A MULTI-LEVEL ANALYSIS OF THE ROLE OF INSTRUMENTALIST FACTORS AND WORLDVIEWS IN SHAPING CO2 EMISSIONS TRENDS

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Abstract

This thesis explores the factors behind national CO2 emissions trends. It highlights four instrumental – economic, social, political and environmental - explanations that scholars have posited to account for emissions behaviour and subsequently demonstrates that the artificial segregation of these approaches in the literature poses a major problem for the field. Since all of these factors matter some of the time, it argues that the research program needs to identify when each factor matters more than others and why. This thesis proposes that ideas play a key role in bringing instrumental factors to bare on climate policy. Fusing together social constructivism and the concepts of worldviews and problem representations from cognitive psychology, it proposes that instrumental factors will only have their alleged effects on emissions when a country, or the policymakers who act on its behalf, believes that the factor is of importance to world politics more broadly. Drawing on three of the leading schools of international thought, it proposes three ideal worldviews and problem representations, each of which envisages a different set of instrumentalist drivers and strategic response to climate change. Specifically, the neo-realist worldview upholds that emissions policy should maximise the gains of the state relative to others. The neo-liberal worldview, on the other hand, suggests that a state should design climate policy to minimise the domestic cost-benefit ratio of emissions behaviour. Painting a very different picture, the structuralist worldview prescribes that emissions policy should serve a state's transnational class interests.

The thesis tests these explanatory approaches by conducting a large-N study of 3,381 country-years, spanning eight supranational regions and 147 countries from 1990 to 2012. It builds a three-level model that accounts for (country and regional) clustering in emissions behaviour, thus reducing the potential for type I errors. The findings confirm that instrumental factors are indeed significant drivers of emissions trends. However, unlike previous quantitative work in the field, the results of the multilevel analyses suggest that most of these factors have heterogeneous effects between countries. The findings also suggest that worldviews play a critical role in determining what these effects are in two of the cases examined in the thesis: (i) democratization has a positive effect on emissions reduction in countries that subscribe to the neo-liberal worldview while (unexpectedly) inhibiting emissions reduction in countries that do not and (ii) a structuralist mind-set makes countries prioritise economic growth over a clean climate, thereby inhibiting emissions reduction.

Abbreviations

AOSIS	Alliance of Small Island States
BASICs	Emerging economies (Brazil, South Africa, India and China)
CACAM	Central Asia, Caucasus, Albania and Moldova
COPs	Conferences of Parties to the UNFCCC
EIT	Environmental Integrity Group
EU	European Union
FCP	First Commitment Period
KP	Kyoto Protocol
LDCs	Least Developed Countries
LR	Likelihood Ratio
MIDCs	Middle-income Developing Countries
OCA	Operational Code Analysis
OLS	Ordinary Least Squares regression
OPEC	Organisation of Petroleum Exporting Countries
RCM	Random Coefficient Model
RIM	Random Intercept Model
SCP	Second Commitment Period
UG	Umbrella Group
UNFCCC	United Nations Framework Convention on Climate Change

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Chapter One: Introduction

Why do some countries undertake stringent emissions reductions and others do not? At first glance, one might expect that emissions behaviour is driven by instrumentalist[1] reasoning - in the sense that a state pursues the emissions policy which most efficiently serves its national interests. But what is a national interest in the climate arena? Is it to bolster one's position in the international system, minimise the domestic cost-benefit ratio of climate policy or enhance one's power in the world economy? Like most questions in social science, the delineation of policy goals, which constitute the boundaries of instrumentalist decision-making, is a subjective affair. As the preceding questions try to demonstrate, the possible definitions and combinations of policy goals are endless. Thus, although instrumentalist factors play a vital role in shaping emissions behaviour, what constitutes a goal of climate policy and the level priority that it receives relative to other goals are intrinsically social questions.

This thesis speaks directly to these questions. It analyses the social drivers and processes behind emissions behaviour. Specifically, it attempts to understand whether countries' worldviews play a role in determining which instrumentalist factors are brought to bear on climate policy, and begins the task of analysing their implications for the global climate regime.

[1] In keeping with its conventional meaning, I use the term 'instrumentalism' to denote any action that is done to satisfy a motive.

The introduction proceeds by discussing the nature of the emissions 'puzzle' in the context of the multilateral climate negotiations. This is followed by a brief review of the leading explanations of emissions behaviour, which form the backbone of my own theoretical approach, as discussed in the third section. I then go onto discuss the theoretical and methodological aims of the thesis as well as its policy relevance. The last section presents the structure of the thesis and concludes with a brief summary of the chapters.

Context

It is often said that 'global problems require global solutions', and climate change is no exception. In response to insurmountable scientific evidence documenting the extent and implications of global warming, the representatives of 154 nations convened on June 12th 1992 to sign the United Nations Framework Convention on Climate Change (UNFCCC). In this document, the international community called for 'the widest possible cooperation by *all* countries and their participation in an effective and appropriate international response' (Preamble, UNFCCC). The respective responsibilities that each nation would be expected to contribute to this response were subsequently codified by the Kyoto Protocol (KP) in 1998, in which 37 industrialised countries collectively pledged to reduce world emissions by 'at least 5 percent below 1990 levels' (Article 3.1, KP 1998) over the First Commitment Period (FCP) from 2008 to 2012. Collectively, these two documents laid the foundations for the leading international initiative to combat global warming to date - the *global climate change regime*[2].

Yet despite these promising developments, it was not long before experts and scholars began to talk about 'ossification' and 'deadlock' in the multilateral climate negotiations.[3] Several symptoms are indicative of this stagnation: Although most countries are party to the climate regime, the emissions targets stipulated by the KP come nowhere near the level required to prevent the much feared two-degree temperature rise from materialising [4] Moreover, the climate regime lacks an effective enforcement mechanism for ensuring that its parties comply with even these modest targets. Ultimately, the development of an effective successor regime for the post-Kyoto era is obstructed by the entrenchment of the major negotiating alliances and interregional tensions (especially between the geopolitical North and South), which are repeatedly observed in the Conferences of Parties to the Convention (COPs), as most recently witnessed in last year's Paris summit.

[2] Following conventional practice (e.g. Depledge 2005; Bodansky 2012), I use the term 'global climate change regime' to refer to the system of international climate governance that is established by the UNFCCC and subsequent international agreements on climate change. Throughout this thesis, I employ the terms 'global climate regime' or simply 'climate regime' interchangeably to refer to this system.

[3] See, for example, Barrett and Stavins (2003), Buchner and Carraro (2006), Christoff (2006), Depledge (2006), Thompson (2006), Penny (2007), Prins and Rayner (2007), Kasa et al. (2008) and Howes (2009).

[4] According to the leading scientific authorities on climate change, a two degree rise in average world temperature is the critical point after which global warming would result in 'grave damage to ecosystems and... a host of non-linear consequences' (IPCC 2007:99-100,2013).

Perhaps the most striking sign of trouble, however, is the reluctance, and at times, outright refusal, of some countries, notwithstanding some of the world's largest polluters, to impose restrictions on domestic emissions levels. Despite initially agreeing to meet its Annex B target,[5] George W Bush made the unprecedented move of withdrawing from the KP in 2001 on the grounds that the agreement was too demanding on the national economy and exempted key polluting nations (like the rapidly emerging economies) from quantitative emissions commitments. While the absence of one of the world's strongest countries and pioneers of international cooperation poses serious challenges for the future of the climate regime, it soon became evident that resistance to domestic emissions restrictions would not be limited to the US. Having repeatedly expressed dissent with the KP, Canada went onto breach its emissions target[6] and withdrew from the climate regime on December 13th 2011. Canadian Environment Minister Peter Kent (cited in *The Guardian* 13 December 2011) had these words to say on the decision:

> 'The KP originally covered countries generating less than thirty percent of global emissions. Now it covers less than thirteen percent and that number is only shrinking... The KP does not cover the world's largest emitters - the US and China - and, therefore, cannot work. It is now clear the KP is not the path forward for a global solution to climate change. If anything, it is an impediment.'

These concerns are also shared by other countries. To date, only 59 states have ratified the Doha Amendment, which extends the KP to the Second Commitment Period (SCP) (UNFCCC 2015a). Moreover, the

[5] Quantitative emissions targets for Annex countries are stipulated under Annex B of the KP.
[6] Canada's Annex B target is a six percent reduction in emissions from 1990 levels. By the end of the FCP, Canadian emissions had increased by twenty percent (International Energy Agency and Organisation for Economic Co-operation and Development 2012).

latest round of the COP negotiations in Paris suggests that an uncertain future awaits the climate regime. On December 12th 2015, 196 countries reaffirmed the continuing will of the international community to combat climate change by signing the Paris Agreement, a new climate treaty under international law. The document establishes binding commitments by countries to make 'nationally determined contributions' to reduce emissions (Article II, UNFCCC 2015b). However, as many critics and experts have pointed out, these targets are not legally binding. In his denunciation of the Paris Agreement, former National Aeronautics and Space Administration scientist James Hansen declared: 'It's a fraud really, a fake… It's just worthless words. There is no action, just promises' (cited in Milman 2015). While the apparent unwillingness of countries to commit to binding international emissions targets is an important issue in its own right, this predicament is symptomatic of a deeper problem: widespread reluctance to reduce domestic emissions levels ultimately signals the failure of international efforts to combat climate change altogether.

Hence the core puzzle motivating this thesis is; *despite strong political and scientific demand for taking urgent preventative action against climate change, why are some states reluctant to reduce domestic emissions?* Specifically, I am interested in why emissions reduction is neither unanimous nor consistent across countries, which raises two further questions: (i) *why do some states undertake significant emissions reductions while others do not?* and; (ii) *out of the countries that do adopt* *effective climate policy, why are some willing to do more – in terms of emissions reduction – than others?* The results of this thesis suggest that emissions behaviour is driven by relative power concerns[7], fossil fuel dependency, reputational cost, democracy, economic power and export diversity. However, the degree of influence that these factors (excluding relative power) have over emissions reduction varies across countries. Sometimes, these differences are attributable to worldviews: as I explain below, countries afford more importance to democracy and economic power when they (respectively) believe that domestic costs and transnational class interests are important factors in world politics more broadly. However, differences in the between-country effects of fossil fuel dependency, reputational cost and export diversity do not appear to be related to worldviews.

Leading Explanations and Gaps in the Literature

Scholars have attributed emissions behaviour to economic, social, political and environmental factors. The most dominant approach asserts that economic factors as production levels, input and output mixed and technology are the primary driving force behind emissions levels. Another approach emphasises the role of social factors such as living standards, environmental awareness and demographic patterns. Others look to the political arena for explanation, underlining the importance of regime type, domestic institutional capacity and international environmental institutions in shaping emissions behaviour. A fourth approach contends

[7] As elaborated below, relative power refers to a country's level of (physical) power in the international system, in relation to other countries.

that a country's willingness to reduce emissions is determined by its level of vulnerability to the adverse effects of climate change.

While these approaches make an invaluable contribution to our understanding of the drivers behind emissions behaviour, as *standalone* explanations, they exhibit various shortcomings. First, economic, social, political and environmental factors do not have uniform effects on emissions trends. The results of more recent works in the field that employ more sophisticated modelling techniques indicate that the influence of at least some of these factors varies significantly between different countries and regions (e.g., Beck and Joshi 2015; Farzin and Bond 2006; Orubi and Omotor 2007; Sharma 2011; Sulemana et al. 2016; He 2007). Second, even when these factors do have their predicted effects over emissions behaviour, most explanations do not provide a complete account of causality: they prioritise tangible, instrumentalist factors and overlook the role of cognitive factors in structuring the framework of rational decision-making (Pettenger 2007; Hulme 2009). Yet the assumptions that we make about the world have a huge impact on our assessments about whether or not and, if so, in which direction material factors and specifically, instrumentalist concerns, should shape emissions behaviour. This proposition lies at the heart of this thesis.

Of course, I am not suggesting that material variables and instrumentalist processes do not play an important role emissions behaviour. On the contrary, I expect that a combination of economic, social, political and environmental factors are simultaneously at play. However, the inability of the leading approaches to come up with generalizable explanations indicates that they are missing something. I contend that what is needed is a coherent approach for weighing the relative salience and direction of influence of multiple instrumentalist concerns over individual emissions behaviours. The theoretical approach which I devise in chapter three goes some way towards filling this gap.

Theoretical Framework

In this thesis, I adopt a fundamentally different approach to the majority of explanations that populate the literature. My vantage point is the social constructivist tradition in IR, which contends that world politics is governed by intersubjective – material and *social* – factors (see, for example, Wendt 1999; Finnemore and Sikkink 2001; Barnett 2006; Fierke 2010). While proponents of this approach focus more on compliance with the global climate regime rather than emissions trends, several studies draw on this expanded understanding of ontology to investigate the role of social factors such as identity (Weiss and Burke 2011), norms (Fogel 2007; Hulme 2009), ethical principles (Jaggard 2007; Lahsen 2007), ideas (Parks and Roberts 2010; Terhalle and Depledge 2013) and legitimacy (Bernstein 2002) in international climate politics. This thesis adds to this literature: the independent variable is policymakers' ideas about international life, which I refer to as 'worldviews' over the following chapters, and the dependent variable is national emissions behaviour.

To make my approach more concrete, I follow in the footsteps of Holsti (1962), Axelrod (1973), Larson (1988), Herrmann and Fischerkeller (1995), Mowle (2003) and Goldberg (2009), who in turn draw on the concepts of worldviews and problem representations from cognitive psychology. Worldviews consist of broad positive and normative beliefs that individuals hold about the world (Freud 1914 and Miller and Cook-Greuter 1994). Problem representations, on the other hand, are narrower; they come into existence when we take the beliefs of a worldview and apply them to a particular issue-area (Newell and Simon 1972; Sylvan et al. 1991; Beasley 1998 and Sylvan and Voss 1998). The dominant cognitive processing model tells us that humans try to make sense of the world by simplifying complex phenomena into comprehensible ideas. According to Festinger’s (1957) well-known cognitive dissonance theory, it is imperative to the mental wellbeing of the individual that incoming information coheres with our pre-existing beliefs about the world. Thus, when confronted with unfamiliar events or puzzling situations, individuals try to maintain cognitive congruity by framing them in accordance with their pre-existing worldviews (Shank and Abelson 1979).

Fusing together constructivism and cognitive psychology, I argue that policymakers interpret climate change through the lens of their worldviews and go onto develop corresponding problem representations, which shape the emissions decisions that they take on behalf of the state. To narrow down the range of ideational possibilities, I propose that policymakers' worldviews can align, more or less, with three of the leading schools of international thought – namely: neo-realism, neo-liberal institutionalism[8] and structuralism. As I discuss in chapter three, this is a reasonable assumption to make as policymakers' beliefs about international politics are predominantly shaped by socialisation, education and incoming information from foreign policy advisors, which almost always involves some exposure to IR theory along the way (Tetlock 1993; Doyle 1997 and Mowle 2003).

Each approach envisages a different driver of emissions behaviour, which, as I argue below, captures the major bargaining positions that dominate the multilateral climate negotiations. Neo-realists argue that the unequal distribution of the costs and benefits of climate governance across states makes it rational for some countries to reduce emissions and others not to.[9] When it comes to the negotiating blocks, the US expresses neo-realist concerns over the domestic costs of emissions reduction relative to those of other states, particularly rapidly emerging economies, which are currently exempted from binding targets (Vezirgiannidou 2008; Purdon 2013). Neo-liberals, on the other hand, contend that states are more concerned about the costs of emissions

[8] Hereafter referred to as neo-liberalism.
[9] See, for example, Swain (1996), Dabelko and Simmons (1997), Salmon (1998), Busby (2005), Fisher (2006), Grundig (2006), Dubash (2009), Dimitrov (2010) and Hsiang et al. (2013).

reduction to their own state rather than those incurred by other nations. Moreover, international institutions like the climate regime can play a fundamental role in overcoming these disincentives by lowering the costs of emissions reduction.[10] In the climate negotiations, the EU embodies the neo-liberal approach and looks to the climate regime for institutional solutions to overcome the domestic costs of emissions reduction (Bailey 2007; Koehane and Victor 2010). Structuralists, who take their cue from neo-Marxist theories of world politics, paint yet another picture. Adherents of this approach provide a compelling explanation of developing countries' aversion towards emissions reduction. From this perspective, climate change is primarily an ethical problem that stems from the inequitable nature of the capitalist system. Since the KP seeks to curb global emissions without addressing the economic factors that contribute to the climate problem, the idea of emissions targets for developing countries is seen as an artefact of the colonial era, which is designed to maintain the dominance of the North over the South. Thus developing countries are unwilling to bear the burden of cleaning up the climate problem which the North (primarily) produced, not least because they are the most vulnerable and ill-equipped to deal with climate change.[11] The demands for economic debt relief and global economic restructuring from the Group of 77 and China are highly emblematic of structuralist arguments (Parks and Roberts 2006,2007,2010; Betsill et al.

[10] E.g. Ward (1993), Paterson (2006), Penny (2007), Keohane and Victor (2010) and Bodansky (2012).
[11] E.g. Mwandosya (2000), Betsill et al. (2006), Okereke and Bulkely (2007) and Roberts and Parks (2007,2010),

2007). The proposed theoretical-regional linkages and associated preconditions for emissions reduction are illustrated in figure 1.1.[12]

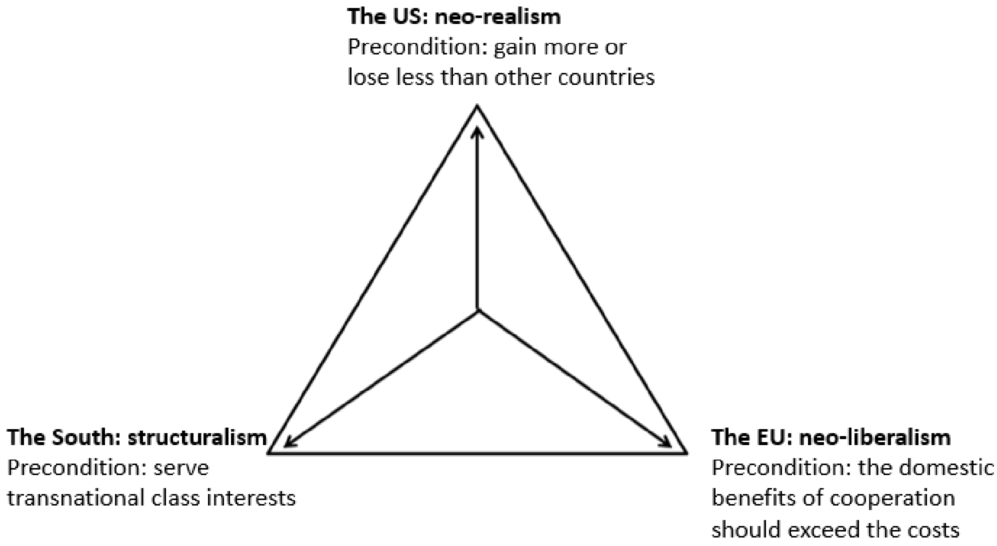

Figure 1.1: Hypothetical theoretical-regional relationships and emissions arguments proposed by this thesis

Pushing the level of abstraction further, I devise three ideal-typical problem representations of climate change which flow from each worldview. As I elaborate in chapter three, since each worldview subscribes to a different set of theoretical assumptions about world politics, their corresponding problem representations envisage different remedies to climate change. Moreover, it is not difficult to deduce how these strategies translate into (often conflicting) emissions decisions for individual states, which is fleshed out in chapters two and three.

The value added by this approach is that it situates rationalism, or rather policymakers' conceptions of rational decision-making, within a cognitive framework, potentially arriving at a more complete picture of the causal

[12] These claims are tested empirically in chapter eight.

processes behind emissions behaviour. Unlike the leading explanations, I contend that the influence of material variables over emissions behaviour is not automatic or exogenous to the puzzle. Rather, economic, social, political and environmental factors acquire value and causal power from the underlying worldviews that inform policymakers' perceptions of reality. This is consistent with the broader constructivist argument that social factors assign connotation to physical things (see, for example, Ruggie 1998; Wendt 1999 and Lebow 2009). Thus in relation to climate politics, material variables will only have their predicted effects over emissions when policymakers subscribe to the same assumptions of the theoretical approach that is doing the prescribing. Crucially, this framework could help illuminate why some countries with similar material interests exhibit different levels of emissions reduction and, inversely, why others that have attained remarkably different levels of socio-economic development pursue similar emissions policies.

Aims and Significance

This thesis has three aims. Theoretically, its most important contributions are to the scholarship on emissions behaviour. This thesis opens up a new avenue of investigation into the role of cognitive factors (specifically worldviews) and their interaction with mainstream, instrumentalist variables in shaping emissions behaviour. Taking issue with the widely held, yet rarely acknowledged, assumption that economic, social, political and environmental factors automatically shape foreign policy, it is a vital first step towards identifying the facilitating conditions under which the leading explanations of emissions trends hold. By demonstrating that theoretical worldviews could play a role in switching on and off the mainstream drivers behind emissions behaviour, this thesis also provides a coherent framework for bringing together and balancing the leading explanations in the field.

The research is also relevant to cooperation dilemmas beyond international climate politics. If it is indeed found that policymakers' worldviews play a role in shaping emissions behaviour, then it is possible that other issue-areas where environmental (and potentially other forms of) regulation is lacking may also be beset by conflicting beliefs rather than (only) insufficient material incentives. Conversely, more successful cases of international cooperation may be facilitated by compatible worldviews – in addition to, of course, conducive material circumstances.

This thesis also adds to the empirical constructivist research programme in IR. Owing to its (social) ontological focus, most constructivist scholarship is more theoretical than empirical (Finnemore and Sikkink 2001). Constructivist research that does engage in empirical analysis relies mainly on discursive evidence, rather than physical actions, to support its claims of ideational causality. By combining worldviews and problem representations with multilevel modelling, this thesis is a novel application of constructivism, which studies the effects of ideas over physical acts of emissions behaviour. The proposed interaction between instrumental and cognitive factors (theoretical-worldviews) also comprises a novel interpretation of the intersubjectivity assumption, which claims that world politics is simultaneously shaped by material and ideational factors. Many regard intersubjectivity as the defining feature of constructivism.[13] Yet despite its fundamental place in this theoretical tradition, the assumption is rarely tested empirically.[14] Hence this thesis also adds to this research agenda.

The thesis also makes two core methodological contributions. First, it goes beyond existing quantitative studies on emissions trends by employing multilevel modelling to arrive at more sophisticated conclusions about the drivers of emissions behaviour. Most quantitative research in the field relies on single-level regression (see, for example, Dolsak 2001; von Stein 2008; Battig and Bernauer 2009 and Bernauer and Bohmelt 2013). These studies treat observations of emissions behaviour as independent cases. Yet, as demonstrated in chapter four, observations from the same country or supranational region are likely to be correlated, thus raising the risk of committing the type I error. As I later elaborate, a major advantage of the three-level model that I devise in chapter four is that it estimates a unique regression equation for each country and region, which allows independent variables to have different effects on different countries and regions. Ultimately, this approach arrives at more sophisticated conclusions about the drivers behind emissions, while accounting for country and regional clustering.

[13] See, for example, Kratochwil (1989), Hopf (1998), Ruggie (1998), Wendt (1999), Checkel (2001), Finnemore and Sikkink (2001) and Fierke (2010).
[14] Checkel (2001) is a valuable exception to this.

Second, by devising a quantitative approach to investigate the behavioural effects of worldviews, this thesis also makes a methodological contribution to the cognitive research agenda in IR. Owing to its (ideational) subject matter, most cognitive research is qualitative in nature. An exception to this is Operational Code Analysis (OCA), which looks for word frequencies and patterns to infer policymakers' worldviews.[15] Yet OCA does not deal explicitly with the *physical* behavioural effects of worldviews over foreign policy. Instead, most scholars only include in their sample empirical events that (appear to) corroborate their claims of ideational causality. Although these correlations are indeed plausible, without sampling large datasets which leave open the possibility for including observations that contradict the claim of ideational causality, such inferences are highly vulnerable to bias. I attempt to overcome this problem by devising a quantitative approach that allows me to test the tangible effects of worldviews over compliance behaviour across a large dataset spanning 3,375 observations. Because quantitative analysis lends well to analysing large volumes of data, it provides a relatively efficient means for testing the policy effects of multiple variables against entire data sets – including observations that could refute my claim - rather than scrolling through and cherry-picking evidence to support my hypotheses. Another advantage of large-N analysis is that it allows me to access and compare, in a transparent and easily replicable manner, the levels of influence that different worldviews have had over emissions trends across multiple

[15] See, for example, e.g. George (1969), Holsti (1970), Hall (1990), Shimko (1992) and Renshon (2008).

countries, supranational regions and years. Finding evidence that worldviews are active in diverse spatial and temporal contexts would demonstrate my hypothesis more conclusively than in-depth qualitative analysis of a small number of case studies. Using quantitative methods to test the effects of economic, social, political and environmental factors and worldviews over emissions makes it possible to establish statistically which (if any) explanation is the strongest and by what degree. Crucially, this approach ensures that the research allows for its primary claim – ideational causality - to be falsified, which also reduces the possibility of committing the type I error.

Perhaps the most significant contribution of this thesis, however, is empirical. A better understanding of the drivers behind emissions trends with the KP would have direct implications for the multilateral climate negotiations. One decade ago, Joanna Depledge (2006:19) described compliance with emissions targets as ‘the greatest single factor that would help revitalise the 15-year old climate change negotiations’. The recent wave of withdrawals from the KP, low number of signatories to the Doha Amendment and continued reluctance of most countries to undertake legally binding emissions targets as demonstrated by the Paris Agreement suggest that this argument is equally, if not more, valid today. What began as an exceptional act of non-compliance by the US has spilled over into other countries and now threatens to undermine the entire regime-building process. Moreover, the overwhelming reason that these countries - and others - are giving for abstaining from the KP is that some major emitters are not undertaking domestic emissions reductions. This state of affairs is evident in expert commentaries of the post-Kyoto negotiations:

> '... the European Union is willing to consider a second commitment period only as part of a comprehensive framework including the United States and China. The United States is unwilling to accept a new legal agreement unless it includes new commitments of the same legal character by all of the world's major economies... And China seems unwilling to accept any legal commitment to limit its emissions, no matter how differentiated. The gridlock can be relieved only if one or more parties back out of their current positions [by committing to effective emissions reductions].'[16]

This thesis injects new life into the research on emissions trends. If it is indeed found that worldviews are at least partly responsible for emissions behaviour, then this would suggest the need for a different kind of remedy to the gridlock problem. Specifically, constructivist strategies like trust-building and persuasion might prove more effective than incentives and coercion at fostering agreement on mitigation commitments across opposite sides of the negotiating table (Checkel 2001). Building on Vogler and Imber's (1996:16) assertion that the climate problem cannot be resolved with an 'institutional bandage', I argue that cognitive approaches are worth exploring because they may provide new answers where conventional remedies have failed.

With the inability of the international community to reach agreement on a new climate treaty for the post-Kyoto era, the climate regime remains stuck in a 'legal gap period' that is devoid of any binding commitments (Bodansky 2012:1).[17] Compounding the political dilemma, there is an

[16] Daniel Bodansky (2011), Climate Change Coordinator of the US Department of State under the Clinton Administration.
[17] The 'legal gap period' began when the KP expired at the end of 2012.

upper time limit on how long this can take.[18] Thus the field, now more than ever, needs to develop a better understanding of effective emissions policy so that it can find ways to promote it.

Structure

My investigation of the drivers of emissions trends consists of three parts - a theoretical framework, empirical investigation and conclusion. The following two chapters lay out the theoretical foundations of the research by discussing the existing explanations in the field and developing a theoretical approach for the thesis. The second part consists of chapters four to eight, which entails the empirical component of the thesis. After setting up the research design in chapter four, chapters five to seven present the results of the regression models that test the core explanations of emissions behaviour that flow from the neo-realist, neo-liberal and structuralist worldviews. Building on these findings, I test my main claim - that worldviews play a role in conditioning the effects of instrumentalist factors over emissions behaviour – in the penultimate chapter. Chapter nine comprises the third section, which concludes by summarising the main findings and discussing their methodological and theoretical contributions and policy relevance.

The aim of the next chapter is to develop a clear understanding of what emissions behaviour entails and review how it has been explained in the literature. Drawing on the scholarship on international compliance more broadly as well as the climate politics literature, I consider the relationship

[18] According to the IPCC (2013), emissions must peak within the next ten years and steeply decline thereafter.

between emissions behaviour and two related terms – mitigation and compliance with the climate regime.

The second half of chapter two identifies the leading approaches that scholars have taken to explain emissions trends. As discussed above, most of these explanations can be associated with four causal drivers – namely: economic, social, political and environmental. These approaches and the core hypotheses that they propagate constitute a focal point of my thesis: I integrate them into my own theoretical approach in chapter three and return back to them when examining the mainstream explanations in the second (empirical) part of the thesis. A key conclusion of the literature review is the need to build bridges between the different theoretical approaches and to venture out of instrumentalist theory.

The third chapter is where I develop my own theoretical approach, which traces the role played by theoretical worldviews in conditioning the effect of some of the mainstream drivers of emissions. In developing my approach, I merge together two bodies of literature. My vantage point is social constructivist theories of social constitution, which complement, rather than replace, conventional theories of material causation by exploring the role of ideational factors in facilitating instrumentalist causal processes. Building on the concepts of worldviews and problem representations from cognitive psychology, I create three ideal-typical worldviews and problem representations of climate change, which flow from the neo-realist, neo-liberal and structuralist approaches to climate politics. I argue that the assumptions which states, or the policymakers who act on their behalf, make about world politics have a direct influence over which policy priorities are deemed important enough to shape emissions behaviour. In other words, economic, social, political and environmental factors will only shape emissions behaviour if decision-makers believe that the alleged causal driver matters in world politics more broadly.

The second part of the thesis entails a methodological approach for the empirical investigation of the instrumentalist explanations of emissions trends that flow from the neo-realist neo-liberal, structuralist worldviews as well as my proposition that worldviews play a role in conditioning the effect of instrumentalist drivers and their subsequent analysis. Chapter four builds a three-level model to test the drivers of emissions trends. By demonstrating (both conceptually and statistically) that emissions behaviour is clustered across countries and supranational regions, I argue that a (quantitative) investigation of emissions needs to employ a more sophisticated approach than single-level regression, which is the method of choice in the field. To this end, I review four methodological approaches that could be used to account for clustering, ultimately deciding on multilevel modelling as the best option. I also delineate the temporal and spatial boundaries of the empirical analysis and operationalise the dependent and independent variables that were identified in chapters two and three. The last part of the chapter proposes a three-level model to explain emissions behaviour, which is gradually built up over a series of four successive models, starting with the simplest single-level multivariate regression and ending with a random coefficient model with interaction effects. These models provide the blueprint for the empirical analyses that follow.

As discussed in chapter four, I devote a separate chapter to investigate the core hypotheses that flow from each of the proposed worldviews. Thus chapter five entails an empirical investigation of the influence of neo-realist inspired drivers of emissions. I use relative power, fossil fuel dependency and reciprocity as proxies for relative gains associated with emissions reduction. In accordance with neo-realist expectations, powerful countries tend to engage in less emissions reduction because they are better equipped to unilaterally defend themselves against climate change without the need for global mitigation. I also find that when dependency on fossil fuels is high, as in OPEC or CACAM, then increasing dependency inhibits emissions reduction. However, for most countries, dependency levels are not so high, and increases in fossil fuel dependency are (unexpectedly) associated with more emissions reduction. One explanation, which is explored further in chapter five, is the marginal efficiency gains hypothesis; that when the relative mitigation costs associated with fossil fuel dependency are manageable, switching from high to low carbon activity also creates marginal efficiency benefits, which (apparently) outweigh the relative costs of transitioning away from carbon intensive production. Also contrary to neo-realist expectations, the promise of reciprocal commitments does not appear to be correlated with larger emissions reductions. On average, annex countries, which do not have the assurance of reciprocal commitments under the KP, exhibit greater emissions reductions than non-annex parties.

Chapter six investigates the effects of neo-liberal predictors on emissions trends. As proxies for domestic mitigation costs, I focus on national participation in international environmental agreements, reputational costs and democracy levels. The three main findings of this chapter run against neo-liberal intuition: First, once we account for the hierarchical structure of emissions behaviour, international institutions do not appear to affect emissions levels. Second, the reputational costs associated with increasing emissions activity do not boost emissions reduction, except for in the largest emitters. Third, once we account for clustering, democracy has a negative effect on emissions reduction. Chapter six discusses two possible explanations for this unexpected finding: first, the (long) time it takes for the benefits of effective climate policy to materialise gives democratically elected decision-makers less incentive to comply with the climate regime. Second, the more open political environment also creates more opportunities for anti-environmentalists to express their opposition towards emissions cuts.

Chapter seven examines the effects of structuralist predictors on emissions trends. As proxies for transnational class interests, I focus on class status, economic power [19] and the diversification of the export sector. In accordance with structuralist intuition, core countries are, apparently due to the inherent core bias in the climate regime, more compliant than periphery states. Contrary to expectations, I find that economic power tends to inhibit emissions reduction. The inhibitory effect

[19] As discussed in chapters two and three, economic power denotes the position of the country in the world economy. For various reasons, which are elaborated in chapter four, I operationalise economic power as GDP.

is strongest in the poorest countries, which suggests that the countervailing pressures for economic growth (and more emissions activity) trump the increased mitigative capacity that is created by economic growth. Another unexpected finding is that export diversification tends to inhibit emissions reduction, especially when export diversity is low to begin with. A possible explanation for this unexpected finding, which is considered in chapter seven, is that more diverse export sectors tend to be dominated by strong business interests, which are able to pressure their governments into safeguarding existing emissions activities. The changing roles of economic growth and export diversification on emissions reduction across different levels of development cohere with the environmental Kuznets literature, which predicts declining emissions levels only kick-in after a certain level of economic development has been attained.

Chapter eight is where I test my own claim that worldviews play a role in shaping the effects of instrumentalist drivers over emissions behaviour. To do this, I model the alleged conditioning effect of worldviews over the corresponding instrumentalist drivers as interaction effects. Specifically, I introduce several interaction terms (namely: neo-realism and relative gains, neo-liberalism and domestic cost-benefit ratios and structuralism and transnational class interests) to the random coefficient models from chapters five to seven. I find that two out of the five interaction terms investigated in the chapter have their alleged conditioning effects: First, increasing the level of democracy has a weak inhibitory effect on emissions reduction in countries that perceive the world from a neo-liberal (in the worldview sense of the term) perspective. Conversely, democratization strongly inhibits emissions reduction in countries that do not subscribe to neo-liberalism. Second, also in accordance with my worldviews approach, a structuralist mind-set makes countries less willing to reduce domestic emissions as they undergo economic development. By the same token, non-structuralist countries tend to better at reconciling economic growth with environmental protection, and consequently go onto engage in higher levels of emissions reduction as their economies develop. Although these findings offer some support for my claim, worldviews are not found to be a source of heterogeneity in the other three instrumentalist drivers that were found to have significant random effects (namely: fossil fuel dependency, reputational cost and export diversity).

The last part concludes by discussing the most important findings of the thesis, evaluating their robustness and drawing out the main contributions to the literature and policy relevance. The results of the empirical part generate three core findings: first, relative gains, domestic cost-benefit ratios and transnational class interests do indeed play a significant role in shaping emissions trends. Second, quantitative work in the field needs to take into account the clustered nature of emissions behaviour as the results of the multilevel models illustrate that single-level analysis can often generate misleading results. Third, at least some of the time, worldviews play a critical role in determining the influence that instrumentalist factors have over emissions behaviour in different countries.

The conclusion suggests that most of the results are unlikely to be affected by endogeneity. Moreover, four out of the five most influential drivers of compliance continue to be statistically significant and operate in the same direction after they are incorporated into a 'grand' random intercept model that spans the three theoretical approaches in the field. Also, most of the variables also demonstrate construct validity, although some concerns exist over reputational cost and economic power.

The chapter concludes by reflecting on the main contributions of the thesis. Theoretically, the results of this thesis arrive at more sophisticated explanations of the drivers behind emissions behaviour, particularly by disaggregating the effects of instrumentalist factors on different countries. Methodologically, the results of the multilevel models highlight the need for quantitative work in the field to move beyond single-level regression by modelling the hierarchical structure of emissions behaviour. While reaffirming the centrality of instrumentalist factors over emissions, the results of the random coefficient model suggest to policymakers their effects differ across countries and therefore need to be understood within the national context. Furthermore, the critical role played by worldviews in conditioning the effect of instrumentalist drivers suggests that ideational factors are also an integral part of the obstacles to, and potential solutions for, international environmental cooperation.

Chapter 2: Explanations of Emissions Trends

Introduction

What are the driving factors behind national emissions levels? This question is the subject of much debate amongst economists and political scientists working in the field of climate politics. Broadly, scholars have attributed emissions behaviour to four main drivers. One group of scholars singles out economic factors such as production scales, input and output mixes and technology as the driving force behind emissions behaviour. Others emphasise the role of social factors such as policy preferences, environmental awareness and demographic trends. Another perspective contends that countries' emissions levels are primarily shaped by political variables such as the domestic regime type, institutional capacity and international pressure for effective climate policy. A fourth approach asserts that environmental vulnerability plays a critical role in shaping emissions behaviour by influencing the willingness of a country to curb emissions.

The main objective of this chapter is to take stock of the leading explanations that scholars have proposed to account for national emissions levels. To this end, I group together compatible explanations which emphasise the same variable as the primary driver behind emissions trends. Specifically, I propose that the most prominent explanations can be categorised as economic, social, political and environmental approaches to the emissions question. Although these appellations are not used by authors themselves, most scholars working in the field do acknowledge the existence of these different approaches, albeit under a different nomenclature.[20]

While these approaches provide a valuable insight into the various drivers behind emissions trends, I contend that they also suffer from various shortcomings. In particular, I focus on two of the most important explanatory limitations, which I then try to address in the remainder of the thesis. First, most explanations assume that the aforementioned drivers have uniform effects on emissions trends.[21] Yet recent studies show that the influence of at least some of these drivers varies significantly between different countries and regions (e.g., Beck and Joshi 2015; Farzin and Bond 2006; Orubi and Omotor 2007; Sharma 2011; Sulemana et al. 2016; He 2007).[22] Second, to my knowledge, all of the leading explanations of emissions prioritise tangible, instrumental factors and afford little attention to the role of cognitive factors in shaping emissions. I argue that this creates a large explanatory hole as cognitive factors might explain why some drivers are more influential over emissions behaviour in certain countries and regions than in others. In the next chapter, I argue that ideational factors (specifically, countries' worldviews) play a critical role in accounting for some of this

[20] For example, in his comprehensive review of the emissions literature, Stern (2004:1421) distinguishes between economic explanations, which he refers to as 'proximate causes', and social, political and environmental explanations, which he groups together as 'underlying variables'.
[21] This is also true for explanations that allow for a driver to have varying effects across different levels of the alleged driver (for example, the environmental Kuznets curve discussed below) as in such cases, the (varying) effect is assumed to be the same for all countries and regions.
[22] In chapter four, where I set out the research design of the thesis, I set-up a random coefficient model to allow for the effects of emissions drivers to vary between countries and regions.

heterogeneity by determining the level and direction of influence that some of these mainstream factors have over emissions behaviour in specific countries and regions.

This chapter consists of three parts. I begin by delimiting the boundaries of the review by defining the dependent variable under investigation – emissions trends – and discussing how it differs from two related, but distinct, concepts – namely: compliance and mitigation. In the second section, I turn to the core focus of the chapter – the mainstream explanations of emissions trends. Here I set out and critically evaluate the leading explanations that dominate the field by discussing the main arguments and limitations of economic, social, political and environmental explanations of emissions. The third section draws some conclusions from this review, reflects on systematic problems in the existing explanations and suggests potential directions for future research. In doing so, it also highlights the potential contributions of this thesis.

The Dependent Variable: Emissions Trends

In this section, I begin by defining the dependent variable under investigation and present the rationale for focusing on emissions trends. I then move on to address some potential misconceptions which could hinder our discussion of explanatory approaches. Specifically, although emissions trends have important implications for compliance with the climate regime and mitigation policy, I argue that they should not be regarded as synonymous. There are important differences between the terms and the core focus of this thesis is specifically on the former.

This thesis seeks to enrich our understanding of countries' roles in causing and mitigating climate change by looking at their emission of greenhouse gases, which collectively comprises the main anthropogenic source of global warming. The focus is on national emissions reduction, which, in the context of this thesis, amounts to a country's annual level of CO2 emissions relative to a base-year.[23] CO2 is an appropriate focal point because it is widely recognised as the worst offender and therefore has important implications for the international regulation of emissions and effectiveness of the global climate regime. Indeed, consistent with this point, the KP only entered into force after it was signed by 55 parties to the UNFCCC that account for 55 percent of CO2 emissions produced by industrialised countries in 1990.[24] Furthermore, as discussed in chapter four, there are also important methodological reasons for focusing on CO2 levels, for example, because it is the greenhouse gas for which the most comprehensive data is available. Thus the dependent variable under investigation in this thesis is countries' CO2 emissions trends.[25]

Having established the dependent variable, it is important to delimit the explanatory focus further by ruling out some common misconceptions which could potentially hinder our discussion. Specifically, although emissions trends have important implications for compliance with the climate regime and mitigation, the terms are by no means synonymous.

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[23] Full details of the operationalisation of the dependent variable and justification for the 1990 base year are given in chapter four.
[24] This is stated in article 25 of the KP (1998).
[25] Throughout this thesis, I employ the terms 'behaviour', 'trends' and 'trajectories' interchangeably.

Moreover, as the following paragraphs illustrate, the conclusions that are drawn from an investigation of the former may not extend to the latter. Since compliance with the climate regime is a more ambiguous concept than mitigation, I spend some more time defining the concept before discussing its relationship with emissions trends.

There is no universal agreement on what compliance with the climate regime actually entails. Oran Young's (1979) ground-breaking work on compliance with world authorities provides a useful starting point for our discussion: 'Compliance can be said to occur when the actual behaviour of a given subject conforms to prescribed behaviour, and non-compliance or violation occurs when actual behaviour departs significantly from prescribed behaviour'. Given that my current interest is compliance in the climate arena, the prescribed behaviour to which states should conform is enshrined in the founding documents of the climate regime - the UNFCCC and KP. Therefore, in the context of this discussion, compliance occurs when a country acts in accordance with the norms and its assigned commitments under the climate regime and non-compliance occurs when it diverges from them.

But *what does compliance with the climate regime actually look like and how can we measure it?* At what point is a state regarded to comply with the climate regime? Is it when she signs and ratifies the KP, adopts national legislation in harmony with the climate regime, invests resources in meeting her international commitments or actually achieves a specified reduction in domestic emissions levels? Merely citing these questions illustrates the ambiguity of the compliance concept and limitations of using a single proxy to measure it. Since the majority of work in the field is more concerned with explaining compliance rather than defining it, most authors do not provide an explicit definition of compliance behaviour. Unfortunately, despite the clear need for a more sophisticated approach, most research on compliance with the climate regime equates international climate cooperation with the signing or ratification of the KP. However, a small number of authors (e.g. Dolsak 2001; Bernauer and Bohmelt 2013; von Stein 2008; Battig and Bernauer 2009) have made a valuable contribution to the way that we operationalise and measure compliance with the climate regime. Building on these works, I propose that it is possible to conceptualise (non)compliance behaviour as a state's willingness to: (a) commit to and (b) implement the KP. Commitment consists of discursive and diplomatic acts that demonstrate a country's intention to conform to the climate regime. Implementation, on the other hand, denotes stronger acts of compliance behaviour that involve the investment of physical resources into fulfilling the UNFCCC and KP. The specific indicators that I propose to measure commitment and implementation are listed in table one.

As a first step, public opinion, the take of the media and public debates between members of the legislature can provide a valuable insight into a nation's *willingness to commit* to the climate regime. Yet these sources are, of course, only expressions of intent and, as far as discourse is vulnerable to distortion and manipulation, one should not read too much into them without considering whether they have been carried through to implementation (Schmidt 2008; Larson 1988). As such, public expressions of intent to commit make up the weakest pillar of compliance behaviour. The next two indicators are the signing and ratification of the KP, although, as I argue below, these indicators are also not always carried through to implementation and therefore, do not go much further than discursive expressions.

Implementation, on the other hand, denotes stronger, physical acts of conformity with the climate regime. The most basic level of implementation is preparing and submitting the necessary documents (e.g. reports, inventories and action plans) which are stipulated by the climate regime. A stronger indicator is the harmonisation of national legislation in accordance with international commitments under the KP. The penultimate indicator is investing financial resources in climate governance, whether this be in the domestic sphere or international climate funds to assist other countries in complying. The strongest compliance act is an actual observed reduction in national emissions levels, ideally to the extent stipulated by the climate regime.

Compliance behaviour:
(a) Commitment:
1. Public expression
2. Signing
3. Ratification
(b) Implementation:
4. Monitoring and reporting
5. Harmonising national legislation
6. Financial investment in climate regime
7. Observed reduction in national emissions levels

Table 1.1: Indicators of compliance behaviour with the climate regime

While the hierarchy between these acts means that they can be treated as ordinal categories for measuring a state's level of compliance with the climate regime as a whole, it is also possible to differentiate between different degrees of compliance within the same compliance act.[26] If this latter approach is taken, then emissions trends – the dependent variable of this thesis – also appears to be a good indicator of compliance with the climate regime. A fall in a country's emissions is consistent with the aim of the KP to reduce global emissions, which is indicative of compliance. Larger emissions reductions should be indicative of stronger compliance than smaller emissions cuts. Emissions rises, on the other hand, contradict the KP's mitigative aims and can therefore be construed as deviation from the regime.

Yet there are several problems with this approach which suggest that emissions trends may not be as good an indicator of compliance with the climate regime as first expected. First, only annex parties are assigned emissions targets under (annex B of) the KP, which means that emissions commitments are only binding for this subset of (65) industrialized countries. In other words, declining emissions levels do not imply compliance - and nor do emissions rises deviation – for 153 non-annex parties which are not bound by emissions targets under the KP. This issue can be overcome by restricting the sample of the emissions-compliance investigation to annex parties. However, as discussed in chapter four, this option is not plausible in the context of this thesis as the

[26] Of course, this is not possible for signing and ratification as these are binary acts.

three-level multilevel approach employed in the empirical chapters requires a larger sample size.[27]

A second more serious problem with treating emissions levels as indicative of compliance is that parties can also meet their emissions targets in ways other than regulating domestic emissions levels. Specifically, the KP permits annex parties to make use of three ‘flexible mechanisms’ to meet part of their annex B targets abroad. Emissions trading allows annex parties to trade emissions credits with each other, so developed countries can meet their Kyoto targets by purchasing the credit for ‘excess’ emissions reductions that have been attained by other developed countries. Developed countries can also claim towards emissions targets through joint implementation, whereby it funds and claims emissions credits for emissions-reducing-projects in other developed countries. Lastly, and more controversially, the clean development mechanism allows developed countries to also fund emissions-reducing-projects in developing countries and count the resulting emissions credits towards their own Kyoto targets. Hence, without factoring in these additional mechanisms that are available for annex parties to meet their emissions targets under the KP, emissions trends are likely to be a poor indicator of compliance with the climate regime, even when it is narrowly defined as emissions behaviour.

[27] Since this is a methodological issue, it is discussed more comprehensively in chapter four, the research design chapter. Yet at this point, it worth noting that even with this smaller sample, emissions cuts do not necessarily imply compliance and rises deviation as Kyoto targets allow some countries to increase emissions levels while countries with reduction targets are not required to reduce by the same magnitude. In chapter four I propose a solution to this problem that involves calculating a country’s deviation from the target.

I now briefly consider the second related concept – namely: mitigation. As with compliance, although emissions trends have important implications for mitigation, the terms are not synonymous. Mitigation consists of policies that are designed specifically for the purpose of emissions reduction. Thus, mitigative acts are intentional. Emissions trends, on the other hand, are the outcome of both intentional and non-intentional behaviour. For example, emissions might fall as a result of productivity changes or technological advances which are designed to increase efficiency and profitability rather than reduce environmental impact. These types of emissions will show up as lower emissions trajectories, but do not indicate a rise in mitigation.[28] Therefore, in light of these caveats, the primarily focus of this thesis is on emissions trends.

Explaining Emissions Trends

In this section, I discuss the leading explanations that scholars have leveraged to explain emissions trends. As mentioned in the introduction to this chapter, I group together the compatible explanations that attribute emissions behaviour to the same type of driving factor, resulting in four broad approaches – namely: economic, social, political and environmental. I do not assume that these explanatory variables are mutually exclusive, conflicting or entirely independent from one another. On the contrary, and as demonstrated at various points in the following paragraphs, most of the explanations covered under the different headings are compatible and could, therefore, enrich each other. For example, the environmental Kuznets curve that is reviewed under the

[28] At best, declining emissions levels could represent increasing compatibility with mitigation.

economic literature asserts that economic development initially increases a country's emissions before eventually resulting in lower emissions after a certain level of development has been attained. While the explanations reviewed under the heading economic approaches attribute this bell shape relationship to economic factors, the changing preferences hypothesis that is posited by proponents of social approaches demonstrates how changing perceptions of priorities which accompany socio-economic development can give rise to the Kuznets curve in emissions trends.

In this review, I make no attempt to prioritise one set of explanations over another, but merely use the labels as pragmatic analytical constructs for navigating through the various explanations that dominate the field. I also flesh out the main hypotheses that arise from each approach, which I then draw on when developing my own theoretical approach in chapter three. [29] I conclude the chapter by reflecting on the systematic weaknesses that permeate all of the major explanatory approaches.

Economic Explanations

The economic approach towards emissions trends is the most dominant out of all the mainstream approaches. Most of its proponents take their cue from Grossman and Krueger's (1991) pioneering work on NAFTA impacts which found that the adverse effect of economic development on the environment follows an inverted U-shaped path. This bell shaped relationship between environmental impact and economic development has come to be known as the environmental Kuznets curve (EKC).

[29] These hypotheses are summarised in table 2.2.

According to this approach, at low levels of economic development, development increases the level of CO_2 emitted to the atmosphere. Yet after a certain level of development has been attained[30], further bouts of development begin to be associated with lower emissions levels.

As it stands, the EKC is not an explanation of emissions behavior, but rather, a description of the changing impact of development on emissions levels. Broadly, economists have attributed the bell shaped relationship between development and emissions to four economic factors, which I categorise together as 'economic' explanations.

First, there is the economies of pollution argument, which asserts that emissions regulation becomes easier to enforce on a larger scale, thus rendering mitigation policy more feasible in bigger, more advanced economies (Andreoni and Levinson 2001). As discussed above, stronger mitigation is likely to trickle down into emission behavior, resulting in lower emissions at high levels of development. The economies of scale of pollution argument leads to our first prediction about emissions trends:

Hypothesis 1: larger economies are more likely to have lower emissions levels than smaller economies because the former have the advantage of economies of scale that make it easier to regulate emissions at high scales of production.

Second, some economists contend that the changing effect of development on emissions arises from changes in the output mix which occur over the process of industrialization. During the heydays of industrialization, emissions initially soar as economies transition from

[30] This is sometimes referred to as the 'turning point' (e.g., Stern and Common 2001; Perman and Stern 2003; Sulemana et al. 2016).

agriculture to resource intensive industries. Eventually, this upward pressure on emissions subsides as medium-developed economies begin shifting to lighter industries that are less dependent on emissions producing activities such as services (Stern 2004). As considered under social approaches, this shift to lighter industries is often accompanied by higher public demand for effective environmental policy and emissions regulation (see, for example, Friedl and Getzner 2003).[31] This leads to our second hypothesis:

Hypothesis 2: advanced economies are more likely to have lower emissions than less advanced economies because the former tends to have a lower carbon output mix than the latter.

A related argument upholds that changes in the input mix are responsible for declining emissions at high levels of development. According to this perspective, developed economies naturally substitute high emissions inputs like coal and high sulphur coal with low emissions inputs such as natural gas and low sulphur coal (Stern 2004). Again, this substitution process in the input mix is likely to be encouraged by increasing public awareness of climate change. Thus our third hypothesis is that:

Hypothesis 3: advanced economies are more likely to have lower emissions than less advanced economies because the former tends to have a lower carbon input mix than the former.

Lastly, economists also attribute emissions trends to technological advancements which are thought to accompany the process of economic development. Advances in technology tend to increase productivity,

[31] As discussed in the next chapter, this proposition is also compatible with (Marxist inspired) structuralist approaches which contend that developing countries have a right to emit high levels of greenhouse gases as they are latecomers to the industrialization process.

thereby resulting in lower emissions (Grossman 1995; Stern et al. 1996; Stern 2004). Technologically induced reductions in emissions levels may be the result of changes in total productivity, which lowers the amount of emissions per unit of output even though this may not necessarily be an intended outcome. On the other hand, emissions reductions may also arise from the use of new technologies that are designed to reduce emissions such as renewable energy sources.[32] Regardless of the intention, technologically-induced productivity gains should result in lower emissions, giving rise to our fourth hypothesis:

Hypothesis 4: countries that can access advanced technology are more likely to have lower emissions than countries without technology as the former can benefit from productivity gains.

However, as is the case for all of the leading explanations, some of the predictions that flow from the economic-based approach are disputed by empirical results. In particular, scholars who employ more sophisticated emissions models which go beyond simple multivariate regression have found evidence that the EKC shaped emissions-development relationship is not universally valid. For example, Freidl and Getzner (2003) find that once observations of emissions are limited to the same country (in their case, Austria), economic growth results in higher, rather than lower, emissions. Martinez and Morancho (2004) find that the proposed EKC relationship for CO2 emissions varies significantly between different countries and regions, suggesting that the relationship can be misleading in many contexts. Others argue that the effect of economic development on emissions is better described as an ‘n’ curve

[32] It is recalled that the latter type of intentional policy is mitigation.

because emissions usually begin to increase again after high levels of development (e.g., Galeotti 2007; Musolesi and Mazzanti 2010; Beck and Joshi 2015). More concerning for the EKC approach, some scholars conclude that the EKC does not exist at all for greenhouse gas emissions (e.g.,Galeotti 2007; Dijkgraaf and Vollebergh 2005). This position is often premised on the argument that EKC does not apply to climate change because the transboundary distribution of emissions weakens government resolve to regulate emissions (Beck and Joshi 2015; Carson 2010; Torras and Boyce 1998).

Social Explanations

Another group of scholars argues that emissions trends are governed by social factors. This approach is comprised by three main explanations. First, there is the proposition that policy preferences are the driving force behind emissions behaviour. People who live in vulnerable countries with weak economies have a different set of priorities and policy goals than inhabitants of stronger, wealthier countries. Crucially, the former must deal with a host of pressing issues like poverty eradication, disease control and securing basic living standards, which casts environmental concerns like climate control as a secondary concern. As Bruneau and Echevarria (2009) put it, 'the poor are too poor to be green'.[33] In developing countries, the demand for catching up with Northern living standards causes emissions to soar until a certain level of socio-economic development has been attained (Lieb 2001). While this may appear to be an economic argument, it is important to note that the driving

[33] This perspective is also consistent with the structuralist scholarship that is reviewed in the next chapter.

force is the demand for social, rather than economic, development. The demand for social development, which inhibits developing countries from adopting effective mitigation policy, subsides after the majority of the general public graduates from poverty to 'well to do lifestyles' (Hubacek et al. 2007). Thus emissions are the outcome of *social* needs, which are facilitated through economic development. The logical inference to be drawn from this line of argument is that after an acceptable level of socio-economic development has been attained and pressing social needs catered for, the trade-off between environment and development evens out and emissions control becomes a more viable policy (Portney 2000). This logic underlies our first social hypothesis:

Hypothesis 1: Countries with high living standards are more likely to have lower emissions than countries with low living standards because the most pressing social needs have been met in the former, creating higher demand for effective emissions policy.

Yet some have found that even after adequate living standards have been attained, policy preferences may not shift in favour of the environment. Torras and Boyce (1998), for example, find that better living standards are associated with more consumption, demand for luxury goods and higher emissions. If this is the case, then social development should have a positive effect on emissions across all levels of social development.[34]

A second social explanation contents that awareness of environmental issues such as climate change is likely to result in higher demand for

[34] In other words, the social development-emissions relationship will not resemble a bell shaped curve.

effective climate policy and thus play an influential role in curbing emissions (Bostrom et al. 1994; Dunlap 1998). Of course, the influence of the public (over policymaking and, in particular, emissions policy, is contingent on other variables like the openness of public institutions and the influence of other competing interests like energy lobbies (Farzin and Bond 2006), some of which are explored below under the section of political explanations. My aim at this point in the discussion to theorise the possibility that higher social awareness of environmental problems might translate into more effective climate policy and lower emissions. Inversely, a less informed public (for example, that is less exposed to media coverage of environmental issues and possesses low levels of environmental education) should presumably place less value on and be less supportive of mitigation policies (Brody et al. 2008; Sampei and Aoyagi-Usui 009). This leads to our second social hypothesis:

Hypothesis 2: Countries with high environmental awareness should have lower emissions than countries with low awareness as better informed publics in the former are more likely to support emissions cuts.

Yet environmental awareness might not necessarily be the highest where one might expect. While there are obvious reasons for expecting publics in more affluent regions of the world to be better informed (e.g. better education, free media coverage of contested issues like climate change) and, therefore, more supportive of climate policy, some have found that this is not the case. As discussed below under environmental explanations, countries that are more exposed to climate change often have higher risk perceptions than less vulnerable countries in the geopolitical North (Brody et al. 1998), which might serve as a catalyst for effective climate policy.[35] Indeed, Stern (2004) finds that many environmental standards in developing countries are as high as in developed countries. Furthermore, they are often implemented with shorter time-lags. If these arguments apply to the realm of climate change, then developing countries, which are typically located in high vulnerability regions of the world, should be more environmentally conscious and supportive of government efforts to restrict emissions.

Another popular social explanation attributes emissions behaviour to demographic trends. Population growth increases the demand for economic activity (e.g. electricity, consumer goods), thereby putting more pressure on environmental resources such as carbon inputs (Fan et al. 2006; Dietz and Rosa 1997; Bongaarts 1992; O'Neill et al. 2010; Dalton et al. 2008).

Hypothesis 3: Countries with smaller populations and slower population growth rates should have lower emissions than countries with bigger populations and higher growth rates because of the lower demand for emissions producing activity in the former.

Political Explanations

Political scientists in the field have proposed three main explanations to account for emissions behaviour. The most popular is the democracy argument, which proposes that democracy has a positive effect on mitigation policy and, therefore, is associated with lower emissions. Why might democracy promote emissions reduction? First, democracies are meant to put higher value on human and needs and quality of life,

[35] While there is a vibrant collection of work exploring the effect of risk perception on public support for climate policy (e.g., Brody 2003; Brody et al. 2008; Tierney et al. 2001; Correia et al. 1998), to my knowledge, no such works have evaluated empirically whether the effects of risk perception are carried through to shape emissions trends.

including environmental goals such as clean air and a safe climate (Burnell 2012; Bernauer 2009; Farzin and Bond 2006). Democratic governments, for their part, are more sensitive to these demands and generally better at providing public goods than authoritarian regimes - not least because the median voter in democracies incurs lower opportunity costs from environmental protection than the median member of a ruling elite in a non-democracy (Battig and Bernauer 2009). Third, regular political elections ensure that democratically elected politicians are held accountable to public demand for effective climate policy (Neumayer 2002; Roberts et al. 2004). When combined with a more liberal political environment, which is conducive for concerned citizens to express and champion their environmental woes (for example, by forming civil society groups and NGOs), democratic influence leads to our first political hypothesis:

Hypothesis 1: Democracies should be more likely to engage in emissions reduction than non-democracies because publics in the former are more likely to voice demands for effective climate policy and their governments more likely to listen.

