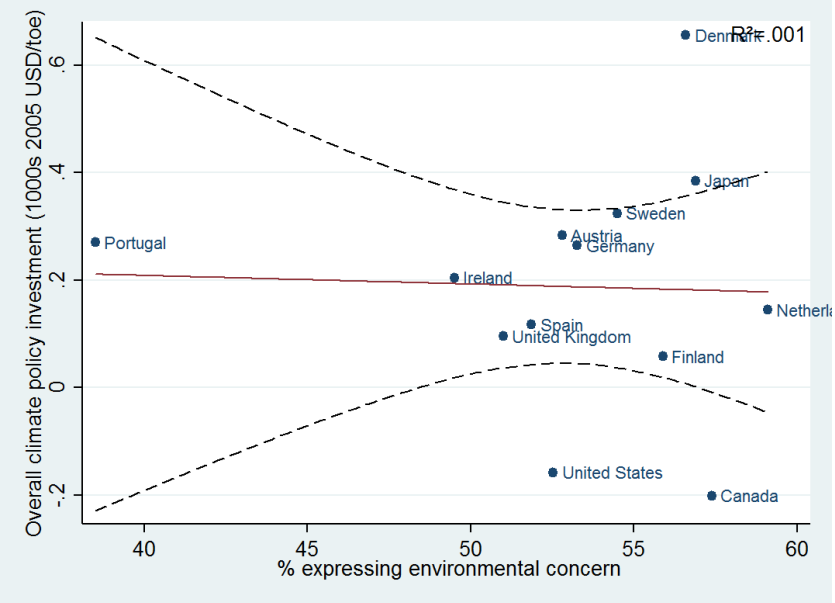


Figure A3. Willingness to pay and overall climate policy investment (with 95% CIs)

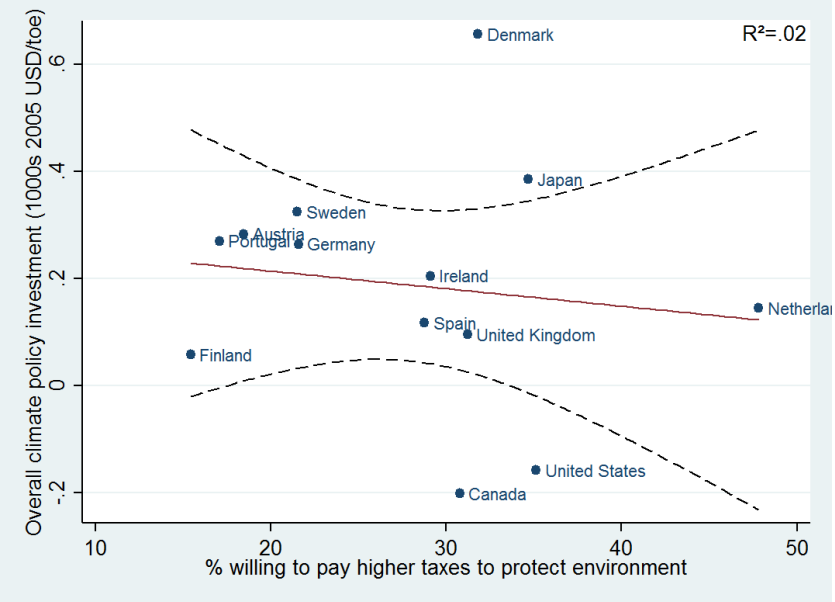
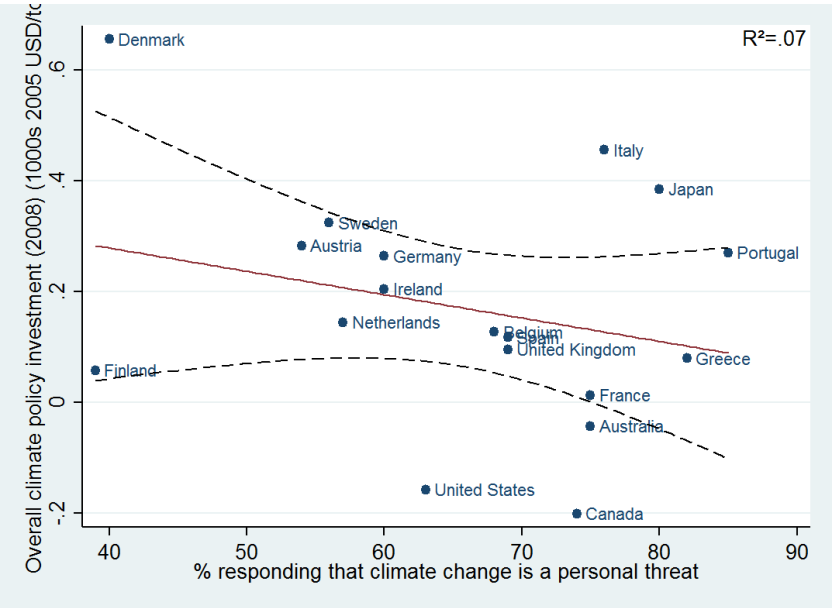


Figure A4. Personal threat and overall climate policy investment (with 95% CIs)



CHAPTER 3

Changing Prices in a Changing Climate: Electoral Competition and Fossil Fuel Taxation

Abstract: For over 40 years economists have advocated carbon taxes as the most efficient policy for addressing climate change. However, not all governments have increased the price of fossil fuels. When do politicians decide to increase consumer prices? This paper highlights the role of electoral competition. I argue that carbon tax increases are most likely when competition is low and politicians are insulated from voter punishment. Moreover, this effect depends on the personal costs that tax increases impose on voters. If a good is not widely consumed, politicians can tax it more easily, even when competition is high. I test this explanation using a new dataset on gasoline taxes and new data on electoral competitiveness across high-income democracies between 1978 and 2013. The results are consistent with the theory. In addition, a case study of eco-tax reform in Germany across two sequential electoral periods demonstrates how changes in the electoral fortunes of the Social Democratic-Green coalition generated changes in fossil fuel tax policy. This analysis points to a crucial mechanism that plausibly accounts for the differential ability of governments to tackle a wider range of long-term policy challenges.

1. Introduction

For over 40 years economists have advocated carbon taxes as the most efficient policy for combatting climate change (Nordhaus 1977). By increasing their price, taxes should reduce the consumption of carbon-intensive goods and services and therefore reduce carbon dioxide emissions. However, by some estimates, 85% of global greenhouse gas emissions remain unpriced (High-Level Commission on Carbon Prices 2017). The OECD recently found that only 10% of emissions are priced at or above 30 Euros per tonne – the lower-end estimate needed to meet the objectives of the Paris Agreement (OECD 2016). Why have governments been so reluctant to increase the price of fossil fuels? Surprisingly, we know very little about the politics of such policy decisions. Indeed, political science has been virtually silent on this question, which is especially puzzling given the importance of climate change as a policy problem (Bernauer 2013; Keohane 2015).

This paper examines the influence of one factor: electoral competition. A key characteristic of carbon taxation is its temporal structure. Costs are imposed in the short-term in order to generate future benefits. Research on the politics of long-term policymaking and structural economic change suggests that a necessary condition for such policies is electoral safety (Garrett 1993; Jacobs 2011). It is only governments that have a low risk of losing office that can assume the long-term time horizon needed to engage in policy-induced structural change, such as decarbonizing the economy. Indeed, the nascent comparative climate politics literature suggests that electoral incentives play a key role in policy outcomes, however a direct theoretical and empirical link between fossil fuel taxation and electoral competition has yet to be made (Aklin and Urpelainen 2013; Harrison and Sundstrom 2010, Ch 1; Rabe 2010; 2018). Though separate literatures in American politics, comparative political economy, and economics suggest a link between link between electoral competition and tax policy (F. S. Berry and Berry 1992; Besley, Persson, and Sturm 2010; Rogowski and Kayser 2002).

This paper extends these insights to offer a novel theoretical account of the relationship between electoral incentives and fossil fuel taxation, specifying the electoral conditions under which tax increases are most likely. It argues that increases are likely when competition is low and politicians are insulated from voter punishment. When electoral competition is high, however, politicians face greater incentives to respond to voters' tax preferences. I argue that a key heuristic used by politicians to gauge such

preferences will be the short-term personal costs that tax increases impose on voters. Fossil fuel tax increases that generate few personal costs, for example because fuel consumption is low, should be less politically risky at any level of electoral competition. However, tax increases that generate high personal costs engender political risk. As costs rise, stiff electoral competition should sharply reduce incentives to raise rates.

I test these arguments by analyzing the taxation of one widely consumed and important fossil fuel: gasoline. Using an original dataset of gasoline excise tax rates and new data on electoral competitiveness, I examine the relationship between competition and taxation across twenty high-income democracies between 1978 and 2013. A consistent picture emerges. High levels of electoral competition are associated with low gasoline tax rates, controlling for country and year fixed effects and a host of potential confounders. Furthermore, the negative effect of competition increases with personal costs. Using lagged gasoline consumption as a proxy for personal costs, I find that electoral competition has little effect when costs are low. But as consumption rises, the marginal negative effect of competition increases. Put simply, governments increase fossil fuel taxes when electoral competition is low and when voters consume less of the taxed fuel. However, as competition and consumption rise, governments are less likely to adopt tax increases. To provide an illustration of how electoral competition affects fossil fuel tax rates I undertake a case study of eco-tax reform in Germany across two sequential electoral periods from 1998 to 2005. I demonstrate how changes in the electoral fortunes of the Social Democratic-Green (Red-Green) coalition after the 2002 election generated changes in fossil fuel tax policy.

In addition to elucidating the political economy of fossil fuel taxation, the results offer a number of additional implications. First, they suggest a long-run positive feedback effect between electoral competition, fossil fuel consumption, and fossil fuel taxation. Lower taxes mean lower prices, which in turn encourage higher consumption, and vice versa. Higher consumption should make it more difficult for politicians to increase tax rates in the future, even at low levels of competition. This effect should be present in the case of any good that is widely consumed by voters. In the case of fossil fuels, it should generate strong path dependencies over time that push countries onto different fossil fuel consumption and taxation trajectories. For those caught in a "high consumption-low tax trap", changing trajectories will likely prove difficult, especially in times of heightened electoral competition. Secondly, the results imply a two-way causal relationship between tax rates and consumption. Standard economic theory predicts

that tax rates affect consumption, however the evidence here demonstrates that consumption also affects the tax rate by shaping politicians' perceptions of voter preferences. Lastly, the arguments highlight a causal mechanism – electoral competition – that links political institutions to climate change policy. Chapter 2 contends that electoral rules structure possibilities for long-term climate policy investment by shaping electoral safety. This paper tests the mechanism underlying this argument. Because they have lower average levels of competition, I show that countries with proportional electoral rules indeed have higher levels of gasoline taxation.

This paper contributes to the academic and policy literatures in several ways. First, by developing a theory of fossil fuel taxation based on electoral incentives it contributes to the nascent literature on the comparative political economy of climate change policy (Harrison 2015; Hughes and Urpelainen 2015; Lipscy 2019; Mildenberger 2020; Tobin 2017) – an under-researched area (Cao et al. 2014; Keohane 2015; Purdon 2015). Secondly, it contributes to literature on long-term policymaking and the policy effects of electoral competition (e.g., Abou-Chadi and Orlowski 2016; Berliner 2014; Berliner and Erlich 2015; Immergut and Abou-Chadi 2014; Jacobs 2011). Lastly, it provides a general theoretical framework that specifies the electoral conditions under which increases in consumption taxes are politically feasible, thereby providing a more complete explanation of the political economy of increasing consumer prices through taxation (Rogowski and Kayser 2002; Chang et al. 2010). I focus on carbon taxes, but the argument is applicable to any long-term policy problem that requires short-term changes in consumer prices. From a policy perspective the paper has practical implications for addressing climate change. Increased fossil fuel prices are needed to shift production and consumption onto a more sustainable path. However, in democracies such a policy will likely face strong political headwinds if elections are highly competitive and fossil fuel consumption is diffuse. Policymakers should take these electoral incentives into account when designing and implementing carbon taxes.

2. The challenge of fossil fuel taxation

A tax on fossil fuels (natural gas, coal, gasoline, diesel, heating oil, and other petroleum products), or "carbon tax", is consistently advocated by environmental economists as the most cost-effective policy to reduce CO_2 emissions (e.g., Nordhaus 1977, 2008; Weitzman 2014). By increasing the price of fossil fuels, taxes should reduce their

consumption, and by doing so, reduce emissions.[28] In the case of the transport sector, fossil fuel taxes are arguably "the single most powerful climate policy instrument adopted to date" (Sterner 2007, 3194). Without them, fuel demand and its associated CO_2 emissions would be much higher.

Governments have a number of policy design options when increasing taxes on fossil fuels (Sumner, Bird, and Dobos 2011). They may adopt an explicit "carbon tax" – a flat tax based on the carbon content of the fuel; an energy tax – a flat tax based on the energy content of the fuel; an "environmental" or "eco-tax" – an excise tax by a different name; or simply increase existing excise or value-added tax (VAT) rates.[29] In addition, they may impose the tax directly on fuel consumed by households (downstream) or producers (upstream). That is, on voters or industry or both.[30] For the purposes of this paper, I use fossil fuel and carbon taxes to mean any direct tax on fossil fuels, regardless of name. It therefore includes all of the design options described above. Lastly, I focus exclusively on taxes that are directly imposed on voters, leaving aside an analysis of industrial tax rate changes.

The challenges for politicians of effectively responding to climate change, by increasing fossil fuel taxes for example, are well-known. A stable climate is a global public good *par excellence*, which reduces the incentives of any one country to provide it, there is uncertainty about the scale and timing of future impacts, and policy responses engender intertemporal and cross-sectional distributive consequences (Ch.1 this thesis; Levin et al. 2012; Hovi, Sprinz, and Underdal 2009; Bernauer 2013). However, despite these challenges, many governments *have* adopted climate policy over the past three decades years, including increased fossil fuel taxation. To be sure, thirteen advanced economies have passed carbon tax legislation since 1990. The result is that tax levels on fossil fuels vary widely across countries. What explains this variation? Surprisingly, we lack general theory about the politics of such policy decisions (Cao et al. 2014; Purdon 2015).

A rich qualitative literature has examined fossil fuel taxation in single cases or regions: including Scandinavia (Daugbjerg and Pedersen 2004; Kasa 2000), Germany (Beuermann and Santarius 2006), the UK (Pearce 2006), Ireland (Convery et al. 2014),

[28] A number of studies have found that carbon taxes are indeed effective in reducing emissions (e.g., Andersson 2019; Davis and Kilian 2011).
[29] Governments can also use emissions trading schemes to put a price on carbon, however in this paper I focus only on taxes.
[30] Here I am describing only policy design considerations and therefore leave out a detailed discussion of tax incidence.

and British Columbia (Harrison 2012), as well as the politics of carbon pricing more generally (Rabe 2018). In addition, a related set of studies have focused on the failures of fossil fuel taxation in the US (Erlandson 1994), France (Deroubaix and Lévèque 2006), and Australia (Bailey et al. 2012). While this work offers important descriptions of carbon tax politics in particular instances, we still lack general theorizing about the conditions under which politicians are likely to increase tax rates. For this reason, the literature has yet to identify or test a common set of key political variables that should affect politicians' strategic calculations regarding carbon taxation. For example, a number of studies suggest that electoral incentives play a key role in structuring politicians' decision-making (Kasa 2000; Pearce 2006; Harrison 2012). However, few have identified specific incentives or demonstrated their empirical relationship to particular policy outcomes. For example, Rabe (2010) convincingly argues that carbon taxes have failed in the US because there is considerable aversion among politicians to directly impose costs on voters. However, the source of this incentive remains unexplored. Similarly, the US case cannot account for the adoption of carbon taxes in other similar democracies. Only very recently have scholars began to identify and test the role of electoral incentives (Lipscy 2019). This paper seeks to contribute to this effort by developing a novel theoretical account that explains the relationship between electoral incentives and fossil fuel taxation. In particular, it focuses on the role of electoral competition in structuring politicians' preferences for imposing short-term costs on voters.

3. Electoral competition and fossil fuel taxation: A theoretical framework

In democratic settings, the governing party competes with one or more other parties to win a plurality of seats at the next election.[31] The governing party has vote-, office-, and policy-seeking preferences (Strom 1990). The ordering of these preferences depends on the competitiveness of the electoral environment (described further below). Under these constraints, assume that the party considers a policy that will increase the household tax rate on one or more fossil fuels. A key feature of the policy is that it constitutes an intertemporal distribution of resources. That is, the tax increase is a long-term "policy investment" that imposes short-term costs on voters in order to generate future public goods (Ch.1 and 2 this thesis; Jacobs 2011). Such goods can include, for

[31] In the case of coalition governments, I refer to the prime minister's party as the governing party. This party is typically also the largest party in the coalition.

example: mitigated climate change, energy security, and/or improved infrastructure (as a result of using revenues to repair roads and bridges). The crucial point is that, from the perspective of voters, fossil fuel taxes entail non-simultaneous exchange. Benefits arrive in the future and are therefore not temporally aligned with costs.

The precise reasons why the governing party prefers increased fossil fuel taxation will vary. Since the late 1980s all governments in high-income democracies have faced international pressure to address climate change. At the same time, economists have consistently advocated fossil fuel taxes as the most efficient policy for doing so. Against this backdrop, some parties and politicians will be ideologically committed to a pro-climate policy agenda and view taxation as the best instrument to achieve these ends. Yet its unclear ex-ante which actors might consistently take this position. Green parties are likely to be committed to tackling climate change, but their views on taxation as a policy instrument might vary. The positions of left and right parties are similarly ambiguous. Indeed, existing evidence is mixed. Some studies suggest a link between green parties and environmental performance (Jahn 2016, Ch 7; Jensen and Spoon 2011), left parties and the environment (Jahn 2016, Ch. 7; Knill, Debus, and Heichel 2010; Ward and Cao 2012; Tobin 2017), and left parties and taxation (Ashworth, Geys, and Heyndels 2006; Beramendi and Rueda 2007; Solé Ollé 2003); while others find little evidence of partisan effects (Aklin and Urpelainen 2013; Bordignon, Cerniglia, and Revelli 2003; Caplan 2001; Fankhauser, Gennaioli, and Collins 2015b; Neumayer 2003; Rafaty 2018; Scruggs 2003). Another motivation for increased fossil fuel taxation is revenue maximization (Levi 1989). Increased revenues can be used to fund other programs important to the governing party or meet budget shortfalls. Previous work suggests a link between fiscal health and fuel tax increases (F. S. Berry and Berry 1992; Geschwind 2017). Lastly, these two channels may interact. For example, Beramendi and Rueda (2007) contend that left parties increase consumption taxes (which include fossil fuel taxes) in order to raise revenue to fund the welfare state.

In all cases, a preference is a necessary but not sufficient condition for policy change. Simply because the governing party prefers to increase fossil fuel taxes does not mean that it will propose such a policy or indeed succeed. Given the typically diffuse consumption of fossil fuels amongst voters, I assume that the governing party will view directly increasing their price via taxes to entail some political risk, since they will expect that price increases will enjoy some level of unpopularity amongst voters. Survey research in environmental psychology supports this assumption. Individuals' support

for environmental policy decreases as the personal costs of the policy rise (Drews and Bergh 2015). Moreover, consistent with a basic retrospective model of electoral accountability, there is evidence that voters tend to punish politicians at the next election for tax increases (Fiorina 1978; Kone and Winters 1993; Niemi, Stanley, and Vogel 1995).

Governing parties that prefer to increase fossil fuel taxes will therefore require a *political opportunity* (F. S. Berry and Berry 1992; Karapin 2016). These will be moments when the party is shielded from the political costs of such increases.[32] Evidence suggests that political opportunities exist just after a government wins election, when it has political capital to spend.[33] Studies find that opportunities also exist in times of inflation (when prices are rising across the economy), when the price of oil is dropping, and in times of fiscal stress (F. S. Berry and Berry 1994; Geschwind 2017; Goel and Nelson 1999).

Electoral competition should also play a key role in structuring political opportunities for increasing fossil fuel tax rates. Electoral competition is the expected probability of a change in government control at the next election as perceived by the governing party (Boyne 1998, 212; Kayser and Lindstädt 2015, 243). Put simply, the more uncertain the governing party expects an upcoming election to be, the more competitive it is (Strom 1989, 281). Competitiveness matters because it structures the governing party's tradeoff between vote-seeking strategies on the one hand and policy-seeking ones on the other (Strom 1990).

When competition is low, the governing party has a low probability of losing power at the next election. They enjoy an electoral advantage because they possess a surplus of committed voters, which they believe can be relied upon to vote in their favour even if fossil fuel taxes are increased.[34] This insulates the party against marginal losses in vote shares that may result from a backlash of some committed voters, and by doing so generates a political opportunity for policies that may otherwise be unpopular.[35] Specifically, these electoral conditions should push myopic vote-seeking

[32] I assume that marginal political costs are equal to the marginal loss of votes at the next election (Hettich and Winer 1988).
[33] Building on Nordhaus (1975), there is a large literature on electoral cycles and the timing of tax increases. For examples see Mikesell (1978), Royed and Borrelli (1999) and Nelson (2000).
[34] I assume that these voters are committed to the party for primarily non-climate change-related reasons, such as economic reasons.
[35] Indeed, in times of low electoral competition governing parties have been found to adopt otherwise unpopular policies, such as liberal immigration reform (Abou-Chadi 2016), fiscal consolidation (Hübscher and Sattler 2017), welfare state retrenchment (Immergut and Abou-

strategies down the party's preference ordering, which in turn should enable it to contemplate and adopt long-term climate policy investments that impose short-term costs on constituents (Garrett 1993; Jacobs 2011). Hence, it is in these moments that the party should be most likely to increase fossil fuels taxes, all else equal.

Conversely, when competition is high, the outcome of the upcoming election is uncertain. Here the party's vote-seeking preferences should dominate and push it to pursue a short-term strategy of vote-maximization in an effort to win the next contest.[36] Assuming that the party perceives tax increases to be electorally risky, they should be unlikely to increase them for fear of losing marginal votes. As a result, electoral competition should have an overall negative effect on fossil fuel taxation, all else equal.

However, the assumption that tax increases will always be politically risky can be relaxed. Doing so enables us to theorize how the governing party's perceptions of political risk moderate the relationship between competition and taxation. One factor that should guide party's calculation of risk is their perception of voters' carbon tax preferences. At high levels of competition, the party should be more responsive to the preferences of the electorate since such a strategy should improve its chances of winning (Hobolt and Klemmensen 2008; Strom 1989).[37] How will the governing party perceive such preferences? Informational asymmetries exist between politicians and voters making it difficult for the governing party to be entirely certain about what voters want. We should therefore expect that they rely on heuristics.

One important heuristic should be costs. Similar to other taxes, voter preferences toward fossil fuel taxes should be shaped by the costs and benefits to them of such taxes (Hettich and Winer 1988). As mentioned, the crucial problem for the governing party is that, like other long-term policy investments, the costs and benefits of increased carbon taxation are not temporally aligned for voters. Instead, it represents non-simultaneous exchange. The costs are felt immediately in the short-term, while the primary benefits (in particular a stable climate) are gained over the long- to very-long

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Chadi 2014), business and property taxes (Solé Ollé 2003), and policies that increase consumer prices (Rogowski and Kayser 2002). Similarly, high levels of competition have been shown to push governments to adopt "pro-growth" policies (Besley, Persson, and Sturm 2010) and undertake institutional reforms, particularly related to transparency and freedom of information (Berliner 2014; Berliner and Erlich 2015; Geddes 1994; Grzymala-Busse 2006).

[36] Competition may increase for a number of reasons. For example, when there is a decline in committed voters, which increases voter volatility as the proportion of voters that are open to party persuasion increases (Strom 1989, 281).

[37] In the classic Downsian setup, the governing party should be more responsive to the preferences of the median voter.

Table 3.1. Electoral competition and personal costs: Two-by-two of interaction effect

	Perception of low personal costs	**Perception of high personal costs**
Low electoral competition	• Least political risk (Most likely to increase carbon tax rate)	• More political risk
High electoral competition	• Less political risk	• Most political risk (Least likely to increase carbon tax rate)

term.[38] Voters may value these future benefits, but at a discount rate that is likely to be high (Frederick, Loewenstein, and O'Donoghue 2002; Jacobs and Matthews 2012). Moreover, short-term costs imposed on households via direct taxation are highly visible, and as a consequence are likely to enjoy high political salience in the media and amongst voters (Gamage and Shanske 2011; Li, Linn, and Muehlegger 2014).

The governing party should therefore expect that voter preferences for fossil fuel taxes depend primarily on the average short-term individual cost, or *personal cost*, that such taxes generate. For example, they should know SUV drivers are unlikely to prefer an increase in the gasoline tax rate, while cyclists are likely to be indifferent or even supportive. This reasoning is also consistent with survey research in environmental psychology mentioned above. Furthermore, it is consistent with the logic of cost-benefit analysis, which describes costs in terms of average short-term costs to households and is typically used by governments to evaluate the distributional effects, and political feasibility, of carbon taxes.

The negative effect of electoral competition on fossil fuel taxation should therefore be different at different levels of personal cost (see Table 3.1). When the governing party perceives the personal costs of a tax increase to be low, there should be less political risk in adopting it, even at high levels of competition; because the party should expect voters to be relatively indifferent about rate changes. Put simply, it should be politically safe to increase taxes if such increases do not cost voters anything. However, as personal costs rise, the governing party should expect that voter preferences are tilted against an increase in the tax rate. High personal costs coupled

[38] To be sure, voters may also enjoy immediate benefits from increased fossil fuel taxation, including: co-benefits such as reduced air pollution and/or increased spending on public goods (e.g., if revenues are used to increase social policy funding) or lower taxes on other goods (such as income via environmental tax reform, see Andersen and Ekins 2009). However, I argue that these benefits will always be ancillary to the primary aim of increased fossil fuel taxation, which is to combat climate change.

with high electoral competition should generate strong incentives for the governing party to not increase rates or even reduce them.

4. Empirical analysis

4.1. Research design

To test these arguments I examine the relationship between levels of electoral competition and gasoline taxation within 20 high-income democracies between 1978 and 2013.[39] Gasoline is a major source of carbon pollution across these countries. Emissions from transportation made up, on average, more than one quarter of their total CO_2 emissions over the period (IEA 2019). For this reason, gasoline taxes are arguably the most important tax on carbon, and therefore climate policy, adopted to date (Sterner 2007). Furthermore, even though all gasoline taxes are not explicitly labelled "carbon taxes", all carbon taxes imply a tax on gasoline. Indeed, virtually every carbon tax adopted by high-income democracies to date is applied to gasoline (see Table 3.2). In practical terms, gasoline is widely consumed by voters across the sample of countries and over time, which is not the case for other fossil fuels (e.g., coal, natural gas, or heating oil). Moreover, motorists frequently visit gasoline stations to fill up, making changes in gasoline prices highly visible to voters. For these reasons, gasoline represents a very good case for analyzing the political economy of directly taxing a fossil fuel that is consumed widely and frequently by voters.

Gasoline is typically taxed via two general instruments: excise taxes and *ad valorem*, or value-added, taxes (VAT). Because VAT rates vary little over time and not all countries have them, I analyze excise taxes.[40] Excise taxes on gasoline have been adopted by all countries in the sample and offer variation across space and time (Figure 3.1). To measure gasoline excise taxes I compile an original dataset of excise tax levels per litre of regular gasoline in national currencies from a variety of national and international sources.[41] In addition to standard excise taxes, the measure includes any carbon taxes or other special environmental taxes that are applied to gasoline.

[39] The sample includes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, New Zealand, Netherlands, Norway, Portugal, Spain, Sweden, UK, and USA.
[40] Though I control for VAT rates in the empirical analysis.
[41] Depending on the country, regular household gasoline is either RON 91 or RON 95. See Appendix B2 for data sources.

Across the sample period, governments have tended to either not change nominal tax rates (47% of country-years) or increase them (46%) (Table 3.3). Very rarely are they decreased (7%). However, there is wide variation by country. In the US the tax rate has been increased only three times since 1978, whereas in Sweden and the UK it was increased in 25 of 36 years.

Table 3.2. Carbon taxes and gasoline

Country	Year of carbon tax adoption	Applied directly to gasoline as an excise tax?
Australia	2011[a]	No
Canada	2018	Yes
Denmark	1992	Yes
Finland	1990	Yes
France	2014	Yes
Germany	1999[b]	Yes
Ireland	2009	Yes
Japan	2012	Yes
Netherlands	1990	Yes
Norway	1991	Yes
Portugal	2014	Yes
Sweden	1991	Yes
United Kingdom	2001[c]	No

Notes: [a] The Carbon Pricing Mechanism was repealed in 2014. [b] Refers to Germany's "eco-tax". [c] Refers to the UK's Climate Change Levy.

Table 3.3. Changes in nominal gasoline tax rates across high-income democracies (1978-2013)

Rate change	Freq.	%
Decrease	41	6.89
No change	281	47.23
Increase	273	45.88
Total	*595*	*100*

4.2. Operationalizing key variables

A valid cross-nationally comparable measure of gasoline taxation needs to capture the timing and magnitude of tax rate changes. Furthermore, it needs to be a policy variable that politicians have direct control over. Using rates in nominal national currencies is the most precise measure, however it is not cross-nationally comparable. Unfortunately,

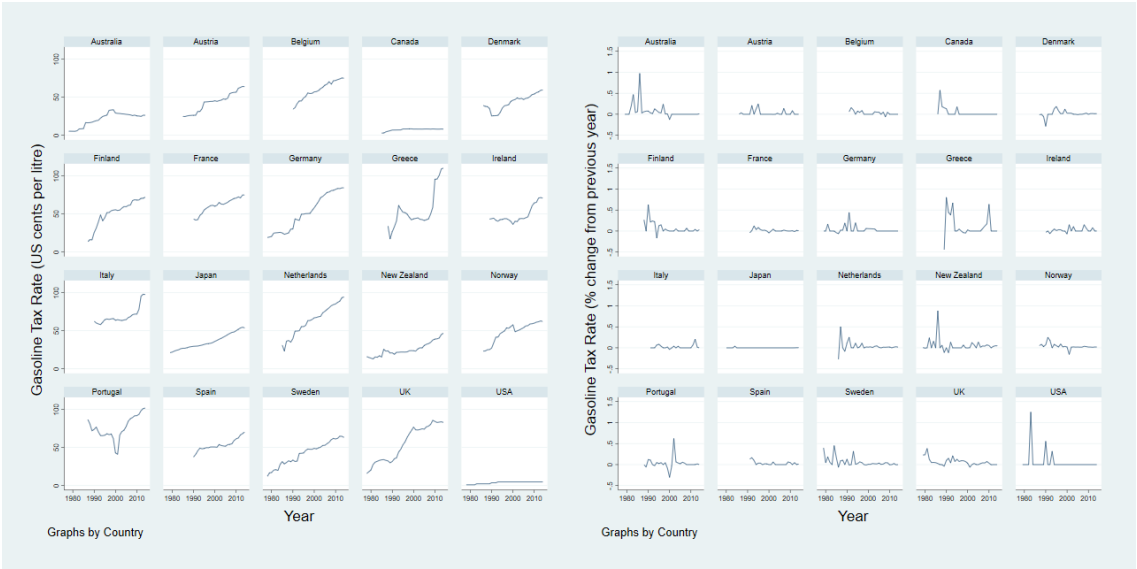
no comparable measure can precisely capture both timing and magnitude. For this reason, I develop two dependent variables to test my arguments.

The first measures the level of the tax rate by converting national currency rates into a common unit – nominal US cents, using USD purchasing power parity exchange rates (Figure 3.1 – left side). The benefit is that the measure captures tax levels in a comparable way over time. The downside is that some artificial variation is introduced as a result of exchange rate fluctuations, which are independent of tax decisions by politicians. To minimize this potential measurement error I include a range of macroeconomic controls that tend to affect exchange rates, including: inflation, public debt, and economic growth.

The second dependent variable measures annual percent changes in tax rates. To do this, I divide the first difference of the national currency tax rate by the rate in the previous year (Δtax $rate_{i,t}$ / tax $rate_{i,t-1}$) (Figure 3.1 – right side). This measure can be thought of as the growth rate of gasoline taxation. The benefit is that it accurately captures changes in rates and therefore political decision-making. The downside is that it does not precisely capture the magnitude of those changes. Percent changes are higher for countries with low rates in the previous year and lower for countries with high rates. For example, in 1983 the US increased the tax rate from 1.0567 cents per litre to 2.378, a change of 125%, the highest in the sample, even though the absolute tax level (2.378) is relatively low. While in 2010, the UK increased its rate from 56 to 58 pence, a modest change of 3.6%. However, the new level (58p) is relatively large in magnitude. In effort to address this measurement error, I include a lag of the tax rate level (from above) to control for the past level of taxation from which changes are made.

I calculate both dependent variables based on nominal rather than real rates. As mentioned, the measure needs to capture the behavior of politicians, since this is the phenomenon that my arguments seek to explain. Therefore, the variables need to be policy variables that politicians have direct control over. Indeed, politicians *only* have direct control over the nominal rate. Moreover, it is nominal increases in tax rates that tend to be politicized in the media (Li, Linn, and Muehlegger 2014). Methodologically, it is also useful to use nominal rates. This way inflation can be included in the model as a separate independent variable, which enables the estimation of its independent influence on politicians' behavior. For these reasons, previous studies of gasoline

Figure 3.1. Gasoline taxation across high-income democracies



taxation have also used nominal rates (Decker and Wohar 2006; Goel and Nelson 1999).

To measure electoral competition I use new data on loss probability from Kayser and Lindstädt (2015). Their measure is appropriate to test my arguments since it captures the "expected probability that the plurality party in parliament loses its seats plurality in the next election" from the perspective of that party (Kayser and Lindstädt 2015, 243). It is a function of two elements: (1) the expected variability, or uncertainty, of a party's national vote share at the next election from the perspective of politicians in that party, and (2) the way in which changes in national vote shares produce changes in legislative seat shares (i.e., the country's seats-votes elasticity), which depends on national electoral rules and the geographic distribution of each party's voters.

The measure is forward-looking and captures the view of the dominant policymaker regarding the electoral security of their position. Moreover, because loss probabilities are estimated from the first day after an election they enjoy exogeneity from policy-related dependent variables (in my case gasoline taxes). This data offers the most sophisticated measure for the countries in my sample. Additionally, it enables me to overcome data limitations that have previously prevented climate politics researchers from directly testing the effects of loss probability (e.g., Aklin and Urpelainen 2013).

Kayser and Lindstädt (2015) estimate loss probabilities for the plurality party in the legislature. While this party is typically also the governing party, in some cases it is not. Because I'm making arguments about the governing party, I drop 56 observations

in which the plurality party in the legislature is not the prime minister's party. However, the results are robust to the full sample.[42] Because of missing data for both loss probability and tax rates, the panel is not balanced.

Electoral competition is highest at middle values of loss probability. Therefore, the functional form between it and fossil fuel tax rates should be quadratic (i.e., U-shaped) (Kayser and Lindstädt 2015, 249). However, I also intend to estimate a linear model that interacts electoral competition with personal cost. I therefore need to capture electoral competition in a single variable. To do so, I transform loss probabilities into electoral competition by measuring the absolute distance of each governing party's loss probability from 0.5, or theoretically perfect competition.[43] This new measure assumes that governing parties that have a low probability of losing at the next election (i.e., "likely winners" with a loss probability below 0.5) and those that have a high probability of doing so (i.e., "likely losers" with a loss probability above 0.5) behave similarly. I test and validate this assumption in Appendix B3.

A measure of politicians' perceptions of voters' personal costs presents a number of possibilities. The most reasonable and straightforward measure of costs is gasoline consumption per capita. The more the average voter consumes gasoline, the more a tax increase will cost her or him, all else equal. Consumption also captures voters' average transport technology choice. For example, a country where most people drive will have higher average consumption than one where most take public transport or cycle. In this way, it can control for patterns of urbanization (i.e., urban-rural divide) and public transport infrastructure. To be sure, these changes will be endogenous to the tax rate. I therefore used lagged fuel consumption. To measure fuel consumption, I calculate average gasoline consumption (litres per capita) using data on household gasoline consumption and population.[44] The results are also robust to using an alternative measure of personal cost: expenditure on gasoline as a percentage of household income.[45]

[42] See Appendix B4.
[43] See Appendix B3 for details. The approach is virtually identical to the one used in American politics to calculate the Ranney Index of electoral competition (e.g., Flavin and Shufeldt 2016).
[44] Data on median gasoline consumption would be ideal, but it is unavailable for the sample of countries.
[45] See Appendix B4.

4.3. Controlling for potential confounders

I am interested in the effect of electoral competition on gasoline taxes and therefore need to control for confounding variables that may also have an effect on the tax rate. I include two sets of controls. The first set controls for differences in tax policy preferences (i.e., policy-seeking preferences) across governing parties. To control for partisan effects I include two measures: percentage of cabinet seats held by green parties and percentage held by non-green left parties. To control for differences in fiscal health, which may push governments to maximize tax revenues, I include measures of the budget deficit and public debt (F. S. Berry and Berry 1992, 1994). To control for the influence that oil companies may exert on governments, I include domestic oil production per capita. Lastly, I include a dummy for ratification of the Kyoto Protocol, since this may have compelled otherwise reluctant governments to increase taxation in order to comply with international climate-related agreements.

The second set of controls includes factors that may influence political opportunities for tax rate increases. That is, variables other than electoral competition that could influence vote-seeking behavior. To control for the effect of electoral cycles I include a dummy for election years (Nordhaus 1975). I control for inflation, since times of inflation may provide cover to increase taxes or tax increases may be indexed to inflation (F. S. Berry and Berry 1992, 1994; Goel and Nelson 1999). I also include nominal GDP growth to control for national economic shocks that may affect voters' sensitivity to price increases (F. S. Berry and Berry 1992). I include VAT rates on gasoline to control for the level of taxation apart from excise taxes. Lastly, I control for the saliency of environmental issues across the political system. Regardless of partisanship, the governing party may find it less risky to increase fossil fuel tax rates in times when the environment is a salient political issue. To measure saliency I collect party-specific data on pro-environmental issue attention and then calculate the average across all parties in a given country-year.[46] This measure should also provide a proxy for green issue salience amongst voters, since issue attention amongst parties should reflect underlying voter preferences.[47]

Restricting the analysis in the first instance to these variables offers the most parsimonious and theoretically-motivated approach. However, the results are robust to

[46] I use the variable per501 from the Comparative Manifestos Project.
[47] Sources and summary statistics for all variables are provided in Appendix B1.

the inclusion of a wide variety of additional controls, including: government ideology (e.g., left vs right and green vs growth), type of government (e.g., single-party vs coalition), political constraints (i.e., veto players), spending on social policy, GDP per capita, urbanization, income tax structure, and EU membership.[48]

4.4. Model specification

The time-series cross-sectional (TSCS) structure of my data allows for the use of country and year fixed effects models. The primary advantage of this modelling strategy is that it enables me to rule out two threats to causal inference: time-invariant country-specific confounders (e.g., time-invariant political institutions as well as cross-national differences in culture that may influence attitudes toward taxation or the environment) and year-specific shocks that affect all countries equally (e.g., changes in the global price of oil, global economic shocks, international climate change negotiations, scientific knowledge about climate change, and growing public awareness about climate change). The remaining primary threat to causal inference is omitted variable bias that may result from the omission of a time-varying country-specific confounder. To minimize this threat I include a variety of controls (described above).

There is typically a lag between when gasoline tax rates are decided by politicians and when they are implemented. Excise taxes are usually set in the current year when drafting the annual budget for the upcoming year. That is, the tax rate in time *t* is a result of political decisions made in time *t-1*. For example, this is the approach taken by the German government detailed in the case study below. I therefore assume that the tax rate in time *t* reflects information available to politicians in time *t-1*. To model this delay, I lag all variables one year (apart from the electoral cycle). This structure also attenuates potential endogeneity between gasoline consumption and the tax rate, since the tax rate in time *t* is unlikely to have a direct effect on gasoline consumption in time *t-1*. Given its theoretical foundation, this lag structure is the preferred approach. However, the results are robust to a two-year lag structure.[49]

I estimate two equations. The first analyzes tax rate levels:

$$y_{it} = \beta_1 x_{it-1} + \beta_2 z_{it-1} + \beta_3 x_{it-1} * z_{it-1} + \beta_4 \mu_{it} + \theta c_{it-1} + \alpha_i + v_t + e_{it} \quad (1)$$

[48] See Appendix B4.
[49] See Appendix B4.

where y_{it} is the nominal tax rate level (in US cents per litre) in country *i* in year *t*; x_{it-1} and z_{it-1} are key independent variables of interests lagged one year; $x_{it-1} * z_{it-1}$ is the quadratic or interaction term (depending on the model); $\mu_{i,t}$ is the electoral cycle; $c_{i,t-1}$ is a vector of lagged control variables; α_i are country fixed effects; v_t are year fixed effects; and e_{it} is the error term.

The second equation analyzes changes in the tax rate:

$$\Delta y_{it} = \tau_1 \varphi_{it-1} + \beta_1 x_{it-1} + \beta_2 z_{it-1} + \beta_3 x_{it-1} * z_{it-1} + \beta_4 \mu_{it} + \theta c_{it-1} + \alpha_i + v_t + e_{it} \quad (2)$$

where Δy_{it} is the percent change in the excise tax rate from the previous year (based on rates in national currencies) and φ_{it-1} is a lag of the nominal tax rate to control for past taxation levels. It is the same variable as y_{it} in Equation 1. All other variables are the same as Equation 1.

There are two types of problems that may arise when analyzing TSCS data. The first is that the errors terms may suffer from autocorrelation and/or heteroskedasticity. To correct for both I use robust standard errors clustered at the country level.[50] The second potential problem is nonstationarity. If both my dependent variables and key independent variables are heavily trended upward or downward, then they may be nonstationary. If so, an association between them may be spurious. An Im-Pesaran-Shin unit root test of loss probability, electoral competition, and the percent change in tax rates rejects the null hypothesis that all panels contain a unit root at the 1% level. In the case of tax rate levels, the evidence against the null is weaker and can only be rejected the 10% level. Since all dependent variables and key independent variables are not nonstationary, I proceed with the analysis. As a final check, I use jackknife resampling to investigate whether one country in the sample is driving the results.[51] I find no evidence of this.

As a robustness check I also estimate a logit model with country and year fixed effects. The dependent variable equals 1 if the tax rate is increased and 0 otherwise.[52]

[50] There is an ongoing debate in the literature regarding the number of units that is needed for valid inference when clustering standard errors, however there still no consensus on what that number is (see Cameron and Miller 2015, 341). Given the availability of data on loss probability, my sample is naturally fixed at 20 countries.
[51] See Appendix B4.
[52] See Appendix B4.

This setup assumes that all tax increases are equal in magnitude, which in practice is not valid. However, it enables a very strict test of whether competition decreases the probability of *any* tax increase. This alternative specification does not substantively alter the results.