Yet some empirical investigations suggest that democracy might unexpectedly be conducive to higher, rather than lower, emissions levels. Held and Harvey (2011), for example, find that the positive link between democracy and mitigation is weaker than expected. Li and Reuveney (2006) show that the emissions-lowering effect of democratization is only weak in the short-run, but intensifies in the long-run. More concerning for the democracy hypothesis, Battig and Bernauer (2009) find that although democracies tend to demonstrate more (political) commitment to mitigation (e.g. by ratifying international climate agreements), they usually go onto implement smaller emissions reductions than non-democracies. They propose that this unexpected finding might be due to the unwillingness of democracies to restrict individual freedom of movement in the transport sector, which is where the majority of emissions cuts must come from. Farzin and Bond (2006) assert that a host of other factors such as underlying societal preferences, age distribution, environmental awareness and income equality play a role in determining the effect that democracy has on emissions in a given country.

Another strand of political approaches emphasises the role of domestic political institutions in shaping emissions trends. Specifically, countries with stronger domestic institutions are believed to find it easier to formulate and implement environmental policy (Dinda 2004). In the context of emissions regulation, the effectiveness of the two major policy instruments – environmental legislation and market based incentives – is determined by the existence of well-functioning legislature, environmental public bodies and market institutions (Bernauer and Kobi 2009). Thus our second political hypothesis is as follows:

Hypothesis 2: Countries with stronger domestic institutions should be more likely to engage in emissions reduction because they find it easier to design and implement effective emissions policy than countries with weak institutions.

The proponents of the political approach also draw attention to the role of international institutions in creating incentives for emissions reduction. Political scientists with a legal leaning argue that the institution of international climate law has an important influence over national emissions trends. For example, the UNFCCC and KP, which comprise the foundation of the global climate regime, encourage parties to reduce emissions by regulating the costs of mitigation between countries and creating additional incentives for emissions control (Depledge 2005; Bodansky 2011,2012).[36] The KP establishes binding emissions targets for developed countries that are classed as annex parties under the climate regime, which creates international legal obligations for emissions reduction for these countries. This logic has led various scholars to predict that countries that are annex parties to the climate regime should be more willing to reduce their emissions than non-annex parties (e.g., Dolsak 2001; Thompson 2005; von Stein 2008).

Hypothesis 3: Countries that participate in binding international environmental institutions are more likely to reduce emissions than countries that do not because institutions create incentives for international environmental regulation.

This hypothesis is challenged by the important counter-argument that international institutions like the climate regime may not have any autonomous power to bring about changes in their members' emissions levels. As Simmons (1998) rightly emphasises, international agreements like the KP are the creation of state negotiation. Therefore, states set the rules (in this case, emissions responsibilities such as mitigation targets) of international regulation, implying that the order of causality is reversed. For example, states can negotiate ineffective targets to give the impression that they complying with emissions regulation or establish

[36] As elaborated under the discussion on neo-liberal institutionalist approaches in the next chapter, international climate law reduces the costs of international climate cooperation by creating means for enforcement, information sharing, transparency and reporting.

other provisions to avoid the domestic costs of mitigation. Indeed, the three flexibility mechanisms described above are often cast in such terms (Thompson 2005). If this is the case, then countries with binding emissions targets under the KP should be no more likely to decrease emissions than non-annex parties.[37]

Environmental Explanations

A fourth approach draws attention to the role of environmental factors in shaping emissions behaviour. Most of these explanations revolve around the concept of environmental vulnerability, which consists of two dimensions: (i) a country's exposure to the adverse effects of climate change and (ii) its capacity to defend itself against these adverse effects (UNEP et al. 2010).[38] According to this perspective, countries that are more vulnerable should be more willing to combat climate change (Brody et al. 2008). Since the most effective way of addressing climate change is to prevent it from occurring, this line of argument suggests that the most vulnerable countries, which are generally members of the geopolitical South such as the Least Developed Countries and Alliance of Small Island States, should be more willing to restrict emissions than less vulnerable countries in the North (Kasa et al. 2008). Indeed, empirical studies have found that exposure to environmental catastrophes has a significant positive effect on support for effective climate change policy (e.g. Brody et al. 2008; Zahran et al. 2008). However, whether or not environmental vulnerability-induced support for

[37] In chapter four, I suggest a methodological approach for overcoming this endogeneity problem.

[38] The latter is often referred to as 'adaptive' capacity.

emissions regulation actually goes on to reduce emissions levels has not been tested empirically. Thus our environmental hypothesis is as follows:

Hypothesis 1: Countries that are highly vulnerable to climate change are more likely to reduce emissions than less vulnerable countries because the former have more to gain from preventing climate change than the latter.

Systematic Problems and Directions for Future Research

While the explanations reviewed above shed light on some of the most important determinants of emissions, they are also limited by some systematic problems that cut across all four approaches. In this section, I reflect on these limitations, ultimately identifying four issues which, if addressed, could greatly enrich the field.

First, as highlighted at various points in the last section, the predictions that flow from most of the leading explanations are disputed by empirical results. Different empirical studies find different results, which sometimes supports and, at other times, contradicts the previous hypotheses. As we saw above, this is even the case for the most dominant – economic – hypothesis, alongside the social, political and environmental approaches. As the field has grown, scholars have begun to work with new datasets spanning wider temporal and geographical boundaries. Modelling techniques have also become more sophisticated, for example, by employing random effects models to evaluate whether drivers have uniform effects. These works provide strong evidence that most of the economic, social, political and environmental factors reviewed in this chapter have significantly different effects on different countries and regions (e.g., Beck and Joshi 2015; Farzin and Bond 2006; Orubi and

Omotor 2007; Sharma 2011; Sulemana et al. 2016; He 2007). Moreover, the context-dependency of emissions drivers suggests that universal conclusions spanning multiple countries and regions can often be misleading. This also has important policy ramifications as non-uniform effects suggest that the key strategies for emissions reduction (such as socio-economic development) may not always have their intended effects.

Second, most empirical studies approach the emissions puzzle from a single explanatory approach, which leads them to prioritise a certain variable or set of variables in the empirical models that they employ for hypothesis testing. While it is not possible to focus on everything and, therefore, the decision to focus on a single part of the explanatory framework serves an important methodological advantage, this means that most empirical work in the field does not subject its explanation of choice to robust tests. Excluding other putative drivers runs the risk of committing the omitted variable bias, whereby observed results (driver effects) might be significantly different if other independent variables were controlled for. Moreover, the fragmentation of the empirical work is a serious obstacle to the development of the field which could occur through the exploration of interactions between different drivers. Dolsak (2001) and Battig and Bernauer's (2009) studies of emissions trends stand out in this respect as they take measures to control for all of the leading putative drivers in their models. Dolsak's (2001) study is quite unusual in that it reviews and empirically evaluates almost all of the leading explanations in the field. Battig and Bernauer, on the other hand, are primarily interested in the effects of democracy on emissions. Despite this focal point, however, they control for all of the leading explanations in the field to guard against the omitted variable bias.

Third, and related to the last point, because most empirical work operates within a single explanatory framework, the field lacks an overarching approach for bringing together the various explanations. Even when a work does mention alternative approaches, it is usually assumed that economic factors are the most influential and relevant emissions drivers, with all other – social, political and environmental – factors having only indirect, and often ambiguous, influence.[39] Since existing empirical work has shown that all of the mainstream explanations do matter at least some of the time, an important task is to identify when each factor matters more than others and why. I expect that certain factors play a critical role in facilitating other drivers to act on emissions. For example, a more democratic political environment may allow for social preferences to have more influence on emissions policy (and outcomes) than would be possible in an authoritarian context.

Fourth, all of the mainstream explanations of emissions behaviour focus on tangible, instrumental drivers. Even when the driver is social such as, for example, social priorities and policy preferences, the explanation is instrumental as the assumption is that emissions policy is designed to cater for public demand (and presumably avoid the negative politico-social costs associated with policy that is insensitive to public demand).

[39] Even Stern (2004) takes this approach in one of the most comprehensive reviews of the field.

Yet instrumental decision making is always conducted within a cognitive framework that consists of normative and positive beliefs. Moreover, as discussed in the next chapter, material factors like economic, social, political and environmental interests only matter in climate policymaking because of the value and connotation that policymakers ascribe to them (Hulme 2009).

This is not an entirely foreign argument to the field of emissions trends. As mentioned above, there is a vibrant literature on the relationship between risk perception and climate policy – the dominant argument being that countries with higher risk perceptions are more willing to undertake emissions cuts in the name of preventing climate change (e.g. Brody et al. 2008; Sampei and Aoyagi-Usui 2009 Brody 2003; Tierney et al. 2001; Correia et al. 1998). Others working within the constructivist IR tradition draw attention to the role of ideas, values and beliefs in shaping public support for mitigation policy (e.g. Pettenger 2007; Terhalle and Depledge 2013; Eckersley 2004). However, both bodies of work are mainly theoretical or anecdotal rather than empirical. Moreover, the dependent variable is (elite or public) support for effective climate policy rather than emissions behaviour, leaving it (for the time being at least) on the fringes of the emissions literature.

I argue that the field could greatly benefit from closer engagement with the cognitive scholarship. Ideas could play a vital role in determining which factors go onto shape emissions behaviour and the extent of this influence in a given context (country or region). This approach also creates the existing possibility or bringing together and weighing the leading explanations: it acknowledges that they are all potentially important drivers of emissions, but that their causative effects are contingent on exogenous ideational conditions. In the next chapter, I take advantage of this opportunity and develop a theoretical framework for fusing together mainstream instrumentalist drivers of emissions with cognitive factors.

Approach	**Causal variable**	**Hypothesis**
Economic	Economies of scale	Countries with larger economies are more likely to reduce emissions than countries with smaller economies
	Output mix	Countries with lower carbon output mixes are more likely to reduce emissions than countries with higher carbon output mixes
	Input mix	Countries with lower carbon input mixes are more likely to reduce emissions than countries with higher carbon output mixes
	Technology	Countries with high technology access are more likely to reduce emissions than countries with poor access
Social	Living standards	Countries with high living standards are more likely to reduce emissions than countries with low living standards
	Environmental awareness	Countries with high environmental awareness are more likely to reduce emissions than countries with low awareness
	Population	Countries with small populations are more likely to reduce emissions than countries with large populations
Political	Regime type	Democracies are more likely to reduce emissions than non-democracies
	Domestic institutional power	Countries with stronger domestic institutions are more likely to reduce emissions than countries with weak institutions
	International environmental institutions	Countries that participation in international environmental institutions are more likely to reduce emissions than countries that do not
Environmental	Vulnerability	Countries that are highly vulnerable to the adverse effects of climate change are more likely to reduce emissions than countries with low vulnerability

Table 2.2: Leading approaches, causal variables and hypotheses about emissions trends

Chapter Three: Theoretical Framework

> "Not ideas, but material and ideal interests, directly govern men's conduct. Yet very frequently the 'world images' that have been created by 'ideas' have, like switchmen, determined the tracks along which action has been pushed by the dynamic of interest. 'From what' and 'for what' one wished to be redeemed and, let's not forget, 'could be' redeemed, depended on one's image of the world."

(Max Weber 1946:280)

Introduction

In the last chapter, we saw that economists and political scientists have posited several explanations to account for national emissions behaviour. We also saw that the literature suffers from various problems, three of which are particularly notable. First, empirical research in the field shows that the leading explanations of emissions do not always hold true. So far, scholars have only scratched the surface of understanding when and why economic, social, political and environmental factors play a more influential role in emissions behaviour. Second, most authors approach the emissions puzzle from a single theoretical perspective and do not engage with alternative explanations. I argued that this misses an important opportunity for the enrichment of theories of emissions trends and increases the risk that most quantitative findings in the field commit the omitted variable bias. Third, the leading explanations focus mainly on tangible instrumentalist drivers of emissions. Towards of the last chapter, I argued that this is potentially a major oversight as cognitive factors like and ideas and values could play a critical role in determining the level of influence that instrumental factors play in shaping emissions trends. The theoretical approach that I develop in this chapter goes some way towards addressing these issues.

My vantage point is the social constructivist tradition in IR, which contends that social factors like ideas and identities play a central role in international life (Wendt 1999; Finnemore and Sikkink 2001; Barnett 2006 and Fierke 2010). Yet despite the centrality of social ontology to constructivist theory, attempts to explain why and how ideas matter *without* resorting to instrumentalist reasoning have been surprisingly rare. In recognition of this deficiency, some of the leading constructivists have called for a closer engagement with cognitive psychology (e.g. Finnemore and Sikkink (1998,2001), Wendt (1999), Checkel (2001) and Lebow(2009)).

The theoretical approach that I develop in this chapter speaks directly to this demand. Specifically, I draw on the concepts of worldviews and problem representations from cognitive psychology to devise a framework for investigating the effect of ideas over compliance with the climate regime. Worldviews are the positive and normative beliefs that individuals hold about the world and their role within it. Psychologists have found that individuals attempt to make sense of the world by interpreting phenomena through the lens of their worldviews (Freud 1914). At the state level, different theoretical approaches can be conceptualised as different worldviews about international relations (Keohane 1984, Kegley 1995; Doyle 1997 and Mowle 2003). For reasons that I elaborate below, I concentrate specifically on three ideal-typical worldviews – namely: neo-realism, neo-liberalism and structuralism – which represent the leading instrumentalist theories of climate politics in the IR discipline.[40] Problem representations come into existence when we take the beliefs of a worldview and use them to interpret a particular issue-area. At the most fundamental level, they consist of a problem definition and solution (Beasley 1998; Newell and Simon 1972 and Sylvan and Voss 1998).

Climate change is a novel, complex problem, which makes it a potential trigger for deep anxiety. If, as I argue below, cognitive psychology is applicable to international life, then states, or the policymakers who act on their behalf, should seek to avoid cognitive anxiety by interpreting climate change through the lens of their worldviews. By shaping problem representations, worldviews indirectly structure policymakers' beliefs about goals, constraints and the effectiveness of different policy options. I argue that the ideational context of decision-making has a discernible effect on compliance behaviour. Specifically, neo-realist states should make their compliance conditional on securing relative gains from cooperation while neo-liberal states should look for institutional incentives to overcome the domestic costs of climate governance. Structuralist states, on the other hand, should construct a very different kind of prerequisite – global economic restructuring. Of course, these theoretical prescriptions do not tell us directly whether or not a state

[40] Unlike the economic, social, political and environmental approaches reviewed in the last chapter, which try to explain emissions trends, the explanatory focal point of neo-realist, neo-liberal and structuralist theories of international climate politics is on compliance with the climate regime.

should comply with the climate regime. This can only be deduced by taking into account idiosyncratic variables to flesh out which compliance strategy the state should pursue to maximise relative power, domestic gains or fulfil its transnational class interests. In this chapter, my main aim is to trace how theoretical worldviews shape emissions behaviour by constructing the boundaries of rational decision-making.

From the outset, it should be noted that my approach is not an alternative to the existing explanations that dominate the fields of emissions trends or international climate politics. I focus on a different stage of the causal process than that which is conventionally investigated. Specifically, I explore the role of intervening – ideational - variables in constructing the boundaries of rational decision making and activating the causal pathways that are leveraged by the mainstream approaches. Thus, I do *not* replace instrumentalist drivers with ideas. On the contrary, instrumentalist variables continue to play an important role; translating theoretical policy prescriptions into concrete emissions behaviour. Nor is it not contradictory to my approach that ideas may themselves be the outcome of instrumentalist processes. Indeed, as I discuss below, the conventional strand of constructivism that I subscribe to envisages material and social factors to be in a constant state of mutual constitution (e.g. Adler 1997, Finnemore and Sikkink 1998, Onuf 1998, Ruggie 1998, Wendt 1999, Bernstein 2002). In this thesis, I concentrate on the effects of ideas rather than their origins. The latter is an extensive task in itself and falls beyond the scope of this thesis.

I develop my theoretical approach in four stages. In the next section, I return to the theoretical issues mentioned in the opening paragraph and elaborate the constraints they impose on the literature. After reviewing the theoretical terrain, in the second section, I move onto the core building blocks which provide the analytical tools for my own theoretical approach. Specifically, I discuss the concept of constitutive causality within the constructivist tradition in IR and the concepts of worldviews and problem representations in cognitive psychology. I also defend my move to anthropomorphise the state. In the third section, I put these components together and apply them to the compliance puzzle in climate politics. I end the chapter by discussing the potential contributions that my theoretical approach could make to three bodies of literature – namely: emissions trends, social constructivism and cognitive psychology.

The Theoretical Terrain

In the last chapter, we saw that there are several holes in the leading explanations that IR scholars have leveraged to account for emissions trends. While there is little value in repeating them all here, three particular problems stand out and inform my own theoretical approach.

First, there is the issue of the inconclusiveness of the mainstream approaches that dominate the field. My review of the literature illustrated that instrumentalist factors do not always have their predicted effects over emissions behaviour, which suggests the involvement of other - intervening - variables in facilitating – or inhibiting – the influence of mainstream drivers (Brody et al. 2008; Sampei and Aoyagi-Usui 2009).

Thus, even in cases where instrumentalist factors do generate their predicted effects, economic, social, political and environmental explanations are incomplete: they miss out the vital (prior) stage of the causal process through which putative variables acquire causal power (Hulme 2009 and Espagne et al. 2012). In this chapter, I argue that ideas (specifically worldviews) play an intervening role in bringing instrumentalist variables to act on compliance behaviour.

The second issue that I seek to address is the artificial separation of the leading approaches in the field. Perhaps the most fundamental problem identified by my review in the last chapter is that most authors approach the compliance puzzle from a single explanatory perspective. Yet emissions behaviour is usually the outcome of multiple factors: some (e.g. economic factors) have a direct bearing over climate policy while others (e.g. social preferences, domestic regime type) play an intervening role in determining which factors become influential drivers. Thus the dominant approach for understanding compliance behaviour - through a single explanatory pathway - is crudely reductionist and overlooks the complexity of the multiple concerns that are behind emissions decisions (Dolsak 2001). Moreover, since existing empirical research suggests that each approach is better suited to explaining the behaviour of certain countries and regions, the leading explanations are unable to account for numerous 'anomalies' that are not explained by their own approach. Consequently, the field lacks a generalizable explanation of emissions behaviour at the international level. The theoretical approach that I develop in this chapter provides a way for bringing together and weighing the emissions effects of the leading putative causes. In doing so, it also aims to enhance our understanding of systemic patterns in emissions trends.

Third, the leading approaches in the field focus on material factors which are envisaged to shape emissions behaviour by shaping the instrumental boundaries of rational decision making. For example, a democratic environment might promote effective mitigation policy by raising the political costs of inaction that are faced by the government. Similarly, environmental vulnerability might encourage a country to reduce its emissions by increasing the benefits (e.g. physical security) associated with mitigation. In these such approaches, the locus of explanation is on individualist, rational choice decision making.

Towards the end of the last chapter, we saw that some scholars have emphasised the role of cognitive factors such as risk perception and values in influencing climate policy. Also, constructivist scholars of international climate politics have argued more explicitly that a host of cognitive factors like ideas, norms and beliefs play an important role in shaping climate policy through non-instrumentalist processes. Yet, unlike the focus in this thesis, the dependent variable in both bodies of work is climate policy (and often, public support for climate policy) rather than emissions trends. Though studies that analyse emissions policy and emissions trends side by side are rare, those that have compared climate policy outputs with policy outcomes find strong evidence that the two do not usually operate in the same direction. In other words, a country might say it intends to reduce emissions and even adopt legislation to this effect, but these acts of political have been found to have only minimal effects on emissions levels in practice (Battig and Bernauer 2009; Neumayer 2002). The approach that I present in this chapter provides a strategy for linking theoretically ideas to emissions trends.

Drawing on the works of the most prominent constructivist scholars[41] in the IR discipline, I argue that the approach could make a valuable contribution by elucidating the *social* processes through which ideas shape emissions behaviour. Unlike instrumentalist processes, social processes such as social learning and argumentative persuasion influence world politics by shaping the meaning and salience that actors ascribe to different policy options rather than creating incentives or disincentives for action (Checkel 2001). In this chapter, I draw on cognitive psychology to develop a theoretical framework for investigating one type of social process in particular – the perception of the climate problem.

Theoretical Building Blocks: Social Constructivism, Cognitive Psychology and a Defence of Anthropomorphising the State

Causation

The ideational theory of emissions behaviour that I develop in this chapter takes its cue from social constructivist theory, particularly the notion of social causation (or constitution). In order to understand what social constitution contributes to our understanding beyond conventional theories of causation, I begin this section by briefly reviewing the conventional meaning of the concept of causality. King et al.'s *Designing*

[41] See, for example; Kratochwil (1998), Ruggie (1998), Wendt (1999), Checkel (2001) and Lebow (2009).

Social Inquiry (1994:91-94) provides one of the most well established definitions of causality in the IR discipline. Essentially, causal claims are premised on our predictions about the likely outcome in the dependent variable that would have occurred if the explanatory variable was different to its actual value at the same place and time.

To see how this looks in the context of this thesis, let us consider a simple example. Suppose that I wanted to determine the influence of economic growth on emissions behaviour (in other words, whether economic growth 'causes' emissions to increase or decline). Ideally, I would observe the difference between the emissions behaviour of the same country in the same year while increasing or decreasing the size of the economy in one observation. By allowing economic activity to vary and holding all other factors constant, it should be possible to attribute the changes in emissions to the rise in economic activity. Yet since it is impossible to return to the same country and year with a higher amount of economic activity, the next best option is to predict the likely emissions behaviour that would have occurred if this counterfactual situation were true and see how it differs from the actual emissions behaviour that was observed under different economic conditions. In this thesis, I follow in the footsteps of King et al. and use the term causality to refer to the difference between the actual outcome and the likely outcome that would have occurred in the counterfactual situation, which, as discussed in the next chapter, I try to model by using emissions data.

Conventionally, IR scholars, like most others across the social sciences, have assumed that causation is motivated by instrumentalist reasoning -

in the sense that explanatory variables have their alleged causal effects because they have a bearing on the course of action that most efficiently allows actors to achieve their predefined goals. Yet proponents of the social constructivist tradition assert that causation is not entirely reducible to instrumentalist reasoning, to which I now turn.

Social Constructivism and Constitutional Causality

According to some of the tradition's most prominent scholars, the defining feature of constructivism is the intersubjectivity assumption, which asserts that the world consists of material and *social* factors (Finnemore and Sikkink 1998,2001; Ruggie 1998; Wendt 1999; Barnett 2006 and Fierke 2010). This expanded understanding of ontology leads constructivists to identify a novel kind of causality, which is associated with social factors and processes. *Social constitution* or *constitutive causality*, as it is often termed in the literature, is the process through which social factors assign meaning and value to physical things (Finnemore and Sikkink 1998,2001; Ruggie 1998; Wendt 1998,1999; and Lebow 2009). Crucially, it is only because of the connotations and causal powers that we, as political agents, ascribe to material factors that the latter are able to exert the effects which are posited by the mainstream theories such as those reviewed in the last chapter. Thus social constitution is temporally prior to, and a necessary precursor for, material causation. Ideas do not replace material factors, but instead play a vital role in facilitating - or inhibiting - the rational choice mechanisms that are familiar to conventional theorising. Once activated, instrumentalist causal processes continue to operate as usual. Therefore, social constructivism is entirely compatible with rationalist theorising (Little and Smith 1988; Wendt 1999 and Checkel 2001).[42]

Yet even constructivists themselves do not fully understand the precise mechanisms through which social constitution operates (Checkel 2001; Finnemore and Sikkink 2001 and Lebow 2009). Indeed, most constructivist work falls back on the same consequentialist logic which is posited by conventional approaches to explain how social factors influence world politics. In recognition of this deficiency, leading constructivists have called for more attention to be channelled towards demonstrating that states can respond to social stimuli *even in the absence of coercion or sanctioning* (Finnemore and Sikkink 1998,2001; Wendt 1999 and Checkel 2001;). In this model, the (constitutive) causal mechanism is consensual persuasion. Actions are taken on the basis of the merits of argument, rather than instrumentalist calculation, thereby shifting the locus of explanation from material factors to ideas and knowledge. Many have looked to individualist theories from sociology, psychology and cognitive theory to enhance our understanding of constitution at the international level (e.g. Onuf 1989; Wendt 1999; Checkel 2001 and Lawson and Shilliam 2010). Following in their footsteps, I now turn to cognitive psychology for some answers.

[42] Indeed, all of the traditional schools of international thought implicitly acknowledge the facilitating role played by ideas in activating material causal processes. Neo-realists, for example, have found that states oscillate between offensive and defensive behaviour depending on whether they perceive other states' intentions as hostile or friendly respectively (Jervis 1999). Similarly, neo-liberals concede that in the absence of clear material incentives, states have little reason to abide by international law – unless they believe in the claim that international institutions can, and do, shape other states' actions (Doyle 1986). Alongside their emphasis on economic power, Gramscian structuralists afford ideology a vital role in sustaining - or changing - the world economy.

Cognitive Psychology: Worldviews and Problem Representations

Psychologists have found that individuals experience anxiety when they are confronted with complex, unfamiliar situations that they cannot understand (Rapaport 1960). Thus, they attempt to avoid such anxiety by harmonising incoming information with their pre-existing beliefs (Freud 1914 and Miller et al. 1960). This harmonisation process takes place on a subconscious level and is (usually) unknown to the individual. Humans understand the world through the 'interpretive lens' of their own beliefs (Miller and West 1993).[43] In 1926, Sigmund Freud (1959:76) first used the term *worldview* to denote individual 'Handbooks to Life... [that are] designed to tie the world up into neat and explainable packages.' Since then, the concept has gathered a large following amongst cognitive psychologists (e.g. Kluckholm 1950; Kelly 1955; Wrightsman 1964 and Maslow 1970).

Broadly, worldviews consist of two fundamental elements – positive and normative beliefs (Rokeach 1973).[44] Positive beliefs tell an individual 'what the world is like'. They answer ontological and instrumentalist questions such as: *What does the world consist of? What is my role within it? What are the best strategies that I should employ to achieve my life goals? Who are the other actors? How will they behave?* Normative beliefs, on the other hand, deal with ethical issues about 'what the world should be like'. They speak to a different set of questions, such as: *What*

[43] The worldview concept originates from the German word Weltanschauung, which refers to 'one's total outlook on life, society and its institutions' (Wolman 1973:406).

[44] The cited authors also distinguish between evaluative and prescriptive normative beliefs, which respectively entail a judgement about the ethical desirability of an object and action. Since both elements are closely interrelated in individual's perceptions of the climate problem, I group them together as normative beliefs.

are appropriate objectives to aspire to in the world? What comprises legitimate behaviour? How should I, and other actors, behave?

Problem representations are more specific than worldviews. They are created when we take the broad beliefs of a worldview and apply them to a specific problem (Newell and Simon 1972 and Sylvan et al. 1991). Thus while worldviews consist of general assumptions about the nature of the universe, a problem representation is a narrow set of concrete beliefs that an individual holds about a particular issue-area. In its most basic form, a problem representation consists of a problem definition and proposed solution (Beasley 1998 and Sylvan and Voss 1998). Both elements invoke positive and normative beliefs from worldviews: in order to define a problem, we need to delineate its physical and ethical characteristics, while its solution is dependent on our beliefs about the effectiveness and normative desirability of different responses. By shaping beliefs about goals, constraints, the efficacy and ethical value of different courses of action, problem representations have a clear impact on the way that we solve problems. On a theoretical level, they provide the vital link between ideas and action.

Since problem representations are filtered through the lens of the worldview, they are *not* mirror images of reality, but rather, representations of reality that the person experiences as reality itself. Incongruities between objective reality (to the extent that it exists)[45] and individual reality perceptions can pave the way for erroneous behavioural

[45] The conventional strand of constructivist that I subscribe to accepts that there is an objective reality which exists independently from our beliefs about it.

decisions that may appear irrational to the external observer (Brecher et al. 1969). If problem representations emanate from worldviews, differences in individual belief systems may help explain why individuals respond differently to the same problem (Fiske and Taylor 1984 and Beasley 1998).

States and Cognitive Psychology

Thus far, I have argued that the individual need for cognitive harmony drives humans to interpret the world through the lens of their pre-existing beliefs. Yet states are non-human entities that operate at the international level. Therefore, they may not be governed by the same logic. In this section, I try to demonstrate that this is not the case. Specifically, I consider the rationale for applying the concepts of worldviews and problem representations to states.

My claim that cognitive psychology is applicable to states rests on three specific arguments. First, the contention that states have a physiological need for cognitive harmony is no more problematic than the assumption that states have physical security needs. The latter assertion, which has become a well-accepted tenet of mainstream international theory, is premised on the assumption that states have something akin to physical bodies. Yet this assumption raises a host of conceptual questions of its own: what exactly is a state's physical body? Whether a state's physical existence is defined by its territory, population, or sovereignty, what proportion of it must die in order for it to experience insecurity? Of course, my aim is not to refute the claim that states have physical security needs, but merely to echo an argument that has been made before: most international theorising is predicated on some form of human analogy and abstraction (see, for example, Wendt 1999 and Mitzen 2006;). In this respect, social constructivists are by far the most enthusiastic proponents of the states-as-humans thesis, with some of their key research programmes comprising identity-construction, threat perception and ideas.

Second, since states are constituted by human beings, it is rational to assume that 'what applies to agency at the individual level must apply to the collective level of states' (Mcsweeney 1999:103). This argument is particularly compelling when we consider that states and foreign policy decisions are governed by humans – political elites and, at least in democracies, the general public. Moreover, since states are abstract entities without any autonomous means of interpreting the world, it is reasonable to equate their reality perceptions with the collective worldviews and problem representations of the people that constitute them and act on their behalf (e.g. Holsti 1962; Herrmann 1985; Herrmann and Fischerkeller 1995 and Mowle 2003;). Indeed, psychologists make similar inferences about the shared perceptions of other human collectivities such as groups, organisations and institutions (e.g. Janis 1982 and Beasley 1998;).

Lastly, even if neither of the preceding arguments is compelling, the assumption that states interpret reality through their worldviews and behave in accordance with their beliefs provides us with valuable analytical tools for predicting international outcomes. Indeed, some of the most celebrated explanations of social phenomena like rationalism and economics use micro-level assumptions to elucidate macro-level outcomes by treating the behaviour of collective entities as the aggregate outcome of individual decisions. Scholars have solved some of the most important IR puzzles by employing theories of cognitive psychology to explain 'anomalous' foreign policy decisions.[46] Thus my argument is *not* that we should simply do as others have done, but rather, anthropomorphising the state enables us to make what generally proves to be accurate predictions about international life.

Putting the Pieces Together: A Cognitive Theory of Emissions Behaviour

In this section, I develop a theoretical framework for bringing together social constitution, worldviews and problem representations to investigate the influence of ideas over emissions trends. My central argument is that theoretical worldviews condition states' perceptions of the climate problem, which shapes their attitudes, discourse, emissions policy and behaviour. I also propose that, by shaping the contours of rational decision making, worldviews play a key role in determining (or constituting) which material factors become influential drivers of emissions trends. Before fleshing out these ideas, I discuss why worldviews are especially important in the field of climate politics.

Climate change is truly a novel problem, which makes it a potential trigger for deep anxiety. First, it is a particularly complicated and difficult issue to resolve issue. Climate change has the potential to interact with several other security concerns like energy and food security, health, the

[46] See, for example, Jervis (1976), Herrmann and Fischerkeller (1995), Larson (1997) and Hayes (2009,2012).

economy, migration, military strength, socio-political stability and even physical conflict - warranting its title as the 'threat multiplier of the 21st century' (United Nations General Assembly 2009). In addition, the transboundary causes and consequences of climate change make it the archetypical global problem. Even though its worst effects are expected to be concentrated in the Southern hemisphere, the increased risk of eco-migration,[47] physical conflict[48] and economic instability means that climate change also poses very serious *indirect* security challenges to more powerful countries in the North (Pumphrey 2008).

Yet, as securitization theorists point out, climate change has not received the same level of priority or resources that traditional – political, military and economic – security concerns have, which means that states are generally inexperienced in dealing with it (Buzan et al. 1998). This is especially true for developing countries, which have typically been forced to channel their scarce resources into more pressing concerns like poverty eradication and socio-economic development (Betsill et al. 2006 and Parks and Roberts 2007,2010).

Compounding matters, international efforts to combat climate change have created as many problems as they have resolved. The multilateral climate negotiations are a confusing place to be: traditional leaders of international cooperation are transformed into laggards in the climate

[47] See, for example, El-Hinnawi (1985), Grubb (1995), Hugo (1996), Swain (1996), Charnley (1997), Black and Sessay (1998) and Bates (2002).
[48] Homer-Dixon (1994), Levy (1995), Buhaug et al. (2007), Salehyan (2008) and Hsiang et al. (2013).

regime while hitherto peripheral actors like the BASICs command exceptional bargaining power.

Thus if the human analogy is correct, worldviews should become especially important in the climate arena. Without any prior experience to draw on, states should turn to their pre-existing beliefs to escape the confusion created by climate change.

Three Ideal Theoretical Worldviews

States' actions are not reflexive; rather, they flow from the beliefs that their foreign policymakers hold about the world (Boulding 1956; Holsti 1962 and Little and Smith 1998). IR scholars with a cognitive leaning have found that the most influential ideas are reminiscent of the positive and normative beliefs that make up worldviews (Barber 1993; Woods 1995; Young 1998 and Mowle 2003). Operational code analysts, for example, focus on the philosophical and instrumentalist ideas that structure political leaders' beliefs about 'the political universe' (Leites 1951; George 1969). Other approaches include Judith Goldstein and Robert Keohane's (1993) well-known *Ideas and Foreign Policy and* Robert Axelrod's (1973,1976) *Cognitive Maps*.

When it comes to the interesting task of actually pinning down states' (or policymakers') worldviews, the researcher has to find a way of dealing with the infinite range of possibilities. Some of the greatest social theorists have overcome the infinity problem by concentrating on ideal-typologies (e.g. Max Weber, Robert Dahl). Following in their footsteps, I propose three ideal worldviews to represent distinct ways of interpreting the world. I do not seek to develop a full map of a worldview: that would be an (almost) impossible task. Instead, I concentrate primarily on the beliefs that are relevant to emissions policymaking and behaviour. Crucially, I do not expect policymakers to subscribe to any of these worldviews in their entirety. In the real world, people hold complex, mixed belief systems that draw on parts of all three typologies (as well as other ideas that fall outside this framework); however, it is still reasonable to expect that empirical beliefs will naturally align differently with each ideal worldview, thereby making the typologies a useful analytical construct for categorising real life belief systems.

Specifically, I propose that policymakers' worldviews align with the leading instrumentalist theories of international climate politics – namely neo-realism, neo-liberalism and structuralism. The proposition that policymakers' ideas resemble international theory is certainly not new (Grieco 1990; Hellman and Wolf 1993 and Mowle 2003). However, since the claim is central to my approach, it needs validating. First, international theory serves a similar cognitive purpose to worldviews. Waltz (1979) famously argued that the best theories are parsimonious; they strip down complex reality into simple, comprehensible phenomena. Corroborating this claim, Tetlock (1993) and Herrmann (1985) have found strong evidence that policymakers rely heavily on theory to process incoming information. Second, the acquisition of beliefs through the socialisation process (Beasley 1998 and Renshon 2008) gives us further reason to expect that policymakers' worldviews overlap with the leading schools of international thought. Since most foreign policymakers are educated in Western institutions, it is reasonable to assume that their worldviews are influenced by the leading theoretical traditions. Indeed, Doyle (1993) found that the worldviews of Western political elites closely resemble neo-realism and neo-liberalism. In the climate arena, Southern policymakers have been very vocal in their support of structuralist ideas (Betsill et al. 2006 and Roberts and Parks 2007,2010). Therefore, if worldviews do indeed play a role in shaping emissions behaviour, countries that prescribe to the same theoretical approach should design their emissions behaviours in accordance with the same set of material drivers that are prioritised by the corresponding worldview.

My decision to focus on the leading instrumentalist theories of climate politics is based on two arguments. First, these theories mirror the empirical positions of the leading political alliances that dominate the multilateral climate negotiations. As discussed in the introduction chapter, US behaviour towards the climate regime tends to resemble neo-realism, the EU neo-liberalism and Southern countries structuralist approaches. Thus, if ideas influence emissions behaviour, each worldview could potentially explain a *different* region's approach towards the climate regime.

My second justification is that the three ideal worldviews represent the interpretive disputes that divide scholars and practitioners over the impediments to effective climate governance and mitigation. As will become evident in the next section, each theoretical perspective emphasises a different set of factors in climate policymaking, which overlaps with the drivers of emissions that were emphasised by the leading explanations reviewed in the last chapter. If ideas do really matter, they should play a role in mediating the effect of multiple material drivers spanning the economic, social, political and environmental approaches.

Each ideal worldview consists of two types of beliefs. To incorporate the positive beliefs inherent in individual belief sets, I propose that theoretical worldviews contain answers to ontological questions about the world and specifically, the possibility for emissions regulation within it. Such questions include: *Which forces shape world politics? What are the intentions of other actors? What is the basis for effective foreign policy? Is international cooperation effective? Which conditions must be present for cooperation to succeed?* The second component of a theoretical worldview is normative beliefs, which comprise policymakers' ideas about ethical state behaviour. Exemplary questions include: *Is it acceptable to renege on international commitments? When can states legitimately use force to pursue their objectives? What are legitimate goals of foreign policy?*

With these components in mind, I now turn to fleshing out the ideal theoretical worldviews from the core positive and normative assumptions of neo-realism, neo-liberalism and structuralism. I consider how these worldviews translate into emissions behaviour in the following section on problem representations.

As the oldest school of international thought, *neo-realism* has made what has proven to be some of the most enduring assumptions about world politics. Perhaps its most definitive claim is that the absence of an overarching hegemon allows states to use any means necessary to ensure their survival (Waltz 1979). States can, for example, renege on their international commitments, conceal their true intentions or even harm other states in order to fulfil their national interests. The anarchical nature of the international system renders this kind of behaviour both legitimate and necessary. In a Hobbesian world where everything goes, international relations is determined by the distribution of physical capabilities across like-minded states. Hence the ultimate objective of foreign policy is to maximise the *relative* power of the state vis-à-vis other states.

Just how much power a state needs in order to feel safe in the self-help system is contested within the neo-realist school. Defensive neo-realists argue that states are usually content when they acquire sufficient power to render themselves secure (e.g. Glaser 1994 and Jervis 1999). Opposing this position, offensive neo-realists claim that states never give up the pursuit for power as the best means to security is to acquire as much power as possible (e.g. Mearsheimer 1994). If one had to choose between these two strands of neo-realist thought, climate change would most likely be construed as an offensive issue.[49]

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[49] My rationale for this is three-fold: First, the non-excludability of climate goods makes it impossible to regulate the benefits of cooperation across states, regardless of how much (or little) they have undertaken to reduce global emissions (Grundig 2006 and Hirschi 2009). Second, the opportunity costs of emissions reduction, coupled with the time lag involved for the benefits of mitigation to materialise, tips the scale in favour of unilateral action (Victor 2006). Third, international cooperation is expected to significantly redistribute resources from the North to the South, thereby rendering developed countries especially sensitive to relative gains concerns. According to the neo-realist theory of hegemonic stability, international regimes can only prevail so long as 'a clear hegemon or group of privileged states [possesses] an interest in regime formation' (Hasenclever et al. 1996:199, see also: Snidal 1985 and Gilpin 1987). Thus, although the previous two points might not preclude the possibility for effective

As the other traditional school of thought, *neo-liberalism* accepts most of the positive assumptions that neo-realism makes about world politics - with only two *main* exceptions. First, neo-liberals assert that states are motivated by absolute, rather than, relative gains, which means that international cooperation is much easier to elicit than neo-realists acknowledge (Keohane 1984 and Grieco 1988). Accordingly, a state should cooperate - so long as the domestic benefits of compliance outweigh the costs, even if this means gaining less than other cooperating states.

The second point of contestation relates to international agency. While neo-liberals recognise a much wider range of actors in world politics, they place special emphasis on the power of international institutions to influence state behaviour. Precisely how they do this is a matter of contestation in neo-liberal thought. Contractualist adherents of neo-liberalism draw attention to the role of international institutions in reducing the domestic costs of international cooperation (Young 1979 and Duffield 2007). For example, global regimes, which are a specific type of international institution, can elicit compliance by providing the means for monitoring and enforcement, creating a forum for communication and sharing information among cooperating states. They can also provide material (e.g. financial compensation for emissions reduction) and social (e.g. 'the reputational effect' of regime compliance) incentives for international cooperation (Nagtzaam 2009). Another group of neo-liberal

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international emissions regulation, the third point makes this prospect less likely. Without the support of powerful developed countries, the climate regime is unlikely to create effective incentives for mitigation.

scholars contends that international institutions can do more than provide incentives; they can redefine states' interests in line with cooperation (e.g. Bernstein 2002). By communicating political messages, expert advice and creating new behavioural rules, institutions can convince policymakers that they have a rational interest in protecting the climate irrespective of the incentives in favour of cooperation.

These two departures from neo-realism result in a more optimistic picture: If absolute gains and international institutions matter in world politics, then international mitigation efforts are much more likely to succeed. It is just a matter of states learning that their true interests reside in cooperation and creating sufficient incentives for states to comply with emission targets, which is much easier to accommodate if one subscribes to the neo-liberal claim that states are motivated by absolute gains.

The third approach is markedly different from the other two theories reviewed in this section. With its roots in Marxism, *structuralism* rejects most of the assumptions that the traditional schools make about world politics. It also encompasses a broader range of theoretical traditions than neo-realism and neo-liberalism – most prominently World Systems Analysis (Wallerstein 1979), Dependency Theory (Prebisch 1950) and neo-Gramscianism (Cox 1981). Thus structuralism is more eclectic. Nonetheless, many scholars contend that it is still possible to meaningfully speak about a structuralist approach to international relations – specifically in the field of international environmental politics (e.g. Paterson (2000), Roberts et al. (2004), Betsill et al. (2006), Parks and Roberts (2007,2010), Prum (2007) and Mejia (2010)). Following in their footsteps, I now turn to delineating the core arguments that hold these different perspectives together – specifically, their emphasis on the international structure, economic materialism and a normative agenda.

Like neo-realism, structuralism focuses on the systemic distribution of power across unitary actors in the international arena. In the structuralist case, however, power is defined in economic terms and, as I discuss below, the units are economic classes rather than nation-states. Thus proponents of this approach explain foreign policy by looking at the position of states in the global economy, which is regarded as the driving force of world politics. By prioritising the global system over unitary actors and defining a state's (economic) power in relation to other actors, structuralists sit closer to neo-realists than neo-liberals on the relative-absolute gains debate (Paterson 1996,2000).

Having stated that proponents of this approach explain world politics in terms of the world economy, it is worth elaborating precisely what this structure entails. By analogy to Marxist theories of domestic politics,[50] structuralism proceeds from the assumption that international relations is determined by the (transnational) dichotomy between the capitalist proletarian classes. According to this perspective, the colonial experience forced countries in Africa, South East Asia, South America and the Caribbean to specialise in low value primary goods, which was used to fuel industrialisation in the colonial homelands. Structuralists contend that, despite the end of the colonial era, world politics continues

[50] See, for example, Marx (1990).

to be shaped by unequal class dynamics; industrialised countries with the strongest economies form the capitalist core, while developing countries in the geopolitical South comprise the periphery[51] (Wallerstein 1979; Amin 1987). Core countries maintain their subjugation of the periphery through the structural practice of 'unequal exchange', whereby the declining prices of primary goods in the world markets forces developing countries into exporting an ever increasing volume of goods merely to survive in the global system (Prebisch 1950).

Yet structuralists do not suffice with describing – and criticising - the centrality of the global economy in world politics: They supplement these positive ideas with a normative agenda to emancipate peripheral countries.[52] Some of the more prominent suggestions include international financial and technological transfers and debt relief for the South (Paterson and Grubb 1992; Roberts et al. 2004; Betsill et al. 2006 and Parks and Roberts 2007,2008,2010).

Ideal Representations of the Climate Problem

Like individuals, states, or the policymakers who act on their behalf, invoke their pre-existing beliefs to make sense of problems and delineate appropriate ways for overcoming them (see, for example, the volumes in Sylvan and Voss 1998). Many, for example, have found that bilateral relationships in the Cold War were shaped by elite images of other states (e.g. Cottam (1977), Herrmann (1985), Holsti (1987), Shimko (1991),

[51] Wallerstein (1979) also proposed that there exists a smaller, intermediate class of states – the 'semi-periphery' – which has characteristics of both the core and periphery.
[52] According to Rowlands (2001), this is what distinguishes structuralists from historical materialists, who lack the normative agenda.

Herrmann and Fischerkeller (1995)). Others have focused on the behavioural effects of particular problem issues like foreign aid (Breuning 1998), humanitarian intervention (Voss et al. 1998) and physical conflict (Mowle 2003).

Building on this scholarship, I argue that states attempt to reduce uncertainty in the face of climate change by interpreting the issue through the lens of their worldviews. I map out three ideal representations of the climate problem that follow from the theoretical worldviews proposed above. The problem representations are deduced from the normative and positive beliefs of the corresponding worldview, as well as theoretical accounts of climate politics in the IR literature. Each problem representation includes two dimensions – (i) a definition of the climate problem and (ii) strategic response. I argue below that states' constructions of strategic responses to climate change govern their emissions behaviour. A visual representation of these dynamics is depicted in figure 3.1.

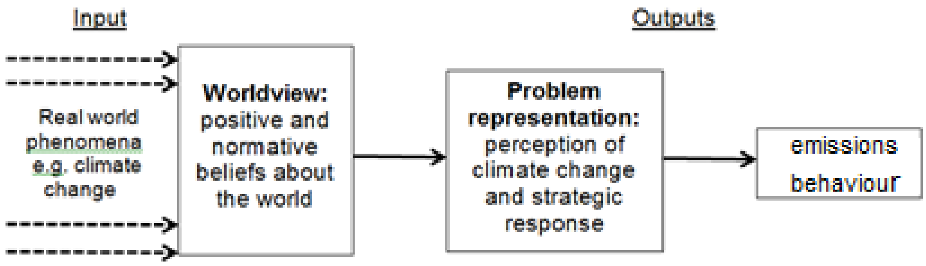

Figure 3.1: Theoretical framework proposed by the thesis

I propose three pure judgements to incorporate the definitional possibilities that are embedded in the neo-realist, neo-liberal and structuralist worldviews. The ideal problem representations are summarised in table 3.1.

Theoretical approach	**Problem definition**	**Strategic response**
Neo-realism	Relative gains problem with the potential to upset the balance of international power	Maximise relative power
Neo-liberalism	Collective action problem	Maximise absolute power
Structuralism	Ethical problem rooted in the global economy	Fulfil transnational class interests

Table 3.1: Ideal neo-realist, neo-liberal and structuralist representations of the climate problem

Neo-realist policymakers would perceive climate change as a relative gains issue that could disturb the international balance of power (Schwartz and Randall 2003; Vezirgiannidou 2008; Sunstein 2009 and Purdon 2013). This perception is reinforced by the unequal distribution of the costs and benefits of climate change as well as those of international efforts to mitigate the problem (Grundig 2006; Vezirgiannidou 2008; Underdal et al. 2012 and Purdon 2013). Moreover, the insights of hegemonic stability theory give neo-realist policymakers reason to be pessimistic about the prospect for international climate cooperation. Although the EU has provided strong leadership in the multilateral climate negotiations, it is well-known that the climate regime cannot succeed unless the major emitters undertake solid commitments to reduce emissions, which, judging from the trajectory of the climate negotiations, seems unlikely to happen in the near future.[53] This is compounded by the difficulty of reconciling American interests with those of the rapidly

[53] Hence the neo-realist scholarship on climate change is replete with apocalyptic titles like ‘climate cataclysm’ (Campbell 2008) and ‘climate wars’ (Dyer 2009).

developing economies (most prominently the BASICs), which must also agree to share in the responsibility of emissions reduction (Pickering et al. 2012 and Tuck and Habib 2014).

In the absence of a strong hegemon that is capable of mobilising the level of international support necessary to prevent dangerous levels of global warming from materialising, states are forced to fend for themselves. In this context, the best option available to states is to maximise their national power by building up physical capabilities and channelling them into defending their *own* state against climate change (Purdon 2013 and Tuck and Habib 2014). Since neo-realists are primarily concerned about relative gains, policymakers cannot just choose the option that would provide them with the highest benefits or lowest costs. Instead, they need to compare the situation of their own country with other states and devise a solution that would bolster their position in the international system, even if this means losing in absolute terms (Sprinz and Luterbacher 2001; Grundig 2006 and Vezirgiannidou 2008). Thus, unlike the other approaches, the relative power assumption also suggests to policymakers that their country can be (more) secure against climate change even if other states are not (Tuck and Habib 2014). Moreover, the inability of the international community to solve the climate problem means that neo-realist policymakers would place primary emphasis on enhancing their own defences against climate change rather than waiting around for international efforts to regulate global emissions levels.[54] As

[54] The former strategy of building up *defensive* capabilities against the adverse effects of climate change is referred to as 'adaptation', which is often contrasted with 'mitigation'. The latter attempts to *prevent* climate change through emission reduction.

Purdon (2013:11) points out: ‘adaption avoids [the] relative-gains dilemmas [that are associated with mitigation]’.

Thus neo-realism envisages a national-level solution to climate change, although this is not to deny that emissions reductions or even complying with the climate regime could be a means for serving national interests. Ultimately, this boils down to one fundamental issue: a country will reduce domestic emissions if this is likely to result in relative gains.

A more optimistic problem representation flows from the *neo-liberal* worldview. The positive beliefs that international institutions and absolute gains matter in world politics would lead adherents of this approach to perceive climate change as a solvable problem (Paterson 1996,2000). Since neo-liberals are more concerned about the power of their own state rather than that of others, they will be more likely to regulate domestic emissions than neo-realists - so long as the benefits of emissions cuts offset the domestic costs.[55] Moreover, if international institutions are indeed powerful, then they can play a vital role in overcoming the *absolute* losses associated with emissions reduction, which are much easier to accommodate than relative gains concerns (O’Brien and Leichencko 2003; Victor 2006 and Paterson and Lachapelle 2013). Thus the neo-liberal representation of climate change can be construed as a collective action problem.[56]

[55] I elaborate below why this condition may not be as easily satisfied as it may first appear.
[56] This perception is particularly evident in Keohane and Victor (2010), Paterson and Newell (2010) and Bodansky (2012).

Although absolute gains concerns are easier to accommodate than relative gains, they do not automatically result in effective climate policy. The benefits of emissions reduction do not always outweigh the domestic costs. For the sake of argument, let us assume that all policymakers have (or will eventually of) agreed that preventing dangerous levels of global warming is a national interest. However, a state has numerous and often conflicting interests, of which climate change is only one example. Their weighing 'will reflect the interests of the major constituencies that exert influence over state leaders' (Keohane and Victor 2010:3), which implies that the priority that climate change receives will vary across states. Policies that combat climate change without compromising higher priority interests will be perceived as rational options. Those that do not will be deemed to come at 'too high' a cost. Speaking directly to this point, Eckersley (2004:86) argues that neo-liberals typically determine whether a state will be 'a leader, bystander or laggard [in the global climate regime] on the basis of relative ecological vulnerability and abatement costs'.

The neo-liberal worldview suggests that international institutions can drastically reduce the domestic costs of emissions reduction. Regime-building is a gradual process, and policymakers who believe in the power of institutions like diplomacy and international law would perceive the multilateral climate negotiations as an effective forum to (eventually) have their needs addressed. This is especially true in the climate context - where the only way of regulating global emissions levels is through an internationally concerted effort. Thus adherents of this approach would call on institutional solutions to 'realign incentives when parties do not perceive an immediate interest in the outcome that others favour' (Keohane and Victor 2010:11). Institutions could, for example, provide the means for monitoring and enforcing compliance with global emissions targets (Victor 2006; Duffield 2007 and Nagtzaam 2009), create opportunities for carbon trading and investing in carbon technologies (Keohane and Victor 2010 and Parker and Karlsson 2010) and raise the reputational costs of abstaining from the climate regime (Bernstein et al. 2010 and Paterson 2010) – all of which would tip the scale in favour of compliance.

Proceeding from radically different theoretical assumptions, *structuralist* policymakers would interpret climate change as an ethical problem which stems from structural inequalities in the global economy.[57] Structuralist studies of climate change stress that the colonial experience has enabled Northern countries to attain advanced levels of industrialisation at the expense of the South. In this way, the climate problem originates in the North, while the South is only responsible for a negligible share of (cumulative) global emissions levels[58] (Betstill et al. 2006; Parks and Roberts 2007,2009,2010; Prum 2007 and Mejia 2010). Structuralists contend that there is a qualitative difference between the 'luxury' emissions of the North and 'survival' emissions of the South, which has

[57] It is noted that the claim that the characterisation of climate change as an ethical problem is not unique to structuralists as classical liberals also make the same argument without, of course, asserting that these injustices are due to economic sources. Examples of the latter include; Shue (1999), Gardiner (2004) and Vanderheiden (2008,2011).
[58] The share of developing countries' net global emissions levels has soared with the rapid growth of emerging economies like the BASICs.

been locked into ecologically unsustainable production since the colonial era (Gupta 1997; Mwandosya 2000). They also draw attention to the hidden environmental costs of production which are often outsourced from industrialised to developing countries.[59] According to this approach, the climate injustice is magnified by the fact that the world's poorest regions, which are also the most vulnerable, will be exposed to the worst effects of climate change (Betsill et al. 2006; Parks and Roberts 2007,2009,2010). In comparison to the traditional schools of thought, the policy relevance of this approach is somewhat easier to visualise as Southern policymakers frequently champion structuralist beliefs in the multilateral climate negotiations (e.g. Mwandosya (2000), Gupta (2007), Parks and Roberts (2007,2008,2009,2010), Prum (2007) and Mejia 2010)).

At best, the climate regime would be criticised by structuralist policymakers for being too conservative. At worst, it would be perceived as an attempt by developed countries to pursue an ecological form of imperialism (see, for example, Parks and Roberts (2007) and Bohm et al. (2012)). In place of the climate regime, adherents of this approach would uphold that the only effective solution is to target the real culprit – global capitalism. Radically restructuring the world economy along egalitarian lines would eradicate the structural causes of emissions activities, particularly in the South, which is where the majority of future emissions are expected to originate from. If technology, know-how and capital-intensive, high value activity were evenly distributed across the world,

[59] This is referred to as the concept of 'ecologically unequal exchange' in the literature.

developing countries would have the means to climb up the development ladder and graduate from the periphery without having to drastically increase their consumption of fossil fuels. One such proposal is that Northern states should provide developing countries with 'ecological compensation' for the global climate injustice, which resonates with broader structuralist demands for debt relief and international financial and technological transfers (e.g. Gupta (1997), Betsill et al. (2006) and Roberts and Parks (2007,2008,2009)).

The Social Constitution of Emissions Behaviour

By conditioning beliefs about goals, constraints and the desirability of different responses to climate change, worldviews determine how decision makers define and formulate rational emissions policy. Specifically, a state will only reduce domestic emissions if this action coheres with the strategy delineated in its representation of the climate problem.[60] Of the three theoretical approaches examined in this chapter, neo-liberals are the most likely to reduce emissions as they would settle for incentives that would offset the domestic costs of emissions cuts. Neo-realists, on the other hand, would only reduce emissions if they expect this to enhance their position in the international system. Structuralists are unlikely to be persuaded by either of these prospects. Instead, they would make their emissions behaviour conditional on the fulfilment of transnational class interests, which, for peripheral countries

[60] These strategies are listed in the third column of table 3.1.

in the Southern core, would entail radical restructuring of the world economy.[61]

At this point in the discussion, I want to make my approach more concrete by fleshing out how these strategic responses might actually translate into emissions behaviour. Specifically, I identify nine hypotheses that demonstrate the conditions under which emissions reduction is deemed to be consistent with relative power maximisation, the maximisation of domestic cost-benefit ratios and fulfilment of transnational class interests.

The critical issue in the neo-realist approach is to establish when emissions reduction is likely to allow a country to gain more or lose less than other countries. The neo-realist worldview and representation of the climate problem identifies at least three such scenarios. First, it is widely acknowledged that climate governance will redistribute resources from more advanced economies in the North to developing countries in the South. As I discuss below, this is partly due to the architecture of the climate regime itself: the annex based classification system (Article 4, UNFCCC) and the Principle of Common But Differentiated Responsibilities (CBDR) (Article 3, UNFCCC), which imposes binding quantitative emissions targets on Annex (developed) countries, while exempting non-Annex (developing) countries from reciprocal commitments. The most advanced subset of developed countries listed under Annex II also has additional responsibilities to assist industrialising

[61] At this point, I am not suggesting that Southern policymakers subscribe to the structuralist view: it could be the case that they are motivated by national interests or, as Galtung (1971) argues, even form part of the transnational core. My point here is to flesh out the conditions under which countries would be likely to comply *if* they subscribed to a given worldview.

countries transition to low carbon economies and develop their defensive capabilities against climate change (Article 4, UNFCCC). Developing countries are also disproportionately vulnerable to climate change – both in terms of the extent of their direct exposure to geophysical change and their ability to defend themselves against these adverse effects (IPCC 2012,2013). Arguably, then, the weakest and most vulnerable countries (especially the Least Developed Countries (LDCs) and Alliance of Small Island States (AOSIS)) have the most to gain from an effective international response against climate change (Depoo and Rosner 2011; Brown and McLeman 2009; Kasa et al. 2008). In contrast, while developed countries are certainly not immune to climate threats, their superior socio-economic and military resources make them better equipped to deal with climate change unilaterally and thus less reliant on international efforts to combat climate regime (Swain 1996; Busby 2005; Purdon 2013; Tuck and Habib 2014). The distribution of the benefits of climate governance generate the following neo-realist hypothesis:

Hypothesis 1: weak countries are more likely to reduce emissions because they are more reliant on international efforts to combat climate change.

Yet this does not imply that powerful states will *always* incur relative losses and, therefore, abstain from emission reduction. Essentially, arguments about the relative costs of emissions cuts boil down to two issues - fossil fuel dependency and reciprocity. On the one hand, carbon intensive activity is likely to feature heavily in countries that are endowed with *relatively* abundant natural resources. Therefore, these states – most notably members of the UG, Organisation of Petroleum Exporting

Countries (OPEC) and Brazil, South Africa, India and China (BASICs) – face higher opportunity costs from conforming to emissions targets than countries that are relatively less dependent on fossil fuels. Arguably, these latter states stand to gain from their ability to reduce emissions at relatively lower costs than fossil fuel dependent countries. EU leadership of the climate regime and US deviation have often been attributed to this kind of relative gains calculation (e.g. Sunstein 2009; Parker and Karlsson 2010; Yohe 2001; Luderer et al. 2012).[62] Thus we can deduce a second hypothesis from the neo-realist worldview:

Hypothesis 2: Countries that are relatively less dependent on fossil fuels are more likely to reduce emissions because they stand to incur lower costs from emissions reduction.

Yet is still possible for fossil fuel dependent countries to avoid relative losses so long as competitor states agree to be bound by reciprocal commitments under the climate regime. Most prominently, members of the UG and BASIC states have frequently expressed that they will only agree to be bound by emissions targets on the condition that the other geopolitical alliance accepts reciprocal commitments. Some authors have explicitly employed neo-realist theory to account for the non-compliance of the most obstinate countries towards the climate regime (e.g. Purdon 2013; Tuck and Habib 2014; Vezirgiannidou 2008). Thus a third neo-realist hypothesis is that:

Hypothesis 3: States are more likely to reduce emissions when their competitors undertake reciprocal commitments.

[62] Incidentally, it has also been argued that EU states are likely to enjoy additional relative gains from the EU's unique institutional structure, which grants its members more flexibility in meeting their emissions targets under the climate regime (e.g. Schmidt 2008; Schreurs et al. 2013).

Thus, the neo-realist worldview and problem representation suggests that emissions reduction is likely to occur if a country lacks the means to unilaterally defend itself against climate change, is less dependent on fossil fuels than other states or expects its rivals to be bound by reciprocal commitments. When these conditions hold, it is likely that emissions reduction will bolster the position of the country in the international system, thus serving the ultimate quest for more power.

The neo-liberal worldview and problem representation give rise to another set of hypotheses. First, we saw above that neo-liberals place most emphasis on the creation of international institutional incentives to overcome the collective action problem posed by climate change - for example, by providing the means for enforcement, information sharing, transparency and reporting (Bodanksy 2010,1011; Depledge 2005; Bodanksy 2011; Paterson and Newell 2010; Victor and Keohane 2010; Wijen and Ansari 2007). Thus our first neo-liberal hypothesis predicts that:

Hypothesis 1: Countries that participate more regularly in international environmental institutions are more likely to reduce emissions than countries that seldom participate in these institutions.

Second, international institutions like the climate regime can also create non-material incentives for emissions reduction. Since the climate regime represents the common interests of humankind, at the international level, domestic emissions reduction is associated with morally defensible, responsible behaviour. By the same token, non-regulation of domestic emissions is suggestive of self-interested behaviour – prioritising one's national interests over the common good of the international community (Bernstein 2002). The transparency of the regime's reporting system, coupled with an active transnational media and thriving array of environmental NGOs ensures that states are held accountable for climate policy and go onto experience the reputational consequences of emissions policy.

Although there is no obvious way to measure the reputational costs (and benefits) of emissions behaviour on a country, the climate ethics and global justice literature (discussed below) provides some guidance: countries that generate a large share of global emissions face higher moral and reputational pressures to take a proactive stance towards the climate regime. It is impossible for the international community to effectively regulate atmospheric greenhouse gases without the participation of the world's largest emitters, which should, therefore, face higher reputational incentives to cooperate. Conversely, the minimal contribution of small polluters to global emissions levels should give these latter countries more incentive to free-ride. Moreover, the largest polluters are also more complicit in causing climate change and should, from a moral perspective, play a leading role in combating climate change. These reputational incentives inform our second neo-liberal hypothesis:

Hypothesis 2: Countries that are responsible for a large share of atmospheric greenhouse gases are more likely to reduce emissions than smaller emitters because they face higher reputational costs from non-compliance and have less incentive to free-ride.

Neo-liberal minded states are also likely to be sensitive to the domestic political costs of emissions behaviour. As with the political approaches reviewed in the last chapter, this approach depicts democracy as a critical driver of emissions (Roberts et al. 2004). The rationale is as follows: regular political elections ensure that democratically elected politicians are held accountable to public demand for effective climate policy (Neumayer 2002; Roberts et al. 2004). When combined with a more liberal political environment, which is conducive for concerned citizens to express and champion their environmental woes (for example, by forming civil society groups and NGOs), democratic influence leads to a third neo-liberal hypothesis:

Hypothesis 3: Democracies are more likely to reduce emissions than non-democracies as democratically elected politicians face higher domestic demand for public environmental goods and are typically better at providing them.

Another set of hypotheses flows from the structuralist worldview and problem representation. First, structuralist countries would expect developed 'core' countries to be more willing to reduce emissions as a means of complying with the unequal climate regime which they primarily designed to serve core class interests. Various structuralists have criticised the mitigation clauses under the KP for setting ineffective emissions targets for annex parties that are bound by the regime and establishing legal mechanisms for developed countries to transfer the burden of emissions targets to the poorest countries[63] (e.g. Betsill et al.

[63] The clean development mechanism (discussed in chapter two), which allows developed countries to meet their emissions targets under the KP by purchasing carbon credits from clean technology projects funded in developing countries is particularly controversial in this respect.

2007; Parks and Roberts 2007,2008,2010; Bohm et al. 2012). Moreover, even if developed countries were to adopt stringent emissions caps, they have the advantage of already having attained advanced levels of economic development in the absence of emissions restrictions. Hence our first structuralist hypothesis is:

Hypothesis 1: Core countries are more likely to reduce emissions because this paves the way for the transferral of the mitigation burden to periphery countries.

This does not necessarily mean that developing countries will always avoid undertaking emissions reductions. After all, they were exempted from mitigation commitments under the Annex system and could, therefore, comply with the KP without undertaking emissions targets. Yet this is unlikely to be the case in the post-Kyoto era as developed countries are pushing hard for universal emissions targets. Furthermore, structuralism also gives us reason to expect that Northern countries have more power to coerce developing countries into complying - whether they want to or not. Therefore, the former hypothesis might be counteracted by a country's exemption from emissions targets and ability to act as it so chooses. [64]

Structuralists also attribute emissions behaviour to the ability of countries to fulfil their responsibilities under the climate regime. As discussed above, the colonial insertion of the periphery into the world economy has left most developing countries dependent on exporting unprocessed raw materials (Betsill et al. 2006; Parks and Roberts 2006,2007,2010;

[64] Although this reasoning is compatible with relative gains approaches, it differs from neo-realism as the causal variable is the global capitalist system, which necessitates zero-sum behaviour, rather than relative gains concerns itself.

Roberts et al. 2004). Thus, even if Southern countries did not reject emissions reductions on ethical grounds, they would still continue increasing emissions levels because strong compliance acts (especially emissions reduction) would endanger their primary source of income.

Of course, an undiversified export sector does not *always* indicate high dependency on fossil fuels. For example, a country that specialises in the production and export of agricultural goods is likely to be less dependent than a country that exports fossil fuels or makes intensive use of them. Yet even when an undiversified export sector is not accompanied by fossil fuel dependency, countries that depend on the export of a small number of unprocessed goods will typically have a strong export sector elite that depends on the state's rents and, therefore, pressures developing country governments into ignoring environmentalist demands (Roberts et al. 2004). Hence our second structuralist hypothesis is that:

Hypothesis 2: Countries with diversified export sectors are more likely to reduce emissions because they typically have the capacity to reduce emissions without endangering domestic livelihoods and are less constrained by export sector elites.

A related argument is that even if countries have undiversified export sectors, stronger economies will be better equipped to offset the domestic costs of emissions reduction, for example, by providing socio-economic relief to affected producers or making available alternative means for employment in non-carbon intensive sectors (Roberts et al. 2004; Price 1996). In contrast, a country that is both highly dependent on exporting primary goods and economically weak would have a much more difficult time trying to overcome the domestic costs of emissions cuts.[65] Thus our third structuralist hypothesis is that:

Hypothesis 3: Countries with stronger economies are more likely to reduce emissions because they have greater capacity to offset the domestic costs of emissions reduction.

Ultimately, each worldview-problem representation set gives rise to a different strategic response, which, in turn, identifies a different set of instrumental drivers behind emissions behaviour. The neo-realist approach, for example, delineates relative power maximisation as the strategic response to climate change, which envisages (relative) physical state power, fossil fuel dependency and reciprocal commitments as the key (instrumental) drivers behind emissions behaviour. Moreover, these drivers are compatible with the leading – economic, social, political and environmental - explanations of emissions trends that were discussed in chapter two.[66] Table 3.2 illustrates that each of the worldviews hypotheses tap into various explanations of emissions behaviour from chapter two.[67] For example, our first neo-realist driver, physical state power, can be conceptualised as a mixture of domestic institutional capacity, technology, population, environmental vulnerability and economies of scale. Thus, if worldviews do indeed play a role in mediating the effect of instrumental drivers, it is reasonable to expect that

[65] Multicollinearity tests and an examination of the distribution of export diversity and economic power between countries and supranational regions in chapter seven indicate that the two factors are not correlated and therefore, warrant treatment as distinct factors.
[66] The areas of overlap between the theories of emissions trends reviewed in chapter two and the hypotheses derived from the ideal worldviews proposed in this chapter are presented in table 3.2.
[67] Chapter four maps out how some of the leading causal variables from chapter two are used to operationalise the instrumentalist drivers that underlie the worldviews-based hypotheses proposed in this chapter.

countries' beliefs in a given worldview should increase the influence of the corresponding material driver. Hence, returning to the (relative) physical power example, belief in neo-realism should cause policymakers to afford more emphasis to concerns relating domestic institutional capacity, technology, population, environmental vulnerability and economies of scale that underlie relative power calculations relating to emissions behaviour. Moreover, the significant degree of overlap between the causal variables proposed by my theoretical approach and the leading explanations from chapter two suggests that countries' worldviews should explain why certain countries and regions afford more emphasis to different emissions drivers.

Worldview and strategic response	Emissions driver (chapter 3)	Hypothesis	Emissions driver (chapter 2)	Explanation of compatibility
Neo-realism: maximise relative power	Relative physical power	Weak countries are more likely to reduce emissions than powerful countries	Economies of scale, technology, population, domestic institutional power, vulnerability	The components in column 4 are components of a country's relative physical power.
	Relative fossil fuel dependency	Countries that are less dependent on fossil fuels are more likely to reduce emissions	input mix	Countries with lower carbon input mixes are less dependent on fossil fuel incomes.
	Reciprocal commitments	States are more likely to reduce emissions when their competitors undertake reciprocal commitments	IEAs	The KP, and example of an IEA, establishes binding emissions targets for annex parties.
Neo-liberalism: maximise absolute power	International environmental institutions	States are more likely to reduce emissions when they participate frequently in IEAs	IEAs	IEAs create incentives for international environmental regulation.
	Reputational effects	Countries are more likely to reduce emissions when they face higher reputational costs from non-compliance	Economies of scale, IEAs	Countries with larger economies are more complicit in causing climate regime and therefore face high reputational pressure to reduce emissions. Participation in IEAs increases these pressures.
	Regime type	Democracies are more likely to reduce emissions than non-democracies	Regime type	Democracies are more sensitive to public demand for emissions reduction.
Structuralism: fulfil transnational class interests	Class status	Core countries (with high GDPs and cumulative emissions levels) are more likely to reduce emissions than periphery states.	Economies of scale, input mix, output mix, technology, vulnerability, living standards	All factors in column 4 are components of transnational class status.
	Economic power	Countries with strong economies are more likely to reduce emissions because they have higher mitigative capacities than weaker economies.	Economies of scale	Larger economies are generally stronger and more advanced.
	Export diversity	Countries with diversified export sectors are more likely to reduce emissions as they typically have higher mitigative capacities and face less pressure from export elites.	output mix	Countries with lower carbon output mixes tend to have more diverse economies.

Table 3.2. Worldviews and leading explanations of emissions behaviour

By this point, it should be evident that; *by themselves, worldviews and problem representations do not provide a complete explanation of emissions behaviour*. In order to judge whether emissions reduction fits with states' strategic goals, we need to account for idiosyncratic material variables – a task that I devolve to the empirical chapters. At this point, I merely want to note that this move – to marry ideas with instrumentalist variables - is compatible with cognitive and constructivist theorising. The former assigns material factors a key role in the cognitive process: beliefs are formed partly in response to incoming information about the physical world. Similarly, as we saw above, constructivism contends that the world consists of intersubjective – material and social factors. Moreover, proponents of constitutive causality assert that social processes are usually precursors to material causation, which is the precise role that I envisage worldviews to play in the formation of emissions behaviour.

My approach is founded on a similar logic to Weber's (1946) switchman metaphor, which was quoted at the beginning of this chapter. I propose that worldviews and problem representations act as gatekeepers for material causation: they activate the causal pathways that fit with a state's pre-existing beliefs about international politics and switch off those that do not. Thus worldviews facilitate material causation: it is through them that physical factors acquire the connotations, values and causal powers to influence emissions behaviour as postulated by the instrumental explanations reviewed in chapter two.

To illustrate this argument, let us treat worldviews as coloured lenses through which states interpret the world, as depicted in figure 3.2. When a state perceives the world through a neo-realist lens, its emissions behaviour is likely to be determined by its relative gains expectations about climate policy, thereby activating the neo-realist causal pathway

(1), while switching off neo-liberal (2) and structuralist (3) causal processes. Neo-liberal and structuralist worldviews play the same facilitating role in activating absolute gains and economic power-based compliance behaviour.

Social constitution		
Constitutive variable: Worldview	**Material causation**	
	Strategic response	**Dependent variable**
1. Neo-realism	Maximise relative gains	Emissions behaviour
2. Neo-liberalism	Maximise absolute gains	
3. Structuralism	Fulfil transnational class interests	

Figure 3.2: Constitutive-causal framework proposed by this thesis

Contributions

The approach that I develop in this chapter contributes to three bodies of literature. First, its most substantive contributions are to the scholarship on emissions behaviour. As I discussed at the beginning of this chapter, the field suffers from some fundamental problems, which, I contend, can be partly overcome through the fusion of social constructivism and cognitive psychology. Specifically, the scholarship struggles to explain why material factors do not always have their predicted effects over emissions behaviour. Very little attention is paid to intervening variables and facilitating conditions. In this chapter, I suggested that worldviews play a vital role in activating the causal processes that are leveraged by the leading materialist approaches; they construct the contours of rational decision making, which determines the salience and causal power of material drivers.

Another problem with the emissions literature is that it focuses solely on instrumental drivers. Little room is given to the role of ideas and social processes in shaping emissions behaviour. While I am certainly not suggesting that ideas do not have instrumentalist effects, a core tenet of constructivism is that it can understand more of the world by uncovering ideational (constitutive) processes (Ruggie 1998; Kratochwil 1999; Wendt 1999; Checkel 2001 and Lebow 2009). Although some scholars have begun exploring the role that ideas, risk perceptions and values play in affecting public support for climate policy (e.g. Hulme 2009; Pettenger 2007; Parks and Roberts 2008,2010 and Roberts et al. 2004), the link to emissions trends has yet to be established (both theoretically and empirically). In this chapter, I proposed that the concepts of worldviews and problem representations provide one option for theorising the effects of non-instrumentalist factors over emissions trends.

The third issue that I seek to address is the artificial segregation of the different theoretical approaches to emissions trends. My approach provides a framework for bringing together and weighing the leading explanations in the field. Specifically, I proposed that an investigation of the ideational context of decision making can help explain which material factors are more important drivers of compliance behaviour in certain countries and regions.

Second, my approach contributes to the broader social constructivist tradition. As I noted above, some of the most prominent constructivists in the discipline have suggested that an engagement with cognitive psychology could help elucidate the dynamics behind social constitution (e.g. Wendt (1999), Checkel (2001) and Lebow (2009)). The theoretical approach that I develop in this chapter is a novel application of constitutive causality. It is one of few attempts to explain compliance with the climate regime through a 'strong' constructivist framework, which does not rely solely on instrumentalist reasoning.[68]

Lastly, by illustrating the potential utility of worldviews and problem representations in explaining compliance with the climate regime, my work is a novel application of cognitive psychology. More broadly, it adds to the thriving 'strong' constructivist scholarship in IR (Kratochwil 1998; Ruggie 1998; Wendt 1999; Kydd 2000 and Checkel 2001), which has done an excellent job of fostering dialogue with cognitive psychology (e.g. Holsti 1962; Axelrod 1973; George 1979; Herrmann 1985; Herrmann and Fischerkeller 1995; Larson 1997; Mowle 2003; Mitzen 2006 and Steele 2008).

[68] My usage of the term 'strong' constructivism is in accordance with Checkel (2001) to denote ideational processes that shape outcomes through non-instrumentalist pathways such as consensual persuasion and perception.

Chapter Four: Research Design

Introduction

In the introduction to this thesis, I drew attention to a critical question that remains unanswered in the climate politics literature: *why are some countries more willing to reduce domestic emissions than others?* My review of the literature in chapter two found that most explanations attribute emissions behaviour to one of four broad types of causes – economic, social, political and environmental. In the last chapter, I developed my own theoretical approach and fleshed out where my potential contributions to the literature lay. Drawing on constructivist theory, I argued that emissions behaviour is (in part) determined by social constitutive processes, which are usually overlooked by the instrumentalist explanations that dominate the field. Moreover, instrumentalist concerns can only shape a state's emissions behaviour if the state, or the policymakers who act on its behalf, believes in the positive and normative assumptions of the corresponding worldview(s); thereby ascribing causal power(s) to the instrumentalist concern(s). The aim of this chapter is to develop a methodological strategy to test both my own theoretical approach and (some of) the 'mainstream' explanations of emissions behaviour. To this end, I draw on multilevel modelling to build a three-level model of emissions trends. My aim is not to find a single regression coefficient or effect for each driver; rather, it is to develop a deeper understanding of emissions behaviour by examining how the effects of several factors vary across different national and regional contexts.

This chapter consists of four sections. I begin by laying out the need for a multilevel approach to the project by demonstrating both conceptually and statistically that emissions behaviour is clustered across countries and supranational regions. I solidify my decision to use multilevel modelling by discussing the limitations of three alternative approaches – namely: conducting separate regressions for different regions, multiplicative regression and a grand interactionist model - that could also be used to model the nested data structure instead of multilevel regression. In the second section, I demarcate the spatial-temporal domain of the empirical analysis. The third section is where I operationalise the variables and specify the data sources that will be consulted during the coding process. I end the chapter by setting up my own three-level model of emissions behaviour; working up from the simplest single-level regression to a three-level random coefficient model with interaction effects.

Approach

In this section, I justify my decision to use multilevel modelling to study emissions behaviour. My defence rests on two core arguments: First, emissions behaviour is clustered at the country and supranational regional levels, which makes it necessary to go beyond ordinary least squares regression and employ a more sophisticated approach to model the hierarchical data structure. Second, multilevel modelling is able to account for this clustering without creating the problems that are associated raised by three alternative options. I now discuss each of these points in turn.

The Hierarchical Nature of Compliance Behaviour

Simple linear regression is the methodology of choice for quantitative work on international climate politics (e.g. Dolsak 2001; Roberts et al. 2004; von Stein 2008; Battig and Bernauer 2009 and Bernauer and Bohmelt 2013). Yet I contend that this approach is unsuitable for studying compliance with the climate regime. Specifically, I demonstrate that compliance behaviour violates one of the core assumptions of single-level regression, which casts doubt on some of the conclusions that can be drawn from most quantitative work in the field.

While this is certainly not the place for a detailed introduction to regression, the research design and foundation of the following empirical chapters is premised on the claim that single-level regression cannot cope with the hierarchical structure of emissions data. Before fleshing out precisely what this means, I begin with a brief introduction into the theory behind simple linear regression, which is vital if we are to understand where it falters in the context of this research and why multilevel modelling offers a way forward.

As the simplest example, a linear model that contains only one predictor (x) and dependent variable (y) takes the form: $y = \beta_0 + \beta_1 x$. Yet an individual's (i's) actual y-value is not exactly equal to the y-value predicted by the model ($\hat{y}_i$);[69] rather, it deviates from the predicted value by a residual term (e_i). Hence the formula becomes: $\hat{y}_i = \beta_0 + \beta_1 x_i + e_i$.

[69] If this were true, regression would have perfect predictive power.

Simple linear regression uses a technique known as ordinary least squares (OLS) to estimate the values of the population parameters (β_0, the intercept and β_1, the slope) that minimise the sum of the squared residuals. Yet in order for OLS to work, the residuals must be completely independent from each other. If the residual independence criterion is met, then the residuals should not be correlated with each other. This means that there should be no way of inferring whether any two observations of compliance behaviour are likely to be similar to (or different from) each other. In this section, I demonstrate that emissions behaviour violates this criterion.

It is informative to consider for a moment precisely what is being argued. Conceptually, my claim is very simple. I am suggesting that, due to a host of factors (some of which are tested in the empirical chapters), certain observations of emissions behaviour are more likely to be more similar to each other than others. Specifically, I propose that we are likely to see correlation between the observations that are taken from the *same* country and region. In the remainder of this section, I demonstrate this claim. To make my case, I explain how the clustered structure of emissions behaviour gives rise to correlation and support my claim with statistical tests for clustering.

The source of correlation is rooted in the clustered nature of emissions trends. The aggregation of different countries' emissions behaviour over several years forms a complex data structure that is characterised by three different levels – namely: country-years, countries and supranational regions. The relationship between the levels is hierarchical, which means that a lower level unit only belongs to one higher level unit and group membership does not change over time.

The country-year is the lowest level of the model. Each country-year belongs to a country (level two unit) and since countries are observed over the same time period, all countries are observed for an equal number of country years. Moving up the hierarchy, each country belongs to a supranational region (level three unit), which represents the common interests of its members in the multilateral climate negotiations.[70] In this thesis, I focus on eight major regions – namely: the European Union (EU), Umbrella Group (UG), emerging economies (BASICs), middle-income developing countries (MIDCs), Least Developed Countries and Alliance of Small Island States (LDCs and AOSIS), Petroleum Exporting Countries (OPEC), Central Asia, Caucasus, Albania and Moldova (CACAM) and the Environmental Integrity Group (EIG).[71] Although several smaller negotiating alliances like the League of Arab States and the Agence intergovernementale de la francophonie are also represented, I focus solely on the eight most influential bargaining blocs in the negotiations. This selection also makes sense from a methodological perspective, as, in order to keep the model simple (i.e. hierarchical), it is important that each country only belongs to a single

[70] Throughout the thesis, I use the term region in this sense of the term.
[71] Country members of these groups are listed in the chapter appendix.

region. Including smaller groups would have created overlapping memberships, particularly in the South where several Arab and African states have formed their own groups to act alongside the broader LDC position.

Most developed countries in the geopolitical North belong to one of two regions – the EU, which acts on behalf of its members, or the UG, a US-led coalition for states that are well endowed with fossil fuels. Things are a little more complicated in the South, where developing countries typically belong to one of four regions. The BASICs represent the interests of the most advanced developing countries, which sometimes act separately from the broader Southern position of the G77 and China. Unlike the other regions, the MIDCs is a pseudo group, which I created to denote the middle-income developing countries that do not formally belong to any of the smaller Southern blocs. The LDCs and AOSIS is the largest region, representing the poorest states which are the most vulnerable to climate change. OPEC represents a small group of developing countries who supply most of the world's oil. The remaining two regions are populated by intermediate countries which are neither (strictly speaking) developed nor developing. CACAM represents the interests of a select group of energy abundant states, most of which are undergoing the transition to the market economy. The EIT is the smallest group of countries, which encompasses intermediary countries that do not share CACAM's energy interests.

Most of the regions are recognised as distinct entities in world politics more broadly and often work together in other issue-areas. This is most apparent in the case of the EU, which boasts a highly sophisticated institutional architecture that coordinates several high-priority interests such as the national economy, security, trade and the promotion of political values. Similarly, the BASICs has established itself as a narrow subset of economically advanced, rapidly emerging developing countries in the multilateral trade negotiations. The LDCs and AOSIS states are often singled out as the most vulnerable countries in several international matters such as trade, finance, poverty eradication, political conflict, epidemic disease and environmental issues. OPEC was established to coordinate the interests of oil exporting countries while the shared Soviet experience frequently prompts CACAM countries collaborate in a range of other issue-areas. The situation is very different for the UG, MIDCs, and EIG regions, which are only active in the climate negotiations. Thus, my decision to treat these latter groups as separate regions is informed by their behaviour in the narrow realm of climate politics. A major advantage of multilevel modelling is that is does not matter whether the regions are defined exogenously to the behaviour that is being modelled or by the behaviour to be explained. Nor does it matter that the former regions are more institutionalised, active and widely recognised as distinct groups than the UG, MIDCs and EIG. Multilevel modelling provides the tools for accounting for regional clustering, irrespective of whether the clustering is captured by the variables in the model.[72]

[72] See, for example, Hox (2002) and Rabe-Hesketh and Skondral (2012).

The hierarchical structure of emissions data is illustrated in figure 4.1. The unit diagram (left) only displays a snippet of the total number of units that are analysed in the thesis. Nonetheless, it clearly illustrates that emissions behaviour is hierarchical; country-years are nested in countries, which are nested in regions. Since it is impractical to display a large number of observations in the same diagram, the classification diagram to the right is a more concise representation of the research problem.

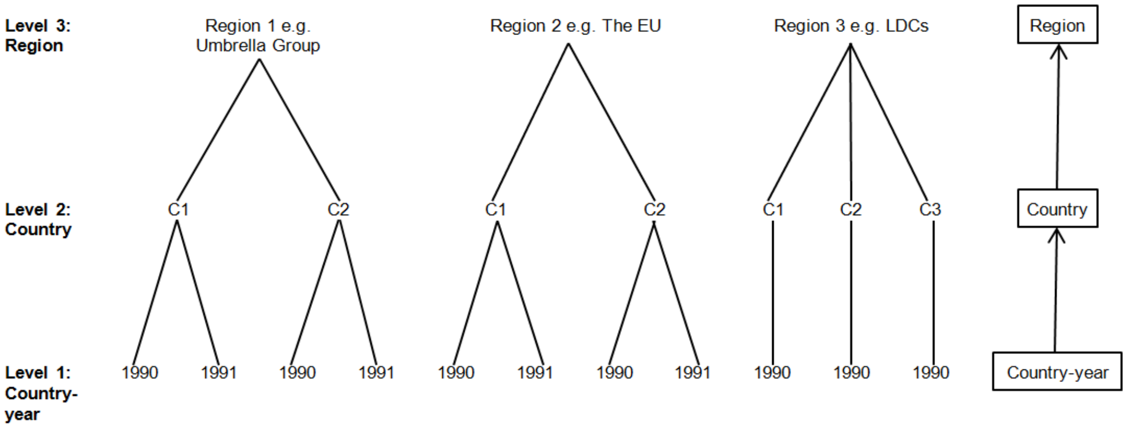

Figure 4.1: Unit diagram and classification diagram for the three-level structure of country-years within countries within regions

Statistical Checks for Clustering

I now move onto validating my claim that emissions behaviour is clustered at the country and regional levels by conducting statistical tests on the emissions data that is analysed in this thesis.[73] Stata's xtmixed command is used to fit a series of 'null' multilevel models that include only the dependent variable, emissions behaviour, and the levels included in

[73] Full details of the spatial-temporal boundaries, sources and coding of the dataset are presented below.

the model. I use the likelihood values of these models to conduct maximum likelihood tests which compare the three-level model with simpler (two and single-level) models. After establishing that the three-level model is the best fit for the research, I then disaggregate the total variance in emissions behaviour into intrastate, interstate and interregional variance components.

Since my current aim is merely to demonstrate the existence of clustering within the country and regional levels rather than explain it, the model does not include any predictor variables (these are gradually incorporated into the model over the empirical chapters). Instead, it includes only an intercept, region and country random intercepts, and a country-year level residual error term. The null model can be written as:

$$Embeh_{ijk} = \beta_0 + v_k + u_{jk} + e_{ijk}$$

where $Embeh_{ijk}$ is the observed emissions behaviour in country-year i (i=1,…,3381) in country j (j = 1,…,147) in region k (k=1,…,8), β_0 is the mean emissions behaviour across all regions, v_k is the effect of region k, u_{jk} is the effect of country j, and e_{ijk} is the country-year level residual error term. The region, country effects and country-level residual errors are assumed to be independent and normally distributed with zero means and constant variances, which can be expressed as:

$v_k \sim N(0,\sigma_v^2)$

$u_{jk} \sim N(0,\sigma_u^2)$

$e_{ijk} \sim N(0,\sigma_e^2)$

I begin by conducing likelihood ratio (LR) tests to determine whether accounting for country and region level clustering improves the fit of the model. Table 4.1 shows the results of pairwise LR tests, which were calculated by doubling the difference between the likelihood value[74] of the nested model and equivalent single-level mode.

Model	Likelihood value	p-value
1 (country-years un-nested)	-20739.14	<0.001
2A (country-years nested in countries)	-19780.12	<0.001
2B (country-years nested in regions)	-20555.35	<0.001
3 (country-years nested in countries nested in regions)	-19771.38	<0.001

Table 4.1: Likelihood values for clustered models

The low p-values indicate that in all cases, the nested models are better fits than single-level regression. Table 4.2 displays the results of LR tests that compare the three-level model with simpler two-level country-years nested in countries (2A) and country-years nested in regions (2B). The results of these tests also confirm that country and regional variance are separately significant, therefore, the three-level model is preferred.

Pairwise comparison	LR test statistic	p-value
3 and 2A	17.48	<0.001
3 and 2B	1567.95	<0.001

Table 4.2: Likelihood ratio test statistics comparing three-level model with two-level models

Checking the Significance of Variance Components at Each Level

Having established that the three-level model is the best fit, I calculate variance partition coefficients (VPC) at each level of the model. VPCs measure the proportion of observed variation in emissions behaviour that

[74] The likelihood value is the probability of obtaining the observed data (emissions values for the sampled observations) if that model were true.

lies at the region, country and country-year levels. The region level VPC is calculated as:

$$VPC_v = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2} = \frac{1220.198}{1220.198 + 5292.961 + 6274.011} = 0.095$$

$$VPC_u = \frac{\sigma_u^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2} = \frac{5292.961}{1220.198 + 5292.961 + 6274.011} = 0.414$$

$$VPC_e = \frac{\sigma_e^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2} = \frac{6274.011}{1220.198 + 5292.961 + 6274.011} = 0.491$$

We see that 9.5% of the variation in emissions behaviour lies between regions, 41.4% lies within regions between countries and 49.1% lies within countries between country-years. Thus, most of the variance in emissions behaviour across country-years is concentrated within regions at the country and country-year levels; interregional variance is only modest, though still important.[75]

Why does Clustering Matter?

Having established that clustering exists, I now turn briefly to the important matter of why it needs to be accounted for in the model. Since emissions behaviour is clustered, the effective sample size (ESS), that is, the number of independent observations, is less than the total number of observations (3,381). For example, if all country-years in a country or countries in a region exhibited the same level of compliance behaviour, then the ESS would be equal to the number of groups – 147 or eight respectively. Although the level of clustering is not so extreme and, therefore, the ESS is greater than the number of groups, this hypothetical case illustrates that, due to the compromised independency of observations, the standard errors derived from multilevel modelling are

[75] Clustering is significant when the VPC approaches ten percent (Rabe-Hesketh and Skrondal 2012).

likely to be higher than those obtained from single-level regression. Consequently, the risk of committing the type I error is greater in the latter model because confidence intervals are likely to be narrow and p-values too small, which could lead us to incorrectly infer that a predictor has a real effect over emissions behaviour when in fact it could be due to chance.[76]

The clustered structure of emissions behaviour also violates one of the core assumptions of the concept of causality as it is understood in the context of this thesis. In the last chapter, I specified that my use of the term causality refers to the difference between the actual outcome and the likely outcome that would have occurred at the same time and place with a different value of the explanatory variable (King et al. 1994:91-94)). Since causal claims are premised on the outcome that is expected to occur in some ideal counterfactual situation rather than actual data, it is imperative that causal inferences are based on homogenous units, which, in the context of this thesis, means that the observations of emissions behaviour should be similar in all respects except for the values of the explanatory variables. In failing this, it is possible that any observed correlations are caused by factors other than the alleged causal variable. As discussed above, for a host of reasons (only some of which are tested in this thesis), observations from the same country or region are more likely to be similar than observations from different countries or

[76] The problems of 'hidden' clustering in quantitative research is well documented in the IR literature e.g. Burton, Beck and Katz (1995), Steenbergen and Jones (1997), Zorn (2001) and Bartels (2008).

regions. Therefore, estimating the average effect of a predictor within each country or region provides stronger foundations for inferring causality beyond what is facilitated by single-level regression. In the latter case, the observations are not homogeneous, which means that variation in emissions behaviour is just as likely to be caused by interstate and interregional differences as it is to be caused by the independent variables.

Alternative Approaches

Before incorporating predictors into the three-level model, I wish to solidify my approach further by explaining why I decided not to use an alternative approach to multilevel modelling. Perhaps the most obvious option would have been to conduct separate regressions for the observations of emissions behaviour collected from different countries or regions and then compare the regression coefficients to weigh the relative importance of various drivers across countries or regions. However, as pointed out in most introductory texts to multilevel modelling, regression coefficients should be compared across different samples of observations because the coefficients would be based on observations that hold constant (and ignore) group-level factors (Jones and Steenbergen 1997). Thus, even if the samples were similar in terms of the number of observations they entailed and the time period covered, their parameters would only apply to the particular country or region from which the observations were taken. There would be no way of knowing whether differences in the coefficients would be due to unobserved heterogeneity rather than effects of the alleged causal predictor.

Another approach is to absorb clustering through a series of dummy variables – that is, creating separate binary variables to indicate that an observation belongs to a particular country or region. In statistical notation, this could look something like:

$$Embeh = \beta_0 + \beta_1 x_1 + \beta_2 D_1 + \beta_3 D_2 + \ldots + \beta_k D_{j-1} + e_i,$$

where β_0 is the fixed intercept (mean emissions behaviour for all observations), β_1 is the effect of some non-group specific variable x_1, β_2 is a binary value (either 0 or 1) that indicates the membership of the observation to group D_1, a specific country or region, which is different from $D_2 \ldots \beta_k D_{j-1}$.

Yet this approach also raises problems. First, supposing that we worked with the same dataset, the number of additional parameters introduced to the model would be huge (155 to be precise) as each country and region would require its own dummy variable, significantly increasing the degrees of freedom for error. Second, although the approach estimates the effects of group-level predictors (Bartels 2008), it is unable to estimate group residuals, which makes it impossible to test cluster-specific hypotheses that pertain to all countries or regions. Lastly, and related to the last point, because dummies do not have any substantive meaning beyond indicating group membership, the approach would not explain any interstate or interregional differences that are detected by the model – not least by looking for micro-macro interactions[77] (Steenbergen and Jones 1997,2002 and Hox 2002).

A third option, which, as I explain below, is widely regarded as the best alternative to multilevel regression, is to create a grand interactionist model. This approach assumes that the relationship between the predictor(s) and independent variable is mediated by a higher group-level variable. For example, the bivariate slope between emissions behaviour and national economic power is interacted with a contextual variable like, for instance, the economic power of the region to which the country belongs (z_{ij}). This can be expressed as:

$$Embeh = \beta_0 + B_1x_{1i} + \beta_2z_{1j} + \beta_3x_{1i}z_{1j} + e_i$$

This approach has clear advantages over conducting separate regressions or collapsing contextual effects into dummy variables: data is pooled, which means that regression coefficients are comparable across countries and regions and the interactionist term allows for effects to vary across clusters (Friedrich 1982). However, although the interactionist term introduces random effects at the individual level (i.e. predictor effects are allowed to vary by a product of the level one predictor and contextual factor), random error at the higher levels of hierarchy is assumed to be zero (Steenbergen and Jones 1997 and Bartels 2008). Since the effects of level one predictors varies both within

[77] As I explain below, micro-macro interactions are drivers of emissions behaviour that arise from the interactions of independent variables from different levels of the model.

and across clusters, overlooking the complex error structure at the country and regional levels does not overcome the problem of unobserved heterogeneity.

Having demonstrated the need to account for country and regional-level clustering and exposed potential problems in the leading alternative approaches to multilevel regression, the remainder of this chapter is devoted to developing a three-level model of emissions behaviour. Over the following pages, I fix the spatial-temporal boundaries of the empirical part of the thesis, operationalise the variables and lay out the testing strategy that will be employed over the following chapters.

Spatio-temporal Domain

This thesis uses cross-section time series data [78] to analyse the emissions behaviour of 147 countries from 1990 to 2012. The unit of analysis is the country-year, where one observation is the emissions behaviour of a given country in a given year. Simple multiplication (147 countries X 23 years) brings the total number of observations to 3,381.[79] There is no definitive answer to the sampling size question: standard regression textbooks recommend that the number of *additional* observations required for each independent variable is somewhere in the range of five to 100 (Wilson et al. 2007). Since I test a total of twelve (nine mainstream and three worldviews) hypotheses, this sample size satisfies even the most stringent sampling criterion.

[78] Since the same countries are observed over 23 years, the research can also reasonably be construed as a panel study.
[79] As I explained above, the 'effective sample size', that is, the number of independent observations when we account for clustering, is significantly less than this.

The spatial domain was largely dictated by the availability of data pertaining to the predictor variables analysed in the thesis. A country was excluded from the sample if it had *a complete set of* missing values for two or more predictor variables. As discuss below, some variables that were coded at the country-year level were not recorded over certain years. In these cases, all countries have missing values for the same years. The criterion for excluding a country from the sample is when there is no data at all on the country for at least two predictor variables (e.g. power and resource dependency) over the entire time period under investigation.

The lower time limit was set to 1990 as this is the year that climate change entered the political agenda. Important developments in climate policy occurred over the following decades: in the heydays of the climate regime, countries convened to draft the UNFCCC, which opened for signature in 1992. This was followed by negotiations to codify national commitments under a legally binding treaty, which culminated in the KP in 1998. The race to coopt the necessary level of support for the KP to enter into force ushered in a dynamic period in climate diplomacy and saw the widening of transatlantic tensions, with the US withdrawing from the KP in 2005. In the seven years that followed, parties to the KP went onto achieve their collective emissions target, while all countries (including non-parties) returned to the negotiating table to reach agreement on a successor regime for the post-Kyoto era. 2012 is an appropriate cut-off point as it marks the end of the First Commitment Period and expiry of the KP. If, as some approaches claim, emissions behaviour is indeed time dependent, then longitudinal trends should manifest over this vibrant period in climate politics.

Operationalisation

In chapter two, I reviewed the leading explanations that scholars have proposed to account for emissions trends. I argued that most approaches could be associated with four instrumentalist approaches – namely: economic, social, political and environmental, which were disaggregated into ten hypotheses.[80] In the last chapter, I developed a constructivist approach to emissions behaviour which suggested that worldviews play a critical role in shaping emissions behaviour: they determine which instrumentalist factors are perceived to be important by policymakers, thereby conditioning the effect of instrumental drivers of emissions trends. To make my argument more concrete, I proposed three ideal worldviews and problem representations, which were derived from the leading instrumentalist theories of IR, and fleshed out nine hypotheses to illustrate theoretically how these worldviews could translate into concrete emissions behaviours. We saw that each worldview led to a problem representation, which, in turn, constructed a strategic response (namely: relative power maximisation, absolute power maximisation and the fulfilment of transnational class interests) to climate change. This strategic response was critical because it identified *which* instrumental factors its adherents were likely to treat as important determinants of

[80] These were summarised in table 2.2 in chapter two.

emissions policy, thereby establishing the linkage between ideas and action.

Since the primary aim of the thesis is to ascertain whether worldviews play a conditioning role in emissions behaviour, the material drivers that are to be investigated are those that are most likely to be affected by countries' beliefs in neo-realist, neo-liberal and structuralist worldviews. In other words, the selection of independent variables is informed by the hypotheses and strategic responses that flow from the worldviews and problem representations in chapter three. Hence the hypotheses under scrutiny are:

Neo-realism

- *Weak countries are more likely to reduce emissions because they are more reliant on international efforts to combat climate change.*
- *Countries that are relatively less dependent on fossil fuels are more likely to reduce emissions because they stand to incur lower costs from emissions reduction.*
- *Countries are more likely to reduce emissions when their competitors undertake reciprocal commitments.*

Neo-liberalism

- *Countries that participate more regularly in international environmental institutions are more likely to reduce emissions than countries that seldom participate in these institutions.*
- *Countries that are responsible for a larger share of atmospheric greenhouse gases are more likely to reduce emissions than smaller emitters because they face higher reputational costs from inaction.*
- *Democracies are more likely to reduce emissions than non-democracies as democratically elected politicians face higher domestic demand for public environmental goods and are typically better at providing them.*

Structuralism

- *Core countries are more likely to reduce emissions because their class interests are better served by global regulation of emissions.*
- *Countries with diversified export sectors are more likely to reduce emissions because they typically have the capacity to reduce emissions without endangering domestic livelihoods and are less constrained by export sector elites.*

- *Countries with stronger economies are more likely to reduce emissions because they have greater capacity to offset the domestic costs of emissions reduction.*

Social constructivism

- *Countries are more likely to shape emissions behaviour in accordance with instrumentalist drivers (relative gains, domestic cost-benefit ratios and transnational class interests) when they subscribe to a (neo-realist, neo-liberal and structuralist) worldview that affords primacy to the corresponding driver in world politics more broadly.*

Moreover, because of the significant overlap between the neo-realist, neo-liberal and structuralist hypotheses flowing from my worldviews approach and the leading instrumentalist approaches of emissions trends, the preceding hypotheses also test some of the mainstream explanations from chapter two. [81] As such, the interpretation of the empirical results in the following chapters will be conducted with reference to the relevant literature from chapter two.

In this section, I suggest concrete proxies that can be used to measure these drivers, alongside emissions behaviour, so that they can be incorporated into the multilevel model.[82] Variables were coded at the lowest feasible level in order to maximise the explanatory potential of the predictor by capturing, where possible, both its longitudinal (country-year) and cross-sectional (national and regional) qualities. Not all variables could be measured at the country-year level. To determine which level was appropriate for each variable, I worked my way up from

[81] This point is elaborated below.
[82] Tables one to three in the chapter appendix display the results of multicollinearity tests, which confirm that the correlations between the independent variables are low enough to warrant inclusion as separate variables.

the country-year to the region, evaluating at each level, whether: (i) the measurement makes intuitive sense and (ii) data was available for that level of measurement. If the answers to both questions were affirmative, then the variable was coded at that level. If not, the same questions were repeated at the (adjacent) higher level of the model. All independent variables were centred in order to produce a stable succession of variance estimates across the models.[83]

The Dependent Variable: Emissions Behaviour

The dependent variable is emissions behaviour (EMBEH), which measures the annual level of CO2 emissions reduction in a country. The focus is on CO2 levels because it is widely recognised as the worst offender and is also the greenhouse gas for which the most comprehensive data is available. Since the *ultimate* goal of the climate regime is to reduce greenhouse gas emissions, rather than, say, to elicit expressions of support for climate governance or investment in mitigation, emissions behaviour is the closest indicator we have to gauge whether the climate regime is working[84] - a point which I return to in the conclusion chapter.

Emissions data is taken from the World Resource Institute *Climate Data Explore*r (CDE) database and weighed against emissions levels in the year 1990 using the formula:

[83] Hox (2002) provides an excellent discussion on why the results of centred variables are easier to interpret and compare across different models.

[84] Battig and Bernauer (2009) provide an excellent discussion on the need to differentiate between the former, which they refer to as 'outcome' and latter, which they term 'output'.

$$\text{EMBEH} = \left(\frac{(\text{emissions}_{1990} - \text{emissions}_{\text{actual}})}{\text{Emissions}_{1990}} \times 100 \right) + 100$$

Comparing emissions to a baseline year instead of using raw emissions data has the advantage of holding constant a range of country-specific attributes (such as the size of the economy, population, territory climatic conditions) which could have a bearing on emissions levels if uncontrolled for. This is especially important in the context of this thesis because the limits imposed by the degrees of freedom (n=8, df=7) by the third level of the model means that only a small number of factors can be explicitly controlled for as independent variables.[85] Thus, in this way, it is possible to concentrate on emissions behaviour while treating other potential drivers as constant. The year 1990 is used as the baseline because the KP stipulates that global emissions should return to 1990 levels by the end of the First Commitment Period.

Subtracting actual emissions from 1990 levels reverses the order of raw emissions values so that high scores are indicative of higher compatibility with mitigation (and low emissions levels) and low scores low compatibility with mitigation (and high emissions). By adding 100 to the deviation, a score of 100 denotes 100 percent attainment of 1990 emissions levels. Values above 100 denote emissions reductions that go beyond the 1990 baseline value (i.e. actual emissions levels are lower than the 1990 level) and are thus indicative of compatibility with mitigation. Scores between zero to 100 indicate suboptimal reductions in emissions and negative values actual emissions levels that are more than double 1990 emissions levels, denoting incompatibility with mitigation.

Independent Variables

In the last chapter, we saw that the worldviews-based hypotheses that are central to my theoretical approach tap into various causal drivers

[85] This point is elaborated below.

associated with the leading explanations of emissions trends from chapter two. The neo-realist understanding of relative power, for example, is comprised by several attributes such as the scale of the economy, composition of the input and output mix, technological capabilities, population size, domestic institutional power and environmental vulnerability. Table 3.2 illustrated that, like relative power, most of the drivers that flow from the worldviews also encompass multiple elements of the drivers of emissions trends. Since it is not feasible to measure all of these elements in the space of this thesis, over the following paragraphs, I operationalise the causal variables that flow from the worldviews by using proxies that capture the core elements of the variable being measured. This inevitably excludes some aspects of the variable. However, the trade-off is justified for at least two reasons. First, one needs to draw the line somewhere and focusing on the key components of a variable is a reasonable way of measuring it. Second, the relatively large number of variables tested in this thesis (both in the main body and in the robustness tests) means that most of the drivers proposed by the leading explanations of emissions trends do end up being investigated, albeit under a different name. I now layout the operationalisation strategy for the thesis.

- Neo-realist Predictors: Relative Power

Power

As we saw in chapter two, neo-realists define power in broad, material terms. The Correlates of War Project maintains a Composite Index of National Capabilities (CINC) which assigns countries a score from zero (low) to one (high) based on their level of iron and steel production, military expenditure, military personnel, primary energy consumption, total population and urban population in a given year.[86] These components are a good fit with the neo-realist understanding of power. The CINC database provides annual data for all 147 countries over the first 18 years (1990 to 2007) of the time period under investigation. Since neo-realists focus on relative, as opposed to absolute, gains, I am specifically interested in where a country sits in relation to other countries in the international system rather than their absolute level of power. Therefore, instead of working with raw CINC data, CINC scores were centred for each year by subtracting the world mean power level in a given year from a country's CINC score in that year. For example, if a country has a CINC score of twelve in 1990 and the world average CINC score for that year was ten, the centred score would be equal to (12-10) two, which would indicate that, for that year, the country's power level was two points above the world average.[87] Since states' power levels can (and usually do) vary over time and CINC data is recorded annually, power was coded at the country-year level.

[86] The CINC range is much narrower than the ranges of the other independent variables (approximately 100), therefore, CINC scores were multiplied by 1,000 in order to aid the comparability of power coefficients with other estimates.

[87] The advantage of this approach over ranking country scores in a given year is that the differences between the centred scores are still proportionate to the actual differences in the dataset, whereas ranked variables would distort the data by treating all inter-country differences as equal to one (rank).

Fossil Fuel Dependency

Fossil fuel dependency denotes the proportion of national income that comes from fossil fuels – either as an export or as a component of production. The World Bank's World Development Indicator's (WDI) database records the percentage of country's GDPs that is accrued, in one way or another, from fossil fuels. Although a country's endowment of natural resources is likely to be stable over time (unless, for example, new resources are discovered), its relative dependency on fossil fuels as a share of GDP can change.[88] Therefore, there is a strong theoretical reason for looking into longitudinal changes in fossil fuel dependency by coding at the country-year level. As with the power variable, the focus is on *relative* dependency patterns vis-a-vis other states rather than absolute dependency in domestic terms. Therefore, the same approach of annual mean centering is used to convert raw WDI values into relative fossil fuel dependency levels.

Reciprocity

There is no obvious proxy to measure reciprocal commitments under the climate regime. Since the most salient cleavages in the climate negotiations revolve around the issue of quantitative mitigation targets, the annex categories serve as a useful focal point. Specifically, my (admittedly imperfect) proxy for reciprocal commitments is whether parties of the opposite annex group are bound by quantitative emissions targets under the KP. Thus reciprocity is a binary variable that is coded

[88] For example, industrialisation increases fossil fuel consumption.

‘one’ for non-annex parties who are exempted from quantitative commitments under the climate regime and ‘zero’ for Annex I parties, who are assigned binding emissions targets and do not enjoy the assurance that non-Annex parties are bound by reciprocal commitments.[89] Since emissions targets are institutionalised by the KP, reciprocity does not vary longitudinally. Nor do the Annex categories, which is the basis of quantitative emissions targets under the regime, overlap (perfectly) with the regions identified by this study. Therefore, reciprocity is measured at the country level.

The institutionalisation of reciprocal commitments under the KP rules out the possibility for endogeneity. For example, reciprocal commitments were not periodically altered or made available to non-compliant states to entice them into complying. Yet one could argue that the multilateral negotiation of the climate regime, specifically the classification of parties under the Annex system, creates a different kind of endogenous risk - one which is not sensitive to temporal fluctuations in emissions behaviour. States might have only signed up to the KP and agreed to be bound by Annex commitments if they were intending to reduce emissions in the first place, irrespective of the prospect of reciprocal commitments. Yet this argument is weakened if we consider that several countries have tried (often) unsuccessfully to change their annex categorisation under

[89] Annex listings can be found on the last page of the KP and also in the appendix to chapter five.

the climate regime [90] and, as illustrated in the first chapter, even withdrawn from the KP after the act of signing. Therefore, it is wrong to claim that states dictated the terms of their participation, not least their classification and assurance of reciprocity under the climate regime.

- Neo-liberal Predictors: Domestic Costs and Benefits

Reputational Cost

There is no agreement on how to measure the reputational costs of complying with the climate regime, although the scholarship on climate ethics provides some direction. It is widely agreed that the most economically advanced countries bear disproportionate responsibility for causing and, therefore, combatting climate change. As the main source of greenhouse gases in the atmosphere, these countries are under a high moral obligation to comply (Grubb 1992; Paterson and Grubb 1992 and Parks and Roberts 2007,2008). The World Bank's WDI database maintains excellent records of states' annual greenhouse gas emissions including land use and forestry (measured in million metric tons of carbon dioxide equivalent (MtCO2e), which is then converted into a country's share of total greenhouse gases circulating the atmosphere in a given year. There are strong theoretical reasons for coding at the country-year level as greenhouse gas emissions vary over time (for example, in response to fluctuations in economic activity). Since a single country can

[90] Depledge (2009) offers an excellent account of three exceptional cases in which Belarus, Kazakhstan and Turkey have tried to amend their classification under the Annex system.

only be responsible for a small share of atmospheric emissions (the highest share being 22 percent), the range of values are small compared to other variables. Therefore, the percentages were multiplied by four in order to arrive at a comparable range of values.

Democracy

The Freedom House's Freedom in the World database maintains comprehensive records on the level of democracy in a country in a given year. Countries are assigned separate scores from one (most free) to seven (least free) to denote the level of political rights and civil liberties.[91] Neo-liberal explanations of compliance emphasise both components of democracy: political rights (electoral process, pluralism and functioning government) are expected to hold political elites accountable to their publics and civil liberties (freedom of expression and rule of law) increase the influence of domestic actors over climate policy. Therefore, democracy measures both of these dimensions by taking the mean of both scores for each country-year. In order to aid the interpretation of the democracy coefficient, the scores are inverted so that high (low) values denote high (low) levels of democracy.[92] Although political regimes are generally stable over the FCP (i.e. a democracy usually remains a democracy), the level of political rights and civil liberties, and by association, degree of democracy, in a country frequently rises or falls. It

[91] Freedom House also maintains a binary democracy dataset which codes countries as 'democratic' or 'non-democratic', but this conceals the nuances in democracy levels that are captured by the seven-point index.
[92] The democracy scores are multiplied by ten to make the range more comparable to other variables.

will be interesting to see if these longitudinal changes are associated with variation in emissions behaviour. Thus, democracy is coded at the country-year level.

International Environmental Agreements (IEAs)

IEAs is a numerical variable that measures a country's participation in IEAs. As discussed in chapter two, focusing on state participation in a broad range of IEAs rather than treaties dealing only with climate change makes it more likely that any correlations between compliance IEAs reflect the influence of institutions over member states rather than national interests and countries' willingness to commit to the climate regime, thereby alleviating endogeneity concerns.[93] The University of Oregon's National Science Foundation's International Environmental Agreements Database Project records signing, ratification (or equivalent acts) to and withdrawal from IEAs. IEAs records the total number of IEAs that a country has ever signed and ratified, deducting two points for any withdrawals.[94] Since international environmental treaties are not created every year, the appropriate level of coding is the country as this allows us to get a sense of the country's participation in international environmental institutions over the entire lifetime of environmental diplomacy.

[93] Simmons (2000) provides an excellent account of the endogenous relationship.
[94] Withdrawals count as more than one negative point because they denote a definitive step away from international institutions.

- Structuralist Predictors: Transnational Class Interests

Class Status

Class is a dichotomous variable that equals one if a country belongs to the transnational core and zero for all other (periphery) countries. Class entries are multiplied by 100 to generate a similar range to the other variables. Data for country class status is derived from Chase-Dunn et al.'s (2000) frequently cited study on trading activity, which is summarised in figure 4.2.[95]

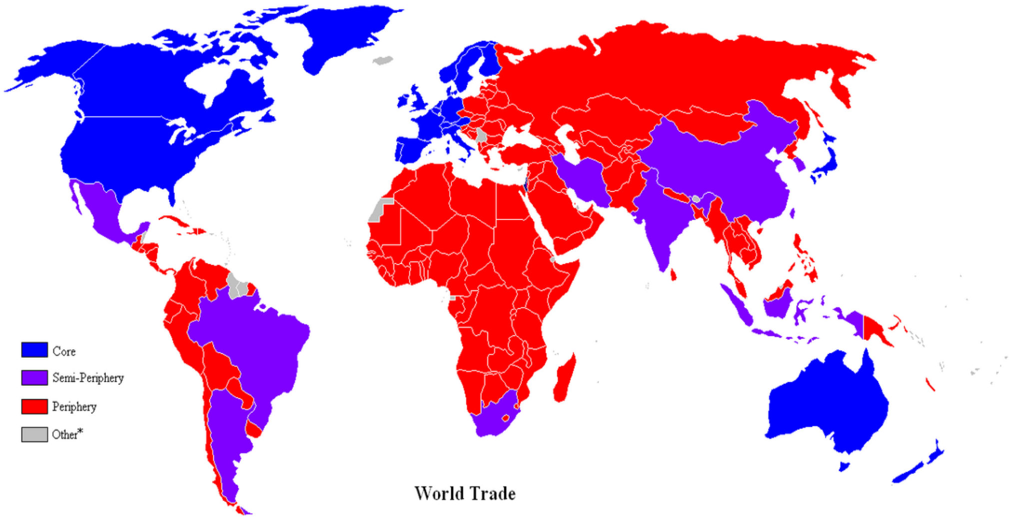

Figure 4.2: A world map of countries by transnational economic class based on Chase-Dunn et al.'s (2000) *Trade Globalization since 1795*.

The transnational classes emphasised by structuralist theory overlap with the regions of the three-level model: the UG, EU and EIG comprise the core and periphery consists of the LDCs and AOSIS, MIDCs, OPEC and

[95] Chase-Dunn et al. use countries' trading activity as base to determine their membership to the transnational core, periphery or semi-periphery classes in accordance with Wallerstein's world systems analysis.

CACAM. Although the BASICs region corresponds to the semi-periphery in the world map, this intermediary class was omitted because it created collinearity problems when running the regression. Therefore, BASICs were coded as periphery countries in accordance with their traditional ties and recent political leadership of the Southern bloc.[96] Hence class is a regional variable that is fixed over time.

Economic power

Economic power is a proxy for structuralist evaluations of state power in the international system. Data for economic power comes from the World Bank's World Development Indicators GDP figures for 1990 to 2012. GDP provides a snapshot of the level of economic activity in a country irrespective of the size of its population, territory or level of social development and equality. Unlike neo-realists, structuralists are primarily interested in a country's ability to influence the global economy, rather than, for example, the latter attributes. Therefore, GDP is an appropriate proxy for economic power. Longitudinal changes in economic power are likely to occur as countries undergo industrialisation or economic decline. Structuralist approaches expect these kinds of events to have a direct impact on emissions levels, hence there are strong theoretical reasons for taking into account temporal variation in economic power. Thus economic power is coded at the country-year level.

[96] As noted in the introduction to this thesis, the BASICs ally closely with the G77 and China position in the multilateral climate negotiations.

Export diversification

Export diversification is a continuous variable that measures a country's reliance on the export of a few, barely processed raw materials, as a proportion of GDP. Data for export diversity comes from the International Monetary Fund's Export Diversification Index (EDI), which assigns countries a score from zero (low export diversity) to seven (high export diversity). EDI scores were multiplied by ten to stretch out the range in accordance with other variables. Since export diversity tends to rise in tandem with economic development, longitudinal trends are of interest. Therefore, the variable is coded at the country-year level.

- Constructivist Predictors: Worldviews

Drawing on the theoretical approach that I proposed in chapter three, I argue that it is possible to infer states' worldviews from their discursive remarks about the climate regime. Moreover, the arguments that states make to support their climate policies can be associated with three problem representations that mirror the ideal-typical neo-realist, neo-liberal and structuralist worldviews which were discussed in the last chapter.[97]

There is no obvious source to turn to for inferring states' representations of the climate problem. One option is to analyse the official communications that are submitted by parties to the UNFCCC Secretariat, but most of these texts are tailored for very specific issue-

[97] I borrow this approach from Mowle (2005).

areas and more technical than political in nature. Moreover, there is ample room to doubt whether submissions to an international audience provide much insight into countries' true intentions at all. Another option is to analyse the summaries of the Conferences of Parties that are recorded by the Environmental Negotiations Bulletin. Despite its excellent cross-sectional breadth, however, the resource is too brief for inferring stances towards the regime as the summaries afford no more than two or three sentences to each country position. In light of these problems, I turned to the Lexis-Nexis database to infer states' public positions towards the global emissions regulation (mitigation policy) from a large collection of national newspapers on climate change. After limiting the number of articles per country-year to 40, country-specific searches for English language newspaper articles containing the terms 'Kyoto Protocol*' OR 'climate change*' AND the name of the country under scrutiny retrieved 8,021 articles spanning eight regions, 74 countries and the 23 years under investigation (1990 to 2012).[98] Although this is admittedly narrower than the entire dataset of 3,381 observations, it provides the most comprehensive insight into representations of the climate problem across the world and spans over half of the countries analysed in this thesis.[99] Working with online English language articles overcomes linguistic and geographical barriers that could have otherwise limited the cross-sectional breadth of the analysis. Of course, this did not solve the problem entirely as just under half of the countries sampled in

[98] Preliminary searches including the term 'global warming' did not significantly alter the number of retrieved articles. The term was consequently omitted from the searches.
[99] Thankfully, most non-English speaking countries published English newspapers, which are available on the Nexis database.

the thesis do not publish English newspapers. Yet this should not bias the results too much as the proportion of countries missing from each region were quite evenly spread and can thus be treated as ‘missing at random’. This is important because it suggests that the potential risk for an Anglophile bias is low since missing countries are unlikely to be correlated with any of the variables investigated in this thesis. Most articles were also of adequate length to ensure that authors had word space to develop their arguments and positions towards mitigation. Also, the fact that national newspapers are directed towards domestic readers suggests that articles capture public perspectives towards climate policy more openly than sources targeting international audiences. Unlike the UNFCCC communications or COP speeches, most newspaper journalists made no attempt to conceal their positions towards mitigation policy. Furthermore, where possible, a state’s problem representation for a given year was inferred from multiple articles from multiple newspapers, which is arguably more representative of the diverse range of domestic views than sampling a single official document.

Thus, for various reasons, national newspaper articles on climate change provide a valuable insight into the rationale behind states’ positions towards global emissions regulation. Building on the ideal-typical representations of the climate problem that were summarised in table 3.1 in chapter three, I employ computer-aided content analysis to look for justificationary arguments that are characteristic of neo-realist, neo-liberal and structuralist worldviews. A major advantage of computer-aided content analysis is that it enables a large volume of text to be analysed in a relatively efficient, transparent and easily replicable manner.