5. Results

5.1. Loss probability and gasoline tax rates

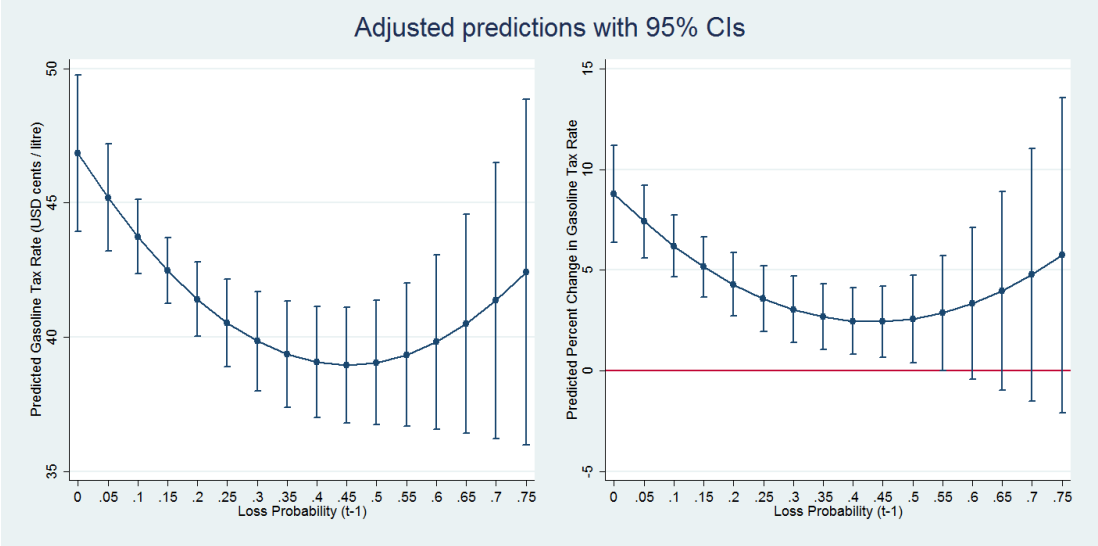
I first estimate the effect of loss probability on gasoline taxation. Electoral competition should be highest around the middle values of loss probability and lowest at very high values and very low values. At these levels politicians should be less responsive to voters since modest changes in vote shares are unlikely to win or lose them seats in the next election (Kayser and Lindstädt 2015, 249).

To model this U-shaped relationship, I estimate quadratic fixed effects models that include loss probability and its square (Models 1 and 4 in Table 3.4). The coefficients have the correct signs and are statistically different from zero. Plotting predicted tax levels and percent changes over different values of loss probabilities, holding all other variables at their means, enables easier interpretation (Figure 3.2). As expected, we observe a U-shaped relationship in the case of tax levels and changes. Both are predicted to be lowest at middle values of loss probability where electoral competition is highest. Similarly, they are highest at very low levels of loss probability, where competition is lowest. These findings support my theoretical arguments.

However, we also observe large confidence intervals at very high values of loss probability. The likely reason is the distribution of the loss probability data.[53] There are very few observation above 0.6 and none above 0.754 (which is why the x-axis is scaled 0-0.75). Though I test and confirm that the behavior of "likely losers" and "likely winners" is not statistically different, it may be that the behavior of "likely losers" is more variable, and therefore less uniform than the behavior of "likely winners". The dearth of observations of governing parties with high loss probabilities prevents me from exploring this possibility further. However, it should be an area for future research.

[53] The variable has a mean of 0.254 and a standard deviation of 0.218. See Appendix B1.

Figure 3.2. Loss probability and gasoline taxation



5.2. Electoral competition and tax rates

I next estimate the effect of electoral competition on gasoline tax rates. To do so, I estimate fixed effects models and include my measure of electoral competition (Models 2 and 5 in Table 3.4). This specification tests the linear relationship within countries over time between electoral competition and tax rate levels and changes. The coefficients for electoral competition have a negative sign and are statistically significant at conventional levels. Competition and gasoline tax rates are negatively correlated. Higher (lower) levels of electoral competition are associated with: (1) lower (higher) levels of gasoline taxation and (2) lower (higher) annual percent changes in the tax rate, all else equal.

In the case of tax rate levels, a one-unit increase in electoral competition is associated with a decrease in the tax rate of around 7.9 cents per litre, all else equal (Model 2). However, since the range of electoral competition is 0-1, a more sensible interpretation is to consider a one standard deviation increase (0.34), which is associated with a decrease of 2.67 cents per litre. In the case of changes, a one standard deviation increase in competition decreases the annual growth rate of taxation by around 1.9 percentage points (Model 5). Put simply, countries' tax rates grow slower under high levels of competition.

Table 3.4. Fixed effects models: Electoral competition and gasoline taxation

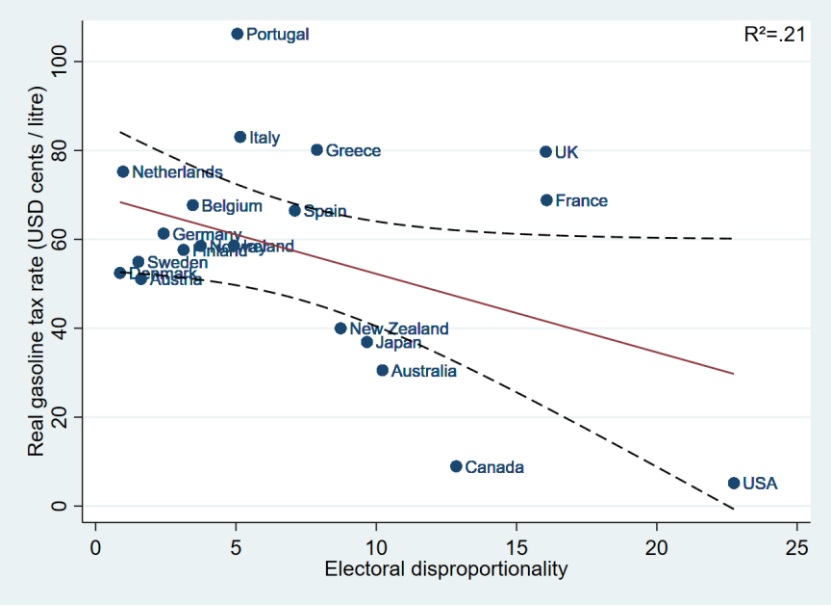
	Tax rate level (US cents per litre)			%Δ		
	(1)	(2)	(3)	(4)	(5)	(6)
Loss probability (t-1)	-34.99**			-29.16**		
	(12.40)			(10.47)		
Loss probability² (t-1)	38.77**			33.47*		
	(17.90)			(17.75)		
Electoral competition (t-1)		-7.857***	-0.848		-5.576**	6.374***
		(2.383)	(2.486)		(2.510)	(2.165)
Gasoline consumption (t-1)			-1.617			1.088
			(1.235)			(1.260)
Electoral competition *			-1.199***			-2.107***
Gasoline consumption (t-1)			(0.293)			(0.332)
Green cabinet seats (t-1)	0.212	0.225	0.198	0.0414	0.0492	-0.00130
	(0.185)	(0.193)	(0.179)	(0.241)	(0.238)	(0.242)
Left cabinet seats (t-1)	0.0437**	0.0436*	0.0357*	0.0231	0.0220	0.0215
	(0.0209)	(0.0208)	(0.0194)	(0.0318)	(0.0325)	(0.0324)
Environmental saliency (t-1)	-0.110	-0.110	-0.0306	-0.166	-0.165	-0.142
	(0.319)	(0.321)	(0.303)	(0.272)	(0.267)	(0.268)
Kyoto Protocol (t-1)	14.11***	13.14***	9.167***	12.66***	11.81***	7.601*
	(3.658)	(3.491)	(2.405)	(3.563)	(2.973)	(4.294)
Election year	-1.113***	-1.068***	-1.004***	-2.444*	-2.399*	-2.406*
	(0.359)	(0.361)	(0.344)	(1.318)	(1.345)	(1.343)
Budget deficit (t-1)	0.240	0.250	0.285	0.604**	0.615**	0.642**
	(0.216)	(0.216)	(0.197)	(0.267)	(0.266)	(0.260)
Government debt (t-1)	0.143*	0.135*	0.107	0.0274	0.0193	0.0372
	(0.0735)	(0.0712)	(0.0646)	(0.0548)	(0.0497)	(0.0604)
Inflation (t-1)	1.175**	1.177**	1.085**	1.458**	1.446**	1.550**
	(0.418)	(0.423)	(0.402)	(0.537)	(0.532)	(0.562)
Oil production (t-1)	0.919***	0.922***	0.835***	0.727**	0.719**	0.624**
	(0.214)	(0.201)	(0.169)	(0.299)	(0.302)	(0.267)
GDP growth rate (t-1)	-0.529**	-0.511**	-0.550**	-0.0462	-0.0302	-0.00969
	(0.222)	(0.222)	(0.209)	(0.342)	(0.343)	(0.337)
VAT rate (t-1)	0.278	0.300*	0.173	0.211	0.227	0.102
	(0.167)	(0.167)	(0.163)	(0.187)	(0.182)	(0.178)
Tax level (t-1)				-0.571***	-0.565***	-0.620***
				(0.132)	(0.130)	(0.134)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 - within	0.796	0.795	0.809	0.281	0.278	0.299
R^2 - between	0.329	0.324	0.674	0.058	0.071	0.082
R^2 - overall	0.462	0.460	0.724	0.132	0.135	0.140
Countries	20	20	20	20	20	20
N	426	426	426	418	418	418

Notes: Robust standard errors in parentheses clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

These effects are substantively significant. Consider the case of Sweden. It has the lowest average level of electoral competition in the sample. Moreover, its carbon tax is the highest in the world and contributed to an average annual increase in the gasoline tax rate of 3% a year between 1991 (its year of adoption) and 2013. If electoral competition was to suddenly increase one standard deviation, we would expect the country to move onto a growth trajectory that is around 2 percentage points lower on average, all else equal.

The results also offer evidence of a causal mechanism that links political institutions to long-term climate change policy investments. As I argue in Chapter 2, electoral competition is structured in part by electoral rules. Because countries with proportional (PR) rules tend to have lower average long-run levels of electoral competition compared to countries with majoritarian rules (Kayser and Lindstädt 2015), politicians in PR countries should routinely experience higher levels of electoral safety.[54] The implication of this argument here is that electoral rules should systematically structure political possibilities for gas tax increases. As a result, we should expect long-term tax averages to vary cross-nationally by electoral rules. Indeed, this is the relationship we observe in Figure 3.3. Countries with more proportional rules have higher average real tax rates over the sample period compared to those with disproportional (i.e., majoritarian) rules.

Figure 3.3. Electoral rules and gasoline taxation (with 95% CIs) (avg. 1978-2013)



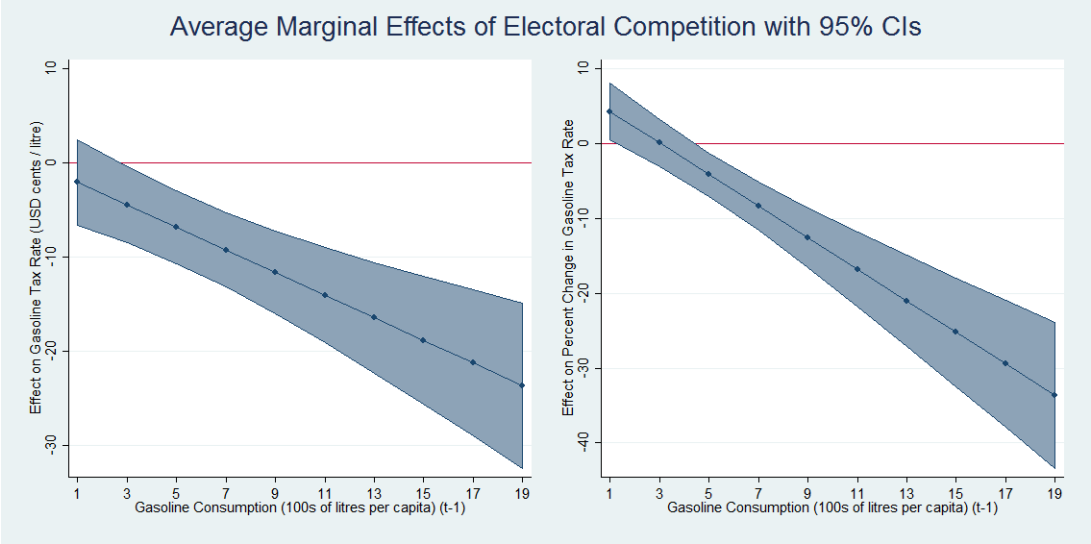
[54] See Appendix B5 for a discussion of the relationship between electoral rules and electoral competition.

Turning briefly to the control variables in Models 2 and 5 in Table 3.4, I find that most conform to expectations. Tax rates are lower in election years, confirming findings from a large literature on political business cycles (e.g., Mikesell 1978; Nordhaus 1975; Royed and Borrelli 1999). Also in line with previous research, the case for partisanship is mixed (see Section 3 above). While the coefficients for green cabinet seats are positive, as expected, they do not reach conventional levels of statistical significance. Left cabinet seats are also associated with increased tax rates, however the coefficients are much smaller than those for green seats. Moreover, they are not always statistically significant. The fiscal health variables have the expected positive sign, but again do not reach statistical significance. On the other hand, inflation is a significant predictor of tax increases, in line with previous findings (e.g., Goel and Nelson 1999). Similarly, tax rates are significantly higher after countries' ratify the Kyoto Protocol, suggesting a positive role for multilateral agreements. Last I find, perhaps counter-intuitively, that increased domestic oil production is associated with higher tax rates.

5.3. Moderating effect of personal costs

Models 3 and 6 are the interaction models. They test whether gasoline consumption (the proxy for personal costs) moderates the relationship between electoral competition and the tax rate. The coefficients for the interaction terms are negative and statistically significant. This indicates that the effect of electoral competition on gasoline taxation is indeed different at different levels of gasoline consumption, as predicted. Graphing the marginal effect of a one-unit increase in competitiveness at different levels of consumption, we see that as consumption increases the effect of electoral competition also increases (Figure 3.4). When consumption is 500 litres per capita (close to the average for the sample) a one standard deviation increase in competition is associated with a decrease in the tax level of 2.33 cents per litre and a decrease of the tax growth rate of 1.41 percentage points, all else equal. But as per capita consumption doubles to 1,000 litres, the same increase is now associated with a decrease of 4.37 cents per litre and 5 percentage points, all else equal.

Figure 3.4. Marginal effects of electoral competition



We also see that electoral competition has no marginal effect on the tax rate at very low levels of fuel consumption (i.e., at or below around 300 litres per capita). This supports the argument that when the personal costs of a tax increase are low, electoral competition is unlikely to affect politicians' decision-making, since increases in tax rates on goods that are not widely consumed are less likely to lose votes. Indeed, in a world where no voter consumes fossil fuels putting up fossil fuel tax rates would involve little political risk. Taken together, these results provide strong support for the hypotheses that electoral competition reduces electoral incentives to increase fossil fuel tax rates and that government perceptions of personal costs to voters moderate the relationship between electoral competition and tax rates.

In addition, they offer two important implications. The first is a two-way causal relationship between consumption of the taxed good and the tax rate. Standard economy theory predicts that tax rates affect consumption, however the results here demonstrate how consumption also affects the tax rate. Empirical research in economics has found a similar relationship between the number of smokers and the tobacco tax rate in US states (Hunter and Nelson 1992) and gasoline consumption and gasoline tax rates across OECD countries (Hammar, Löfgren, and Sterner 2004). The hypothesis is that "sin tax" policy may be influenced by the size of the group subject to the tax. Yet no detailed theoretical account has been provided. My argument offers such an account. Consumption of a taxed good shapes politicians' perceptions of voter preferences. When it is high, the governing party is reluctant to increase rates, especially when the next election is expected to be close. Hence, it is the behavior of vote-

maximizing politicians that moderates the relationship between consumption and the tax rate.

Secondly, the results imply a long-run positive feedback effect between electoral competition, fossil fuel consumption, and tax rates. Lower taxes mean lower prices, which in turn encourage higher consumption. Higher consumption should then make it more difficult for politicians to increase tax rates in the future, even at low levels of competition. As a result, there may be a "high consumption-low tax trap". Conversely, higher taxes mean higher prices, which helps to reduce consumption, and by doing so, make it easier for politicians to raise taxes in the future. Higher taxes also lead to clean innovation. Recent evidence suggests that automotive firms innovate more in clean technologies when they are located in countries with higher fuel prices (Aghion et al. 2016). By increasing the efficiency of automobiles, such innovation should further drive down consumption and again make it less risky for politicians to further increase tax rates. Taken together, these effects should generate strong path dependencies over time that push countries onto different fossil fuel consumption, taxation, and innovation trajectories. Those on high tax-low consumption trajectories should find it more politically feasible to purge fossil fuels from the economy over time. However, for those caught in a high consumption-low tax trap, changing trajectories will likely prove difficult, especially in times of heightened electoral competition. Such a dynamic may help to explain why high consumption-low tax countries such as the US have found it so politically difficult to increase fossil fuel prices via taxation (Rabe 2010).

6. The case of eco-taxation in Germany

To provide an illustrative case of how changes in electoral competition generate changes in fossil fuel tax rates I examine fossil fuel tax increases adopted by the same Social Democratic-Green (Red-Green) coalition in two sequential electoral periods: 1998-2002 and 2002-2005. This within-country research design exploits variation in electoral competition over the two periods, while holding constant potential confounding variables.

In March 1999, less than a year after winning the 1998 German federal elections, the Red-Green coalition adopted the Law Initiating the Ecological Tax Reform.[55] The goal was to make "labour cheaper and energy use more expensive" by

[55] Gesetz zum Einstieg in die ökologische Steuerreform

increasing the price of polluting sources of energy, in order to reduce their consumption and meet climate change-related goals, and use the increased revenues to boost employment through lowering employers' non-wage labour costs (Lightfoot and Luckin 2000, 163; Mehling 2013, 92).[56] As of April 1, 1999, existing excise tax rates on the household consumption of transport fuels (diesel and gasoline) were to increase by 3.07 Euro cents per litre (6 pfennings), on heating oil by 2.05 Euro cents per litre (4 pfennings), and natural gas by 0.16 Euro cents per kilowatt-hour (0.32 pfennings) (Beuermann and Santarius 2006, 920; Mehling 2013, 92-4).[57] The new revenues were earmarked to reduce employers' pension insurance contributions by 0.8 percent. In December 1999, the government adopted further tax increases via the Law Continuing the Ecological Tax Reform.[58] This second law was to come into force January 1, 2000 and mandated four additional tax increases on road fuels and electricity (of 3.07 Euro cents per litre and 0.26 Euro cents per kilowatt-hour, respectively), to be imposed on January 1 of 2000, 2001, 2002 and 2003.

The tax increases were unpopular with the public and industry (Beuermann and Santarius 2006; Mehling 2013, 93; Weidner and Mez 2008, 365). The situation was exacerbated in 2000 when global oil prices spiked and fuel price protests erupted in Germany and across Europe (Imig 2002). However, the government stayed the course and continued with its planned annual increases, even while the main opposition party, the Christian Democrats (CDU), advocated scrapping the tax altogether and governments in other European countries moved to provide relief to consumers (Imig 2002; VerkehrsRundschau 2000a and 2000b).

Between 2000 and 2002 the government was ambivalent on whether it intended to increase rates after 2003 (Spiegel 2002; Taz 2001a and 2001b). The Greens wanted to continue to increase rates to meet environmental goals. However, initially the Social Democrats (SPD) would not publicly agree to additional increases, arguing instead that such a matter should be decided after the 2002 election. But by April 2002 (five months before the election) Chancellor Gerhard Schröder (SPD) publicly announced that the eco-tax would not be increased under a future SPD government. The party's 2002 election manifesto made the same declaration (SPD 2002, 23). The Greens on the other hand pledged to "further develop" the tax, while the opposition CDU/CSU pledged to

[56] This type of reform is referred to as environmental tax reform, see Andersen and Ekins (2009).
[57] Industry was also targeted, but enjoyed exemptions (as expected in light of the arguments laid out in Chapter 2). However, I focus here only on households.
[58] Gesetz zur Fortführung der ökologischen Steuerreform

not only not increase the eco-tax in 2003, but to abolish it (CDU-CSU 2002, 9; Greens 2002, 19).

The Red-Green coalition was re-elected in 2002. During post-election bargaining, the Greens demanded further increases in the eco-tax while the SPD opposed them (Lutz 2002; NZ 2002). In the end, the coalition agreement left the door open to further increases by vaguely stating that in 2004 the government would "examine whether and how [ecological] taxation should be further developed" (SPD-Greens 2002, 21). This was a very different outcome than the explicit rate increases laid out in the 1998 agreement. However, not even two weeks after the agreement was signed, Chancellor Schröder (SPD) came out against further increases, while the Greens continued to push for them (BZ 2002). In the end, the SPD won out and the eco-tax was not increased after 2003.

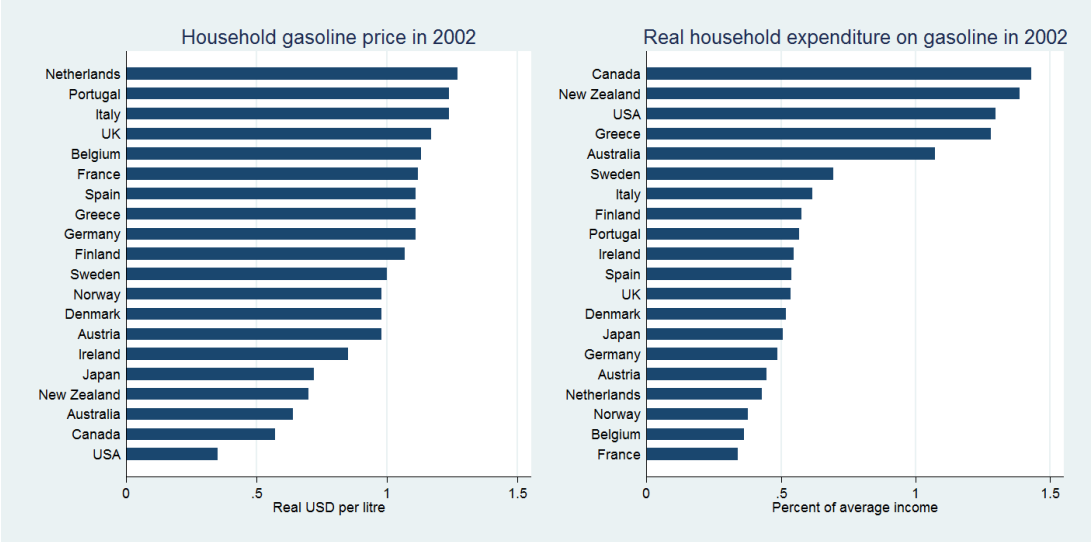
Why was the SPD willing to increase tax rates on fossil fuels after the 1998 election, but not after the 2002 election? Which variables changed enough between the two periods to explain this change in the party's behavior? Indeed, many political and fiscal variables changed little in 2002 compared to 1998 (Table 3.5). In public statements, Chancellor Schröder and other SPD politicians argued that the eco-tax could not be increased because "load limits" for consumers had been reached, suggesting that consumers could simply not afford additional increases (Spiegel 2002, Schultz and Wiskow 2002). Yet the real price of gasoline (market price plus taxes) in Germany in 2002 was lower than in eight other European countries (Figure 3.5 left side). Similarly, as a percentage of average income, German households spent less on gasoline in 2002 than fourteen other countries in the sample (Figure 3.5 right side). Most importantly, why was the SPD now suddenly concerned with unhappy consumers when in 2000 it had ignored public protests and demands to repeal the tax? For the answer I examine how the competitiveness of the electoral environment shifted dramatically after the 2002 election.

In the 1998 election, the SPD won a plurality of votes for the first time since 1972. The party enjoyed a 5.8% vote margin over the CDU/CSU – the largest vote margin over its rival in the post-war period (Döring and Manow 2016). During the electoral cycle from 1998-2002, the electoral competition score for the party was 0.369; slightly higher than the German long-run average (1983-2012) of 0.314, but lower than the average for the entire sample of countries (0.438). From this relatively secure electoral position the party would have been open to increasing fossil fuel tax rates on

Table 3.5. Key variables across two electoral periods

	Electoral period	
	Oct. 1998 – Sept. 2002	Oct. 2002 – Sept. 2005
Dependent variables		
Tax increase (nominal Euro cents/litre)	12.27	3.07
Average percent change from previous year	4.5%	1.64%
Key independent variables		
Electoral competition	0.369	0.638
SPD vote margin over CDU/CSU	5.8%	0%
Other independent variables		
Cabinet seat share of SPD	80%	78.6%
Cabinet seat share of Greens	20%	21.4%
Gasoline consumption (litres per capita) (avg.)	473	412
Saliency of environment	3.81	3.44
Budget deficit (% of GDP) (avg.)	1.98	3.725
Government debt (% of GDP) (avg.)	60.11	66.075
Inflation (avg.)	1.27%	1.42%

Figure 3.5. Household gasoline prices and expenditure in 2002



voters, especially if it meant securing a coalition agreement with the Greens and leading a government for the first time since 1982. Hence, during coalition bargaining with the Greens the SPD agreed to specific increases in fossil fuel tax rates (SPD-Greens 1998, Section III.3). This result would not have necessarily been predicted before the election. The 1998 SPD election manifesto mentions ecological tax reform in very general terms, but offers no specifics on tax increases for voters (SPD 1998). Indeed, it states that "excessive and intolerable [eco-tax] burdens will not happen under the SPD" (SPD

1998, 36). But after the favorable electoral result, the party could let the policy preferences of its coalition partner dominate its own vote-seeking preferences.However, after the 2002 election the SPD found itself in a very different competitive environment. The party's margin over the CDU/CSU shrank to zero as both parties received 38.5% of the vote (Döring and Manow 2016). The electoral competition score increased dramatically to 0.638. This sudden increase in electoral uncertainty would have re-ordered the SPD's preferences going into a new round of coalition bargaining with the Greens (a party that was now emboldened by an increased vote share of 1.9%). Given the importance of eco-tax policy to the Greens, it's no surprise that in order to secure a coalition agreement the SPD left the door open to further increases, even though it had already ruled them out in its own manifesto. However, the SPD would have already known that new increases were not going to happen. Given its weakened electoral position, the party would need to focus on maximizing votes in the next election (scheduled for 2006) over satisfying the policy preferences of its coalition partner. Therefore, while the SPD may have been able to safely ignore vocal voter opposition to the tax in the previous electoral period, the now highly competitive electoral environment meant that it had to be responsive to unhappy voters if it was to maximize its chances of winning the next election. Further increases in the fossil fuel tax rate simply entailed too much political risk for the vulnerable party and were therefore not adopted after 2003.

7. Conclusion

For decades economists have been championing the use of carbon taxes as the most efficient policy instrument to address climate change. But not all governments have been eager to obey their advice. This paper provides a resolution to this puzzle. For governments wishing to do so, increasing tax rates on goods that are widely consumed by voters, such as fossil fuels, entails political risk. I find evidence that in times of low electoral competition, when governing parties feel secure in office, they are able to tolerate such risk and increase tax rates. I argue that these political conditions re-order the party's preferences, allowing its policy preferences to dominate its vote-seeking ones. However, when competition is high and the outcome of the upcoming election is uncertain, the governing party's best strategy is vote-maximization. Under these conditions, the party is unlikely to increase fossil fuel tax rates for fear of losing

marginal votes. I also find that the negative effect of electoral competition depends on how politicians' perceive voter preferences regarding tax increases. When increases in tax rates are expected to impose large personal costs on voters, because consumption of the taxed good is high, increases in competition generate even stronger incentives to respond to voter preferences and not increase rates.

The arguments and empirical results help to clarify how electoral incentives structure politicians' behavior vis-à-vis climate change policy, and by doing so fill a large gap in the political science literature. Existing work has hinted at the crucial role of such incentives, but has yet to offer a theoretical account of their micro-foundations or large-N empirical tests. Relatedly, the results contribute to research on the politics of long-term policymaking and structural change (Garrett 1993; Jacobs 2011). Electoral safety is hypothesized to be a key necessary condition for politicians to adopt policies that impose short-term costs for long-term benefits. Only governments that feel secure in office can assume the long-term time horizon needed for engaging in the politics of structural change. Conceptualizing gasoline taxation as a type of long-term climate change mitigation policy that aims to hasten the decarbonization of the national economy (long-term structural change *par excellence*), I find evidence that politicians are indeed most likely to increase tax rates when they enjoy a low risk of losing office. Furthermore, the findings point to a causal mechanism – electoral competition – that links institutions to long-term climate policy investments. Politicians elected under PR rules tend to enjoy systematically lower levels of electoral competition relative to those elected under majoritarian rules. For this reason we observe a positive relationship between average long-run gasoline tax levels and electoral proportionality. In this way, the essay offers additional support to the arguments laid out in Chapter 2.

The findings also shed light on the politics of climate policy instrument choice. In instances of low competition, we should expect governments to be more likely to directly increase consumer energy prices using taxes. However, when competition is high such policies are unlikely to be politically feasible. Instead, politicians should be expected to use policy instruments that hide costs from voters. For example, in the case of the transport sector they should be expected to choose fuel efficiency standards (which directly impose costs on manufacturers) or subsidies for electric vehicles (funded through general revenues), over fuel tax increases for consumers. Indeed, electoral competition should systematically structure how politicians distribute the short-term costs of climate policy between producers and consumers.

The results have at least two additional implications. The first is a two-way causal relationship between tax rates and consumption. Standard economy theory predicts that tax rates affect consumption, however the evidence here demonstrates that consumption also affects the tax rate by shaping politicians' perceptions of voter preferences. Secondly, the results imply a long-run positive feedback effect between electoral competition, fossil fuel consumption, and fossil fuel taxation, which should generate strong path dependencies over time that push countries onto different fossil fuel consumption and taxation trajectories. For those caught in a "high consumption-low tax trap", changing trajectories will likely prove difficult, especially in times of heightened electoral competition. This effect should be present in the case of any good that is widely consumed by voters.

This essay is the first to offer a theoretical account and empirical analysis of the relationship between electoral incentives and fossil fuel taxation. There is much room for additional research. Future research could, for example, explore the two implications outlined above in more detail. Such an inquiry could further examine fossil fuel taxation or analyze other consumption taxes. Additionally, further research could investigate the relationship between electoral competition and taxes on other fossil fuels, such as natural gas or carbon-intensive electricity. Gasoline taxation is highly visible to voters and therefore may be much more politically salient than tax increases on other fuels. Similarly, the relationship between electoral incentives and industrial fossil fuel taxes is ripe for exploration.

To effectively address climate change, the standard prescription has been to increase the price of fossil fuels using taxation. However, doing so is likely to entail too much political risk for governments when elections are close and fuel consumption is high, which helps to explain why the price of fossil fuels and their consumption varies across countries and over time.

APPENDIX B

B1. Summary Statistics

Table B1. Summary statistics and data sources

Variable	Source	Obs.	Mean	Std. Dev.	Min	Max
Tax rate on household gasoline (nominal US cents PPP per litre)	See Appendix B2	615	44.0566	23.6749	1.0567	110.197
Percent change from previous year in excise tax rate on household gasoline (based on national currency rates)	See Appendix B2	595	4.26021	12.6167	-44.445	125.040
Loss probability (Prime Minister's party)	Kayser and Lindstädt (2015)	500	0.25404	0.21824	0	0.75381
Loss probability (Plurality party)	Kayser and Lindstädt (2015)	556	0.25529	0.21930	0	0.75381
Electoral competition (Prime Minister's party)	Author's calculations based on data from Kayser and Lindstädt (2015)	500	0.43825	0.34175	0	0.99711
Electoral competition (Plurality party)	Author's calculations based on data from Kayser and Lindstädt (2015)	556	0.43822	0.34083	0	0.99711
Long-run average electoral competition (1960-2012)	Author's calculations based on data from Kayser and Lindstädt (2015)	18	0.52018	0.27131	0.09277	0.99306
Gasoline consumption (100s of litres per capita)	IEA (2018b); OECD (2018a)	740	5.36200	3.70104	1.04307	19.0594
Expenditure on gasoline (% of average income spent on gasoline)	IEA (2018a); OECD (2018b)	511	0.00814	0.00553	0.00241	0.03846
Green cabinet seats (% of cabinet seats	Author's calculations	740	0.51076	2.40402	0	18.75

held by green parties)	based on Armingeon et al. (2016b)					
Left cabinet seats (% of cabinet seats held by non-green left parties)	Armingeon et al. (2016a)	740	34.1812	38.8052	0	100
Environmental saliency (sum of per501 across all parties divided by number of parties)	Volkens et al. (2015)	727	5.64070	3.46457	0.09	18.33
Kyoto Protocol ratification	UNFCCC (2009)	740	0.31757	0.46585	0	1
Election year	Based on Armingeon et al. (2016a)	740	0.28649	0.45243	0	1
Budget deficit (Annual deficit as % of GDP)	Armingeon et al. (2016a)	712	2.97153	4.77404	-18.7	32.55
Government debt (Gross general government debt as % of GDP)	Armingeon et al. (2016a)	740	68.5487	34.5958	13.03	227.67
Inflation (Annual growth rate of CPI)	Armingeon et al. (2016a)	740	4.38328	4.60194	-4.48	28.38
Oil production (Domestic oil production - tonnes per capita)	IEA (2018b)	720	1.50017	4.99064	0	35.0829
GDP growth (Annual growth rate of nominal GDP per capita)	OECD (2018b)	740	6.64904	5.45623	-9.42	26.45
VAT on gasoline (Value added tax rate on gasoline - %)	IEA (2016)	708	14.2299	8.69575	0	36
GDP per capita (Nominal – 10,000 USD PPP)	OECD (2018b)	740	2.41984	1.1981	0.42819	6.68122
Green vs growth (government ideology score)	Jahn (2016)	740	3.87551	6.26911	-16.794	32.1406
Left vs right (government ideology score)	Jahn (2016)	740	1.89867	6.21638	-18.584	21.9580
Single-party gov (Government in comprised of one party)	Based on Armingeon et al. (2016a)	733	0.43656	0.4963	0	1
Political constraints (POLCONIII)	Henisz (2002)	740	0.47444	0.09179	0.21091	0.71811
Social expenditures	Armingeon	630	21.4855	5.32803	9.87	36.01

(Total public and mandatory private social expenditure as % of GDP)	et al. (2016a)					
Urbanization (% of population living in urban areas)	World Bank (2018)	740	76.2144	10.3192	41.979	97.818
Income tax structure (Taxes on individual income as a % of total taxation)	OECD (2018c)	729	29.3955	10.6344	9.7	61.6
EU membership	Armingeon et al. (2016a)	740	0.60541	0.48909	0	1
Electoral disproportionality	Armingeon et al. (2016a)	739	7.214	7.088	0.35	43.895
Long-run average electoral disproportionality (1945-2010)	Lijphart (2012)	18	6.58	5.28234	1.21	20.88

B2. Data sources for gasoline taxation

Table B2. Data sources for excise tax rates on regular household gasoline

Country	Data source(s)
Australia	IEA (2016); James (1996)
Austria	IEA (2016)
Belgium	IEA (2016)
Canada	IEA (2016); International Fuel Tax Agreement (2015)
Denmark	IEA (2016); Statistics Denmark (2017)
Finland	IEA (2016)
France	IEA (2016)
Germany	IEA (2016); German Federal Ministry of Finance (2014)
Greece	IEA (2016)
Ireland	IEA (2016)
Italy	IEA (2016)
Japan	IEA (2016)
Netherlands	IEA (2016)
New Zealand	IEA (2016)
Norway	IEA (2016)
Portugal	IEA (2016)
Spain	IEA (2016)
Sweden	IEA (2016); SPBI (2016)
UK	IEA (2016); Institute for Fiscal Studies (2018)
USA	IEA (2016); US Federal Highway Administration (2018)

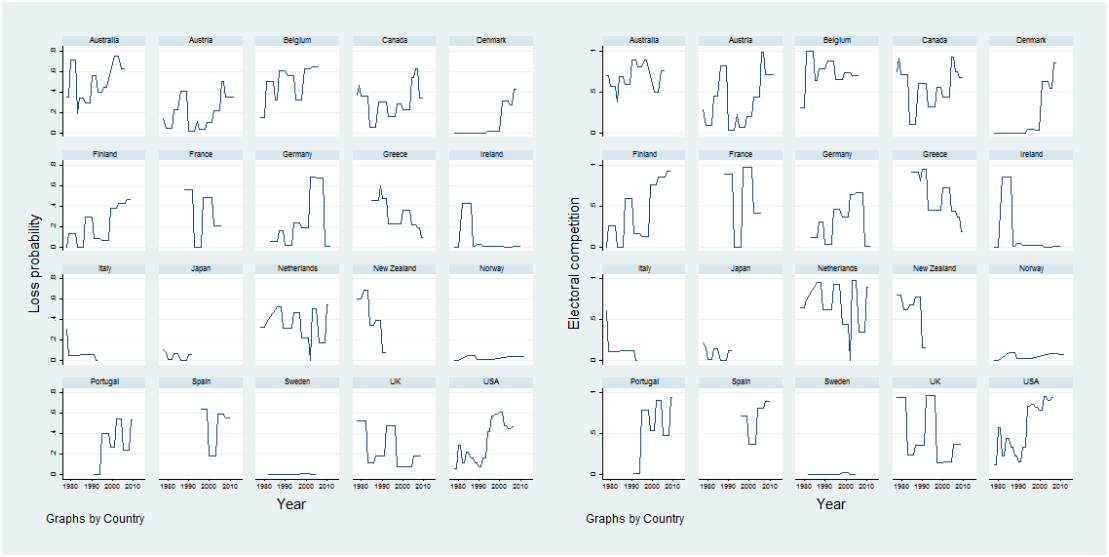
B3. Measuring electoral competition

To generate a measure of electoral competition I measure the absolute distance of each governing party's loss probability from 0.5, or theoretically perfect competition, and then rescale the variable to a range of 0 to 1 using Formula 1, where 1 is equal to perfect competition. This approach is very similar to the one used in American politics when calculating the folded Ranney Index (see for example Chapter 4 of this thesis and Flavin and Shufeldt 2016).

$$\left(\frac{1-|loss\ probability_{i,t} - 0.5|}{0.5}\right) - 1 \quad (1)$$

The left side of Figure B1 shows the original data from Kayser and Lindstädt (2015). The right side shows the new measure of electoral competition.

Figure B1. Electoral competition of prime minister's party



Validating new measure

My new measure assumes that loss probabilities that are equidistant from 0.5 generate the same incentives for the governing party. Parties that have a low probability of losing their seats plurality at the next election ("likely winners" with a loss probability of 0.25) and those from parties that have a high probability of doing so ("likely losers" with a

loss probability of 0.75) will behave similarly. Both therefore receive the same score after the variable is transformed (a score of 0.5).

To test this, I generate a dummy variable that equals 1 when a party's loss probability is less than 0.5. These parties can be considered "likely winners" since they have a high probability of winning the next election. I then estimate a fixed effects model and interact this dummy with my measure of electoral competition and include the same controls from the main analysis. If the interaction is not statistically significant it would indicate that there is no statistical difference between the behaviour of likely winners and likely losers at different levels of electoral competition. Table B3 provides the results. The coefficient for the interaction term is not statistically significant from zero. Graphing the predictive margins, we see that the confidence intervals overlap, indicating no statistical difference in behaviour between the two groups at different levels of competition (Figure B2). I take this as evidence that validates the assumption that likely winners and likely losers tend to behave similarly.

Figure B2. Likely winners vs. likely losers

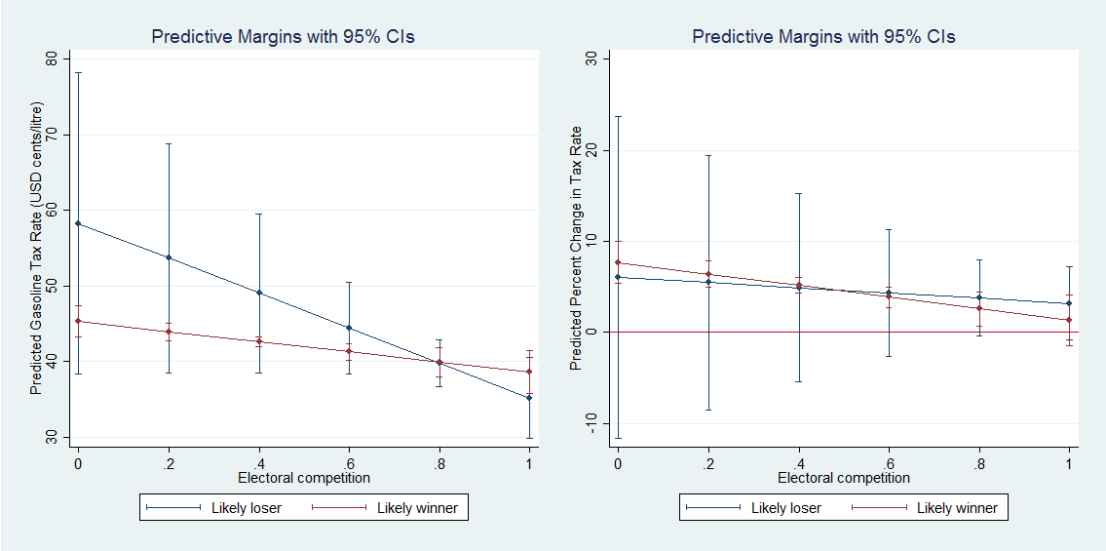


Table B3. Validating new measure of electoral competition

	(1) Tax level	(2) %Δ
Electoral competition (t-1)	-23.11*	-2.877
	(12.28)	(9.708)
Loss probability dummy (t-1)	-13.00	1.621
	(10.43)	(9.613)
Electoral competition * Loss probability dummy (t-1)	16.41	-3.500
	(12.75)	(10.38)
Green cabinet seats (t-1)	0.173	0.0558
	(0.201)	(0.238)
Left cabinet seats (t-1)	0.0452**	0.0215
	(0.0210)	(0.0324)
Environmental saliency (t-1)	-0.101	-0.154
	(0.333)	(0.274)
Kyoto Protocol (t-1)	14.00***	11.51***
	(3.467)	(3.448)
Election year	-0.993**	-2.447*
	(0.350)	(1.304)
Budget deficit (t-1)	0.257	0.615**
	(0.210)	(0.271)
Government debt (t-1)	0.137*	0.0199
	(0.0707)	(0.0533)
Inflation (t-1)	1.157**	1.454**
	(0.420)	(0.546)
Oil production (t-1)	0.929***	0.713**
	(0.194)	(0.308)
GDP growth rate (t-1)	-0.521**	-0.0219
	(0.215)	(0.350)
VAT rate (t-1)	0.296*	0.222
	(0.167)	(0.183)
Tax level (t-1)		-0.558***
		(0.136)
Country FE	Yes	Yes
Year FE	Yes	Yes
R^2 – within	0.798	0.279
R^2 – between	0.371	0.069
R^2 – overall	0.456	0.136
Countries	20	20
N	426	418

Notes: Robust standard errors in parentheses clustered at the country level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B4. Robustness tests

I subject my results to a wide variety of robustness tests (Tables B4-B6):

- **Alternative lag structure (Table B4: Models 1-6):** I re-estimate the main results using a two-year lag structure. A two-year lag between the adoption and implementation of a tax increase is also theoretically plausible. Furthermore, this lag structure has been used in previous studies (Goel and Nelson 1999). Using this structure does not alter the results.
- **Jackknife resampling (Table B4: Models 7-12):** It could be the case that one country is driving the results. To test this I re-estimate the main results using jackknife resampling, which drops each country from the dataset, calculates the estimates, and then calculates the average across all of these estimates. The results indicate that my main results are not driven by any single country in the sample.
- **Expanded sample (Table B5: Models 1-6):** My main results estimate the effect of electoral competition from the perspective of the prime minister's party. However, I also have data on competition from the perspective of the plurality party in the legislature, which is usually, but not always, the prime minister's party. To demonstrate that the relationship holds for the largest party in the legislature, regardless of whether it's the prime minister's party, I re-estimate the main results using electoral competition scores for the plurality party. The results do not substantively differ from the main results.
- **Alternative measure of personal costs (Table B5: Models 7-8):** The main results use gasoline consumption per capita as a proxy for personal costs. To ensure the robustness of the results I construct and test an alternative measure of personal costs: expenditure on gasoline as a percentage of household income. I construct this variable by multiplying gasoline consumption per capita by the pre-tax price per litre of gasoline and then dividing the product by nominal GDP per capita (Equation 2). I then re-estimate the models using this measure instead of gasoline consumption per capita. Using this alternative measure does not substantively alter the results.

$$\frac{gasoline\ consumption_{it} * pretax\ price_{it}}{nominal\ GDP\ per\ capita_{it}} \quad (2)$$

- **Additional controls (Table B6: Models 1-6):** I include a wide variety of additional controls to further rule out possibilities of omitted variable bias:
    - To control for differences in income over time, which may make voters more willing to pay higher fossil fuel taxes, I include nominal GDP per capita.
    - To control for government ideology (in addition to partisanship) I use party scores for left vs right and green vs growth from Jahn (2016). The latter should be a good measure of the "greenness" of party's policy preferences.
    - Coalition governments may find it easier than single-party ones to increase tax rates if multi-party governments make it more difficult for voters to assign responsibility and blame to specific parties. To control for this I include a dummy for single-party government.
    - It may be that government politicians are simply increasing tax rates when they face fewer veto players. To control for this, I include a commonly used measure of political constraints from Henisz (2002).
    - If governments use new revenues to fund spending on public goods, the temporal lag from the perspective of voters between the costs and benefits of tax increases may be reduced, making voters more amenable to such increases. Knowing this, governments may be more willing to increase rates. To control for this I include a measure of government social expenditure.
    - The cost of a tax increase to voters could also depend on the availability of other transportation options. When other options are readily available, such as walking, cycling, or using public transport, politicians may predict that an increase in the gasoline tax will be less risky. Since no perfect measure exists for this, I use the proportion of the population living in urban areas. The assumption is that voters in urban areas will have more readily available transport alternatives that those living in rural areas.
    - Governments may simultaneously increase taxes on fossil fuels and decrease other taxes, particularly on income (a process referred to as environmental tax reform). Similar to changes in social expenditure, this may bring immediate benefits to voters and thus make it more politically

feasible to increase fossil fuel taxes. To control for this I include income tax revenue as a percentage of total taxation.