A word dictionary was compiled to identify words and word patterns that are indicative of neo-realist, neo-liberal and structuralist worldviews. Dictionary entries were selected based on their ability to encompass the core issues and concepts that are typical of the three theoretical approaches towards climate change. When a concept was important to multiple theories (e.g. ethics, justice, economy) it was excluded from the dictionary because it would increase the number of occurrences under multiple worldview variables. The dictionary is summarised in table 4.4.

Worldview	**Indicator**
Neo-realism	advantage*, adversar*, burden sharing, burden-sharing, compensat*, compet*, countries, rich, deadlock, , energy price*, exclu*, exempt*, *, firewall, foreign import, importing, imports, , largest econom*, oil, price*, reciproc*, redistribut*, resource rich, resource-rich, security, special need*, stalemate, , unilateral*, universal emissions target*, voluntar*, withdr*
Neo-liberalism	acceptable, cost-benefit, cost-effective, costs and benefits, disincentive, domestic, economic opportunity, efficien*, image, incentive*, international pressure, job*, leadership, legitima*, lobbies, lobby, lobbying, private sector, public, reputation*, unemploy*, world opinion
Structuralism	AOSIS Protocol, AOSIS protocol, abilit*, assist developing countr*, blame, capacit*, common but differentiated responsibilities, culprit*, debt*, developing countries need, differentiate*, economic development, equit*, financial market*, help developing countr*, historical, industrialis*, industrializ*, know-how, loophole*, low income, low-income, per capita, perpetrator*, poor*, poverty, principally responsible, restructur*, rich, right to develop*, small island*, support developing countr*, transfer*, victim*, vulnerab*

Words with an (*) are wildcard entries that count all words that contain the preceding letter combination as occurrences (e.g. countr* counts ‘country’ and ‘countries’).

Table 4.4: Worldviews dictionary

Articles from the same country-year were merged into a single document and treated as a single coding unit, which was converted into text format and fed into the Yoshikoder software package for content analysis. A concordance report was produced to calculate the total number of neo-realist, neo-liberal and structuralist word occurrences per country-year. Although the proportions involved were small, it was possible to draw out some about countries' underlying worldviews.[100] Since the number of articles and word frequencies is not uniform across country-years, the substantive value of a single word occurrence varies depending on the total number of occurrences for that country-year. For example, the value of five neo-realist words is higher when the total number of occurrences is ten (50 percent, very neo-realist) than it is when the total frequency is fifty (ten percent, weakly neo-realist). Therefore, rather than working with word frequencies, the number of word occurrences were converted into percentages of the total number of word occurrences in a given country-year.

Fitting the Model

Having devised a strategy for operationalising the variables, the next step is to incorporate them into the three-level model. Following in the footsteps of some of the leading multilevel regression experts,[101] I work my way up from the simplest single-level regression and gradually relax the assumption of fixed parameters to set up a three-level random

[100] The dictionary indicators comprised approximately five percent of the entire sample of newspaper articles.
[101] I draw particularly on the works of Steenbergen and Jones (1997), Hox (2002), Gelman et al. (2007), Bartels (2009) and Ghitza and Gelman (2013).

coefficient model with interaction effects.[102] The simplest multilevel model is the random intercept model, which allows the intercepts (β_0) to vary across countries and regions. I then set up a more complicated random coefficient model, which models causal heterogeneity by allowing the effects (β_1's) of predictors to vary across countries and regions. The last model is the most complicated. Building on the previous models, I introduce a series of interaction variables to test my hypothesis from chapter three that worldviews condition the effect of the instrumentalist drivers of emissions behaviour.[103]

In order to keep the degrees of freedom within acceptable limits, I group together the drivers of emissions behaviour according to their theoretical foundations in the three ideal worldviews: chapters five to seven build up a sophisticated understanding of the effects of neo-realist, neo-liberal and structuralist variables respectively by gradually modelling more aspects of the hierarchical data structure. In chapter eight, I test my worldviews claim by introducing interaction effects into the corresponding random coefficient models from the preceding chapters. This approach also makes sense from a theoretical perspective, as it is intuitive to test related hypotheses that are derived from the same theoretical approach together.

[102] Differences between subsequent models are indicated in bold in the formulae.
[103] All of the models in this thesis were fitted in Stata using the 'regress' command for single-level regressions and 'xtmixed' for multilevel models.

Yet despite the methodological and theoretical advantages of this approach, running separate models for different theoretical approaches raises the risk that omitted variables, which are tested in different chapters, could compromise the causal inferences that are drawn from the models (King et al. 1994:87-89). One way to address this issue is to incorporate all independent variables into a single model (in the concluding chapter for instance) and look for substantive changes in the coefficients. However, due to the small number of regions (n) sampled in the third level of the model as well as computational problems, it is not possible to fit such a grand model using my dataset. A more feasible strategy for addressing the problem of omitted variable bias is to fit a more modest random intercept model, which incorporates the most significant drivers from across the three theoretical approaches under the same model while simultaneously modelling the hierarchical structure of the data without using up the degrees of freedom. More predictors can only be facilitated by omitting the random effects, which use up one degree of freedom each. Nonetheless, a more simplified grand random intercept model is a practical way of checking that the findings are robust to the inclusion of variables associated with other theoretical approaches, while simultaneously comparing the relative influence of these drivers over emissions. In accordance with Hodges and Sargent's (2001) approach in *Counting the Degrees of Freedom in Hierarchical and Other Richly-Parameterised Models*, the degrees of the freedom in my dataset is equal to the seven.[104] Two of these parameters will be used up by the

[104] This is calculated by subtracting one from the sample size (n = eight regions) of the highest level of the multilevel model.

country and region level intercepts, which means that a maximum of five predictors can be included in the grand model. If more than five predictors are found to be significant drivers of emissions in chapters five to seven, then only the five most influential drivers (measured by effect size) will be included in the final model, which will be fitted in the concluding chapter.[105] Any substantive changes in the findings will be treated as evidence of omitted variable bias in the causal inferences that are drawn from the preceding empirical chapters.

The strategy described above provides a birds-eye view of the robustness of the thesis' overall findings while keeping within the degrees of freedom of the model. Yet in order to do this, it admittedly has to exclude some variables that are emphasised by other worldviews-derived hypotheses which are analysed in another chapter, thereby reducing the strength of the robustness check. Furthermore, the risk of omitted variable bias is increased by a second type of omission: as illustrated by the various explanations in chapter two, emissions trends are likely to be affected by other material variables that are not (explicitly at least) emphasised by the neo-realist, neo-liberal and structuralist worldviews – namely: population size, environmental vulnerability and technology. Nonetheless, these drivers (which are not delineated as independent variables in the context of this thesis) might play role in influencing emissions behaviour in the background. I therefore conduct an additional set of robustness checks in each of the empirical chapters

[105] The regression equation for this model is given in chapter nine.

to evaluate whether the inclusion of these variables results in significant changes to the random effect estimates obtained from the random coefficient models in chapters five to seven as well as the random coefficient models with interaction effects in chapter eight.[106] Specifically, I will look for differences in the level of statistical significance of the random effect terms as well as differences in the signs and magnitudes of the random effects that are calculated from the mean posterior estimates of each region. Full details of the operationalisation of the additional variables that are not tested in any the empirical chapters (and therefore not listed above) are given in the appendix to this chapter. From the outset, it is emphasised that introducing the full set of causal variables (from chapters two and three) means that these robustness models inevitably exceed the degrees of freedom. Nonetheless, the checks are still worth conducting as compatible results would indicate that the findings are likely to hold even when the other leading explanations of emissions are accounted for. By the same token, conflicting results would indicate the presence of bias resulting from omitted variables.

While I set up the neo-realist, neo-liberal, structuralist and worldviews models separately at the start of each empirical chapter, in this chapter, I lay out my methodological strategy by applying it to the first – neo-realist – approach and illustrate how interaction terms are added to the random

[106] The tests are not conducted for the single level and random intercept models because, in these models, there are no random effects. This means that the robustness test for one model (say the neo-realist RIM) would be the same as a test for the others (in this case, the neo-liberal and structuralist RIMs).

coefficient model to test for the conditioning effect of neo-realist worldviews over relative gains.

Single Level Regression

I begin by setting up a single-level multivariate regression that incorporates all of the neo-realist predictors:

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + \beta_2 resdeprank_{ijk} + \beta_3 reciprocity j_k + e_{ijk}$$

$$e_{ijk} \sim N(0,\sigma_e^2)$$

Unlike the multilevel models below, the intercept is fixed, which means that it is assumed to be constant for all countries and regions and there are no country or region-level random effects in the model. Furthermore, unlike the random slope and random slope with interactionist effects models, the regression coefficients of the predictors are also fixed. As the simplest model, the coefficients estimated from the single level regression will serve as references for the more complicated models that follow. The sign, size and significance of the coefficients will tell us whether the results of the single-level regression are in accordance with the hypotheses tested in the chapter. The adjusted R-squared value indicates what percentage of the compliance data is explained by the model.

Random Intercept Model

I begin modelling the hierarchical data structure by allowing the intercept, which represents the average emissions level, to vary across countries and regions. This is facilitated by introducing the random error terms from the null three-level model above:

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + + \beta_2 resdep_{ijk} + \beta_3 reciprocity_{jk} + \mathbf{v_k + u_{jk}} + e_{ijk}$$

$$v_k \sim N(0,\sigma_v^2)$$
$$u_{jk} \sim N(0,\sigma_u^2)$$
$$e_{ijk} \sim N(0,\sigma_e^2)$$

In this model, the random effects and residual errors are assumed to follow normal distributions with zero means and are independent from the predictors. σ_v^2 is the between-region variance, σ_u^2 is the between-country variance and σ_e^2 the between country-year variance once we account for variability in emissions associated with the predictors. β_0 is the overall mean emissions behaviour for all observations across all countries and regions, $\beta_0 + v_k$ is the mean emissions behaviour for all observations from region k and $\beta_0 + v_k + u_{jk}$ is the mean emissions behaviour for all observations from country j nested in region k.[107]

To evaluate the results of the random intercept model, I look at the signs, sizes and significance levels of the coefficients and compare them with the estimates of the previous single-level regression. Differences in the signs of the coefficients would indicate cluster-confounding: that is, the predictor has contradictory within and between-cluster effects and size differences would suggest differences in the strength of the effect. We can determine whether the model is a better fit than the single-level regression by looking for shrinkages in the variance components from the null model fitted at the start of this chapter.[108] As a second check on the

[107] In other words, the country and regional intercepts vary by an equal magnitude to the random error terms.
[108] These can be regarded as equivalent to the adjusted-R squared value in the single-level regression.

goodness of fit, LR tests will be carried out to compare the random intercept model with the previous single-level regression and null model.

Random Coefficient Model

In the random intercept model above, it was assumed that predictors had the same effect on emissions behaviour across all countries and regions. I relax this assumption in the random slope model. By modelling random effects, a major advantage of the random slope model is that it detects and, as I discuss below, explains causal heterogeneity. As the simplest example, let us consider a two-level random slope model with one predictor that is allowed to exhibit varying effects across level-two units:

$Y_{ij} = \boldsymbol{\beta_{0j}} + \boldsymbol{\beta_{1j}} x_{ij} + e_{ij}$

$\beta_{0j} = \beta_0 + u_{0j}$

$\beta_{1j} = \beta_1 + u_{1j}$

Notice in this model, the intercept coefficient, β_{0j}, has been assigned a zero subset to distinguish it from the random slope coefficient β_{1j}, which is also allowed to vary. Like the random intercept model, the average intercept of observations from group j is equal to $\beta_0 + u_{0j}$, the only difference being the addition of zero subsets. β_1 is the average effect of predictor x_{ij} across all groups, while the group-specific effect is equal to the sum of u_{1j} and β_1, the overall average effect. Substituting the random coefficients into the same formula gives:

$Y_{ij} = \beta_0 + \beta_1 x_{ij} + u_{0j} + \boldsymbol{u_{1j} x_{ij}} + e_{ij}$

A new term, $u_{1j}x_{ij}$, has been added, which means that there are now two level-two random effects in the model. These are assumed to be bivariate normal with zero means, and e_{ij}, the level-one random error, is normally distributed with zero mean:

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \end{pmatrix} \sim N\left\{\begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ \sigma_{u01} & \sigma_{u1}^2 \end{pmatrix}\right\}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

This simple example demonstrates that, for each level of every random slope that is introduced to the model, a new random error term is also added to the model. The variance of the random effect, σ_{u1}^2, is also interacted with the intercept variance, σ_{u1}^2, which creates a new variance parameter, σ_{u01}, the covariance that describes the relationship between the intercept and slope.

Fitting a complete set of random coefficients to the three-level compliance model would result in a highly complex variance structure with an unwieldy number of parameters. Therefore, instead of randomising all predictors simultaneously, I follow the recommendation of some of the most prominent experts in the field[109] and run a series of diagnostic tests to determine which, if any, predictors have significant random effects terms relative to their standard errors, initially at the country-level. I also evaluate the goodness of fit of the models by conducting LR tests with the random intercept and single-level models. After identifying any significant random effects at the country level, these effects are incorporated into a single model. To evaluate the goodness

[109] My approach was particularly influenced by the recommendations of the Learning Environment for Multilevel Methods and Applications, which is run by the Centre for Multilevel Modelling at Bristol University and Hox (2002).

of fit of the model, I will look for changes in the variance components and conduct LR tests with the random intercept model and equivalent single-level regression.

For example, suppose that we are interested in determining whether the effect of power varies significantly across countries:

$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + \mathbf{u_{1jk} power_{ijk}} + \beta_2 resdeprank_{ijk} + \beta_7 reciprocity_{jk} + v_{0k} + u_{0jk} + e_{ijk}$

$v_{0k} \sim N(0, \sigma_{v0}^2)$

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ \sigma_{u01} & \sigma_{u1}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0, \sigma_e^2)$

The new random effect, $u_{1jk} power_{ijk}$, appears in the model to denote country-level random effects of power. The level-two random effects are assumed to be bivariate normal with zero mean. Level-one and three variances are constant and normally distributed with zero means.

After establishing the significant random effects at the country level, the same diagnostic tests are run at the regional level, this time looking for evidence of significant random effects between regions.

For illustrative purposes, let us consider the hypothetical case in which all of the neo-realist predictors had significant random effects at both the country and regional levels. The model becomes:[110]

$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + u_{1jk} power_{ijk} + v_{1k} power_{ijk} + \beta_2 resdep_{ijk} + u_{2jk} resdep_{ijk} + v_{2k} resdep_{ijk} + + \beta_3 reciprocity_{jk} + u_{3jk} reciprocity_{jk} + v_{3k} reciprocity_{jk} + v_{0k} + u_{0jk} + e_{ijk}$

$$\begin{pmatrix} v_{0k} \\ v_{1k} \\ v_{2k} \\ v_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{v0}^2 & & & \\ 0 & \sigma_{v1}^2 & & \\ 0 & 0 & \sigma_{v2}^2 & \\ 0 & 0 & 0 & \sigma_{v3}^2 \end{pmatrix}$$

$$\begin{pmatrix} u_{0k} \\ u_{1k} \\ u_{2k} \\ u_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & & & \\ 0 & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & 0 & \sigma_{u3}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

Random Coefficient Model with Interaction Effects

I now demonstrate how causal heterogeneities that were picked up by the preceding models can be accounted for by incorporating interaction effects into the random coefficient model. Interaction effects occur when a predictor has a conditioning effect over the effect of another variable (or variables) over the dependent variable. In chapter three, I suggested that worldviews could have a conditioning effect over the influence of

[110] I found no evidence of significant random effects at the regional level in any of the empirical chapters. Therefore, the fitted models were much simpler than the example here and kept within the degrees of freedom.

neo-realist, neo-liberal and structuralist predictors over emissions. I test this claim by creating interaction variables, which are essentially the product of a worldview and mainstream predictor, to determine whether worldviews have this kind of conditioning effect over emissions behaviour.

For the purpose of illustration, let us set-up a neo-realist random coefficient model that incorporates three cross-level interaction effects.[111] Let us assume that we expect states' average levels of subscription to realism worldviews to moderate the country-level effects of power, resource dependency and reciprocity over compliance. Since we are interested in explaining random effects of neo-realist predictors, their coefficients are allowed to vary across countries.

The interaction terms are the products of the country level realist worldview and each of the neo-realist predictors; $realism_{jk}Xpower_{ijk}$, $realism_{jk}Xresdep_{ijk}$ and $realism_{jk}Xreciprocity_{jk}$. Since these are new terms, they are assigned their own regression parameters, β_5, β_6 and β_7.

This can be modelled as:[112]

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + u_{1jk} power_{ijk} + \beta_2 resdeprank_{ijk} + u_{2jk} resdeprank_{ijk} + \beta_3 reciprocity_{jk} + u_{3jk} reciprocity_{jk} + \beta_4 realism_{jk} + \boldsymbol{\beta_5 realism_{jk} Xpowerrank_{ijk}} + \boldsymbol{\beta_6 realism_{jk} Xresdeprank_{ijk}} + \boldsymbol{\beta_7 realism_{jk} Xreciprocity_{jk}} + v_{0k} + u_{0jk} + e_{ijk}$$

---

[111] When the interaction effect involves variables from different levels, then it is referred to as a cross-level interaction effect.

[112] Once again, the model shown here is just for illustrative purposes. Diagnostic tests (reported in the following chapters) revealed that a maximum of one interaction term was significant in any one model, which resulted in a simpler model than the example. When the introduction of an interaction term exceeded the degrees of freedom, measures were taken to keep within acceptable limits (e.g. omitting insignificant fixed effects or random effects that are not involved in the interaction) and are explicitly stated in the 'approach' section of chapter eight.

$v_0 \sim N(0,\sigma_0^2)$

$$\begin{pmatrix} u_{0k} \\ u_{1k} \\ u_{2k} \\ u_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & & & \\ 0 & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & 0 & \sigma_{u3}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

Any interaction effects without significant coefficients will be removed from the model, which will then be refitted and checked for goodness of fit with the aid of LR tests. If the interaction does explain some of the variance, then I should find that the random effect term of the associated predictor (that is interacted with the worldview) will decrease, and the size of at least one of the variance components should decrease in the model with interaction effects.

Chapter Five: Neo-realist Explanations of Emissions Behaviour

Introduction

This is the first of three empirical chapters in which I test the role of the core instrumentalist drivers of emissions behaviour that flow from the ideal worldviews that were proposed in chapter three. Since these drivers overlap with some of the causal variables that are proposed by the mainstream – economic, social, political and environmental – approaches to emissions trends, these chapters also evaluate some of leading explanations from chapter two. I build on these findings in the penultimate chapter to test my claim that the effects of instrumentalist variables (i.e. proxies for relative gains, absolute gains and transnational class interests) are conditioned by countries' worldviews and perceptions of the climate problem.

The focus of this chapter is on the explanations that can be associated with the worldview that flows from the most traditional school of international thought - neo-realism. As we saw in the literature review, adherents of this approach attest that climate policy is determined by the relative gains and losses that states, or the policymakers who act on their behalf, expect to make from emissions policy. While one can define the stakes of cooperation in various terms (e.g. socio-economic or political), the alleged driver behind emissions behaviour is essentially constant: *states are more likely to reduce emissions when they expect to gain more or lose less than other countries. By the same token, they are likely to avoid emissions cuts if they expect to incur relative losses.*

The theoretical approach I proposed in chapter three identified three hypotheses that are premised on the relative gains approach:

(i) In comparison to powerful countries, weak countries are more likely to reduce emissions because they possess scarce defensive capabilities against the adverse effects of climate change;

(ii) Countries that are relatively less dependent on fossil fuels are more likely to reduce emissions than more dependent countries as they stand to incur lower costs from emissions reduction;

(iii) Non-annex parties to the climate regime are more likely to reduce emissions because they have the assurance that annex parties are bound by emissions targets under the KP. Annex parties, on the other hand, should be deterred by the absence of reciprocal commitments for non-annex parties.

A visual representation of the leading relative gains hypotheses is given in figure 5.1.

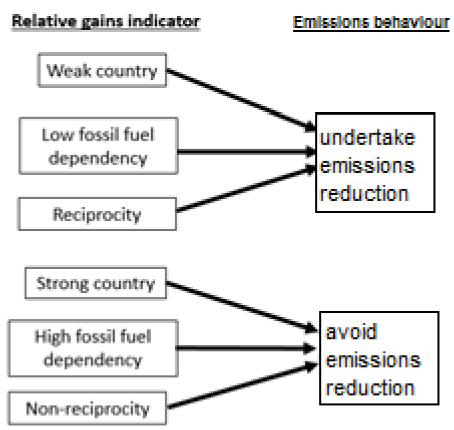

Figure 5.1: Neo-realist derived hypotheses

My empirical investigation of these hypotheses consists of four parts. In the first section, I recall the proxies that were proposed to serve as concrete indicators of relative gains and explore how they are distributed across country-years, countries and regions. Based on these distributional patterns, I flesh out some concrete neo-realist predictions of compliance behaviour and take a sneak preview at the statistical associations between emissions behaviour and relative power, fossil fuel dependency and reciprocity. Section two lays out the testing strategy for the chapter by fitting the methodological approach outlined in the research design chapter to neo-realist variables. The third section reports and interprets the findings of the single-level regression, random intercept and coefficient models. The last section concludes by summarising the chapter findings and reflecting on their contributions to the field and policy relevance.

Measuring Relative Gains, Preliminary Predictions and Associations

Relative Gains Indicators

In the last chapter, I created three proxies to denote the core dimensions of the relative gains considerations that neo-realist-minded states should take into account when designing emissions policy – namely: relative power, relative dependency on fossil fuels and reciprocity. Table 5.1 summarises the sources and levels of indicators used to operationalise these proxies.[113]

[113] A detailed discussion and justification of the operationalisation strategy was given in chapter four.

	Indicator	Operationalization	Source	Variable
(i)	Power	Ranked CINC (Composite Index of National Capabilities)	Correlates of War Project	$power_{ijk}$
(ii)	Fossil fuel dependency	Ranked percentage of GDP dependency on natural resource income	World Bank World Development Indicators	$ffdep_{ijk}$
(iii)	Reciprocity	Quantitative emissions commitment of opposite Annex group	The KP	$reciprocity_{jk}$

Table 5.1: Relative power indicators

Note: Variable subsets denote the level of coding: ijk level-one variable coded at country-year (i) nested in country (j) nested in region (k); kj level-two variable coded at country (j) nested in region (k); and k level-three variable coded at region (k).

Distributional Patterns and Preliminary Predictions

If neo-realist explanations are right, then relative gains indicators should allow us to predict which countries and regions are likely to reduce domestic emissions. Over the next few pages, I explore the distribution of relative power, fossil fuel dependency and reciprocity across each level of the model and flesh out some concrete predictions which I return to when evaluating the empirical implications of the neo-realist inspired models.

(i) Level One: Country-year

Figure 5.2 provides an overview of the longitudinal distribution of relative gains from 1990 to 2012 by using nonparametric, locally weighted scatter plot smoothers (Lowess plots), which are indicated by the red line. The first plot indicates that in the heydays of the climate regime, most countries commanded less power in the international system than they did across the rest of the First Commitment Period (FCP).[114] The upward

[114] Since all predictors are centred, the zero point on the y-axis always corresponds to the mean value across all observations.

slant of the line shows that power levels gradually increased and levelled out at the average level across all observations in 1997. If neo-realists are right, then the level of emissions reduction should gradually wane from 1990 to 1997, as countries become better equipped to unilaterally defend themselves against climate change, and remain relatively stable thereafter. The flat slope of the second plot tells us that the average level of relative dependency on fossil fuels has remained fairly constant over the FCP. Therefore, this predictor does not give us reason to expect emissions levels to vary longitudinally. Similarly, since annex status (and associated emissions targets) is institutionalised by the KP, reciprocity remains constant over the FCP, once again predicting uniform emissions levels.

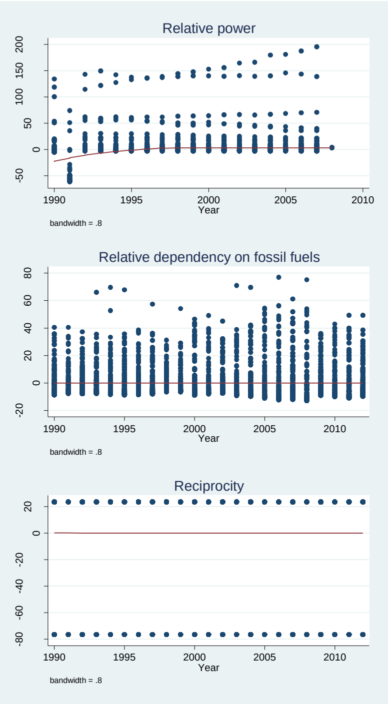

Figure 5.2: Longitudinal distribution of relative gains predictors from 1990 to 2012
Note: Each point represents a country-year

(ii) Level Two: Country

Figures one to three in the chapter appendix rank countries according to their mean power, fossil fuel dependency and reciprocity levels over the FCP. Since CINC data is not available from 2008 onwards, average power levels are calculated for the period of 1990 to 2008. If hypothesis (i) is correct, then the most powerful countries, which fall on the right of figure one (namely: China, the US, India, Russia and Japan) should be the least dependent on international efforts to mitigate climate change and therefore be less willing to reduce emissions. Conversely, the weakest countries, which fall on the left of the figure (namely: Saint Kitts and Nevis, Grenada, Saint Lucia, Antigua and Barbuda and Samoa) should be the most willing to reduce emissions.

Figure two in the chapter appendix ranks countries according to mean fossil fuel dependency from 1990 to 2012. According to hypothesis (ii), the countries with the lowest dependency on fossil fuels (namely: Lithuania, Slovenia, Iceland, Malta and Saint Kitts and Nevis) should be the strongest supporters of emissions reduction as they stand to reap benefits from being able to cut emissions at relatively lower costs than other countries. In contrast, fossil fuel dependent countries (namely: Kuwait, Qatar, Azerbaijan, Saudi Arabia and Nigeria) stand to incur the highest relative losses, allegedly making them the most reluctant to curb emissions.

Since reciprocity measures the existence of respective emissions targets under the climate regime, the equivalent distributional characteristics of this variable are enshrined in the Annex listings, which are represented visually in figure three of the chapter appendix. Hypothesis (iii) leads us to expect that Annex countries, which fall on the left of the figure will be less likely to reduce emissions as they are bound by quantitative targets without the assurance that non-Annex parties have reciprocal commitments.[115]

(iii) Level three: region

Figure 5.3 displays mean regional power, fossil fuel dependency and reciprocity levels from 1990 to 2012. According to the power chart, the BASICs region should be the least likely to reduce emissions as it has the highest capacity to defend itself against climate change without relying on global climate governance. Conversely, the LDCs group, which is closely followed by CACAM and the MIDCs, should be the most dependent on global mitigation efforts and therefore willing to reduce emissions. The middle chart indicates that OPEC and CACAM have the highest regional dependency on fossil fuels. Therefore, they should be the least willing to reduce emissions as they stand to incur to the highest relative costs from emissions reduction. In contrast, the EU and EIG have the lowest dependency levels, which should make them the strongest supporters of emissions cuts. Since the regions analysed in this thesis broadly overlap with the regime's annex categories, the third chart shows little variation. Nonetheless, it is possible to draw out some broad predictions from regional reciprocity patterns: all of the non-Annex

[115] As discussed in the last chapter, due to data limitations, only 109 non-Annex countries are observed in this thesis.

regions (namely: the BASICs, CACAM, LDCs, MIDCs and OPEC) should be persuaded to engage in emissions reduction because they have the peace of mind that annex countries face legally binding emissions targets. Conversely, non-annex regions (the UG and EU) should be deterred from reducing emissions because they do not have the assurance that non-annex states are bound by reciprocal commitments. The EIG should exhibit intermediate levels of emissions reduction because member states belong to both annex and non-annex categories.

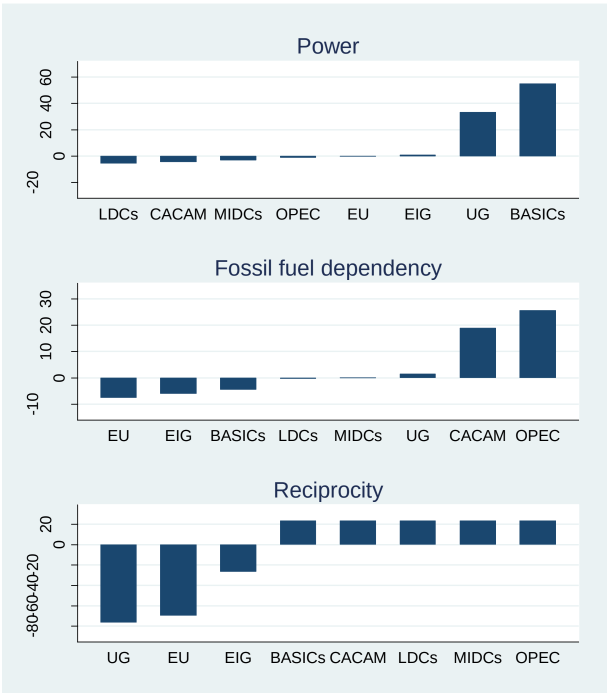

Figure 5.3: Mean regional relative power, fossil fuel dependency and reciprocity levels from 1990 to 2012

Statistical Associations: A Sneak Preview

Before fitting the model, it is helpful to get a feel for the statistical associations between emissions behaviour and the relative gains indicators described above. My aim at this point is not to ascertain which, if any, of the neo-realist hypotheses might be true. Nor is it to determine whether any relationship is statistically significant. Instead, I aim to give the reader a sense of whether and, if so, how emissions behaviour fluctuates across different values of relative gains. Figure 5.4 provides an overview of the statistical associations between emissions behaviour, relative power, fossil fuel dependency and reciprocity by using nonparametric, locally weighted scatter plot smoothers (Lowess plots).

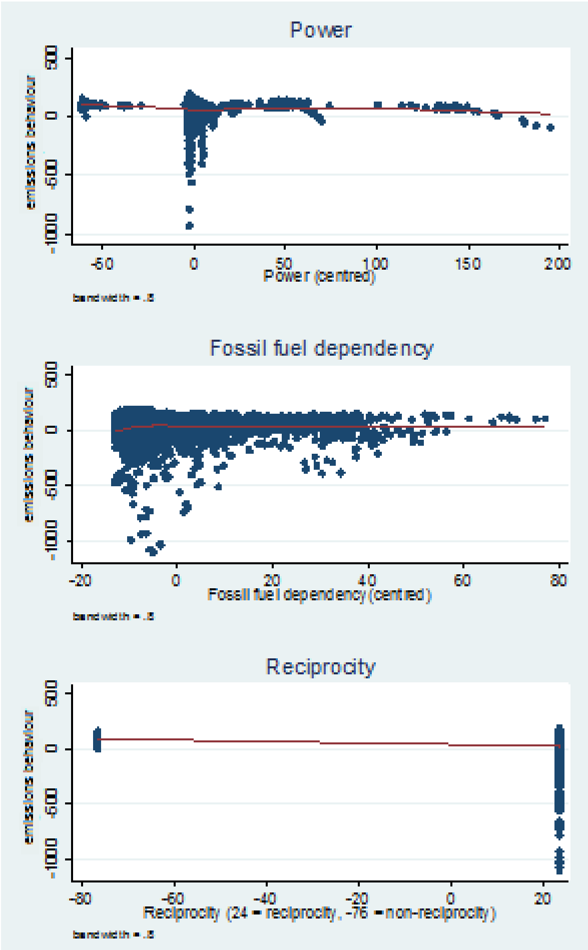

Figure 5.4: Emissions behaviour versus relative gains predictors

All three figures are relatively flat, suggesting that the effect of relative gains on emissions is negligible. Nonetheless, the Lowess plots reveal some subtle patterns. Moving rightwards along the power axis in the first plot is associated with a slight drop in emissions behaviour (compatibility with mitigation), which lends tentative support to the first hypothesis: as countries become more powerful in the international system and, as neo-realist explanations claim, better equipped to deal with climate change, they tend to be less willing to reduce emissions.

The middle graph tells us that at low levels of fossil fuel dependency, increasing reliance on income from carbon-intensive sectors has a slightly positive effect on emissions behaviour, which is illustrated by the positive slope of the Lowess plot. Thus, the lower portion of the graph until around seven points below the grand average contradicts the second hypothesis that fossil fuel dependency inhibits emissions reduction. Thereafter, emissions behaviour levels remain stable and (slightly) almost double 1990 levels (i.e. just above the zero mark on the y-axis).

Since reciprocity is a binary indicator (where -76 denotes reciprocity and 24 non-reciprocity), the Lowess plot is a straight line. Contrary to hypothesis (iii), the negative slope suggests that non-Annex countries, which meet the reciprocity criterion, are generally less willing to reduce emissions than Annex parties. The vertical distance covered by the reciprocity line is noticeably wider than that of the power and fossil fuel dependency plots, thus suggesting at this preliminary stage that reciprocity is the most influential driver of emissions behaviour out of the three predictors.

Approach

In line with the methodological approach outlined in the research design chapter, I begin by fitting a single-level multiple regression which includes all of the neo-realist predictors discussed above:

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + \beta_2 ffdep_{ijk} + \beta_3 reciprocity_{jk} + e_{ijk}$$

$$e_{ijk} \sim N(0,\sigma_e^2)$$

(Model 1: Single-level OLS)

The next step is to set up a random intercept model that allows mean emissions levels to vary across countries and regions by introducing the random terms u_{jk} and v_k respectively. Hence the model becomes:

$$EMBEHe_{ijk} = \beta_0 + \beta_1 power_{ijk} + \beta_2 ffdep_{ijk} + \beta_3 reciprocity_{jk} + v_k + u_{jk} + e_{ijk}$$

$$v_k \sim N(0,\sigma_v^2)$$
$$u_{jk} \sim N(0,\sigma_u^2)$$
$$e_{ijk} \sim N(0,\sigma_e^2)$$

(Model 2: Random intercepts)

I then move onto modelling the proposition that relative gains has heterogeneous effects over emissions behaviour by allowing the slopes of the predictors to vary across countries and regions. As discussed in the research design chapter, randomising all of the predictors introduces many new variance terms and drastically increases the degrees of freedom. In order to avoid this and keep the model simple, I follow the advice of Hox (2002) and test each predictor for random effects separately by looking for significant random coefficients at the country level.[116] I also look for significant changes in the variance components to

[116] Since it is possible for predictors to have random effects without significant fixed effects (Hox 2002), I test all of the predictors for significant random coefficients.

check whether modelling causal heterogeneity enhances the explanatory power of the model. As a third check for goodness of fit, I conduct LR tests between the random slope and intercept models. All of the significant random effects are then incorporated into a single model. After setting up the country-level random intercepts, I check whether the predictors also have regional random effects by running the same diagnostic tests.

For illustrative purposes, let us consider the hypothetical case in which all of the neo-realist predictors were found to have significant random effects at both the country and regional levels.[117] Two new random effects terms, u_{njk} and v_{njk}, are introduced to represent causal heterogeneity in (n) country and region level predictors respectively, so the model becomes:

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + u_{1jk} power_{ijk} + v_{1k} power_{ijk} + \beta_2 ffdep_{ijk} + u_{2jk} ffdep_{ijk} + v_{2k} ffdep_{ijk} + + \beta_3 reciprocity_{jk} + u_{3jk} reciprocity_{jk} + v_{3k} reciprocity_{jk} + v_{0k} + u_{0jk} + e_{ijk}$$

$$\begin{pmatrix} v_{0k} \\ v_{1k} \\ v_{2k} \\ v_{3k} \end{pmatrix} \sim N \left[\begin{matrix} 0 \\ 0 \\ 0 \\ 0 \end{matrix} \right] \begin{pmatrix} \sigma_{v0}^2 & & & \\ 0 & \sigma_{v1}^2 & & \\ 0 & 0 & \sigma_{v2}^2 & \\ 0 & 0 & 0 & \sigma_{v3}^2 \end{pmatrix}$$

[117] As discussed below, diagnostic tests revealed that none of the predictors exhibit significant random effects at the regional level, so the fitted model was much simpler than the example here.

$$\begin{pmatrix} u_{0k} \\ u_{1k} \\ u_{2k} \\ u_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & & & \\ 0 & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & 0 & \sigma_{u3}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

(Model 3: Random intercepts and random slopes)

Results

Model 1: Single-level OLS

Are relative gains significant drivers of emissions behaviour? According to the results of the single-level multivariate model, the answer is a resounding yes. Table 5.2 presents the results of the 'flat' OLS regression, which treats the 3,421 observations as independent cases of emissions behaviour. All of the relative gains predictors are statistically significant at the 0.01 or 0.001 levels.[118] Despite these significant p-values, the adjusted R-squared value tells us that the model only accounts for around 6.3 percent of emissions behaviour - an issue which I return to when evaluating the goodness of fit of all the neo-realist models examined in this chapter. The average level of emissions across all observations is 57.4 points on a scale from -1102 to 191, where 100 represents the perfect attainment of a country's 1990 emissions levels, values above 100 correspond to emissions reductions above those

[118] Unless otherwise stated, all of the test statistics reported in this thesis are the result of two-tailed tests. (Two-tailed tests are more appropriate that one-tailed tests because I am interested in ascertaining whether a variable has an effect on emissions behaviour, even if the direction of the effect contradicts the hypothesis under investigation).

needed to meet 1990 levels and negative values indicate emissions levels that are more than twice 1990 emissions levels.

Parameter	**Estimate**
Power	-0.32 (0.07)***
Fossil fuel dependency	0.43 (0.13)**
Reciprocity	-0.49 (0.04)***
Intercept	57.42 (1.59)***
Adjusted R-squared:	0.063

Table 5.2: Single-level regression of neo-realist emissions predictors
Note: Coefficient entries are ordinary least squares estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

How do these results mesh with the neo-realist hypotheses discussed at the start of the chapter? The negative sign of the power coefficient lends support to the first hypothesis – that powerful countries, which have the capacity to (unilaterally) defend themselves against climate change, are less likely to reduce emissions: a one-point increase in power ranking is associated with 0.32 points less emissions reduction. This finding is significant at the 0.001 level.

The signs of the fossil fuel dependency and reciprocity coefficients, however, are unexpected. According to the second hypothesis, countries with high fossil fuel dependency should be more reluctant to reduce emissions because they need to make drastic socio-economic changes in order to meet their emissions targets. The positive sign of the fossil fuel dependency coefficient suggests the very opposite: a one-point increase in fossil fuel dependency is associated with 0.43 points more emissions reduction, a finding which is significant at the 0.01 level. This unexpected result could be due to marginal differences in carbon efficiency: countries with higher resource dependency stand to reap higher marginal benefits from closing down inefficient industries when compared to less-resource dependent countries that are already operating at high efficiency levels - a point which I return to below.

The reciprocity coefficient also runs against neo-realist intuition. Contradictory to the third hypothesis, countries are not persuaded by the prospect of reciprocal commitments: on average, and holding power and fossil fuel dependency constant, non-Annex parties reduce their emissions by 49 points less than their Annex counterparts.[119] This coefficient has the strongest effect out of all the neo-realist predictors and the statistical significance is at the 0.001 level.

What do these results tell us about regional emissions behaviour? The single-level model allows us to predict the regional emissions levels that are likely to accompany the average relative power, fossil fuel dependency and reciprocity values of each region. The regression equation is:

EMBEH = 57.42 -0.32power + 0.43resource dependency - 0.49reciprocity

To illustrate how our single-level model arrives at these predictions, it is helpful to consider how it simulates the relationship between emissions and relative gains variables. Figure 5.5 displays the regional emissions levels that are predicted from our first relative gains indicator, relative

[119] The effect size of reciprocity is equal to 100 times the coefficient as the variable was multiplied during the coding stage to produce a comparable range of values.

power, with 95 percent confidence intervals.[120] Unlike the multilevel models discussed below, the single-level model represents the emissions-relative power relationship as a single straight line, with the average regional emissions behaviour levels located on various points on the line. To avoid repetition, the equivalent graphs for fossil fuel dependency and reciprocity are not shown here, but they are also simulated as a single straight line with slope equal to the coefficient and same intercept, 57.42.

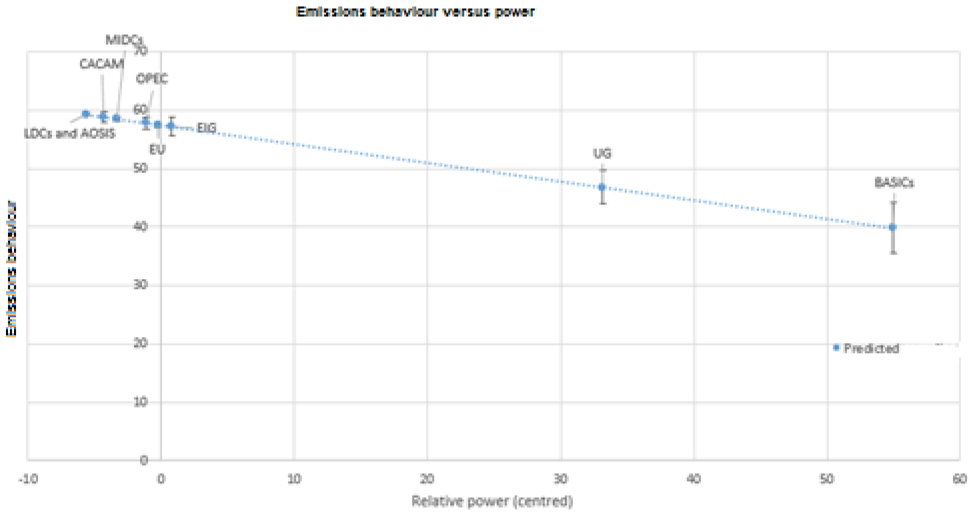

Figure 5.5: Predicted mean regional emissions behaviour as a function of relative power in the single-level model

Figure 5.6 displays the regional emissions predictions estimated by the ‘complete’ regressions (including all three neo-realist explanatory variables) with 95 percent confidence intervals. Overlapping confidence intervals indicate that we cannot be certain that the emissions behaviour of the concerned regions are different from each other, as the values can fall anywhere within the confidence intervals. Thus, on the basis of

[120] The 'pure' effect of relative power on emissions behaviour was isolated by setting the values of fossil fuel dependency and reciprocity to zero, which, since the predictors are centred, corresponds to the average level of indicator across all observations.

relative gains attributes, we can predict with 95 percent confidence that relative gains differentials generate four interregional cleavages in emissions behaviour: the regions with the highest emissions reductions will be the UG and EU, which will be followed by the EIG, OPEC and CACAM, then the LDCs and AOSIS and MIDCs and lastly, the BASICs.

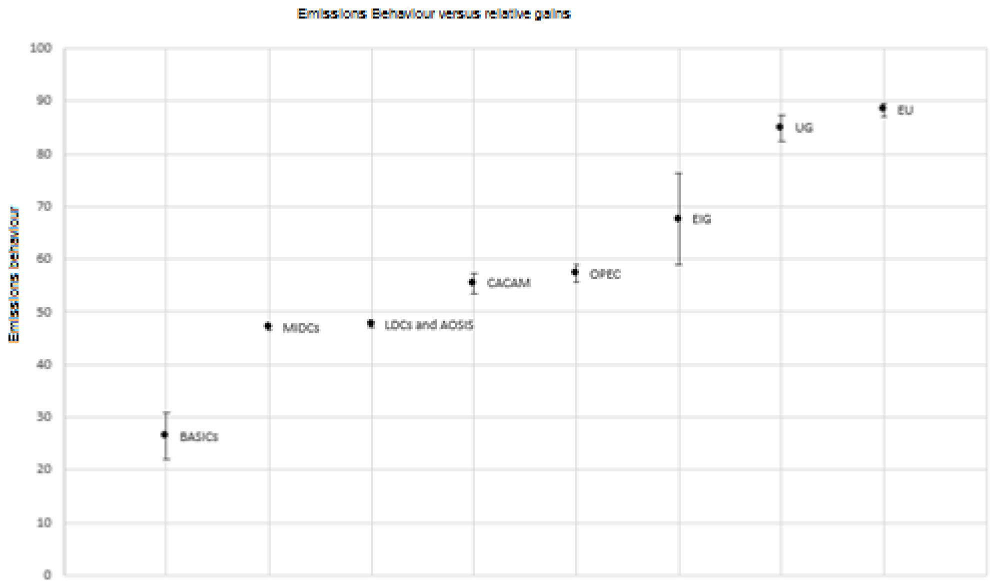

Figure 5.6: Emissions behaviour versus relative gains
Note: the points represent the predicted regional emissions levels estimated by the neo-realist single-level regression model. The vertical lines depict the 95 percent confidence intervals.

How do these predictions fit the actual data? Figure 5.14 plots the regional emissions values predicted by each neo-realist model alongside the mean emissions figures observed in the dataset. Actual emissions behaviour values are represented by the patterned column on the left and the single-level predictions are represented by the adjacent column in light grey. The vertical distance between the actual and estimated emissions behaviour values indicates the accuracy of the predictions. As expected, the single-level predictions are the worst fit with the real data. Two erroneous predictions are particularly striking: the model paints an overly optimistic picture of emissions reduction by OPEC and drastically underestimates emissions reductions by CACAM. Interestingly, however, the model does capture some interregional patterns in the North: it correctly predicts that the EU is more willing to reduce emissions than the UG, which is followed by the EIG. Nonetheless, the figure affirms what we already know from the adjusted R-squared value - the single-level neo-realist model is a poor predictor of emissions behaviour.

Model 2: Random Intercepts

Are the results of the single-level regression robust to country and regional clustering? To answer this question, I begin modelling the multilevel structure of the dataset by allowing average emissions levels to vary across countries and regions. The fixed effects estimates of the random intercept model (RIM) are displayed in table 5.3, alongside the coefficients from the single-level regression.

Parameter	**OLS**	**RIM**
Power	-0.32 (0.07)***	-0.70 (0.08)***
Fossil fuel dependency	0.43 (0.13)**	0.14 (0.17)
Reciprocity	-0.49 (0.04)***	-0.32 (0.19)
Intercept	57.42 (1.59)***	67.84 (9.98)***

Table 5.3: Relative gains coefficients in the single-level regression and random intercept model

Note: Single-level entries are ordinary least squares estimates and RIM entries and maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

The results of the RIM differ in important respects from the last model. First, as expected, accounting for clustering has caused the standard errors of the coefficients to increase.[121] Consequently, fossil fuel

[121] As discussed in the research design chapter, this is because the effective sample size in multilevel models is equal to the number of observations per group (in my case, country or region) rather than the total number of observations.

dependency and reciprocity have ceased to be significant drivers of emissions. Second, although the signs of the coefficients remain the same, the sizes of the effects have changed: a one-point increase in a country's power is now associated with 0.7 points less emissions reduction, which is more than double the estimate (-0.32) in the single-level regression. In contrast, the influence of the other predictors on emissions appears to be weaker: a one-point increase in fossil fuel dependency is associated with 0.14 points less emissions reduction, which is almost a third of the previous estimate, while, on average, non-annex parties that meet the reciprocity criterion reduce emissions by 32 points less than their annex party counterparts.

What do the differences between the coefficients in the single level regression and RIM mean? The coefficients in the first model estimate the average effect on all observations, without taking into account the country or region that the observation comes from. In contrast, the RIM differentiates between observations from different countries and regions and estimates the average effect of the predictor on observations from the same cluster. Although the signs of the coefficients are the same across the two models, which indicates that there is no cluster-confounding, the size of the predictor effect varies within and between regions. This phenomenon is represented visually in figure 5.7. Each plot contains three clusters (countries or regions), which are represented by round dots. Solid lines represent the within-group effects and dashed lines between-cluster effects.

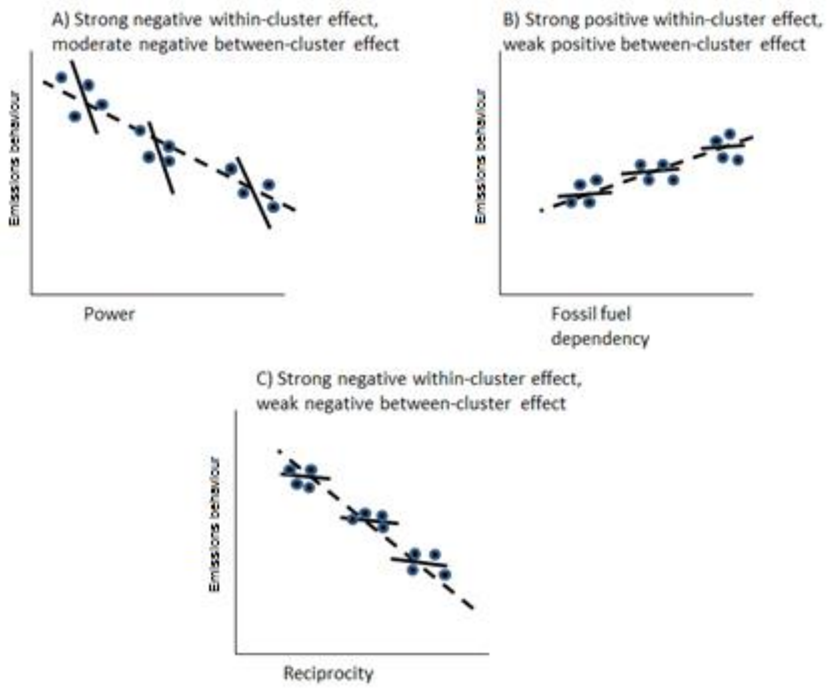

Figure 5.7: Within and between-cluster effects of relative gains predictors

Plot A represents power effects, which, as indicated by the negative slopes, are inhibitory both within and between countries and regions. The steeper slope of the solid lines tells us that the inhibition effect is stronger when we limit our analysis to observations from the same country or region. Plot B represents fossil fuel dependency effects. Once again, all lines are in the same direction, indicating that increasing fossil fuel dependency always has a positive effect on emissions. However, the solid lines are flatter than the dashed line, which tells us that the positive effect is weaker when we are dealing with the emissions behaviour of the same country over time or member states of the same region. Plot C represents the within and between-cluster effects of reciprocity on emissions trends. The negative slopes of the solid and dashed lines indicate that reciprocity always constrains emissions reduction; however, the steeper slope of the dashed line indicates that reciprocity has a weaker constraining effect on the emissions trend of a single country over time or member countries that belong to the same region relative to the grand mean effect across all observations.

I now move onto evaluating the goodness of fit of the model. For this purpose, I compare the random effects of the RIM with the null model that was fitted in the research design chapter. I also conduct LR tests with the null model and equivalent single-level regression to check my inferences. Table 5.4 displays the relevant statistics. The far right column entitled 'explained variance' indicates the percentage of variance from the null model that is explained by the random intercept model. Thus, by disaggregating the amount of unexplained variance into regions, countries and country-years, the variance components effectively provide us with three R-squared values, thus providing a much more sophisticated insight into the goodness of fit of the model than the single-level model.

Parameter	**Null**	**RIM**	**Explained Variance (%)**
Variance components			
Region	1220.99 (856.62)	424.56 (484.71)	64.78
Country	5292.96 (664.46)***	3065.95 (405.30)***	42.08
Country-year	6274.01 (156.57)***	2959.19 (87.53)***	52.83
LR tests			
LR $test_{OLS}$	1935.52 (p<0.000)	1334.31 (p<0.001)	
LR $test_{NULL}$	-	12838.35 (p<0.001)	

Table 5.4: Random effects estimates in the random intercept and null models

Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

The neo-realist random intercept model is a significant improvement over the null model, which explained just over six percent of emissions behaviour. Adding the relative gains predictors has substantially reduced the variance components at all three levels. Regional variance drops from 1220.99 to 424.56, which is a 65 percent decline in unexplained variance. Yet we should not read too much into this because, as in the null model, the new regional variance term is not statistically significant.[122] We can, however, draw more conclusive inferences from the changes in the lower level variance terms: country variance has dropped by around 42 percent and country-year variance is less than half of what it was in the null model. Both of the new variance terms are statistically significant at the 0.001 level. The LR tests provide strong evidence that the RIM is a significantly better fit than the null model and equivalent single-level regression.

What do the results of the random intercept model imply for regional emissions with the climate regime? As before, we can examine the model's predictions for regional emissions by plugging in mean regional power, fossil fuel dependency and reciprocity levels into the regression equation:

$$EMBEH_{ijk} = 67.84 – 0.7power_{ijk} + 0.14ffdep_{ijk} – 0.32reciprocity_{jk} + v_0$$

Figure 5.8 illustrates the predicted relationship between emissions behaviour and plus and minus one standard deviation of our first predictor, relative power.[123]

[122] The small number of regions (eight) sampled in the study makes it very difficult to come up with statistically significant results at the regional level.
[123] As before, the values of the other predictors (fossil fuel dependency and reciprocity) are set to zero to isolate the 'pure' relative power effects.

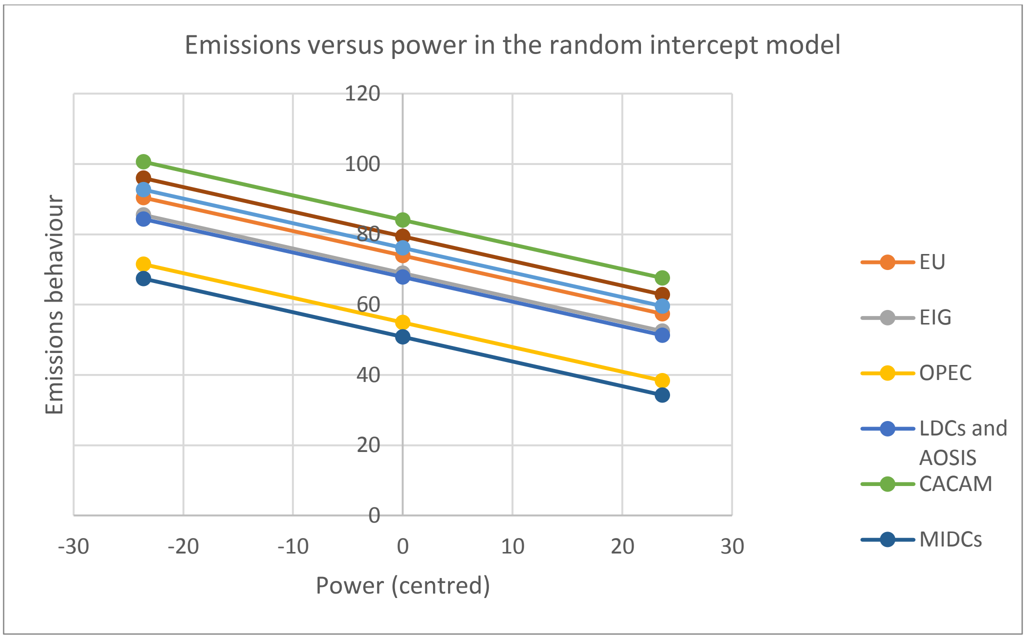

Figure 5.8: Emissions behaviour versus power in the random intercept model

Unlike the equivalent single-level model, the RIM assigns each region a separate regression line, which, as demonstrated by the decrease in the variance components and increase in pseudo-R-squared values, substantially improves the goodness of fit of the model. Since the effects are fixed across countries and regions, the lines are parallel.[124] On average, CACAM (green) is the region with the highest emissions reductions while the MIDCs (dark blue) is the least willing to curb emissions.

As before, we can estimate the regional emissions behaviour by inputting mean regional relative power, fossil fuel dependency and reciprocity values into the model. Figure 5.9 plots the regional predictions with the

[124] For this reason, the vertical distances between the regional intercepts would remain the same if we replaced relative power with fossil fuel dependency or reciprocity on the x-axis.

95 percent confidence intervals. The order of the regional emissions levels is slightly different to the order of the regional intercepts shown in 5.8. This is because the predictions in figure 5.9 are based on the mean relative gains values for each region, as opposed to the hypothetical range of values plotted in figure eight. Another way of looking at this apparent discrepancy is that the predictions in figure nine correspond to a single point on the regional lines in figure 5.8. For example, despite have a higher intercept than the MIDCs, figure three told us that, on average, OPEC states have more relative power than MIDCs countries, which pulls the OPEC emissions behaviour prediction below the MIDCs.

Since regional emissions levels can take any value within the confidence intervals, we can only be (95 percent) certain that there are substantive differences between the emissions behaviour of regions whose confidence intervals *do not* overlap. Broadly, our relative gains model allows us to predict that the order of most to least emissions-reducing regions will follow a four-stage ranking: (i) CACAM, (ii) the EU, UG and EIG, (iii) BASICs and (iv) MIDCs, LDCs and AOSIS and OPEC.

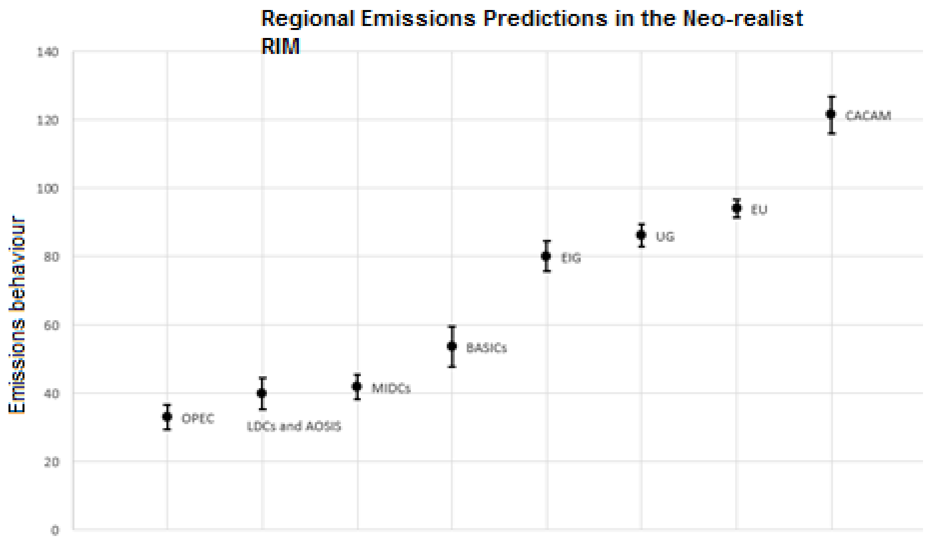

Figure 5.9: Regional emissions behaviour predictions in the RIM
Note: the points represent the predicted regional compliance levels estimated by the neo-realist RIM. The vertical lines depict the 95 percent confidence intervals.

To get a sense of the reliability of these predictions, we can refer to figure 5.14, which plots the regional emissions values predicted by the neo-realist models against the actual values observed in the data. The predictions of the RIM are depicted by the third column in medium grey. While the predictions are not precise (especially in the South where actual compliance levels are lower than expected), they are a significant improvement over the predictions of the single-level regression: except for the BASICs, the vertical distances between the actual and predicted emissions values are substantially smaller than those projected by the single-level regression. In accordance with the smaller variance components, allowing countries and regions to have their own regression lines has significantly improved the fit of the neo-realist model.

Model 3: Random Coefficients and Intercepts

The next stage of the analysis is to determine whether relative gains indicators have uniform effects over emissions trends across countries and regions. I ran a series of diagnostic tests to check *separately* for signs of causal heterogeneity in the effects of each predictor by allowing the slopes (i.e. effect) of power, fossil fuel dependency and reciprocity to vary between countries. Since it is possible for a variable to have significant random effects without significant fixed effects (see, for example, Hox 2002), I allowed the fossil fuel dependency and reciprocity slopes to vary even though they were not found to be significant in the RIM. The goodness of fits of the diagnostic RCMs were compared to the RIM and equivalent single-level regression with LR tests. The results of these diagnostic tests are presented in table 5.5, alongside the variance components and likelihood value of the RIM for reference.[125]

[125] The fixed effects estimates are analysed below when the final random coefficient model is fitted.

Parameter	RIM	Power	Fossil fuel dependency	Reciprocity
Variance component				
Region	424.56 (484.71)	424.54 (482.71)	<0.001 (<0.001)	424.54 (482.71)
Country	3065.95 (405.30)***	3065.95 (405.30)***	5176.34 (788.66)***	3065.95 (405.30)***
Country-year	2959.19 (87.53)***	2559.20 (87.53)***	1659.82 (51.12)***	2559.20 (87.53)***
Random effects				
Random effect, ux	-	<0.001 (<0.001)	158.72 (22.33)***	<0.001 (<0.001)
LR tests				
Likelihood value	-13352.2	-13352.2	-12903.166	-13352.2
LR_{OLS}	1334.31 (p<0.001)	1334.31 (p<0.001)	2232.38 (p<0.001)	1334.31 (p<0.001)
LR_{RIM}	-	0.00 (p=1)	898.07 (p<0.001)	0.00 (p=1)

Table 5.5: Random slope models of neo-realist predictors
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Out of all the neo-realist predictors, only fossil fuel dependency has significant random effects. With a statistical significance of 0.001, the second diagnostic test provides very strong evidence that fossil fuel dependency exhibits heterogeneity between countries. I found no evidence that relative power or reciprocity exhibit causal heterogeneity at the country level. The results of the LR tests confirm that, although the random coefficient models are preferred to the equivalent single-level regression, only the second model with random fossil fuel dependency effects is preferred to the random intercept model without any random effects.

To check whether these results remain robust when other variables are included in the model, the neo-realist predictors with random effects were inserted (one at a time) into a grand model including all of the independent variables from the other theoretical worldviews as well as technology and population.[126] The results of these tests, which are presented in table 5.6, indicate that the risk of bias due to omitted variables is low. Strikingly, neither relative power nor reciprocity are associated with significant random effects when the other variables are included in the model. Furthermore, fossil fuel dependency continues to exhibit very significant random effects at the 0.001 level even in the grand model.

Parameter	**Power**	**Fossil fuel dependency**	**Reciprocity**
Random effect, u_X	0.09 (0.10)	12.21 (0.98)***	<0 (<0)

Table 5.6: Robustness checks for random effects of neo-realist predictors
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

Returning to the results in table 5.5, in the model with random fossil fuel effects, significant changes occur in all three variance components: regional variance is almost eliminated, although, as before, we cannot read too much into this change as the estimate is small relative to its standard error. In other words, the sharp drop in regional variance is not statistically significant. Country variance increases from 3065.95 to 5176.34, which is a 69 percent increase in the amount of unexplained variance from the RIM. The reason for this increase is that allowing fossil fuel dependency to have different effects across countries increases the amount of variation in between-country effects. In other words, the country acted like a suppressor variable in the previous models without

[126] This robustness check was described in chapter four.

random country-level effects. The amount of country-year variance drops from 2959.19 to 1659.82, marking a 44 percent decline in unexplained variance at the first level of the model. Both the country and country-year variance terms are significant at the 0.001 level. Referring back to the total unexplained variance at the country-year level in the null model, the pseudo-R-squared value in the model with random fossil fuel dependency effects is 73.54 percent - a vast improvement from the equivalent R-squared value of 6.3 percent in the single-level model.

In stark contrast, the variance terms in the models with random power and reciprocity effects do not differ at all from the RIM, confirming once again that the (insignificant) random terms do not enhance the explanatory power of the model. In light of these findings, I continue with the second diagnostic model with random fossil fuel dependency effects. Hence the equation for the RCM becomes:

$$EMBEH_{ijk} = \beta_0 + \beta_1 power_{ijk} + \beta_2 ffdep_{ijk} + u_2 ffdep_{jk} + \beta_3 reciprocity_{jk} + v_{0k} + u_{0jk} + e_{ijk}$$

The complete results of the random coefficient model are presented in table 5.6.

Parameter	RIM	RCM
Fixed effects		
Power	-0.70 (0.08)***	-0.50 (0.06)***
Fossil fuel dependency	0.14 (0.17)	5.26 (1.15)***
Reciprocity	-0.32 (0.19)	-0.25 (0.15)
Intercept	67.84 (9.98)***	96.76 (6.81)***
Random effects		
ffdep random effect, u_{2jk}	-	158.72 (22.33)***
Regional variance	424.56 (484.71)	<0.001 (<0.001)
Country variance	3065.95 (405.30)***	5176.34 (788.66)***
Country-year variance	2959.19 (87.53)***	1659.82 (51.12)***
Likelihood value	-13352.2	-12903.166
LR_{OLS}	1334.31 (p<0.001)	2232.38 (p<0.001)
LR_{RIM}	-	898.07 (p<0.001)

Table 5.6: Random coefficient model with random fossil fuel dependency effects

Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Before analysing the random components of the model, some important changes in the fixed effects coefficients are worth noting. Although the signs of the coefficients are the same as in the single-level regression and RIM, the sizes of the fixed effects have changed. Introducing random fossil fuel dependency effects has caused the effect of relative power to drop from -0.7 to -0.5. Similarly, the inhibitory effect of reciprocity on compliance has dropped from 32 to 25 points. The most significant change has occurred in the fossil fuel dependency coefficient: on average, a one-point increase in fossil fuel dependency is now associated with 5.26 points more emissions reduction, a significant increase from the RIM estimate (0.14). Moreover, the variable is now significant at the 0.001 level while reciprocity ceases to be significant.

I now move onto examining the random effects. The random effect term tells us that, on average, the between-country effect of fossil fuel dependency varies by 158.72 points. Figure 5.10 illustrates the extent of heterogeneity by plotting predicted emissions levels as a function of fossil fuel dependency. Each line represents the relationship between emissions behaviour and fossil fuel dependency for a different country. Clearly, the level of heterogeneity is substantial: some of the lines follow an upward trajectory, indicating that increasing relative dependency on fossil fuels promotes emissions behaviour that is consist with mitigation while downward sloping lines represent countries in which increasing fossil fuel dependency inhibits emissions reduction. Thus it is unsurprising that modelling these random effects substantially improves the goodness of fit of the model, which is confirmed by the results of the LR tests.

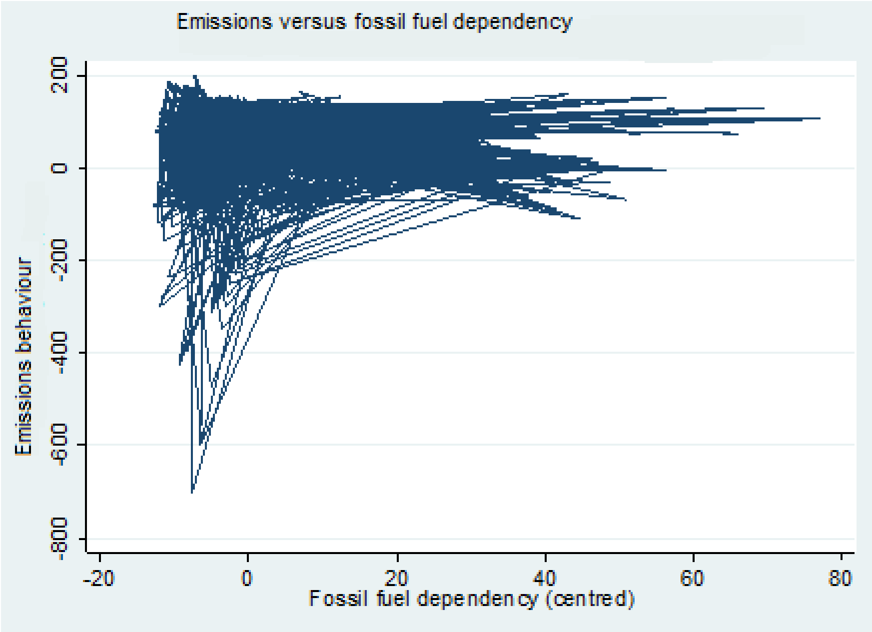

Figure 5.10: Predicted emissions behaviour as a function of fossil fuel dependency in the random coefficient model

Figure 5.11 plots the country-level fossil fuel dependency slopes as a function of fossil fuel dependency. For countries with below average fossil fuel dependency, which are on the left of the y-axis, fossil fuel dependency has a positive effect on emissions reduction. As we move along the y-axis to countries with higher dependency, the positive effect of fossil fuel dependency gradually weakens and eventually becomes inhibitory.[127] Thus, although the positive sign of the fixed effect coefficient (dashed line) goes against neo-realist intuition, the random residuals paint a more sophisticated picture which lends support to the second hypothesis: in countries with low levels of dependency, increasing fossil fuel dependency promotes compatibility with mitigation. A possible explanation for this unexpected positive association is that low levels of

[127] This critical transformation takes place at ten points above the mean fossil fuel dependency level across all observations (zero).

dependency ensure that the marginal benefits of transitioning to carbon efficient activity outweigh the relative costs of emissions reduction in these countries. Presumably, the absence of longstanding structural dependency on fossil fuels makes it relatively easier for these countries to make the leap to green activity. Conversely, raising fossil fuel dependency in countries with high dependency levels has the expected inhibitory effect on emissions cuts. A neo-realist interpretation of this trend is that countries with high fossil fuel dependency are aware that they stand to incur higher costs from emissions reduction relative to other countries; therefore, they evade emissions cuts in an attempt to avoid the relative losses that are created by high levels of fossil fuel dependency.

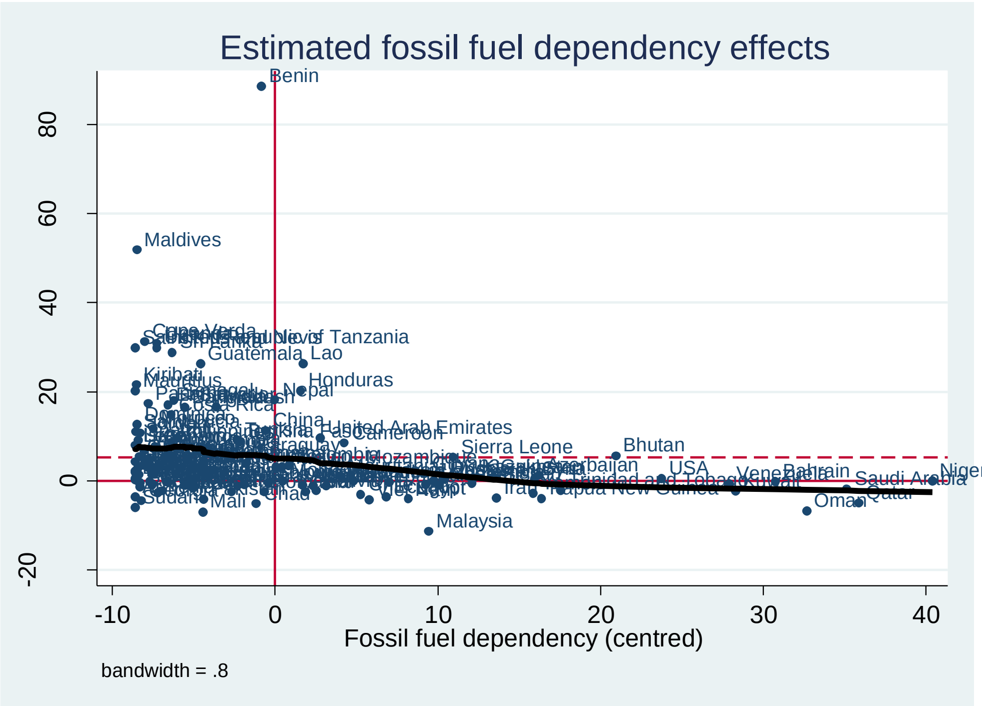

Figure 5.11: Estimate fossil fuel dependency effects as a function of fossil fuel dependency
Note: Each point represents a country-level effect

Another point of interest in figure 5.11 is the line between the average (fixed) effect of fossil dependency (y=5.26) and the intercept (y=0). In countries that are located in-between the horizontal lines, fossil fuel dependency continues to promote emissions reduction, but the effect is weaker than the average effect across all observations, which is indicated by the dashed line. It could be that in these countries, the marginal gains to be accrued from investing in more efficient carbon technologies offsets the relative costs created by above average fossil fuel dependency levels, thus resulting in (weaker) positive slopes.

As a second step in the development of the RCM, I tried allowing the power, fossil fuel dependency and reciprocity effects to vary between regions. None of the relative gains predictors had significant random effects at the regional level. LR tests with the (country) random slope model confirmed very strongly, with a p-value equal to one, that neo-realist variables do not exhibit heterogeneity between regions.

Nonetheless, it is still possible to simulate the regional predictions of the random coefficient model by estimating the emissions levels of some hypothetical countries that possess the mean relative power, resource dependency and reciprocity values of each region. The regression equation for the random coefficient model is:

$EMBEH_{ijk} = 96.76 - 0.5power_{ijk} + (5.26 + u_{2jk})ffdep_{ijk} - 0.25reciprocity_{jk} + v_{0k} + u_{0jk} + e_{ijk}$[128]

[128] Note that the fossil fuel dependency coefficient includes the country-level random effect term (u_{2jk}).

Figure 5.12 plots emissions behaviour as a function of average regional fossil fuel dependency levels. As before, the regression equations are plotted across mean fossil fuel dependency plus and minus on standard deviation, with relative power and reciprocity set to zero, the grand mean across all observations. Unlike the RIM, the (hypothetical) regional lines are not parallel because fossil fuel dependency effects are allowed to vary across countries (and indirectly regions). The direction and steepness of the slope indicate the sign and size of the fossil fuel dependency effect on each region. Since we are primarily interested in differences in regional effects, the figure does not plot the random intercepts, so all the lines cross the y-axis at the same point. Working from the same intercept makes it easier to compare the slopes of the lines.

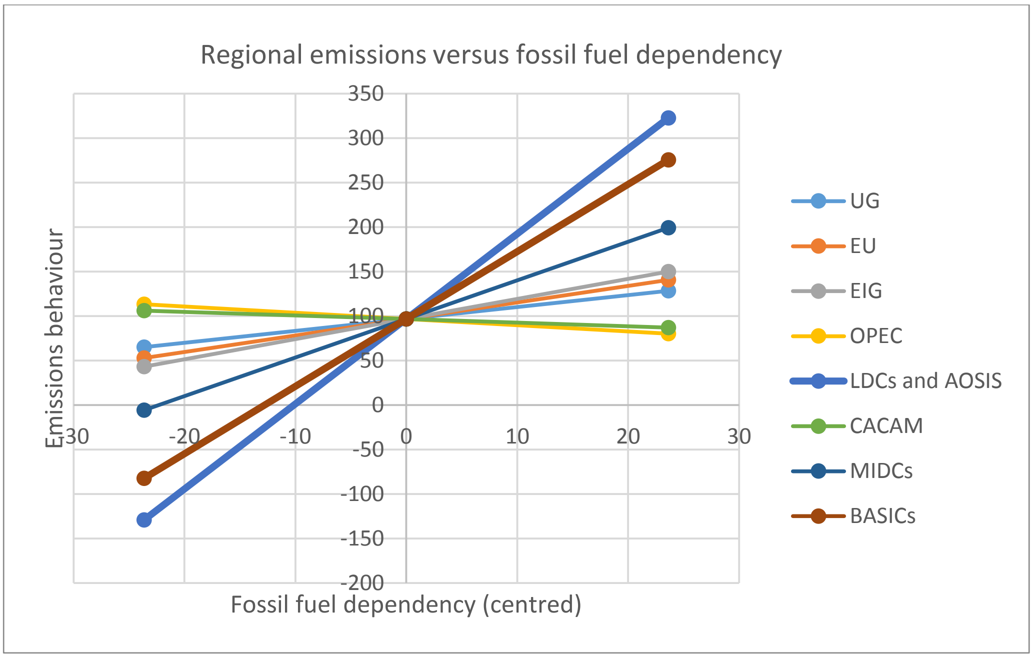

Figure 5.12: Predicted regional emissions behaviour as a function of fossil fuel dependency in the random slope model

Six of the regional lines tilt upwards, indicating that in the majority of regions, fossil fuel dependency has a positive effect on emissions behaviour. As discussed above, the positive direction of the effect contradicts our second hypothesis that fossil fuel dependency makes it harder for countries to reduce emissions and, therefore, comply with the climate regime. The widespread positive correlation between fossil fuel dependency and emissions reduction in most parts of the world lends credit to the marginal efficiency gains argument: while there is no way of establishing this on the basis of these results alone, it seems plausible that increasing dependency on fossil fuels promotes mitigation by raising the marginal benefits that are likely to be accrued from closing down inefficient industries. Conversely, low fossil fuel dependency levels suggest that the country is already operating at high efficiency, thus reducing the marginal benefits associated with emissions reduction. The steepness of the (dark) blue slope indicates that the strongest positive (random) effects are concentrated in the LDCs and AOSIS. This might be because the most vulnerable countries are typically eligible for international assistance for mitigation; therefore, they do not need to bear the total costs of emissions reduction, which would otherwise dampen the compliance-push of marginal gains.

Yet increasing fossil fuel dependency does not always promote compliance. The downward slope of the OPEC and CACAM lines tells us that in these regions, which happen to be the most dependent on fossil fuels,[129] the association is reversed. The inhibitory effect of fossil fuel

[129] Regional dependence on fossil fuels was illustrated in figure 5.3.

dependency in these regions is clearly in accordance with our second neo-realist hypothesis. Yet the results of the RCM show that the expected negative effect is only active in regions with very high levels of fossil fuel dependency. Once again, there is no way of knowing for sure why this is the case, but one possible explanation is that long-term structural dependency on fossil fuels in OPEC and CACAM counteracts the marginal gains effect, making it harder for member states to curb emissions in the presence of higher fossil fuel dependency in comparison to countries in other regions.

To check the robustness of these inferences against the inclusion of other variables, the mean (random plus fixed) effects of fossil fuel dependency on each region were estimated from the robustness model with random fossil fuel dependency effects (model two in table 5.6). The predicted regional effects are shown in table 5.7 alongside the estimates from the previous model depicted in figure 5.12. Strikingly, most of the signs and magnitudes of the posterior estimates are consistent with the simulations in figure 5.12. In both models, fossil fuel dependency has the strong negative effect on emissions reduction in OPEC, which is followed by CACAM. Also consistent with the results of the first model, increasing the level of fossil fuel dependency has the strongest positive effect on emissions reduction in the LDCs and AOSIS. However, there are some changes in the relative (positive) strength of the fossil fuel dependency effect on emissions behaviour in the countries that fall between these extremes (i.e. UG, EU, EIG, MIDCs and BASICs), which may indicate evidence of omitted variable bias. Nonetheless, the robustness of the signs and magnitudes of the random effects on the regions which are predicted to experience the strongest (negative and positive) effects is strong evidence that the most important inferences of this chapter are likely to hold even when we hold constant the other main putative drivers of emissions behaviour.

Region	**Model 1**	**Model 2 (robustness check)**
OPEC	-0.7	-1.84
CACAM	-0.4	-0.17
UG	1.38	5.3
EU	1.86	1.48
EIG	2.26	0.8
MIDCs	4.34	2.4
BASICs	7.57	4.01
LDCs and AOSIS	9.56	7.23

Table 5.7: Predicted random fossil fuel dependency effects on regions

The regional emissions behaviour levels predicted by the RCM are shown in figure 5.13 with the 95 percent confidence intervals. Since the predictions are based on all three relative gains variables (not just fossil fuel dependency), the figure helps to put fossil fuel dependency effects into perspective. The (regional) random effects of fossil fuel dependency are clearly not decisive: positive random effects do not always translate into above average emissions behaviour levels and negative random effects do not always mean that a region (or country) exceeds its 1990 emissions levels. For example, even though fossil fuel dependency inhibits emissions reduction in CACAM[130], the region still goes onto exhibit the highest level of emissions reduction.

[130] We know that the size of the constraining effect is not negligible because CACAM has the highest regional dependency, which means that the region is operating somewhere towards the right side of the green line in figure 5.12 (where the inhibitory effect is magnified).

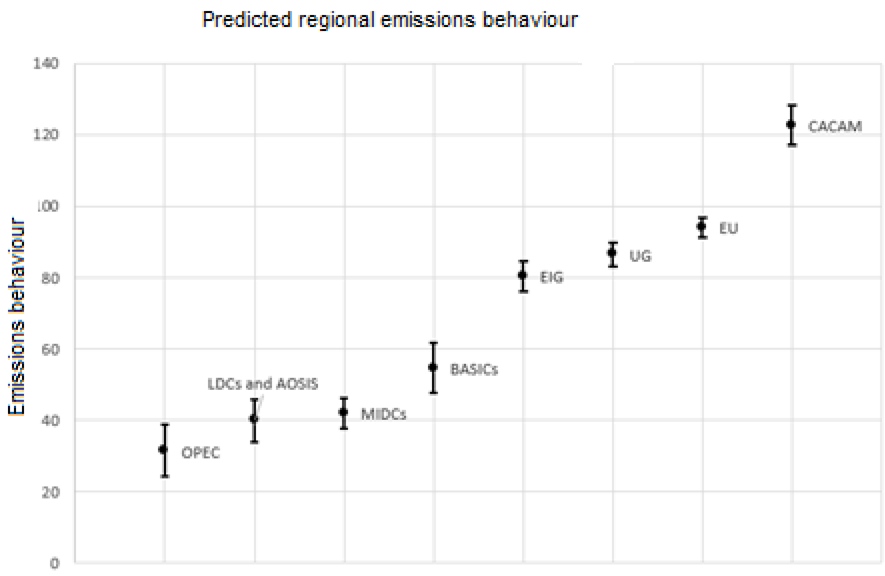

Figure 5.13: Emissions versus relative gains in the random coefficient model
Note: the points represent the predicted regional compliance levels estimated by the neo-realist random coefficient model. The vertical lines depict the 95 percent confidence intervals.

Nonetheless, in the RCM, relative gains provide solid grounds for predicting regional emissions behaviour. Figure 5.13 indicates that we can be 95 percent confident that (i) CACAM will be the most emissions-reducing region, which will be followed by (ii) the EU, UG and EIG, (iii) the BASICs and (iv) MIDCs, LDCs and AOSIS and OPEC.

Do these predictions hold in reality? Figure 5.14 compares the emissions values predicted by the neo-realist models with actual emissions behaviour observed in the dataset. The RCM predictions, which are represented by the fourth column in black, are the closest to the actual values in the striped column. The decreasing vertical distances between the predicted and actual values confirm that our predictions become more accurate as more aspects of the hierarchical data structure are accounted for with each successive model.

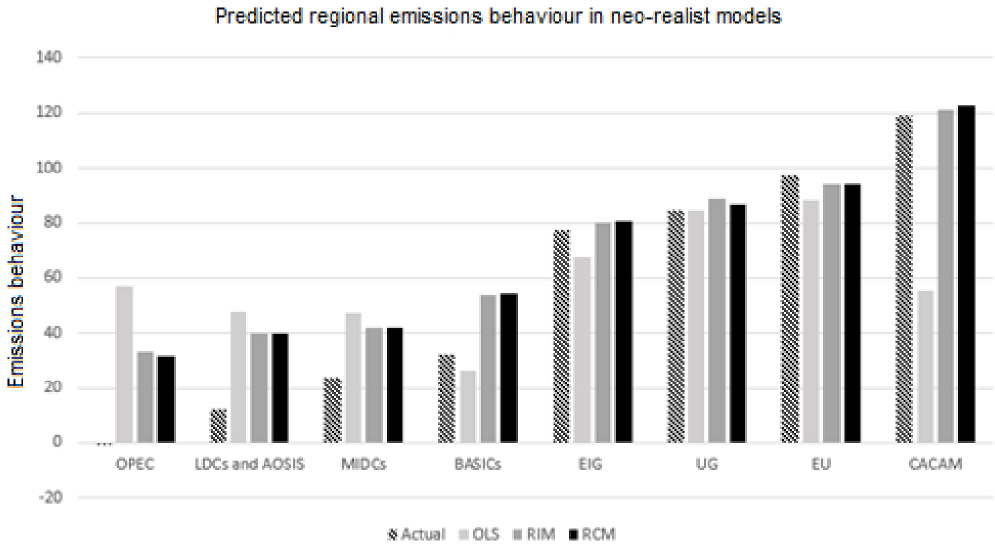

Figure 5.14: Actual regional emissions levels versus neo-realist predictions

Conclusion

I started the chapter with three neo-realist explanations of emissions behaviour. How do they mesh with the chapter findings? Although the sizes and significance levels of the relative gains predictors vary between the models, all of the models concurred on three points. First, more power tends to make countries comply less with the climate regime. The negative direction of this effect is in accordance with the first hypothesis that powerful countries are less willing to reduce emissions than weaker countries, which are relatively more reliant on international efforts to combat climate change. The finding that power inhibits mitigation - even when we account for country and regional clustering - comprises the first quantitative evidence in support of the frequently made argument that relative power reduces dependency on international cooperation.[131]

[131] See, for example, Swain (1996), Dalby (1999), Pumphrey (2008), Busby (2005), and Tuck and Habib. (2014)

These findings are also of relevance to the mainstream literature on emissions trends. In keeping with the multifaceted, physical neo-realist understanding of power, a composite index was used to measure the variable. As discussed in the last chapter, the CINC index encompasses various attributes (namely: a country's level of iron and steel production, military expenditure, military personnel, primary energy consumption, total population and urban population) which touch on several of the explanations reviewed in chapter two. First, the finding that power reduces a state's willingness to mitigate is consistent with four of the economic, social and environmental hypotheses reviewed in chapter two. First, the total population and urban population elements of the CINC index mean that the negative power relationship found in this chapter is consistent with the largely accepted claim that the high demand for emissions faced by large populations inhibits emissions reduction (see, for example, Fan et al. 2006; Dietz and Rosa 1997; O'Niell et al. 2010; Dalton et al. 2008).

Second, although environmental vulnerability is not a component of the CINC index, some of its components such as military expenditure have a direct bearing on the ability of a country to defends itself against the adverse effects of climate change (adaptive capacity), which is indicative of lower environmental vulnerability.[132] Thus the negative power finding coheres with the hypothesis that vulnerable (less powerful) countries are more dependent on mitigation and therefore more likely to reduce

[132] It is recalled from chapter two that environmental vulnerability is a dual concept that encompasses exposure to adverse climate effects and the capacity to defend oneself against these adverse effects.

emissions than less vulnerable (powerful) countries (Brody et al. 2008; Kasa et al. 2008; Zahran et al. 2008). Moreover, to my knowledge, it is also the first quantitative evidence that the effect environmental vulnerability extends beyond political discourse to actual emissions levels.

Third, the finding is also consistent with two of the leading economic explanations of emissions behaviour. While indicative of state power, a high level of steel and iron production in a country implies high carbon input and output mixes, which are frequently singled out as leading causes of emissions (e.g., Stern 2004 and Friedl and Getzner 2003). The indication from this chapter is that a powerful state that has the means to produce its own iron and steel is also likely to be more reluctant to reduce emissions than a weaker state. In the environmental Kuznets curve literature, a high carbon mix is taken to indicate a less advanced economy rather than a powerful country. By shifting the focus from economic development to power, this chapter suggests that power and self-reliance might be an alternative explanation for the negative relationship between carbon mix and emissions reduction.

Lastly, the finding contradicts the scale of pollution hypothesis that larger economies should find it easier and thus be more willing to reduce emissions than smaller economies (e.g., Andreoni and Levinson 2001). Primary energy consumption, which is one of the elements of the CINC index, is generally also indicative of the size of an economy. Therefore, the negative relationship between a powerful country (that presumably has a large economic which consumes a high volume of primary energy) and emissions behaviour contradicts the argument that economies of scale with respect to the enforcement of pollution regulation should promote emissions reduction.

The second set of empirical findings relate to the role of fossil fuel dependency in shaping emissions levels. The indication from this chapter is that higher fossil fuel dependency usually promotes emissions reduction. The positive correlation contradicts our second neo-realist hypothesis that the relative costs of emissions reduction dissuade fossil fuel dependent countries from cutting emissions. However, the RCM found strong evidence that the effect of fossil fuel dependency is more complicated and, at times, contradictory to the average effect across all countries (the fixed effect). When dependency levels are high enough, as they are in OPEC and CACAM, fossil fuel dependency has the expected inhibitory effect on emissions reduction. Conversely, in countries with low to intermediate dependency levels, increasing fossil fuel dependency tends to be associated with more emissions reduction.[133] One possible explanation for this finding is that countries with low to intermediate levels of fossil fuel dependency can use the marginal benefits associated with closing down inefficient carbon sectors to offset the relative costs of emissions reduction. In contrast, regions that dependent heavily on fossil fuels face long-term structural obstacles to emissions cuts. These results offer a more nuanced interpretation of the frequently made claim that fossil fuel dependency inhibits emissions reduction (see, for example,

[133] Figure 5.11 illustrated that the effect of fossil fuel dependence on emissions behaviour follows a bell curve.

Dolsak 2001 and von Stein 2008).[134] This finding also develops one of the core hypotheses of the environmental Kuznets curve literature: if fossil fuel dependency is indicative of the carbon input mix, then this chapter provides a strong indication that increasing the carbon content of the input mix of an economy is only likely to have its expected – inhibitory – effect on emissions reduction if the carbon input mix is already high.[135] In other cases, where the input mix is not carbon-intensive, changes in the input mix towards carbon activity are likely to increase the marginal gains associated with emissions reduction and thus increase compatibility with mitigation.

The third set of conclusions to be drawn for this chapter indicate that reciprocity does not promote emissions reduction. Contrary to the third neo-realist hypothesis, non-Annex parties are not affected by the knowledge that Annex countries are bound by quantitative emissions targets. The results of this chapter cast doubt on the frequently made claim that countries are unwilling to comply with emissions targets under the climate regime because competitor states do not possess reciprocal commitments (e.g. Vezirgiannidou 2008; Purdon 2013 and Tuck and Habib 2014).[136] Yet although this finding contradicts the neo-realist reciprocity hypothesis, it lends credit to one of the leading political explanations of emissions trends – namely: that international

[134] In chapter eight, I explore whether some of this heterogeneity is attributable to neo-realist worldviews.
[135] This kind of relationship is predicted by Stern (2004) and Frield and Getzner (2003).
[136] This might be down to a question of capacity to comply rather than relative gains: as structuralist approaches contend, developing countries, which are non-Annex parties to the KP, may have the will, but lack the means to comply. This proposition is tested empirically in chapter seven.

environmental institutions like the climate regime have the power to reduce the emissions of their members (Depledge 2005; Bodansky 2011,2012; Thompson 2005; von Stein 2008). Indeed, the negative reciprocity finding can also be interpreted as evidence of the effectiveness of the KP as annex parties, who were the only ones bound by quantitative emissions targets, exhibited larger emissions reductions than non-annex countries. Yet one should not accept this conclusion prematurely. As noted in chapters two and four, there is an important endogeneity risk here: annex countries shaped their Kyoto emissions targets rather than harmonising their emissions levels to meet the targets.[137]

What are the policy implications of this chapter? First, the negative correlation between emissions behaviour and relative power suggests that policymakers need to ensure that countries remain committed to the climate regime as they become more powerful. This is especially true if we consider the neo-realist hegemonic stability theory, which gives us reason to expect that the climate regime can only succeed if it has the support of the most powerful (hegemonic) states.[138] Thus, in tandem with the provisions that are designed to address developing country concerns (such as, for example, the Principle of Common But Differentiated Responsibilities and the Annex classification system), it is important that emissions reduction – and especially emissions targets under the climate regime - is also seen to benefit powerful countries. I evaluate one such

[137] I reflect on this possibility more in the conclusion chapter.
[138] This is particularly striking in the context of climate change as the largest polluters must participate in order for international mitigation efforts to succeed.

strategy in the next chapter when I explore whether the prospect of the reputational payoffs associated with emissions reduction plays a role in promoting the (economically) powerful to regulate emissions.

Second, if decreasing fossil fuel dependency does not promote emissions reduction, which is the case for the majority of countries and regions, then we need to find another way of promoting emissions reduction that goes beyond encouraging countries to shift to low carbon activity. At least in the South, where emissions reduction is most lacking and critical for future mitigation efforts, the results of this chapter suggest that it is erroneous to assume that countries will automatically be more willing (and able) to curb emissions as they wean themselves from fossil fuels. The tentative indications from this chapter suggest that this only holds true for countries with a long-term structural disposition to carbon-intensive activity. For the majority of countries, decreasing fossil fuel dependency is likely to depress the marginal efficiency benefits associated with emissions reduction, thereby impeding effective climate policy.

Third, the promise of reciprocal commitments apparently fails to promote emissions reduction, thus adding to the ambiguity surrounding what needs to be done to promote mitigation, particularly in the South. Neither the reduction of fossil fuel dependency nor the promise of reciprocal commitments are effective strategies for persuading developing countries to adopt more stringent climate policy. The next two chapters ascertain whether neo-liberal and structuralist variables offer more insight into the factors that obstruct emissions reduction in the poorest part of the world.

Chapter Six: Neo-liberal Explanations of Emissions Behaviour

Introduction

In this chapter, I focus on the instrumentalist explanations that flow from the second worldview proposed in chapter three – neo-liberal institutionalism. As we saw in that chapter, neo-liberals[139] contend that climate policy is determined by the domestic costs and benefits of emissions behaviour. Although costs and benefits can be defined in various ways (e.g. socio, economic or political), the underlying logic is thus: *countries are more likely to reduce emissions when they, or the policymakers who act on their behalf, expect the domestic gains of emissions cuts to outweigh the costs. Conversely, countries are unlikely to cut emissions when they expect to incur more domestic costs than benefits.*[140]

My review of the literature in chapter two identified three core explanations from the emissions trends scholarship that are compatible with the domestic cost-benefit approach:

(i) *Countries that participate more frequently in international environmental institutions are more likely to reduce emissions*

[139] Throughout this chapter (and entire thesis), references to neo-liberalism refer to the neo-liberal school of international thought and not the neo-liberal theory of domestic politics.

[140] As emphasised in chapter three, the main difference between neo-liberal and neo-realist approaches is that the former focuses on the absolute costs and benefits faced by states in the domestic arena whereas the latter prioritises the relative costs and benefits faced by states in comparison to other states.

than countries that resist international environmental cooperation;

(ii) *Countries that are responsible for a large share of atmospheric greenhouse gases are more likely to reduce emissions than smaller emitters because they face higher reputational costs from inaction and have less incentive to free-ride;*

(iii) *Democracies are more likely to reduce emissions than non-democracies as democratically elected politicians tend to face higher domestic demand for public environmental goods.*

The aim of this chapter is to empirically test these neo-liberal hypotheses, which are illustrated in figure 6.1.

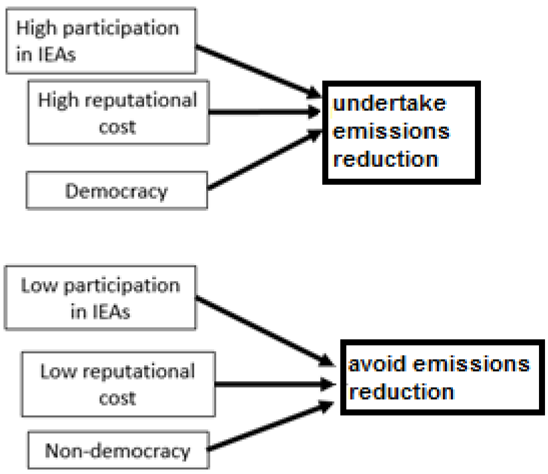

Figure 6.1: Neo-liberal hypotheses

My empirical investigation of the neo-liberal hypotheses proceeds the same way as the last chapter. In the first section, I recall the proxies that were proposed as absolute gains indicators in chapter four and explore how they are distributed across country-years, countries and regions. Building on these distributional patterns, I flesh out some concrete neo-liberal predictions and take a brief look at the preliminary statistical associations between emissions behaviour, participation in international environmental agreements (IEAs), reputational cost and democracy. In the second section, I apply the methodological approach developed in the research design chapter to the neo-liberal hypotheses. Part three is where I present the results of the neo-liberal single-level regression, random intercept and random coefficient models. I conclude the chapter with a discussion of the main contributions of the chapter to the literature and its policy relevance.

Measuring Absolute Gains, Distributional Patterns and Preliminary Associations

In chapter four, I created three proxies to measure the core domestic costs and benefits of emissions reduction – namely: reputational cost, participation in IEAs and democracy. Table 6.1 summarizes the sources and levels of measurement used to operationalise these proxies.

Absolute gains indicator		Operationalisation	Source	Variable
(i)	International institutional incentives	Number of IEAs signed and ratified (minus two points per withdrawal) by a country	The University of Oregon's National Science Foundation's International Environmental Agreements Database Project	IEA_{jk}
(ii)	Reputational cost	A country's share of atmospheric greenhouse gas emissions in a given year	The World Bank's World Development Indicators database	$reputation_{ijk}$
(iii)	Political costs	The level of democracy in a country in a given year	Freedom House's Freedom Index	$democracy_{ijk}$

Table 6.1: Absolute gains indicators

Note: Variable subsets denote the level of coding: ijk level-one variable coded at country-year (i) nested in country (j) nested in region (k); kj level-two variable coded at country (j) nested in region (k); and k level-three variable coded at region (k).

Distributional Patterns and Preliminary Predictions

If neo-liberal explanations are right, then the distribution of absolute gains should allow us to predict which countries are likely to reduce (or avoid reducing) emissions. In this section, I explore how participation in IEAs, reputational cost and democracy are distributed across all three levels of the model and flesh out some concrete predictions, which I return to when evaluating the empirical implications of the neo-liberal approach.

(i) Level One: Country-year

Figure 6.2 provides an overview of the longitudinal patterns in absolute gains predictors by using nonparametric, locally weighted scatter plot smoothers (Lowess plots). The flat lines in the first two graphs indicate that participation in IEAs and reputational costs are distributed uniformly over the First Commitment Period (FCP). For the first variable, this is because IEA records the total number of IEA ratifications (minus withdrawals) per country from 1990 to 2012 and is therefore fixed across country-years. Reputational cost, on the other hand, is coded at the country-year level and is thus sensitive to temporal fluctuation. The flat line suggests that even though individual country shares of atmospheric greenhouse gases have changed over time, increasing contributions are roughly counter-balanced by decreasing emissions levels. Hence the average level of contribution per country-year remains stable. The democracy plot is the only variable to exhibit longitudinal variation. The (slightly) positive slope of the democracy line tells us that, on average, countries have become more democratic over time. Therefore, on the basis of the third hypothesis, we should expect a parallel increase in emissions reductions over the FCP.

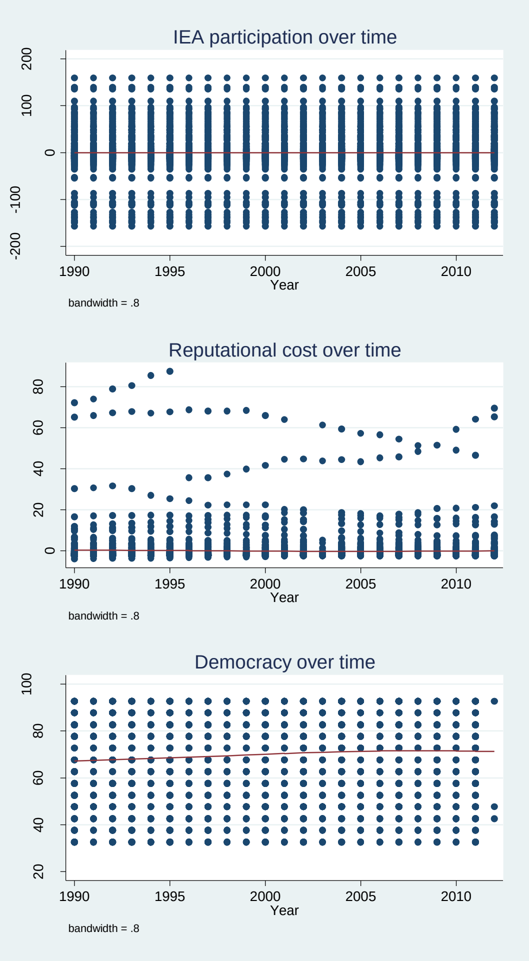

Figure 6.2: Longitudinal distribution of absolute gains predictors from 1990 to 2012.
Note: each point represents a country in a given year

(ii) Level Two: Country

Figures one to three in the chapter appendix rank countries according to mean participation in IEAs, reputational cost and democracy. If the first hypothesis is correct, participation in IEAs should promote emissions reduction. According to the first figure, France, Norway, Sierra Leone, Denmark and Italy, should exhibit the largest emissions cuts. In contrast, low levels of participation by Dominica, the Solomon Islands, Seychelles, Venezuela and Mauritius in IEAs should make these countries the least willing to reduce emissions.

Figure two in the chapter appendix tells us that the US, China, Russia, India and Brazil face the highest reputational costs from inaction against climate change. If the second hypothesis is correct, then the fear of (high) reputational costs should persuade these countries to reduce emissions. Conversely, as the least complicit countries, Bhutan, Samoa, Kiribati, Niue and the Cook Islands should not be under reputational pressure to reduce emissions and also face the highest incentives to free-ride.

According to the third hypothesis, democratic countries should face the highest domestic demand for effective climate policy and thus be more willing to reduce emissions. The third figure indicates that these countries are the US, Switzerland, Sweden, Norway and New Zealand. In stark contrast, the least democratic countries, which are the Sudan, Cuba, Turkmenistan, Syria and Saudi Arabia, should be the least willing to undertake emissions cuts.

(iii) Level Three: Region

Figure 6.3 displays mean regional participation in IEAs, reputational cost and democracy levels. According to the first graph, the EIG has the highest regional participation in IEAs. Thus, based on precedence, this region should be the most willing to comply with emissions caps. Conversely, the CACAM should be the least willing region to reduce emissions given its poor track record of participation in IEAs. The second graph indicates that the BASICs is by far the largest contributor to atmospheric emissions. As the most complicit region, the BASICs should cave into the enormous reputational pressures to curb emissions and face minimal incentives to free-ride. In contrast, the LDCs and AOSIS should not experience any reputational disincentives against inaction. The third graph plots mean regional democracy levels over the FCP. As the most democratic regions, the EU and UG should be the most willing to regulate emissions. Conversely, low average democracy scores in the OPEC and CACAM should make these regions the strongest opponents to emissions cuts.

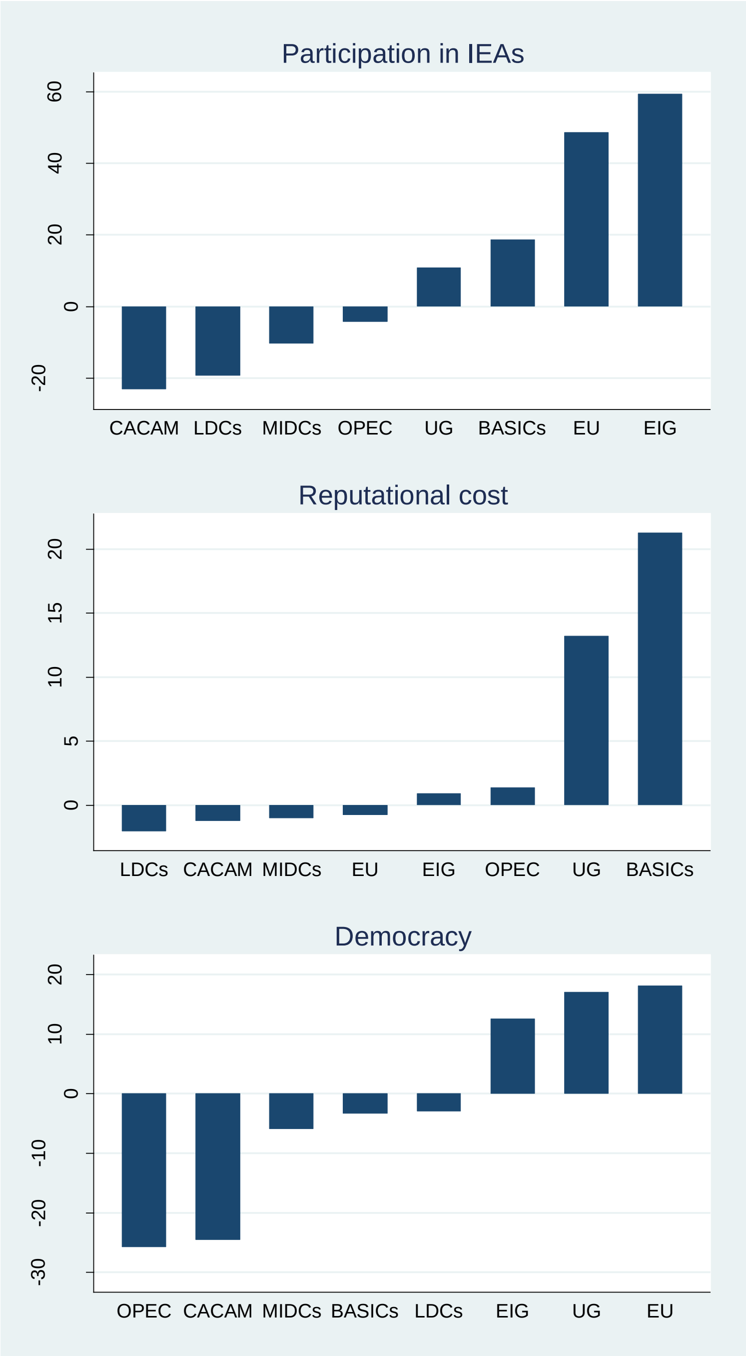

Figure 6.3: Mean regional participation in IEAs, reputational cost and democracy from 1990 to 2012

Statistical Associations: A Sneak Preview

Before fitting the models, it is helpful to take a brief look at the statistical associations between emissions behaviour and the absolute gains predictors discussed above. Figure 6.4 provides an overview of the preliminary patterns between emissions, participation in IEAs, reputational cost and democracy by using nonparametric, locally weighted scatter plot smoothers (Lowess plots).

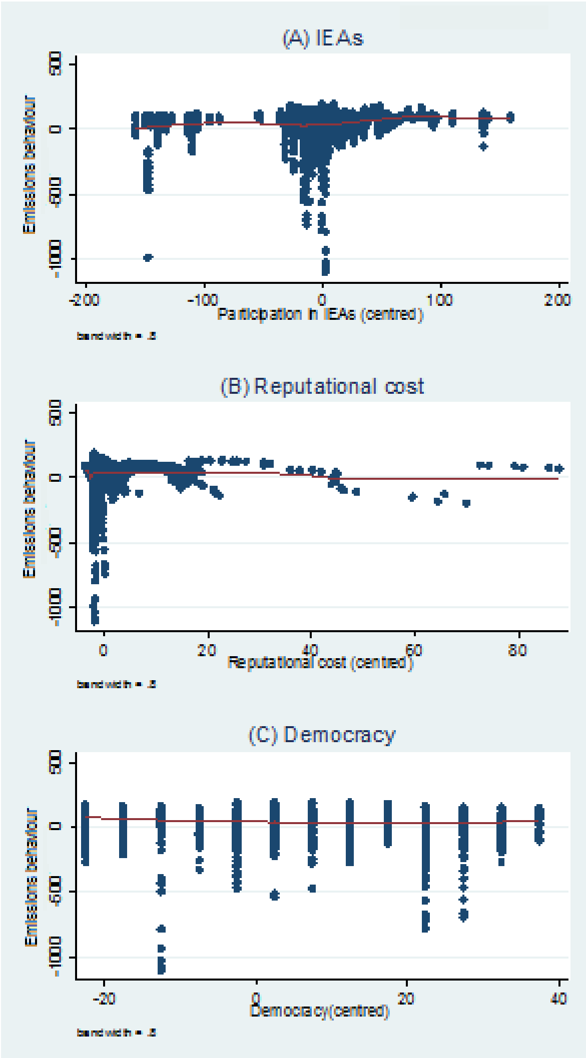

Figure 6.4: Emissions behaviour versus domestic costs and benefits
Note: Each point represents a country-year.

The upwards slope of plot A exhibits a weak positive relationship between emissions behaviour and IEAs. In accordance with neo-liberal intuition, states that participate more in IEAs tend to engage in more emissions reduction. Plot B suggests that countries that face higher reputational costs have lower compatibility with mitigation, which contradicts our second hypothesis. The democracy line in plot C is less informative: the line is very flat and dips slightly in the middle, suggesting that countries at either end of the authoritarianism – democracy continuum are slightly more willing to reduce emissions than countries with average democracy levels. At this preliminary stage, the statistical associations are too weak to draw out any concrete predictions about any of the hypotheses.

Approach

I now fit the methodological approach outlined in the research design chapter to the neo-liberal hypotheses discussed above. As in the last chapter, I begin by running a single-level multiple regression which includes all of the neo-liberal predictors:

$EMBEH_{ijk} = \beta_0 + \beta_1 IEA_{jk} + \beta_2 reputation_{ijk} + \beta_3 democracy_{ijk} + e_{ijk}$

$e_{ijk} \sim N(0,\sigma_e^2)$ ***(Model 1: Single-level OLS)***

The next step is to allow the mean emissions behaviour levels to vary across regions and countries by introducing the random intercept terms u_{jk} and v_{jk} respectively. The equation of the random intercept model becomes:

$EMBEH_{ijk} = \beta_0 + \beta_1 IEA_{jk} + \beta_2 reputation_{ijk} + \beta_3 democracy_{ijk} + v_{jk} + u_{jk} + e_{ijk}$

$v_k \sim N(0,\sigma_v^2)$
$u_{jk} \sim N(0,\sigma_u^2)$
$e_{ijk} \sim N(0,\sigma_e^2)$ ***(Model 2: Random intercepts)***

In the third model, I whether domestic costs and benefits have heterogeneous effects across countries and regions. To do this, I allow the coefficients to vary across countries and regions. In order to keep things simple and minimise the degrees of freedom, I conduct a series of diagnostic tests to check for significant random effects by allowing the effects of each predictor to vary separately, initially at the country level. I also look for significant changes in the variance components to determine whether modelling causal heterogeneity enhances the explanatory power of the model. As a third check on the goodness of fit, I conduct LR tests between the random coefficient and random intercept models as well as the equivalent single-level regression. All of the predictors with significant random effects are then incorporated into a single model. After setting up the country-level random effects, I check whether the predictors also have significant regional random effects by running the same diagnostic tests at the third level of the model.

For illustrative purposes, let us consider the hypothetical case that all of the neo-liberal predictors have significant country and regional random effects.[141] The new random effect terms, u_{nji} and v_{nk}, are introduced to model causal heterogeneity in (n) country and regional level random effects respectively, so the random coefficient model becomes:

$$EMBEH_{ijk} = \beta_0 + \beta_1 IEA_{jk} + u_{1jk}IEA_{jk} + v_{1k}IEA_{jk} + \beta_2 reputation_{ijk} + u_{2jk}reputation_{ijk} + v_{2k}reputation_{ijk} + \beta_3 democracy_{ijk} + u_{3jk}democracy_{ijk} + v_{3k}democracy_{ijk} + v_{0jk} + u_{0jk} + e_{ijk}$$

$$\begin{pmatrix} v_{0k} \\ v_{1k} \\ v_{2k} \\ v_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{v0}^2 & & & \\ 0 & \sigma_{v1}^2 & & \\ 0 & 0 & \sigma_{v2}^2 & \\ 0 & 0 & 0 & \sigma_{v3}^2 \end{pmatrix}$$

141 The diagnostic tests found no evidence of significant regional random effects, so the fitted model is much simpler than the example shown here.

$$\begin{pmatrix} u_{0k} \\ u_{1k} \\ u_{2k} \\ u_{3k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & & & \\ 0 & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & 0 & \sigma_{u3}^2 \end{pmatrix}$$

$$e_{ijk} \sim N(0,\sigma_e^2)$$

(Model 3: Random intercepts and random slopes)

Results

Model 1: Single-level regression

Is emissions behaviour shaped by absolute gains? According to the results of the single-level regression, the answer is affirmative. Table 6.2 displays the results of the first model, which treats all 3,081 country-years as independent observations. Two out of the three predictors are statistically significant with undetectable p-values. The average emissions behaviour score across all observations is 45.74 points on a scale from -1102 to 191, where 100 represents perfect attainment of a country's 1990 emissions levels, values above 100 indicate emissions reductions in excess of 1990 levels and negative values denote emissions that exceed 1990 levels (i.e. negative emissions reduction). The adjusted R-square score tells us that the model only accounts for around three percent of emissions behaviour, which is around half of the value obtained for the equivalent neo-realist and structuralist models in chapters five and seven respectively.

Parameter	Estimate
IEA	0.26 (0.03)***
Reputational cost	-0.11 (0.24)
Democracy	0.48 (0.10)***
Intercept	45.74 (1.87)***
Adjusted R-squared	0.030

Table 6.2: Single-level regression estimates of absolute gains indicators
Note: Coefficient entries are ordinary least squares estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

How do the results mesh with the neo-liberal hypotheses presented at the beginning of the chapter? The positive sign and size of the IEA coefficient lends strong support to the first hypothesis. On average, a one-point increase in IEA participation is associated with 0.26 higher emissions behaviour. This finding is significant at the 0.001 level.

Reputational cost, however, is inversely correlated with emissions reduction: on average, a one-point increase in reputational cost is associated with 0.11 points less emissions behaviour. Thus the results of the first model contradict the second hypothesis that rising reputational costs and diminishing incentives to free-ride compel the states to reduce emissions.

Our third coefficient suggests that democracy has the expected positive effect on emissions behaviour. On average, a one-point increase in a country's democracy score is associated with 0.48 points more emissions reduction. This predictor has the largest effect out of all the neo-liberal predictors and the level of significance is 0.001.[142]

What do these results imply for regional emissions behaviour? To answer this question, I predict the average regional emissions values by inputting the typical domestic cost-benefit characteristics of each region to the regression equation:

$EMBEH_{ijk} = 45.74 + 0.26IEA_{jk} – 0.11reputation_{ijk} +0.48democracy_{ijk}$

The single-level model simulates the relationship between emissions and IEA participation, reputational cost and democracy as a single straight line, with the regional coordinates located on various points across the line. For illustrative purposes, figure 6.5 plots emissions behaviour as a function of our first neo-liberal predictor, IEA participation, with 95 percent confidence intervals. To avoid repetition, the equivalent graphs for reputational cost and democracy are not shown here, but also follow a single straight line with the same intercept, 45.74.

[142] The effect size is more striking if we recall that one-point of the democracy variable used in this thesis is only equal to a tenth of one-point in the original Freedom House index. In other words, a one-point increase in the original index is associated with 48 points more emissions reduction.

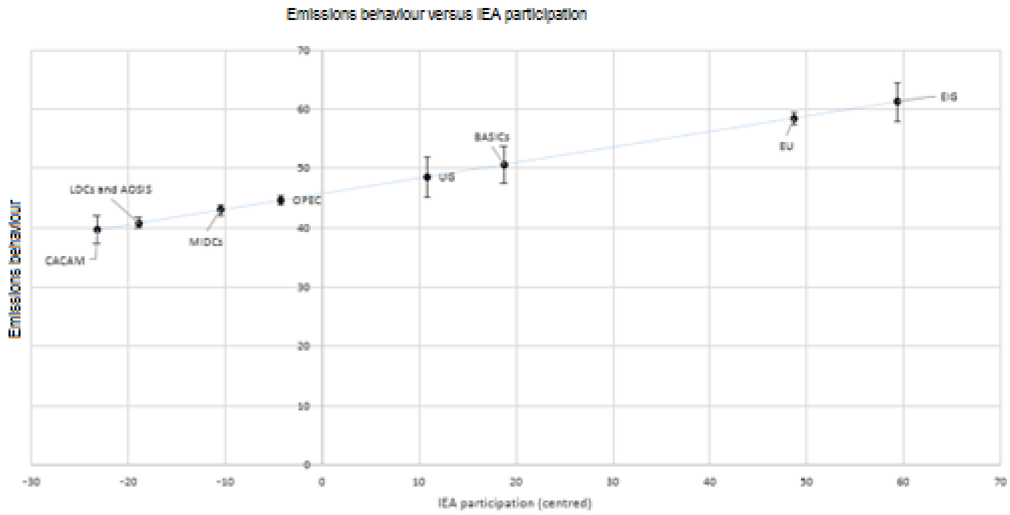

Figure 6.5: Predicted regional emissions behaviour as a function of mean participation in IEAs

Figure 6.6 displays the regional emissions predictions of the 'complete' regressions with the three neo-liberal variables and 95 percent confidence intervals. Overlapping confidence intervals indicate that the actual emissions behaviour of the concerned regions can be similar to each other, as real values can fall anywhere within the confidence intervals. Thus, on the basis of absolute gains, we can predict, with 95 percent confidence that the order of most to least emissions-reducing regions will be: (i) the EIG and EU, followed by (ii) the UG, (iii) BASICs, (iv) MIDCs and LDCs and AOSIS, (v) OPEC and (vi) CACAM.

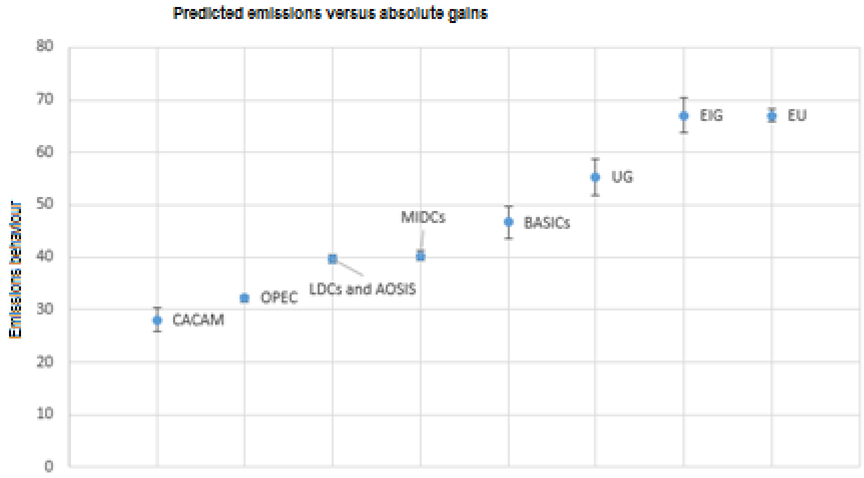

Figure 6.6: Emissions behaviour versus absolute gains
Note: the points represent the predicted regional emissions behaviour scores estimated by the neo-realist single-level regression model. The vertical lines depict the 95 percent confidence intervals.

How do these predictions fare? Figure 6.17 plots the regional emissions behaviour values predicted by the three neo-liberal models fitted in this chapter alongside the mean emissions figures from the dataset. Actual emissions values are represented by the patterned column on the left and the values predicted by the single-level model are in the adjacent column in light grey. The vertical distance between the actual and estimated compliance values indicates the accuracy of the predictions. As in the last chapter, the single-level predictions are the worst fit with the real data. Most strikingly, the model significantly underestimates emissions reduction in the North and overestimates emissions reduction in the South. This affirms what we already know from the adjusted R-squared value – the single-level regression is a poor predictor of regional emissions behaviour. The model does, however, correctly predict the order of regional emissions behaviour in the South: the BASICs is the most emissions-reducing region, which is followed by the MIDCs, LDCs and AOSIS and OPEC respectively.

Model 2: Random Intercepts

Are the results of the single-level regression robust to country and regional clustering? To answer this question, I begin modelling the multilevel structure of the dataset by allowing average emissions behaviour lto vary across countries and regions. The fixed effects estimates of the RIM are displayed in table 6.3, alongside the coefficients from the single-level regression.