- To control for the influence of the European Union I add a dummy for EU membership, as some countries became members during the sample period. In 2003 the EU issued the Energy Tax Directive, which set a minimum gasoline tax rate for all member states of 0.359 Euros/litre; though this would have had little effect for my sample. All EU countries in my sample apart from Greece had a tax rate higher than this in 2003.

Including these additional controls does not substantively change the results. None of the additional coefficients are statistically significant at conventional levels. Comparing the within-unit R^2 values of the models with additional controls to the main results indicates that the expanded models fit the data little better than the parsimonious models.

- **Alternative specification (Table B6: Models 7-10)**: To ensure that the results are not dependent on model specification, I estimate a logit model with country and year fixed effects as an alternative specification. The dependent variable equals 1 if the tax rate was increased and 0 otherwise. This is the most conservative setup since it assumes that the politics of all tax increases are equal, which in practice is not valid. For example, a large increase should be much more politically risky than a small one. However, it enables a very strict test of whether competition decreases the probability of *any* tax increase. I find evidence of this. A one-unit increase in electoral competition decreases the odds of a tax increase by between 60% and 70%, all else equal. (The difference between Models 7 and 8 and Models 9 and 10 is that the first set includes a dummy for Kyoto Protocol ratification. However, this specification drops a number of year dummies after 2003, indicating multicollinearity. I therefore estimate a second set of models without the Kyoto Protocol dummy to ensure the robustness of the results.)

Table B4. Robustness tests (1)

	Two year lag structure						Jackknife resampling					
	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Loss probability	-31.65**	-16.54					-34.99**	-29.16**				
	(11.13)	(10.62)					(16.30)	(11.79)				
Loss probability^2	33.90**	11.91					38.77	33.47				
	(16.11)	(16.13)					(23.30)	(21.19)				
Elect. competition			-7.424***	-5.487**	-0.928	-0.175			-7.857**	-5.576*	-0.848	6.374**
			(2.178)	(1.929)	(2.470)	(3.138)			(3.264)	(3.033)	(3.259)	(3.040)
Gasoline consump.					0.000242	0.991					-1.617	1.088
					(1.446)	(1.363)					(1.907)	(1.507)
Elect. comp. * Gas consump					-1.097***	-0.923					-1.199**	-2.107***
					(0.290)	(0.548)					(0.425)	(0.616)
Green cabinet seats	0.227	0.0505	0.232	0.0327	0.196	0.00585	0.212	0.0414	0.225	0.0492	0.198	-0.00130
	(0.198)	(0.226)	(0.205)	(0.218)	(0.205)	(0.222)	(0.326)	(0.691)	(0.314)	(0.673)	(0.277)	(0.668)
Left cabinet seats	0.0293	0.0111	0.0294	0.0119	0.0262	0.0129	0.0437	0.0231	0.0436	0.0220	0.0357	0.0215
	(0.0219)	(0.0257)	(0.0220)	(0.0264)	(0.0207)	(0.0247)	(0.0293)	(0.0416)	(0.0281)	(0.0415)	(0.0254)	(0.0433)
Environmental saliency	-0.167	-0.331	-0.164	-0.313	-0.140	-0.317	-0.110	-0.166	-0.110	-0.165	-0.0306	-0.142
	(0.344)	(0.264)	(0.342)	(0.262)	(0.334)	(0.272)	(0.404)	(0.362)	(0.401)	(0.349)	(0.386)	(0.350)
Kyoto Protocol	15.62***	11.08***	14.81***	11.10***	11.89***	9.488**	14.11**	12.66**	13.14*	11.81***	9.167**	7.601
	(3.423)	(3.566)	(3.162)	(3.374)	(2.157)	(3.597)	(6.533)	(4.704)	(6.691)	(3.993)	(3.738)	(8.839)
Election year	-0.391	-1.804	-0.344	-1.806	-0.352	-1.827	-1.113**	-2.444	-1.068**	-2.399	-1.004**	-2.406
	(0.419)	(1.419)	(0.415)	(1.434)	(0.380)	(1.447)	(0.459)	(1.515)	(0.459)	(1.557)	(0.456)	(1.534)
Budget deficit	0.484**	0.842**	0.493**	0.850**	0.509**	0.858**	0.240	0.604	0.250	0.615	0.285	0.642
	(0.215)	(0.341)	(0.217)	(0.343)	(0.203)	(0.333)	(0.309)	(0.388)	(0.311)	(0.384)	(0.283)	(0.384)
Government debt	0.131*	-0.0376	0.124*	-0.0368	0.122	-0.0207	0.143	0.0274	0.135	0.0193	0.107	0.0372
	(0.0687)	(0.0497)	(0.0666)	(0.0481)	(0.0711)	(0.0558)	(0.104)	(0.0681)	(0.0985)	(0.0610)	(0.0927)	(0.0749)
Inflation	1.080***	-0.0923	1.089***	-0.0806	1.063**	0.00429	1.175**	1.458*	1.177**	1.446*	1.085**	1.550**
	(0.348)	(0.484)	(0.355)	(0.492)	(0.399)	(0.503)	(0.507)	(0.720)	(0.517)	(0.714)	(0.402)	(0.724)

Oil production	0.859***	0.0367	0.865***	0.0436	0.789***	0.0136	0.919	0.727	0.922	0.719	0.835	0.624*
	(0.189)	(0.271)	(0.179)	(0.283)	(0.150)	(0.279)	(4.022)	(2.098)	(3.455)	(1.561)	(2.779)	(0.339)
GDP growth rate	-0.506**	0.914*	-0.492**	0.916*	-0.491***	0.926*	-0.529*	-0.0462	-0.511*	-0.0302	-0.550**	-0.00969
	(0.187)	(0.449)	(0.184)	(0.453)	(0.171)	(0.472)	(0.255)	(0.417)	(0.253)	(0.419)	(0.239)	(0.414)
VAT rate	0.278	0.120	0.294*	0.123	0.219	0.0805	0.278	0.211	0.300	0.227	0.173	0.102
	(0.169)	(0.217)	(0.167)	(0.214)	(0.162)	(0.235)	(0.228)	(0.289)	(0.229)	(0.280)	(0.224)	(0.271)
Tax level (t-1)		-0.430***		-0.432***		-0.455***		-0.571***		-0.565***		-0.620***
		(0.124)		(0.127)		(0.126)		(0.177)		(0.170)		(0.174)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 – within	0.794	0.300	0.794	0.300	0.801	0.304	0.796	0.281	0.795	0.278	0.809	0.299
R^2 – between	0.362	0.041	0.356	0.046	0.487	0.066	0.329	0.058	0.324	0.071	0.674	0.082
R^2 – overall	0.470	0.177	0.467	0.178	0.564	0.151	0.462	0.132	0.460	0.135	0.724	0.140
Countries	20	20	20	20	20	20	20	20	20	20	20	20
N	433	426	433	426	433	426	426	418	426	418	426	418
Lag structure			Two year						One year			
Standard errors			Cluster robust						Jackknife			

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B5. Robustness tests (2)

			Plurality party				Alternative measure of personal costs	
	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Loss probability (t-1)	-34.99**	-29.16**						
	(12.40)	(10.47)						
Loss probability^2 (t-1)	38.77**	33.47*						
	(17.90)	(17.75)						
Elect. competition (t-1)			-8.281***	-5.946**	-1.814	5.217**	1.295	0.0693***
			(2.332)	(2.438)	(2.427)	(2.166)	(3.040)	(0.0226)
Gasoline consump. (t-1)					-2.045	0.596		
					(1.268)	(1.279)		
Elect. comp. * Gas consump. (t-1)					-1.105***	-1.974***		
					(0.301)	(0.339)		
Expenditure on gasoline							299.5	18.55***
							(443.2)	(2.734)
Elect. comp. * Expenditure on gasoline (t-1)							-1182.4***	-18.22***
							(384.5)	(3.728)
Green cabinet seats (t-1)	0.212	0.0414	0.301	0.166	0.253	0.109	0.217	0.00129
	(0.185)	(0.241)	(0.187)	(0.235)	(0.161)	(0.228)	(0.159)	(0.00205)
Left cabinet seats (t-1)	0.0437**	0.0231	0.0343*	0.0112	0.0314*	0.0116	0.0331*	-0.000105
	(0.0209)	(0.0318)	(0.0165)	(0.0217)	(0.0153)	(0.0236)	(0.0185)	(0.000248)
Environmental saliency (t-1)	-0.110	-0.166	-0.0839	-0.0256	0.0119	-0.0162	-0.0448	-0.00104
	(0.319)	(0.272)	(0.295)	(0.244)	(0.268)	(0.236)	(0.321)	(0.00221)
Kyoto Protocol (t-1)	14.11***	12.66***	13.99***	11.77***	9.727***	7.347*	8.922**	0.103**
	(3.658)	(3.563)	(3.272)	(2.855)	(2.336)	(4.041)	(3.178)	(0.0434)
Election year (t-1)	-1.113***	-2.444*	-1.256***	-2.604*	-1.170***	-2.622*	-1.044**	-0.0171
	(0.359)	(1.318)	(0.386)	(1.312)	(0.380)	(1.308)	(0.372)	(0.0119)
Budget deficit (t-1)	0.240	0.604**	0.299	0.678**	0.330	0.703**	0.163	0.00440**
	(0.216)	(0.267)	(0.244)	(0.264)	(0.217)	(0.257)	(0.179)	(0.00179)

Government debt (t-1)	0.143*	0.0274	0.113	0.0115	0.0851	0.0182	0.141*	0.000414
	(0.0735)	(0.0548)	(0.0688)	(0.0450)	(0.0588)	(0.0540)	(0.0752)	(0.000464)
Inflation (t-1)	1.175**	1.458**	0.980**	1.343***	0.869**	1.388***	1.419***	0.0157**
	(0.418)	(0.537)	(0.404)	(0.459)	(0.372)	(0.472)	(0.477)	(0.00695)
Oil production (t-1)	0.919***	0.727**	0.797***	0.443**	0.719***	0.366**	0.983***	0.00649**
	(0.214)	(0.299)	(0.138)	(0.186)	(0.118)	(0.155)	(0.237)	(0.00251)
GDP growth rate (t-1)	-0.529**	-0.0462	-0.320	0.0790	-0.381*	0.0914	-0.425	-0.00126
	(0.222)	(0.342)	(0.225)	(0.304)	(0.221)	(0.313)	(0.254)	(0.00289)
VAT rate (t-1)	0.278	0.211	0.267	0.142	0.161	0.0275	0.181	0.00444*
	(0.167)	(0.187)	(0.160)	(0.167)	(0.143)	(0.149)	(0.170)	(0.00214)
Tax level (t-1)		-0.571***		-0.531***		-0.589***		-0.00569***
		(0.132)		(0.134)		(0.134)		(0.00128)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 - within	0.796	0.281	0.812	0.264	0.826	0.282	0.779	0.403
R^2 – between	0.329	0.058	0.333	0.072	0.712	0.072	0.332	0.074
R^2 - overall	0.462	0.132	0.486	0.142	0.753	0.162	0.424	0.170
Countries	20	20	20	20	20	20	20	20
N	426	418	465	456	465	456	374	372
Sample			Plurality party				PM's party	

Notes: Robust standard errors in parentheses clustered at country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B6. Robustness tests (3)

			Additional controls					Logit models		
	Tax level	%Δ	Tax level	%Δ	Tax level	%Δ		Tax increase		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Loss probability (t-1)	-35.72**	-21.74*								
	(12.68)	(11.23)								
Loss probability^2 (t-1)	38.94*	20.17								
	(19.46)	(18.48)								
Elect. competition (t-1)			-7.742***	-5.088*	-0.691	9.142***	0.301**	2.356	0.359*	2.567
			(2.115)	(2.838)	(3.278)	(2.522)	(0.169)	(2.530)	(0.195)	(2.552)
Gasoline consump. (t-1)					-2.475**	2.927		2.191**		2.366***
					(1.108)	(1.738)		(0.750)		(0.782)
Elect. comp. * Gas consump. (t-1)					-1.160**	-2.524***		0.683**		0.708**
					(0.493)	(0.498)		(0.130)		(0.114)
Green cabinet seats (t-1)	0.207	-0.175	0.183	-0.200	0.170	-0.219	1.117**	1.119**	1.107*	1.104*
	(0.262)	(0.281)	(0.258)	(0.279)	(0.228)	(0.261)	(0.0610)	(0.0628)	(0.0594)	(0.0608)
Left cabinet seats (t-1)	0.0581**	0.000157	0.0574**	-0.00132	0.0425*	-0.00235	1.007	1.008*	1.009**	1.010**
	(0.0227)	(0.0325)	(0.0219)	(0.0327)	(0.0218)	(0.0281)	(0.00445)	(0.00460)	(0.00433)	(0.00444)
Environmental saliency (t-1)	-0.237	-0.341	-0.218	-0.303	-0.0545	-0.299	1.047	1.041	1.049	1.040
	(0.432)	(0.321)	(0.416)	(0.289)	(0.370)	(0.297)	(0.0577)	(0.0587)	(0.0569)	(0.0581)
Kyoto Protocol (t-1)	14.46***	13.83***	13.62***	13.40***	8.413***	8.552	2.41202e+10	5.07369e+10		
	(2.528)	(4.317)	(2.426)	(4.207)	(1.438)	(5.217)	(4.73433e+14)	(1.40565e+15)		
Election year (t-1)	-1.193***	-2.636*	-1.152***	-2.615*	-1.083***	-2.590*	0.907	0.916	0.888	0.899
	(0.384)	(1.434)	(0.388)	(1.438)	(0.341)	(1.442)	(0.260)	(0.266)	(0.248)	(0.256)
Budget deficit (t-1)	0.152	0.648	0.205	0.683*	0.305	0.621	1.057	1.052	1.059	1.061
	(0.254)	(0.387)	(0.262)	(0.385)	(0.230)	(0.378)	(0.0617)	(0.0622)	(0.0601)	(0.0611)
Government debt (t-1)	0.163**	0.0144	0.161**	0.0150	0.136*	0.0627	0.992	1.001	0.992	1.003
	(0.0684)	(0.0726)	(0.0656)	(0.0673)	(0.0656)	(0.0708)	(0.0119)	(0.0131)	(0.0116)	(0.0129)
Inflation (t-1)	1.309***	1.430**	1.294**	1.404**	1.048**	1.576**	1.222**	1.288**	1.185*	1.256**
	(0.450)	(0.513)	(0.453)	(0.509)	(0.445)	(0.588)	(0.124)	(0.136)	(0.114)	(0.126)
Oil production (t-1)	0.886***	0.354	0.876***	0.339	0.809***	0.0884	0.905	0.837	0.943	0.842
	(0.261)	(0.372)	(0.245)	(0.382)	(0.214)	(0.277)	(0.176)	(0.157)	(0.198)	(0.168)

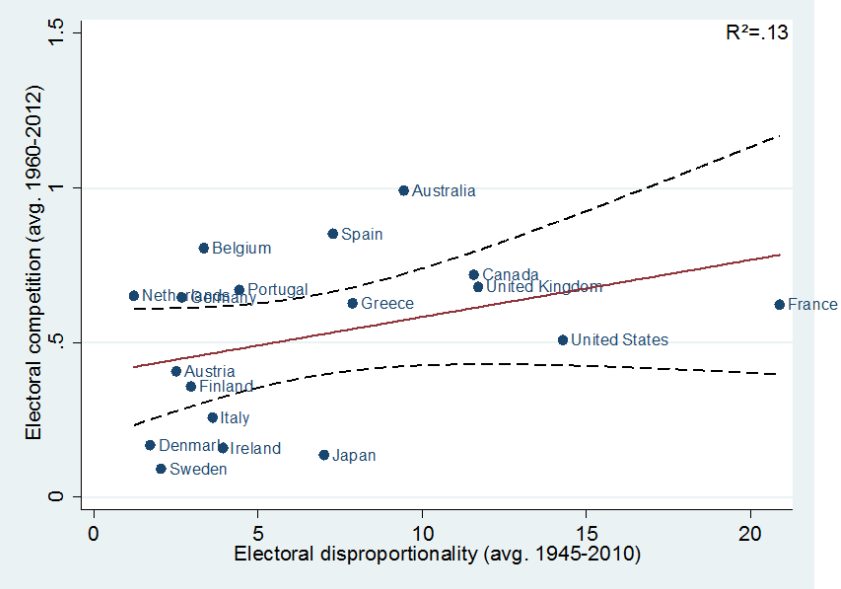
GDP growth rate (t-1)	-0.480	-0.0945	-0.494	-0.0999	-0.615**	-0.0838	0.968	0.984	0.960	0.977
	(0.306)	(0.353)	(0.304)	(0.353)	(0.287)	(0.332)	(0.0685)	(0.0710)	(0.0658)	(0.0682)
VAT rate (t-1)	0.181	0.434*	0.206	0.436*	0.0797	0.354	1.060*	1.049	1.043	1.034
	(0.242)	(0.232)	(0.241)	(0.219)	(0.229)	(0.215)	(0.0306)	(0.0316)	(0.0294)	(0.0305)
GDP per capita (t-1)	-4.969	-0.778	-4.820	-0.321	-3.036	0.822				
	(3.487)	(3.476)	(3.576)	(3.204)	(3.236)	(3.633)				
Green ideology (t-1)	-0.0221	-0.216	-0.0520	-0.227	-0.0992	-0.250				
	(0.242)	(0.319)	(0.237)	(0.339)	(0.233)	(0.310)				
Left vs right (t-1)	0.163	-0.0271	0.165	-0.0328	0.175	0.0466				
	(0.164)	(0.245)	(0.156)	(0.260)	(0.169)	(0.229)				
Single-party gov (t-1)	-1.343	0.303	-1.553	0.599	0.775	2.939				
	(2.230)	(5.062)	(1.868)	(4.445)	(1.738)	(4.725)				
Political constraints (t-1)	6.583	-5.425	3.492	-6.526	4.695	-4.459				
	(11.87)	(18.16)	(11.92)	(17.74)	(12.30)	(18.05)				
Social expenditure (t-1)	-0.0893	0.0417	-0.197	-0.00818	-0.468	-0.118				
	(0.633)	(0.697)	(0.675)	(0.680)	(0.632)	(0.651)				
Urbanization (t-1)	0.129	-0.326	0.126	-0.313	0.431	-0.364				
	(0.606)	(0.438)	(0.604)	(0.430)	(0.490)	(0.412)				
Income tax (t-1)	-0.325	-0.0209	-0.360	-0.0457	-0.242	0.189				
	(0.430)	(0.518)	(0.423)	(0.519)	(0.444)	(0.492)				
EU (t-1)	-1.127	-8.209	-1.269	-8.011	-0.561	-8.457				
	(5.170)	(5.563)	(5.368)	(5.262)	(5.176)	(5.270)				
Tax level (t-1)		-0.522***		-0.514***		-0.533***	0.915***	0.920***	0.933***	0.939***
		(0.148)		(0.150)		(0.154)	(0.0210)	(0.0224)	(0.0198)	(0.0211)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 - within	0.795	0.293	0.793	0.291	0.809	0.317				
R^2 – between	0.437	0.028	0.422	0.036	0.627	0.072				
R^2 - overall	0.523	0.121	0.509	0.123	0.705	0.081				
Log likelihood							-161.70	-157.61	-170.12	-165.49
Countries	20	20	20	20	20	20	20	20	20	20
N	406	400	406	400	406	400	418	418	418	418

Notes: Coefficients for logit models are odds ratios. Robust standard errors in parentheses clustered at country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B5. Electoral rules and electoral competition

Kayser and Lindstädt (2015) show that long-term average loss probabilities are higher in countries with majoritarian electoral rules relative to those with proportional rules. Here I investigate the long-run relationship between my measure of electoral competition and electoral disproportionality. To do so, I calculate average electoral competition in each country for the period between 1960 and 2012 (all years for which loss probability data is available) and collect data on average electoral disproportionately between 1945 and 2010 from Lijphart (2012). Plotting the variables against each other reveals a positive association, in line with expectations. Countries with more majoritarian electoral rules tend to have higher average levels of electoral competition. That said, there are a number of outliers and the R^2 statistic is relatively low, suggesting that electoral rules are one of a variety of factors driving competition.

Figure B3. Electoral rules and electoral competition (with 95% CIs)



CHAPTER 4

Energy Politics over the Long Run: Gasoline Taxes in US States since 1919

Abstract: Addressing long-term policy challenges requires governments to look beyond the next election to promote societies' long-run welfare. Which factors shape politicians' time horizons? This chapter examines the effect of electoral competition in the case of one long-term policy: gasoline taxation in US states over the past nearly one hundred years. It builds on Chapter 2 and 3, arguing that competition matters for long-term policymaking because it structures levels of electoral safety. Politicians should be more willing to look beyond the next election and adopt policies that translate short-term pain into long-term gain when they enjoy a wide lead over their rivals. To investigate the long-run dynamics of these arguments this paper makes use of new, original data on gas tax policy decisions going back to 1919. I find strong evidence of a negative relationship between levels of electoral competition and levels of taxation. Furthermore, underlying trends in competition matter. Increases in long-term average levels of competition have a larger influence on the tax rate than short-term fluctuations. Second, dynamic analysis using error correction models suggests that the negative effect of electoral competition lasts years into the future. Instrumental variable analysis using federal intervention in the US South as a result of the 1965 Voting Rights Act as a source of exogenous variation suggests that the relationship between electoral competition and gasoline taxation is causal.

1. Introduction

From crumbling infrastructure to climate change, governments across the high-income democracies face significant long-term policy challenges. An effective response requires that governments look beyond the next election to invest in policy solutions that promote societies' long-run welfare. Though such a task is not always easy for democratically-elected politicians. The ever-present electoral cycle, as well as quotidian disruptions and crises, tend to myopically orient elected officials to the short-term politics of the day rather than the problems of the future. Moreover, long-term policy investments usually entail short-term costs for voters, which means political risk – a further discouragement for action. Yet despite the challenges, governments in many instances have taken action to address long-term challenges. However, we still know surprisingly little about the factors that influence these decisions.

This paper builds on theoretical arguments laid out in the previous two chapters, which contend that electoral competition influences long-term climate policy investments by shaping the political opportunities and risks of imposing short-term costs on voters. When the upcoming contest is expected to be close, the governing party will find it difficult to think beyond it to society's long-run welfare. Instead they will tend to focus efforts on maximizing vote shares. Any policies that impose short-term costs on voters will likely be abandoned for fear they could produce punishment at the ballot box. However, when governing parties enjoy a wide lead over rivals, electoral safety offers them the opportunity to contemplate the costs and benefits of policy change across much longer time horizons.

Chapter 3 finds empirical support for these arguments in the case of fossil fuel taxation at the country level. Here I further investigate them over a much longer period. I again examine gasoline tax policy decisions. However, this time at the subnational level in a competitive political economy – the US. US state-level gas taxes are an ideal setting for testing my arguments because these policy decisions are quintessential long-term policy investments. Since their first adoption in 1919, they have been conceived of as "user fees" for public highways and roads. The rationale is that those using public roads the most, as measured by their gasoline consumption, should pay the most for their construction and maintenance. Indeed, gas tax revenues in virtually every state are earmarked for road infrastructure; a benefit that is not immediately available to voters, but instead takes time to materialize. Beyond infrastructure, gas taxes generate a number

of additional long-term benefits, including energy conservation and energy security, reduced congestion and air pollution, and climate change mitigation. In all cases, adopting gas tax increases requires that politicians contemplate their state's long-term wellbeing.

While a number of important works have examined climate politics in US states generally (e.g., Rabe 2004), less than a handful of studies have focused specifically on the politics of gasoline taxation (F. S. Berry and Berry 1992; Geschwind 2014; Goel and Nelson 1999; Shmanske 1990). Findings have been mixed. The most recent study concludes that gas taxes are not associated with *any* observable socioeconomic, political, or industrial variables (Li, Linn, and Muehlegger 2014). In contrast to previous work, this essay reconceptualizes gas taxes as long-term policy investments, and as such, argues that they are driven by a distinct political economy. A key feature of this political economy is the role that electoral safety, a variable left out of all existing analyses, plays in lengthening politicians' time horizons.

To analyze gas tax politics I collect an original dataset of tax rates in every US state since the year of their first adoption. The data spans almost one hundred years from 1919 to 2016 and provides virtually the entire universe of state-level gasoline tax changes. The very long time series offers one of the first glimpses into long-run trends in fossil fuel taxation anywhere. Relying on two datasets to construct measures of electoral competition since the 1910s and 1930s, I use fixed effects models and dynamic error correction models to investigate the relationship between electoral competition and energy taxation over nearly a century.

The results offer a consistent picture. First, I find a robust negative relationship between levels of electoral competition and gasoline taxation. Tax rates are lower (higher) when competition is higher (lower). Furthermore, underlying trends in competition matter. I find that increases in long-term average levels of competition have a larger influence on the tax rate than short-term fluctuations. In other words, successive highly competitive contests are associated with even lower tax rates than election-to-election changes. To address concerns of potential reverse causality from the tax rate to levels of electoral competition I use federal intervention in the US South as a result of the 1965 Voting Rights Act as a source of exogenous variation. The results of the instrumental variable (IV) analysis provides strong evidence that the relationship between electoral competition and gasoline taxation is causal. Second, dynamic analysis using error correction models suggests that the negative effect of electoral competition

lasts years into the future. While the largest part of this effect occurs in the year following a shock to competition, it decays slowly over time. For example, I find that it takes between 20 and 25 years for half of the total long-term effect of competition to dissipate. IV analysis provides further causal evidence of competition's significant long-term negative effects on gasoline taxation. Lastly, I gather data on the average vote share of Democratic candidates in all statewide races to construct a proxy measure of electoral competition that extends to the earliest part of the twentieth century. Doing so allows me to analyze nearly all state-level gas tax rate changes. The results strongly support the main findings: electoral competition has a significant and sustained negative effect on gasoline taxation.

Taken together, the results provide strong evidence that politicians' strategic concerns about electoral safety are an important driver of long-term policy investments. Governments facing tight electoral contests are routinely reticent about increasing the price of fossil fuels for fear of an electoral backlash. The analysis is all the more compelling considering that gas taxes are used to fund highly visible transport infrastructure for motorists. Yet even in this "least likely" case, politicians tend to be unwilling to invest in long-term policy solutions if it means increased short-term political risk. In this way, electoral competition works to moderate politicians' myopia, and as a result, the provision of long-term policy investments.

The paper makes a number of contributions. First, it provides additional empirical tests, this time with much more data, of novel arguments regarding the relationship between electoral competition and fossil fuel taxation. Chapter 3 offers evidence of this relationship at the country level since 1978. This study confirms its presence at the level of US states throughout much of the twentieth century. Second, it contributes to the nascent literature on the politics of long-term policymaking (Jacobs 2011, 2016). In particular, it offers a detailed examination of the key role that electoral competition plays in moderating the time horizons of governments. By conceptualizing gas taxes as long-term policy investments, the analysis contributes to the sparse political science literature on the political drivers of gasoline taxation in US states (F. S. Berry and Berry 1992). Lastly, the paper contributes to research on the politics of climate change policy. Economists routinely advocate fossil fuel taxes as the most efficient means to address climate change. However, many governments have tended to ignore such advice. The findings in this paper suggest that it is only governments that enjoy large leads over rivals that are most likely to think beyond the next election and

contemplate policies that promote society's long-run aggregate welfare, such as fossil fuel taxes.

2. The politics of fossil fuel taxation

The previous two chapters offer a theoretical framework that links electoral competition to climate change policy, particularly fossil fuel taxation. The argument builds on Garrett (1993) and Jacobs (2011) to theorize that electoral safety is required for governments to adopt long-term policy investments, or policies that impose direct short-term costs on voters for greater long-term benefits. Climate change policies, such as increased fossil fuel taxes, are quintessential long-term policy investments. They increase the short-term cost of carbon-based energy for consumers and deliver greater future benefits in the form of a stable climate. Electoral safety should therefore be a key factor that structures the incentives of governments to adopt such policies.

One key predictor of electoral safety is electoral competition, or the expected probability of a change in government control at the next election as perceived by the governing party(ies) (Boyne 1998, 212; Kayser and Lindstädt 2015, 243). Competition structures the governing party's strategic tradeoff between its vote-seeking preferences on the one hand and policy-seeking ones on the other (Strom 1990). When it is low, the governing party enjoys a surplus of committed voters, and as a result, a wide lead over its rivals. These conditions insulate it from marginal losses in vote shares that may result from the imposition of short-term costs on voters, such as those associated with long-term climate policy investments. Most importantly, these electoral conditions should push myopic vote-seeking strategies down the party's preference ordering and raise its policy-seeking preferences. In the case of fossil fuel taxation, imagine that the governing party would prefer to increase such taxes in an effort to address climate change. However, it knows that directly increasing the cost of fossil fuels for voters could foment voter backlash. The party's willingness to implement its policy preference and subvert its incentives for vote maximization should therefore crucially depend on the competiveness of the electoral environment. Low levels of competition make this tradeoff politically feasible, opening up political opportunities for ambitious long-term climate policy investments. Conversely, when competition is high, governing parties should find such a tradeoff too risky. Their efforts should instead be focused on a short-term strategy of vote maximization in an effort to win the next contest. Indeed,

we should expect that they go to great lengths to not "rock the boat". In this way, competition should moderate governments' time horizons. When it is high, politicians should be more likely to focus myopically on the next election rather than society's long-term aggregate welfare.

If these arguments are correct, we should observe a negative relationship between levels of electoral competition and levels of long-term climate policy investment, especially those that visibly and directly increase short-term costs for voters, such as fossil fuel taxation. The previous chapters provide evidence of this relationship at the country level. Chapter 2 shows that high-income democracies with more proportional electoral rules, which tend to generate lower levels of electoral competition, impose higher climate policy costs on voters. Chapter 3 examines the relationship between electoral competition and gasoline taxation within countries over time and finds a robust, negative relationship. This essay further examines this relationship in the context US states and over the very long run. To do so, I compile an original dataset of state-level excise tax rates on gasoline using data from *Highway Statistics* reports of the US Federal Highway Administration. It includes almost one hundred years of observations, from the first year of the tax's adoption in each state up until 2016.

The US is an archetypal competitive political economy. Majoritarian electoral rules mean that two political parties – Democrats and Republicans – compete over the median voter for political office at both the federal and state level. This context provides a number of analytical benefits. Most importantly, it lends itself to a straightforward conceptualization of electoral competition as seat margins over the opposition party and enables comparable, consistent measurement across states and over time. Since it is the same two parties throughout the sample, it also allows me to separate out and control for the effect of partisanship and ideology in a consistent way. Lastly, studying the US context in detail should offer insights into the politics of long-term policymaking across a wider class of similar political economies, namely Australia, Canada, and the UK.

To my knowledge only one study in political science has analyzed state-level gasoline taxes. Using event history analysis, F. S. Berry and Berry (1992) examine the political drivers of the initial adoption of gas taxes by states in the period from 1919 to 1929. They find that the probability of a state government adopting a tax on gasoline increases with the number of registered vehicles and with the number of neighboring

states that have previously adopted a tax. It decreases with proximity to gubernatorial elections and per capita income. They find no evidence that government ideology, single party control of government, or the historical degree of control by the governing party influences the probability of initial gas tax adoption. In the economics literature, Shmanske (1990) uses pooled time-series analysis to investigate the determinants of state-level gas tax rates between 1973 and 1980. Highway maintenance costs, the proportion of non-car owners, and pollution externalities are positively associated with the tax rate, while congestion, revenues from tolls, oil industry size, and inflation are negatively associated with it. Though the results should be read with some caution. Because the data is pooled, the analysis may suffer from omitted variable bias. Also in economics, Goel and Nelson (1999) theorize that politicians will raise tax rates during periods of declining pre-tax gasoline prices. Examining nominal gas taxes within states from 1960 to 1994, they find evidence in support of their arguments. Most recently, economists Li, Linn, and Muehlegger (2014) examine nominal state-level gas taxes between 1966 and 2008. They conclude that tax rates are not associated with any observable socioeconomic, political, or industrial variables. Finally, from the history literature, Geschwind (2014) argues that throughout the 1920s and 1930s increases in gas taxes were frustrated by strong opposition from motorists and oil companies.

This study extends these analyses in important ways. First, it offers a reconceptualization of gas taxes as long-term policy investments. From this starting point, it offers a theory of the politics of gasoline taxation that emphasizes the role of electoral competition in moderating politicians' time horizons. Second, it investigates tax rates over a much longer period than any previous study. Indeed, the large dataset comprises virtually all gas tax changes in the states. Lastly, it utilizes static, dynamic, and instrumental variable analysis to examine the short- and long-term effects of shifts in competition, as well as address issues of potential endogeneity.

3. Gasoline taxation in US states

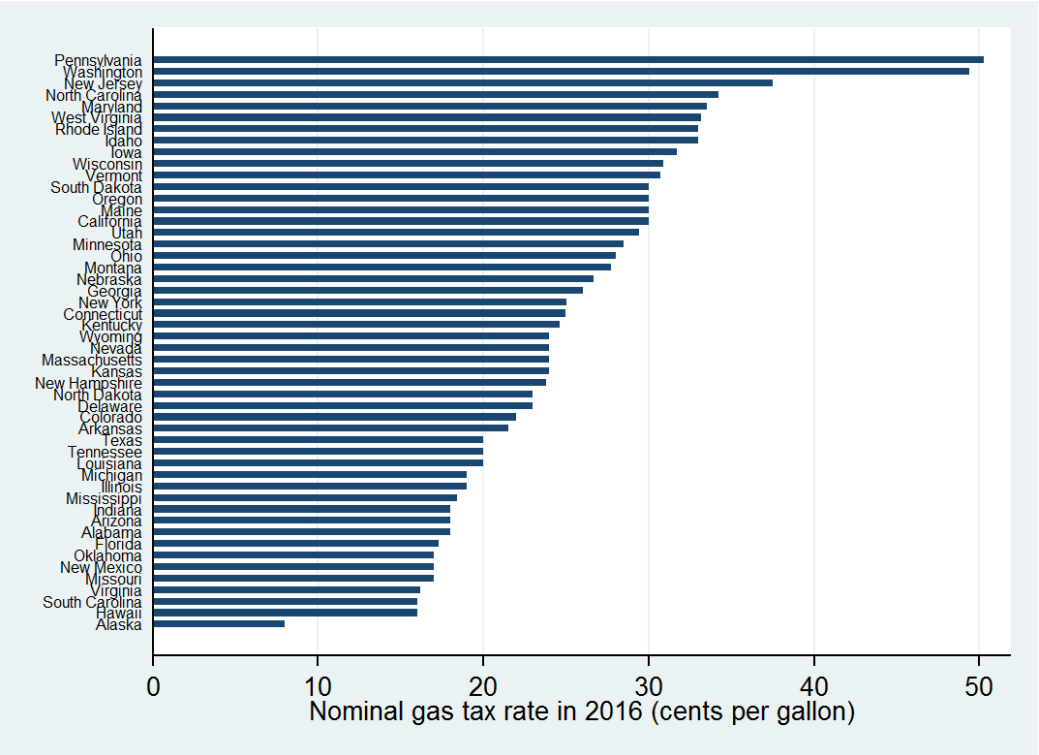
Gasoline is one of the primary fossil fuels used in the transportation sector. The sector is a significant source of carbon pollution, accounting for around 25% of global carbon dioxide emissions in 2016 (IEA 2019). In the US it is currently *the largest source* of CO_2 emissions (Rhodium 2019). Moreover, US emissions from transport have been increasing since around 2012. Getting a handle on transportation-related fossil fuel use

is crucial for addressing climate change. Fossil fuel taxes are one key policy lever for doing so. By increasing the price of transport fuels like gasoline, taxes reduce their consumption and the associated CO_2 emissions (Andersson 2019). Davis and Kilian (2011) estimate that a 10 cent per gallon increase in the federal US gas tax would reduce overall US carbon emissions by around 1.5% a year.

The federal excise tax on gasoline is currently 18 cents per gallon (cpg), which is low in comparison to other high-income democracies (see Chapter 3). In addition to this national rate, states impose their own excise taxes on the fuel. In 2016, state-level rates varied considerably, from around 50 cpg in Pennsylvania to 8 cpg in Alaska (Figure 4.1). From the perspective of climate mitigation, the US government under the Obama administration estimated that the "social cost of carbon", or the net present value of monetized social damages from an additional emitted tonne of carbon dioxide, is $46 in 2017 dollars, which corresponds to 41 cpg for gasoline (Gillingham and Stock 2018). As can be seen in Figure 4.1, the majority of states are well below this threshold.

In every state gasoline is taxed using a flat excise tax that corresponds to a fixed rate per gallon. Changes to this rate occur when the state legislature adopts new legislation or revises existing statutes. Legislated changes to tax rates tend to be salient and attract substantial media attention as state lawmakers propose, counter-propose,

Figure 4.1. State-level gasoline tax rates in 2016



deliberate, and adopt rate changes (Watts, Frick, and Maddison 2012). For example, Li, Linn, and Muehlegger (2014) show that gas tax increases receive significantly more media attention than similar changes in the pre-tax gasoline price (i.e., increases in global oil prices). Moreover, news coverage typically mentions the current nominal tax rate in the state and the new nominal rate under the proposed legislation.

Before 1977, gas taxes were changed exclusively by the legislated decisions of state governments (Ang-Olson, Wachs, and Taylor 2000). However, since then, a number of states have adopted variable rate structures in addition to a fixed rate excise tax (Ang-Olson, Wachs, and Taylor 2000; Davis 2011). Currently twenty states tax gasoline via a combination of fixed and variable rates (NCSL 2019). In seven states (Connecticut, Kentucky, New York, Pennsylvania, Vermont, Virginia, and West Virginia) the variable rate portion is adjusted based on changes in the pre-tax price of gasoline. In California, Florida, Michigan, and Rhode Island it varies with inflation. While in Hawaii and Illinois it varies with the sales tax rate. In Georgia, Indiana, Maryland, Nebraska, New Jersey, North Carolina, and Utah it varies based on a combination of these factors. A number of states have implemented variable rate structures only to repeal them later; for example, when the retail price of gasoline dropped dramatically, reducing revenues, or increased dramatically, causing the tax rate to surge (Ang-Olson, Wachs, and Taylor 2000). Moreover, it is not always the case that variable rates are allowed to adjust automatically. On a number of occasions state governments have blocked so-called "automatic" increases in the variable portion of the tax rate for political reasons (Ang-Olson, Wachs, and Taylor 2000).

3.1. A short history of the gas tax

In 1919, four states were the first to adopt an excise tax on gasoline: Colorado, New Mexico, North Dakota, and Oregon. The policy diffused quickly and within ten years all 48 states had one, while both Alaska and Hawaii instituted the tax upon receiving statehood in 1959 (see Table 4.2 below).[59] The tax was explicitly conceived as a "user fee".[60] Those using the roads most, as indicated by their fuel consumption, would pay the most for their maintenance. A common view amongst historians is that the impetus

[59] The federal government implemented a national gasoline excise tax with the Revenue Act of 1932.

[60] Some argue that gasoline taxes represent the first such example of a user fee in the US (Burnham 1961).

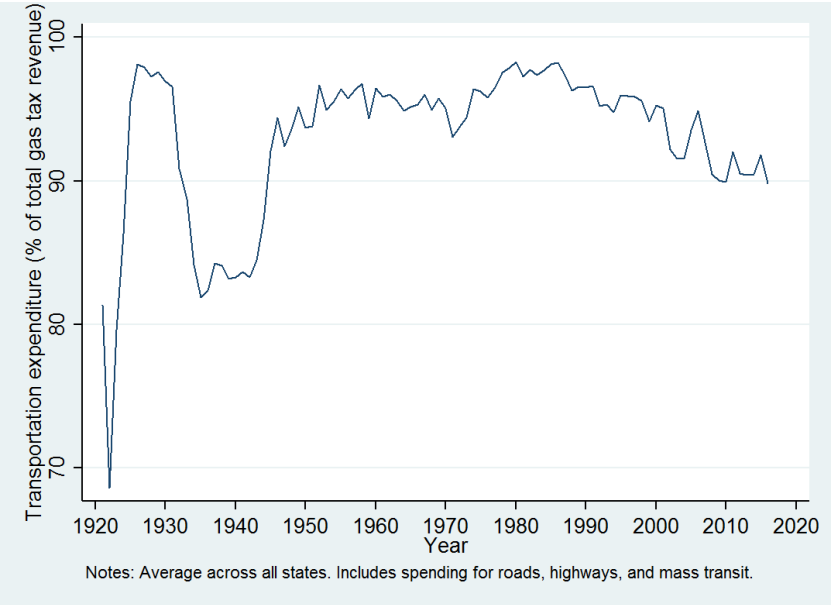
for the tax grew out of pressure from an increasing number of motorists advocating for more and better roads (Burnham 1961; Dunn 1978; Wells 2012). Before gasoline taxes, roads were funded by local governments out of property tax revenues. But these funds proved to be insufficient to improve the extent and quality of roads, especially under the weight of surging automobile ownership in the first decades of the twentieth century.