Parameter	**OLS**	**RIM**
IEA	0.26 (0.03)***	0.11 (0.13)
Reputational cost	-0.11 (0.24)	-1.86 (0.49)***
Democracy	0.48 (0.10)***	-1.71 (0.19)***
Intercept	45.74 (1.87)***	59.84 (20.17)**

Table 6.3: Absolute gains coefficients in the single-level regression and random intercept model.

Note: Single-level entries are ordinary least squares estimates and RIM entries and maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

The fixed effects in the RIM differ in important respects from the results of the single-level regression. Although the effect of participation in IEAs is still positive, the size of the effect is less than half of what it was in last model. After accounting for country and regional clustering, a one-point increase in IEA participation is associated with 0.11 points increase in emissions reduction. However, the size of the coefficient is small relative to the standard error, which means that the variable ceases to be a significant driver of emissions behaviour. Since the p-value is well above 0.05, the random intercept model does not provide strong evidence in support of the first hypothesis.

The size of the effect of reputational cost is substantially higher than the single-level coefficient. On average, a one-point increase in reputational cost is now associated with 1.86 points less emissions reduction. The sign of the effect contradicts the second hypothesis that high reputational costs and the absence of incentives to free-ride push states to cut emissions. In contrast to neo-liberal expectations, countries become less likely to reduce emissions as their share of atmospheric emissions increases.[143] This finding is significant at the 0.001 level.

The most striking changes occur in the democracy variable: in the previous model, a one-point increase in democracy was associated with 0.48 points more emissions reduction. This effect is completely reversed in the random intercept model, where, on average, a one-point increase in democracy is associated with 1.71 points less emissions reduction. The negative effect of democracy on compliance contradicts our second hypothesis that democratization promotes mitigation.[144]

Why do the coefficients change when we begin modelling the multilevel data structure? The coefficients in the first model estimate the average effect on all observations, without taking into account the country or

[143] Separate tests of country-years nested within regions (output not reported) confirm that this effect is also valid at the second level of the model: within the same region, the largest polluters are the least likely to reduce emissions with the climate regime. This finding is significant at the 0.001 level.
[144] This finding casts doubt on most of the existing work in the field, which finds that democracies are more willing to reduce emissions (e.g. Bernauer and Bohmelt 2012; von Stein 2008), a point which I return to in the conclusion.

region that the observation comes from. In contrast, the RIM differentiates between observations from different countries and regions and estimates the average effect of the predictor on observations from the same cluster. For IEAs and reputational cost, the signs of the coefficients are the same across the two models, but the size of the effect varies within and between regions. The change is even more striking in the case of democracy, which switches from promoting to inhibiting emissions reduction. The sign change indicates the presence of cluster-confounding - democracy has contradictory effects within and between clusters. This phenomenon is represented visually in figure 6.7. Each plot contains three clusters (countries or regions), which are represented by round dots. Solid lines represent the within-group effects and dashed lines between-cluster effects.

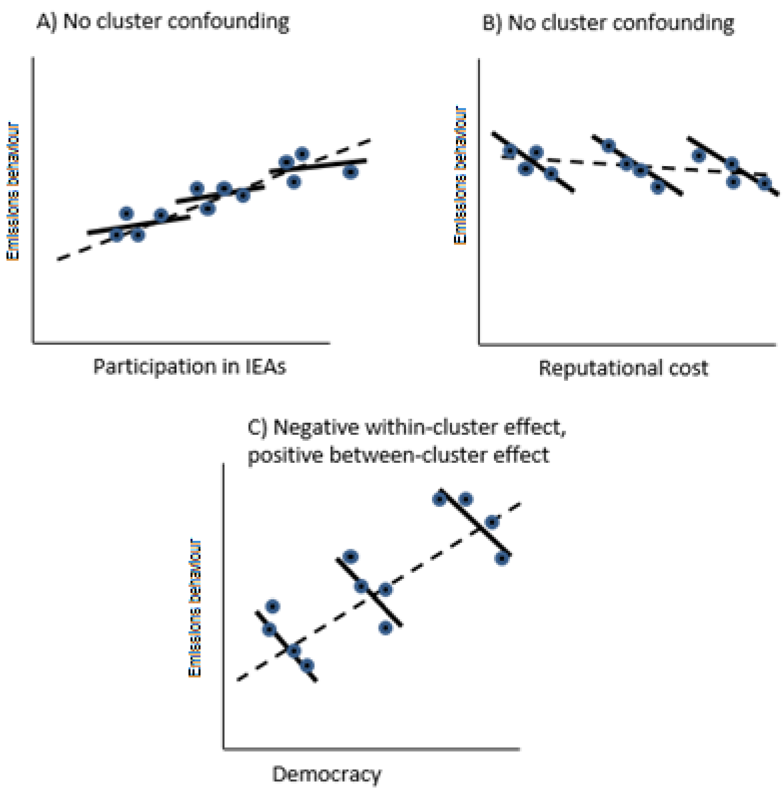

Figure 6.7: Within and between-cluster effects of absolute gains variables

Plot A represents the effect of IEA participation on emissions behaviour, which, as indicated by the upwards slope, is positive both within and between countries and regions. The flatter slope of the solid lines tells us that the effect is weaker when we limit our analysis to the same country or region.

Plot B represents reputational cost effects. Once again, the solid and dashed lines are in the same direction, indicating that reputational cost always inhibits emissions reduction. The steeper slope of the solid lines suggests that the negative relationship between emissions behaviour and the reputational cost is stronger when we focus on the reputational costs faced by a single country over time and interstate differences in reputational costs within the same region relative to the correlation between all observations.

Plot C represents the democracy effect. Unlike the other two predictors, the solid and dashed lines point in different directions, indicating the presence of cluster-confounding: the positive slope of the dashed line tells us that democracy is associated with higher levels of emissions reduction between regions. Yet when we limit our analysis to a single region or country, the within-cluster effect of democracy becomes inhibitory. In the new model, more democratic countries within the same region or democratic spells in a given country are associated with lower levels of emissions reduction. The single-level regression conflates these distinct within and between cluster democracy effects.

I now move onto evaluating the goodness of fit of the model. I compare the random effects of the RIM with the null model that was fitted in the research design chapter. I also conduct LR tests with the null model and equivalent single-level regression to check my inferences. The 'explained variance' column on the right indicates the percentage of variance from the null model that is explained by the RIM. Disaggregating variance into regional, country and country-year components effectively provides us with a more sophisticated understanding of the explanatory power of the model than the single R-squared value provided by the single-level regression. The results are presented in table 6.4.

Parameter	**Null**	**RIM**	**Explained variance (%)**
Variance Components			
Region	1220.99 (856.62)	2439.06 (1583.09)	-99.75
Country	5292.96 (664.46)***	5549.78 (726.62)***	-4.85
Country-year	6274.01 (156.57)***	5163.09 (134.48)***	17.7
LR tests			
LR $test_{OLS}$	1935.52 (p<0.000)	1768.23 (p<0.001)	
LR $test_{NULL}$	-	3982.492 (p<0.001)	

Table 6.4: Random effects estimates in the neo-liberal random intercept model and null model

Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Introducing the random intercept terms has changed the variance components from the null model. The amount of unexplained variance at the regional level has almost doubled from 1220.99 to 2439.06, decreasing the amount of explained variance by 99.75 percent.[145] This is because the region acted like a suppressor variable, so modelling mean regional compliance levels has increased the amount of unexplained variance. However, we should not read too much into the new variance term because, as in the null model, it is small relative to the standard error. Country variance has also increased slightly from 5292.96 to 5549.78, which is a 4.85 percent increase in unexplained variance. As with regional variance, the larger variance component indicates that the country has a suppressor effect on variance. Yet the larger number of countries sampled in the second level makes the new parameter significant at the 0.001 level. Country-year variance, on the other hand, has dropped from 6274.01 to 5163.09, marking a 17.7 percent decline in residual variance. Even with the larger country and regional variance components, the RIM is a significant improvement over the single-level regression, which accounted for just three percent of variation at the country-year level. The LR tests confirm that the RIM is a significantly better fit to the data than the null model and equivalent OLS.

What do the results of the random intercept model contribute to our understanding of regional emissions behaviour? As before, we can examine the model's regional predictions by plugging in mean regional participation in IEAs, reputational cost and democracy values to the regression equation:

[145] Snijders and Bosker (1994) describe the increase in unexplained variance that can occur when independent variables are added to multilevel models as 'negative R-squared values', which is the approach taken here.

$EMBEHe_{ijk} = 59.84 + 0.11IEA_{jk} - 1.86reputation_{ijk} - 1.71democracy_{ijk} + v_0 + u_0$

Figure 6.8 is a simulation of the predicted relationship between emissions behaviour and plus and minus one standard deviation of our first predictor, IEA participation.[146]

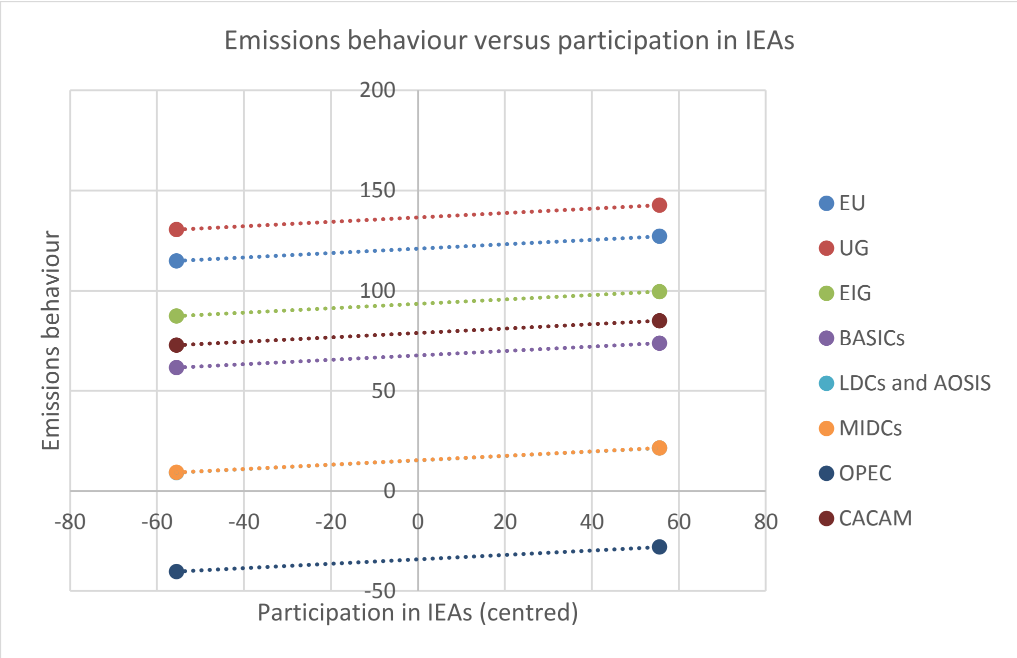

Figure 6.8: Emissions versus IEA participation in the random intercept model

The RIM assigns each region a separate regression line, which, as indicated by the increase in proportion of explained variance at the country-year level, significantly improves the goodness of fit of the model from the single-level regression. Since the effects are fixed across countries and regions, the lines are parallel.[147] On average, the UG (red) is the most and OPEC (navy blue) last compliant region.

[146] The values of the other predictors (reputational cost and democracy) are set to zero to isolate the 'pure' effects of IEA participation.
[147] For this reason, the vertical distances between the regional intercepts are the same in the equivalent reputational cost and democracy graphs, which are not shown here to avoid repetition.

As before, we can get a birds-eye view of the model by considering the net effects of the absolute gains predictors simultaneously. Figure 6.9 plots the regional predictions with the 95 percent confidence intervals. Since regional emissions levels can take any value within the confidence intervals, we can only be (95 percent) confident that there are substantive differences between the emissions behaviour of regions whose confidence intervals *do not* overlap. Broadly, our relative gains model allows us to predict that the order of most to least emissions-reducing regions will follow a six-stage ranking: (i) CACAM, (ii) the EU, (iii) UG, (iv) EIG, (v) BASICs, MIDCs and LDCs and AOSIS and (vi) OPEC.

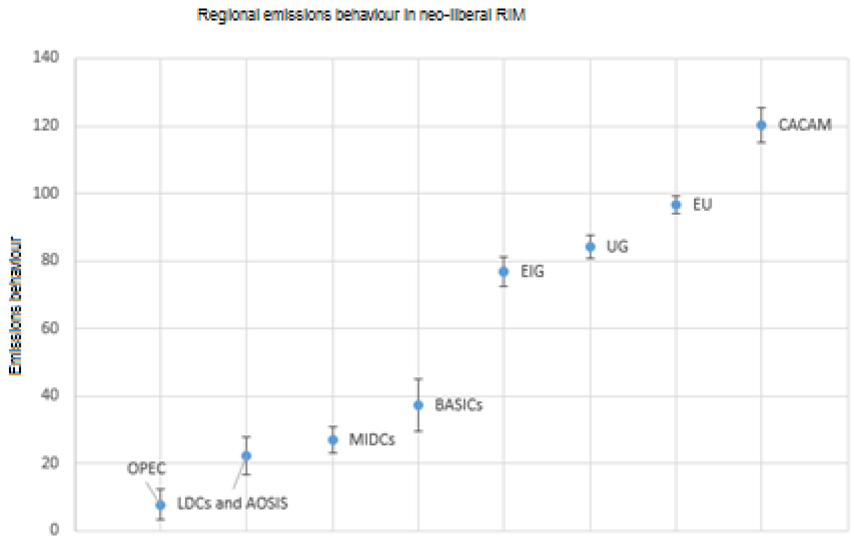

Figure 6.9: Regional emissions predictions in the RIM
Note: the points represent the regional emissions behaviour scores estimated by the neo-realist RIM. The vertical lines depict the 95 percent confidence intervals.

The order of the regional emissions behaviour values is slightly different to the order of the regional intercepts shown in figure 6.8. It is particularly striking that the CACAM, which is shown to possess an intermediate intercept in figure 6.8, is predicted to be the most emissions-reducing region in figure 6.9. This discrepancy occurs because predictions in figure

6.9 are based on the average regional values of the neo-liberal variables rather than the hypothetical range of values plotted in figure 6.8t. This is easier to illustrate in relation to reputational cost and democracy, which have larger effect sizes than IEA participation. Figure 6.3 told us that CACAM's democracy score is approximately 23 points below the world average, which is more than one standard deviation (19) of democracy. In contrast, the Northern regions (the EU, UG and EIG) have the highest democracy levels in the world (approximately 17 points). Figure 6.10 extends the predicted emissions-democracy relationship to capture CACAM's low democracy score. Extrapolation from the mean regional democracy scores on the x-axis illustrates how regional cost-benefit attributes make CACAM the most emissions-reducing region despite having a lower intercept value than the Northern regions.

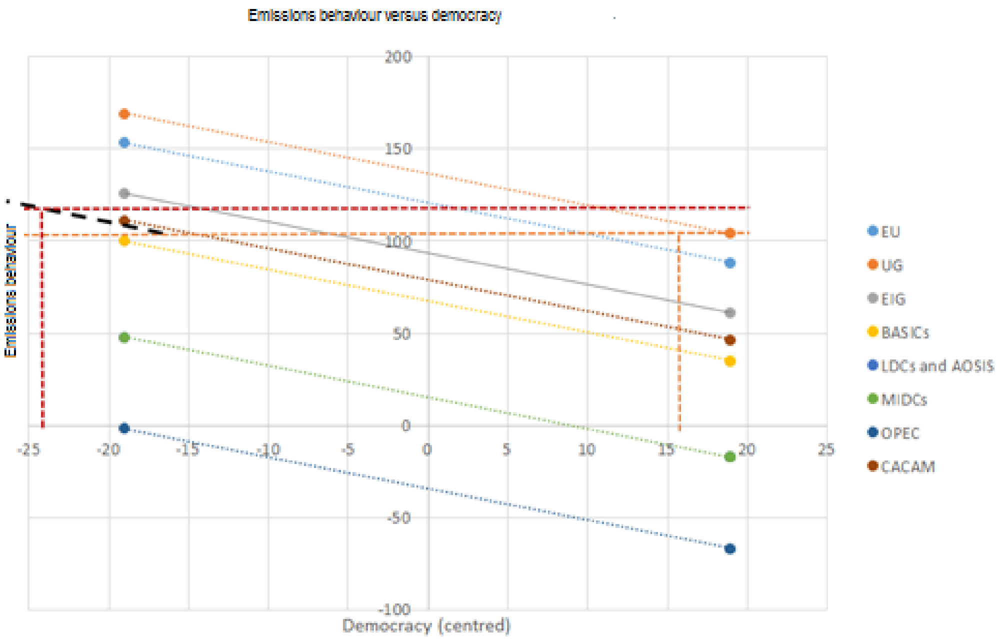

Figure 6.10: Extrapolation from mean regional democracy values to predict emissions behaviour in the neo-liberal RIM

To get a sense of the reliability of these predictions, we can refer again to figure 6.17 to compare the simulations with the regional emissions behaviour values observed in the dataset. The regional compliance values predicted by the RIM are indicated by the third column shaded in medium grey. While the predictions are certainly not precise (especially in the South where actual emissions behaviour levels are lower than expected), the differences between the actual values in the striped column are substantially lower than those in the single-level regression. Moreover, the RIM predictions correctly mirror the order of regional emissions behaviour observed in the actual dataset. Clearly, allowing countries and regions to have their own regression lines has significantly improved the fit of the neo-liberal model.

Model 3: Random Coefficients

The next step is to determine whether the effects of the neo-liberal predictors vary between countries and regions. I begin this section by running a series of diagnostic tests to check for signs of heterogeneity at the country-level, allowing the coefficient to each predictor to vary across countries. Specifically, I am looking for significant random effect terms and changes in the variance components. Since it is possible for a variable to have significant random effects without significant fixed effects (Hox 2002), I allow the IEA and reputational cost slopes to vary even though they were not found to be significant in the RIM. I also conduct LR tests to compare the goodness of fit of the models with the RIM and single-level regression. The results of the random effects and LR tests are presented in table 6.5, alongside the variance components of the random intercept model for reference.[148]

Parameter	RIM	IEA participation	Reputational cost	Democracy
Regional variance	2439.06 (1583.09)	1551.32 (1063.83)	2207.90 (1410.13)	~0 (~0)
Country variance	5549.78 (726.62)***	5584.30 (761.26)***	50299.37 (14982.57)***	33371.72 (5140.12)***
Country-year variance	5163.09 (134.48)***	5160.44 (135.30)***	4341.89 (119.07)***	867.53 (150.20)***
Random effect, ux	-	0.24 (0.08)**	24014.14 (6096.25)***	33.61 (5.27)***
Likelihood value	-17780.131	-17770.242	-17657.358	-17569.771
LR test$_{OLS}$	1768.23 (p<0.001)	1788.01 (p<0.001)	2013.78 (p<0.001)	2188.95 (p<0.001)
LR test$_{RIM}$	-	19.78 (p<0.001)	255.55 (p<0.001)	420.72 (p<0.001)

Table 6.5: Diagnostic tests for random effects in neo-liberal predictors
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

All three predictors exhibit significant random effects between countries. The IEA random effect is significant at the 0.01 level and reputational cost and democracy random effects are significant at the 0.001 level. The results of the LR tests confirm that all three models are separately preferred to the RIM without random effects as well as the equivalent single-level regression.

A series of diagnostic tests were conducted to check whether these variables continue to exhibit country-level random effects even when other putative drivers of emissions are controlled for. In accordance with

[148] The fixed effects are analysed below when the final random coefficient model is fitted.

the robustness checks devised in chapter four, each of the neo-liberal variables with random effects were added into a grand model which includes all of the predictors that flow from the neo-realist and structuralist worldviews as well as the additional controls from the emissions trends literature (population and technology). The results of two out of the three tests, which are presented in table 6.6, are consistent with the results obtained in the previous table. Even when all of the other putative drivers of emissions are controlled for, democracy and reputational cost continue to exhibit significant random effects between countries. The random effect term for democracy continues to be highly significant at the 0.001 level, but the significance of the random effect term for reputational cost drops to 0.05 (p=0.044, with a z-score of 1.71). Nonetheless, both random effect terms continue to be significant, indicating that the risk of omitted variable bias is low. This warrants an investigation of the country-level random effects of reputational cost and democracy on emissions behaviour.

The remaining test yields an insignificant random effect term for international environmental agreements, suggesting that the significant result in table 6.5 could be due to a spurious relationship caused by correlation between the predictor variable and one (or more) of the other control variables that are included in the larger model. For example, it could be that economically powerful countries have the means to undertake larger emissions reductions and also participate in more international environmental agreements.[149] If this is the case, then economic power becomes the underlying causal variable and the association between emissions and international environmental agreements spurious. Consequently, the results of the diagnostic tests warrants the omission of the random effect term for international environmental agreements.

Parameter	**IEA**	**Reputational cost**	**Democracy**
Random effect, u_X	<0 (<0)	557.79 (325.44)*	11.27 (2.30)***

Table 6.6: Robustness checks for random effects of neo-liberal predictors
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Returning to the previous set of results in table 6.5, modelling random effects leads to significant changes in the variance components. In all three models, regional variance declines from the equivalent RIM value. As before, however, we cannot read too much into the changes in regional variance as the estimates are low relative to their standard errors. Country variance increases in all three models, which again, indicates that countries have a suppressor effect on variance. Thus, it is only at the country-year level that we observe a statistically significant decline in unexplained variance. However, the decline in residual variance in the random IEA model is negligible (less than five points). In contrast, the other two models show substantive reductions in country-year variance – the random reputational cost model sees a decline of

[149] The first part of this proposition is tested in the next chapter.

sixteen percent and in the random democracy model, the decline in residual variance reaches 83 percent.

The next step is to incorporate all of the random effects into the same model. This is feasible (within the limits imposed by the 7 degrees of freedom of the model) as the diagnostic tests in table 6.6 suggest that the random IEA effect is not robust to the inclusion of other putative drivers. Furthermore, as the preceding discussion shows, out of all three diagnostic models, the model with random IEA effects has the smallest random effect term (0.24 compared to 24014.14 and 33.61) and showed only a negligible decline in residual variance at the country-year level. Therefore, omitting random IEA effects should not significantly compromise the explanatory power of the RCM. Hence the model becomes:

$$EMBEH_{ijk} = \beta_0 + \beta_1 IEA_{jk} + \beta_2 reputation_{ijk} + u_2 reputation_{ijk} + \beta_3 democracy_{ijk} + u_3 democracy_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$$

The complete results of the RCM are presented in table 6.7, alongside the RIM estimates for reference.

Parameter	RIM	RCM
Fixed effects		
IEA	0.11 (0.13)	0.11 (0.20)
Reputational cost	-1.86 (0.49)***	-11.28 (4.99)*
Democracy	-1.71 (0.19)***	-1.62 (0.45)***
Intercept	59.84 (20.17)**	19.99 (22.70)
Random effects		
Reputation random effect, u_{2ijk}	-	1753.64 (569.51)**
Democracy random effect, u_{3ijk}	-	22.15 (3.61)***
Regional variance	2439.06 (1583.09)	732.08 (999.35)
Country variance	5549.78 (726.62)***	42182.97 (6808.42)***
Country-year variance	5163.09 (134.48)***	3777.95 (102.19)***
LR tests		
Likelihood value	-17774.295	-17510.894
LR test$_{OLS}$	1779.71 (p<0.001)	2306.1(p<0.001)
LR test$_{RIM}$	-	526.80 (p<0.001)

Table 6.7: Random coefficient model with random reputational cost and democracy effects
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Before analysing the random components of the model, some important changes in the fixed effects coefficients are worth noting. Although the signs of the fixed effects are the same as in the RIM, the sizes and significance levels have changed. Introducing the random effects has increased the standard deviation of IEA participation on emissions behaviour by six points, so the effect is still insignificant. The inhibitory effect of reputational cost has increased substantially from -1.86 to -11.28. This finding is significant at the 0.05 level. Thus the RCM provides even stronger evidence against our second hypothesis. Democracy continues to inhibit mitigation, although the size of the effect has decreased slightly by nine points. The level of significance remains the same at 0.001. The intercept estimate drops to 19.99, indicating that the average observation before taking into account random fossil fuel dependency effects is just twenty percent of 1990 emissions levels.

I now move onto examining the random effects of the model. The random effect terms tell us that, on average, the between-country effects of reputational cost and democracy vary by 1753.64 and 22.2 points respectively. Figure 6.11 illustrates the extent of heterogeneity by plotting predicted emissions behaviour levels as a function of the variables. Each line represents the relationship between emissions behaviour, reputational cost and democracy for a different country. Clearly, the level of heterogeneity is substantial. Hence modelling these random effects significantly enhances the goodness of fit of the model, which is confirmed by the results of the LR tests.

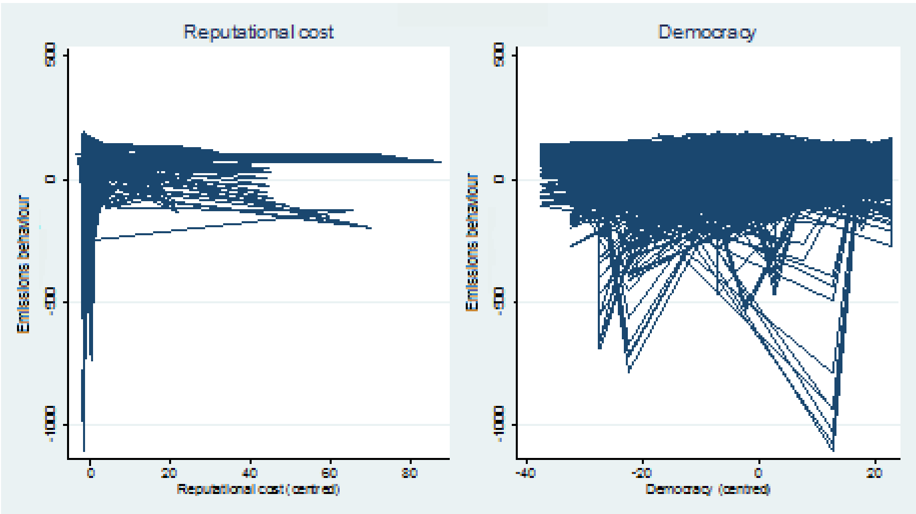

Figure 6.11: Predicted emissions behaviour as a function of reputational cost and democracy in the random coefficient model

Figure 6.12 plots the (sum of the fixed and random) reputational cost coefficients, which represents the average effect of reputational cost on a country, as a function of reputational cost. Countries that are responsible for a small share of atmospheric emissions and, therefore, face lower reputational costs, tend to have negative cost curves. In other words, increasing these countries' share of global emissions is associated with less emissions reduction. On the one hand, this finding contradicts our second hypothesis that reputational costs promote emissions reduction. On the other hand, the negligible share of global emissions that these countries command suggests that opposition to emissions reductions by these countries not likely to entail the same kind of reputational cost as countries on the right of the y-axis. Nor is it likely to have a noticeable effect on the overall success of the climate regime as, even in the presence of rising emissions, the contribution to global emissions is low relative to other countries and incentive to free-ride high. Low levels of emissions also suggest that these countries are not completely industrialised. According to the popular structuralist argument, such countries have the right to continue developing (and increase their emissions) in order to catch up with the most advanced economies in the North. If emissions activity does not impose the same kind of reputational costs in these countries as it does in larger emitters, it is not incompatible with neo-liberal intuition that countries which face low (or perhaps no) reputational costs and high free-riding incentives tend to emit more as their share of global emissions increases.

Moreover, the reputational cost curve becomes positive for the largest polluters which are located on the right of the y-axis (namely: the US, China, Russia, Brazil). Although this is only a small number of countries, these countries collectively account for 40 percent of global emissions over the First Commitment Period (FCP). Thus they are too critical to climate mitigation efforts to be regarded as outliers. For these countries, reputational cost (and low incentive to free-ride) has the expected effect of promoting mitigation. Yet the distribution of reputational costs does not explain everything. Countries in the top left quadrant, which have low shares of global emissions have positive reputational cost curves. Clearly, then, there is a need to explore other sources of heterogeneity in reputational cost effects, one of which is evaluated in chapter eight.

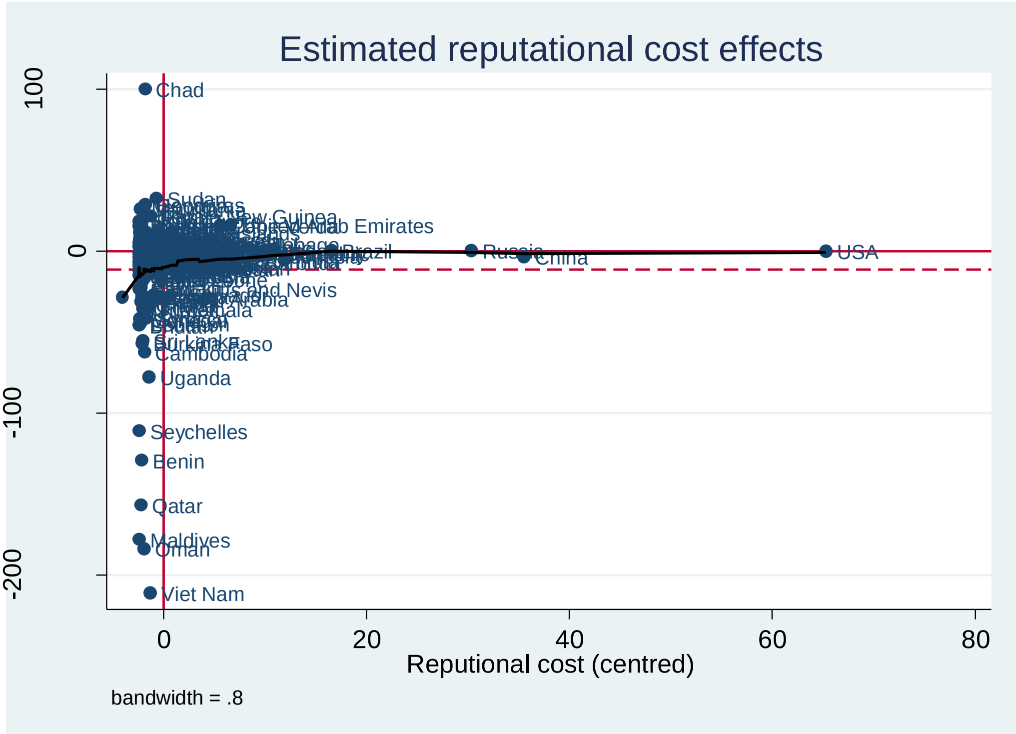

Figure 6.12: Estimated reputational cost effects as a function of reputational cost

Figure 6.13 plots the equivalent graph for democracy. Unlike reputational cost, the average democracy effect, which is represented by the Lowess line, is always negative. Furthermore, the inhibitory effect is strongest in authoritarian states, which are on the left of the y-axis. This graph tells us that as countries democratise, for example, by granting more political rights to express pro and anti-environmental sentiment and holding more regular political elections, they become less willing to reduce emissions.

Clearly, this inhibitory effect contradicts our third hypothesis – that democracy promotes effective climate policy. One possible explanation for this unexpected finding is the time-lag argument: democracy impedes compliance because democratically elected political leaders do not expect to remain in power by the time that the benefits of effective climate policy materialise. Thus, rather than risking the possibility of non-re-election with contentious emissions cuts, it is prudent to avoid the backlash that is likely to occur from industry and other actors in the economy whose interests are threatened by emissions reduction. Another plausible explanation is that while allowing greater expression of pro-environmental sentiment, more democratic environments also grant anti-environmentalist groups and energy lobbies greater opportunity to express their opposition to emission cuts, thus impeding mitigation. Indeed, some pluralism in democracies has been found to empower influential interest groups in obstructing the provision of other public goods (see, for example, Midlarsky 1998). Battig and Bernauer (2009) provide another explanation for the negative democracy effect: according to their investigation of the influence of democracy on emissions trends, democracies comply less with Kyoto targets because emissions cuts amount to a restriction on individual freedom in the transport sector, which is where the majority of emissions cuts in highly democratic, industrialised countries come from.

While these arguments might account for the negative effect of democracy on emissions behaviour, they do not explain why it tends to be stronger in authoritarian countries. Nor do they shed light on the substantial dispersion of country points around the Lowess line, which indicates that the (country-level) effect of democracy on emissions reduction is far more heterogeneous than reputational cost effects. Moreover, the weak correlation between democracy slopes and democracy levels suggests the involvement of other factors in determining the effect that democracy has on emissions behaviour in a given country. In chapter eight, I explore whether neo-liberal worldviews are one such factor.

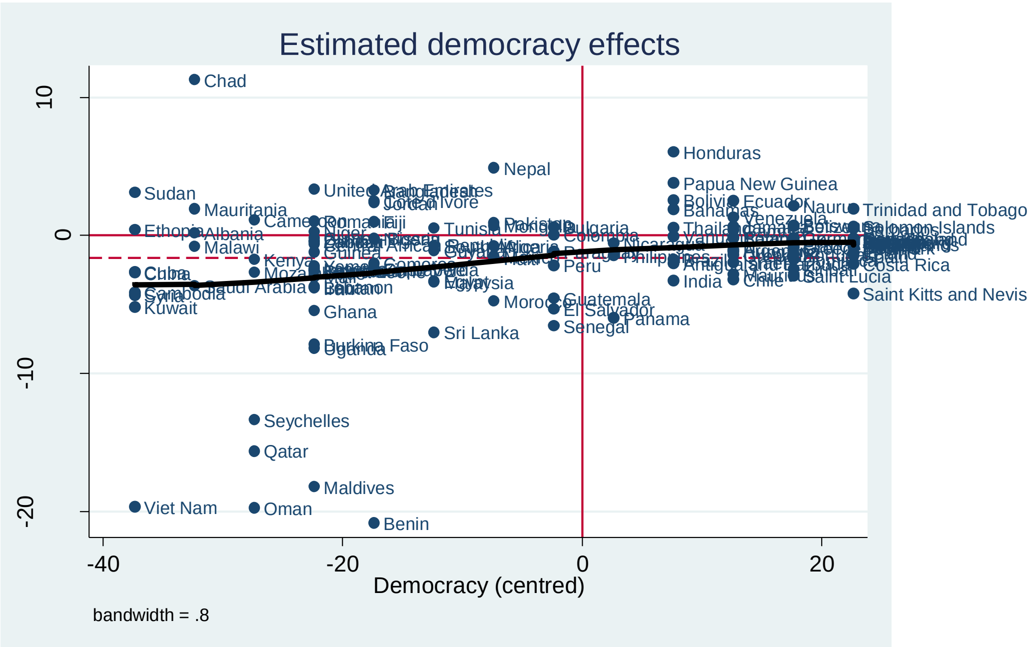

Figure 6.13: Estimated reputational cost effects as a function of reputational cost

As a second step in the development of the random coefficient model, I tried allowing the effects of IEA participation, reputational cost and democracy to vary between regions. None of the relative gains predictors had significant random effects at the regional level. LR tests with the (country) random slope model confirmed very strongly, with a p-value equal to one, that neo-liberal variables do not exhibit heterogeneity between regions.

Nonetheless, it is still possible to predict regional emissions behaviour by estimating the compliance values of some hypothetical countries that possess the mean IEA participation, reputational cost and democracy characteristics of each region. Thus the regression equation becomes:

$$EMBEH_{ijk} = 19.99 + 0.11IEA_{jk} + (-11.28+u_{2jk})reputation_{ijk} + (-1.62+u_{3jk})democracy_{ijk}$$

Figures 6.14 and 6.15 plot emissions behaviour as a function of mean reputational cost and democracy respectively. As before, the regression lines are plotted across plus and minus one standard deviation of the predictor mean with all other variables set to zero, the grand mean across all observations. Unlike in the RIM, the hypothetical regional lines are not parallel because the effects are allowed to vary across countries (and indirectly, regions). The sign and steepness of the slope indicates the direction and size of the predictor effect on a region respectively. In order to focus more closely on interregional differences in predictor effects, the random intercepts are excluded from the simulation. Omitting the random intercepts allows the regional lines to share the same intercept, helping us in our visual comparison of regional effects, which are represented by slopes.

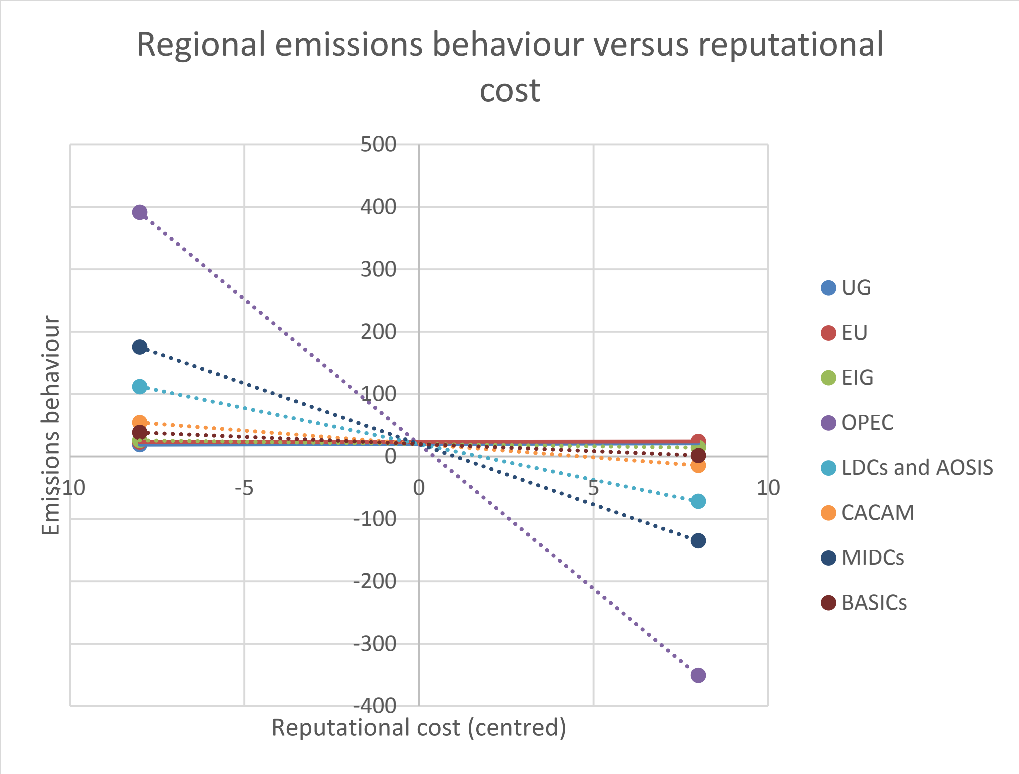

Figure 6.14: Predicted regional emissions behaviour as a function of reputational cost in the random slope model

In figure 6.14, only two of the eight lines tilt upwards, indicating that reputational costs usually inhibit compliance. On average, EU and UG (highlighted with red line) states exhibit larger emissions reductions as their share of global emissions, and associated reputational costs, increase. As suggested above, this could be because, these regions host the world's largest polluters and therefore face higher public scrutiny and social pressure to claim responsibility for climate change. The disproportionate share of atmospheric emissions means that these regions also have less incentive to free-ride as their contribution stands to make all the difference to the international mitigation.

In all other regions, the effect of reputational cost, or increasing one's share of global emissions, on emissions reduction is negative. The strongest inhibitory relationship is in OPEC (the purple line), where, as we saw in the last chapter, regional dependency on fossil fuels is at its highest. For these countries, it appears that economic performance overrides reputational costs. There may even be an argument that countries as highly dependent on carbon-intensive activity as OPEC may not face as high reputational costs from non-compliance as countries with near-average dependency as the former need to undertake major structural changes to curb emissions.[150] While not as pronounced as in OPEC, rising emissions also inhibit compliance in the South. As previously noted, although the most advanced developing economies currently command a large share of global emissions, the LDCs and AOSIS, MIDCs and BASICs are not sensitive to reputational costs in the same way as the rest of the world. The G77 and China have frequently claimed exemption from the types of moral responsibilities that accompany high emissions levels in the North on the grounds that developing countries only have negligible historical responsibility for causing climate change.

To check whether these regional simulations are likely to hold when we account for other drivers of emissions, the equivalent mean regional effects of reputational cost on emissions behaviour were estimated from a grand model that included all of the predictors associated with the neo-

[150] This argument is also applicable to CACAM, which has above average dependency on fossil fuels.

realist and structuralist worldviews as well as the controls from chapter two (population and technology). In accordance with the present RCM, the model also randomised the country-level effect of reputational cost and democracy on emissions behaviour. The predicted regional (fixed plus random) effects are shown in table 6.8. alongside the coefficients from the previous model depicted in figure 6.14. Although the estimates are spread more narrowly, some of the results of the new model reaffirm the regional simulations above. Strikingly, OPEC continues to be the region that experiences the strongest negative effect of reputational cost (or increasing economic activity) on emissions reduction. The MIDCs, CACAM and BASICs also continue to experience negative reputational effects of comparable magnitude to the previous model. However, two estimates in the North are particularly striking as they go against the regional simulations discussed above: in the first model, both the EU and UG were predicted to exhibit higher emissions reduction as their share of emissions (and associated reputational costs) increased. After accounting for other variables in the new model, this association is completely reversed and both regions are predicted to become less willing to undertake emissions reductions as they experience higher reputational costs. The reversal is particularly striking in the case of the UG, which now becomes the region to experience the third strongest negative effect. Overall, the results of the robustness check cast even more doubt over the neo-liberal claim that reputational costs associated with inaction should promote mitigation. Even in the North where the reputational costs are presumably the greatest, this robustness check suggests that the indications of positive reputational effects that were obtained from the first model are likely due to omitted variable bias as the positive effect ceases to exist once we account for other variables.

Region	**Model 1**	**Model 2 (robustness check)**
OPEC	-19.43	-6.72
MIDCs	-11.49	-2.65
LDCs and AOSIS	-4.3	-0.04
CACAM	-2.32	-2.78
BASICs	-0.72	-0.67
EIG	-0.46	-1.12
EU	0.07	-0.82
UG	0.11	-2.7

Table 6.8: Predicted random reputational cost effects on regional emissions behaviour

I now move on to analysing the regional implications of random democracy effects of emissions behaviour. The downward slope of the lines in figure 6.15 indicates that democracy has a negative effect on emissions behaviour all over the world. The strongest inhibition effect is felt in OPEC states (purple line), which, we recall from figure 6.3, is also the least democratic region. In the case of OPEC, we are talking about the effect of increasing democracy levels (i.e. democratisation) on authoritarian states, which is a very different kind of political environment to that in the North, where, as I discuss below, the inhibition effect is much weaker. One possible explanation for this finding is that national governments in OPEC countries have more social control over their publics, so even if there is greater opportunity to express environmental concerns, these types of concerns are likely to be easier to resist. Furthermore, in a region where fossil fuels account for a large share of national incomes, it is plausible that more opportunity for public expression translates into more public opposition against emissions cuts. Hence democratization in OPEC strongly inhibits emissions reduction.

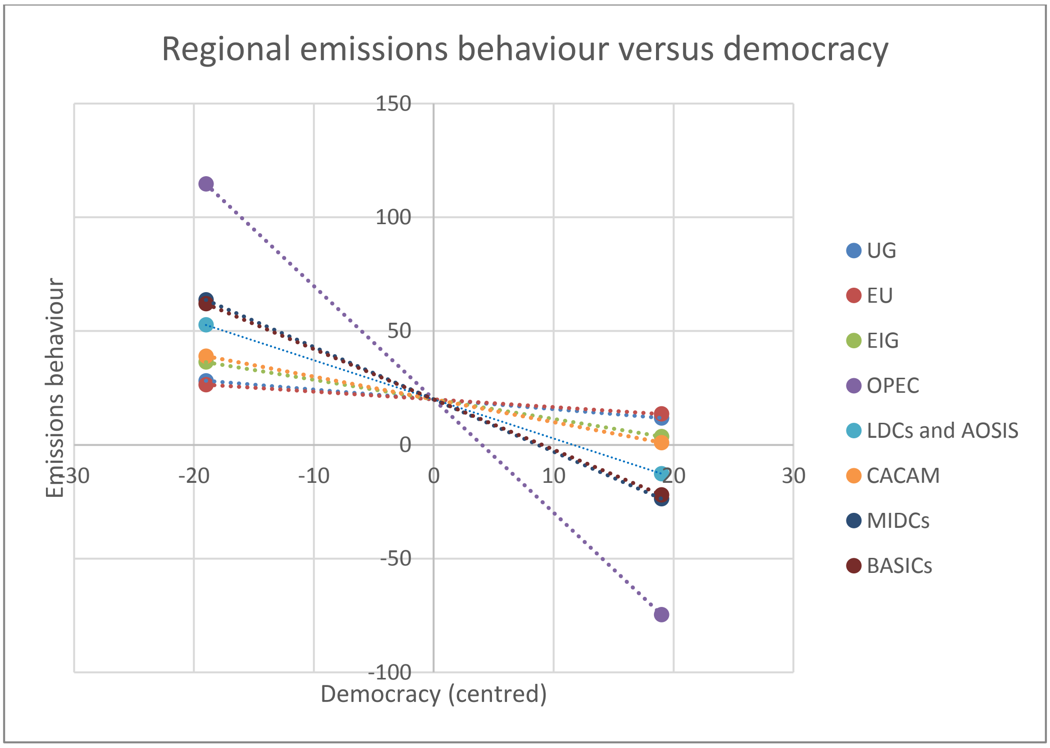

Figure 6.15: Predicted regional emissions as a function of democracy in the random slope model

The downward slopes of the BASICs, MIDCs and LDCs and AOSIS lines indicate that democratization also constrains emissions reduction in the South. However, the relatively flatter slopes tell us that the size of the inhibitory effect is less pronounced than in OPEC. The negative relationship is likely due to the particular type of conflicting policy demands in the region: presumably, the demand for poverty eradication, employment and socio-economic development is more pressing than the demand for environmental protection in the South.

Although still negative, the democracy effect is much weaker in the North. Thus compared to OPEC and the South, policymakers in Northern regions are relatively more receptive to the demand for environmental goods, which lends some support to our third hypothesis.

As for reputational cost, the robustness of the inferences drawn from figure 6.15 were checked by estimating the mean regional effects of democracy from a grand model that includes all of the main controls. These estimates are displayed alongside the coefficients associated with the regional simulations in table 6.9. Most of the results from the new model are in accordance with the simulations discussed above. Strikingly, democracy continues to have the strongest inhibitory effect on regional emissions behaviour even after we control for the main putative drivers. Also as in the first model, the inhibitory effect is relatively weak in the Northern regions (namely: the EIG and EU). However, two of the estimates stand out from the previous model: first, and most notably, democracy goes from having a weak inhibitory effect to a strong positive effect on emissions reduction in the UG. This finding strengthens the inferences drawn from the previous finding: it suggests that after the other main drivers have been controlled for, increasing the level of democracy in highly democratic contexts is likely to have a positive effect on climate policy. The second estimate of interest is the notable decline in the inhibitory effect of democratization in the BASICs (from -2.12 to 0.24). Contrary to the first set of regional predictions, the new model lends suggests that the inhibitory effect of democratization on emissions reduction is likely to fizzle out as we take into account other important drivers of emissions trends such as a country's economic mitigative capacity.

Region	Model 1	Model 2 (robustness check)
OPEC	-4.98	-4.63
MIDCs	-2.32	-2.36
BASICs	-2.12	-0.24
LDCs and AOSIS	-1.72	-1.05
CACAM	-1.03	-2.38
EIG	-0.86	-1.26
UG	-0.43	4.01
EU	-0.34	-0.87

Table 6.9: Predicted random democracy effects on regions

Figure 6.16 displays the regional emissions behaviours predicted by the RCM with the 95 percent confidence intervals. Since the predictions are based on all three absolute gains variables, the figure helps to put the random effects of reputational cost and democracy into perspective. The regional effects of both variables are similar: the strongest inhibitory effects are felt in OPEC, followed by the Southern regions and the weakest effects are concentrated in the North. Thus, for all but one region, the order of emissions predictions displayed in figure 6.16 mirrors the effect sizes (slopes) of the regional effects plotted in figures 6.14 and 6.15: OPEC is the least emissions-reducing, followed by the Southern regions (LDCs and AOSIS, MIDCs and BASICs), which is followed by the EIG and UG, then the EU and lastly, CACAM, which exhibits the greatest effort to return to 1990 emissions levels (and indeed go beyond the target year by twenty percent). At first glance, it seems inconsistent that CACAM is predicted to be the region that undertakes the most emissions reduction when both reputational cost and democracy have been found to inhibit emissions cuts in the region. Yet if we recall from figure 6.3 that CACAM has the second to lowest reputational cost and democracy levels in the world, then the random effects simulations above suggest that the size of the inhibitory effects are small.[151]

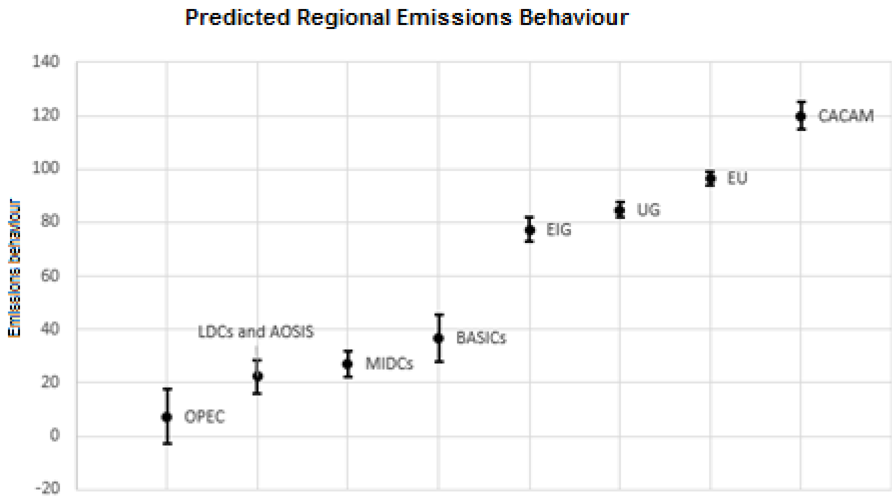

Figure 6.16: Emissions behaviour versus absolute gains in the random coefficient model
Note: the points represent the predicted regional emissions behaviour levels estimated by the neo-liberal random coefficient model. The vertical lines depict the 95 percent confidence intervals.

Do these predictions hold in reality? Figure 6.17 compares the emissions behaviour values predicted by each successive neo-liberal model with the actual values observed in the dataset. The RCM predictions are indicated by the right column in black and are closest to the actual compliance values in the striped column. The decreasing vertical distances between the predictions and actual values confirm that the neo-liberal model becomes more accurate with each successive model, as more aspects of the hierarchical data structure are modelled.

[151] Another way of looking at this is discrepancy is that the average levels of reputational cost and democracy faced by CACAM states fall on the far left of the regional line in figures 6.19 and 6.20, which translates into higher emissions behaviour scores, which are indicative of greater compatibility with mitigation.

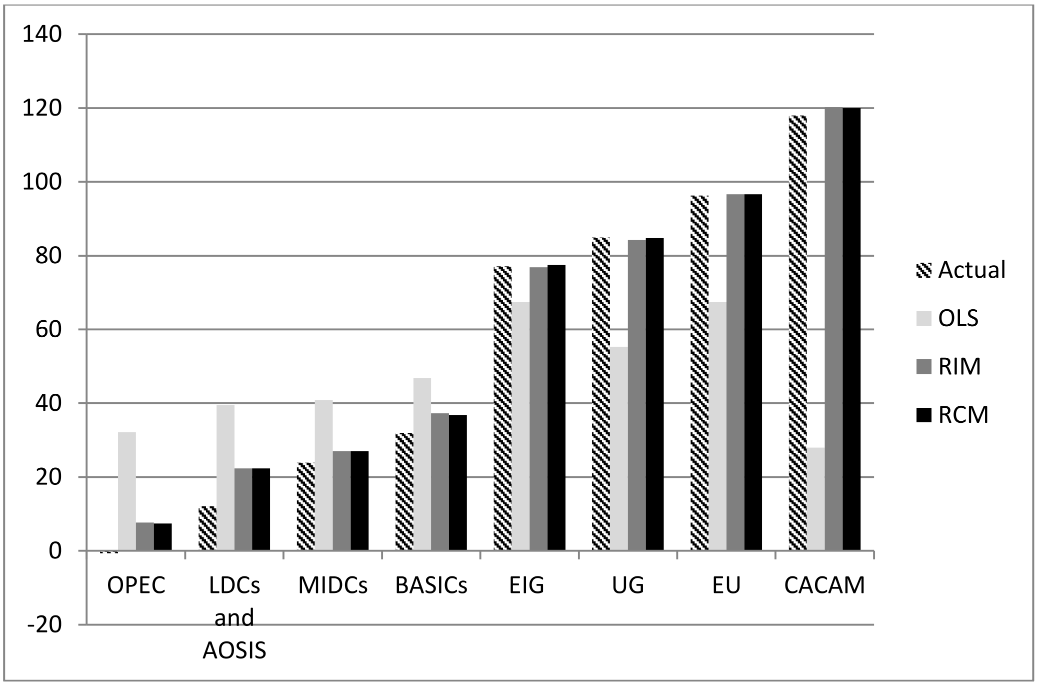

Figure 6.17: Actual regional emissions behaviour versus neo-liberal predictions

Conclusion

At the beginning of this chapter, I outlined three core hypotheses that are premised on the neo-liberal worldview and problem representation that emissions behaviour is shaped by the domestic costs (and benefits) of climate policy. Are they supported by the chapter findings? The results of the single-level regression found that participation in IEAs is positively associated with emissions, which coheres with the first hypothesis. However, once I began modelling the hierarchical data structure, IEA participation ceased to be a significant driver of emissions behaviour, indicating that the results of the first model committed the type I error, which arises because observations from the same country and region were too similar to be regarded as independent. This finding casts doubt over the frequently made claim that international institutions can overcome the compliance vacuum in climate politics (see, for example, Depledge (2005), Bodanksy and Rajamani (2013), Paterson and Newell (2010) and Victor and Keohane (2010).[152]

With each successive model, we saw an increase in the substantive and statistical significance of the inhibitory effect of reputational cost on emissions behaviour. The negative sign of the effect is clearly contradictory to the second neo-liberal hypothesis - that countries should undertake more stringent emissions cuts more in order to avoid the reputational costs of inaction. Since our proxy for reputational costs (a country's share of global CO2 emissions) is also a marker for economic activity and industrialisation, the finding is also of relevance to the environmental Kuznets curve approach to emissions trends that was reviewed in chapter two (e.g., Stern 2004; Andreoni and Levinson 2001 and Stern and Common 2001). The negative sign of the fixed effect tells us that, on average, once economic development starts, it unleashes powerful countervailing forces, which usually mask environmental concerns.[153] This inhibitory effect of economic activity on emissions reduction suggests that most countries are operating at the first part of the EKC, which is a reasonable assertion to make.

My examination of the random effects of reputational cost also uncovered more sophisticated results that presented new evidence in support of the reputational cost hypothesis and EKC literature: reputational cost has a

[152] In the conclusion chapter, I reflect on the possibility that the IEA results found in this chapter could be affected by endogeneity.
[153] I test this proposition in the next chapter.

positive effect on emissions in countries that command a large share of global emissions. Arguably, countries with lower emissions have not yet industrialised or have only a small impact on international efforts to regulate global emissions. Therefore, they are not subjected to the same kind of reputational costs that larger emitters experience as a result of inaction and also face incentives to free-ride. Thus, reputational costs do have their predicted effect where they matter the most – in the world's largest polluters. This finding offers a more nuanced understanding of the positive impact of the capacity to affect global emissions than that found in previous studies, which are based on single-level regression (e.g. Dolsak 2001). To my knowledge, the chapter also comprises the first quantitative test of the hitherto unsubstantiated reputational cost hypothesis,[154] ultimately finding evidence that reputational cost does indeed promote emissions reduction by the largest polluters.

In terms of the mainstream emissions literature, the indication of a transformation in the effect of economic scale on emissions reduction from an inhibitor to a weak, yet positive driver of effective climate policy offers new evidence in support of the EKC hypothesis. Specifically, the results of the multilevel models suggest that even after we account for country and regional clustering, there are indications of a 'turning point' in the effect of economic activity on emissions-related environmental impact (e.g., Andreoni and Levinson 2001; Stern and Common 2001; Sulemana et al. 2016). However, we should not be too keen to such to

[154] See, for example, Bernstein (2002) and Nagtzaam (2009).

any firm conclusions as the robustness tests indicate that these positive effects might be misleading once we control for other variables which might be closely associated with economic activity.[155]

Perhaps the most substantive findings of the chapter, however, relate to the effect of democracy on emissions. The results of the single-level regression found that higher levels of democracy are associated with greater emissions reduction. This finding is consistent with the first hypothesis, as well as most quantitative work in the field (see, for example, von Stein (2008), Battig and Bernauer (2009) and Bernauer and Bohmelt (2013). However, democracy switched from positive to inhibitory once I began modelling the multilevel data structure. Since most studies rely on single-level regression, their results may be compromised by cluster-confounding, which arises due to the conflicting effects of democracy within and between countries and regions. My investigation of country-level random effects revealed that, on average, higher democracy levels are associated with less emissions reduction throughout the world. This is consistent with Battig and Bernauer's (2009) finding that democracies have the largest 'words-deeds' gaps in the climate arena. The negative democracy effect could be due to the time-lag that it takes for the benefits of climate policy to materialise, which creates disincentives for democratically elected policymakers to implement emissions pledges. It could also be a by-product of the more pluralist environment, which grants more opportunity for anti-

[155] I reflect on this issue in the concluding chapter.

environmentalists to express their interests. I also found that the inhibitory effect is stronger in authoritarian countries. Unlike the reputational cost results, these findings were largely robust to omitted variable bias. In chapter eight, I explore whether some of the heterogeneity in democracy effects stems from the level of belief that countries hold in the neo-liberal worldview.

On a policy level, this chapter has three substantive implications: First, countries' track records in international cooperation do not appear to have a noticeable impact on emissions behaviour. As demonstrated by the multilateral climate negotiations, even the most cooperative countries in other international issue-areas can become laggards in climate politics.

Second, although the reputational costs associated with rising emissions are not generally sufficient to mask countervailing forces for economic development (which go hand in hand with emissions trends), there is an important exception to this pattern: reputational costs are positively correlated with higher emissions cuts in the largest polluters. Therefore, according to the preliminary results of this chapter, there is reason to pay ear to the popular argument that countries will cave in to domestic and international pressures to fulfil their international mitigation commitments after they have attained a critical level of economic development. In chapter eight, I assess whether neo-liberal worldviews play a role in determining the effect that reputational costs have in a given country.

Perhaps the most important policy implication of this chapter, however, is that increasing the level of democracy does not automatically promote mitigation. Contrary to the popular prescription that ‘a spread of democracy around the world will lead to enhanced environmental commitment worldwide’ (Neumayer 2002:158), my findings suggest that this is not always the case. Further research needs to be done into the conditions which facilitate democracy to have its alleged positive effect on climate policy. Chapter eight explores whether neo-liberal worldviews are one such condition.

Chapter Seven: Structuralist Explanations of Emissions Behaviour

Introduction

This is the last of three empirical chapters in which I test the core explanations of emissions behaviour that flow from the ideal worldviews which underlie my theoretical approach. The focus of this chapter is the structuralist approach, which has its roots in neo-Marxist theories of world politics.[156] As we saw in chapter three, adherents of this approach attest that climate policy is determined by global capitalism and the *transnational economic class*[157] interests that it perpetuates. Broadly, countries are more likely to reduce emissions when they have the will and means for emissions reduction. Conversely, states are likely to avoid emissions reduction when they expect their class interests to be harmed by emissions cuts or lack the means for emissions reduction.