Given that the primary goal of gasoline taxation was to fund transportation infrastructure, more than 90% of tax revenues have typically been devoted to this purpose (see Figure 4.2). Though in the early days many governments diverted some funds to other programs. This was especially true during the Great Depression, when revenues were used to fund anti-poverty and education programs (Smart and Hart 1941, 477; Wells 2012, 76). In response, coalitions of state automobile clubs, taxpayer associations, and road user groups, aided by their national affiliates, launched "anti-diversion" campaigns (Dunn 1978, 42). They advocated for legislation that would link gas tax revenues exclusively to spending on highway infrastructure. A move encouraged by the federal government with the Haydon-Cartwright Act of 1934. In the 1920s, governments in Kansas, Minnesota, and Missouri had already adopted amendments to their state constitutions that mandated the earmarking of tax receipts for highway purposes. Between 1934 and 1956 twenty-five additional states adopted such amendments (Dunn 1978, 42). By 1974, forty-six of fifty states earmarked gas tax revenues either by constitutional amendment or statute (Dunn 1978, 42).[61]

Beyond raising funds for roads, the gas tax was also soon recognized for its energy conservation and environmental benefits. Since the 1960s, it has been advocated as a way to combat air pollution and traffic congestion (e.g., New York Times 1969). Similarly, since the oil price shocks of the 1970s politicians and others have argued for increasing the gas tax as a way of incentivising consumers to use less oil (e.g., New York Times 1974 and 1980a). For example, in 1980 Republican Congressperson John B. Anderson ran for President on a platform of increasing the federal gasoline tax to 50 cpg to hasten energy conservation (New York Times 1980b). In the case of climate change, fossil fuel taxes have been advocated as an efficient way to reduce carbon pollution since the late 1970s (Nordhaus 1977). In the 1980s, newspapers ran editorials that identified gasoline taxes in particular as a policy lever to address climate change (e.g., Washington Post 1988). By the early 1990s, then President Bill Clinton advocated

[61] See Appendix C3 for a timeline anti-diversion amendments.

Figure 4.2. Expenditure on transportation infrastructure (% of total gas tax revenues)



a tax to increase the price of energy, including gasoline, in order to address climate change and balance the budget (Karapin 2016, Ch. 9). More recently, state governments have proposed or adopted increased gas taxes to address a range of challenges, including crumbling transport infrastructure and climate change. The key point is that, throughout its long history, gasoline taxation has always been linked to long-term benefits. To be sure, the nature of these benefits has changed over time, from new roads in the 1920s to climate change mitigation in the 1990s, yet the *intertemporal* nature of the policy has not. It has consistently represented short-term pain for long-term gain.

Since their first adoption, gas taxes have experienced varying waves of public support. By historical accounts they enjoyed wide support in the 1920s (Burnham 1961; Wells 2012). For example, Burnham (1961, 435) argues that "because of its purpose and rationale, this tax [the gas tax] was not subject to the usual social resistance to taxation". Indeed, framing the tax as a user fee meant it was seen by voters as an "uncontroversial", or even "popular", solution to a fiscal problem (Burnham 1961; Wells 2012, 74). It also helped that the 1920s were a period of simultaneous economic expansion and falling gasoline prices, which reduced the overall costs of the tax to voters (Burnham 1961, 449). The levy even enjoyed support amongst oil companies who saw a direct link between better roads and increased gasoline sales (Burnham 1961, 444 and 450-53; Wells 2012, 75).

However, support from voters and Big Oil did not last long. The American Petroleum Institute (API) came out against any further increases in 1929 (Burnham

1961, 454). Public support also began to wane. While a complete time-series of public opinion is missing, surveys throughout the years have at times asked respondents for their views. Respondents have tended to oppose gas tax increases, though not uniformly. A 1959 Gallup poll found that 49% of respondents were against a gas tax increase to pay for highway building (compared to 39% in favor) (Gallup Organization 1959). In 1978, only 20% of respondents supported an increase to reduce oil consumption in response to the ongoing energy crisis (Gallup Organization 1978). In 1982, 53% were in favor of an increase to fund highway repairs (compared to 41% opposed) (Gallup Organization 1982). By 1990, 85% were opposed to a tax increase to reduce dependence on foreign oil (Chicago Council on Foreign Relations 1990). In 1996, 55% said that the recently approved 4.3 cent per gallon increase in the federal rate should be eliminated (39% said it should be kept) (Cable News Network and USA Today 1996). More recently in 2013, two-thirds said they were opposed to any state law that increased the gasoline tax by up to 20 cpg, even if the revenues were dedicated to improving highways, bridges, and mass transit (Brown 2013). That same year Massachusetts voters repealed a state law by ballot initiative that automatically indexed gas taxes to inflation (Ball and Moran 2016, 9-11). Yet in 2018, California voters supported a ballot initiative to prevent the repeal of a recent gas tax increase (57% to 43%) (Ballotpedia 2018).

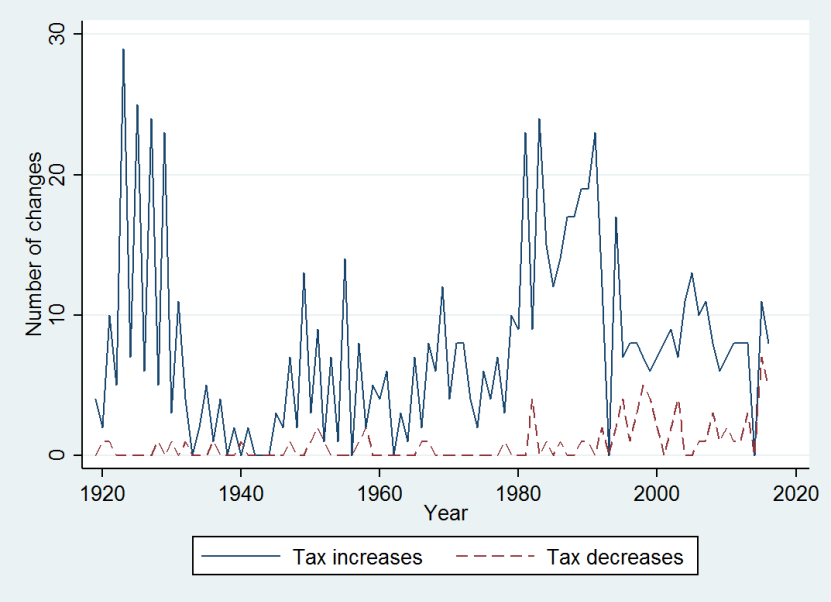
3.2. Trends in gasoline taxation since 1919

Across all states, governments have rarely changed the gas tax rate over the past almost one hundred years (Table 4.1). It has been increased in only around 16.5% of state-years and decreased in less than 2%. In 82% of state-years it did not change. Over time, most increases are concentrated in the 1920s and 1980s, while most decreases occur after 1980 (Figure 4.3). In terms of tax levels, Figure 4.4 shows the average gasoline tax rate

Table 4.1. Frequency of nominal tax rate changes (1919-2016)

Rate change	Frequency	Percent of sample
Increase	762	16.45%
Decrease	80	1.73%
No change	3,791	81.83%
Total	*4,633*	*100.00*

Figure 4.3. Tax changes over time across all states



across all states between 1919 and 2016 in both nominal and real cents per gallon. Nominally, the average tax rate rises over time with three periods of sharp increases: the 1920s, 1980s, and 2010s. In real terms, the picture is quite different. The average real tax rate increases dramatically throughout the 1920s, reaching its historic peak in 1933 at around 76 cpg in 2015 dollars. But by the mid-1940s the real rate begins a steady decline, with the sharpest decrease coming in the 1970s – a period of rapidly rising oil prices and inflation. Both the 1980s and 2010s see increases in the real rate, though these are much smaller than those of the 1920s.

All-state averages mask substantial variation both across states and within them over time (Figure 4.5). Some states have changed their rates very infrequently, while others have changed them many times (Table 4.2). For example, nine states have increased gas taxes less than ten times: Alabama, Alaska, Georgia, Hawaii, Louisiana, Missouri, New Jersey, Tennessee, and Texas. On the other hand, four states have increased them over 25 times: Florida, Nebraska, North Carolina, and Wisconsin. As mentioned above, Pennsylvania, Washington, and New Jersey currently have the highest nominal tax rates while Alaska, Hawaii, and South Carolina have the lowest (see Figure 4.1 above). The picture changes considerably if we look at the average real rate from the year of adoption until 2016 (Figure 4.6). Instead of a static picture, this view offers insight into each state's average real level of gasoline taxation since the early twentieth century. Here we see the Southern states at the top. Indeed, seven of the ten states with

Figure 4.4. Average gasoline tax rate across all states

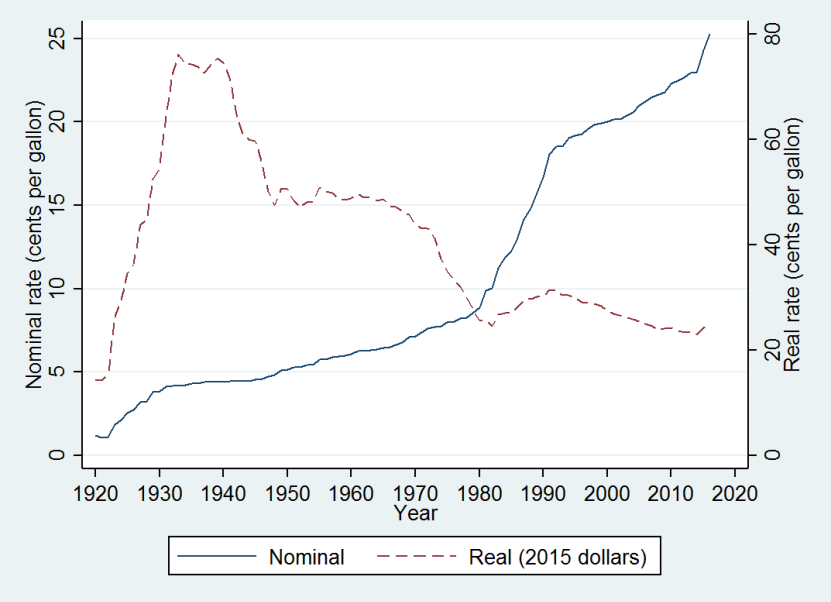
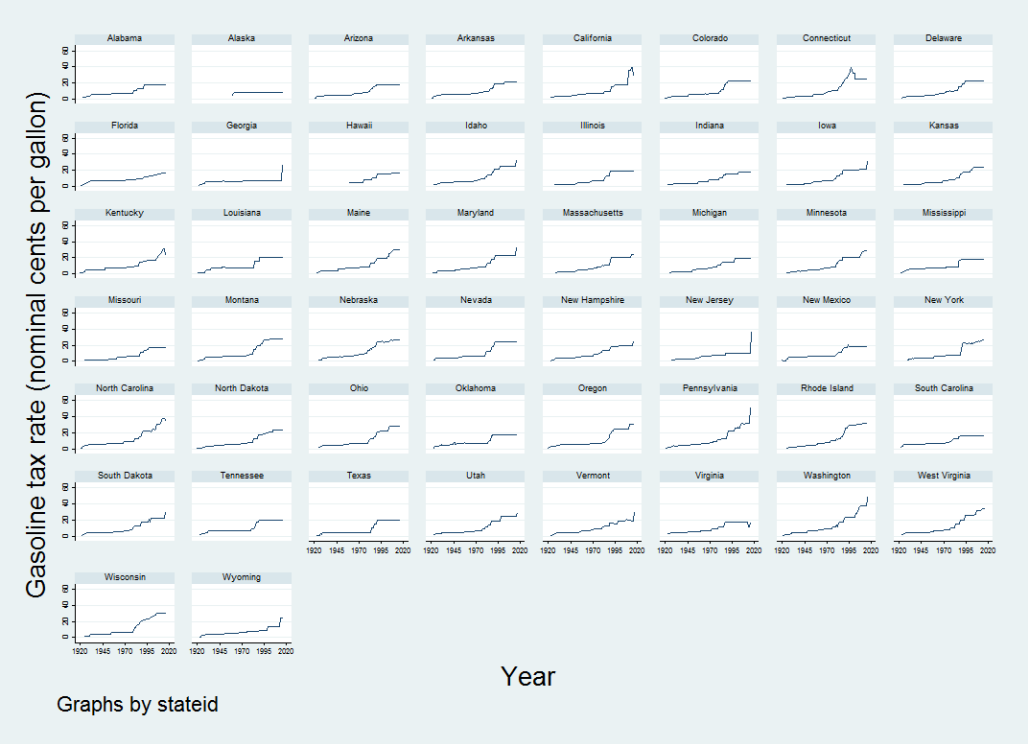


Figure 4.5. Nominal tax rates by state

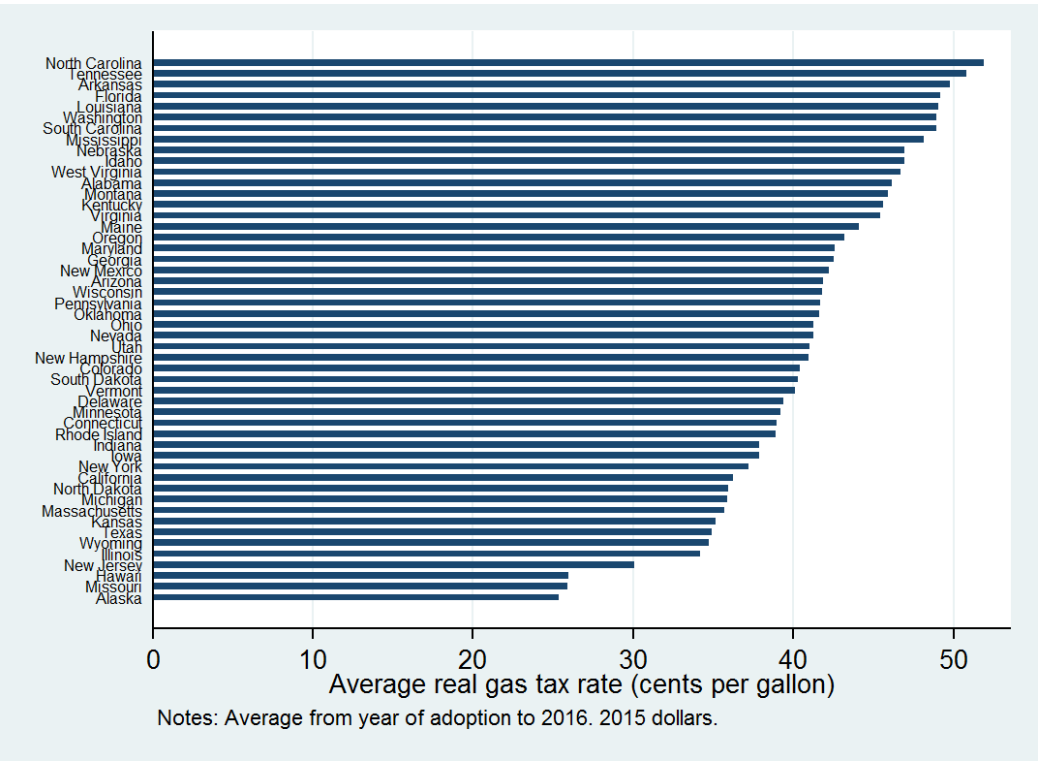


the highest average real tax rate since the 1920s are former members of the Confederacy. It is especially striking in the case of Louisiana and Tennessee. Each state has increased its tax rate only nine times since 1921 and 1923, respectively. Yet, because most increases took place before World War II, they translate into very large real increases.

Table 4.2. Number of tax rate changes per state

State	Number of increases	Number of decreases	Year of adoption
Nebraska	32	12	1925
Florida	31	1	1921
Wisconsin	27	2	1925
North Carolina	26	9	1921
Connecticut	22	3	1921
New York	22	11	1929
Pennsylvania	22	5	1921
Washington	21	1	1921
Iowa	20	1	1925
Maine	19	0	1923
Oregon	19	0	1919
Rhode Island	19	1	1925
Kentucky	18	2	1920
Montana	18	1	1921
New Hampshire	18	0	1923
Idaho	17	0	1923
Minnesota	17	1	1925
New Mexico	17	6	1919
Ohio	17	0	1925
Vermont	17	3	1923
West Virginia	17	3	1923
Delaware	16	1	1923
Kansas	16	0	1925
Arkansas	15	2	1921
South Dakota	15	1	1922
Arizona	14	0	1921
California	14	1	1923
Massachusetts	14	1	1928
Mississippi	14	1	1922
North Dakota	14	0	1919
Oklahoma	14	3	1923
Maryland	13	0	1922
Colorado	12	2	1919
Nevada	12	0	1923
South Carolina	12	0	1922
Utah	12	0	1923
Illinois	11	0	1927
Virginia	11	2	1923
Indiana	10	0	1923
Michigan	10	0	1925
Wyoming	10	0	1923
Georgia	9	1	1922
Louisiana	9	1	1921
New Jersey	9	0	1927
Tennessee	9	0	1923
Alabama	8	0	1923
Missouri	8	0	1925
Texas	7	1	1923
Hawaii	5	1	1959
Alaska	3	0	1959

Figure 4.6. Real tax rate by state (avg. Year of adoption-2016)



3.3. State-level gas taxes as a "least likely" case

Gas taxes are long-term policy investments. As mentioned, they were first conceptualized and framed politically as "user fees" whose revenues would be dedicated to road construction and maintenance. To this day, funding for transportation infrastructure remains a key political argument for increasing tax rates. For example, when defending a recent gas tax increase from repeal by ballot initiative in the 2018 election, Proposition 6 in California framed the benefits of a gas tax increase exclusively in terms of roads and transport infrastructure (Ballotpedia 2018). Crucially, the benefits of this type of infrastructure are not immediately available to voters. They are instead long-term benefits that take time to materialize, as does the tax's additional long-term benefit of climate change mitigation. The intertemporal bargain is that voters pay a little bit more for gasoline today so that they have better roads and a stable climate tomorrow.

There are a number reasons to suspect that electoral competition may have little effect on this particular case of long-term policy investment. First, to ensure that future governments do not renege on their end of the bargain, gas tax revenues are statutorily earmarked for transport infrastructure in almost every state, in many cases by

constitutional amendment. They cannot easily be diverted to the general fund to achieve politically expedient ends, such as the generation of short-term benefits for voters. Second, voters should particularly value expenditure on road infrastructure. It is highly visible to motorists, and therefore to those who pay the tax. Furthermore, it should be relatively easy for voters to connect gas taxes with better roads, especially when politicians have used this framing for almost one hundred years. Lastly, while infrastructure projects do take time to complete, they are arguably more immediately tangible for voters than a stable future climate.

For these reasons, this unique setting offers a "least likely" case to test my arguments. While voters have to make an intertemporal tradeoff, the associated future benefits are visible, tangible, and virtually certain. Under these conditions, governments might reasonably expect voters to be more supportive of tax increases and therefore anticipate less political risk. If so, electoral competition should have little effect. However, if an effect is observed, it provides strong evidence that competition plays a key role in systematically structuring politicians' incentives vis-à-vis long-term policy investments.

4. Data and measurement

4.1. Operationalizing electoral competition

The previous section describes data for the dependent variable: gas tax rates. In this section I present data for the key independent variable: electoral competition. What I wish to measure is the expected probability of a change in government control at the next election as perceived by the governing party (Boyne 1998, 212; Kayser and Lindstädt 2015, 243). No measure of expected probabilities exists at the state level. Instead I use the folded Ranney Index (FRI), a widely-utilized variable in the state politics literature that measures the level of competition between Democrats and Republicans for control of state government (Ranney 1976; Shufeldt and Flavin 2012).[62]

[62] A separate but related measure of competition used by American politics scholars is from Holbrook and Van Dunk (1993). The HVD variable measures the average level of district-level competition in each state. I use the Ranney Index instead because, in line with my theoretical arguments, I am interested in measuring competition over control of state government. I do not carry out robustness tests using the HVD measure because it is measuring a separate and distinct phenomenon. Indeed, scholars have warned against using them as proxies for one another. For a full discussion of both measures see Shufeldt and Flavin (2012).

The FRI is constructed in two steps (Shufeldt and Flavin 2012). I first calculate the average of four components: (1) the proportion of seats controlled by Democrats in the lower chamber of the state legislature (the House); (2) the proportion of seats controlled by Democrats in the upper chamber (the Senate); (3) the two-party vote share of the Democratic candidate in the gubernatorial election; and (4) the percentage of time the governorship and state legislature are both controlled by the Democratic party (measured by a dummy variable that equals 1 if all three branches are controlled by Democrats and zero otherwise). This yields a measure that ranges from zero (complete Republican control of state government) to 1.0 (complete Democratic control). Exactly in between these two extremes (at 0.5) lies perfect competition between the two parties. I therefore calculate a "folded" version of the Ranney Index using the following formula[63]

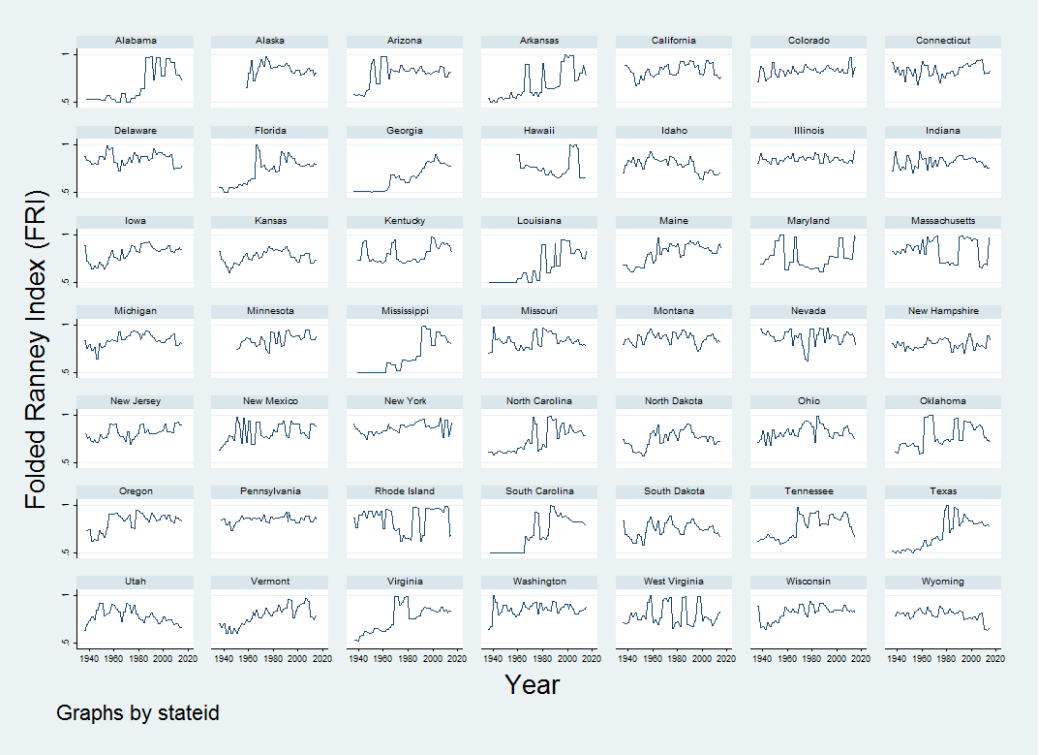
$$Folded\ Ranney\ Index\ (FRI)_{i,t} = \left(\frac{1 - \left|Ranney\ Index_{i,t} - 0.5\right|}{0.5}\right) - 1 \qquad (1)$$

The resulting measure runs from 0 (one party dominance) to 1 (perfect competition). It can be conceptualized as the intensity of competition between the Democratic and Republican parties for control of the statehouse and the state's policymaking agenda (Flavin and Shufeldt 2016). I assume that governing parties experiencing higher (lower) levels of competition (as measured by higher (lower) FRI scores) perceive a change in government control at the next election to be more (less) likely. The underlying data for the measure is collected from Klarner (2013) for the period 1937 to 2011 and from state-level sources for the period 2012 to 2016. Nebraska is excluded because its legislature is officially nonpartisan. Figure 4.7 presents the variable. We see that competition varies substantially between states and within them over time.

The FRI changes with every election and therefore captures short-term shifts in the level of electoral competition. I expect these to be important. However, I am also interested in the underlying dynamics of competition over longer time periods. To separate the "signal" of longer-term shifts in competition from the "noise" of election-to-election fluctuations, I calculate moving averages of electoral competition over the

[63] In contrast to most other studies, I re-scale the variable from 0-1 (instead of 0.5-1) for ease of interpretation.

Figure 4.7. Electoral competition in US states (1937-2016)



previous ten and twenty years, which roughly correspond to the last five and ten elections, respectively. Finally, to analyze the entire dataset of gas tax rates going back to 1919 I calculate a proxy variable for electoral competition based on data from Hirano and Snyder (2019) on the average vote share of Democrats in all statewide races (described further in Section 5.3 below).

Table 4.3 presents summary statistics for the gas tax data and the measures of electoral competition. The distributions of all three FRI measures (annual, 10-year moving average, and 20-year moving average) and the proxy variable are negatively skewed. The median level of competition is above 0.6 in all cases, indicating relatively high levels of competition in US states throughout most of the twentieth century. It is consistent with research that finds electoral competition to be generally higher under majoritarian electoral rules (Kayser and Lindstädt 2015; Rogowski and Kayser 2002). Though, as described further below, before the latter part of the twentieth century high levels of competition were more common in Northern states than Southern ones.

There is a valid concern that the FRI measure is not necessarily exogenous to the gasoline tax rate. For example, it is plausible that increases in the tax rate in one period generate increases in electoral competition in a future period, especially if gas

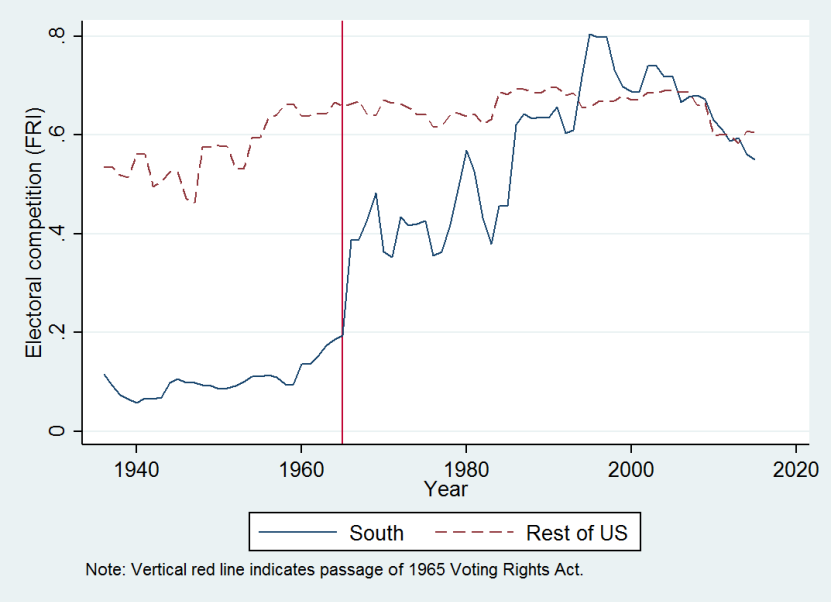
Table 4.3. Summary statistics for key variables

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
Gasoline tax rate (nominal US cents per gallon)	4,633	10.601	7	7.764	1	50.5
Electoral competition (Folded Ranney Index (FRI))	3,883	0.578	0.616	0.233	0	0.999
Electoral competition (10-year moving avg.)	3,442	0.585	0.643	0.198	0	0.950
Electoral competition (20-year moving avg.)	2,952	0.592	0.644	0.179	0	0.924
Electoral competition proxy	5,979	0.802	0.865	0.198	0.022	0.999

taxes become politically salient and cause voter backlash against the governing party, reducing its vote margin and increasing its electoral vulnerability at the next contest. The possibility of this type of reverse causation implies a positive correlation between the tax rate and electoral competition, which would bias my estimates upwards. Since I expect a negative coefficient for competition, this means the estimate would be closer to zero and therefore smaller in magnitude than the true effect.

I partly address this concern by lagging competition one year (see Section 5 below). To further mitigate it, I use federal intervention in the South as a result of the 1965 Voting Rights Act (VRA) as a source of exogenous variation. Prior to the VRA, Democratic politicians in Southern states used a variety of techniques, including literacy tests, poll taxes, and all-white primaries, to suppress voter turnout, especially among African Americans (Key 1949). The result was very low levels of electoral competition and virtual one-party Democratic dominance of Southern politics from the late 1800s to the mid-1960s. This can be seen clearly in Figure 4.8, where before 1965 (the vertical red line) average competition is much lower across the Southern states. It was not until the VRA that electoral competition was significantly re-introduced to the region. The Act outlawed impediments to voting, such as poll taxes and literacy tests, and empowered the Attorney General to monitor voter registration in states and counties. After the VRA's passage, federal courts moved quickly to strike down remaining poll taxes in Alabama, Mississippi, Texas, and Virginia, while Georgia, Louisiana, Mississippi, South Carolina, Virginia, 40 counties (of 100) in North Carolina, one county (of 15) in Arizona, and one county (of five) in Hawaii were targeted by federal officials and monitored to ensure no voter suppression was taking place.

Figure 4.8. Electoral competition by region



While the Civil Rights Act of 1964 resulted from long-fought struggles of the civil rights movement, the passage of the VRA came suddenly and as much more of a surprise to Southern politicians (Besley, Persson, and Sturm 2010; Davidson 1992). For example, President Lyndon Johnson did not mention it in his 1965 State of the Union address in January. But after witnessing the brutal crackdown on March 7 of police in Selma, Alabama on protesters marching to the state capital to register to vote, Johnson moved quickly to draft and adopt stringent voting rights legislation. On March 15, Johnson presented his bill to Congress. By August 6 it was signed into law, having passed the House and Senate with bipartisan support split along regional lines: Northern politicians supporting it and Southerners opposing it.

To measure the exogenous intervention of the federal government in the South as a result of the VRA, I construct a variable that equals the share of the state population subject to a poll tax or a literacy test (or both) that attracted federal scrutiny.[64] Prior to 1965, the variable is 1.0 for Alabama, Georgia, Louisiana, Mississippi, South Carolina, Texas, and Virginia, 0.018 for Arizona, 0.819 for Hawaii, and 0.451 for North Carolina. From 1965 onwards, the value is zero for all states.

The key identifying assumption – the exclusion restriction – is that, conditional on the controls included in the regression, federal intervention has no direct effect on gasoline taxation. Put differently, the effect of intervention on the gas tax rate occurs

[64] A similar approach has been used by Besley, Persson, and Sturm (2010) and Husted and Kenny (1997).

solely through its effect on electoral competition and not some other unmeasured variable. The validity of this assumption is plausible. Federal intervention surely had an effect on the partisan composition of state governments in the South as Republicans won more contests, which could affect tax rates. However, this partisan effect would act *through* the VRA's effect on electoral competition. Though to be sure, I control for partisanship in my analysis. The VRA also changed the composition of the electorate. In particular, it increased the number of poor voters (Husted and Kenny 1997), which could influence politicians' perceptions of voters' gas tax preferences. Gas taxes can be regressive. Knowing this, politicians might refrain from tax increases in an effort to win over poor voters. Yet again, this channel is not wholly independent from electoral competition, since competition should moderate politicians' responsiveness to the perceived preferences of the electorate. Still, I include both average income per capita and income inequality in the regressions to control for the earnings of the average citizen and the distribution of those earnings across income groups. Admittedly, it is only a proxy for the number of poor voters, however such a measure is not readily available.

Beyond partisanship and a changed electorate there are few other obvious channels through which federal intervention would directly affect gas taxes. As mentioned, the most recent study found no stable predictors of gas tax rates (Li, Linn, and Muehlegger 2014). Though other analyses highlight the role of the pre-tax price of gasoline, fiscal health, and the size of the oil industry (Geschwind 2014; Goel and Nelson 1999; Shmanske 1990). While there is little evidence that federal intervention had a direct impact on any of these variables, I still control for them in my analysis below.

This identification strategy causally estimates the local average treatment effect (LATE) among "compliers" (Sovey and Green 2011). In my case, this group is comprised of the ten states listed above in which the federal government intervened. Whether this effect is generalizable to the sample as a whole, and is therefore homogenous, depends on whether federally-induced shocks to state-level electoral competition have the same effect on state-level gasoline taxation as other types of shocks, such as political scandals or sudden changes in the share of committed partisan voters, for example. It is not immediately obvious, nor is there much evidence to suggest, that the type of shock matters. I therefore assume that all shocks to

competition have a similar effect on gasoline taxation and that the causal effects identified by the IV analysis are generalizable to the sample as a whole.

4.2. Controlling for potential confounding variables

To investigate whether my results are due to changes in electoral competition rather than changes in other potentially confounding variables, I include a number of controls. Similar to Chapter 3, the first set controls for differences in tax policy preferences (i.e., policy-seeking preferences) across Democratic and Republican governments. To control for partisan differences, I include two dummy variables. The first indicates whether the governor is a Democrat. The second indicates whether Democrats control both the upper and lower houses of the legislature. In addition, I include a measure of state government ideology from Berry et al. (2010) based on NOMINATE scores. Higher values indicate that the average elected official has a more left-leaning ("liberal") ideology. To control for differences in fiscal health, which may push governments to maximize tax revenues, I collect state finance data from the US Census (F. S. Berry and Berry 1992; Geschwind 2014). I construct and include measures of the fiscal balance (total revenue / total expenditure) and debt to revenue (total debt outstanding / total revenue). However, we should expect that these variables have little effect. As mentioned, in the majority of states gasoline taxes are earmarked for highway use. Governments cannot easily divert funds for general purposes like filling holes in the budget or paying down debt. To explicitly control for anti-diversion constitutional amendments, which prohibit gas tax revenues being diverted to non-highway uses, I collect data on state constitutions and construct a binary variable that takes the value of one after such an amendment has been adopted.[65] To control for the influence that oil companies may exert on politicians' tax policy preferences, I include a measure of state-level oil production.

The second set of controls includes factors that may influence political opportunities for tax rate increases other than electoral competition. Many states have adopted fiscal rules that require legislative supermajorities for tax changes, including those for gasoline. To control for the differential ability of governments to adopt tax increases, I use data from Heckelman and Dougherty (2010) and Knight (2000) to construct an ordinal variable that takes the value zero if no rule exists, 1 for a three-

[65] See Appendix C3.

fifths majority rule, 2 for two-thirds, and 3 for three-fourths. To control for the effect of the electoral cycle, which may affect the timing of rate increases (Nordhaus 1975), I include a dummy for election years. Regardless of partisanship, the governing party may find it less risky to increase fossil fuel tax rates in times when public opinion is perceived to support it. To my knowledge no state-level measure of public mood toward fuel taxes is available that stretches back to the first part of the twentieth century. As a proxy, I use the variable "mass economic liberalism" from Caughey and Warshaw (2017). It is available from 1936 to 2015 and is calculated based on survey data for questions concerning issues such as taxes, social policy, and labor regulations, including questions regarding gasoline taxation, environment, energy, highways, and pollution. Higher values mean that citizens have more "liberal" (i.e., pro-tax) views. Politicians may also be more willing to increase gas taxes when their associated costs are imposed on fewer drivers. To control for this possibility, I collect data from Federal Highway Statistics on the number of licensed drivers as percentage of the population. Governments may refrain from increasing gas taxes if voters already have a relatively high tax burden. I therefore control for motor vehicle license and operation taxes and individual income taxes, both as a percentage of personal income and based on US Census data. I include nominal personal income per capita, its growth rate, and a measure of income inequality (gini coefficient) to control for state-level income, economic conditions, and income inequality, which may affect politicians' perceptions of voters' sensitivity to price increases (F. S. Berry and Berry 1992). Data for each control variable is not available over the full sample period.[66] In an effort to make full use of the sample, I include them in the analysis step-wise in groups.

Lastly, I include state and year fixed effects in all regressions to control for all time-invariant factors at the state level, as well as variables that affect all states equally over time, such as the federal gasoline tax rate and the national economic climate. Both the national Democratic and Republican parties have undergone ideological shifts and realignment over time, especially after 1965. The time dummies also control for these changes in party platforms at the national level. In addition, they control for inflation and the international price of oil (the primary driver of the pre-tax price of gasoline). In this way, the time fixed effects also control for any variable tax rate structures that states may have in addition to the fixed rate excise tax, since variable rates are indexed to one or both of these variables.

[66] See Appendix C1 for complete summary statistics.

Restricting the analysis in the first instance to these variables offers the most parsimonious and theoretically-motivated approach. However, the results are robust to the inclusion of a wide variety of additional controls, including: citizen ideology, urbanization, access to public transportation, length of public roads maintained by the state government, spending on roads, and spending on social policy.[67] Any lingering concerns of omitted variable bias are further addressed by the IV strategy described above.

5. Empirical strategy and results

The crucial mechanism highlighted by my theoretical arguments is that electoral competition shapes incentives for politicians to increase direct and highly visible taxes on gasoline. To investigate this link empirically, I proceed in two steps. I first analyze the static relationship between levels of electoral competition and levels of gasoline taxation using fixed effects models. I then estimate a series of error correction models to examine dynamics over time between competition and changes in the tax rate.

5.1. Electoral competition and gasoline taxation: Static models

If my arguments are correct, higher levels of electoral competition should be associated with lower gas tax rates. To test this relationship, I estimate a series of regressions of the form

$$Y_{it} = \beta_1 K_{it-1} + \beta_2 P_{it} + \beta' X_{it-1} + \gamma_i + \tau_t + \varepsilon_{it} \quad (2)$$

where Y_{it} is the nominal excise tax rate (US cents per gallon) in state *i* at year *t*; K_{it-1} is electoral competition (FRI measure) lagged one year; P_{it} is an election year dummy; X_{it-1} is a vector of lagged control variables; γ_i and τ_t are state and year fixed effects; and ε_{it} is the error term. Similar to Chapter 3, I analyze nominal instead of real tax rates because the dependent variable needs to capture political decision-making. Politicians can only make decisions about the nominal rate. Because I assume that the tax rate in

[67] See Appendix C4.

year *t* is generally the result of political decisions made in the previous year *t-1*, I lag all of independent variables one year apart from the election year dummy.[68]

To correct for autocorrelation and heteroskedasticity of the error terms I use robust standard errors clustered at the state level. I also check for nonstationarity. An Im-Pesaran-Shin unit root test of the FRI measure rejects the null hypothesis that all panels contain a unit root at the 1% level. In the case of tax rate levels, the evidence against the null is weak and cannot be rejected. Indeed, the nominal rates are clearly trending upwards over time (see Figure 4.5 above). However, since both tax rates *and* electoral competition are not nonstationary, I proceed with the analysis. Any lingering concerns are fully addressed by the error correction models, which specify gas tax rates as changes rather than levels (see below). As a final check, I use jackknife resampling to investigate whether one state in the sample is driving the results.[69] I find no evidence of this.

Table 4.4 presents the results. As mentioned, data for all controls is not available since 1937. I therefore include controls step-wise depending on their time coverage. For this reason, the sample period shrinks as additional controls are included. Models 1-4 estimate the relationship between electoral competition measured in annual levels and the nominal gasoline tax rate. As theorized, high levels of electoral competition are indeed associated with lower levels of gasoline taxation, all else equal. Furthermore, the estimates remain statistically significant and stable across a range of sample periods and conditional on a range of controls.

Model 5 contains the estimates for the IV analysis. To address the possibility of reverse causation and omitted variable bias, I instrument electoral competition with the exogenous intervention of the federal government in the South as a result of the 1965 VRA (as described in Section 4.1 above). In an effort to maximize the sample size prior to 1965, and therefore variation in the instrument, I estimate these models using the same controls as those in Model 2. The IV estimate has the same sign as the OLS estimates and is statistically significant. It is also much larger in magnitude. The coefficient is around four times the size of the comparable estimate in Model 2, which suggests that the OLS estimate may be biased upwards (i.e., closer to zero).

Lastly, Models 6 and 7 examine lower frequency variation in the data – ten- and twenty-year moving averages – in order to estimate the effect of underlying trends in

[68] The results are robust to an alternative two-year lag structure. See Appendix C4.
[69] See Appendix C4.

Table 4.4. Electoral competition and gasoline taxation: Static models

	Gas tax rate (cents per gallon)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Electoral competition (t-1)	-2.902***	-2.469***	-2.374***	-1.891**	-10.61***		
	(0.861)	(0.834)	(0.803)	(0.862)	(3.318)		
Electoral competition (10 yr. avg.) (t-1)						-4.258***	
						(1.378)	
Electoral competition (20 yr. avg.) (t-1)							-6.011***
							(1.854)
Election year		-0.0704	-0.00432	-0.154***	-0.0605	-0.0719	-0.0900
		(0.101)	(0.0652)	(0.0571)	(0.0979)	(0.0667)	(0.0599)
Democratic governor (t-1)		0.162	-0.183	-0.369	-0.884*	0.151	0.0975
		(0.223)	(0.190)	(0.281)	(0.464)	(0.222)	(0.237)
Democratic legislature (t-1)		1.136**	0.631*	0.612*	0.693	0.902**	0.562
		(0.468)	(0.363)	(0.332)	(0.429)	(0.446)	(0.425)
Fiscal rule: 3/5 (t-1)		1.145	1.010	1.828*	1.754	1.365	1.594
		(1.273)	(1.040)	(0.977)	(1.153)	(1.155)	(1.078)
2/3 (t-1)		-0.410	-0.462	-0.585	-0.612	-0.452	-0.507
		(1.209)	(1.157)	(1.175)	(1.165)	(1.180)	(1.200)
3/4 (t-1)		-3.234***	-3.118***	-3.134***	-2.940***	-2.866***	-2.660***
		(0.738)	(0.735)	(0.855)	(0.734)	(0.692)	(0.656)
Anti-diversion amend. (t-1)		-0.423	-0.940	0.210	-0.507	-1.132	0.142
		(0.674)	(0.669)	(0.778)	(0.649)	(0.882)	(0.683)
Mass econ. liberalism (t-1)		-0.328	-0.164	0.748	0.308	0.182	0.268
		(1.132)	(1.060)	(1.075)	(1.259)	(1.156)	(1.292)
Income inequality (t-1)		2.086	0.181	1.349	1.897	4.345	7.364
		(5.306)	(8.661)	(9.655)	(6.085)	(7.784)	(8.410)
Fiscal balance (t-1)			0.889	1.278			
			(0.770)	(0.914)			
Debt to revenue (t-1)			0.959	1.361			
			(0.644)	(1.125)			

Motor vehic. taxes (t-1)			147.8	241.3			
			(219.4)	(291.1)			
Income taxes (t-1)			89.80	91.33			
			(64.77)	(75.82)			
Gov. ideology (t-1)				0.0115			
				(0.0155)			
Licensed drivers (t-1)				-8.377*			
				(4.507)			
Income growth (t-1)				1.928			
				(2.552)			
Income per cap. (t-1)				-0.0583			
				(0.163)			
Oil production (t-1)				-1.654			
				(2.292)			
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2015	1943-2009	1961-2009	1937-2015	1946-2015	1956-2015
Method	OLS	OLS	OLS	OLS	IV	OLS	OLS
First stage *F* - statistic					81.65		
R^2 – within	0.857	0.865	0.875	0.856	0.842	0.860	0.850
States	49	49	49	49	49	49	49
N	3834	3784	3057	2401	3784	3344	2854

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

electoral competition. Again, I estimate these models using the same controls as in Model 2 in order to maximize sample size.[70] The coefficients are statistically significant and larger in magnitude than the estimate for the annual measure in Model 2. The results suggest that changes in underlying long-term state-level trends in electoral competition exert a greater influence on the tax rate than election-to-election fluctuations. Indeed, it is further evidence that the estimates in Models 1-4 may be biased upwards as a result of substantial short-term oscillations in competition.

Turning briefly to the other variables, tax rates are significantly lower after the adoption of fiscal rules that require a three-fourths legislative majority for tax changes, as we might expect. Also, tax rates tend to be lower in election years, confirming findings from a large literature on political business cycles (e.g., Mikesell 1978; Nordhaus 1975; Royed and Borrelli 1999); though the estimates do not consistently reach statistical significance. There is little evidence that the fiscal health of governments plays a role, as predicted. Remember that revenues are earmarked and therefore cannot generally be used to shore up state finances. The case of partisanship is mixed. Democratic control of the legislature is positively associated with taxes. However, the estimates lack precision and are therefore not always statistically significant. There is little evidence that either the governor's party or the ideology of the state government as a whole have a direct relationship with gasoline taxation. These findings that are consistent with previous studies (F. S. Berry and Berry 1992; Li, Linn, and Muehlegger 2014).

The results for electoral competition are not only statistically significant, but substantively important. The estimates of the impact of competition on taxation in Models 1-4, for example, suggests that a one standard deviation increase in the annual level of competition (0.233) reduces the gasoline tax rate by between 0.44 and 0.68 cpg relative to a sample mean tax rate of 10.6 cpg. In the case of long-term trends, a one standard deviation increase in the ten-year moving average (0.198) decreases the tax rate by around 0.84 cpg. In the case of the twenty-year average (0.179), it is a decrease of 1.08 cpg. These results suggest that both short-term fluctuations in the degree of electoral competition *and* long-term underlying trends are important. Past dynamics of political contestation have persistent effects. Fuel taxes are lower when states experience successively high levels of competition over long periods, suggesting that the effects of electoral competition are sticky. Rather than immediately and completely re-

[70] The results are similar when the full set of controls is included. See Appendix C4.

calibrating their assessment of political risk after each election, politicians and parties appear to use the information to update their existing knowledge of the political environment. The estimates suggests that such knowledge has a lifespan of at least twenty years.

Turning to the IV estimate, we see that a one standard deviation increase in competition reduces the tax rate by around 2.47 cpg. As described above, the coefficient can be interpreted causally as the local average treatment effect (LATE) for "compliers" – the ten states in which the federal government intervened: Alabama, Arizona, Georgia, Hawaii, Louisiana, Mississippi, North Carolina, South Carolina, Texas, and Virginia. If we assume that the effect is homogenous and therefore generalizable across all states, as I argue above that we should, it is substantially large when compared to the sample mean of 10.6 cpg. Since the IV strategy relies on the once-and-for-all elimination of voting restrictions, it likely also partly captures long-term underlying trends in electoral competition (Besley, Persson, and Sturm 2010). The result provides further evidence that both short-term fluctuations and long-term trends in competition are key drivers of gas tax politics.

5.2. The long-term effects of electoral competition: Dynamic models

The models above provide robust evidence of a negative relationship between levels of electoral competition and gasoline tax rates. However, they provide little information regarding the long-term cumulative effects of shifts in competition nor the dynamics of adjustment between competition and the tax rate. Indeed, the total effect of a change in electoral competition may not be observed in the year after it occurs, but persist for years into the future. My large dataset provides an ideal setting for investigating these long-run dynamics.

To do so, I utilize error correction models since they are well-suited to analyze the long-term effects of independent variables (De Boef and Keele 2008). I estimate a series of general error correction models (GECMs) of the form

$$\Delta Y_{it} = \alpha_1 Y_{it-1} + \beta_0 \Delta K_{it} + \beta_1 K_{it-1} + \beta' \Delta X_{it} + \beta' X_{it-1} + \gamma_i + \tau_t + \varepsilon_{it} \qquad (3)$$

where ΔY_{it} is the change in the nominal gasoline tax rate from the previous year; Y_{it-1} is the lagged nominal rate; ΔK_{it} is the change in electoral competition from the previous

year; K_{it-1} is its lagged level; and ΔX_{it} and X_{it-1} are the changes and lagged levels of a vector of control variables. γ_i and τ_t are state and year fixed effects and ε_{it} is the error term.

This empirical strategy presumes that there is an equilibrium gas tax rate for each state that depends in part on the level of electoral competition. Exogenous shocks to competition may affect two kinds of changes in the rate. The first is the short-term effect of a change in competition on a change in the tax rate – measured by β_0. The second is the long-term effect of a persistent shock to competition that disturbs the equilibrium relationship between it and the tax rate, pushing the rate to a new equilibrium corresponding to the new level of competition. This effect is measured by the long-run multiplier (LRM) given by β_1 / -α_1, where β_1 is the coefficient for lagged competition and α_1 is the error correction rate. α_1 measures the tax level's rate of return to its long-term equilibrium after a shock to competition. If the model is correctly specified, α_1 lies between -1 and 0. Put simply, the LRM represents the cumulative effect of a sustained one-unit increase in competition on the long-term equilibrium level of gasoline taxation in each state.

Theoretically, I do not anticipate that changes in electoral competition have a contemporaneous, short-term effect on gasoline taxation. Rather I assume a one year lag between when political decisions are made regarding tax policy and when they are implemented. Furthermore, and perhaps more importantly, my arguments predict that levels of competition matter, not relative changes. Hence, I do not expect β_0 to be statistically different from zero. I therefore also estimate a series of more restricted error correction models, or "dead start" models, that are identical to Equation 3 except that they leave out the first differenced independent variables (De Boef and Keele 2008). I use robust standard errors clustered at the state level. Jackknife resampling offers no evidence that one state in the sample is driving the results.[71]

Table 4.5 presents the results. Looking first at the GECMs (Models 1, 3, 5, and 7), changes in competition have no immediate short-term effect on changes in the tax rate, as expected. However, electoral competition has a negative and significant long-term effect on rate changes, as indicated by the coefficients for lagged competition. The robustness of the results are confirmed by the corresponding estimates from the dead start models in columns 2, 4, 6, and 8. Estimates of long-term effects across both specifications are similar in size, direction, and statistical significance. Lastly, Model 9

[71] See Appendix C4.

re-estimates Model 4 using federal intervention in the South as an instrument for competition. The coefficient is negative and statistically significant. Similar to above, the coefficient is around 3 times larger in magnitude compared to Model 4.[72]

To interpret the long-term effect of a change in competition on gasoline taxation I calculate the LRM for each model.[73] The estimates are shown in the last row of the table. Strong competition is indeed associated with long-term changes in gasoline taxation. Specifically, increased competition has a negative and statistically significant impact on states' long-term equilibrium tax rate, and this effect is robust across all models. The LRM estimate for Model 4, for example, suggests that the expected total long-term effect of a sustained one standard deviation increase in electoral competition is a reduction in the tax rate of around 1.9 cpg; again, relative to a sample mean of 10.6. In the case of the IV estimates (Model 9), the expected total long-term effect is a decrease of around 5 cents. That is, a sustained one standard deviation increase in competition reduces the long-term equilibrium tax rate by around 50% relative to the sample mean.

These substantial long-term effects do not occur all at once but over many future years. The error correction rate offers information about how they manifest themselves over time. Looking across the models, the coefficients for the lagged tax rate vary between -0.0271 and -0.0545, which translates to an error correction rate of between 2.7% and 5.5%. This low rate suggests that the total effect of competition on the tax rate comes about very slowly. For example, the error correction rate of -0.0271 in Model 4 indicates that 2.7% of the total long-term effect of a shift in electoral competition occurs at time $t + 1$, an additional 2.7% of the remaining effect takes place at time $t + 2$, and so on until the total long-term effect has been distributed.[74] This process can be seen clearly in Figure 4.9, which illustrates the annual long-term effects of a one standard deviation increase in competition for Model 4 and the IV estimates from Model 9. Indeed, we see that the total effect comes about slowly. In the case of the IV estimates, it takes around 21 years for 50% of the total effect of a shock to competition in a particular year to be realized in the tax rate. In the case of the Model 4, it is approximately 25 years.

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[72] Estimates of moving averages of electoral competition are not included because these variables are themselves measures of long-term trends and therefore do not straightforwardly lend themselves to the ECM setup.

[73] I use the Stata command nlcomm to compute LRMs and their standard errors.

[74] Another way to interpret the LRM is as an impulse response function (IRF).

Table 4.5. Electoral competition and gasoline taxation: Dynamic models

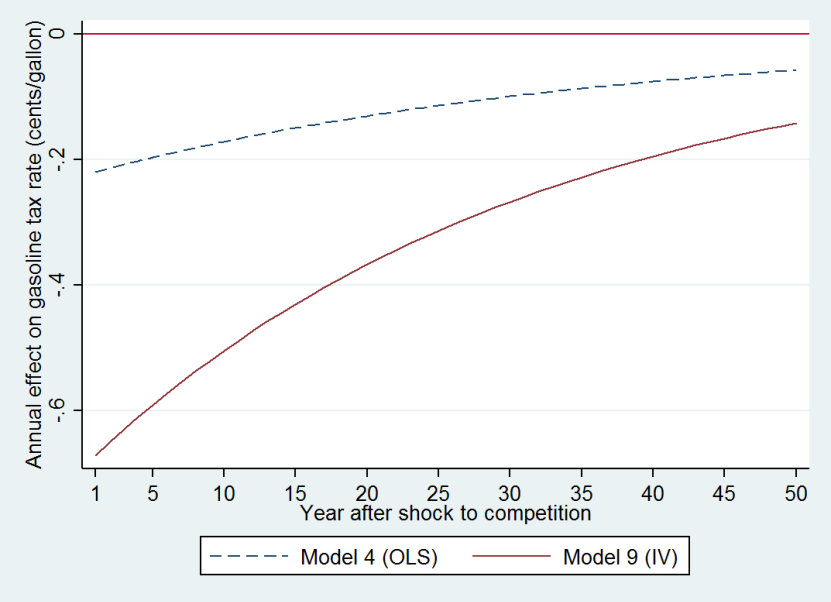
	Δ Gas tax rate (cents per gallon)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Long-Term Effects									
Electoral competition (t-1)	-0.184*	-0.176*	-0.213**	-0.217**	-0.282***	-0.299***	-0.350**	-0.332***	-0.671**
	(0.103)	(0.0955)	(0.0986)	(0.0926)	(0.103)	(0.0909)	(0.152)	(0.118)	(0.275)
Election year (t-1)			-0.0861	0.198***	-0.124	0.208***	-0.124	0.221***	0.201***
			(0.142)	(0.0363)	(0.139)	(0.0433)	(0.169)	(0.0532)	(0.0343)
Democratic governor (t-1)			0.0163	0.000600	-0.0197	-0.0325	-0.114	-0.0539	-0.0561
			(0.0341)	(0.0317)	(0.0340)	(0.0308)	(0.100)	(0.0535)	(0.0463)
Democratic legislature (t-1)			0.0423	0.0315	0.0393	0.0288	0.0216	0.0392	0.0125
			(0.0495)	(0.0447)	(0.0485)	(0.0456)	(0.0748)	(0.0543)	(0.0438)
Fiscal rule: 3/5 (t-1)			0.127	0.112	0.0642	0.0388	0.0366	0.0241	0.150
			(0.108)	(0.107)	(0.103)	(0.0960)	(0.133)	(0.124)	(0.115)
2/3 (t-1)			0.0189	0.0204	-0.0146	-0.00681	-0.0339	-0.0293	0.00734
			(0.103)	(0.104)	(0.128)	(0.125)	(0.138)	(0.132)	(0.106)
3/4 (t-1)			-0.249***	-0.258***	-0.221***	-0.211***	-0.243**	-0.245**	-0.250***
			(0.0483)	(0.0491)	(0.0700)	(0.0683)	(0.0985)	(0.0929)	(0.0487)
Anti-diversion amend. (t-1)			-0.00786	-0.00672	0.0402	0.0276	0.0970	0.159	-0.0135
			(0.0409)	(0.0384)	(0.108)	(0.0839)	(0.158)	(0.120)	(0.0452)
Mass econ. liberalism (t-1)			-0.167	-0.122	-0.126	-0.0522	-0.0739	0.0377	-0.0938
			(0.130)	(0.118)	(0.187)	(0.183)	(0.203)	(0.198)	(0.122)
Income inequality (t-1)			0.520	0.178	-0.675	-0.703	0.0733	0.0225	0.172
			(0.879)	(0.709)	(1.152)	(1.161)	(1.202)	(1.223)	(0.712)
Fiscal balance (t-1)					-0.436**	-0.353**	-0.201	-0.209	
					(0.187)	(0.164)	(0.268)	(0.232)	
Debt to revenue (t-1)					-0.00784	-0.0470	0.0742	0.00301	
					(0.0862)	(0.0784)	(0.118)	(0.104)	
Motor vehic. taxes (t-1)					-14.22	-20.25	-6.274	-15.30	
					(21.12)	(19.88)	(24.34)	(24.11)	

Income taxes (t-1)			2.786	1.955	-0.963	-0.260
			(6.551)	(6.300)	(6.711)	(6.677)
Gov. ideology (t-1)					0.00591	0.00143
					(0.00550)	(0.00293)
Licensed drivers (t-1)					0.0473	0.123
					(0.673)	(0.610)
Income growth (t-1)					-1.349	-0.419
					(1.052)	(0.536)
Income per cap. (t-1)					-0.0174	-0.0136
					(0.0148)	(0.0143)
Oil production (t-1)					-0.477*	-0.570**
					(0.265)	(0.228)
Short-Term Effects						
Δ Electoral competition	-0.0432	-0.0347	0.0651		0.0812	
	(0.189)	(0.147)	(0.182)		(0.218)	
Δ Election year		-0.159*	-0.183**		-0.188*	
		(0.0807)	(0.0831)		(0.100)	
Δ Democratic governor		0.0685	0.0579		0.0838	
		(0.0710)	(0.0415)		(0.0529)	
Δ Democratic legislature		0.0509	0.0498		0.0658	
		(0.0498)	(0.0502)		(0.0625)	
Δ Fiscal rule		-0.0342	-0.0538		-0.0576	
		(0.0680)	(0.0508)		(0.0530)	
Δ Anti-diversion amend.		-0.00916	0.181		0.115	
		(0.0290)	(0.143)		(0.132)	
Δ Mass econ. liberalism		-0.150	-0.197		-0.276	
		(0.201)	(0.223)		(0.268)	
Δ Income inequality		2.162	0.695		1.379	
		(1.500)	(1.228)		(1.700)	
Δ Fiscal balance			-0.118		0.0657	
			(0.161)		(0.182)	

Δ Debt to revenue					0.440*		0.822**		
					(0.256)		(0.314)		
Δ Motor vehic. taxes					32.99		30.02		
					(25.64)		(32.43)		
Δ Income taxes					19.06*		19.79		
					(10.45)		(12.40)		
Δ Gov. ideology							0.00634		
							(0.00553)		
Δ Licensed drivers							-0.392		
							(0.738)		
Δ Income growth							-1.148		
							(0.763)		
Δ Income per cap.							-0.0251		
							(0.0763)		
Δ Oil production							1.006**		
							(0.466)		
Error Correction Rate									
Gas tax rate (t-1)	-0.0438***	-0.0437***	-0.0271***	-0.0268***	-0.0465***	-0.0458***	-0.0545***	-0.0528***	-0.0313***
	(0.0132)	(0.0131)	(0.00845)	(0.00834)	(0.0123)	(0.0124)	(0.0120)	(0.0124)	(0.00904)
Long-run multiplier (LRM)	-4.199*	-4.02*	-7.876**	-8.08**	-6.073**	-6.538***	-6.426**	-6.289**	-21.454**
	(2.481)	(2.353)	(3.597)	(3.356)	(2.411)	(2.275)	(3.188)	(2.535)	(8.364)
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2016	1937-2014	1937-2014	1951-2008	1951-2008	1961-2008	1961-2008	1937-2014
Method	GECM	Dead Start	GECM	Dead Start	GECM	Dead Start	GECM	Dead Start	IV
First stage *F* - statistic									58.03
R^2 – within	0.0964	0.0963	0.130	0.127	0.159	0.154	0.162	0.154	0.130
States	49	49	49	49	49	49	49	49	49
N	3833	3833	3735	3735	2824	2824	2352	2352	3735

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 4.9. Long-term effect of electoral competition over time



Taken together, the results suggest that electoral competition has very long-term and lingering effects on gasoline taxation. Furthermore, the dynamics of adjustment play out slowly over time. After a shock to competition, it is predicted to take many years for the tax rate to return to its long-run equilibrium level. Put differently, the tax rate in any given year is affected by levels of competition stretching back decades into the past. This suggests that sustained increases in competition make governments very risk-averse far into the future. This evidence complements the results from the previous section, which show that gas taxes are influenced by long-term underlying trends in electoral competition, as well as short-term shifts. Indeed, the results offer insight into why we observe so few changes in tax rates over time. The long-term and persistent negative effects of relatively high average levels of electoral competition in US states attenuate the frequency of tax increases, dampening long-run taxation trajectories.

5.3. Robustness

To test the robustness of the results, I calculate separate measures of electoral competition for each branch of state government: governor, senate, and house.[75] I then re-estimate the models above. The results are similar in direction, size, and statistical significance to both the static and dynamic main results. There are a number of ways to

[75] See Appendix C5.

substantively interpret these findings. The most straightforward is to conclude that the effect of electoral competition does not appear to vary by office. For example, under heightened competition governors do not behave much different from senators, who do not behave differently from house members. A second interpretation entails that we first consider that gas tax increases require the agreement of *all* three branches of state government. The strategic electoral incentives of any one branch will not be sufficient. That is, the governor cannot simply increase tax rates whenever she or he is enjoying a wide lead of over rivals. Rather, rate changes come when all three branches *simultaneously* experience electoral safety. In which case, the tax rate changes we observe are associated with similar levels of competition across all branches, and as a result the separate coefficients for each branch do not differ much.

5.4. The very long-run relationship

In this last empirical section, I turn to investigating the relationship between electoral competition and gasoline taxation since 1919. For data availability reasons, the time series for my primary measure of electoral competition begins in 1937. As a consequence, almost 20 years of gas tax data is left unanalyzed. In an effort to provide additional support for my arguments, I develop a proxy of electoral competition based on data from Hirano and Snyder (2019) who measure the average vote share of Democrats in all statewide races. The data is available from the late 1800s for most states and therefore enables me to examine virtually the entire universe of state-level gasoline tax rate changes.

I construct a measure of electoral competition using Formula 1, substituting the average Democratic vote share for the Ranney Index. The resulting proxy is correlated with the FRI measure (0.61). Similar to the FRI, the variable ranges from 0 to 1, with increasing values indicating higher levels of competition. The estimates can therefore be directly compared to those for the FRI above. However, it is important to note that they are measuring different phenomena. The proxy measures competition in *all* statewide races, rather than just races for those offices that set gas tax policy (i.e., governorship, senate, and house). As a consequence, it likely introduces a degree of measurement error into my estimates. The results should be interpreted with this in mind.

I use the same empirical strategy as above, estimating both static and dynamic specifications, as well as undertaking IV analysis. Apart from state and year fixed effects, I do not include controls in any model since doing so would reduce my sample size. Table 4.6 provides the results. The estimates of the static models are very similar in size, direction, and statistical significance to the main results in Table 4.4 above. A one standard deviation increase in competition is associated with a 0.72 cpg decrease in the tax rate (Model 1). In the case of the 10- and 20-year moving averages, it is associated with a decrease of 0.99 and 1.13 cpg, respectively (Models 3 and 4). Similar to above, the IV estimate is larger in magnitude than the OLS estimate, suggesting a causal effect size of around 1.8 cpg.

Turning to the dynamic specifications, again the estimates are similar to the main results in Table 4.5, including those for the error correction rate and LRM. A sustained one standard deviation increase in the equilibrium level of competition reduces the tax rate by a total of between 1.37 and 1.63 cpg over future periods (Models 5 and 6). In the case of the IV analysis, the long-term effect is 3.1 cpg (Model 7). The error correction rates are somewhat higher than the main results above, suggesting that the long-term effects decay slightly quicker. For example, in the case of the OLS estimate it takes around 17 years for 50% of the effect to dissipate (Model 6). For the IV estimate it is around 14 years. Figure 4.10 graphs the long-term effect over time for both estimates. As indicated by the higher error correction rate, we observe steeper slopes than in Figure 4.9. Taken together, the results provide strong evidence of a significant, negative relationship between electoral competition and gasoline taxation in US states since the early twentieth century.

6. Conclusion

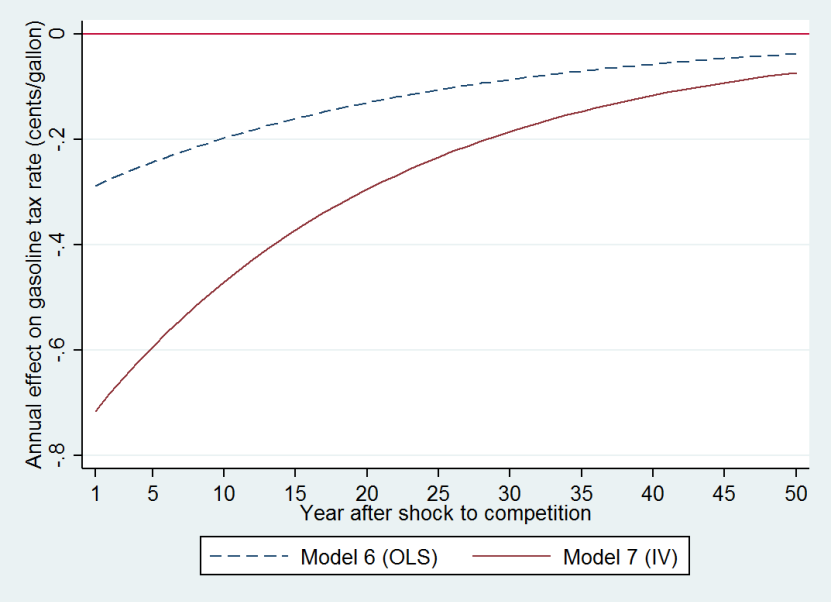
This essay examines the role that electoral competition plays in shaping political opportunities for, and risks of, long-term policy investments. It analyzes the case of gasoline taxes in US states since 1919. The evidence strongly supports the conclusion that state-level politicians throughout much of the twentieth century made gas tax policy decisions based on strategic calculations about their electoral security. These findings are consistent with a theoretical model that reconceptualizes state-level

Table 4.6. Electoral competition and gasoline taxation over the very long term (1919-2016)

	Gas tax rate (cents per gallon)				Δ Gas tax rate (cents per gallon)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Electoral competition proxy (t-1)	-3.624***	-9.094***					
	(0.999)	(2.712)					
Electoral competition proxy (10 yr. avg.) (t-1)			-5.597***				
			(1.546)				
Electoral competition proxy (20 yr. avg.) (t-1)				-6.666***			
				(1.781)			
Short-Term Effects							
Δ Electoral competition proxy					-0.220		
					(0.141)		
Long-Term Effects							
Electoral competition proxy (t-1)					-0.343***	-0.287***	-0.715***
					(0.109)	(0.0953)	(0.195)
Error Correction Rate							
Gas tax rate (t-1)					-0.0416***	-0.0410***	-0.0457***
					(0.0131)	(0.0130)	(0.0137)
Long-Run Multiplier (LRM)					-8.248***	-7.004***	-15.663***
					(2.395)	(2.055)	(4.030)
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1919-2016	1919-2016	1919-2016	1919-2016	1920-2016	1920-2016	1920-2016
Method	OLS	OLS IV	OLS	OLS	GECM	Dead Start	Dead Start IV
First stage *F* - statistic		82.734					65.157
R^2 – within	0.875	0.869	0.880	0.884	0.101	0.101	0.103
States	50	50	50	50	50	50	50
N	4632	4629	4612	4568	4583	4583	4583

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 4.10. Long-term effect of electoral competition over time using proxy measure



gasoline taxation as a type of long-term policy investment. By structuring electoral safety, electoral competition shapes how politicians' assess the political risks of undertaking these kinds of policy decisions, which impose short-term costs on voters in order to generate greater long-term benefits. Even in this least likely case, where tax revenues are used to fund highly visible transportation infrastructure for motorists, politicians tend to be unwilling to invest in long-term policy solutions if it means increased short-term political risk. It is in this way that competition represents one important channel through which the time horizons of governments are moderated. Governments that enjoy a comfortable lead over rivals should be those most likely to engage in the politics of long-term policy investment and structural change, since they can afford to look beyond the next election to society's long-run aggregate welfare. The results complement recent work in economics, which finds that higher re-election probabilities for incumbents (i.e., lower electoral competition) is associated with higher levels of public investment, less targeted spending (i.e., pork), and less overall economic short-sightedness (Azzimonti 2015; Fiva and Natvik 2013).

Importantly, I find evidence that *both* election-to-election shifts in the competitiveness of the electoral environment and underlying trends in competition matter. States that experience successive highly competitive contests have even lower tax rates. This suggests that the effects of electoral competition are sticky. Rather than immediately and completely re-calibrating their assessment of political risk after each election, politicians and parties seem to use the information to update their existing

knowledge of the political environment. Further evidence of this is provided by the results of the error correction models, which show that shifts in competition have long-term effects on the tax rate that stretch decades into the future. Overall, the results demonstrate that the past matters. Politicians' behaviour today is influenced by previous electoral dynamics.

Taken together, the results help to shed light on why, from an international perspective, gas taxes have been so low in the US. At the state-level, politicians have experienced relatively high levels of electoral competition throughout the entire period of gasoline taxation. We should expect that these trends reduce the frequency and magnitude of tax increases, and by doing so, dampen long-run taxation trajectories; and this is what we observe. Tax rates in the states are generally low and increases are rare, occurring in only 16.5% of state-years over the last almost one hundred years. More broadly, these findings shed light on the political economy of fossil fuel taxes in competitive political economies with majoritarian electoral rules. Because electoral competition between two main political parties tends to run high, these types of political economies will tend to have relatively low levels of fossil fuel taxation. Indeed, these electoral dynamics help to explain why directly increasing the price of fossil fuels has gained little traction not only in the US, but also in Australia, Canada, and the UK. More generally, they provide a mechanism that explains the low consumption tax rates across the Anglo-Saxon democracies (Beramendi and Rueda 2007).

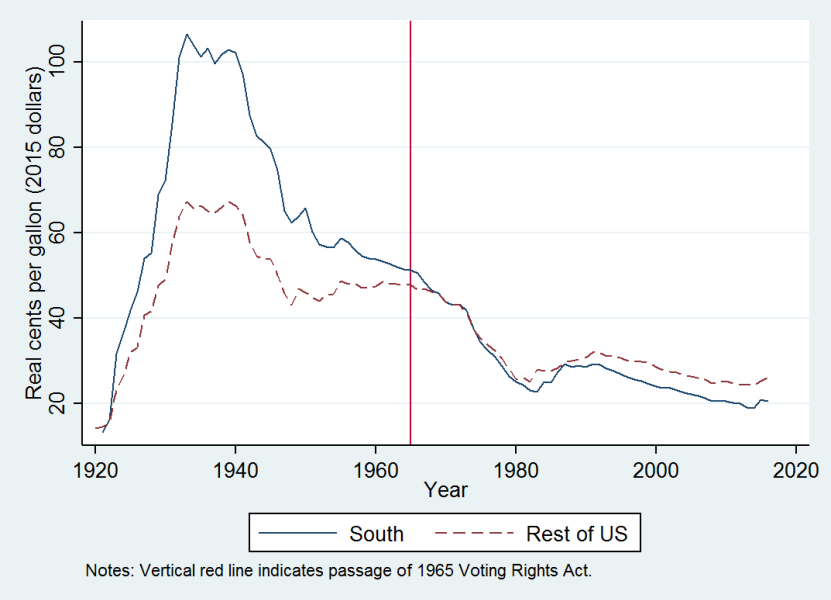
In US states, the only time when competition was systematically below the sample average was in the Southern states in the decades before the 1965 Voting Rights Act. As expected, it is precisely in these states in this period that we observe the highest real levels of gasoline taxation in US history (Figure 4.11). Indeed, in the 1920s average tax rates rose much quicker in the South compared to the other states and plateaued at over $1 per gallon in 2015 dollars. A high rate when compared to the average real tax rate across all states in 2015 of around 25 cpg. Moreover, seven of the ten states with the highest average real tax rate since the 1920s are former members of the Confederacy (Figure 4.6 above).

Lastly, I find little evidence that government partisanship or ideology have a direct effect on gasoline taxation. That is, neither Democrats nor Republicans appear to routinely increase or decrease rates. This finding is perhaps surprising, especially when viewed from the current era of hyper-partisanship in the US. However, it is consistent with previous studies, as well as the other two essays in this thesis. When it comes to

the politics of long-term climate change policymaking, partisanship appears to play a much less important role than electoral safety.

The findings provide additional empirical support for the novel theoretical arguments laid out in Chapters 2 and 3. They confirm the crucial role of electoral safety in driving the politics of climate change, particularly around fossil fuel taxation. The study also fills a large gap in the political science literature which has curiously overlooked the politics of gasoline taxation in US states. In contrast to the handful of previous studies that have found few stable predictors of state-level gasoline taxes, this paper sheds light on the key role that electoral competition plays in shaping politicians' incentives to directly impose tax increases on voters. Lastly, the study contributes to emerging research on the politics of long-term policymaking. Researchers have previously underscored the importance of electoral safety (Garrett 1993; Jacobs 2011), however empirical tests are still scant. Looking across virtually the entire universe of state-level gas taxes, this study provides strong evidence in support of these theoretical arguments.

Figure 4.11. Real gas tax rates in Northern and Southern states



APPENDIX C

C1. Summary statistics

Table C1. Summary statistics

Variable	Source	Obs	Mean	Std. Dev.	Min	Max
Gas tax rate (nominal cents per gallon)	FHWA (2018)	4,633	10.60113	7.763579	1	50.5
Gas tax rate (real cents per gallon, 2015 dollars)	FHWA (2018)	4,633	41.22832	19.15548	7.509488	128.1774
Folded Ranney Index (FRI)	Author's calculations based on data from Klarner (2013)	3,883	0.577685	0.232794	0	0.999672
Folded Ranney Index (FRI) (10-year moving avg.)	Author's calculations based on data from Klarner (2013)	3,442	0.585451	0.197902	0	0.949977
Folded Ranney Index (FRI) (20-year moving avg.)	Author's calculations based on data from Klarner (2013)	2,952	0.591716	0.179263	0	0.923637
Electoral competition proxy	Author's calculations based on data from Hirano and Snyder (2019)	5,979	0.802024	0.197957	0.021963	0.999985
Electoral competition proxy (10-year moving avg.)	Author's calculations based on data from Hirano and Snyder (2019)	5,529	0.802006	0.176028	0.032766	0.990281
Electoral competition proxy (20-year moving avg.)	Author's calculations based on data from Hirano and Snyder (2019)	5,029	0.802084	0.170252	0.048528	0.967336
Electoral competition: Governor	Author's calculations based on data from Klarner (2013)	3,883	0.797553	0.229082	0	1
Electoral	Author's	3,883	0.596199	0.294254	0	1

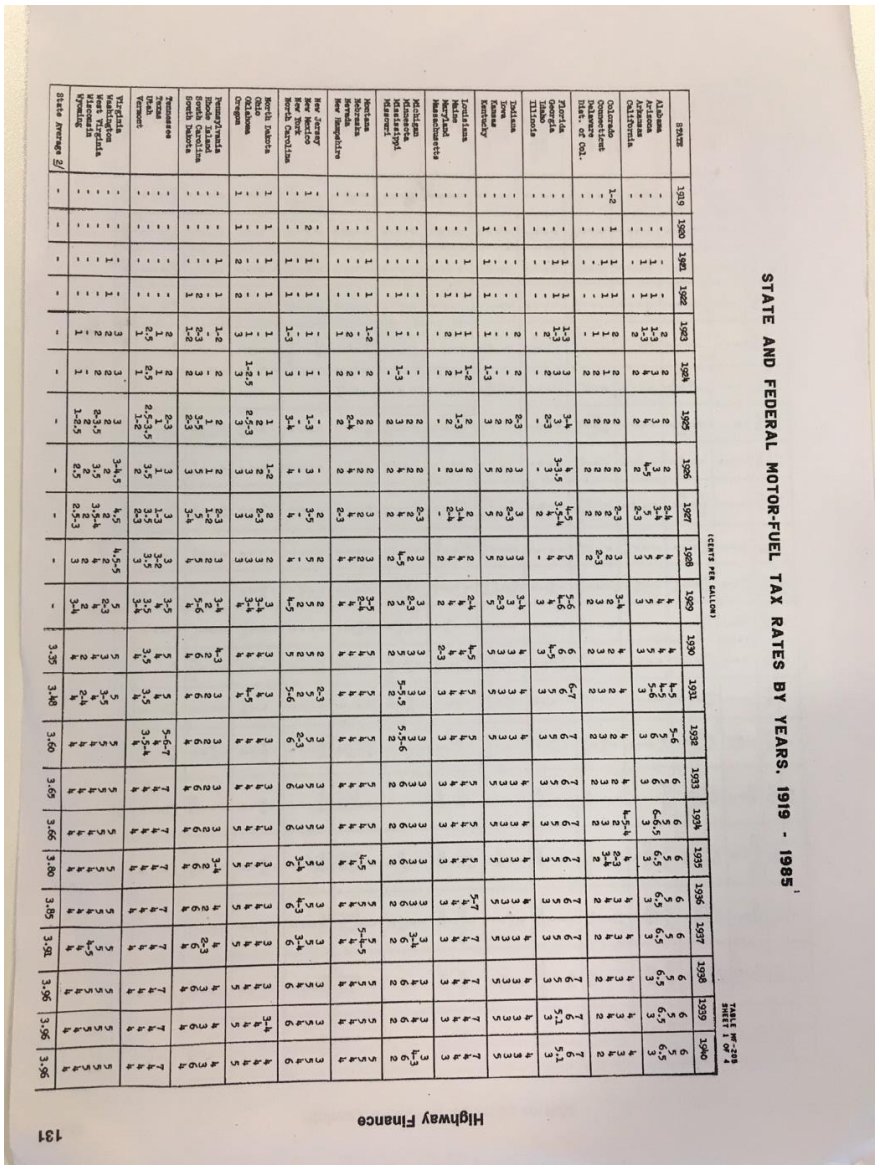
competition: Senate	calculations based on data from Klarner (2013)					
Electoral competition: House	Author's calculations based on data from Klarner (2013)	3,883	0.617521	0.286609	0	1
Intervention of federal government in South	Author's calculations based on data from Besley, Persson, and Sturm (2010) and Husted and Kenny (1997)	4,842	0.072813	0.25457	0	1
Election year	Klarner (2013)	3,883	0.482102	0.499744	0	1
Democratic governor	Klarner (2013)	3,883	0.546742	0.497875	0	1
Democratic majority in legislature	Klarner (2013)	3,883	0.482617	0.499762	0	1
Supermajority rule for tax changes	Heckelman and Dougherty (2010) and Knight (2000)	5,150	0.193592	0.625413	0	3
Anti-diversion constitutional amendment	Various sources. See Appendix C3.	5,150	0.407379	0.491394	0	1
Mass economic liberalism	Caughey and Warshaw (2017)	3,904	-0.02775	0.224658	-0.94382	0.651013
Gini coefficient	Frank (2014)	4,770	0.487532	0.078886	0.23143	0.747416
Fiscal balance of state budget	Author's calculations based on data from US Census (2018)	3,130	1.074626	0.127265	0.598885	3.421497
Debt to revenue ratio of state budget	Author's calculations based on data from US Census (2018)	3,130	0.490488	0.357468	0	2.697253
State taxes on motor vehicles as percentage of personal income	Author's calculations based on data from US Census (2018)	3,125	0.003207	0.001713	0	0.010413
State taxes on individual income as percentage of personal income	Author's calculations based on data from US Census (2018)	3,125	0.012868	0.011013	0	0.043206

Government ideology	(Berry et al. 2010)	2,850	50.59293	13.04324	17.51221	77.88397
Number of licensed drivers as a percentage of the population	Author's calculations based on data from FHWA (2018)	3,379	0.618374	0.108079	0.243917	1.008335
Growth in income per capita	Author's calculations based on data from US Census (2018)	2,888	0.072967	0.041412	-0.11968	0.412206
Income per capita (1000s USD)	US Census (2018)	3,125	12.28789	11.70738	0.432127	55.56892
State oil production (1000s of barrels per person)	Author's calculations based on data from EIA (2018)	2,450	0.027273	0.120522	0	1.471756
Citizen ideology	Berry et al. (2010)	2,850	47.9389	16.53293	0.96254	97.00153
State welfare expenditure (as percentage of total expenditure)	Author's calculations based on data from US Census (2018)	3,130	0.156649	0.06303	0.030223	0.425839
State highway spending (as percentage of total expenditure)	Author's calculations based on data from US Census (2018)	3,130	0.154256	0.086082	0.026931	0.484831
Miles of public roads per registered vehicle	Li, Linn, and Muehlegger (2014)	2,064	0.038091	0.036189	0.005052	0.348733
State population living in metro areas with access to public transportation	Li, Linn, and Muehlegger (2014)	2,064	0.082799	0.186865	0	0.911422
State population living in metro areas	Li, Linn, and Muehlegger (2014)	2,064	0.713551	0.19363	0.289518	1

C2. Example of data source

To collect data on gas tax rates, I first compiled physical copies of tables from the Highway Finance section of *Highway Statistics* reports of the US Federal Highway Administration. Below is an image of one of those tables.

Figure C1. Image of date source: Highway finance statistics



STATE AND FEDERAL MOTOR-FUEL TAX RATES BY YEARS. 1919 - 1985[1]

(CENTS PER GALLON)

TABLE MF-201
SHEET 1 OF 2

State	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Alabama	-	-	-	-	1-2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Arizona	-	-	-	-	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Arkansas	-	-	-	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
California	-	-	-	-	1-3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Colorado	1-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Connecticut	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dist. of Col.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Florida	-	-	-	-	1-3	1-3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Georgia	-	-	-	-	1-2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Idaho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Illinois	-	-	-	-	1-3	-	2-3	-	2-3	2	2	2	2	2	2	2	2	2	2	2	2	2
Indiana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iowa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kansas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kentucky	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Louisiana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maryland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Massachusetts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Michigan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minnesota	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mississippi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Missouri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montana	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nebraska	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Hampshire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Jersey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Mexico	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New York	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Carolina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Dakota	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ohio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oklahoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oregon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pennsylvania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhode Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Carolina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Dakota	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Virginia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Virginia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wisconsin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wyoming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
State Average 2/	-	-	-	-	-	-	-	-	-	-	-	3.35	3.40	3.60	3.69	3.66	3.80	3.85	3.91	3.96	3.96	3.86

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C3. Anti-diversion constitutional amendments

Table C2 provides the dates when each state adopted an amendment to its constitution barring gasoline tax revenues from being used for anything but highway construction and maintenance.

Table C2. Timeline of anti-diversion amendments to state constitutions

State	Year of adoption	Data source
Minnesota	1920	FHWA (1951 and 1965)
Kansas	1928	FHWA (1951); Smart and Hart (1941)
Missouri	1928	FHWA (1951); Smart and Hart (1941)
Colorado	1934	FHWA (1951); Smart and Hart (1941)
California	1938	FHWA (1951); Smart and Hart (1941)
Michigan	1938	FHWA (1951); Smart and Hart (1941)
New Hampshire	1938	FHWA (1951); Smart and Hart (1941)
Idaho	1940	FHWA (1951); Smart and Hart (1941)
Nevada	1940	FHWA (1951); Smart and Hart (1941)
North Dakota	1940	FHWA (1951); Smart and Hart (1941)
Ohio	1940	FHWA (1951 and 1965)
South Dakota	1940	FHWA (1951); Smart and Hart (1941)
Iowa	1942	FHWA (1951 and 1965)
Oregon	1942	FHWA (1951)
West Virginia	1942	FHWA (1951 and 1965)
Maine	1944	FHWA (1951 and 1965)
Washington	1944	FHWA (1951 and 1965)
Kentucky	1945	FHWA (1951 and 1965)
Pennsylvania	1945	FHWA (1951 and 1965)
Texas	1946	FHWA (1951 and 1965)
Massachusetts	1948	FHWA (1951 and 1965)
Alabama	1952	FHWA (1951 and 1965)
Arizona	1952	FHWA (1951 and 1965)
Georgia	1952	FHWA (1951 and 1965)
Wyoming	1954	FHWA (1965)
Louisiana	1956	FHWA (1965)
Montana	1956	FHWA (1965)
Utah	1962	Dunn (1978, 42)

C4. Robustness tests

I subject the results to a variety of robustness tests:

- **Jackknife resampling (Tables C3-C5):** It could be the case that one state is driving the results. To test this I re-estimate the main results for the static (Table 4.4), dynamic (Table 4.5), and proxy (Table 4.6) models using jackknife resampling, which drops each state from the dataset, calculates the estimates and then calculates the average across all of these estimates. The results indicate that my main results are not driven by any single state in the sample. Results from the IV models are excluded below because Stata does now allow jackknife resampling to be used with IV analysis.
- **Alternative lag structure (Table C6):** I re-estimate the main results from the static (Table 4.4) and proxy (Table 4.6) models using a two-year lag structure. A two-year lag between the adoption of a tax change and its implementation is also theoretically plausible. Furthermore, this lag structure has been used in previous studies (Goel and Nelson 1999). Using this structure does not alter the results.
- **Moving average results with full set of controls (Table C7):** In an effort to maximize the sample size, the main results for the 10- and 20-year moving average models include a limited set of controls (Models 6 and 7 in Table 4.4). Here I re-estimate the main results with the full set of controls. The findings do not substantively change.
- **Main results with additional controls (Tables C8-C9):** I include a variety of additional controls to further rule out possibilities of omitted variable bias. Their inclusion does not alter the main findings. (I do not re-estimate the IV models with additional controls because, due to data availability reasons, the sample is restricted to 1967-2009 when these controls are added. There is no variation in the instrument after 1965.)
    - To further control for voter's preferences, which may influence politicians' willingness to take political risks, I include an indicator of citizen ideology from Berry et al. (2010).
    - Voters may be more willing to tolerate gas tax increases if they have easy access to public transportation, since they could more easily switch transport modes with little additional costs. Knowing this information

could influence politicians' perceptions of voter preferences. To control for this possibility I include two measures: the fraction of the state population living in metro areas and the fraction of the state population living in metro areas with rail transport. Both variables are from Li, Linn, and Muehlegger (2014).

- When state governments are responsible for large tracts of public roads they may be more likely to increase gas taxes in an effort to raise revenue. To control for this, I include two variables: miles of public roads per registered vehicle from Li, Linn, and Muehlegger (2014) and total government expenditure on highways (including bridges, tunnels, ferries, street lighting, and snow and ice removal) as a percentage of total expenditure based on US Census (2018).
- Gas taxes can be regressive, which may reduce politicians' willingness to increase them and place disproportionate burdens on low-income voters, especially if they rely on these voters. However, the effect of gasoline price changes on the poor may be reduced when states have robust social welfare programs in place. Knowing this, politicians may be more likely to increase tax rates when welfare spending is high. To control for this possibility, I include government expenditure on public welfare (including, for example, cash assistance, medical care, funerals, and operation of welfare institutions) as a percentage of total expenditure using data from US Census (2018).