My review of the structuralist literature in chapter three identified three core explanations that flow from the structuralist approach:

(i) Core countries are more likely to reduce emissions because this paves the way for the transferral of the mitigation burden to periphery countries [158];

[156] Following conventional practice, my use of the term structuralist refers to the global ethics and climate justice scholarship, which was reviewed in chapter three (see, for example, Roberts et al. (2004), Betsill et al. (2006), Parks and Roberts (2006,2007,2008,2010), Prum (2007) and Mejia (2010).
[157] Hereafter referred to as 'class'.
[158] The rationale for the first hypothesis was discussed in detail in the third chapter, but the basic argument is that the core class of powerful states designed the KP in order to maintain its subjugation over the South.

(ii) Countries with stronger economies are more likely to reduce emissions because they have the capacity to offset the domestic (economic) costs of emissions reduction;

(iii) Countries with diversified export sectors are more likely to reduce emissions as they have the capacity to reduce emissions without undermining domestic livelihoods.

The structuralist hypotheses tested in this chapter are represented visually in figure 7.1.

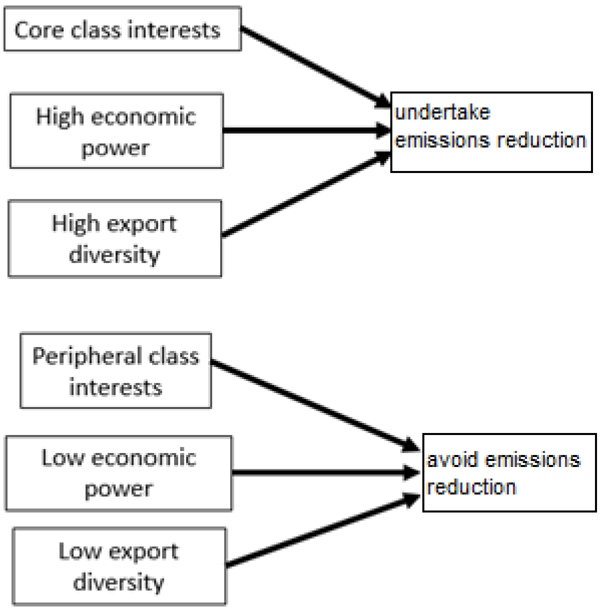

Figure 7.1: Structuralist hypotheses

My investigation of the structuralist hypotheses consists of four parts. In the first section, I recall the proxies that I suggested could serve as concrete indicators of class based factors and explore how they are distributed across the three levels of the model. Based on these distributional patterns, I flesh out some empirical predictions and take a sneak preview at statistical associations between emissions, class, economic power and export diversification. Section two lays out the testing strategy for this chapter by fitting the approach crafted in the research design chapter to structuralist predictors. The third section presents the results of the OLS, random intercept and random coefficient models. I conclude by discussing the chapter's contributions to the literature and its policy relevance.

Measuring Class Interests, Preliminary Predictions and Associations

In the last chapter, I created three proxies to denote the core dimensions of class interests and mitigation capacity – namely: (transnational) class, vulnerability, economic power and export diversity. Table 7.1 summarizes the sources and levels of indicators used to operationalise these proxies.

Structuralist predictor		Operationalisation	Source	Variable
(i)	Class	Core-periphery membership according to trading status	Dunn et al. (2000)'s world map of countries according to trading status	$class_{k}$
(ii)	Economic power	GDP	World Bank World Development Indicators	$econpower_{ijk}$
(iii)	Export diversity	EDI (Export Diversification Index)	International Monetary Fund's Export Diversification Database	$exportdiv_{ijk}$

Table 7.1: Transnational class and mitigative capacity indicators

Note: Variable subsets denote the level of coding: ijk level-one variable coded at country-year (i) nested in country (j) nested in region (k); kj level-two variable coded at country (j) nested in region (k); and k level-three variable coded at region (k).

Distributional Patterns and Preliminary Expectations

If structuralist explanations are right, then the distribution of transnational class interests and mitigative capacities should enable us to predict which countries and regions are more likely to reduce emissions. In the remainder of this section, I explore how class, economic power and export diversity are distributed across each level of the model and draw out some concrete predictions which I then return to when evaluating the empirical contributions of the models.

(i) Level One: Country-years

Figure 7.2 provides an overview of the longitudinal trends in class interests and mitigative capacity by using nonparametric, locally weighted scatter plot smoothers (Lowess plots). Class and export diversity are distributed uniformly over time. In the case of the first predictor, this is because class status is a cross-sectional variable that is measured at the regional level. Export diversity, on the other hand, is measured at the country-year level and is, therefore, sensitive to temporal fluctuation. In this case, the (relatively) flat Lowess plot indicates that the distribution of export diversity across countries is roughly homogenous across the years under investigation. This does not imply that countries' export diversity levels do not change over time; but rather, that the interstate variation in export diversity is roughly homogenous across the years.

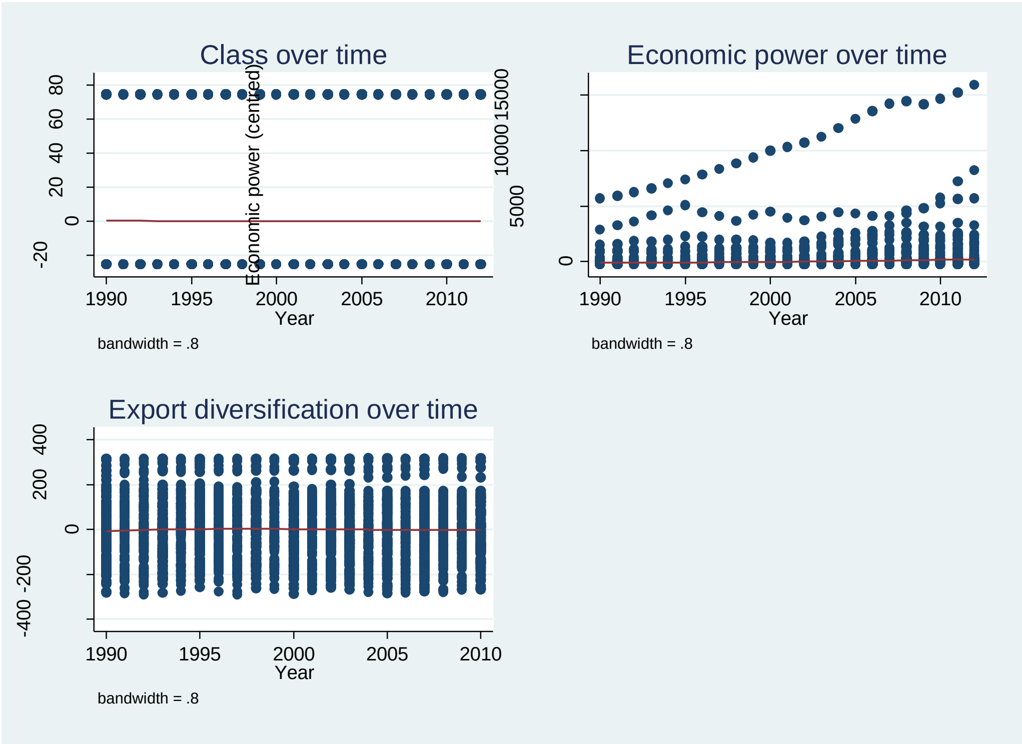

Figure 7.2: Longitudinal distribution of class interests and mitigative capacity over time (1990 to 2012)
Note: Each point represents a country-year.

In comparison to the other variables, economic power shows more longitudinal heterogeneity. The upwards tilt of the Lowess plot indicates that, on average, GDP levels have increased over the First Commitment Period (FCP). Closer examination of the economic power plot in figure 7.3 shows that economic growth is noticeably more pronounced for the US, Japan, China and Germany, which have steeper economic growth trajectories than other countries.

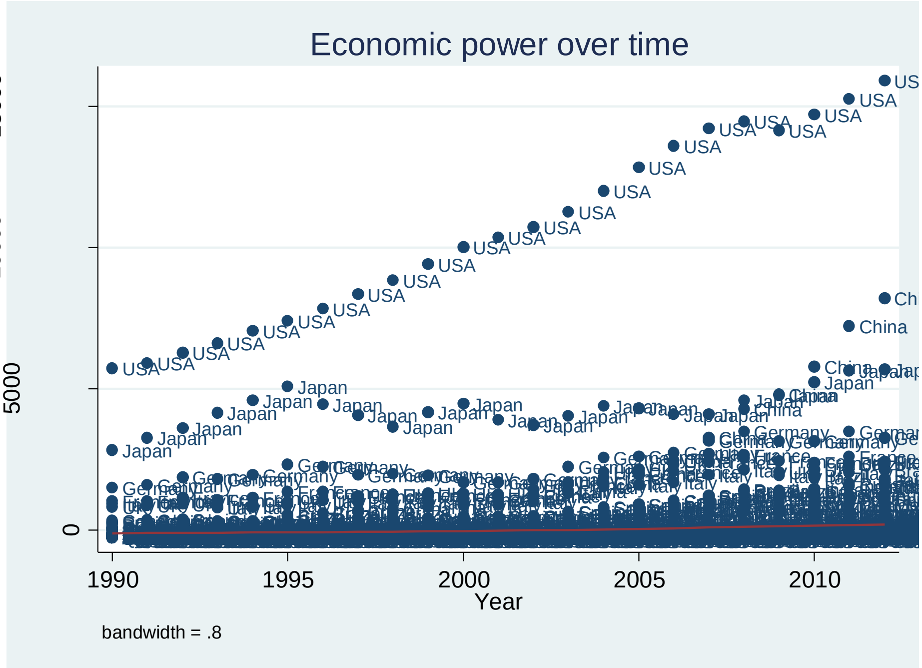

Figure 7.3: Longitudinal distribution of economic power over time

If structuralists are right, class and export diversity should not have a discernible longitudinal effect on total emissions reduction. In contrast, rising economic power levels should boost emissions reduction over time.

(ii) Level Two: Countries

Figures one to three in the chapter appendix rank countries according to class, economic power and export diversity. Hypothesis (i) leads us to expect that core countries, which fall on the right of figure one, should be the most likely to reduce emissions because, for reasons discussed in chapter three, they stand to gain the most from complying with the regime which they (primarily) designed to protect their privileged position in the world economy. Conversely, periphery countries, which are located on the left of the figure, should avoid emissions reduction as this would be perceived as an unjust barrier to Southern development.

Figure two in the chapter appendix plots mean economic power across countries from 1990 to 2012. On average, the US, Japan, Germany, China and France had the highest GDPs over the period under investigation. According to hypothesis (ii), these countries should have the strongest capacity to offset the domestic costs of mitigation, making them the most likely to reduce emissions. In contrast, Kiribati, Dominica, Comoros, Vanuatu and Saint Kitts and Nevis have the lowest economic power and, therefore, capacity for emissions reduction.

The third figure in the chapter appendix ranks countries according to mean export diversity from 1990 to 2012. Home to the most diversified economies, the Netherlands, Italy, France, Austria and Belgium should have the highest capacity to reduce emissions without undermining domestic livelihoods. Conversely, Nigeria, Yemen, Iran, Kuwait and Saudi Arabia have the least diversified economies, suggesting that emissions cuts are likely to be severely disruptive to domestic livelihoods in these countries. Hypothesis (iii) leads us to expect that these states will exhibit the smallest (and even negative) emissions reductions.

(iii) Level Three: Regions

Figure 7.4 displays the average country mean class, economic power and export diversification values for each region. According to the top chart, the EIG, EU and UG, which comprise the core, should be the most likely to reduce emissions as they stand to benefit from the climate regime. In contrast, the periphery, which consists of the BASICs, CACAM, LDCs and AOSIS, MIDCs and OPEC, should resist restrictions on emissions activity.[159] The economic power chart tells us that the UG should be the most willing to reduce emissions because its members have the highest GDP levels and, therefore, mitigative capacities. Conversely, LDCs and AOSIS and CACAM countries have the lowest average GDP levels, which limit their will and capacity to reduce emissions. The last chart predicts that the BASICs should be the highest emissions-reducing region because its member states have the most diversified export sectors. Therefore, emissions reduction is likely to have the least harmful effect on domestic livelihoods in these countries. Conversely, OPEC states should be the most resistive to emissions cuts because they have the lowest average export diversity scores, which raise the domestic costs of emissions reduction.

[159] As discussed in chapter four, these class-based categorisations are derived from Chase-Dunne et al.'s (2000) study of transnational economic status.

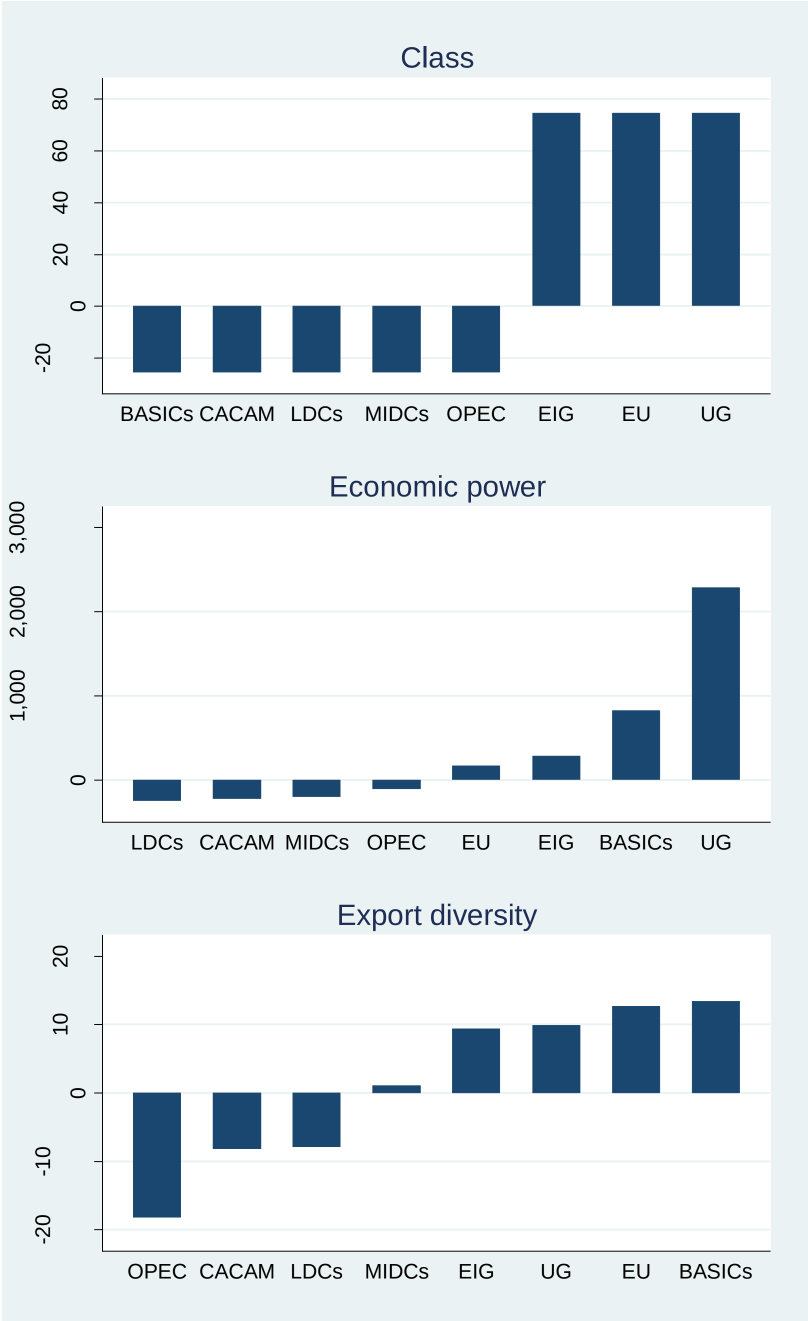

Figure: 7.4: Mean regional class, economic power and export diversification levels from 1990 to 2012

Statistical Associations: A Sneak Preview

While I test these structuralist hypotheses below, my aim at this point is to provide a sense of the preliminary relationships between emissions, class, economic power and export diversification. Figure 7.5 uses nonparametric, locally weighted scatter plot smoothers (Lowess plots) to provide a visual impression of these associations.

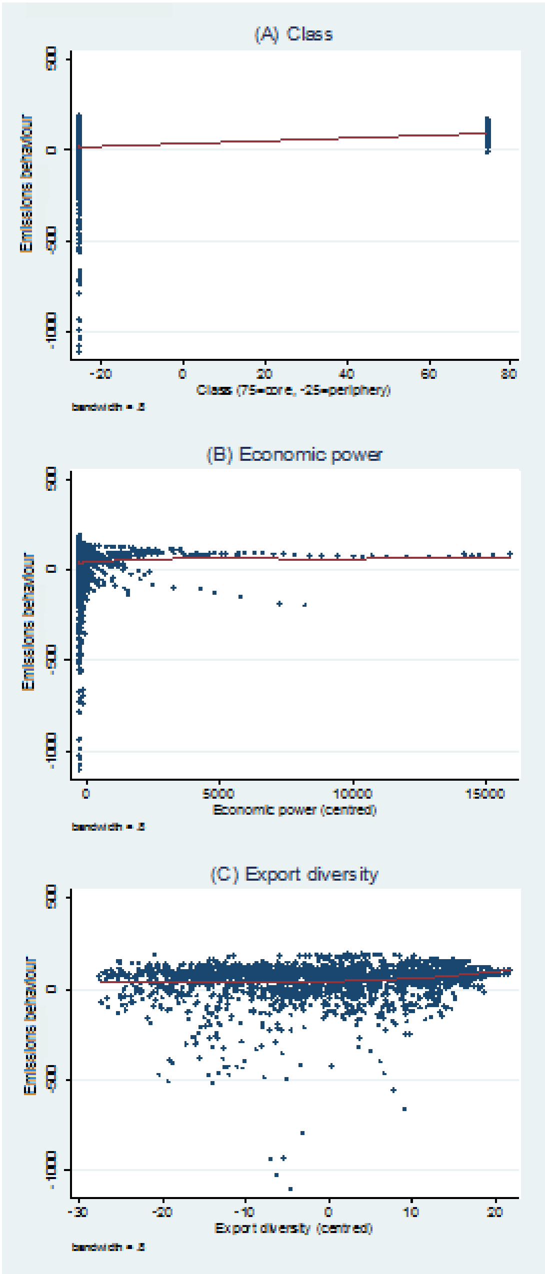

Figure 7.5: Emissions behaviour versus class interest and mitigative capacity

Note: Each point represents a country-year (observation)

The slope indicates the strength of the association. Out of the three variables, class appears to be the most strongly correlated with emissions behaviour: as predicted by hypothesis (i), on average, core countries are noticeably more willing to reduce emissions than periphery states. Although the vertical distance covered by the Lowess plot is not very large (approximately 90 points in a scale of 1,300), the difference is substantively important: core countries are closely clustered around the 90 mark, which is almost equal to 1990 emissions levels. At the other end of the spectrum, the average level of compliance by a periphery state is five points above the zero mark, which corresponds to almost double 1990 emissions levels, thus indicating incompatibility with mitigation.

The economic power and export diversity lines are noticeably flatter than the class line. Although the upward slanting lines are in accordance with structuralist expectations, the slopes are quite flat, indicating that the correlation is weak. As predicted by hypothesis (ii), on average, countries with stronger economies reduce emissions more than countries with weaker economies. Similarly, countries with more diverse export sectors are associated with higher mean emissions reduction levels. The positive direction of the slopes lends support to the argument that emissions behaviour is at least partly determined by mitigative capacity.

Approach

I now fit the methodological approach from the research design chapter to the structuralist hypotheses. As in the other empirical chapters, I begin by running a single-level multiple regression which includes all of the class-based predictors:

$EMBEH_{ijk} = \beta_0 + \beta_1 class_k + \beta_2 econpower_{ijk} + \beta_3 exportdiversity_{ijk} + e_{ijk}$
$e_{ijk} \sim N(0,\sigma_e^2)$

(Model 1: Single-level OLS)

The next step is to allow average emissions behaviour levels to vary across countries and regions by introducing the random terms u_{jk} and v_k respectively. The equation for the random intercept model is:

$EMBEH_{ijk} = \beta_0 + \beta_1 class_k + \beta_2 econpower_{ijk} + \beta_3 exportdiversity_{ijk} + v_k + u_{jk} + e_{ijk}$

$v_k \sim N(0,\sigma_v^2)$
$u_{jk} \sim N(0,\sigma_u^2)$
$e_{ijk} \sim N(0,\sigma_e^2)$ ***(Model 2: Random intercepts)***

In the third model, I move onto testing the claim that class-based factors have heterogeneous effects across countries and regions; by allowing the coefficients of the predictors to vary across the units in the two levels. Before fitting the final random slope model, I run a series of diagnostic tests to check for significant random effects by randomising each predictor separately, initially at the country level. I also look for significant changes in the variance components to determine whether modelling causal heterogeneity increases the explanatory power of the model. As a third check for the goodness of fit, I conduct LR tests between the random coefficient and intercept models, as well as the equivalent single-level regression. All of the predictors with significant random effects are then incorporated into a single model. After setting up the country-level random coefficients, I check whether the predictors also have significant regional random effects by running the same diagnostic tests at the third level of the model.

For illustrative purposes, let us consider the hypothetical case that all of the structuralist predictors have significant random effects at the country and regional levels.[160] The new random effect terms, u_{njk} and v_{nk}, are introduced to model causal heterogeneity in (n) country and region level random effects respectively, so the random coefficient model becomes:

$EMBEH_{ijk} = \beta_0 + \beta_1 class_k + u_{1jk} class_k + v_{1k} class_k + \beta_2 econpower_{ijk} + u_{2jk} econpower_{ijk} + v_{2k} econpower_{ijk} + \beta_3 exportdiversity_{ijk} + u_{3jk} exportdiversity_{ijk} + v_{3k} exportdiversity_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$

$$\begin{pmatrix} v_{0k} \\ v_{1k} \\ v_{2k} \\ v_{3k} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \begin{pmatrix} \sigma_{v0}^2 & & & \\ 0 & \sigma_{v1}^2 & & \\ 0 & 0 & \sigma_{v2}^2 & \\ 0 & 0 & 0 & \sigma_{v3}^2 \end{pmatrix} \right)$$

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \\ u_{2jk} \\ u_{3jk} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \begin{pmatrix} \sigma_{u0}^2 & & & \\ 0 & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & 0 & \sigma_{u3}^2 \end{pmatrix} \right)$$

$e_{ijk} \sim N(0, \sigma_e^2)$

(Model 3: Random intercepts and random slopes)

[160] As in the other empirical chapters, the diagnostic tests found no evidence of significant random effects at the regional level, so the fitted model was much simpler than the example shown here. Crucially, all models were within the degrees of freedom.

Results

Model 1: Single-level OLS

Is emissions behaviour shaped by class dynamics? The single-level regression provides a mixed answer to this question. Table 7.2 displays the results of the first model, which treats all 2,616 country-years as independent observations. Only one of the predictors is statistically significant. The average level of emissions across all country-years is 48.83 points on a scale from -1102 to 191, where 100 represents the perfect attainment of a country's 1990 emissions levels, scores greater than 100 denote emissions reductions that go beyond what is required to meet the 1990 baseline target (i.e. lower emissions levels) and negative values indicate emissions above 1990 levels (the opposite of emissions reduction). The adjusted R-squared value indicates that, like the equivalent neo-realist regression in chapter five, the model only explains around 6.6 percent of emissions behaviour.

Parameter	**Estimate**
Class	0.62 (0.05)***
Economic power	-0.00 (0.01)
Export diversity	-0.15 (0.20)
Intercept	48.82 (1.86)***
Adjusted R-squared	0.066

Table 7.2: Single-level regression of structuralist predictors

Note: Coefficient entries are ordinary least squares estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

How do these results mesh with the structuralist hypotheses presented at the start of the chapter? The positive sign and magnitude of the class coefficient lends strong support to the first hypothesis - that core countries perceive higher class gains in emissions reduction, which, as discussed in chapter two, is compatible with compliance with the climate regime. Table 7.2 tells us that, keeping other things constant, emissions reduction by core countries is 62 points higher than peripheral countries.[161] This finding has the highest significance at the 0.001 level.

The negative sign of the economic power variable contradicts the second hypothesis that stronger economies have more capacity and will to reduce emissions. Yet the size of the effect is negligible (-0.003) and statistically insignificant, suggesting that other factors are more influential drivers of climate policy.[162]

The negative sign of the export diversity coefficient also contradicts our third structuralist hypothesis that export diversification should make states more willing and able to cut emissions. On average, a one-point increase in export diversity is associated with 0.15 points less emissions reduction. Once again, however, we cannot read too much into this estimate as it is not statistically significant. We can infer, however, that for one reason or another, the greater capacity for mitigation, which tends to accompany export diversification, does not appear to trickle down into emissions behaviour.[163]

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161 The effect size is equal to one hundred times the coefficient (0.61) as core countries are coded as 100 and periphery states zero.

162 Since the size of the effect is negligible, I do not dwell on the potential reason for the unexpected (negative) relationship for now. Instead, I address this point below in the random intercept model, where it is found that the effect size and statistical significance of economic power increases.

163 As with the economic power variable, I consider possible explanations for the negative correlation between emissions and export diversity below under the random intercept model, in which export diversity is found to be a significant driver of emissions behaviour.

What do these results contribute to our understanding of regional compliance behaviour? To answer this question, I use the mean transnational class values to estimate the regional emissions behaviour predicted by the model:

$$EMBEH_{ijk} = 48.82 + 0.62class - 0.004econpower - 0.15exportdiversity$$

As with the equivalent neo-realist and neo-liberal models in chapters five and six, the single-level regression simulates the relationship between emissions and class, economic power and export diversity as a straight line, with the regional emissions values located on various points across the line. For illustrative purposes, figure 7.6 plots emissions as a function of our first structuralist predictor, transnational class, with the 95 percent confidence intervals.[164] To avoid repetition, the equivalent graphs for economic power and export diversity as not shown here, but also follow a straight line with intercept 48.82 and slope equal to the beta coefficient.

[164] In order to isolate the 'pure' effect of each predictor, the values of the other predictors (economic power and export diversity) are set to zero, which corresponds to the pooled average value across all observations.

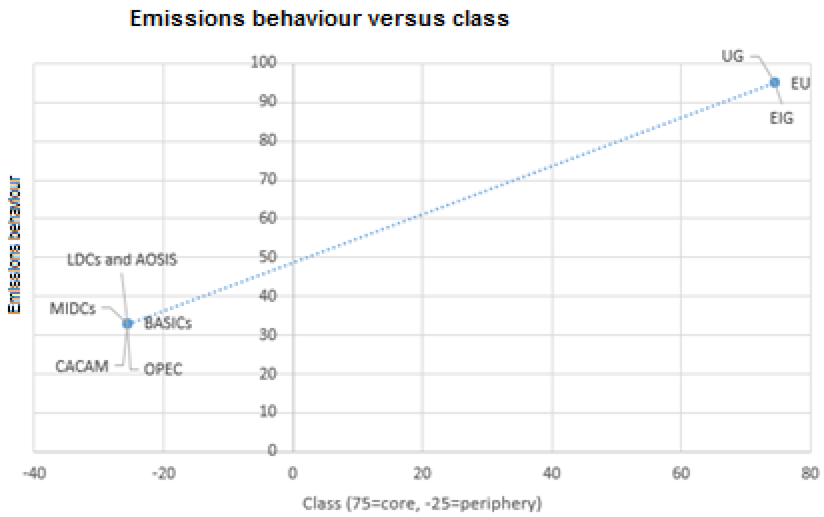

Figure 7.6: Predicted mean regional emissions behaviour as a function of class in single-level regression
Note: the confidence intervals are equal to zero because members of the same region also belong to the same transnational class, which yields a standard error of zero.

Figure 7.7 displays the regional emissions predictions of the 'complete' regressions with the three structuralist variables and 95 percent confidence intervals. Overlapping confidence intervals indicate that the emissions behaviour of the concerned regions may not be different from each other. Thus, according to the structuralist single-level model, the order of most to least emissions-reducing regions will be: (i) the EU, (ii) EIG, (iii) UG, (iv) MIDCs, BASICs, CACAM and the LDCs and AOSIS and (v) OPEC.

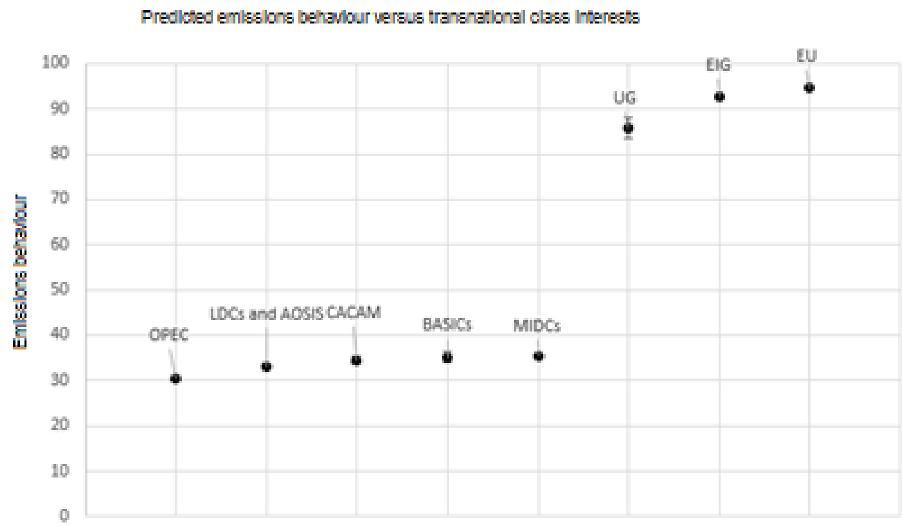

Figure 7.7: Emissions behaviour versus transnational class interests
Note: the points represent the predicted regional emissions behaviours estimated by the structuralist single-level regression. The vertical lines depict the 95 percent confidence intervals.

How do these predictions fit with the real data? Figure 7.17 plots the regional emissions behaviours predicted by the structuralist models alongside the actual emissions figures observed in the dataset. Actual emissions values are represented by the striped column on the left and the single-level predictions are in the adjacent column in light grey. The vertical distance between the actual and estimated emissions behaviour values indicates the accuracy of the predictions. As in the last two chapters, the single-level predictions turn out to be the least accurate. Most strikingly, the model significantly underestimates emissions reduction by CACAM. The model does, however, correctly predict that Northern countries tend to be more willing to reduce emissions than the South.

Model 2: Random Intercepts

I begin modelling the hierarchical structure of emissions behaviour by allowing countries and regions to have their own intercepts. Table 7.3 displays the fixed effects estimates of the random intercept model alongside the coefficients obtained from the single-level regression.

Parameter	**OLS**	**RIM**
Class	0.62 (0.05)***	0.89 (0.19)***
Economic power	-0.00 (0.01)	-0.01 (0.00)***
Export diversity	-0.15 (0.20)	-1.56 (0.31)***
Intercept	48.82 (1.86)***	53.12 (8.55)***

Table 7.3: Single-level regression and random intercept model estimates of structuralist predictors

Note: Single-level entries are ordinary least squares estimates and RIM entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

The results of the random intercept model differ in important aspects from the single-level regression. First, as expected, modelling clustering has increased the magnitude of the standard errors in the random intercept model (except for economic power). Second, economic power and export diversity are now statistically significant drivers of emissions at the 0.001 level. Third, the intercept estimate in the new model, which represents the average emissions behaviour score across all country-years (after we take into account clustering), is slightly higher (around four points) than in the single-level regression. Yet the most substantive changes occur in the coefficient estimates. Core class membership continues to be associated with more emissions reduction, but the size of the class effect is stronger in the new model. Although economic power only has a small effect on emissions behaviour, the effect size is stronger in the RIM. The effect of export diversity is more than ten times the coefficient in the single-level model.

What does the RIM tell us about the influence of class-based factors over emissions behaviour? The RIM coefficients estimate the average effect of a predictor on observations from the same country or region, whereas the coefficients in the flat regression measure the average predictor effect on all observations without accounting for country or regional clustering. Differences in the size of the coefficient tell us that the predictor has different effects within and between-groups.

This phenomenon is represented visually in figure 7.8. Each plot contains three clusters (countries or regions), which are represented by dots. Solid lines represent the within-group effects and dashed lines between cluster effects. Plot A represents class trends, which are positive both within and between countries and regions. Since the dashed and solid lines are both positive, the effect of class status operates in the same direction both within and between countries and regions. Yet the steeper slope of the solid lines tells us that the positive effect of belonging to the core is more pronounced when we are dealing with observations from the same country or region.

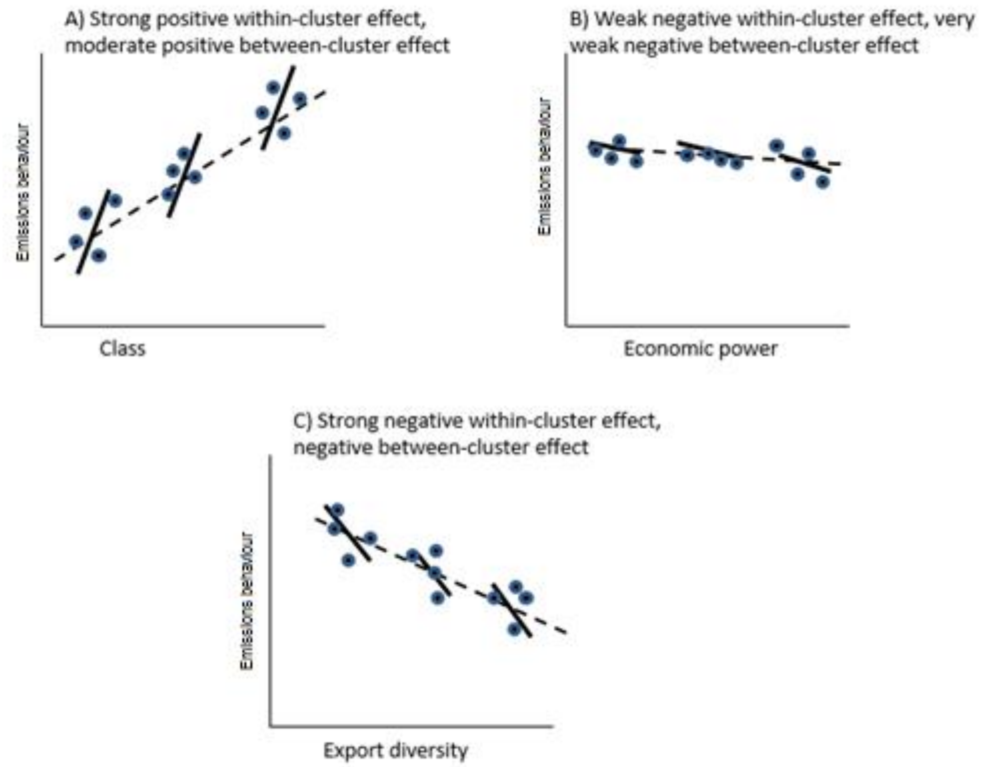

Figure 7.8: Between and within-group effects of transnational class interests

Plot B represents the opposite scenario where negative within-cluster effects combine with negative between-cluster effects. Once again, the dashed and solid lines are in the same direction, suggesting that increasing economic power always inhibits emissions reduction. Although both slopes are flat, which indicates that the size of the effect is weak, the solid lines are noticeably steeper, suggesting that longitudinal increases in economic power in the same country or moving from a country with low to high economic power within the same region inhibits emissions reduction more than moving between observations that are associated with low to high levels of economic power from different regions.[165]

Plot C represents the within and between-cluster effects of export diversity. Both the dashed and solid lines slope downwards, indicating that export diversity has negative between and within-cluster effects. The slope of the solid lines is markedly steeper than the dashed line, which suggests that export diversification has a stronger inhibitory effect on emissions reduction when we move from a country with weak to high export diversification within the same region or the same country undergoes diversification over time.

How do the estimates in the random intercept model mesh with our hypotheses? The size of the class coefficient has increased from 0.62 to 0.89, which tells us that, on average, the emissions cuts undertaken by core countries carries them to meet 89 percent more of their 1990 emissions levels than periphery countries. The sign and (larger) size of the coefficient is in accordance with the first hypothesis that the core stands to gain from global emissions regulation, and therefore, undertake stronger emissions reductions than the periphery. With a significance level of 0.001, this finding is robust to country and regional clustering.

[165] The results of two separate models (one with country-years nested in countries and the other with country-years nested in regions) confirmed that the within country and within region effects of the predictors operate in the same direction.

In the RIM, economic power has a significant negative effect on emissions behaviour, which contradicts our second hypothesis that strong economic powers undertake more emissions reduction. This finding is also statistically significant at the 0.001 level. One possible explanation for this unexpected finding is the dilemma between economic development and environmental protection: more economic activity generates more emissions, therefore, it makes sense that better economic performance obstructs emissions reduction. Thus, even though stronger economies may have more capacity to offset the financial costs of emissions reduction, this trend is masked by countervailing forces which accompany economic development.[166] Another plausible explanation is that economic power makes countries more resilient towards climate change and, therefore, less dependent on international cooperation. This line of argument is in accordance with the negative power effect found in the neo-realist chapter and suggests that emissions policy is more a matter of relative gains calculation rather than mitigative capacity. Nonetheless, even with the increased effect size and significance level, at this point, we should not read too much into the substantive effect of economic power as the size of the effect is still very small (a one-point increase in economic power is associated with a 0.01 point decline in emissions reduction). Our investigation of random effects in the random coefficient model below allows us to determine whether economic power has a more substantive influence on emissions behaviour in certain countries or regions.

[166] As discussed below, this is consistent with the environmental Kuznets curve scholarship reviewed in chapter two.

In the single-level regression, a one-point increasing export diversity was associated with 0.15 points less emissions reduction, although this finding was not statistically significant. After modelling country and regional clustering, a one-point increase in export diversity is associated with 1.56 points less emissions reduction, which contradicts our third hypothesis that export diversification should make states more willing and able to regulate emissions. The finding is highly significant at the 0.001 level. Following from the previous discussion, one obvious explanation for this unexpected finding is that export diversity is positively correlated with economic activity; therefore, more diversified economies avoid emissions reduction because they face higher demand for carbon activity. However, this explanation is unlikely as multicolinearity tests (results reported in table three in the chapter four appendix) revealed that economic power and export diversity are not significantly correlated.[167]

Instead, Falkner's (2010) neo-pluralist perspective on the role of business in climate governance offers a more plausible explanation: according to this approach, countries with more diversified export sectors are generally dominated by stronger business actors, who have higher capacity to lobby their interests and influence government policy on public issues such as, for example, climate change. While I am not suggesting that all business interests are opposed to emissions reduction, the structural disposition, especially during the First

[167] The correlation estimate is 0.33.

Commitment Period, is largely resistive to change as carbon-intensive activity is replete in the economy.

I now move onto evaluating the goodness of fit of the model. For this purpose, I compare the random effects of the RIM with the null model that was fitted in chapter four. I also conduct LR tests with the null model and equivalent single-level regression to confirm my inferences. The 'explained variance' column on the right indicates the percentage of variance from the null model that is explained by the RIM. The results are presented in table 7.4.

Parameter	**Null**	**RIM**	**Explained Variance (%)**
Variance components			
Region	1220.99 (856.62)	160.50 (527.89)	86.90
Country	5292.96 (664.46)***	4521.86 (654.92)***	14.47
Country-year	6274.01 (156.57)***	4643.90 (131.79)***	25.98
LR tests			
Likelihood value	-19771.377	-14951.461	
LR $test_{OLS}$	1935.52 ($p<0.001$)***	1339.97 ($p<0.001$)	
LR $test_{NULL}$	-	9639.83 ($p<0.001$)	

Table 7.4: Random effects estimates in the structuralist random intercept model and null model

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($<p<0.001$)

Adding class-based factors to the model has reduced the proportion of unexplained variance at all three levels. The largest change occurs at the regional level, where the amount of unexplained variance has fallen by

86.9 percent from 1220.99 to 160.5. However, we cannot read too much into this drop because, as in the null model, the size of the variance component is small relative to the standard error, which means that the decline in regional variance is not statistically significant.[168] In contrast, the (smaller) variance estimates at the lower levels of the model continue to be highly significant at the 0.001 level. Country variance has declined from 5292.96 to 4521.86, which is just under fifteen percent and country-year variance has dropped from 6274.01 to 4643.9, approximately a 26 percent decrease in unexplained residual variance - a vast improvement from the 6.6 R-squared value of the single-level model. The LR tests confirm that the random intercept model is a significantly better fit than the null model and equivalent single-level regression, with both tests yielding undetectably low p-values.

What do the results of the random intercept model contribute to our understanding of regional emissions behaviour? As before, we can examine the model's regional predictions by plugging in mean regional class, economic power and export diversity to the random intercept equation:

$$EMBEH_{ijk} = 53.12 + 0.89class_{k} -0.01econpower_{ijk} -1,56exportdiversity_{ijk} + v_{0} + u_{0} + e_{ijk}$$

Figure 7.9 simulates the predicted relationship between class and emissions behaviour over plus and minus one standard deviation

[168] This is because only eight regions are sampled at the third level of the model.

transnational class.[169] As in the previous chapters, the RIM assigns each region a separate regression line, which, as confirmed by the increase in explained variances, significantly improves the fit of the model from the single-level regression. Since the effects are fixed, the lines are parallel. On average, CACAM (burgundy) is the most and LDCs and AOSIS (light blue) the least emissions-reducing region.[170]

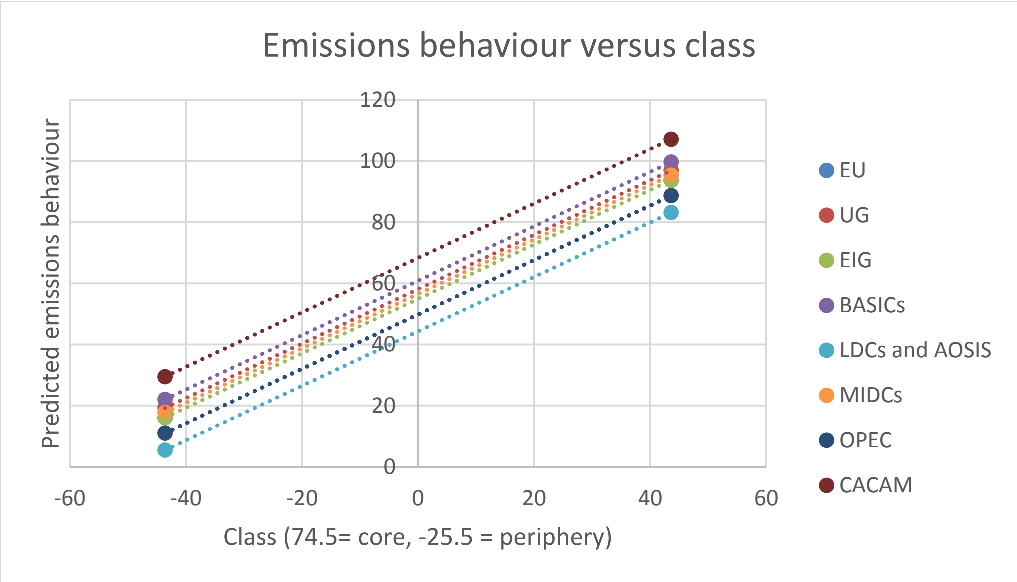

Figure 7.9: Regional emissions behaviour predictions in the structuralist RIM

Once again, we can get a birds-eye view of the model's predictions by considering the net effects of the three structuralist predictors simultaneously. Figure 7.10 shows the regional emissions levels predicted by the random intercept model the 95 percent confidence intervals. Since emissions scores can take any value within the confidence intervals, we can only be (95 percent) certain that there are

[169] The values of the other predictors (economic power and export diversity) are set to zero to isolate the pure effects of class.
[170] For this reason, the vertical distances between the regional lines are the same in the equivalent economic power and export diversity graphs.

substantive differences between the emissions behaviour of regions whose confidence intervals *do not* overlap. Broadly, our structuralist RIM allows us to predict that the order of most to least emissions-reducing regions will follow a five-stage ranking: (i) CACAM, (ii) the EU, (iii) UG, (iv) EIG, (iii) BASICs, MIDCs and LDCs and AOSIS and (v) OPEC.

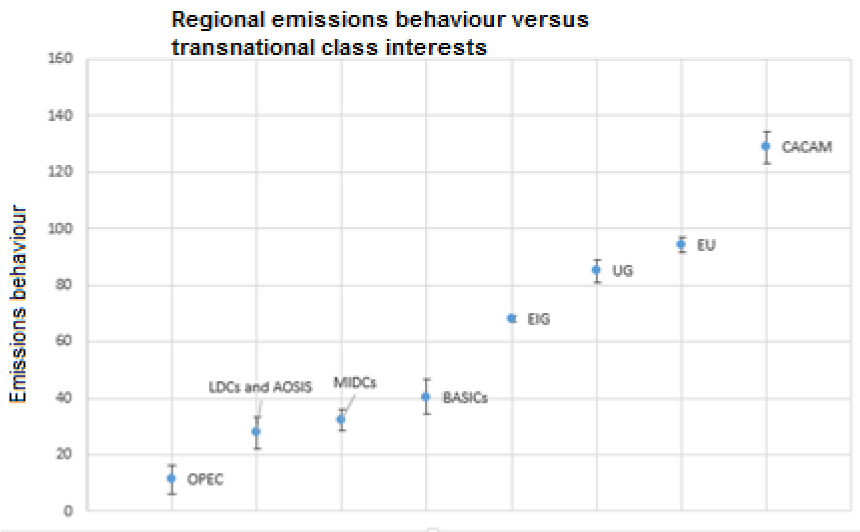

Figure 7.10: Regional emissions behaviour versus transnational class interests
Note: the points represent the predicted regional emissions behaviours estimated by the structuralist random intercept model. The vertical lines depict the 95 percent confidence intervals.

To get a sense of the accuracy of these predictions, we can refer once more to figure 7.17 to compare them with the actual emissions values observed in the dataset. The regional emissions behaviours predicted by the RIM are indicated by the third column shaded in medium grey. While the predictions are certainly not precise, they are much closer to the actual values than those predicted by the single-level model and correctly capture the incremental differences between the emissions behaviour of all eight regions.

Model 3: Random Coefficients and Intercepts

The next stage in the development of the model is to determine whether the structuralist variables have uniform effects across countries and regions. I begin this section by running a series of diagnostic tests to check for signs of causal heterogeneity, allowing the coefficient of each predictor to vary across countries. Specifically, I am looking for significant random effect terms and changes in the variance components. LR tests were also conducted to compare the goodness of fit of the RCMs with the equivalent RIM and single-level regression. The results of the random effects and LR tests are presented in table 7.5, alongside the variance components of the RIM for reference.[171]

Parameter	**RIM**	**Class**	**Economic power**	**Export diversity**
Random effects				
Regional variance	160.50 (527.89)	<0.001 (<0.001)	<0.001 (<0.001)	<0.001 (<0.001)
Country variance	4521.86 (654.92)***	3177.86 (12098.13)	<0.001 (<0.001)	20910.96 (2911.38)***
Country-year variance	4643.90 (131.79)***	4660.84 (132.49)***	925.10 (27.26)***	2672.12 (78.37)***
Random effect, u_x	-	0.70 (6.36)	7406.23 (1122.97)***	158.29 (22.85)***
LR tests				
Likelihood value	-14951.461	-14934.314	-13507.801	-14489.645
LR $test_{OLS}$	1339.97 (p<0.001)	1362.93 (p<0.001)	4215.96 (p<0.001)	2252.27 (p<0.001)
LR $test_{RIM}$	-	34.29 (p<0.46)	2887.32 (p<0.001)	923.63 (p<0.001)

Table 7.5: Diagnostic tests for detecting random class-based effects

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

[171] The fixed effects estimates are analysed below when the final random coefficient model is fitted.

The fourth row (random effect, u_x) indicates that two of the structuralist predictors have significant random effects between countries. The first model provides strong evidence, with a p-value of 0.46, that the influence of class status on compliance is the same across all countries. In contrast, the second and third models find that economic power and export diversity have very significant random effects between countries. Both random effect terms are highly significant at the 0.001 level.

In order to check whether these results are robust to the inclusion of other leading drivers of emissions, the structuralist drivers with random effects were inserted (one at a time) into a grand model including all of the independent variables from the neo-realist and neo-liberal chapters as well as the controls from the emissions literature (population and technology). The results of these tests, which are shown in table 7.6, show that the risk of omitted variable bias is low. Strikingly, in the new model with the full set of predictors, both economic power and export diversity continue to exhibit highly significant ($p<0.001$) between-country random effects.

Parameter	**Class**	**Economic power**	**Export diversity**
Random effect, u_x	<0 (<0)	1708.71 (259.06)***	1.05 (0.17)***

Table 7.6: Robustness checks for random effects of structuralist predictors

Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Returning to the previous set of results in table 7.5, in the models with the significant random effects, accounting for heterogeneity causes substantial changes in the variance components from the RIM. In the model with random economic power effects, unexplained variance at the regional level is almost completely eradicated, although, as the p-values show, the new variance components are not significant relative to their standard errors. Country level variance is suppressed to almost zero, but this estimate is insignificant relative to its standard error. Allowing the effects of export diversity to vary between countries causes the amount of unexplained variance at the country level to increase markedly from 4521.86 to 20910.96, which is significant at the 0.001 level. In the model with random economic power effects, country-year variance falls by approximately 80 percent. The decline in country-year variance in the model with random export diversity effects is about half the size - around 42 percent. Both of the new variance terms are highly significant at the 0.001 levels. The results of the LR tests confirm (with undetectable p-values) that both of the models with significant random effects are significantly preferred to the equivalent RIM and single-level regression. Thus, the next step is to incorporate random economic power and export diversity effects into the same model:

$$EMBEH_{ijk} = \beta_0 + \beta_1 class_k + \beta_2 econpower_{ijk} + u_{1jk} econpower_{ijk} + \beta_3 exportdiversity_{ijk} + u_{2jk} exportdiversity_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$$

The results of the random coefficient model with random economic power and export diversity effects are shown in table 7.7, alongside the RIM for reference.

Parameter	RIM	RCM
Fixed effects		
Class	0.89 (0.19)***	0.10 (0.14)
Economic power	-0.01 (0.00)***	-25.98 (7.87)**
Export diversity	-1.56 (0.31)***	-0.91 (0.42)*
Intercept	53.12 (8.55)***	-7052.74 (2169.35)**
Random effects		
Econpower, u_{1jk}	-	7740.11 (1249.17)***
Exportdiv, u_{2jk}	-	14.34 (3.13)***
Variance components		
Region	160.50 (527.89)	<0.001 (<0.001)
Country	4521.86 (654.92)***	<0.001 (<0.001)
Country-year	4643.90 (131.79)***	795.46 (24.61)***
LR statistics		
Likelihood value	-14951.461	-13425.99
LR $test_{OLS}$	1339.97 (p<0.001)	4379.58 (p<0.001)
LR $test_{RIM}$	-	3050.94 (p<0.001)

Table 7.7: Random coefficient model with random economic power and export diversity effects

Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

Although the signs of the fixed coefficients are the same as in the RIM, the sizes of the effects have changed considerably. The effect of core class status on emissions drops from 0.89 to just 0.1, telling us that, on average, core countries go on to meet just ten percent more of their 1990 emissions levels than periphery countries. Moreover, class (across all country-years) no longer has a significant effect on emissions behaviour. In the RIM, a one-point increase in economic power was associated with a 0.01 point decline in emissions reduction. In the new model, the inhibitory effect increases substantially, so that a one-point rise in economic power is associated with approximately 26 points less emissions reduction. The effect is significant at the 0.01 level.[172] In the RCM, the effect size of export diversity on emissions cuts is about half of the estimate in the RIM. On average, a one-point increase in export diversity is now associated with 0.91 points less emissions reduction. The new estimate is (less) significant at the 0.05 level.

After being incorporated into the same model, both of the random effects continue to be significant at the 0.001 levels. Economic power shows substantially higher variability than export diversity. On average, the between-country effects of economic power vary by 7740.11 and export diversity 14.34. Figure 7.11 illustrates the extent of heterogeneity by plotting predicted emissions behaviours as a function of the structuralist variables with significant random effects. Each line represents the relationship between emissions and economic power or export diversity for a different country. Clearly, the level of heterogeneity is substantial. Thus, modelling country-level heterogeneity significantly enhances the fit of the model, which is confirmed by the results of the LR tests with the equivalent RIM and single-level regression.

[172] Despite this sharp increase, we should not read too much into its substantive significance as 26 points is still only a fifth of one standard deviation of emissions behaviour (113 points).

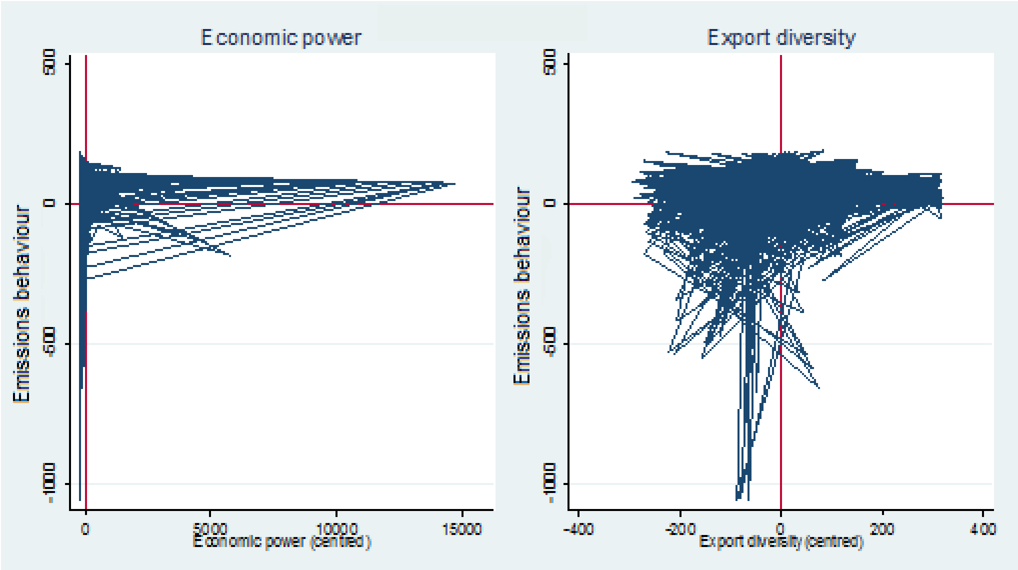

Figure 7.11: Predicted emissions behaviour as a function of economic power and export diversity in the random coefficient model

Figures 7.12 and 7.13 plot the variation in country-level random slopes as a function of economic power and export diversity respectively. Figure 7.12 tells us that economic growth tends to inhibit emissions reduction in weak economies and promote it in strong economies, which fall on the left and right of the y-axis respectively. The inhibition effect is strongest in Seychelles (-798.43) and the Maldives (-248.38), which are the weakest economies and then gradually weakens as we move up the economic power axis. Even a small movement along the x-axis from Seychelles to the Maldives causes the inhibition effect to shrink to just a quarter of the original inhibitory effect. The Lowess plot only crosses the y-axis at approximately the mean centred value, which is zero on the x-axis. The crowded points in the bottom left quadrant show that, contrary to our second hypothesis, economic growth strongly inhibits emissions reduction in the weakest economies. On the other side of the spectrum, economic power has a positive impact on emissions behaviour in countries that have attained above average levels of economic development, which are located in the top right quadrant. The strongest positive effects are felt in the US and Japan. The positive effect of these residuals is in accordance with the second structuralist hypothesis that more powerful economies are more likely to have the means and will to mitigate. Clearly, the effect of economic power on emissions reduction is more heterogeneous than acknowledged by the fixed effect estimate across all countries, which is represented by the dashed line.

Furthermore, and as discussed in the chapter conclusion, these findings cohere with the economies of scale argument under the EKC scholarship: the changing role of economic growth – from obstructing to promoting emissions reduction – across different levels of economic development lends credit to the proposition that larger economies, which have higher GDPs, may benefit from certain economies of scale which make it easier to enforce emissions regulation (e.g., Andreoni and Levinson 2001 and Stern 2004).[173]

[173] These results are also in accordance with the reputational cost (share of global emissions) findings in the last chapter.

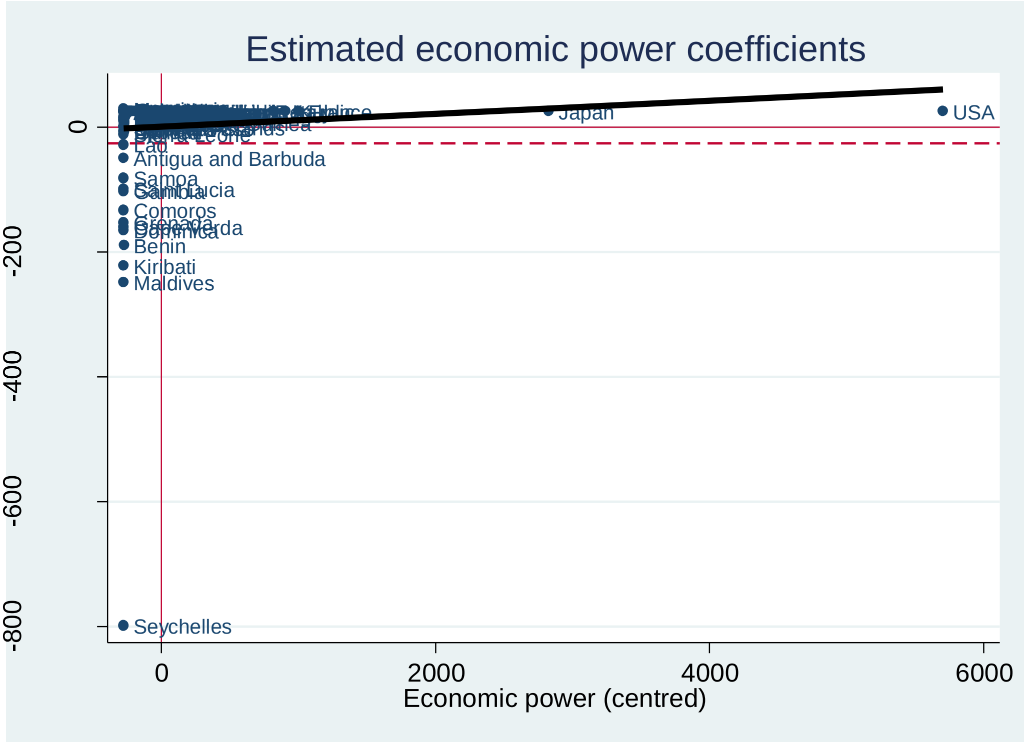

Figure 7.12: Estimated economic power effects as a function of economic power

Figure 7.13 plots the equivalent graph for export diversity. The dashed line indicates that, on average, export diversification inhibits emissions reduction. The positive slope of the solid line indicates that the strongest inhibitory effects are felt where export diversity is at its lowest. The negative effect of export diversity on emissions behaviour tends to weaken as we move to countries with more diversified export sectors and has a weak positive effect in countries with above average levels of export diversification. This segment of positive effects is in accordance with our third structuralist hypothesis. However, the points are distributed more widely around the Lowess line when compared to the economic power plot in figure 7.12, suggesting that random export diversification effects must be influenced by something other than the level of export diversification. In the next chapter, I explore whether countries' structuralist worldviews play a role in conditioning the effect of export diversity on emissions behaviour.