Table C3. Robustness test: Jackknife resampling – Static models

	Gas tax rate (cents per gallon)					
	(1)	(2)	(3)	(4)	(5)	(6)
Electoral competition (t-1)	-2.902***	-2.469***	-2.374***	-1.891**		
	(0.872)	(0.861)	(0.847)	(0.881)		
Elect. comp. (10 yr. avg.) (t-1)					-4.258***	
					(1.440)	
Elect. comp. (20 yr. avg.) (t-1)						-6.011***
						(1.932)
Election year		-0.0704	-0.00432	-0.154**	-0.0719	-0.0900
		(0.128)	(0.0721)	(0.0658)	(0.0818)	(0.0709)
Democratic governor (t-1)		0.162	-0.183	-0.369	0.151	0.0975
		(0.238)	(0.202)	(0.310)	(0.235)	(0.249)
Democratic legislature (t-1)		1.136**	0.631	0.612	0.902*	0.562
		(0.486)	(0.392)	(0.371)	(0.465)	(0.444)
Fiscal rule: 3/5 (t-1)		1.145	1.010	1.828	1.365	1.594
		(1.712)	(1.465)	(1.365)	(1.529)	(1.420)
2/3 (t-1)		-0.410	-0.462	-0.585	-0.452	-0.507
		(1.304)	(1.324)	(1.460)	(1.282)	(1.313)
3/4 (t-1)		-3.234***	-3.118***	-3.134**	-2.866***	-2.660***
		(0.748)	(0.764)	(1.404)	(0.705)	(0.670)
Anti-diversion amend. (t-1)		-0.423	-0.940	0.210	-1.132	0.142
		(0.732)	(0.773)	(0.988)	(1.039)	(0.741)
Mass econ. liberalism (t-1)		-0.328	-0.164	0.748	0.182	0.268
		(1.212)	(1.177)	(1.207)	(1.234)	(1.371)
Income inequality (t-1)		2.086	0.181	1.349	4.345	7.364
		(5.662)	(9.776)	(14.27)	(8.251)	(8.940)
Fiscal balance (t-1)			0.889	1.278		
			(0.938)	(1.644)		
Debt to revenue (t-1)			0.959	1.361		
			(0.693)	(1.293)		
Motor vehic. taxes (t-1)			147.8	241.3		
			(241.6)	(331.1)		
Income taxes (t-1)			89.80	91.33		
			(76.19)	(121.4)		
Gov. ideology (t-1)				0.0115		
				(0.0168)		
Licensed drivers (t-1)				-8.377*		
				(4.424)		
Income growth (t-1)				1.928		
				(3.201)		
Income per cap. (t-1)				-0.0583		
				(0.195)		
Oil production (t-1)				-1.654		
				(23.43)		
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2015	1943-2009	1961-2009	1946-2015	1956-2015
R^2 – within	0.857	0.865	0.875	0.856	0.860	0.850
States	49	49	49	49	49	49
N	3834	3784	3057	2401	3344	2854

Notes: Jackknife standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C4. Robustness test: Jackknife resampling – Dynamic models

	Δ Gas tax rate (cents per gallon)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Long-term effects								
Electoral competition (t-1)	-0.184*	-0.176*	-0.213**	-0.217**	-0.282**	-0.299***	-0.350**	-0.332**
	(0.106)	(0.0978)	(0.102)	(0.0960)	(0.109)	(0.0962)	(0.157)	(0.125)
Election year (t-1)			-0.0861	0.198***	-0.124	0.208***	-0.124	0.221***
			(0.159)	(0.0405)	(0.157)	(0.0486)	(0.190)	(0.0603)
Democratic governor (t-1)			0.0163	0.000600	-0.0197	-0.0325	-0.114	-0.0539
			(0.0348)	(0.0320)	(0.0345)	(0.0310)	(0.105)	(0.0523)
Democratic legislature (t-1)			0.0423	0.0315	0.0393	0.0288	0.0216	0.0392
			(0.0521)	(0.0467)	(0.0508)	(0.0478)	(0.0793)	(0.0574)
Fiscal rule: 3/5 (t-1)			0.127	0.112	0.0642	0.0388	0.0366	0.0241
			(0.130)	(0.137)	(0.123)	(0.113)	(0.167)	(0.154)
2/3 (t-1)			0.0189	0.0204	-0.0146	-0.00681	-0.0339	-0.0293
			(0.115)	(0.116)	(0.148)	(0.144)	(0.169)	(0.162)
3/4 (t-1)			-0.249***	-0.258***	-0.221***	-0.211***	-0.243*	-0.245*
			(0.0517)	(0.0522)	(0.0787)	(0.0762)	(0.135)	(0.131)
Anti-diversion amend. (t-1)			-0.00786	-0.00672	0.0402	0.0276	0.0970	0.159
			(0.0446)	(0.0416)	(0.136)	(0.103)	(0.168)	(0.134)
Mass econ. liberalism (t-1)			-0.167	-0.122	-0.126	-0.0522	-0.0739	0.0377
			(0.135)	(0.121)	(0.206)	(0.198)	(0.224)	(0.212)
Income inequality (t-1)			0.520	0.178	-0.675	-0.703	0.0733	0.0225
			(0.944)	(0.762)	(1.306)	(1.308)	(1.587)	(1.593)
Fiscal balance (t-1)					-0.436**	-0.353*	-0.201	-0.209
					(0.199)	(0.179)	(0.274)	(0.264)
Debt to revenue (t-1)					-0.00784	-0.0470	0.0742	0.00301
					(0.0919)	(0.0842)	(0.128)	(0.115)
Motor vehic. taxes (t-1)					-14.22	-20.25	-6.274	-15.30
					(24.01)	(22.30)	(28.21)	(27.22)

Income taxes (t-1)			2.786	1.955	-0.963	-0.260
			(8.104)	(7.794)	(10.03)	(10.58)
Gov. ideology (t-1)					0.00591	0.00143
					(0.00597)	(0.00305)
Licensed drivers (t-1)					0.0473	0.123
					(0.724)	(0.649)
Income growth (t-1)					-1.349	-0.419
					(1.144)	(0.518)
Income per cap. (t-1)					-0.0174	-0.0136
					(0.0171)	(0.0166)
Oil production (t-1)					-0.477	-0.570
					(2.155)	(2.185)
Short-term effects						
Δ Electoral competition	-0.0432	-0.0347	0.0651		0.0812	
	(0.191)	(0.150)	(0.190)		(0.221)	
Δ Election year		-0.159*	-0.183*		-0.188*	
		(0.0907)	(0.0931)		(0.112)	
Δ Democratic governor		0.0685	0.0579		0.0838	
		(0.0728)	(0.0427)		(0.0502)	
Δ Democratic legislature		0.0509	0.0498		0.0658	
		(0.0517)	(0.0517)		(0.0654)	
Δ Fiscal rule		-0.0342	-0.0538		-0.0576	
		(0.0697)	(0.0496)		(0.0536)	
Δ Anti-diversion amend.		-0.00916	0.181		0.115	
		(0.0308)	(0.178)		(0.128)	
Δ Mass econ. liberalism		-0.150	-0.197		-0.276	
		(0.201)	(0.228)		(0.269)	
Δ Income inequality		2.162	0.695		1.379	
		(1.532)	(1.268)		(1.785)	
Δ Fiscal balance			-0.118		0.0657	
			(0.179)		(0.179)	

Δ Debt to revenue					0.440*		0.822***	
					(0.258)		(0.295)	
Δ Motor vehic. taxes					32.99		30.02	
					(26.12)		(29.93)	
Δ Income taxes					19.06*		19.79	
					(10.58)		(12.79)	
Δ Gov. ideology							0.00634	
							(0.00566)	
Δ Licensed drivers							-0.392	
							(0.753)	
Δ Income growth							-1.148	
							(0.894)	
Δ Income per cap.							-0.0251	
							(0.0816)	
Δ Oil production							1.006	
							(1.274)	
Error Correction Rate								
Gas tax rate (t-1)	-0.0438***	-0.0437***	-0.0271***	-0.0268***	-0.0465***	-0.0458***	-0.0545***	-0.0528***
	(0.0138)	(0.0138)	(0.00913)	(0.00899)	(0.0142)	(0.0142)	(0.0153)	(0.0160)
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2016	1937-2014	1937-2014	1951-2008	1951-2008	1961-2008	1961-2008
Method	GECM	Dead Start	GECM	Dead Start	GECM	Dead Start	GECM	Dead Start
R^2 – within	0.0964	0.0963	0.130	0.127	0.159	0.154	0.162	0.154
States	49	49	49	49	49	49	49	49
N	3833	3833	3735	3735	2824	2824	2352	2352

Notes: Jackknife standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C5. Robustness test: Jackknife resampling – Proxy measures

	Gas tax rate (cents per gallon)			Δ Gas tax rate (cents per gallon)	
	(1)	(2)	(3)	(4)	(5)
Elect. comp. proxy (t-1)	-3.624***				
	(1.025)				
Elect. comp. proxy (10 yr. avg.) (t-1)		-5.597***			
		(1.592)			
Elect. comp. proxy (20 yr. avg.) (t-1)			-6.666***		
			(1.833)		
Short-term effects					
Δ Elect. comp. proxy				-0.220	
				(0.143)	
Long-term effects					
Elect. comp. proxy (t-1)				-0.343***	-0.287***
				(0.112)	(0.0982)
Error Correction Rate					
Gas tax rate (t-1)				-0.0416***	-0.0410***
				(0.0138)	(0.0137)
State and Year FE	Yes	Yes	Yes	Yes	Yes
Sample	1919-2016	1919-2016	1919-2016	1920-2016	1920-2016
Method	OLS	OLS	OLS	GECM	Dead Start
R^2 – within	0.875	0.880	0.884	0.101	0.101
States	50	50	50	50	50
N	4632	4612	4568	4583	4583

Notes: Jackknife standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C6. Robustness test: Two-year lag structure – Static models and proxy measures

	Gas tax rate (cents per gallon)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Elect. comp. (t-2)	-2.935***	-2.507***	-2.455***	-1.938**	-11.06***						
	(0.849)	(0.835)	(0.809)	(0.865)	(3.347)						
Elect. comp. (10 yr. avg.) (t-2)						-4.281***					
						(1.372)					
Elect. comp. (20 yr. avg.) (t-2)							-6.185***				
							(1.845)				
Elect. comp.proxy (t-2)								-3.521***	-9.240***		
								(0.993)	(2.782)		
Elect. comp.proxy (10 yr. avg.) (t-2)										-5.507***	
										(1.542)	
Elect. comp.proxy (20 yr. avg.) (t-2)											-6.611***
											(1.778)
Election year		-0.0152	-0.199***	-0.117	-0.0223	-0.0822	-0.122*				
		(0.0572)	(0.0507)	(0.0719)	(0.0828)	(0.0551)	(0.0728)				
Democratic governor (t-2)		0.120	-0.223	-0.391	-0.978**	0.106	0.0305				
		(0.220)	(0.194)	(0.294)	(0.469)	(0.214)	(0.226)				
Democratic legislature (t-2)		1.166**	0.612*	0.584*	0.700*	0.918**	0.566				
		(0.450)	(0.358)	(0.331)	(0.423)	(0.429)	(0.411)				
Fiscal rule: 3/5 (t-2)		1.060	1.033	1.797*	1.699	1.272	1.495				
		(1.301)	(1.034)	(0.964)	(1.164)	(1.178)	(1.083)				
2/3 (t-2)		-0.426	-0.396	-0.525	-0.638	-0.467	-0.535				
		(1.262)	(1.158)	(1.188)	(1.219)	(1.234)	(1.255)				
3/4 (t-2)		-3.496***	-3.273***	-3.288***	-3.187***	-3.100***	-2.884***				
		(0.738)	(0.747)	(0.880)	(0.728)	(0.688)	(0.649)				
Anti-diversion amend. (t-2)		-0.358	-0.922	0.366	-0.445	-1.085	0.255				
		(0.684)	(0.687)	(0.805)	(0.657)	(0.891)	(0.705)				
Mass econ. liberalism (t-2)		-0.106	-0.206	0.923	0.561	0.457	0.610				
		(1.146)	(1.118)	(1.107)	(1.272)	(1.168)	(1.322)				

Income inequality (t-2)		2.388	-0.160	1.282	2.189	4.851	7.994				
		(4.789)	(8.333)	(9.169)	(5.681)	(6.922)	(7.467)				
Fiscal balance (t-2)			0.640	1.015							
			(0.783)	(0.989)							
Debt to revenue (t-2)			0.902	1.245							
			(0.658)	(1.156)							
Motor vehic. taxes (t-2)			131.2	213.0							
			(224.5)	(294.7)							
Income taxes (t-2)			92.70	93.18							
			(65.46)	(75.70)							
Gov. ideology (t-2)				0.00974							
				(0.0159)							
Licensed drivers (t-2)				-8.046*							
				(4.524)							
Income growth (t-2)				2.395							
				(2.629)							
Income per cap. (t-2)				-0.0621							
				(0.161)							
Oil production (t-2)				-1.984							
				(2.331)							
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2015	1943-2009	1961-2009	1937-2015	1946-2015	1956-2015	1919-2016	1919-2016	1919-2016	1919-2016
Method	OLS	OLS	OLS	OLS	IV	OLS	OLS	OLS	OLS IV	OLS	OLS
First stage *F* - statistic					81.52				79.80		
R^2 – within	0.856	0.861	0.872	0.851	0.836	0.855	0.844	0.875	0.868	0.880	0.884
States	49	49	49	49	49	49	49	50	50	50	50
N	3785	3784	3057	2401	3784	3344	2854	4630	4623	4608	4563

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C7. Robustness test: Moving average results with full controls

	Gas tax rate (cents per gallon)	
	(1)	(2)
Electoral competition (10 yr. avg.) (t-1)	-2.769*	
	(1.566)	
Electoral competition (20 yr. avg.) (t-1)		-5.532***
		(2.028)
Election year	-0.150**	-0.140**
	(0.0614)	(0.0545)
Democratic governor (t-1)	-0.149	-0.192
	(0.240)	(0.252)
Democratic legislature (t-1)	0.646*	0.637*
	(0.338)	(0.332)
Fiscal rule: 3/5 (t-1)	1.793*	0.996
	(0.955)	(0.872)
2/3 (t-1)	-0.678	-1.013
	(1.141)	(1.039)
3/4 (t-1)	-2.949***	-2.704***
	(0.868)	(0.836)
Anti-diversion amend. (t-1)	0.0943	0.153
	(0.803)	(0.774)
Mass econ. liberalism (t-1)	0.633	0.200
	(1.061)	(1.069)
Income inequality (t-1)	2.078	3.324
	(9.752)	(9.500)
Fiscal balance (t-1)	1.268	1.703
	(0.847)	(1.157)
Debt to revenue (t-1)	1.548	0.854
	(1.162)	(0.999)
Motor vehic. taxes (t-1)	281.6	296.2
	(269.6)	(243.8)
Income taxes (t-1)	79.91	12.30
	(76.07)	(60.51)
Gov. ideology (t-1)	0.00276	0.00385
	(0.0147)	(0.0145)
Licensed drivers (t-1)	-6.888	-4.087
	(4.612)	(3.718)
Income growth (t-1)	1.908	-1.513
	(2.696)	(2.304)
Income per cap. (t-1)	-0.0570	-0.0831
	(0.162)	(0.161)
Oil production (t-1)	1.030	10.54***
	(2.643)	(3.617)
State and Year FE	Yes	Yes
Sample	1961-2009	1961-2009
R^2 – within	0.859	0.870
States	49	49
N	2386	2357

Notes: Robust standard errors in parentheses clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C8. Robustness test: Main results with additional controls – Static models

	Gas tax rate (cents per gallon)		
	(1)	(2)	(3)
Electoral competition (t-1)	-1.863**		
	(0.735)		
Electoral competition (10 yr. avg.) (t-1)		-2.625*	
		(1.433)	
Electoral competition (20 yr. avg.) (t-1)			-5.465**
			(2.128)
Election year	-0.171***	-0.171**	-0.174***
	(0.0623)	(0.0642)	(0.0644)
Democratic governor (t-1)	-0.529*	-0.300	-0.316
	(0.300)	(0.262)	(0.260)
Democratic legislature (t-1)	0.652*	0.690*	0.636*
	(0.364)	(0.363)	(0.353)
Fiscal rule: 3/5 (t-1)	0.644	0.713	0.450
	(0.922)	(0.860)	(0.870)
2/3 (t-1)	-1.287	-1.258	-1.297
	(0.952)	(0.950)	(0.949)
3/4 (t-1)	-2.258**	-2.263**	-2.312**
	(0.912)	(0.925)	(0.922)
Mass econ. liberalism (t-1)	0.341	0.108	-0.175
	(1.127)	(1.130)	(1.156)
Income inequality (t-1)	5.228	6.267	8.076
	(8.543)	(8.715)	(8.274)
Fiscal balance (t-1)	2.197*	2.014	1.981
	(1.248)	(1.207)	(1.192)
Debt to revenue (t-1)	0.465	0.477	0.228
	(1.074)	(1.084)	(1.035)
Motor vehic. taxes (t-1)	468.0*	447.3*	406.4
	(268.6)	(260.2)	(255.4)
Income taxes (t-1)	-25.47	-28.69	-36.16
	(64.64)	(65.60)	(65.88)
Gov. ideology (t-1)	0.0189	0.0123	0.0112
	(0.0142)	(0.0135)	(0.0133)
Licensed drivers (t-1)	-5.618*	-4.540	-3.696
	(3.101)	(3.259)	(3.186)
Income growth (t-1)	-2.226	-2.442	-2.212
	(2.835)	(2.912)	(2.838)
Income per cap. (t-1)	-0.0912	-0.0981	-0.117
	(0.177)	(0.178)	(0.177)
Oil production (t-1)	27.83***	26.61***	25.34**
	(9.195)	(9.339)	(9.946)
Citizen ideology (t-1)	-0.0249	-0.0191	-0.00588
	(0.0199)	(0.0195)	(0.0192)
Welfare spending (t-1)	-1.472	-1.034	0.277
	(5.988)	(6.083)	(6.074)
Highway spending (t-1)	11.31	12.34*	12.70*
	(7.201)	(7.119)	(7.026)
Public roads (t-1)	-22.90	-20.03	-15.77
	(15.33)	(15.41)	(14.58)
Metro pop. w/access to rail (t-1)	-3.924	-4.032	-4.590
	(5.172)	(5.070)	(4.656)
Metro pop. (t-1)	-18.72	-16.99	-13.51
	(16.75)	(16.38)	(15.71)

State and Year FE	Yes	Yes	Yes
Sample	1967-2009	1967-2009	1967-2009
Method	OLS	OLS	OLS
R^2 – within	0.865	0.865	0.867
States	49	49	49
N	2021	2021	2018

Notes: Robust standard errors in parentheses clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C9. Robustness test: Main results with additional controls – Dynamic models

	Δ Gas tax rate (cents per gallon)	
	(1)	(2)
Long-term effects		
Electoral competition (t-1)	-0.451**	-0.417***
	(0.182)	(0.136)
Election year (t-1)	-0.183	0.238***
	(0.227)	(0.0581)
Democratic governor (t-1)	-0.197	-0.110
	(0.135)	(0.0703)
Democratic legislature (t-1)	0.0116	0.0524
	(0.0947)	(0.0742)
Fiscal rule: 3/5 (t-1)	-0.0280	0.00353
	(0.142)	(0.136)
2/3 (t-1)	-0.0905	-0.0889
	(0.137)	(0.135)
3/4 (t-1)	-0.318**	-0.276**
	(0.124)	(0.115)
Mass econ. liberalism (t-1)	-0.0989	-0.0303
	(0.227)	(0.218)
Income inequality (t-1)	0.817	0.492
	(1.758)	(1.800)
Fiscal balance (t-1)	-0.179	-0.327
	(0.371)	(0.328)
Debt to revenue (t-1)	0.0210	-0.0526
	(0.157)	(0.140)
Motor vehic. taxes (t-1)	-4.195	-7.172
	(33.96)	(33.82)
Income taxes (t-1)	-12.72	-14.47*
	(8.567)	(7.794)
Gov. ideology (t-1)	0.01000	0.00370
	(0.00709)	(0.00357)
Licensed drivers (t-1)	0.0485	0.110
	(0.800)	(0.739)
Income growth (t-1)	-3.450**	-0.921
	(1.567)	(0.821)
Income per cap. (t-1)	-0.0331*	-0.0244
	(0.0193)	(0.0186)
Oil production (t-1)	2.523**	2.375**
	(1.020)	(1.016)
Citizen ideology (t-1)	-0.00615	-0.00222
	(0.00428)	(0.00305)
Welfare spending (t-1)	-1.001	-1.637*
	(1.073)	(0.891)
Highway spending (t-1)	1.701	0.618
	(1.666)	(1.439)
Public roads (t-1)	-0.0486	0.560
	(2.899)	(2.128)
Metro pop. w/access to rail (t-1)	-0.428	-0.472
	(0.488)	(0.449)
Metro pop. (t-1)	-2.109	-1.861
	(2.290)	(2.209)
Short-term effects		
Δ Electoral competition	0.0550	
	(0.272)	

Δ Election year	-0.225*	
	(0.132)	
Δ Democratic governor	0.0653	
	(0.0616)	
Δ Democratic legislature	0.0630	
	(0.0811)	
Δ Fiscal rule	-0.0705	
	(0.0613)	
Δ Mass econ. liberalism	-0.315	
	(0.346)	
Δ Income inequality	2.266	
	(2.106)	
Δ Fiscal balance	0.0631	
	(0.347)	
Δ Debt to revenue	0.880**	
	(0.400)	
Δ Motor vehic. taxes	31.36	
	(44.45)	
Δ Income taxes	16.12	
	(15.73)	
Δ Gov. ideology	0.00887	
	(0.00680)	
Δ Licensed drivers	-0.421	
	(0.797)	
Δ Income growth	-3.091**	
	(1.167)	
Δ Income per cap.	0.0445	
	(0.0818)	
Δ Oil production	-1.919	
	(5.165)	
Δ Citizen ideology	-0.00535	
	(0.00441)	
Δ Welfare spending	4.043**	
	(1.830)	
Δ Highway spending	2.969*	
	(1.701)	
Δ Public roads	-2.240	
	(4.890)	
Δ Metro pop. w/access to rail	-0.229	
	(0.802)	
Δ Metro pop.	-13.11	
	(14.33)	
Error correction rate		
Gas tax rate (t-1)	-0.0776***	-0.0759***
	(0.0123)	(0.0125)
Long-run multiplier (LRM)	-5.811**	-5.498***
	(2.508)	(1.936)
State and Year FE	Yes	Yes
Sample	1967-2009	1967-2009
Method	GECM	Dead Start
R^2 – within	0.175	0.161
States	49	49
N	1974	1974

Notes: Robust standard errors in parentheses clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C5. Results by government branch

Here I test the relationship between electoral competition and gasoline taxation by branch of the state government (see Section 5.3 of the main text). To do so, I first calculate separate measures of electoral competition for each branch: governor, senate, and house. I then re-estimate the main results (Table C10 and C11). They are similar in direction, magnitude, and statistical significance to the main findings.

Table C10. Results by government branch – Static models

	Gas tax rate (cents per gallon)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Elect. Comp. Governor (t-1)	-3.113***	-2.756***	-1.382	-5.586***								
	(0.899)	(0.857)	(0.835)	(1.430)								
Elect. Comp. Senate (t-1)					-2.915***	-2.372**	-1.923	-14.01***				
					(0.998)	(0.955)	(1.158)	(4.903)				
Elect. Comp. House (t-1)									-3.110***	-2.484**	-2.464*	-10.62***
									(1.064)	(1.000)	(1.403)	(3.409)
Election year		-0.0537	-0.153**	-0.0335		-0.0925	-0.161***	-0.186*		-0.0782	-0.159**	-0.0941
		(0.107)	(0.0582)	(0.109)		(0.0988)	(0.0594)	(0.106)		(0.102)	(0.0596)	(0.100)
Democratic governor (t-1)		0.289	-0.0616	0.0942		0.427*	-0.104	0.172		0.402*	-0.157	0.151
		(0.226)	(0.276)	(0.225)		(0.235)	(0.268)	(0.261)		(0.225)	(0.268)	(0.205)
Democratic legislature (t-1)		1.111**	0.702**	0.948**		0.843*	0.447	-1.253		0.877**	0.472	-0.409
		(0.451)	(0.338)	(0.420)		(0.427)	(0.301)	(0.890)		(0.417)	(0.283)	(0.552)
Fiscal rule: 3/5 (t-1)		1.181	1.705*	1.407		0.999	1.687*	1.187		0.924	1.567	0.804
		(1.101)	(0.958)	(1.011)		(1.273)	(0.959)	(1.505)		(1.289)	(0.953)	(1.178)
2/3 (t-1)		-0.268	-0.545	-0.185		-0.364	-0.507	-0.441		-0.439	-0.578	-0.735
		(1.201)	(1.194)	(1.175)		(1.214)	(1.201)	(1.267)		(1.208)	(1.181)	(1.179)
3/4 (t-1)		-3.579***	-3.334***	-3.843***		-3.044***	-2.924***	-1.679		-3.032***	-2.833***	-2.080**
		(0.708)	(0.843)	(0.683)		(0.746)	(0.893)	(1.113)		(0.751)	(0.936)	(0.904)

Anti-diversion amend. (t-1)		-0.335	0.401	-0.271		-0.489	-0.154	-0.937		-0.494	-0.181	-0.806
		(0.595)	(0.783)	(0.514)		(0.679)	(0.874)	(0.863)		(0.683)	(0.760)	(0.804)
Mass econ. liberalism (t-1)		-0.264	0.648	-0.000751		-0.615	0.528	-1.080		-0.494	0.626	-0.409
		(1.158)	(1.061)	(1.148)		(1.165)	(1.084)	(1.914)		(1.145)	(1.072)	(1.535)
Income inequality (t-1)		2.357	1.611	2.578		2.062	2.173	1.667		1.499	1.304	-0.609
		(5.120)	(9.590)	(5.087)		(5.303)	(10.00)	(7.556)		(5.191)	(9.810)	(6.194)
Fiscal balance (t-1)			1.310				1.178				1.009	
			(0.914)				(0.877)				(0.815)	
Debt to revenue (t-1)			1.452				1.298				1.203	
			(1.142)				(1.105)				(1.095)	
Motor vehic. taxes (t-1)			250.8				198.4				230.8	
			(291.9)				(299.0)				(297.5)	
Income taxes (t-1)			89.16				92.50				89.82	
			(75.46)				(76.54)				(77.34)	
Gov. ideology (t-1)			0.00320				0.00760				0.00845	
			(0.0160)				(0.0161)				(0.0157)	
Licensed drivers (t-1)			-8.600*				-7.717				-7.557	
			(4.458)				(4.644)				(4.822)	
Income growth (t-1)			1.576				1.917				1.631	
			(2.545)				(2.547)				(2.596)	
Income per cap. (t-1)			-0.0577				-0.0736				-0.0942	
			(0.164)				(0.164)				(0.162)	
Oil production (t-1)			-1.878				-1.421				-1.456	
			(2.305)				(2.393)				(2.361)	
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2015	1961-2009	1937-2015	1937-2016	1937-2015	1961-2009	1937-2015	1937-2016	1937-2015	1961-2009	1937-2015
Method	OLS	OLS	OLS	IV	OLS	OLS	OLS	IV	OLS	OLS	OLS	IV
First stage *F* - statistic				59.31				19.24				46.69
R^2 – within	0.859	0.867	0.855	0.870	0.859	0.866	0.856	0.783	0.859	0.866	0.857	0.833
States	49	49	49	49	49	49	49	49	49	49	49	49
N	3834	3784	2401	3784	3834	3784	2401	3784	3834	3784	2401	3784

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C11. Results by government branch – Dynamic models

	Δ Gas tax rate (cents per gallon)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Long-term effects												
Elect. Comp. Gov. (t-1)	-0.224***	-0.178***	-0.230**	-0.344***								
	(0.0789)	(0.0653)	(0.102)	(0.126)								
Elect. Comp. Sen. (t-1)					-0.230**	-0.213**	-0.266**	-0.985**				
					(0.0908)	(0.0821)	(0.120)	(0.470)				
Elect. Comp. Hous. (t-1)									-0.226**	-0.182**	-0.278*	-0.699**
									(0.0945)	(0.0854)	(0.147)	(0.303)
Election year		0.198***	0.221***	0.199***		0.197***	0.222***	0.199***		0.198***	0.222***	0.201***
		(0.0364)	(0.0530)	(0.0354)		(0.0367)	(0.0537)	(0.0359)		(0.0366)	(0.0539)	(0.0354)
Democratic gov.(t-1)		0.0161	0.000870	0.00545		0.0241	-0.00161	0.0111		0.0231	-0.00412	0.0104
		(0.0301)	(0.0523)	(0.0302)		(0.0304)	(0.0519)	(0.0344)		(0.0300)	(0.0515)	(0.0302)
Democratic leg. (t-1)		0.0336	0.0534	0.0271		0.00567	0.0196	-0.121		0.0152	0.0303	-0.0571
		(0.0448)	(0.0533)	(0.0430)		(0.0432)	(0.0573)	(0.0790)		(0.0428)	(0.0547)	(0.0528)
Fiscal rule: 3/5 (t-1)		0.111	-0.00155	0.126		0.0982	-0.00017	0.114		0.0926	-0.00985	0.0893
		(0.100)	(0.117)	(0.0990)		(0.107)	(0.119)	(0.128)		(0.108)	(0.126)	(0.107)
2/3 (t-1)		0.0314	-0.0218	0.0358		0.0235	-0.0163	0.0119		0.0187	-0.0252	-0.00399
		(0.105)	(0.135)	(0.107)		(0.101)	(0.133)	(0.104)		(0.102)	(0.134)	(0.104)
3/4 (t-1)		-0.285***	-0.275***	-0.308***		-0.243***	-0.220**	-0.175**		-0.245***	-0.215**	-0.198***
		(0.0487)	(0.0926)	(0.0467)		(0.0496)	(0.0966)	(0.0724)		(0.0496)	(0.0975)	(0.0569)
Anti-div. amend. (t-1)		-0.00050	0.194	0.00228		-0.0129	0.123	-0.0469		-0.0115	0.142	-0.0343
		(0.0354)	(0.118)	(0.0356)		(0.0396)	(0.133)	(0.0664)		(0.0395)	(0.132)	(0.0570)
Mass econ. liberal. (t-1)		-0.122	0.0203	-0.110		-0.148	0.00877	-0.190		-0.136	0.0265	-0.135
		(0.118)	(0.201)	(0.117)		(0.117)	(0.201)	(0.164)		(0.116)	(0.198)	(0.134)
Income inequality (t-1)		0.198	0.0812	0.214		0.177	0.138	0.160		0.143	0.0139	0.0341
		(0.712)	(1.220)	(0.702)		(0.706)	(1.232)	(0.769)		(0.695)	(1.225)	(0.699)
Fiscal balance (t-1)			-0.206				-0.226				-0.243	
			(0.224)				(0.237)				(0.234)	
Debt to revenue (t-1)			0.0159				-0.00275				-0.00807	
			(0.104)				(0.103)				(0.105)	

Motor vehic. taxes (t-1)			-14.18				-22.60				-18.15	
			(23.34)				(25.50)				(24.63)	
Income taxes (t-1)			-0.679				-0.00326				-0.309	
			(6.610)				(6.828)				(6.751)	
Gov. ideology (t-1)			-0.00007				0.00043				0.00034	
			(0.00291)				(0.00291)				(0.00289)	
Licensed drivers (t-1)			0.0906				0.189				0.166	
			(0.617)				(0.603)				(0.610)	
Income growth (t-1)			-0.477				-0.433				-0.475	
			(0.536)				(0.529)				(0.531)	
Income per cap. (t-1)			-0.0136				-0.0155				-0.0170	
			(0.0139)				(0.0135)				(0.0137)	
Oil production (t-1)			-0.606***				-0.538**				-0.551**	
			(0.223)				(0.238)				(0.234)	
Error correction rate												
Gas tax rate (t-1)	-0.0448***	-0.0272***	-0.0519***	-0.0295***	-0.0453***	-0.0275***	-0.0528***	-0.0376***	-0.0451***	-0.0270***	-0.0530***	-0.0336***
	(0.0137)	(0.00804)	(0.0121)	(0.00812)	(0.0135)	(0.00819)	(0.0124)	(0.0117)	(0.0135)	(0.00825)	(0.0124)	(0.0100)
Long-run multiplier (LRM)	-5.003***	-6.547**	-4.425**	-11.638***	-5.077***	-7.737**	-5.048**	-26.227***	-5.007**	-6.378**	-5.252*	-20.820***
	(1.530)	(2.636)	(2.210)	(4.347)	(1.951)	(3.179)	(2.293)	(9.580)	(2.001)	(3.124)	(2.755)	(7.474)
State and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	1937-2016	1937-2014	1961-2008	1937-2014	1937-2016	1937-2014	1961-2008	1937-2014	1937-2016	1937-2014	1961-2008	1937-2014
Method	Dead Start	Dead Start	Dead Start	IV	Dead Start	Dead Start	Dead Start	IV	Dead Start	Dead Start	Dead Start	IV
First stage *F* - statistic				58.25				13.61				29.40
R^2 – within	0.0970	0.127	0.152	0.136	0.0973	0.128	0.153	0.110	0.0971	0.127	0.153	0.126
States	49	49	49	49	49	49	49	49	49	49	49	49
N	3833	3735	2352	3735	3833	3735	2352	3735	3833	3735	2352	3735

Notes: Robust standard errors in parentheses clustered at the state level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

CHAPTER 5

Conclusion

"We cannot be radical enough in dealing with this issue [climate change]…The question is what is practically possible. How can we take the electorate with us in dealing with these things? Because it costs money… So the question of how fast can we go is how fast can we carry the electorate with us."

- David Attenborough
Testimony before the Business, Energy and Industrial Strategy Committee
UK Parliament
(UK Parliament 2019, mins 10:21:18-10:21:48)

The problem of climate change is daunting. To address it will require the full-scale transformation of economies so that greenhouse gases are wringed out of production and consumption. The speed and scale of this transformation will be determined in large measure by politics. Particularly, the capacity of governments to chart distributive bargains that allocate the costs of structural economic change across social actors in a manner that is politically sustainable. Indeed, David Attenborough's words above ring true. In democracies, the pace of decarbonization will proceed in proportion to the ability of governments to carry voters with them.

Political scientists, especially comparative political economists, have been slow to take up the challenge of investigating comparative climate change politics. The essays in this thesis seek to fill significant gaps in our current understanding of the political forces at work. They provide new theoretical insights that can explain variation in the stringency of long-term climate policy investments across the advanced capitalist democracies. I pay particular attention to the crucial roles of political institutions, which structure political behavior in distinct ways, and electoral incentives, which shape politicians' strategic incentives for directly imposing costs on voters.

This chapter summarizes the main findings of this thesis. It then presents a number of its broader implications, especially in relation to the politics of long-term policymaking. Lastly, I offer a number of areas that are ripe for future research.

1. Summary of main findings

1.1. The foundational role of institutions

A rich tradition in CPE focuses on the role that institutions play in structuring politics and policy across the advanced capitalist democracies. Yet the question of climate change policy has been surprisingly overlooked. We know surprisingly little, theoretically or empirically, about the political determinants of cross-national variation in climate policy stringency across these countries. Chapter 2 addresses this gap by leveraging the tools of CPE to provide a theoretical account of the micro-foundations that link institutions to long-term climate policy investments.

The essay reconceptualizes climate change policy as a type of long-term policy investment: one that entails short-term costs for greater long-term benefits. As such, climate politics are driven by a distinct political economy whereby governments require certain necessary conditions for policy adoption to occur. Building on Jacobs (2011), I focus on two conditions: electoral safety and the capacity of governments to overcome opposition from cost-bearing organized groups. I argue that together they represent *two causal channels* of climate change policy. The first is electoral and structures the relationship between politicians and voters, shaping the political risks that governments face in imposing direct costs on their constituents. The second connects politicians to organized interests, shaping the ability of governments to impose costs on industry. By highlighting the politics of imposing costs along both channels, this theoretical model shifts the focus of climate politics research from one that has focused almost exclusively on the politics of imposing costs on industry to one that examines the political economy of distributing costs *between* industry and voters.

Institutions are important because they influence the two necessary conditions for policy investment to occur, and as such, systematically structure politics along both causal channels. I argue that electoral rules shape electoral safety through two mechanisms: electoral competition and electoral accountability. Under PR, governments tend to experience lower levels of both, and as a result are better insulated against voter backlash. Facing lower political risks, they are more likely to directly impose higher costs on voters, driving overall policy investment. Utilizing new data on shadow carbon prices, I find that electoral rules indeed play an important role in the distributional politics of climate change. Countries with PR rules impose higher direct costs on voters

compared to industry, driving higher overall levels of climate policy investment compared to countries with majoritarian rules.

On the industry side, institutions for interest group intermediation, particularly concertation, structure the relationship between politicians and powerful economic actors. I focus in particular on one mechanism: the way that these institutions enable governments to offer credible and stable compensation to the losers of climate policy by reducing its associated political costs. I argue that when governments are able to credibly commit to compensation for industry, industry is less likely to block policy change or expand the scope of distributive conflict. I present evidence that concertation is indeed associated with higher overall climate policy investment, which is undergirded by a distribution of costs toward consumers and away from producers. I also find suggestive evidence that concertation is associated with higher costs for industry, challenging the view that a close relationship between government and business is always detrimental to climate policy.

Lastly, I argue that the joint presence of both institutions generates powerful complementarities that reinforce their independent effects, shaping the distributive profile of climate policy investment and generating distinct *varieties of decarbonization*. In negotiated political economies, PR rules decrease risks associated with shifting costs toward voters, opening up critical room to maneuver when negotiating compensation with cost-bearing groups in long-standing corporatist forums. Conversely, in competitive political economies majoritarian rules increase the risk of imposing cost on voters, which makes offering compensation to industry more difficult, since doing so can reduce policy stringency and dilute policy effectiveness. The empirical results lend support to these arguments. I find that the influence of institutions for interest group intermediation are reinforced by electoral rules.

The theory has a number of additional implications. In negotiated political economies climate policy should tend to enjoy relative cross-party consensus, support from cost-bearing industry, and low public conflict. Moreover, policy change is likely to be incremental rather than radical and offer compensation to losers. On the other hand, in competitive political economies climate policy investments are likely to enjoy little cross-party support or support from cost-bearing producers. Policy change is more likely to be radical and ignore losers. As a result, public conflict will tend to be high and policy reversals more frequent. I argue that it is these underlying causal mechanisms, which are structured by political institutions, that explain the sharply divergent

trajectories of climate policy investment and decarbonization we observe across the high-income democracies.

1.2. The importance of electoral incentives

Chapter 3 turns the focus to the electoral channel of climate change politics, investigating the role that electoral incentives play in structuring the politics of long-term climate policy investments. To my knowledge, the essay offers the first theoretical arguments for how electoral competition affects politicians' decision-making regarding the imposition of direct and visible costs on voters, particularly those associated with fossil fuel taxes. By examining the case of one specific fossil fuel tax, gasoline taxes, the chapter provides evidence of a causal process through which institutions structure levels of electoral competition, which in turn influence levels of electoral safety and shape politicians' incentives for adopting long-term climate policy investments.

Across the high-income democracies fossil fuels are widely consumed by voters. For this reason, increasing their price through direct taxation entails some degree of political risk. I argue that the extent to which the governing party(ies) is insulated from such risk will influence their willingness to increase fossil fuel taxes on households. Utilizing original data on gasoline tax rates across the advanced democracies between 1978 and 2013, I find evidence that in times of heightened electoral competition, governing parties have little appetite for political risk and decrease (or refrain from increasing) tax rates for fear of losing marginal votes. I argue that these political conditions re-order the party's preferences, pushing its vote-maximization preferences over and above any fossil fuel tax policy preferences it might hold.

I also find that the negative effect of electoral competition depends on how politicians' perceive voter preferences regarding tax increases. When increases in tax rates are expected to impose large personal costs on voters, because fuel consumption is high, increases in competition have an even larger negative effect on tax rates. Put differently, the negative effect of competition is reinforced by high levels of fuel consumption. These findings offer insights on how political processes shape fossil fuel taxation and consumption trajectories across countries. Increased tax rates drive up the price of fuels, decreasing their consumption and, I argue, make it easier for politicians in the future to further increase rates. Conversely, when tax rates remain stubbornly low, as a result of long periods of heightened electoral competition for example, fuel

consumption remains high, increasing the political risks of any future attempt to increase rates. I call this the "low tax-high consumption trap" and argue that it helps to explain the political dynamics of climate change in countries like the US.

Lastly, I find evidence that gasoline taxes vary cross-nationally by electoral rules. A key argument of this thesis is that electoral competition constitutes one causal mechanism that links electoral rules to long-term climate policy investment. For this reason, we observe higher gas tax rates in PR countries compared to majoritarian ones.

1.3. Long-run dynamics

Chapter 4 keeps the focus on the electoral channel, this time offering a detail empirical examination of the long-term impact of electoral incentives on fossil fuel taxation by investigating the case of gasoline taxes in US states between 1919 and 2016. I utilize both static and dynamic regression models to analyze the political drivers of tax rates over nearly a century. Consistent with theoretical expectations from Chapters 2 and 3, I find a robust, negative relationship between electoral competition and gasoline tax rates. Within US states over time, gas taxes are lower when electoral competition is heightened. Instrumental variable analysis supports this central finding, providing strong evidence that the relationship is causal.

Importantly, I also find evidence that *both* short-term, election-to-election shifts in competition and long-term underlying trends matter. States that experience successive, highly competitive contests have even lower tax rates. This suggests that the effects of electoral competition are sticky. Rather than immediately and completely re-calibrating their assessment of political risk after each election, politicians and parties seem to use the information to update their existing knowledge of the political environment. Dynamic analysis using error correction models offers complementary insights. Shifts in competition today have lingering, long-term effects on the tax rate that stretch years into the future. Lastly, instrumental variable analysis provides evidence of a causal long-term relationship between electoral competition and gasoline taxation. Taken together, the results demonstrate that the past matters. Politicians' behaviour regarding fossil fuel taxation today is structured by previous electoral dynamics.

Overall, the findings are consistent with a theoretical model that reconceptualizes state-level gasoline taxation as a type of long-term policy investment. Even in this least likely case, where tax revenues are used to fund highly visible

transportation infrastructure for motorists, politicians tend to be unwilling to invest in long-term policy solutions when electoral competition is running high. In this way, competition represents one important causal channel through which the time horizons of governments are moderated. Governments that enjoy a comfortable lead over rivals are the ones most likely to engage in the politics of long-term policy and structural economic change, since they can afford to look beyond the next election to society's long-run aggregate welfare.

More generally, the results help to shed light on why, from an international perspective, gas taxes have been so low in the US. At the state-level, politicians have experienced relatively high levels of electoral competition throughout the entire period of gasoline taxation. What is more, the findings highlight the political economy of fossil fuel taxes in competitive political economies with majoritarian electoral rules. Because electoral competition between two political parties tends to run high, these types of political economies will tend to have relatively low levels of fossil fuel taxation, and consumption taxes more generally. Indeed, these electoral dynamics help to explain why directly increasing the price of fossil fuels has gained little traction not only in the US but also in Australia, Canada, and the UK.

2. Broader implications

Beyond generating and testing a set of discrete hypotheses about the role of institutions and electoral incentives in shaping long-term climate change policy investments, the thesis offers at least three broader implications for our understanding of the comparative political economy of long-term policymaking and the merits of electoral competition.

2.1. Climate change and the politics of the long term

My findings are broadly consistent with Jacobs' (2011) theoretical arguments. Countries are able to achieve higher levels of climate policy investment when politicians have a low risk of losing office for imposing costs on constituents and can overcome opposition from cost-bearing organized groups. They also extend and contribute to the growing literature on long-term policymaking in important ways.

First, this thesis highlights the uniqueness of climate change as a type of long-term policy investment. In the case of pensions, which is the focus of Jacobs' (2011) study, the short-term costs and long-term benefits accrue primarily to the *same* individual or firm. For example, in the case of individuals, policy reform affects the intra-personal distribution of income over time. Furthermore, the future costs and benefits of pensions policy can be redistributed cross-sectionally between employers and employees. As Jacobs (2011) points out, policy reform can reduce or increase the future costs of pensions for either workers or firms. The point is that "vertical" policy investments, which distribute short-term costs and long-term benefits to the same individuals or groups, are technically possible.

The distributional profile of climate change policy is different. It entails short-term costs for individuals and firms today in exchange for future benefits that are diffuse, global public goods shared by all. They cannot be redistributed cross-sectionally. Similarly, the costs of future climate change can also not be redistributed from one social group to another. In this context of widely share future costs and benefits, "vertical" climate policy investments take on a different meaning. They impose similar short-term costs across society (i.e., on producers and consumers) in exchange for shared future benefits. In this way, given its technical characteristics, climate change is set apart from other types of long-term policies.

Second, and relatedly, I find that the opportunities for and constraints on cross-sectional distribution between producers and consumers today are crucial for overall long-term climate policy investment. To date, high levels of climate policy investment have been underpinned by a specific distributive profile that pushes costs toward voters. Indeed, I find that those countries in which governments distribute costs toward voters and away from industry (i.e., simultaneous cross-sectional and intertemporal redistribution) are those where we find the highest overall levels of policy investment. Denmark is the extreme example. In contrast, countries that impose similar short-term costs on both groups (i.e., pursue vertical investment) have lower levels of overall investment. This suggests a relationship between the distributive profile of policy investment and overall levels of investment. Whether the findings hold true for long-term policies beyond climate change is a topic for future research.

2.2. Differences in capacity to confront long-term problems

I find evidence that countries with consensus-based institutions do more to address the long-term challenge of climate change relative to those with competitive and adversarial institutions. The broader implication is that institutions may systematically structure the ability of entire political economies to tackle long-term problems. Over the years CPE scholars have made arguments that hint at this hypothesis.

For example, when describing consensus democracy Crepaz (1996, 8) argues "the more voices are heard, the more options will be entertained and a greater range of information will be taken into consideration ensuring a steady, long-term, and predictable policy style". Schmidt (1996, 173) writes that bargaining and compromise generate "the politics of continuity rather than discontinuity" and are associated with "limited short-term elasticity in policy making". Birchfield and Crepaz (1998, 179-80) contend that parliamentary-PR political systems are better able "to steer a more stable and long term policy path" and that "…consensual political institutions also have a higher capacity to implement policies as well as escort policies over a longer period of time". Most recently, Lindvall (2017, 113) argues that

> when it comes to reforms with investment-like properties – policy changes that are associated with short-term costs and long-term benefits – reform capacity can be higher in power-sharing systems [i.e., consensus democracies] than in power-concentration systems [i.e., majoritarian democracies]… Power sharing can thus be seen as a partial solution to the problem of short-term bias in democracies.

In the economic sphere, Hall and Soskice (2001, Ch.1) hint that institutions in coordinated market economies (CMEs) foster longer time horizons for companies relative to their peers in liberal market economies (LMEs). They draw particular attention to the role of the financial systems and corporate governance structures. In CMEs, industry tends to rely on "patient" capital provided by banks with whom they have long-standing ties, which "makes it possible for firms…to invest in projects generating returns only in the long run" (Hall and Soskice 2001, 22). The opposite is the case in LMEs, where firms face strong incentives "to be attentive to current earnings and the price of their shares on equity markets" (Hall and Soskice 2001, 27). Similarly, Cusack, Iversen, and Soskice (2007) describe the demand for credible long-term economic agreements, especially between employers and employees, as a driving force

behind the choice of political institutions in the early part of the twentieth century. They write that unions and employers needed

> credible long-run guarantees, which include an appropriate framework agreement at the political level to underwrite the relevant labor market and social security institutions and rules. The political system has to be such that the agreement cannot be changed by a change of government without the consent of the groups. This requires not just a system of proportional representation to enable the different groups to be represented through parties, but also a political system that allows for consensus decision making in the regulatory areas that concern them (Cusack, Iversen, and Soskice 2007, 377-78).

Perhaps the most developed argumentation on the relationship between consensus-based institutions and long-term policy comes from Martin (2013, 2015b). She argues that in consensus democracies "parties in coalition governments broker deals through successive electoral cycles, and these repeated interactions build the trust needed to develop longer-term, value-creating solutions" (Martin 2013, 133). Regarding interests groups she notes, "if the encompassing interest groups are concerned that the long-term costs of not resolving a problem are sufficiently high, they may generate the political will necessary for imposing short-term sacrifices to invest in long-term solutions for society" (Martin 2013, 130). More recently, when describing the political bargaining process in Scandinavia, Martin (2015b, 23) writes, "in 'inclusive negotiations'… participants act toward collective instead of individualistic interests, think about long-term impacts on future generations, and focus on substantive rather than political goals". Reflecting on the competitive, majoritarian democracy of the US, she concludes that "the American legislative process today seems incapable of solving a variety of vexing collective problems, which often require the payment of short- and medium-term costs for long-term gains" (Martin 2013, 121).

The findings of this thesis are consistent with these insights. They also extend them. To my knowledge, no study has attempted to empirically investigate the differential ability of political economies to address long-term challenges. Utilizing the case of climate change – a quintessential long-term problem – I do so here. Moreover, I develop arguments that pinpoint specific causal mechanisms and channels that link consensus-based institutions to long-term policymaking.

One broad implication of this line of research is that there may be variation in society-wide discount rates driven by underlying political and economic institutions.

That is, variation is the way that political economies value present consumption versus future consumption as a result of their institutional environments. What is more, such rates are unlikely to be static but should ebb and flow depending on a number of time-varying characteristics, such as levels of electoral competition. This thesis points in this direction. Though additional research is needed.

2.3. The merits of electoral competition

Electoral competition is often regarded as a key element of representative democracy (Strom 1989; Boyne 1998). Indeed, Schumpeter argues that the "democratic method is that institutional arrangement for arriving at political decisions in which individuals acquire the power to decide by means of a *competitive struggle* for the people's vote" (Schumpeter 1950, 269). Similarly, Dahl (1971) identifies competition, or "public contestation", as one of the defining features of democracy. The idea is that competition among parties for votes pushes governments to deliver policies desired by the electorate. The argument is akin to the economic argument that competition between firms ensures the efficient provision of goods and services desired by consumers (Stigler 1972).

A number of empirical studies provide evidence of benefits associated with heightened competition. Berliner (2014) and Berliner and Erlich (2015) show how increased electoral competition, which creates uncertainty about the future control of government, generates incentives for incumbents to adopt Freedom of Information laws that increase transparency. Beyond transparency, scholars point to competition as the key driver of a range of institutional reforms (e.g., Geddes 1994; Grzymała-Busse 2006). Moreover, competition has been associated with "pro-growth" economic policies (Besley, Persson, and Sturm 2010), higher education spending (Hecock 2006), and policies that are more responsive to what voters want (e.g., Griffin 2006; Hobolt and Klemmensen 2008).

Yet the findings in this thesis provide evidence that electoral competition has a deleterious effect on climate policy by reducing the willingness of politicians to impose direct and visible costs on voters, and by doing so, making them more short-sighted and less able to address long-term policy challenges. That is, assuming that tackling climate change is "something good" for governments to do, *less* competition, not more, may be better in generating this outcome. To be sure, the causal mechanism driving the

outcome, I argue, is related in part to the effect of competition on politicians' responsiveness to voter preferences. However, the results still significantly problematize normative arguments about the virtues of increased competition, as well as positive theories that link it unconditionally to "good governance". While it is beyond the scope of this thesis to reconcile the contrasting views, the evidence presented here should push researchers and policymakers to think carefully about both the benefits *and* costs of increased electoral competition.

3. Areas for future research

Research on the comparative political economy of climate change is slowly emerging, leaving many unexplored areas ripe for research. Below I outline a number of promising topics related to institutions, voter preferences, and political parties.

3.1. Broadening institutional theory

An important insight of CPE research is that institutions complement one another in both economic and political spheres (e.g., Hall and Soskice 2001; Iversen and Soskice 2009; Martin and Swank 2012). Indeed, electoral rules and corporatism "go together" with a number of other important institutions across advanced capitalist democracies. An important area of future research is to broaden the theoretical insights from this thesis to include interactions with these other institutions.

3.1.1. The role of corporatism

A key argument of this thesis is that compensation constitutes a causal mechanism that links one aspect of corporatism – concertation – to higher levels of climate policy investment. Chapter 2 provides supporting quantitative evidence. However, much more work is needed to further uncover this channel. In particular, qualitative comparative case studies that process trace the mechanism would be an especially useful area of research.

Additionally, there is the role of encompassing organizations themselves. CPE scholars have argued that encompassing peak associations help to overcome limits of collective action. For example, they bring together otherwise heterogeneous firms to

resolve internal disagreements in order to exercise political influence and speak with one voice (Martin and Swank 2012, 199), as well as incentivize industry and labor unions to internalize the long-run, general social consequences of government policy (Crepaz 1995, 395; Crouch 1993, 9; Jacobs 2011, Ch. 2; Olson 1971). Moreover, they can have cognitive effects on firm managers by educating them about the benefits of policy change; bringing them into contact with policy experts; channelling ideas that shape their perceptions of their own interests; focusing their attention on broader, shared concerns; and constructing norms of cooperation, trust, and "social partnership" (Martin and Swank 2012, 155-156; Martin 2013, 130). Analyzing the ways in which the organization of firms structures climate politics across countries is a rich area for future research.

3.1.2. Welfare states

CPE has a vibrant research agenda on welfare states (e.g., Esping-Andersen 1990; Huber, Ragin, and Stephens 1993; Iversen 2005; Iversen and Soskice 2006; V. A. Schmidt 2002). We know much less about the political role that the welfare state might play in driving climate politics. For example, does social protection and low inequality have an effect on voter preferences for bearing the costs of decarbonization? MacNeil (2015) argues that carbon taxes have repeatedly failed in liberal market economies like Australia, Canada, and the US because it is in these economies that workers have been the least protected from unembedded market forces, leading to a squeeze on incomes, increasing inequality, and declining public services. All of which makes for fertile ground for virulent anti-tax politics that frame climate policy as an additional burden on workers and families. A number of recent studies have begun to examine the relationship between welfare states and climate policy (Kono 2019) and environmental policy more broadly (Lim and Duit 2017), offering a foundation upon which to undertake future research.

3.1.3. Varieties of capitalism and firm preferences

Firms are key actors in the context of climate change. However, we know relatively little about the origins of their climate policy preferences. For example, why might otherwise similar firms (across or within counties) have different climate-related preferences?

Scholars working at the intersection of business and climate change have recently developed typologies and theoretical expectations about the construction of business preferences, which take seriously the heterogeneity of firm-level preferences over climate policy and offer a foundation for understanding their origins (Kelsey 2018; Meckling 2015). Empirical evidence is also slowly emerging (Downie 2017; Genovese and Tvinnereim 2018).

A missing piece of this research agenda is an account of how cross-national variation in the institutions that underpin capitalist economies, namely varieties of capitalism, shape firms' preferences. For example, as mentioned above, corporate governance practices and ownership structures tend to vary between liberal market economies and coordinated ones. Scholars have highlighted how the ownership structure of firms influences their time horizons (e.g., Deeg and Hardie 2016; Thomsen et al. 2018) When capital is "patient", as is typically the case in CMEs, firms may be better able to absorb the short-term costs of climate policy, and as a result, they may be more politically supportive of a decarbonization agenda. Indeed, economic institutions may condition firm-level discount rates in distinct ways across LMEs and CMEs. Lastly, varieties of capitalism arguments predict that variation in capitalist institutions condition how firms innovate (Hall and Soskice 2001; Witt and Jackson 2016). This should also have an effect on firms' preferences, since low-carbon innovation should structure the short-term costs of climate policy at the firm level.

3.1.4. Legislative committees

Legislative committees shape the way that information flows through the policymaking process as well as which parties are able to exercise influence over policy change (Martin and Vanberg 2011; Mattson and Strom 1995). Importantly, committee structures are correlated with electoral rules and institutions for interest group intermediation (Cusack, Iversen, and Soskice 2007). Negotiated political economies tend to have "strong" systems characterized by: permanent committees that correspond to government ministries; low committee membership; powers granted to legislators that enable them to access ministers, civil servants, and outside experts; and the influence of opposition parties in policymaking (Fortunato, Martin, and Vanberg 2017; Martin and Vanberg 2011; Mattson and Strom 1995; Powell 2000). Conversely, competitive political economies have "weak", ad-hoc committees that do not correspond to government

ministries and enable the government to dominate policymaking. These characteristics should be relevant for climate politics, especially in relation to uncertainty and policy credibility. However, no study has examined them. It is an area ripe for exploration, particularly their complementarity with electoral systems and interest group intermediation.

3.2. The role of voter preferences

The arguments in this thesis assume that the majority of voters tend to dislike higher prices for carbon-intensive goods and services. I present a variety of evidence to support this assumption, from neuroscience to environmental psychology to survey experiments. However, simply because this has tended to be the pattern to date, does not necessarily mean that it will continue to be. There could come a time when climate change becomes highly salient amongst voters, for example as the result of extreme weather events or social movements. If so, we might expect electoral competition to have the opposite effect of what I find here. Remember that electoral competition should moderate politicians' responsiveness to voter preferences. When it is high, governments should pay close to "what voters want". If voters are actively demanding climate action, increased competition should make politicians *more* likely to take strong action. For example, if voters clearly support higher carbon taxes to mitigate climate change, politicians might see putting up such taxes as a winning strategy when competition is high. Future research could explore this possibility in detail.

Similarly, the literature on climate change opinion is expansive, many times larger than the comparative literature (for a review see Drews and Bergh 2015). Yet there are still no studies that provide detailed theoretical arguments or robust empirical evidence that link public opinion to climate policy investment. The arguments above outline one causal channel. Additional research is needed to identify and test more.

3.3. The role of political parties

As outlined in the preceding chapters, existing theory and evidence regarding the relationship between political parties and climate policy investment is decidedly mixed. The analysis in this thesis also presents mixed results, offering little headway in answering questions about the role of political parties in climate politics. Across

countries I find that the greenness of governments' policy preferences (as measured by their manifestos) has a generally positive, though not always statistically significant, influence on climate policy investment. The results are similar within countries and US states over time, where I find a positive association between green and left parties in government and gasoline taxation, however again the coefficients lack precision. In the case of green parties, one limitation is the scarcity of observations. Indeed, green parties have been in government only a handful of times to date.

Forthcoming work by Mildenberger (2020) sheds light on the puzzling relationship between partisanship and climate policy by drawing attention to the coalitions of capital and labor that have historically constituted parties. What is more, there is a rich tradition in comparative politics that examines the effects of political parties on economic policy, particularly social policy (for a recent review see Schmitt 2015). Future climate politics research should leverage insights and methods from these studies to theorize about the conditions under which partisanship should matter and undertake empirical tests. Hypotheses generated in Chapter 2 suggest that partisanship should be a much more important driver of climate policy in competitive political economies where two parties are locked in fierce competition, but less so in negotiated political economies where norms of cross-party consensus tend to prevail.

Lastly, this thesis assumes that all governments across the high-income democracies have come under similar pressure, particularly internationally, to address climate change. By doing so, I take government preferences to act on climate as given. Future research could examine the source of climate policy preferences amongst political parties and politicians in an effort to shed light on the processes of preference formation vis-à-vis climate policy – a little studied area.

* * *

I have presented evidence that some countries are doing more to address climate change relative to others. However, this should not be read as these countries are somehow "doing enough" to cut domestic greenhouse gas emissions. No country is doing enough. The scale of the climate challenge cannot be overstated. The risks of runaway global warming are existential. All future governments will have to do much more than their predecessors to radically decarbonize their economies. As I described in Chapter 1, the principal challenge is not scientific or technological. Similarly, it has little

to do with knowing the right policy investments to make. The most significant challenge is *political*. In an effort to better understand this challenge, this thesis offers insights on the contours of climate politics, identifies key sites of distributional conflict, and theorizes about the political drivers of policy change.

BIBLIOGRAPHY

Abou-Chadi, Tarik. 2016. "Political and Institutional Determinants of Immigration Policies." *Journal of Ethnic and Migration Studies* 42 (13): 2087–2110. https://doi.org/10.1080/1369183X.2016.1166938.

Abou-Chadi, Tarik, and Matthias Orlowski. 2016. "Moderate as Necessary: The Role of Electoral Competitiveness and Party Size in Explaining Parties' Policy Shifts." *The Journal of Politics* 78 (3): 868–81. https://doi.org/10.1086/685585.

Aghion, Philippe, Antoine Dechezleprêtre, David Hémous, Ralf Martin, and John Van Reenen. 2016. "Carbon Taxes, Path Dependency, and Directed Technical Change: Evidence from the Auto Industry." *Journal of Political Economy* 124 (1): 1–51. https://doi.org/10.1086/684581.

Aklin, Michaël, and Johannes Urpelainen. 2013. "Political Competition, Path Dependence, and the Strategy of Sustainable Energy Transitions." *American Journal of Political Science* 57 (3): 643–58. https://doi.org/10.1111/ajps.12002.

Alesina, Alberto, and Guido Tabellini. 1988. "Credibility and Politics." *European Economic Review* 32 (2): 542–50. https://doi.org/10.1016/0014-2921(88)90201-2.

Althammer, Wilhelm, and Erik Hille. 2016. "Measuring Climate Policy Stringency: A Shadow Price Approach." *International Tax and Public Finance* 23 (4): 607–39. https://doi.org/10.1007/s10797-016-9405-4.

Andersen, Mikael Skou. 2019. "The Politics of Carbon Taxation: How Varieties of Policy Style Matter." *Environmental Politics* 28 (6): 1084–1104. https://doi.org/10.1080/09644016.2019.1625134.

Andersen, Mikael Skou, and Paul Ekins. 2009. *Carbon-Energy Taxation*. Oxford: Oxford University Press.

Andersson, Julius J. 2019. "Carbon Taxes and CO2 Emissions: Sweden as a Case Study." *American Economic Journal: Economic Policy*. https://doi.org/10.1257/pol.20170144.

Ang-Olson, Jeffrey, Martin Wachs, and Brian D. Taylor. 2000. "Variable-Rate State Gasoline Taxes." *Transportation Quarterly* 54 (1).

Ares, Elena and Jeanne Delebarre. 2016. "The Carbon Price Floor". House of Commons Library. Briefing Paper Number CBP05927.

Armingeon, Klaus, Christian Isler, Laura Knopfel, David Weisstanner and Sarah Engler. 2016a. Comparative Political Data Set 1960-2013. Bern: Institute of Political Science, University of Berne.

Armingeon, Klaus, Christian Isler, David Wesisstanner and Laura Knopfel. 2016b. Supplement to the Comparative Political Data Set – Government Composition 1960-2013. Bern: Institute of Political Science, University of Berne.

Arrow, Kenneth. 2007. "Global climate change: A challenge to policy." The Economists' Voice 4, 3.

Ashworth, John, Benny Geys, and Bruno Heyndels. 2006. "Determinants of Tax Innovation: The Case of Environmental Taxes in Flemish Municipalities." *European Journal of Political Economy* 22 (1): 223–47. https://doi.org/10.1016/j.ejpoleco.2005.06.004.

Avrami, Lydia, and Detlef F. Sprinz. 2019. "Measuring and Explaining the EU's Effect on National Climate Performance." *Environmental Politics* 28 (5): 822–46. https://doi.org/10.1080/09644016.2018.1494945.

Azzimonti, Marina. 2015. "The Dynamics of Public Investment under Persistent Electoral Advantage." *Review of Economic Dynamics* 18 (3): 653–78. https://doi.org/10.1016/j.red.2014.08.005.

Bailey, Ian, Iain MacGill, Rob Passey, and Hugh Compston. 2012. "The Fall (and Rise) of Carbon Pricing in Australia: A Political Strategy Analysis of the Carbon Pollution Reduction Scheme." *Environmental Politics* 21 (5): 691–711. https://doi.org/10.1080/09644016.2012.705066.

Bailey, Ian, and Susanne Rupp. 2006. "The Evolving Role of Trade Associations in Negotiated Environmental Agreements: The Case of United Kingdom Climate Change Agreements." *Business Strategy and the Environment* 15 (1): 40–54. https://doi.org/10.1002/bse.465.

Ball, Casey, and Courtney Moran. 2016. "Penny Lane, Literally: Funding Roads One Vehicle Mile at a Time." SSRN Scholarly Paper ID 2765567. Rochester, NY: Social Science Research Network. https://papers.ssrn.com/abstract=2765567.

Ballotpedia. 2018. "California Proposition 6, Voter Approval for Future Gas and Vehicle Taxes and 2017 Tax Repeal Initiative (2018)". Accessed June 11, 2019. https://ballotpedia.org/California_Proposition_6,_Voter_Approval_for_Future_Gas_and_Vehicle_Taxes_and_2017_Tax_Repeal_Initiative_(2018).

Banuri, Tariq, Terry Barker, Igor Bashmakov, Kornelis Blok, Daniel Bouille, Renate Christ, Ogunlade Davidson, et al. 2001. *Climate Change 2001: Mitigation*. Geneva, Switzerland: IPCC Secretariat.

Baranzini, Andrea, and Philippe Thalmann. 2004. *Voluntary Approaches in Climate Policy*. New Horizons in Environmental Economics. Cheltenham: Edward Elgar.

Barradale, Merrill Jones. 2010. "Impact of Public Policy Uncertainty on Renewable Energy Investment: Wind Power and the Production Tax Credit." *Energy Policy*, Special Section: Carbon Reduction at Community Scale, 38 (12): 7698–7709. https://doi.org/10.1016/j.enpol.2010.08.021.

Baumeister, Roy F., Ellen Bratslavsky, Catrin Finkenauer, and Kathleen D. Vohs. 2001. "Bad Is Stronger than Good." *Review of General Psychology* 5 (4): 323–70. https://doi.org/10.1037/1089-2680.5.4.323.

Bell, Andrew, and Kelvyn Jones. 2015. "Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data." *Political Science Research and Methods* 3 (01): 133–153. https://doi.org/10.1017/psrm.2014.7.

Beramendi, Pablo, and David Rueda. 2007. "Social Democracy Constrained: Indirect Taxation in Industrialized Democracies." *British Journal of Political Science* 37 (04): 619–641. https://doi.org/10.1017/S0007123407000348.

Berliner, Daniel. 2014. "The Political Origins of Transparency." *The Journal of Politics* 76 (2): 479–91. https://doi.org/10.1017/S0022381613001412.

Berliner, Daniel, and Aaron Erlich. 2015. "Competing for Transparency: Political Competition and Institutional Reform in Mexican States." *American Political Science Review* 109 (1): 110–28. https://doi.org/10.1017/S0003055414000616.

Berliner Zeitung (BZ). "SPD und Grüne streiten wieder über die Ökosteuer Auch Stolpe übt Kritik am Sparpaket der Koalition."Berliner Zeitung, October 28, 2002. https://www.nexis.com/docview/getDocForCuiReq?lni=4GB0-6TD0-TWX2-825N&csi=5949&oc=00240&perma=true (accessed May 9, 2018).

Bernauer, Thomas. 2013. "Climate Change Politics." *Annual Review of Political Science* 16 (1): 421–48. https://doi.org/10.1146/annurev-polisci-062011-154926.

Bernauer, Thomas, and Tobias Böhmelt. 2013. "Are Economically 'Kinder, Gentler Societies' Also Greener?" *Environmental Science & Technology* 47 (21): 11993–1. https://doi.org/10.1021/es403362m.

Berry, Frances Stokes, and William D. Berry. 1992. "Tax Innovation in the States: Capitalizing on Political Opportunity." *American Journal of Political Science* 36 (3): 715–42. https://doi.org/10.2307/2111588.

———. 1994. "The Politics of Tax Increases in the States." *American Journal of Political Science* 38 (3): 855–59. https://doi.org/10.2307/2111610.
Berry, William D., Richard C. Fording, Evan J. Ringquist, Russell L. Hanson, and Carl E. Klarner. 2010. "Measuring Citizen and Government Ideology in the U.S. States: A Re-Appraisal." *State Politics & Policy Quarterly* 10 (2): 117–35. https://doi.org/10.1177/153244001001000201.
Besley, Timothy, Torsten Persson, and Daniel M. Sturm. 2010. "Political Competition, Policy and Growth: Theory and Evidence from the US." *The Review of Economic Studies* 77 (4): 1329–52. https://doi.org/10.1111/j.1467-937X.2010.00606.x.
Beuermann, Christiane, and Tilman Santarius. 2006. "Ecological Tax Reform in Germany: Handling Two Hot Potatoes at the Same Time." *Energy Policy*, Social and political responses to ecological tax reform in Europe, 34 (8): 917–29. https://doi.org/10.1016/j.enpol.2004.08.045.
Birchfield, Vicki, and Markus M.L. Crepaz. 1998. "The Impact of Constitutional Structures and Collective and Competitive Veto Points on Income Inequality in Industrialized Democracies." *European Journal of Political Research* 34 (2): 175–200. https://doi.org/10.1111/1475-6765.00404.
Bolin, Bert. 2007. *A History of the Science and Politics of Climate Change: The Role of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511721731.
Bordignon, Massimo, Floriana Cerniglia, and Federico Revelli. 2003. "In Search of Yardstick Competition: A Spatial Analysis of Italian Municipality Property Tax Setting." *Journal of Urban Economics* 54 (2): 199–217. https://doi.org/10.1016/S0094-1190(03)00062-7.
Boyne, George A. 1998. "Party Competition and Local Spending Decisions." *British Journal of Political Science* 28 (1): 210–22.
Brand, Ulrich, and Adam Pawloff. 2014. "Selectivities at Work: Climate Concerns in the Midst of Corporatist Interests. The Case of Austria." *Journal of Environmental Protection* 05 (09): 780–95. https://doi.org/10.4236/jep.2014.59080.
Brannlund, Runar, and Lars Persson. 2012. "To Tax, or Not to Tax: Preferences for Climate Policy Attributes." *Climate Policy* 12 (6): 704–21. https://doi.org/10.1080/14693062.2012.675732.
Breetz, Hanna, Matto Mildenberger, and Leah Stokes. 2018. "The Political Logics of Clean Energy Transitions." *Business and Politics*, 1–31. https://doi.org/10.1017/bap.2018.14.
Brewer, Thomas L. 2014. *The United States in a Warming World: The Political Economy of Government, Business, and Public Responses to Climate Change*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9781107706569.
Brown, Alyssa. 2013. "In U.S., Most Oppose State Gas Tax Hike to Fund Repairs." Gallup Organization. Accessed June 11, 2018. https://news.gallup.com/poll/161990/oppose-state-gas-tax-hike-fund-repairs.aspx.
Burnham, John Chynoweth. 1961. "The Gasoline Tax and the Automobile Revolution." *The Mississippi Valley Historical Review* 48 (3): 435–59. https://doi.org/10.2307/1891987.
Bündnis 90/DIE GRÜNEN (Greens). 2002. Grün wirkt! Unser Wahlprogramm 2002 – 2006. http://www.glasnost.de/docs02/2002-Gruene-wahlprogramm.pdf (accessed May 9, 2018).
Cable News Network and USA Today. 1996. Gallup/CNN/USA Today Poll, May, 1996. As you may know, three years ago Congress passed a 4.3 cent increase in the federal tax on gasoline. Congress is now debating whether to eliminate this

increase. In your opinion, should Congress now vote to eliminate this 4.3 cent tax on gasoline or should they vote to keep it? USGALLUP.96MY09.R26. Gallup Organization [producer]. Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, iPOLL [distributor], accessed Jun-11-2019.

Calel, Raphael, and Antoine Dechezleprêtre. 2016. "Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market." *The Review of Economics and Statistics* 98 (1): 173–91. https://doi.org/10.1162/REST_a_00470.

Cameron, A. Colin, and Douglas L. Miller. 2015. "A Practitioner's Guide to Cluster-Robust Inference." *Journal of Human Resources* 50 (2): 317–372.

Cao, Xun, Helen V. Milner, Aseem Prakash, and Hugh Ward. 2014. "Research Frontiers in Comparative and International Environmental Politics An Introduction." *Comparative Political Studies* 47 (3): 291–308. https://doi.org/10.1177/0010414013509567.

Caplan, Bryan. 2001. "Has Leviathan Been Bound? A Theory of Imperfectly Constrained Government with Evidence from the States." *Southern Economic Journal* 67 (4): 825–47. https://doi.org/10.2307/1061573.

Carter, Neil. 2014. "The Politics of Climate Change in the UK." *Wiley Interdisciplinary Reviews: Climate Change* 5 (3): 423–33. https://doi.org/10.1002/wcc.274.

Carter, Neil, and Ben Clements. 2015. "From 'Greenest Government Ever' to 'Get Rid of All the Green Crap': David Cameron, the Conservatives and the Environment." *British Politics* 10 (2): 204–25. https://doi.org/10.1057/bp.2015.16.

Caughey, Devin, and Christopher Warshaw. 2017. "Policy Preferences and Policy Change: Dynamic Responsiveness in the American States, 1936–2014." *American Political Science Review*, November, 1–18. https://doi.org/10.1017/S0003055417000533.

Chang, Eric C. C., Mark Andreas Kayser, Drew A. Linzer, and Ronald Rogowski. 2010. *Electoral Systems and the Balance of Consumer-Producer Power*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511761423.

Chang, Eric C. C., Mark Andreas Kayser, and Ronald Rogowski. 2008. "Electoral Systems and Real Prices: Panel Evidence for the OECD Countries, 1970–2000." *British Journal of Political Science* 38 (04): 739–751. https://doi.org/10.1017/S0007123408000367.

Cheon, Andrew, and Johannes Urpelainen. 2013. "How Do Competing Interest Groups Influence Environmental Policy? The Case of Renewable Electricity in Industrialized Democracies, 1989–2007." *Political Studies* 61 (4): 874–97. https://doi.org/10.1111/1467-9248.12006.

Chicago Council on Foreign Relations. 1990. Gallup/CCFR Survey of American Public Opinion and U.S. Foreign Policy, Oct, 1990. (I am going to read you a list of possible policy options to reduce United States dependence on foreign oil. As I read each one, please tell me whether you would support or oppose that particular policy option.)... Imposing an additional 25 cents a gallon tax on gasoline. USGALLUP.90CFRP.R37E. Gallup Organization [producer]. Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, iPOLL [distributor], accessed Jun-11-2019.

Christlich Demokratische Union Deutschlands (CDU) - Christlich-Soziale Union in Bayern (CSU). 2002. Leistung und Sicherheit Zeit für Taten Regierungsprogramm: 2002/2006 von CDU und CSU. https://www.cdu.de/system/tdf/media/dokumente/regierungsprogramm-02-06-b.pdf?file=1 (accessed May 9, 2018).

Clinton, William J. 1993. "Remarks on Earth Day". The American Presidency Project. http://www.presidency.ucsb.edu/ws/?pid=46460 (accessed August 20).
Compston, H., and I. Bailey. 2008. *Turning Down the Heat: The Politics of Climate Policy in Affluent Democracies*. Basingstoke: Palgrave Macmillan.
Convery, Frank, Louise Dunne, Deirdre Joyce, and others. 2014. "Ireland's Carbon Tax in the Context of the Fiscal Crisis." *Cyprus Economic Policy Review* 8 (2): 135–143.
Crepaz, Markus M. L. 1995. "Explaining National Variations of Air Pollution Levels: Political Institutions and Their Impact on Environmental Policy-making." *Environmental Politics* 4 (3): 391–414. https://doi.org/10.1080/09644019508414213.
———. 1996. "Consensus Versus Majoritarian Democracy Political Institutions and Their Impact on Macroeconomic Performance and Industrial Disputes." *Comparative Political Studies* 29 (1): 4–26. https://doi.org/10.1177/0010414096029001001.
Crouch, Colin. 1993. *Industrial Relations and European State Traditions*. Oxford: Oxford University Press.
Culpepper, Pepper D. 2010. *Quiet Politics and Business Power*. Cambridge: Cambridge University Press.
Cusack, Thomas R., Torben Iversen, and David Soskice. 2007. "Economic Interests and the Origins of Electoral Systems." *American Political Science Review*, no. 03 (August): 373–391. https://doi.org/10.1017/S0003055407070384.
Dahl, Robert Alan. 1971. *Polyarchy: Participation and Opposition*. New Haven: Yale University Press.
Daugbjerg, Carsten, and Anders Branth Pedersen. 2004. "New Policy Ideas and Old Policy Networks: Implementing Green Taxation in Scandinavia." *Journal of Public Policy* 24 (02): 219–249. https://doi.org/DOI:10.1017/S0143814X0400011X.
Davidson, Chandler. 1992. "The Voting Rights Act: A Brief History." In *Controversies in Minority Voting: The Voting Rights Act in Perpsective*, edited by Bernard Grofman and Chandler Davidson. Washington, DC: Brookings Institution.
Davis, Carl. 2011. "Building a Better Gas Tax: How to Fix One of State Government's Least Sustainable Revenue Sources." *Institute on Taxation and Economic Policy (ITEP)*, 24.
Davis, Lucas W., and Lutz Kilian. 2011. "Estimating the Effect of a Gasoline Tax on Carbon Emissions." *Journal of Applied Econometrics* 26 (7): 1187–1214. https://doi.org/10.1002/jae.1156.
De Boef, Suzanna, and Luke Keele. 2008. "Taking Time Seriously." *American Journal of Political Science* 52 (1): 184–200. https://doi.org/10.1111/j.1540-5907.2007.00307.x.
Decker, Christopher S., and Mark E. Wohar. 2006. "Determinants of State Diesel Fuel Excise Tax Rates: The Political Economy of Fuel Taxation in the United States." *The Annals of Regional Science* 41 (1): 171–88. https://doi.org/10.1007/s00168-006-0090-6.
Deeg, Richard, and Iain Hardie. 2016. "'What Is Patient Capital and Who Supplies It?'" *Socio-Economic Review* 14 (4): 627–45. https://doi.org/10.1093/ser/mww025.
Delmas, Magali, and Ann Terlaak. 2002. "Regulatory Commitment to Negotiated Agreements: Evidence from the United States, Germany, the Netherlands, and France." *Journal of Comparative Policy Analysis: Research and Practice* 4 (1): 5–29. https://doi.org/10.1080/13876980208412668.
Deroubaix, José-Frédéric, and François Lévèque. 2006. "The Rise and Fall of French Ecological Tax Reform: Social Acceptability versus Political Feasibility in the Energy Tax Implementation Process." *Energy Policy*, Social and political

responses to ecological tax reform in Europe, 34 (8): 940–49. https://doi.org/10.1016/j.enpol.2004.08.047.
Diekmann, Andreas, and Peter Preisendörfer. 2003. "Green and Greenback The Behavioral Effects of Environmental Attitudes in Low-Cost and High-Cost Situations." *Rationality and Society* 15 (4): 441–72. https://doi.org/10.1177/1043463103154002.
Dietz, Simon, Alex Bowen, Baran Doda, Ajay Gambhir, and Rachel Warren. 2018. "The Economics of 1.5°C Climate Change." *Annual Review of Environment and Resources* 43 (1): 455–80. https://doi.org/10.1146/annurev-environ-102017-025817.
Downie, Christian. 2017. "Fighting for King Coal's Crown: Business Actors in the US Coal and Utility Industries." *Global Environmental Politics* 17 (1): 21–39. https://doi.org/10.1162/GLEP_a_00388.
Döring, Holger and Philip Manow. 2016. Parliaments and governments database (ParlGov): Information on parties, elections and cabinets in modern democracies. Development version. http://www.parlgov.org/.
Drews, Stefan, and Jeroen C. J. M. van den Bergh. 2015. "What Explains Public Support for Climate Policies? A Review of Empirical and Experimental Studies." *Climate Policy* 16 (7): 855–76. https://doi.org/10.1080/14693062.2015.1058240.
Dumas, Marion, James Rising, and Johannes Urpelainen. 2016. "Political Competition and Renewable Energy Transitions over Long Time Horizons: A Dynamic Approach." *Ecological Economics* 124 (April): 175–84. https://doi.org/10.1016/j.ecolecon.2016.01.019.
Dunn, James A. 1978. "The Importance of Being Earmarked: Transport Policy and Highway Finance in Great Britain and the United States." *Comparative Studies in Society and History* 20 (1): 29–53. https://doi.org/10.1017/S0010417500008811.
Egan, Patrick J., and Megan Mullin. 2017. "Climate Change: US Public Opinion." *Annual Review of Political Science* 20 (1): 209–27. https://doi.org/10.1146/annurev-polisci-051215-022857.
Energy Information Administration (EIA). 2018. "State Energy Data System (SEDS): 1960-2016." Accessed April 12, 2018. https://www.eia.gov/state/seds/seds-data-complete.php?sid=US.
Environmental Protection Agency (EPA). 2018. "Carbon Pollution Emission Guidelines for Ex-isting Stationary Sources: Electric Utility Generating Units." Regulations.gov. https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-0001 (accessed March 6, 2018).
Erlandson, D. 1994. "The BTU Tax Experience: What Happened and Why It Happened"." *Pace Environmental Law Review* 12 (1): 173–184.
Esping-Andersen, Gosta. 1990. *The Three Worlds of Welfare Capitalism*. Cambridge: Polity.
Fankhauser, Samuel, Caterina Gennaioli, and Murray Collins. 2015a. "Do International Factors Influence the Passage of Climate Change Legislation?" *Climate Policy* 16 (3): 318–31. https://doi.org/10.1080/14693062.2014.1000814.
———. 2015b. "The Political Economy of Passing Climate Change Legislation: Evidence from a Survey." *Global Environmental Change* 35 (November): 52–61. https://doi.org/10.1016/j.gloenvcha.2015.08.008.
Federal Highway Administration (FHWA). 1951. Highway Statistics 1951. Washington, DC: United States Federal Highway Administration.
———. 1965. Summary to 1965. Washington, DC: United States Federal Highway Administration.

———. 2018. "Highway Statistics Series." Washington, DC: US Department of Transportation. Accessed April 20, 2018. https://www.fhwa.dot.gov/policyinformation/statistics.cfm.
Ferree, Karen E., G. Bingham Powell, and Ethan Scheiner. 2013. "How Context Shapes the Effects of Electoral Rules." In *Political Science, Electoral Rules, and Democratic Governance*, edited by Mala Htun and G. Bingham Powell. Washington, DC: American Political Science Association.
Fiorina, Morris P. 1978. "Economic Retrospective Voting in American National Elections: A Micro-Analysis." *American Journal of Political Science* 22 (2): 426–43. https://doi.org/10.2307/2110623.
Fiva, Jon H., and Gisle James Natvik. 2013. "Do Re-Election Probabilities Influence Public Investment?" *Public Choice* 157 (1): 305–31. https://doi.org/10.1007/s11127-012-9946-8.
Flavin, Patrick, and Gregory Shufeldt. 2016. "Party Competition and Citizens' Political Attitudes in the American States." *Electoral Studies* 44 (December): 235–44. https://doi.org/10.1016/j.electstud.2016.09.001.
Fortunato, David, Lanny W. Martin, and Georg Vanberg. 2017. "Committee Chairs and Legislative Review in Parliamentary Democracies." *British Journal of Political Science*, March, 1–13. https://doi.org/10.1017/S0007123416000673.
Frank, Mark W. 2014. "A New State-Level Panel of Annual Inequality Measures over the Period 1916–2005." *Journal of Business Strategies* 31 (1): 241–263.
Franzen, Axel, and Dominikus Vogl. 2013. "Two Decades of Measuring Environmental Attitudes: A Comparative Analysis of 33 Countries." *Global Environmental Change* 23 (5): 1001–8. https://doi.org/10.1016/j.gloenvcha.2013.03.009.
Frederick, Shane, George Loewenstein, and Ted O'Donoghue. 2002. "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature* 40 (2): 351–401.
Fredriksson, Per G., and Eric Neumayer. 2013. "Democracy and Climate Change Policies: Is History Important?" *Ecological Economics* 95 (November): 11–19. https://doi.org/10.1016/j.ecolecon.2013.08.002.
———. 2014. "Corruption and Climate Change Policies: Do the Bad Old Days Matter?" *Environmental and Resource Economics*, December, 1–19. https://doi.org/10.1007/s10640-014-9869-6.
Gallup Organization. 1959. Gallup Poll (AIPO), Aug, 1959. "The money for the federal highway building program has run out. To carry on this work do you think the government should increase the tax on gasoline by 1 cent per gallon, or not?" USGALLUP.59-617.R61. Gallup Organization [producer]. Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, iPOLL [distributor], accessed Jun-11-2019.
———. 1978. Gallup Poll (AIPO), Mar, 1978. "If the consumption of oil and gas is reduced in the United States, which of these two ways would you prefer as a way to achieve this: start a rationing program that would require drivers to reduce the miles they drive by about one-fourth, or raise the tax on gasoline so that a gallon will cost 25 cents more than it currently does?" USGALLUP.998.Q005E. Gallup Organization [producer]. Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, iPOLL [distributor], accessed Jun-11-2019.
———. 1982. Gallup Poll (AIPO), Nov, 1982. "Would you favor or oppose an increase of 5 cents per gallon in the federal tax on gasoline to help pay for the cost of repairing the nation's highways and bridges?" USGALLUP.1205.R4B. Gallup Organization [producer]. Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, iPOLL [distributor], accessed Jun-11-2019.

———. 2009. "Top-Emitting Countries Differ on Climate Change Threat." https://news.gallup.com/poll/124595/Top-Emitting-Countries-Differ-Climate-Change-Threat.aspx#2 (Accessed May 4, 2018).
Gamage, David, and Darien Shanske. 2011. "Three Essays on Tax Salience: Market Salience and Political Salience." *Tax Law Review* 65: 19–98.
Garrett, Geoffrey. 1993. "The Politics of Structural Change Swedish Social Democracy and Thatcherism in Comparative Perspective." *Comparative Political Studies* 25 (4): 521–47. https://doi.org/10.1177/0010414093025004004.
Geddes, Barbara. 1994. *Politician's Dilemma: Building State Capacity in Latin America*. Berkeley: University of California Press.
Genovese, Federica, and Endre Tvinnereim. 2018. "Who Opposes Climate Regulation? Business Preferences for the European Emission Trading Scheme." *The Review of International Organizations*, July. https://doi.org/10.1007/s11558-018-9318-3.
German Federal Ministry of Finance (Bundesministerium der Finanzen). 2014. "Entwicklung der Energie- (vormals Mineralol-) und Stromsteuersätze in der Bundesrepublik Deutschland." Bonn: Bundesministerium der Finanzen.
Geschwind, Carl-Henry. 2014. "Gasoline Taxes and the Great Depression: A Comparative History." *Journal of Policy History* 26 (4): 595–624. https://doi.org/10.1017/S089803061400027X.
———. 2017. *A Comparative History of Motor Fuels Taxation, 1909–2009: Why Gasoline Is Cheap and Petrol Is Dear*. London: Lexington Books.
Gillard, Ross. 2016. "Unravelling the United Kingdom's Climate Policy Consensus: The Power of Ideas, Discourse and Institutions." *Global Environmental Change* 40 (September): 26–36. https://doi.org/10.1016/j.gloenvcha.2016.06.012.
Gillingham, Kenneth, and James H. Stock. 2018. "The Cost of Reducing Greenhouse Gas Emissions." *Journal of Economic Perspectives* 32 (4): 53–72. https://doi.org/10.1257/jep.32.4.53.
Goel, Rajeev K., and Michael A. Nelson. 1999. "The Political Economy of Motor-Fuel Taxation." *Energy Journal* 20 (1): 43.
González-Ricoy, Iñigo, and Axel Gosseries. 2016. *Institutions For Future Generations*. Oxford: Oxford University Press.
Gourevitch, Peter Alexis, and James Shinn. 2005. *Political Power and Corporate Control: The New Global Politics of Corporate Governance*. Princeton: Princeton University Press.
Government of Sweden. 2018. "Sweden's Carbon Tax." http://www.government.se/government-policy/taxes-and-tariffs/swedens-carbon-tax/ (accessed March 6, 2018).
Griffin, John D. 2006. "Electoral Competition and Democratic Responsiveness: A Defense of the Marginality Hypothesis." *Journal of Politics* 68 (4): 911–21. https://doi.org/10.1111/j.1468-2508.2006.00477.x.
Grzymała-Busse, Anna. 2006. "The Discreet Charm of Formal Institutions: Postcommunist Party Competition and State Oversight." *Comparative Political Studies* 39 (3): 271–300. https://doi.org/10.1177/0010414005284216.
Hall, Peter A., and David W. Soskice. 2001. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press.
Hammar, Henrik, Åsa Löfgren, and Thomas Sterner. 2004. "Political Economy Obstacles to Fuel Taxation." *Energy Journal* 25 (3): 1–17.
Harrison, Kathryn. 2012. "A Tale of Two Taxes: The Fate of Environmental Tax Reform in Canada." *Review of Policy Research* 29 (3): 383–407. https://doi.org/10.1111/j.1541-1338.2012.00565.x.
———. 2015. "International Carbon Trade and Domestic Climate Politics." *Global Environmental Politics* 15 (3): 27–48. https://doi.org/10.1162/GLEP_a_00310.

Harrison, Kathryn, and Lisa McIntosh Sundstrom. 2010. *Global Commons, Domestic Decisions: The Comparative Politics of Climate Change*. Cambridge, MA: MIT Press.
Hatch, Michael T. 1995. "The Politics of Global Warming in Germany." *Environmental Politics* 4 (3): 415–40. https://doi.org/10.1080/09644019508414214.
Heckelman, Jac C., and Keith L. Dougherty. 2010. "Majority Rule versus Supermajority Rules: Their Effects on Narrow and Broad Taxes." *Public Finance Review* 38 (6): 738–61. https://doi.org/10.1177/1091142110373608.
Hecock, R. Douglas. 2006. "Electoral Competition, Globalization, and Subnational Education Spending in Mexico, 1999–2004." *American Journal of Political Science* 50 (4): 950–61. https://doi.org/10.1111/j.1540-5907.2006.00226.x.
Henisz, Witold J. 2002. "The Institutional Environment for Infrastructure Investment." *Industrial and Corporate Change* 11 (2): 355–89. https://doi.org/10.1093/icc/11.2.355.
Hermann, Andrea Tony, Karl Hogl, and Michael Pregernig. 2016. "Science–Policy Interactions in Austrian, Dutch, and Swiss Climate Policy: A Comparative Account." *Journal of Environmental Policy & Planning* 0 (0): 1–15. https://doi.org/10.1080/1523908X.2016.1180238.
Hettich, Walter, and Stanley L. Winer. 1988. "Economic and Political Foundations of Tax Structure." *The American Economic Review* 78 (4): 701–12.
High-Level Commission on Carbon Prices. 2017. *Report of the High-Level Commission on Carbon Prices*. Washington, DC: World Bank. https://www.carbonpricingleadership.org/s/ENGLISH-EX-SUM-CarbonPricing.pdf.
Hirano, Shigeo and James Snyder. 2019. *Primary Elections in the United States*. Cambridge, MA: Cambridge University Press, 2019.
Hobolt, Sara Binzer, and Robert Klemmensen. 2008. "Government Responsiveness and Political Competition in Comparative Perspective." *Comparative Political Studies* 41 (3): 309–37. https://doi.org/10.1177/0010414006297169.
Hobolt, Sara, James Tilley, and Susan Banducci. 2013. "Clarity of Responsibility: How Government Cohesion Conditions Performance Voting." *European Journal of Political Research* 52 (2): 164–87. https://doi.org/10.1111/j.1475-6765.2012.02072.x.
Hoegh-Guldberg, Ove, Daniela Jacob, Marco Bindi, Sally Brown, Ines Camilloni, Arona Diedhiou, Riyanti Djalante, et al. 2018. "Impacts of 1.5°C of Global Warming on Natural and Human Systems." In *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°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*. Geneva: Intergovenmental Panel on Climate Change (IPCC). https://www.ipcc.ch/sr15/.
Holbrook, Thomas M., and Emily Van Dunk. 1993. "Electoral Competition in the American States." *The American Political Science Review* 87 (4): 955–62. https://doi.org/10.2307/2938827.
Hovi, Jon, Detlef F. Sprinz, and Arild Underdal. 2009. "Implementing Long-Term Climate Policy: Time Inconsistency, Domestic Politics, International Anarchy." *Global Environmental Politics* 9 (3): 20–39. https://doi.org/10.1162/glep.2009.9.3.20.
Huber, Evelyne, Charles Ragin, and John D. Stephens. 1993. "Social Democracy, Christian Democracy, Constitutional Structure, and the Welfare State." *American Journal of Sociology* 99 (3): 711–749.

Huber, John D., and G. Bingham Powell. 1994. "Congruence Between Citizens and Policymakers in Two Visions of Liberal Democracy." *World Politics* 46 (3): 291–326. https://doi.org/10.2307/2950684.
Hübscher, Evelyne, and Thomas Sattler. 2017. "Fiscal Consolidation under Electoral Risk." *European Journal of Political Research* 56 (1): 151–68. https://doi.org/10.1111/1475-6765.12171.
Hughes, Llewelyn, and Johannes Urpelainen. 2015. "Interests, Institutions, and Climate Policy: Explaining the Choice of Policy Instruments for the Energy Sector." *Environmental Science & Policy* 54 (December): 52–63. https://doi.org/10.1016/j.envsci.2015.06.014.
Hunter, William J., and Michael A. Nelson. 1992. "The Political-Economy of State Tobacco Taxation." *PUBLIC FINANCE-FINANCES PUBLIQUES* 47 (2): 214–228.
Husted, Thomas A., and Lawrence W. Kenny. 1997. "The Effect of the Expansion of the Voting Franchise on the Size of Government." *Journal of Political Economy* 105 (1): 54–82.
Imig, Doug. 2002. "Contestation in the Streets European Protest and the Emerging Euro-Polity." *Comparative Political Studies* 35 (8): 914–33. https://doi.org/10.1177/001041402236300.
Immergut, Ellen M., and Tarik Abou-Chadi. 2014. "How Electoral Vulnerability Affects Pension Politics: Introducing a Concept, Measure and Empirical Application." *European Journal of Political Research* 53 (2): 269–87. https://doi.org/10.1111/1475-6765.12037.
Institute for Fiscal Studies. 2018. "Indirect taxes: Excise Duties – Alcohol, Petrol, and Tobacco." London: Institute for Fiscal Studies. Retrieved from https://www.ifs.org.uk/tools_and_resources/fiscal_facts/.
International Energy Agency (IEA). 2016. "Energy Prices and Taxes: Country Notes." Paris: International Energy Agency.
———. 2017. Energy Statistics of OECD Countries. Paris: International Energy Agency.
———. 2018a. "End-use Energy Prices and Taxes." Paris: International Energy Agency.
———. 2018b. "Oil Supply and Consumption." Paris: International Energy Agency.
———. 2019. "CO2 Emissions from Fuel Combustion." Paris: International Energy Agency.
International Fuel Tax Agreement (IFTA). 2015. "Fuel Tax and Gasoline Tax Overview." San Antonio, Texas: IFTA.
Intergovernmental Panel on Climate Change (IPCC). 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.). Geneva: Intergovernmental Panel on Climate Change.
ISSP Research Group. 1995. International Social Survey Programme: Environment I - ISSP 1993. GESIS Data Archive, Cologne. ZA2450 Data file Version 1.0.0, doi:10.4232/1.2450.
———. 2003. International Social Survey Programme: Environment II - ISSP 2000. GESIS Data Archive, Cologne. ZA3440 Data file Version 1.0.0, doi:10.4232/1.3440.
———. 2019. International Social Survey Programme: Environment III - ISSP 2010. GESIS Data Archive, Cologne. ZA5500 Data file Version 3.0.0, doi:10.4232/1.13271.

Iversen, Torben. 2005. *Capitalism, Democracy, and Welfare*. Cambridge, MA: Cambridge University Press.
Iversen, Torben, and David Soskice. 2006. "Electoral Institutions and the Politics of Coalitions: Why Some Democracies Redistribute More than Others." *The American Political Science Review* 100 (2): 165–81.
———. 2009. "Distribution and Redistribution: The Shadow of the Nineteenth Century." *World Politics* 61 (03): 438–486. https://doi.org/10.1017/S004388710900015X.
Jacobs, Alan M. 2011. *Governing for the Long Term: Democracy and the Politics of Investment*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511921766.
———. 2016. "Policy Making for the Long Term in Advanced Democracies." *Annual Review of Political Science* 19 (1): 433–54. https://doi.org/10.1146/annurev-polisci-110813-034103.
Jacobs, Alan M., and J. Scott Matthews. 2012. "Why Do Citizens Discount the Future? Public Opinion and the Timing of Policy Consequences." *British Journal of Political Science* 42 (4): 903–35. https://doi.org/10.1017/S0007123412000117.
———. 2017. "Policy Attitudes in Institutional Context: Rules, Uncertainty, and the Mass Politics of Public Investment." *American Journal of Political Science* 61 (1): 194–207. https://doi.org/10.1111/ajps.12209.
Jacobs, Alan M., and R. Kent Weaver. 2015. "When Policies Undo Themselves: Self-Undermining Feedback as a Source of Policy Change." *Governance* 28 (4): 441–57. https://doi.org/10.1111/gove.12101.
Jagers, Sverker C., and Henrik Hammar. 2009. "Environmental Taxation for Good and for Bad: The Efficiency and Legitimacy of Sweden's Carbon Tax." *Environmental Politics* 18 (2): 218–37. https://doi.org/10.1080/09644010802682601.
Jahn, Detlef. 2016. *The Politics of Environmental Performance: Institutions and Preferences in Industrialized Democracies*. Cambridge: Cambridge University Press.
James, Denis. 1996. "'Beer and Cigs Up!': A Recent History of Excise in Australia." Australia Parliamentary Research Service, Background Paper No. 5 1995-1996.
Jensen, Christian B., and Jae-Jae Spoon. 2011. "Testing the 'Party Matters' Thesis: Explaining Progress towards Kyoto Protocol Targets." *Political Studies* 59 (1): 99–115. https://doi.org/10.1111/j.1467-9248.2010.00852.x.
Jo, Ara. 2019. "Trust and Compliance: Evidence from the EU Emissions Trading Scheme." *Grantham Research Institute on Climate Change and the Environment Working Paper* No. 298.
Jotzo, Frank. 2012. "Australia's Carbon Price." *Nature Climate Change* 2 (June): 475–76. https://doi.org/10.1038/nclimate1607.
Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. 1991. "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias." *Journal of Economic Perspectives* 5 (1): 193–206. https://doi.org/10.1257/jep.5.1.193.
Karapin, Roger. 2016. *Political Opportunities for Climate Policy: California, New York, and the Federal Government*. Cambridge: Cambridge University Press.
Kasa, Sjur. 2000. "Policy Networks as Barriers to Green Tax Reform: The Case of CO2-taxes in Norway." *Environmental Politics* 9 (4): 104–22. https://doi.org/10.1080/09644010008414553.
Katzenstein, Peter J. 1985. *Small States in World Markets: Industrial Policy in Europe*. Ithaca, NY: Cornell University Press.
Kayser, Mark Andreas, and René Lindstädt. 2015. "A Cross-National Measure of Electoral Competitiveness." *Political Analysis* 23 (2): 242–53. https://doi.org/10.1093/pan/mpv001.

Kelsey, Nina. 2018. "Industry Type and Environmental Policy: Industry Characteristics Shape the Potential for Policymaking Success in Energy and the Environment." *Business and Politics*, 1–28. https://doi.org/10.1017/bap.2018.19.
Kemp, René. 2010. "The Dutch Energy Transition Approach." *International Economics and Economic Policy* 7 (2): 291–316. https://doi.org/10.1007/s10368-010-0163-y.
Keohane, Robert O. 2015. "The Global Politics of Climate Change: Challenge for Political Science." *PS: Political Science & Politics* 48 (01): 19–26.
Keohane, Robert O., and David G. Victor. 2016. "Cooperation and Discord in Global Climate Policy." *Nature Climate Change* 6 (6): 570–75. https://doi.org/10.1038/nclimate2937.
Key, V. O. 1949. *Southern Politics in State and Nation*. New ed. Knoxville: University of Tennessee Press.
Kirton, John J., and Ella Kokotsis. 2016. *The Global Governance of Climate Change: G7, G20, and UN Leadership*. Burlington, VT: Ashgate Publishing, Ltd.
Klarner, Carl. 2013. "State Partisan Balance Data, 1937 - 2011." https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/LZHMG3.
Knight, Brian G. 2000. "Supermajority Voting Requirements for Tax Increases: Evidence from the States." *Journal of Public Economics* 76 (1): 41–67. https://doi.org/10.1016/S0047-2727(99)00082-1.
Knill, Christoph, Marc Debus, and Stephan Heichel. 2010. "Do Parties Matter in Internationalised Policy Areas? The Impact of Political Parties on Environmental Policy Outputs in 18 OECD Countries, 1970–2000." *European Journal of Political Research* 49 (3): 301–36. https://doi.org/10.1111/j.1475-6765.2009.01903.x.
Kone, Susan L., and Richard F. Winters. 1993. "Taxes and Voting: Electoral Retribution in the American States." *The Journal of Politics* 55 (1): 22–40. https://doi.org/10.2307/2132226.
Kono, Daniel Yuichi. 2019. "Compensating for the Climate: Unemployment Insurance and Climate Change Votes." *Political Studies*, April. https://doi.org/10.1177/0032321719836066.
LaChappelle, Erick. 2011. "Energy Security and Climate Change Policy in the OECD: Political Economy of Energy Taxation." PhD Thesis. https://tspace.library.utoronto.ca/bitstream/1807/29780/1/Lachapelle_Erick_201106_PhD_thesis.pdf.
Lasswell, Harold D. 1936. *Politics: Who Gets What, When, How*. New York: Peter Smith.
Lehmbruch, Gerhard. 1984. "Concertation and the Structure of Corporatist Networks." In *Order and Conflict in Contemporary Capitalism*, edited by John Goldthorpe. Oxford: Clarendon Press.
Levi, Margaret. 1989. *Of Rule and Revenue*. Berkeley: University of California Press.
Levi, Margaret, and Laura Stoker. 2000. "Political Trust and Trustworthiness." *Annual Review of Political Science* 3 (1): 475–507. https://doi.org/10.1146/annurev.polisci.3.1.475.
Levin, Kelly, Benjamin Cashore, Steven Bernstein, and Graeme Auld. 2012. "Overcoming the Tragedy of Super Wicked Problems: Constraining Our Future Selves to Ameliorate Global Climate Change." *Policy Sciences* 45 (2): 123–52. https://doi.org/10.1007/s11077-012-9151-0.
Li, Shanjun, Joshua Linn, and Erich Muehlegger. 2014. "Gasoline Taxes and Consumer Behavior." *American Economic Journal: Economic Policy* 6 (4): 302–42. https://doi.org/10.1257/pol.6.4.302.

Lightfoot, Simon, and David Luckin. 2000. "The 1999 German Ecological Tax Law." *Environmental Politics* 9 (2): 163–67. https://doi.org/10.1080/09644010008414530.
Lijphart, Arend. 2012. *Patterns of Democracy: Government Forms and Performance in Thirty-Six Countries*. New Haven: Yale University Press.
Lim, Sijeong, and Andreas Duit. 2017. "Partisan Politics, Welfare States, and Environmental Policy Outputs in the OECD Countries, 1975–2005." *Regulation & Governance* 12 (2): 220–37. https://doi.org/10.1111/rego.12138.
Lindvall, Johannes. 2017. *Reform Capacity*. Oxford: Oxford University Press.
Linzer, Drew A., and Ronald L. Rogowski. 2008. "Lower Prices: The Impact of Majoritarian Systems in Democracies Around the World." *The Journal of Politics* 70 (01): 17–27. https://doi.org/10.1017/S0022381607080012.
Lipscy, Phillip Y. 2019. *The Institutional Politics of Energy and Climate Change*. Book Manuscript. Stanford University, Stanford CA.
Lockwood, Matthew. 2013. "The Political Sustainability of Climate Policy: The Case of the UK Climate Change Act." *Global Environmental Change* 23 (5): 1339–48. https://doi.org/10.1016/j.gloenvcha.2013.07.001.
———. 2016. "The UK's Levy Control Framework for Renewable Electricity Support: Effects and Significance." *Energy Policy* 97 (October): 193–201. https://doi.org/10.1016/j.enpol.2016.07.026.
Lutz, Martin. "Führungswechsel bei den Grünen; Sager und Göring-Eckardt sollen in der Fraktion Müller und Schlauch ablösen - Ökosteuer-Streit mit SPD." DIE WELT, September 27, 2002. https://www.nexis.com/docview/getDocForCuiReq?lni=4PP7-7SD0-TWCN-F37V&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
Mackenzie, Michael K. 2016. "Institutional Design and Sources of Short-Termism." In *Institutional Design and Sources of Short-Termism*, edited by Iñigo González-Ricoy and Axel Gosseries. Oxford: Oxford University Press.
MacNeil, Robert. 2015. "Death and Environmental Taxes: Why Market Environmentalism Fails in Liberal Market Economies." *Global Environmental Politics* 16 (1): 21–37. https://doi.org/10.1162/GLEP_a_00336.
Madden, Nathan J. 2014. "Green Means Stop: Veto Players and Their Impact on Climate-Change Policy Outputs." *Environmental Politics* 23 (4): 570–89. https://doi.org/10.1080/09644016.2014.884301.
Martin, Cathie Jo. 2013. "Conditions for Successful Negotiation: Lessons from Europe." In *Negotiating Agreement in Politics: Report of the Task Force on Negotiating Agreement in Politics*, edited by Jane Mansbridge and Cathie Jo Martin. Washington, DC: American Political Science Association.
———. 2015a. "Labour Market Coordination and the Evolution of Tax Regimes." *Socio-Economic Review* 13 (1). https://doi.org/10.1093/ser/mwu018.
———. 2015b. "Negotiation and the Micro-Foundations of Institutional Change." In *Cooperation and Conflict the Nordic Way: Work, Welfare, and Institutional Change in Scandinavia*, edited by Fredrik Engelstad and Anniken Hagelund. Berlin: De Gruyter. https://doi.org/10.1515/9783110436891-003.
Martin, Cathie Jo, and Duane Swank. 2012. *The Political Construction of Business Interests: Coordination, Growth, and Equality*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9781139088299.
Martin, and Vanberg. 2011. *Parliaments and Coalitions: The Role of Legislative Institutions in Multiparty Governance*. Oxford: Oxford University Press. http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199607884.001.0001/acprof-9780199607884.

Mattson, Ingvar, and Kaare Strom. 1995. "Parliamentary Committees." In *Parliaments and Majority Rule in Western Europe*, edited by Herbert Döring. University of Mannheim: Mannheim Centre for European Social Research (MZES).
Meckling, Jonas. 2011. *Carbon Coalitions: Business, Climate Politics, and the Rise of Emissions Trading*. Cambridge, MA: MIT Press.
———. 2015. "Oppose, Support, or Hedge? Distributional Effects, Regulatory Pressure, and Business Strategy in Environmental Politics." *Global Environmental Politics* 15 (2): 19–37. https://doi.org/10.1162/GLEP_a_00296.
Meckling, Jonas, Nina Kelsey, Eric Biber, and John Zysman. 2015. "Winning Coalitions for Climate Policy." *Science* 349 (6253): 1170–71. https://doi.org/10.1126/science.aab1336.
Meckling, Jonas, and Jonas Nahm. 2018a. "The Power of Process: State Capacity and Climate Policy." *Governance* 31 (4): 741–57. https://doi.org/10.1111/gove.12338.
———. 2018b. "When Do States Disrupt Industries? Electric Cars and the Politics of Innovation." *Review of International Political Economy* 25 (4): 505–29. https://doi.org/10.1080/09692290.2018.1434810.
Mehling, Michael. 2013. "Germany's Ecological Tax Reform: A Retrospective." In *Environmental Sustainability in Transatlantic Perspective*, 91–103. Energy, Climate and the Environment Series. Palgrave Macmillan, London. https://doi.org/10.1057/9781137334480_6.
Michaelowa, Axel. 2003. "Germany—a Pioneer on Earthen Feet?" *Climate Policy*, EU-Implementation Challenges, 3 (1): 31–43. https://doi.org/10.1016/S1469-3062(02)00103-1.
Midttun, Atle, and Oskar Hagen. 1997. "Environmental Policy as Democratic Proclamation and Corporatist Implementation: A Comparative Study of Environmental Taxation in the Electricity Sector in the Nordic Countries as of 1994." *Scandinavian Political Studies* 20 (3): 285–310. https://doi.org/10.1111/j.1467-9477.1997.tb00196.x.
Mikesell, John L. 1978. "Election Periods and State Tax Policy Cycles." *Public Choice* 33 (3): 99–106. https://doi.org/10.1007/BF00154687.
Mildenberger, Matto. 2020. *Carbon Captured: How Business and Labor Control Climate Politics*. Book Manuscript. Cambridge, MA: MIT Press.
National Conference of State Legislatures (NCSL). 2019. "Variable Rate Gas Taxes." Accessed June 21, 2019. http://www.ncsl.org/research/transportation/variable-rate-gas-taxes.aspx.
Nelson, Michael A. 2000. "Electoral Cycles and the Politics of State Tax Policy." *Public Finance Review* 28 (6): 540–60. https://doi.org/10.1177/109114210002800603.
Neumayer, Eric. 2003. "Are Left-Wing Party Strength and Corporatism Good for the Environment? Evidence from Panel Analysis of Air Pollution in OECD Countries." *Ecological Economics* 45 (2): 203–20. https://doi.org/10.1016/S0921-8009(03)00012-0.
New York Times. 1969. "Theodore Kheel urges imposition of new and increased taxes in motorists." Factiva. Accessed June 10, 2019. https://global-factiva-com.gate3.library.lse.ac.uk/redir/default.aspx?P=sa&an=nyta000020011128d1ch082bn&cat=a&ep=ASE.
———. 1974. "Ed supports higher Fed gasoline tax as measure to conserve energy and reduce...". Factiva. Accessed June 10, 2019. https://global-factiva-com.gate3.library.lse.ac.uk/redir/default.aspx?P=sa&an=nyta000020011211d6bg002sh&cat=a&ep=ASE.

———. 1980a. "There are solutions to our economic problems." Factiva. Accessed June 10, 2019. https://global-factiva-com.gate3.library.lse.ac.uk/redir/default.aspx?P=sa&an=NYTF000020060708dc8a008xj&cat=a&ep=ASE.
———. 1980b. "The third man theme." Factiva. Accessed June 10, 2019. https://global-factiva-com.gate3.library.lse.ac.uk/redir/default.aspx?P=sa&an=NYTF000020060708dc9s00hiq&cat=a&ep=ASE.
Niemi, Richard G., Harold W. Stanley, and Ronald J. Vogel. 1995. "State Economies and State Taxes: Do Voters Hold Governors Accountable?" *American Journal of Political Science* 39 (4): 936–57. https://doi.org/10.2307/2111664.
Nordhaus, William D. 1975. "The Political Business Cycle." *The Review of Economic Studies* 42 (2): 169–90. https://doi.org/10.2307/2296528.
———. 1977. "Economic Growth and Climate: The Carbon Dioxide Problem." *The American Economic Review* 67 (1): 341–46.
———. 2008. *A Question of Balance: Weighing the Options on Global Warming Policies*. Yale University Press.
Nürnberger Zeitung (NZ). "Erste Zerreißprobe für die Regierung; Koalition streitet; über die Ökosteuer; Grüne für weitere Erhöhung über 2003 hinaus; SPD lehnt ab - Goppel: Bankrotterklärung." Nürnberger Zeitung, September 27, 2002. https://www.nexis.com/docview/getDocForCuiReq?lni=59FD-1931-JC31-707G&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
Öberg, PerOla, Torsten Svensson, Peter Munk Christiansen, Asbjørn Sonne Nørgaard, Hilmar Rommetvedt, and Gunnar Thesen. 2011. "Disrupted Exchange and Declining Corporatism: Government Authority and Interest Group Capability in Scandinavia." *Government and Opposition* 46 (3): 365–91. https://doi.org/10.1111/j.1477-7053.2011.01343.x.
Olson, Mancur. 1971. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press. https://www.dawsonera.com/guard/protected/dawson.jsp?name=https://lse.ac.uk/idp&dest=http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780674041660.
Organisation for Economic Cooperation and Development (OECD). 2016. *Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems*. Paris: Organisation for Economic Cooperation and Development. http://dx.doi.org/10.1787/9789264260115-en.
———. 2018a. "Demographic References." Paris: Organisation for Economic Cooperation and Development.
———. 2018b. "Gross domestic product (GDP): GDP per head, US $, Current prices, Current PPPs." Paris: Organisation for Economic Cooperation and Development.
———. 2018c. "Revenue Statistics." Paris: Organisation for Economic Cooperation and Development.
Ozymy, Joshua, and Denis Rey. 2013. "Wild Spaces or Polluted Places: Contentious Policies, Consensus Institutions, and Environmental Performance in Industrialized Democracies." *Global Environmental Politics* 13 (4): 81–100. https://doi.org/10.1162/GLEP_a_00199.
Pacala, S., and R. Socolow. 2004. "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies." *Science* 305 (5686): 968–72. https://doi.org/10.1126/science.1100103.

Pearce, David. 2006. "The Political Economy of an Energy Tax: The United Kingdom's Climate Change Levy." *Energy Economics* 28 (2): 149–58. https://doi.org/10.1016/j.eneco.2005.10.001.
Poloni-Staudinger, Lori M. 2008. "Are Consensus Democracies More Environmentally Effective?" *Environmental Politics* 17 (3): 410–30. https://doi.org/10.1080/09644010802055634.
Povitkina, Marina. 2018. "The Limits of Democracy in Tackling Climate Change." *Environmental Politics* 27 (3): 411–32. https://doi.org/10.1080/09644016.2018.1444723.
Powell, G. Bingham. 2000. *Elections as Instruments of Democracy: Majoritarian and Proportional Visions*. New Haven: Yale University Press.
Powell, G. Bingham, and Guy D. Whitten. 1993. "A Cross-National Analysis of Economic Voting: Taking Account of the Political Context." *American Journal of Political Science* 37 (2): 391–414. https://doi.org/10.2307/2111378.
President's Science Advisory Committee. 1965. Restoring the Quality of Our Environment. Report of the Environmental Pollution Panel. Washington: The White House. http://www.climatefiles.com/climate-change-evidence/presidents-report-atmospher-carbon-dioxide/
Purdon, Mark. 2015. "Advancing Comparative Climate Change Politics: Theory and Method." *Global Environmental Politics* 15 (3): 1–26. https://doi.org/10.1162/GLEP_e_00309.
Rabe, Barry G. 2004. *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*. Washington, DC: Brookings Institution Press.
———. 2010. "The Aversion to Direct Cost Imposition: Selecting Climate Policy Tools in the United States." *Governance* 23 (4): 583–608. https://doi.org/10.1111/j.1468-0491.2010.01499.x.
———. 2018. *Can We Price Carbon?* Cambridge, MA: MIT Press.
Rafaty, Ryan. 2018. "Perceptions of Corruption, Political Distrust, and the Weakening of Climate Policy." *Global Environmental Politics* 18 (3): 106–29. https://doi.org/10.1162/glep_a_00471.
Ranney, Austin. 1976. "Parties in State Politics." In *Politics in the American States: A Comparative Analysis*, edited by Herbert Jacobs and Kenneth Vines. Vol. 3. Boston: Little, Brown.
Renn, Ortwin, and Jonathan Paul Marshall. 2016. "Coal, Nuclear and Renewable Energy Policies in Germany: From the 1950s to the 'Energiewende.'" *Energy Policy* 99 (Supplement C): 224–32. https://doi.org/10.1016/j.enpol.2016.05.004.
Rhodium. 2019. "Preliminary US Emissions Estimates for 2018." The Rhodium Group. Accessed June 10, 2019. https://rhg.com/research/preliminary-us-emissions-estimates-for-2018/
Rogowski, Ronald, and Mark Andreas Kayser. 2002. "Majoritarian Electoral Systems and Consumer Power: Price-Level Evidence from the OECD Countries." *American Journal of Political Science* 46 (3): 526–39. https://doi.org/10.2307/3088397.
Rootes, Christopher. 2014. "A Referendum on the Carbon Tax? The 2013 Australian Election, the Greens, and the Environment." *Environmental Politics* 23 (1): 166–73. https://doi.org/10.1080/09644016.2014.878088.
Royed, Terry J., and Stephen Borrelli. 1999. "The Politics and Economics of Revenue Growth: A Cross–National Analysis." *European Journal of Political Research* 36 (1): 87–118. https://doi.org/10.1111/1475-6765.00464.
Rykkja, Lise H., Simon Neby, and Kristin L. Hope. 2014. "Implementation and Governance: Current and Future Research on Climate Change Policies." *Public*

Policy and Administration 29 (2): 106–30. https://doi.org/10.1177/0952076713510344.
Schmidt, Manfred G. 1996. "When Parties Matter: A Review of the Possibilities and Limits of Partisan Influence on Public Policy." *European Journal of Political Research* 30 (2): 155–83. https://doi.org/10.1111/j.1475-6765.1996.tb00673.x.
Schmidt, Vivien A. 2002. "Does Discourse Matter in the Politics of Welfare State Adjustment?" *Comparative Political Studies* 35 (2): 168–93. https://doi.org/10.1177/0010414002035002002.
Schmitt, Carina. 2015. "Panel Data Analysis and Partisan Variables: How Periodization Does Influence Partisan Effects." *Journal of European Public Policy* 0 (0): 1–18. https://doi.org/10.1080/13501763.2015.1091030.
Schmitter, Philippe C. 1974. "Still the Century of Corporatism?" *The Review of Politics* 36 (01): 85–131. https://doi.org/10.1017/S0034670500022178.
Schultz, Harald and Jobst-Hinrich Wiskow. "Kein Spielraum." Focus-Money, October 2, 2002. https://www.nexis.com/docview/getDocForCuiReq?lni=494S-4KH0-TWCF-V2P5&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
Schumpeter, Joseph A. 1950. *Capitalism, Socialism and Democracy*. London: Routledge.
Scruggs, Lyle. 2003. *Sustaining Abundance: Environmental Performance in Industrial Democracies*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511615689.
Shmanske, Stephen. 1990. "The Determinants of State Gasoline Taxation in the 1970s." *Resources and Energy* 12 (4): 339–51. https://doi.org/10.1016/0165-0572(90)90027-G.
Shufeldt, Gregory, and Patrick Flavin. 2012. "Two Distinct Concepts: Party Competition in Government and Electoral Competition in the American States." *State Politics & Policy Quarterly* 12 (3): 330–42. https://doi.org/10.1177/1532440012451154.
Shwom, Rachael, David Bidwell, Amy Dan, and Thomas Dietz. 2010. "Understanding U.S. Public Support for Domestic Climate Change Policies." *Global Environmental Change*, Governance, Complexity and Resilience, 20 (3): 472–82. https://doi.org/10.1016/j.gloenvcha.2010.02.003.
Smart, L. Edwin, and John N. Hart. 1941. "The Distribution of Revenues from State-Collected Consumer Taxes." *Law and Contemporary Problems* 8 (3): 463–81. https://doi.org/10.2307/1189407.
Solé Ollé, Albert. 2003. "Electoral Accountability and Tax Mimicking: The Effects of Electoral Margins, Coalition Government, and Ideology." *European Journal of Political Economy* 19 (4): 685–713. https://doi.org/10.1016/S0176-2680(03)00023-5.
Sovey, Allison J., and Donald P. Green. 2011. "Instrumental Variables Estimation in Political Science: A Readers' Guide." *American Journal of Political Science* 55 (1): 188–200. https://doi.org/10.1111/j.1540-5907.2010.00477.x.
Sozialdemokratische Partei Deutschlands (SPD). 1998. Arbeit, Innovation und Gerechtigkeit: SPD-Programm für die Bundestagswahl 1998. https://www.spd.de/fileadmin/Dokumente/Beschluesse/Bundesparteitag/wahlprogramm_bundesparteitag_leipzig_1998.pdf (accessed May 9, 2018).
———. 2002. Erneuerung und zusammenhalt – Wir in Deutschland: Regierungsprogramm 2002 – 2006. https://www.spd.de/fileadmin/Dokumente/Beschluesse/Bundesparteitag/regierungsprogramm_bundesparteitag_berlin_2002.pdf (accessed May 9, 2018).
Sozialdemokratische Partei Deutschlands (SPD) and Bündnis 90/DIE GRÜNEN (Greens). 1998. Aufbruch und Erneuerung – Deutschlands Weg ins 21.

Jahrhundert Koalitionsvereinbarung zwischen der Sozialdemokratischen Partei Deutschlands und BÜNDNIS 90/DIE GRÜNEN. https://www.spd.de/fileadmin/Dokumente/Beschluesse/Bundesparteitag/koalitionsvertrag_bundesparteitag_bonn_1998.pdf (accessed May 9, 2018).

———. 2002. Koalitionsvertrag 2002 – 2006: Erneuerung – Gerechtigkeit – Nachhaltigkeit. https://www.nachhaltigkeit.info/media/1248173898php7wc9Pc.pdf (accessed May 9, 2018).

SPBI. 2016. "Svenska Petroleum och Biodrivmedel Institutet." Stockholm: SPBI.

Spiegel. 2002. "Ökosteuer: Der Kanzler und sein Herausforderer treten auf die Bremse." Spiegel Online, April 4, 2002. http://www.spiegel.de/politik/deutschland/oekosteuer-der-kanzler-und-sein-herausforderer-treten-auf-die-bremse-a-191973.html (accessed May 9, 2018).

Sprinz, Detlef F. 2014. "Long-Term Policy Problems: Definition, Origin, and Responses." In *Predicting the Future in Science, Economics, and Politics*, edited by Frank W. Wayman, Paul R. Williamson, Solomon Polachek, and Bruce Bueno de Mesquita, 126. Cheltenham: Edward Elgar Publishing. https://books.google.co.uk/books?hl=en&lr=&id=BhxCBAAAQBAJ&oi=fnd&pg=PA126&ots=qgjlWyy2Nk&sig=W9A2qcB993NPp7F2jSGl5EGALyc.

Standaert, Samuel. 2015. "Divining the Level of Corruption: A Bayesian State-Space Approach." *Journal of Comparative Economics* 43 (3): 782–803. https://doi.org/10.1016/j.jce.2014.05.007.

Statistics Denmark (Danmarks Statistik). 2017. "Moms og energiafgifter." Copenhagen: Danmarks Statistik.

Steffen, Will, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, et al. 2018. "Trajectories of the Earth System in the Anthropocene." *Proceedings of the National Academy of Sciences* 115 (33): 8252–59. https://doi.org/10.1073/pnas.1810141115.

Steinmo, Sven, Kathleen Thelen, and Frank Longstreth. 1992. *Structuring Politics: Historical Institutionalism in Comparative Analysis*. Cambridge: Cambridge University Press.

Stern, Nicholas. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511817434.

Sterner, Thomas. 2007. "Fuel Taxes: An Important Instrument for Climate Policy." *Energy Policy* 35 (6): 3194–3202. https://doi.org/10.1016/j.enpol.2006.10.025.

Stigler, George J. 1972. "Economic Competition and Political Competition." *Public Choice* 13 (1): 91–106. https://doi.org/10.1007/BF01718854.

Stokes, Leah C. 2016. "Electoral Backlash against Climate Policy: A Natural Experiment on Retrospective Voting and Local Resistance to Public Policy." *American Journal of Political Science* 60 (4): 958–74. https://doi.org/10.1111/ajps.12220.

Strom, Kaare. 1989. "Inter-Party Competition in Advanced Democracies." *Journal of Theoretical Politics* 1 (3): 277–300. https://doi.org/10.1177/0951692889001003002.

———. 1990. "A Behavioral Theory of Competitive Political Parties." *American Journal of Political Science* 34 (2): 565–98. https://doi.org/10.2307/2111461.

Sumner, Jenny, Lori Bird, and Hillary Dobos. 2011. "Carbon Taxes: A Review of Experience and Policy Design Considerations." *Climate Policy* 11 (2): 922–43. https://doi.org/10.3763/cpol.2010.0093.

Taz. "Gruene haben s schwer." taz, die tageszaitung, March 5, 2001a. https://www.nexis.com/docview/getDocForCuiReq?lni=42GW-BM30-001K-P4FB&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
———. "Oeko-Krach gedaempft." taz, die tageszaitung, March 6, 2001b. https://www.nexis.com/docview/getDocForCuiReq?lni=42H3-B5G0-001K-P4NJ&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
Thomsen, Steen, Thomas Poulsen, Christa Børsting, and Johan Kuhn. 2018. "Industrial Foundations as Long-Term Owners." *Corporate Governance: An International Review* 26 (3): 180–96. https://doi.org/10.1111/corg.12236.
Tobin, Paul. 2017. "Leaders and Laggards: Climate Policy Ambition in Developed States." *Global Environmental Politics* 17 (4): 28–47. https://doi.org/10.1162/GLEP_a_00433.
Tobler, Christina, Vivianne H. M. Visschers, and Michael Siegrist. 2012. "Addressing Climate Change: Determinants of Consumers' Willingness to Act and to Support Policy Measures." *Journal of Environmental Psychology* 32 (3): 197–207. https://doi.org/10.1016/j.jenvp.2012.02.001.
Toke, David, and HelleØrsted Nielsen. 2015. "Policy Consultation and Political Styles: Renewable Energy Consultations in the UK and Denmark." *British Politics* 10 (4): 454–74. https://doi.org/10.1057/bp.2015.38.
Tranter, Bruce, and Kate Booth. 2015. "Scepticism in a Changing Climate: A Cross-National Study." *Global Environmental Change* 33 (July): 154–64. https://doi.org/10.1016/j.gloenvcha.2015.05.003.
Tvinnereim, Endre. 2013. "Paths towards Large, Unilateral Climate Policies: Policy-Seeking, Attenuated Accountability and Second-Order Government Assertiveness." *Journal of Energy & Natural Resources Law* 31: 379.
Union of Concerned Scientists (UCS). "Production Tax Credit for Renewable Energy". Union of Concerned Scientists. http://www.ucsusa.org/clean-energy/increase-renewable-energy/production-tax-credit#.WabKlLKGOHs (retrieved August 30, 2017).
United Nations (UN). 1992. United Nations Framework Convention on Climate Change. FCCC/INFORMAL/84. https://unfccc.int/resource/docs/convkp/conveng.pdf.
United Nations Framework Convention on Climate Change (UNFCCC). 2009. "Kyoto Protocol: Status of Ratification." Bonn: UNFCCC. https://unfccc.int/files/kyoto_protocol/status_of_ratification/application/pdf/kp_ratification.pdf (accessed May 9, 2018).
United States Census. 2018. "Annual Survey of State Government Finances." Accessed April 15, 2018. https://www.census.gov/programs-surveys/state.html.
UK Parliament. 2019. "Business, Energy and Industrial Strategy Committee, Witnesses: Sir David Attenborough." Parliamentlive.tv. Accessed July 10, 2019. https://parliamentlive.tv/event/index/58a776d2-9443-4191-a374-29b5f6eaf55f.
VerkehrsRundschau. 2000a. "Ökosteuer: Deutschland steht ein heißer Herbst bevor; Die CDU/CSU hat eine umfassende Kampagne gegen die Ökosteuer angekündigt," VerkehrsRundschau.de, September 12, 2000. https://www.nexis.com/docview/getDocForCuiReq?lni=4PYB-N4N0-TX5J-706X&csi=5949&oc=00240&perma=true (accessed May 9, 2018).
———. 2000b. "Proteste gegen Spritpreise in Deutschland weiten sich aus; CDU legt Gesetz zur Abschaffung der Ökosteuer vor." VerkehrsRundschau.de, September 15, 2000. https://www.nexis.com/docview/getDocForCuiReq?lni=4PYB-N4N0-TX5J-7062&csi=5949&oc=00240&perma=true (accessed May 9, 2018).

Visser, Jelle. 2015. ICTWSS Data base. version 5.0. Amsterdam: Amsterdam Institute for Ad-vanced Labour Studies AIAS.
Volkens, Andrea, Pola Lehmann, Theres Matthieß, Nicolas Merz, Sven Regel, and Annika Werner. 2015. "The Manifesto Data Collection. Manifesto Project (MRG /CMP / MARPOR)." Version 2015a. Berlin: Wissenschaftszentrum Berlin für Sozialforschung (WZB).
Ward, Hugh, and Xun Cao. 2012. "Domestic and International Influences on Green Taxation." *Comparative Political Studies* 45 (9): 1075–1103. https://doi.org/10.1177/0010414011434007.
Washington Post. 1988. "Greenhouse Heat…" Factiva. Accessed June 10, 2019. https://global-factiva-com.gate3.library.lse.ac.uk/redir/default.aspx?P=sa&an=wp00000020011118dk8e00y0i&cat=a&ep=ASE.
Watts, Richard A., Karen Trapenberg Frick, and Jonathan Maddison. 2012. "Policy Making, Incrementalism, and News Discourse: Gasoline Tax Debates in Eight U.S. States." *Public Works Management & Policy* 17 (3): 238–55. https://doi.org/10.1177/1087724X12437220.
Weidner, Helmut, and Lutz Mez. 2008. "German Climate Change Policy A Success Story With Some Flaws." *The Journal of Environment & Development* 17 (4): 356–78. https://doi.org/10.1177/1070496508325910.
Weitzman, Martin L. 2014. "Can Negotiating a Uniform Carbon Price Help to Internalize the Global Warming Externality?" *Journal of the Association of Environmental and Resource Economists* 1 (1/2): 29–49. https://doi.org/10.1086/676039.
Wells, Christopher W. 2012. "Fueling the Boom: Gasoline Taxes, Invisibility, and the Growth of the American Highway Infrastructure, 1919–1956." *Journal of American History* 99 (1): 72–81. https://doi.org/10.1093/jahist/jas001.
Wines, Michael. 1993. "Tax's Demise Illustrates First Rule Of Lobbying: Work, Work, Work." *The New York Times*, June 14, 1993, sec. U.S. http://www.nytimes.com/1993/06/14/us/tax-s-demise-illustrates-first-rule-of-lobbying-work-work-work.html.
Witt, Michael A., and Gregory Jackson. 2016. "Varieties of Capitalism and Institutional Comparative Advantage: A Test and Reinterpretation." *Journal of International Business Studies* 47 (7): 778–806. https://doi.org/10.1057/s41267-016-0001-8.
Wood, Geoffrey, and Stephen Dow. 2011. "What Lessons Have Been Learned in Reforming the Renewables Obligation? An Analysis of Internal and External Failures in UK Renewable Energy Policy." *Energy Policy* 39 (5): 2228–44. https://doi.org/10.1016/j.enpol.2010.11.012.
World Bank. 2018. "Databank: Urban population (% of total)." Washington, DC: World Bank. Accessed March 13, 2018. https://data.worldbank.org/indicator/sp.urb.totl.in.zs
———. 2019. "Industry (including construction), value added (% of GDP)." Washington, DC: World Bank. Accessed January 21, 2019. https://data.worldbank.org/indicator/NV.IND.TOTL.ZS.
World Bank and Ecofys. 2018. "State and Trends of Carbon Pricing 2018 (May)". Washington, DC: World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/29687/9781464812927.pdf?sequence=5&isAllowed=y.