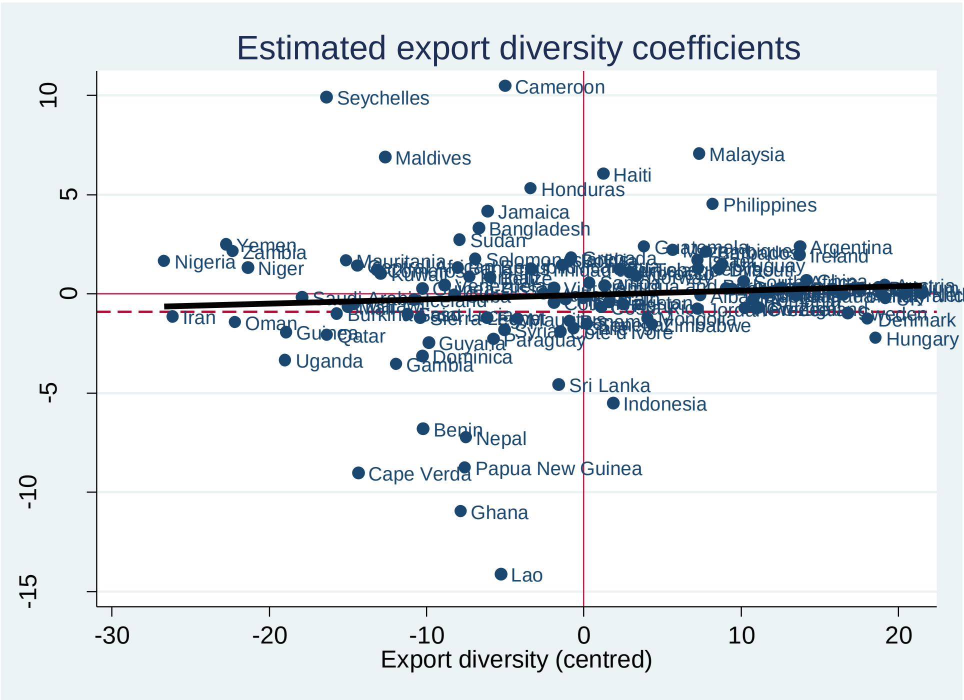

Figure 7.13: Estimated export diversity effects as a function of export diversity

As discussed in the chapter conclusion, these findings also lend credit to another strand of the EKC literature: namely – the output mix hypothesis.[174] In chapter two, we saw that proponents of this approach argue that the start of the industrialisation process creates a shift in the output mix from agriculture to heavy industries, which is associated with increasing emissions. The negative sign of the export diversification that is found at lower levels of economic development corresponds to this early stage of the industrialisation process. The second part of the output mix hypothesis proposes that, after attaining a certain level of economic development, economies then begin to transition to lighter industries like

[174] See, for example, Friedl and Getzner (2003), Stern (2004) and Grossman (1995).

services, which is associated with lower emissions. Once again, the detection of positive export diversity coefficients at high levels of economic development is in accordance with the output mix hypothesis.

Having established that two of the structuralist predictors have heterogeneous effects between-countries, the next step is to determine whether the same thing applies at the regional level. Diagnostic tests revealed that none of the class-based predictors have significant regional random effects. LR tests with the country random coefficient model confirmed very strongly (with a p-value close to one) that random regional effects models were not better fits than the RCM with random country-level effects.

Nonetheless, it is still possible to get a sense of the influence of class-based variables by predicting the emissions behaviour of a set of hypothetical countries that possesses the typical (mean) class, economic power and export diversity characteristics of each region. The regression equation for the random coefficient model is:

$$EMBEH_{ijk} = -7052.74 + 0.1class_k + (-25.98+u_{1jk})econpower_{ijk} + (-0.91+u_{2jk})exportdiv_{ijk} + v_{0k} + u_{0k} + e_{ijk}$$

Figures 7.14 and 7.15 plot emissions behaviour as a function of economic power and export diversity respectively. As before, the regression equations are plotted across the predictor mean plus and minus one standard deviation with the other variables set to zero, the grand mean across all observations. Since the effects are allowed to vary across countries (and indirectly, regions), the hypothetical regional lines are not parallel. The sign and steepness of the slope indicates the direction and size of the predictor effect on a region respectively. In order to aid the visual comparison of these random effects on different regions, which is the value added by the random coefficient model, the random intercepts were omitted from the subsequent regional simulations. This brought the regional lines together, thus allowing their slopes (random effects) to be compared from the same intercept point.[175]

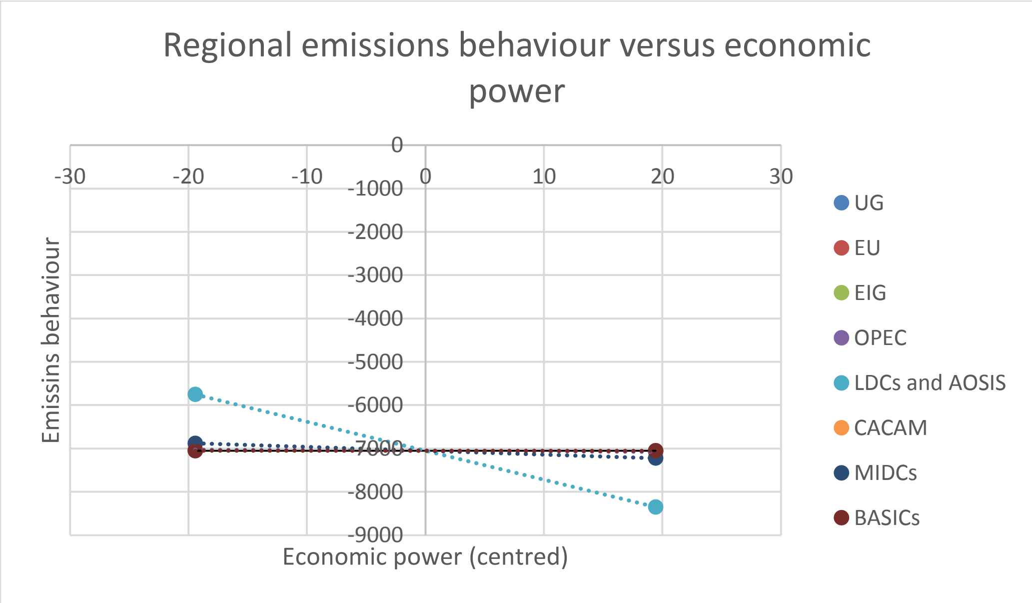

Figure 7.14: Predicted regional emissions behaviour as a function of economic power in the structuralist random coefficient model

[175] The sizes of the regional intercepts are very large (around 7000 points), which causes the compliance levels in the regional simulations in figures fifteen and sixteen to be substantially lower than the estimates predicted by the complete random coefficient model (with random intercepts). These estimates are presented in figure 7.17, which illustrates that all of the regional predictions fall within the expected range of values.

With the exception of the LDCs and AOSIS, all of the regional lines in figure 7.14 are relatively flat, which tells us that, holding other transnational class interests constant, economic power has a negligible effect on emissions behaviour. Why might emissions reduction be unaffected by economic power? One possible explanation is that although active economies are better equipped to offset the domestic costs of emissions cuts, they also face higher demand for fossil fuels, thus counterbalancing the increased capacity for mitigation. The downward slanting blue line suggests that economic growth wins out over the increased capacity for mitigation in the LDCs and AOSIS. This finding is substantively important because out of all the regions, the economic-capacity hypothesis should be the strongest in the most vulnerable part of the world, which is arguably emblematic of the periphery. Although we have no way of inferring this from the model, one possible explanation for the triumph of economic development over mitigation capacity in the LDCs and AOSIS is that economic development is necessarily carbon intensive in the poorest parts of the world, which lack the resources to invest in carbon efficient technology. Thus although economic growth may still enhance mitigative capacity in the background, this trend is masked by the rising emissions which accompany what is clearly a more pressing concern in the South –development.

To check whether these inferences are likely to hold up when other drives of emissions are controlled for, the regional effects of economic power were estimated from a grand model that includes all of the predictors from chapters five and six as well as the controls from the emissions literature (technology and population). Table 7.8 shows these estimates alongside the coefficients associated with the regional simulations in figure 7.14 for reference. Strikingly, the order of economic power effects remains unchanged in the new model, with the LDCs and AOSIS experiencing the strongest inhibitory effect out of all the regions. Also consistent with the previous findings, the MIDCs continues to be experience the second-strongest effect while the remaining six regions exhibit very similar coefficients. Unlike the last model, however, economic power has a positive effect on emissions reduction in all regions other than the LDCs and AOSIS. Thus, although the distinction between the economic power effects felt by the LDCs and AOSIS and remaining seven regions appears to be robust, the introduction of the other variables lends more credit to the structuralist hypothesis that economic development has a positive effect on emissions reduction. With regards the EKC literature, the positive sign of the coefficients and relatively larger magnitude of the effect in the six most economically advanced regions suggests that most of the world has reached the turning point, after which further bouts of development exert a positive effect on emissions policy.

Region	**Model 1**	**Model 2 (robustness check)**
LDCs and AOSIS	-66.85	-11.05
MIDCs	-8.9	2.96
OPEC	-1.3	7.77
CACAM	-0.48	7.87
EU	-0.22	7.67
UG	-0.15	7.66
BASICs	-0.11	7.77
EIG	-0.07	7.81

Table 7.8: Predicted random economic power effects on regions

Figure 7.15 plots the equivalent regional simulations for export diversity. The negative slopes of the regional lines in figure 7.15 indicate that increasing export diversity tends to inhibit emissions reduction throughout the world. Since possible explanations for this unexpected negative association were discussed under the RIM, they will not be repeated here. Instead, I focus on the novel insights provided by the RCM; Allowing the (negative) effect of export diversity to vary between countries gives us reason to expect that the strongest inhibitory effects are felt in the OPEC and LDCs and AOSIS regions. Once again, although there is no way of being certain on the basis of this study alone, the concentration of the strongest negative effects in these regions is in accordance with the neo-pluralistic argument discussed above: both of these regions (OPEC because it specialises in exporting fossil fuels and the LDCs because they lack resources) specialise mainly in carbon-intensive activity. Thus existing business interests in these regions are likely to face the highest risks from emissions cuts and, therefore, exert the most pressure on governments to avoid emissions cuts.

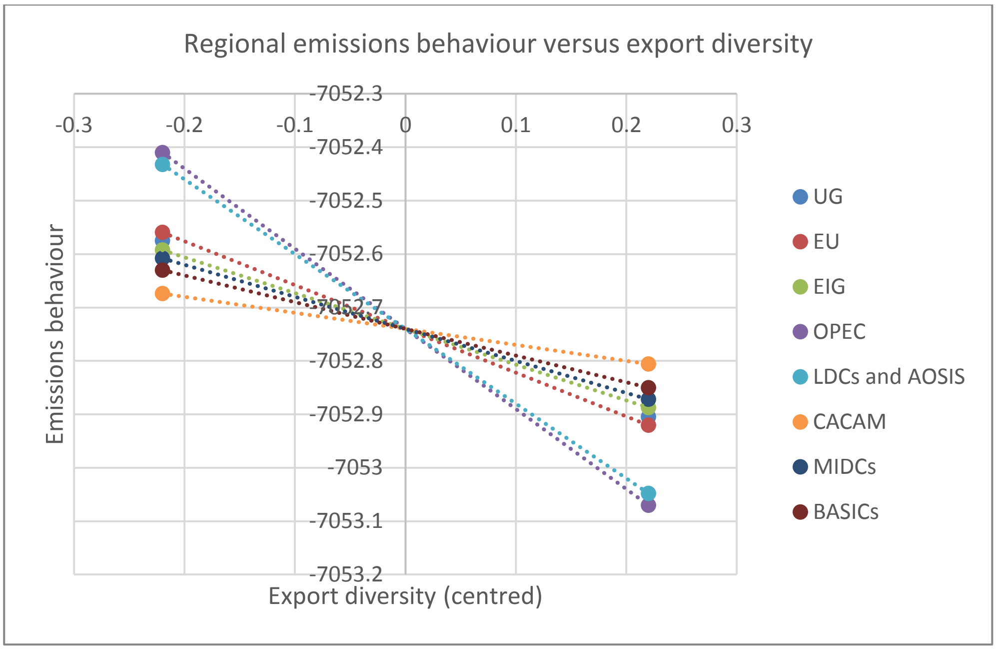

Figure 7.15: Predicted regional emissions behaviour as a function of export diversity in the random coefficient model

As with economic power, the robustness of these inferences were checked by estimating the equivalent set of regional effects from the same grand model including all of the variables described above. Table 7.9 shows the estimated effects of export diversity on each region alongside the coefficients associated with the simulations in figure 7.15. Strikingly, export diversity continued to exhibit the strongest negative effects on emissions reduction in the OPEC and LDCs and AOSIS, suggesting that the above proposition about the level of specialisation in carbon intensive activity is likely to hold even when we hold constant the other putative drivers of emissions. However, introducing the new variables indicates that export diversity may have a weaker inhibitory (and sometimes even positive) effect on emissions reduction than the first model suggests. This is particularly striking in the case of the MIDCs and BASICs, which experience positive export diversity effects in the new model. Although the effect sizes are relatively small, the new estimates lend some support to the structuralist hypothesis that, at least in middle income developing regions, export diversification is likely to enhance mitigative capacity and thus promote emissions reduction.

Region	**Model 1**	**Model 2 (robustness check)**
OPEC	-1.5	-0.25
LDCs and AOSIS	-1.4	-0.1
EU	-0.82	-0.04
UG	-0.75	-0.09
EIG	-0.67	-0.1
MIDCs	-0.6	0.07
BASICs	-0.5	0.00
CACAM	-0.3	-0.03

Table 7.9: Predicted random export diversity effects on regions

Figure 7.16 shows the regional emissions behaviours predicted by the RCM with the 95 percent confidence intervals. The order of regional emissions-reduction remains the same as in the RIM and mirrors closely the actual data. However, we can no longer be (95 percent) confident that OPEC will be the most reluctant region towards emissions reduction as the upper bound of the confidence interval overlaps with LDCs and AOSIS and MIDCs.

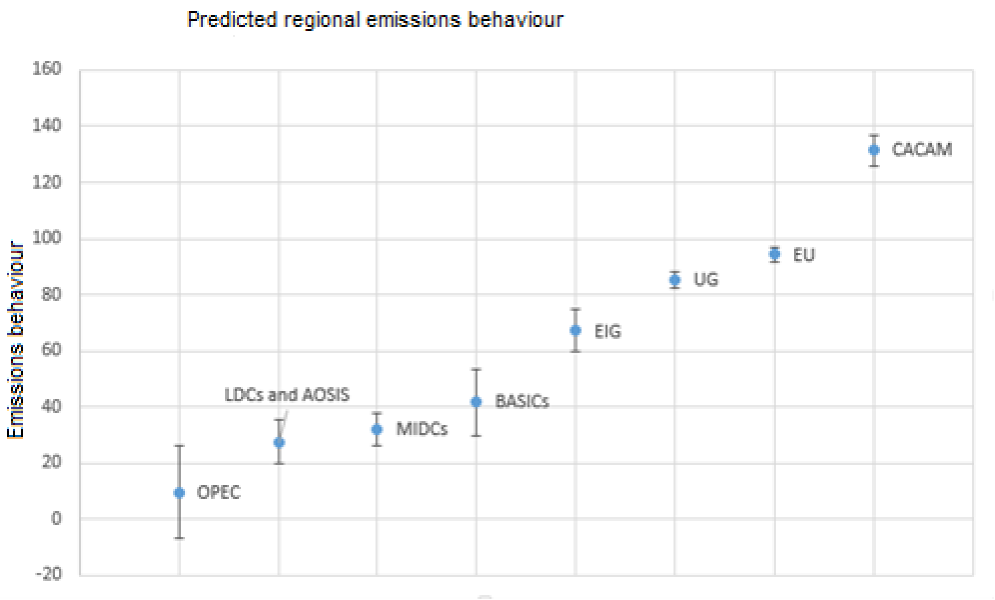

Figure 7.16: Emissions behaviour versus relative gains in the random coefficient model
Note: the points represent the predicted regional emissions scores estimated by the structuralist random coefficient model. The vertical lines depict the 95 percent confidence intervals.

How does the model fit with the actual data? Figure 7.17 compares the emissions levels predicted by each successive structuralist model with the actual values observed in the dataset. The RCM predictions are indicated by the right column in black and are closest to the actual emissions values in the striped column. The decreasing vertical distances between the predictions and actual values confirm that the structuralist model becomes more accurate as more aspects of the hierarchical data structure were modelled.

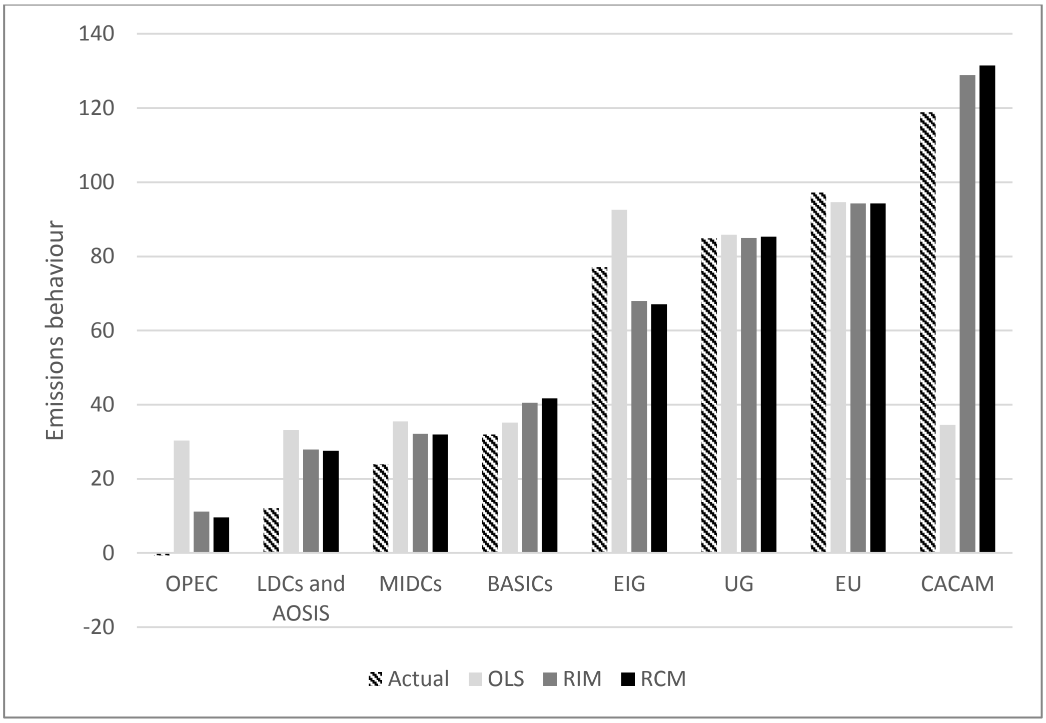

Figure 7.17: Structuralist predictions versus actual emissions behaviour

Conclusion

I started this chapter with three structuralist hypotheses, which were premised on the same assumption that emissions behaviour is shaped by transnational class interests. How do these hypotheses sit with the chapter findings? Although I found strong evidence that emissions behaviour is indeed shaped by structuralist predictors, the answer to this question is not straightforward. Each model revealed a different dimension of the class-based dynamics behind emissions behaviour, sometimes supporting and at other times, contradicting the expectations that I held when I first began this chapter. In this conclusion, I draw out what these findings contribute to the structuralist literature on climate politics as well as the economic explanations of emissions behaviour.

While the single-level and random intercept models found tentative support for the first hypothesis, transnational class status ceased to be a significant driver of emissions once we allowed the effects of economic power and export diversity to vary between countries. Thus, the results of this chapter contradict the first structuralist hypothesis that core countries are likely to reduce emissions more because, by seen to be complying with mitigation commitments under the climate regime, emissions reduction serves their class interests. Thus this finding runs against one of the central claims of the climate ethics and global justice literature.[176] When considered in conjunction with the findings of the other empirical chapters, it is fair to say that binary indicators like transnational class or annex status[177] are not as influential drivers of emissions behaviour as more nuanced, continuous factors like economic development and export diversity.

Economic power was found to be a significant obstacle to emission reduction in all three models and had the strongest substantive effect out of all of the structuralist predictors: in the RCM, on average, a one-point increase in economic power was associated with a 26 point drop in emissions behaviour. The negative direction of the effect runs against the second structuralist hypothesis that economic power increases mitigative capacity. One possible explanation for this finding is that economic growth increases the capacity for emissions reduction while simultaneously raising the demand for carbon activity. The negative sign of the effect coheres with the results of previous research on the influence

[176] See, for example, Mwandosya (2000), Betsill et al. (2006), Parks and Roberts (2006,2007,2008,2010), Mejia (2010), Prum (2010) and Bohm et al. (2012).
[177] Annex status was the proxy for reciprocal commitments in chapter five on neo-realist approaches.

of economic activity on emissions levels (e.g. Dolsak (2001) and Battig and Bernauer (2009)).

This chapter also goes beyond existing research on the influence of economic power over emissions trends. First, it finds that economic growth has a stronger inhibitory effect on emissions reduction when we account for clustering by focusing on longitudinal changes within the same country or cross-sectional differences in the same region.[178] Second, although the average effect of economic growth is to inhibit emissions reduction, the sophisticated results of the RCM suggest that the strongest inhibitory effects are felt in the poorest countries, which presumably have the least capacity to reduce domestic emissions. In these countries, even incremental increases in economic power dramatically dilute the constraining effect of economic power on emissions behaviour. As we move beyond this critical capacity threshold, economic power continues to constrain emissions, but the negative effect gradually diminishes as countries acquire the means to balance the costs of emissions reduction with the need for economic development. A deficiency of economic power appears to constrain the ability of the poorest countries to take advantage of increased capacity for emissions reduction that is created by economic growth. Thus, although economic growth does not automatically translate into more effective climate policy, this chapter finds evidence of a capacity threshold that must be met in order for enhanced economic-capacity to trickle down into emissions

[178] That is, instead of moving randomly between observations from different countries in different regions.

behaviour. This finding provides quantitative evidence in support of the popular structuralist argument that global mitigation efforts are obstructed by a lack of capacity in the South (e.g. Roberts et al. (2004), Betsill et al. (2006) and Parks and Roberts (2006,2008,2010)). Since GDP also measures the scale of economic activity, the finding also comprises new evidence in support of the environmental Kuznets curve hypothesis that larger economies are likely to engage in more emissions reduction because they are able to reap the benefits of certain economies of scale which make it easier to enforce emissions controls at high levels of economic activity (Galeotti et al. 2006; Andreoni and Levinson 2001; Stern 2004).

My investigation of export diversity also uncovered some unexpected findings. Although insignificant, the negative sign of the coefficient in the single-level regression contradicted our third structuralist hypothesis - that export diversity increases countries' capacities and willingness to reduce emissions without undermining domestic livelihoods. This result also runs against Roberts et al.'s (2004) finding that export diversity is positively correlated with domestic institutions, ecosystem wellbeing and environmental NGOs - all factors that promote effective climate policy. The multilevel models in this chapter give us stronger grounds for questioning the alleged ability of export diversification to promote mitigation: both the (negative) effect size and statistical significance of the driver increased with each successive model. Falkner's neo-pluralist theory provides one possible explanation for this unexpected finding:

countries with diverse export sectors tend to host strong business actors, which have the capacity to influence government policy. Since the structural disposition is against emissions cuts, a thriving export sector is likely to translate into stronger opposition against emissions reduction.

A second possibility is the neo-realist argument that export diversity and economic power feed into the power of the nation, making it less dependent on international efforts to combat climate change. Either way, the influence of economic variables on emissions trends is clearly not reducible to capacity, but entrenched within the dilemma between economic development and environmental protection. This chapter suggests that the capacity of business interests to influence government policy prevails over the capacity of countries to reduce emissions.

As with economic power, I also found strong evidence that export diversity has different effects on different countries. Although export diversity tends to inhibit emissions reduction, the strongest negative effects are felt in countries with the least diversified export sectors. Thus, once again, the findings of the RCM cohere with the structuralist capacity argument: after a critical threshold value, the inhibitory effect of export diversification on compliance diminishes.[179] Furthermore, the finding is also of relevance to the economic explanations of emissions trends. Since diversified economies are adept in the production and export of a wide range of goods, they generally have lower carbon output mixes than

[179] In the next chapter, I test whether the effect that export diversity has on a country is influenced by national policymakers' beliefs in structuralism.

less diversified economies. The changing role of export diversification across different levels of export diversity – from inhibiting to promoting emissions reduction – is in accordance with the EKC hypothesis that economic development (which is measured by export diversification) inhibits emissions reduction in developing countries which are newly industrialising and promotes it in advanced economies which have already transitioned to low-carbon activity (e.g., Friedl and Getzner 2003 and Stern 2004).

What are the policy implications of these findings? First, there is no evidence that affiliation with a certain transnational class has any bearing on emissions trends. Contrary to structuralist expectations, a core country is no more likely to return to 1990 emissions levels than a periphery country. This finding in itself can be interpreted as an optimistic sign that perhaps, the North-South divide is not the same obstacle to international environmental cooperation that it is frequently assumed to be.

Second, although economic growth generally inhibits emissions reduction in the vast majority of countries, it promotes it in countries that have attained a certain level of economic development. The changing role of economic power over compliance is in accordance with the frequently made claim that the (economic) capacity to offset to costs of emissions reduction is an influential driver of emissions trends. Therefore, strategies that aim to build mitigation capacity, such as economic aid, foreign investment and the transfer of carbon efficient technology and know-how could play a critical role in bringing about emissions reduction in developing countries, particularly in the poorest parts of the world.

Third, contrary to popular belief, export diversification alone is not enough to make countries adopt effective climate policy. On the contrary, the results of this chapter suggest that export diversification tends to make countries less willing to reduce emissions. This is particularly concerning in the poorest parts of the world, where diversification has frequently been heralded as a leading strategy for promoting emissions reduction (Keane 2011). If, as I suggested above, the increased aversion to mitigation is fuelled by growing business actors in countries with diversified export sectors, a possible solution is to work with businesses to alleviate the longstanding structural barriers to emissions cuts. Crucially, carbon efficient production needs to be transformed into a profitable opportunity by providing new incentives for old businesses to modernise. The ozone regime is a shining example of how business interests can play a pivotal role in effectively governing the global atmosphere. Yet the chapter findings also create reason for optimism: both economic development and export diversification should begin to promote emissions reduction after developing countries have attained a certain level of economic development.

Chapter Eight: The Role of Worldviews in Conditioning the Effects of Relative Gains, Domestic Cost-Benefit Ratios and Transnational Class Interests on Emissions Behaviour

Introduction

Over the last three chapters, I tested the core explanations of emissions behaviour that flow from the ideal neo-realist, neo-liberal and structuralist worldviews which underlie my theoretical approach. While I found that relative gains, domestic cost-benefit ratios and transnational class interests are indeed significant drivers, I also found that the effects of fossil fuel dependency, reputational cost, democracy, economic power and export diversity vary significantly across countries.[180] In this chapter, I test my constructivist claim that at least some of this heterogeneity is attributable to countries' worldviews. In chapter three, I proposed that countries' perceptions of the climate problem and emissions behaviours are shaped by their worldviews – that is; the positive and normative beliefs that they hold about the nature of world politics more broadly. Specifically, I argued that instrumentalist variables will only have their predicted effects over emissions when policymakers subscribe to the same assumptions of the theoretical approach that is doing the prescribing. Conversely, relative gains, domestic cost-benefit ratios and transnational class interests are unlikely to be influential when countries do not perceive them as important drivers of world politics more broadly. Thus, in this chapter, the effects (random coefficients) of the

[180] In other words, these factors were found to have significant random effects.

instrumentalist drivers that were examined in the last three chapters become the dependent variables and worldviews the explanatory variables.

Drawing on the theoretical worldview-problem representation sets that I proposed in chapter three, I test three worldviews-based hypotheses in this chapter:

(i) Relative gains will be an influential driver of emissions behaviour in countries that hold strong belief in the neo-realist worldview;

(ii) Domestic cost-benefit ratios will be an influential driver of emissions behaviour in countries that hold strong belief in the neo-liberal worldview;

(iii) Transnational class interests will be an influential driver of emissions behaviour in countries that hold strong belief in the structuralist worldview.

Figures 8.1 to 8.3 illustrate where these worldviews-based hypotheses sit with the more conventional instrumentalist hypotheses tested in chapters five to seven. In all three figures, mainstream hypotheses are depicted horizontally (from left to right), worldviews hypothesis vertically (top to bottom).

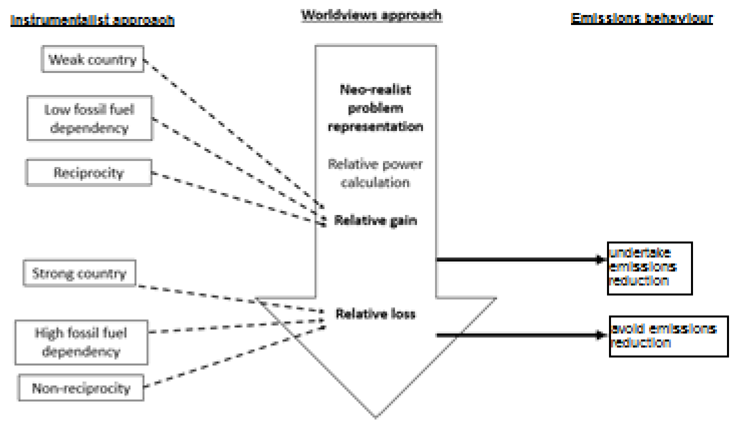

Figure 8.1: Neo-realist and worldviews hypotheses.

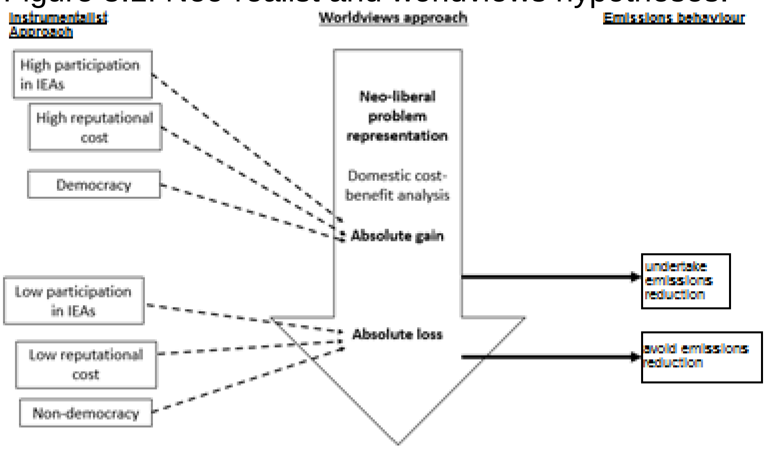

Figure 8.2: Neo-liberal and worldviews hypotheses.

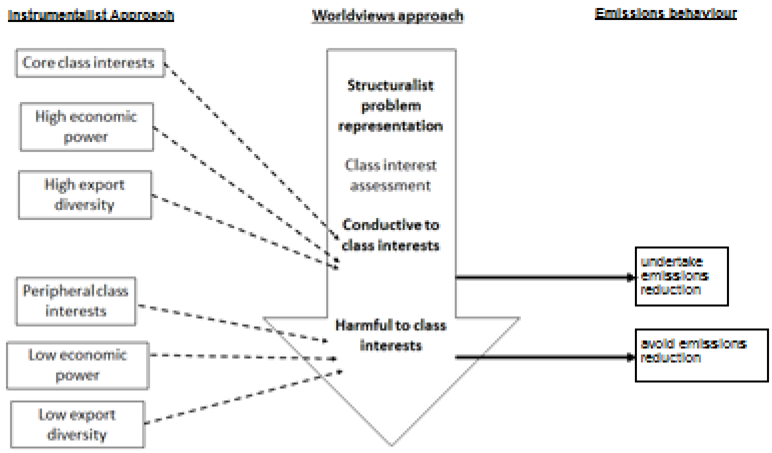

Figure 8.3: Structuralist and worldviews approaches.

This chapter consists of four parts. In the first section, I recall the proxies that I proposed to serve as worldviews indicators in chapter four and explore how they are distributed across country-years, countries and regions. Building on these distributional patterns, I flesh out some concrete predictions about the likely effects of relative gains, domestic cost-benefit ratios and transnational class interests on different countries and regions. I also take a quick look at the statistical associations between neo-realist, neo-liberal and structuralist worldviews and emissions behaviour. In the second section, demonstrate how I go about testing the alleged conditioning effects by incorporating them into the random coefficient models from the preceding empirical chapters as interaction effects. Part three is where I present the results of the neo-realist, neo-liberal and structuralist random coefficient models with interaction effects. I conclude the chapter with a discussion of its main contributions to the literature and policy relevance.

Operationalising Worldviews, Distributional Patterns and Statistical Associations

Operationalising Worldviews

In chapter three, I suggested that it is possible to infer countries' worldviews from their perceptions of the climate problem. Building on this, in chapter four, I devised a strategy for measuring countries' beliefs in three ideal neo-realist, neo-liberal and structuralist problem representations of climate change. Specifically, I conducted computer aided content analysis of 8,021 articles in English language national newspapers about the climate regime, spanning 1990 to 2012 to record the number of occurrences of entries from a worldviews dictionary, which was compiled in chapter four. Since the number of articles published on climate change varies across country-years (such that there are many years with no articles), I recorded the total number of occurrences that were made by each country across all years. Also, since the total number of occurrences differs from country to country, the word frequencies were converted into a proportion of the total number of occurrences from a given country. Thus worldviews were coded at the country level. Full details of the operationalisation strategy and word dictionary used to code worldviews are given in chapter four.

Distributional Patterns and Preliminary Predictions

If my claim that worldviews condition the effect of instrumentalist factors on emissions behaviour is valid, then the distribution of worldviews should allow us to predict with some accuracy the likely effects of relative gains, domestic cost-benefit ratios and transnational class on different countries and regions. In this section, I explore how neo-realist, neo-liberal and structuralist worldviews are distributed across the three levels of the model and flesh out some concrete predictions, which I later return to when evaluating the predictive value of the models.

(i) Level one: country-year

Figure 8.4 provides an overview of the longitudinal distribution of worldviews from 1990 to 2012 by using nonparametric, locally weighted scatter plot smoothers (Lowess plots). Since worldviews are coded at the country level, the three lines are flat, indicating that, in the context of this research, the distribution of neo-realist, neo-liberal and structuralist worldviews remains constant. Thus, at this preliminary stage of the chapter, we cannot draw any inferences about the likely effects of relative gains, domestic cost-benefit ratios or transnational class interests over time.

Figure 8.4: Longitudinal distribution of neo-realist, neo-liberal and structuralist worldviews over time (1990 to 2012)
Note: Each point represents a country-year

(ii) Level Two: Country

Figures one to three in the chapter appendix rank all countries according to their level of belief in neo-realism, neo-liberalism and structuralism. If my first hypothesis is correct, then subscription to neo-realism should increase the influence of relative gains concerns over emissions behaviour. The first figure in the chapter appendix leads us to expect that

Israel, Tunisia, Grana, Bulgaria and Croatia should give the most emphasis to relative gains in climate policy. In contrast, Azerbaijan, Comoros, Kazakhstan, Lao and Latvia should be the least likely to act in accordance with relative gains concerns.

The second of these figures tells us that Lithuania, Latvia, Azerbaijan, Ecuador and Dominica hold the most neo-liberal worldviews. Thus, according to my second hypothesis, emissions behaviour in these countries should be determined largely by domestic cost-benefit calculations. In contrast, Bhutan, Croatia, Kazakhstan, the Maldives and Tunisia should give the least weight to the domestic cost-benefit expectations associated with emissions behaviour.

The third figure indicates that Bhutan, the Maldives, Fiji, Ecuador and Namibia should are the most structuralist countries. My third hypothesis gives us reason to expect that these countries should give the most emphasis to transnational class interests. Conversely, as countries with the least belief in structuralism, Austria, Latvia, Lithuania, Romania and Israel should be the least swayed by transnational class interests in their climate policy.

(iii) Level Three: Region

Figure 8.5 represents the average regional subscription to neo-realist, neo-liberal and structuralist worldviews over the time period under investigation. According to graph A, the MIDCs and UG have the highest regional belief in neo-realism, which leads us to predict that these regions should afford the most emphasis to relative gains in emissions behaviour. Conversely, CACAM, which has by far the lowest regional belief in neo-realism, should by unswayed by relative gains concerns. Graph B gives us reason to expect that domestic cost-benefit calculations should play a decisive role in shaping the emissions behaviour of the EU and EIG, which are the most neo-liberal regions. By the same token, the LDCs and AOSIS states should afford the least importance to the domestic costs and benefits of emissions policy. Lastly, graph C indicates that the LDCs and AOSIS states have the highest belief in structuralism. As such, members of this region should shape emissions behaviour in accordance with their transnational (peripheral) class interests. Conversely, as the least structuralist regions, the EU and UG should pay the least attention to their (core) class interests.

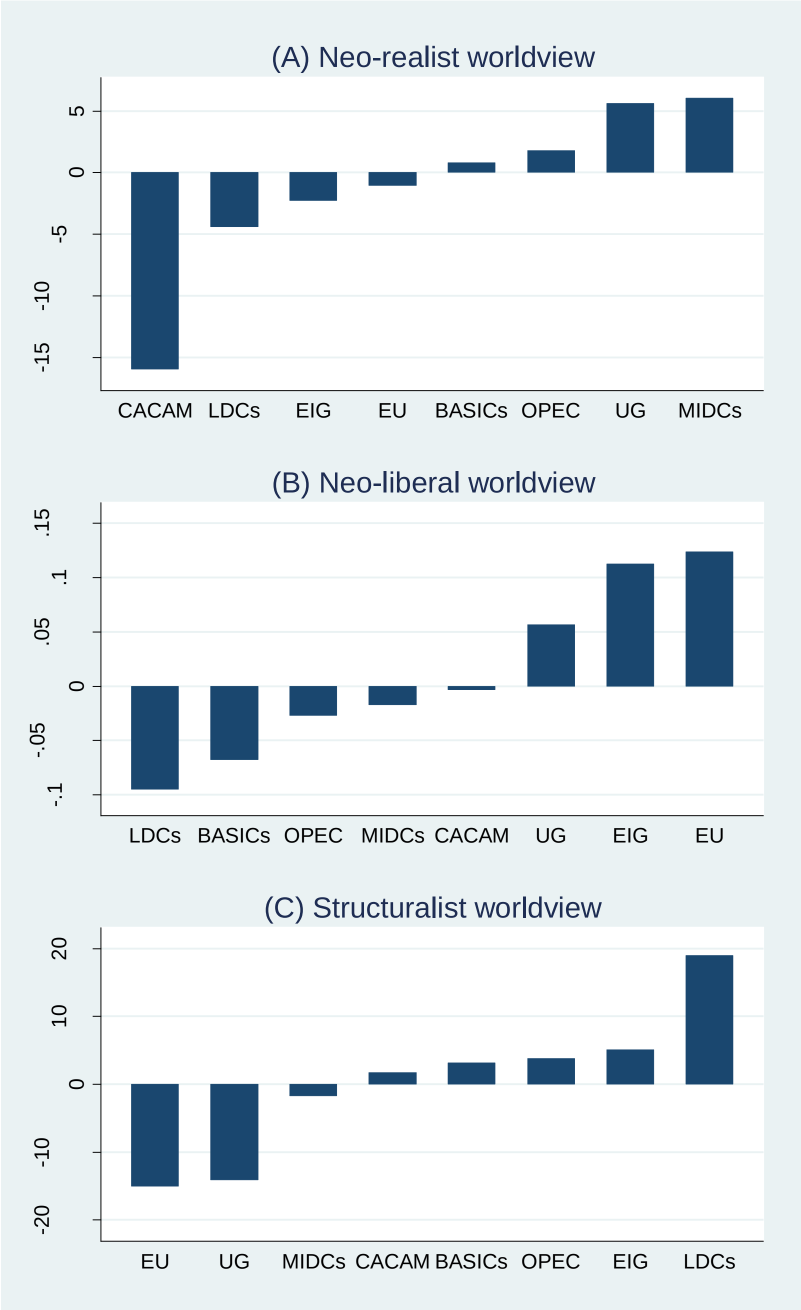

Figure 8.5: Mean regional belief in neo-realist, neo-liberal and structuralist worldviews from 1990 to 2012

It is interesting to return for a moment to the first time in the thesis that I presented my preliminary claims about the distribution of worldviews across regions. My initial expectations were admittedly less nuanced than the eight-regional patterns discussed here. Specifically, I proposed that the UG should be the most neo-realist, EU neo-liberal and South (comprising the LDCs and AOSIS, MIDCs and BASICs) structuralist region.[181] It is interesting to consider whether, and if so, to what extent these expectations are born out. Graph A tells us that the MIDCs is the most neo-realist region, which runs against my initial expectation. However, the UG is a close second, so there seems to be at least some support for my initial hunch. My characterisation of the EU as the most neo-liberal region holds true, as graph B indicates that the EU and EIG fit this category. Lastly, I find some evidence to validate my third expectation – that the South subscribes predominantly to the structuralist worldview. Graph C tells us that the LDCs and AOSIS is indeed the most structuralist region. However, rather than being followed by other Southern regions, the EIG weighs in as the second most structuralist region. OPEC and the BASICs come third and fourth, which lends some support to my claim. However, structuralist beliefs in the MIDCs falls surprisingly below the world average level.[182]

Some worldviews are more widely distributed than others. The range of values of the y-axes in figure 8.5 indicate that the most structuralist region (the LDCs and AOSIS) scores twenty points on the worldviews scale, the most neo-realist region (the MIDCs) scores five points while the most neo-liberal region (the EU) scores a mere one point. The intensity of weak

[181] These claims were summarised in figure 1.1 in chapter one.

[182] While these regional patterns are certainly interesting and tell us something about the distribution of neo-realist, neo-liberal and structuralist beliefs across the world, as will become apparent in the results section below, it is not always possible to infer their substantive effects directly from these trends. What I mean by this is that in order for a worldview to increase the effect of a corresponding instrumentalist driver, a country's level of belief in the worldview must exceed a critical value, after which point, the expected conditioning effect kicks-in. I elaborate precisely what these values are and which regions meet them and experience these kinds of conditioning effects below.

worldviews from the world average also follows a similar pattern. Thus, at this preliminary stage, we can deduce that structuralist worldviews are distributed more heterogeneously than neo-realist worldviews, while subscription to neo-liberalism is more uniformly distributed across regions.

Statistical associations: a sneak preview

Before fitting the models, it is helpful to get a sense of the statistical associations between the ideal theoretical worldviews and emissions behaviour. Figure 8.6 provides an overview of these preliminary patterns by using nonparametric, locally weighted scatter plot smoothers (Lowess plots).

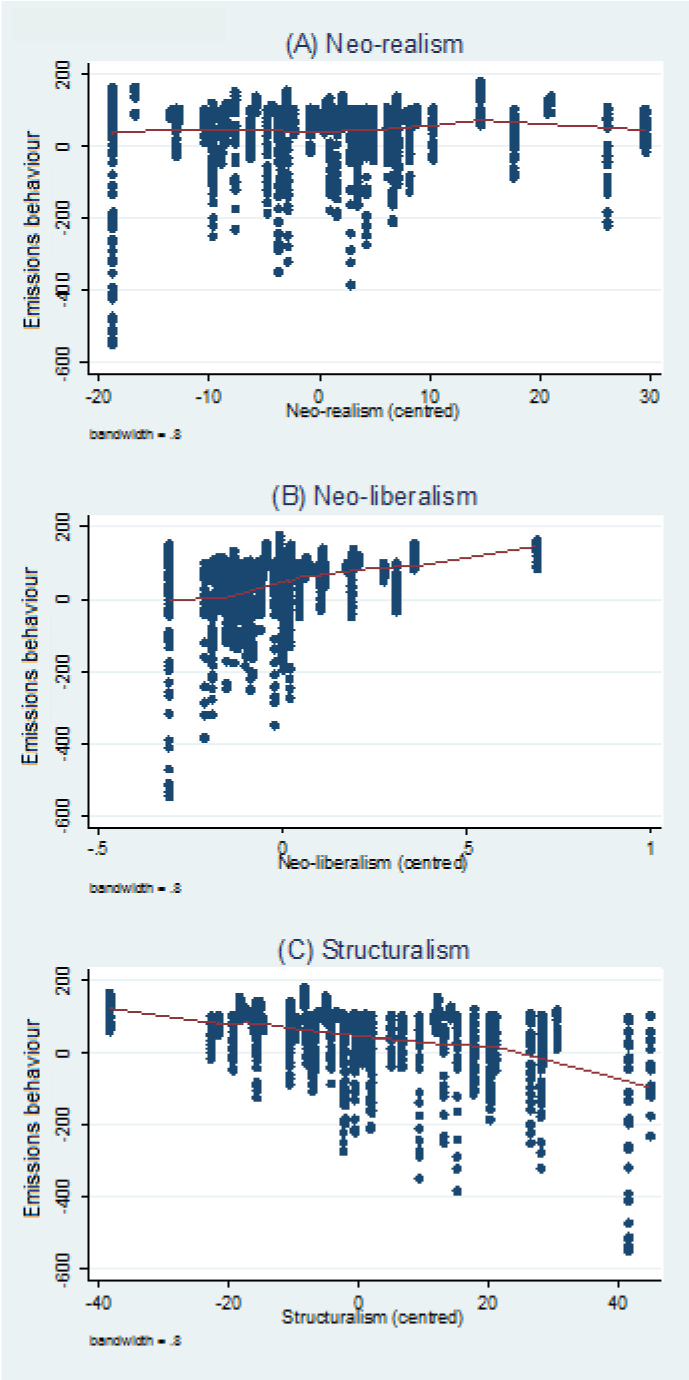

Figure 8.6: Emissions behaviour versus neo-realist, neo-liberal and structuralist worldviews
Note: Each point represents a country-year.

It is difficult to infer from plot A whether belief in neo-realism is positively or negatively correlated with emissions reduction, if at all. The upwards slope of plot B, however, suggests that, on average, high levels of neo-liberalism are associated with more emissions reduction. In stark contrast, the negative slope of plot C suggests the very opposite: that a structuralist mind-set tends to make countries engage in less emissions reduction. Although I am primarily interested in the conditioning effect of worldviews over instrumentalist drivers of emissions behaviour, rather than their direct effects on emissions behaviour, I will check for the interesting possibility that these latter associations are statistically significant after we account for clustering in the multilevel models below.

Approach

In this section, I demonstrate how I employ the methodological approach developed in chapter four to investigate the role of worldviews in conditioning the effects of instrumentalist factors on emissions behaviour. The models fitted in the last three chapters found that six of the total nine variables tested in this thesis are significant drivers of emissions, five of which have significant random effects – namely: relative dependency on fossil fuels, reputational cost, democracy, economic power and export diversity. Since my core aim in this chapter is to explain why relative gains, domestic costs and transnational class interests might have different effects on different countries, I focus solely on the five variables with random effects. I do not examine the interaction between worldviews and the variables that only have significant fixed effects because, in these cases, there is no heterogeneity to explain. I test my claim that worldviews play a role in conditioning the effects of instrumentalist drivers on emissions behaviour by introducing the appropriate interaction term(s) into the random coefficient models from the last three chapters. Table 8.1 illustrates the interaction terms to be tested in each model.

Theoretical approach	Interaction term
Neo-realism	realismXffdep
Neo-liberalism	liberalismXrepcost liberalismXdemocracy
Structuralism	structuralismXeconpower structuralismXexportdiv

Table 8.1: Interaction terms tested in chapter eight.

For each theoretical approach, I begin by running diagnostic tests to ascertain which, if any, of the interactions are significant by introducing the interaction terms together with the corresponding worldview.[183] Interaction terms that are found to be insignificant are omitted from the model. If my worldviews claim is correct, then the interaction terms should have significant fixed effects and reduce the random effect size of the corresponding instrumentalist variable. I also conduct LR tests with the RCM without the interaction effects and equivalent single-level regression to check the goodness of fit of the interaction effect model.

The introduction of a worldview variable and interaction term uses up two additional degrees of freedom. In order to keep within the seven degrees of freedom that are imposed by the sample size of the highest (regional) level of the model, variables that were found to be insignificant in the RCMs in chapters five to seven are omitted from the interaction models in this chapter. Furthermore, in the case of the neo-liberal and structuralist models, which each have two variables with significant

[183] The worldview is also included in the model because both of the 'main effects' (in this case, the worldview and instrumentalist variable) must be included in the model separately when testing for interaction effects (see, for example, Hox 2002; Steele 2002).

random effects, it is not possible to introduce two new interaction terms and a worldview without exceeding the degrees of freedom. Therefore, as a way of overcoming the limitations of the dataset, I run separate models to test whether worldviews are a source of heterogeneity in the significant predictors with random effects. As illustrated in the equations for models 2A, 2B, 3A and 3B below, I fix the effect of the variable that is not (directly at least) involved in the interaction and omit the other interaction term.[184]

Recalling the RCMs from the previous empirical chapters, and omitting the insignificant predictors, the following models are used to test for interaction effects:

Model 1: Neo-realist random coefficient model with realism-ffdep interaction effect

$$EMBEH_{ijk} = \beta_0 + \beta_1 ffdep_{ijk} + u_{1jk} ffdep_{ijk} + \beta_2 ffpower_{ijk} + \beta_3 realism_{jk} + \beta_4 realism_{jk} X ffdep_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$$

$$v_{0k} \sim N(0,\sigma_e^2)$$

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \end{pmatrix} \sim N \quad \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ 0 & \sigma_{u1}^2 \end{pmatrix}$$

$$e_{ijk} \sim N(0,\sigma_e^2)$$

Model 2A: Neo-liberal random coefficient model with liberalism-reputation interaction effect

$$EMBEH_{ijk} = \beta_0 + \beta_1 reputation_{ijk} + u_{1jk} reputation_{ijk} + \beta_2 democracy_{ijk} + \beta_3 liberalism_{jk} + \beta_4 liberalism_{jk} X reputation_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$$

$$v_{0k} \sim N(0,\sigma_e^2)$$

[184] For example, in the neo-liberalist model with the liberalism-democracy interaction (2B), I fix the effect of reputational cost and omit the liberalism-reputational-cost interaction in order to free two degrees of freedom.

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ 0 & \sigma_{u1}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

<u>Model 2B: Neo-liberal random coefficient model with liberalism-democracy interaction effect</u>

$EMBEH_{ijk} = \beta_0 + \beta_1 democracy_{ijk} + u_{1jk} democracy_{ijk} + \beta_2 reputation_{ijk} + \beta_3 liberalism_{jk} + \beta_4 liberalism_{jk} X democracy_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$

$v_{0k} \sim N(0,\sigma_e^2)$

$$\begin{pmatrix} u_{0jk} \\ u_{1jk} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ 0 & \sigma_{u1} \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

<u>Model 3A: Structuralist random coefficient model with structuralism-econpower interaction effect</u>

$EMBEH_{ijk} = \beta_0 + \beta_1 econpower_{ijk} + u_{1jk} econpower_{ijk} + \beta_2 exportdiversity_{ijk} + \beta_3 structuralism_{jk} + \beta_4 structuralism_{jk} X econpower_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$

$v_{0k} \sim N(0,\sigma_e^2)$

$$\begin{pmatrix} u_{0k} \\ u_{1k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ 0 & \sigma_{u1}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

<u>Model 3B: Structuralist random coefficient model with structuralism-exportdiversity interaction effect</u>

$EMBEH_{ijk} = \beta_0 + \beta_1 exportdiversity_{ijk} + u_{1jk} exportdiversity_{ijk} + \beta_2 econpower_{ijk} + \beta_3 structuralism_{jk} + \beta_4 structuralism_{jk} X exportdiversity_{ijk} + v_{0k} + u_{0jk} + e_{ijk}$

$v_{0k} \sim N(0,\sigma_e^2)$

$$\begin{pmatrix} u_{0k} \\ u_{1k} \end{pmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{pmatrix} \sigma_{u0}^2 & \\ 0 & \sigma_{u1}^2 \end{pmatrix}$$

$e_{ijk} \sim N(0,\sigma_e^2)$

Results

1) *Neo-Realist Worldviews*

Model 1: The neo-realism-fossil-fuel-dependency interaction

In chapter five, we established that the effect of fossil fuel dependency on emissions varies significantly between countries. The aim of this model is to assess whether this heterogeneity is (at least partly) attributable to international differences in the level of belief in neo-realism. Specifically, I test my hypothesis that the influence of fossil fuel dependency over emissions behaviour is moderated by (neo-realist) worldviews by introducing the interaction term $realism_{jk}Xffdep_{ijk}$, along with the neo-realist worldview variable.[185] Table 8.2 presents the results of the fixed part of the model.

Parameter	**Coefficient**
Intercept	98.81 (12.16)***
Power	-0.64 (0.09)***
Fossil fuel dependency	3.16 (1.41)*
Realism	-0.12 (0.92)
realismXffdep	-0.15 (0.12)

Table 8.2: Random coefficient model with interaction effect

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

The results indicate that the interaction between realism and fossil fuel dependency is not statistically significant, suggesting that worldviews do not play a role in conditioning the effect of relative gains on emissions reduction.[186] Thus, in this model, I find no evidence in support of my

[185] Reciprocity is omitted from the model in order to keep within the degrees of freedom.

[186] For completeness, the model was also fitted with the interaction variables: $realism_{jk}Xpower_{ijk}$ and $realism_{jk}Xreciprocity_{jk}$. The results (output not shown) confirmed that the interactions were not statistically significant.

worldviews hypothesis - an issue which I return to in the conclusion to this chapter.

2) *Neo-Liberal Worldviews*

In chapter six, I found that reputational costs and democracy influence emissions behaviour differently in different countries. Hence the aim of this chapter is to establish whether neo-liberal worldviews are a source of these heterogeneous effects by introducing the relevant interaction terms. As discussed above, the degrees of freedom of the dataset means that the interactions between liberalism-reputational cost and liberalism-democracy cannot be added simultaneously to the neo-liberal RCM from chapter six. Therefore, they are examined separately in two (more parsimonious) models:

Model 2A: The neo-liberalism-reputational-cost interaction

I test the conditioning effect of neo-liberal worldviews on reputational cost effects by introducing the interaction term $liberalism_{jk}Xreputation_{ijk}$ together with the neo-liberal worldview variable, $liberalism_{jk}$. In order to reduce the degrees of freedom, I omit the variable IEA participation, which was found to be insignificant in the RIM and RCM models in chapter six, and fix the effect of democracy across countries. The fixed part of the diagnostic test is shown in table 8.3.

Parameter	Coefficient
Intercept	47.19 (22.80)*
Reputational cost	-8.91 (3.05)**
Democracy	-1.80 (0.26)***
Liberalism	82.71 (58.13)
LiberalismXrepcost	-17.51 (25.42)

Table 8.3: Diagnostic test for neo-liberalism-reputational-cost interaction
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

The liberalismXrepcost term is not significant. Therefore, the neo-liberal worldview is not a source of heterogeneity in reputational cost effects.

Model 2B: The neo-liberalism-democracy interaction

I test my hypothesis that neo-liberal worldviews condition the influence of democracy over compliance by replacing the liberalism-repcost interaction term with $liberalism_{jk}Xdemocracy_{ijk}$ and retaining the neo-liberal worldview variable. The effects of democracy are allowed to vary between countries and reputational cost effects are held constant. The fixed effect estimates are reported in table 8.4.

Parameter	Coefficient
Intercept	19.15 (27.30)
Reputational cost	-2.16 (0.39)***
Democracy	-2.19 (0.75)**
Liberalism	-356.50 (198.73)
LiberalismXdemocracy	8.48 (3.89)*

Table 8.4: Diagnostic test for neo-liberalism-democracy interaction
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

The results indicate that the interaction between neo-liberalism and democracy is significant at the 0.05 level, which suggests that neo-liberal worldviews do indeed play a role in conditioning the effect of democracy over emissions behaviour.[187] The liberalism-democracy interaction continued to be significant when it was introduced to the neo-liberal RCM in chapter six, which included IEA participation and random reputational cost effects. The results of this model are displayed in table one in the chapter appendix.

As a robustness check, the liberalism-democracy interaction was inserted into a grand model spanning all of the predictors from chapters five to seven as well as the two controls from the emissions trends literature (technology and population). As in model 2B, democracy effects were allowed to vary randomly between countries. The results of the fixed part of the model are shown in table 8.5. Although the sign of the interaction coefficient remains positive, the addition of the other variables renders the term insignificant. As discussed in chapter four, the inclusion of the full set of variables necessarily exceeds the limits of freedom allowed by the model. Therefore, this result is not conclusive evidence that the significant findings in the previous models were due to omitted variable bias. However, the high p-value (p=0.24) of the interaction term in the grand model does indicate that further research needs to be conducted in order to ascertain whether or not the neo-liberal worldview does indeed have its alleged conditioning effect over democracy. Ideally, the same relationship could be tested on a dataset which controlled for the full set of drivers included in the robustness check but without

[187] Although the main effect – democracy – continues to be significant, the interaction effect changes the meaning of the democracy coefficient: in the new model, it now represents the effect of a one-unit increase democracy when liberalism is equal to zero (the average level of neo-liberal worldview across all observations).

exceeding the degrees of freedom (for example, in a three-level model with more regions at the third level). Thus, while the robustness check suggests that we should be cautious of the results, it does not rule out the possibility that the neo-liberal worldview plays its alleged role in climate policy, especially since the interaction term was found to be significant in the previous two models. Therefore, a thorough analysis of the results from model 3A is still worth carrying out.

Parameter	**Coefficient**
Intercept	14.77 (62.08)
Power	-0.46 (0.09)***
Fossil fuel dependency	-0.82 (0.28)**
Reciprocity	-0.73 (0.67)
IEAs	0.53 (0.34)
Reputational costs	-0.46 (0.33)
Democracy	-1.40 (0.49)**
Class	0.58 (0.77)
Economic power	-0.01 (0.00)*
Export diversity	0.03 (0.02)
Liberalism	-89.54 (180.92)
LiberalismXdemocracy	3.22 (2.74)
Technology	2.31 (0.21)***
Population	1.23 (0.29)***

Table 8.5: Robustness test for the liberalism-democracy interaction

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($<p<0.001$)

Thus, returning to model 3A, in order to determine how much heterogeneity is attributable to neo-liberal worldviews, I compare the random effect term of democracy, u_{1jk}, in model 2B with the same term in the equivalent model without the interaction term (and neo-liberal worldview). Table 8.6 displays these results.

Parameter	2B (without interaction)	2B (with interaction)
Fixed effects		
Intercept	26.32 (18.81)	19.15 (27.30)
Reputational cost	-1.86 (0.47)***	-2.16 (0.39)***
Democracy	-1.96 (0.53)***	-2.19 (0.75)**
Liberalism	-	-356.50 (198.73)
LiberalismXdem	-	8.48 (3.89)*
Random effects		
Democracy, u_{1jk}	33.15 (5.20)***	29.95 (6.87)***
Regional variance	490.71 (1082.57)	2270.50 (1835.53)
Country variance	31955.20 (5141.41)***	22849.70 (5246.55)***
Country-year variance	3895.46 (104.90)***	2449.96 (99.91)***
LR statistics		
Likelihood value	-17801.38	-7400.6821
LR_{OLS}	2302.92 (p<0.001)	951.97 (p<0.001)
$LR_{2B(\text{without interaction})}$	-	

Table 8.6: Neo-liberal model with liberalism-democracy interaction
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

The introduction of the interaction term has resulted in a modest decrease in the between-country effect of democracy: the random effect term, u_{1jk}, has dropped by 9.7 percent from 33.15 to 29.95. Thus the neo-liberal worldview accounts for just under a tenth of heterogeneity in democracy effects. Introducing the interaction effect also changes the amount of unexplained variance across the three levels of the model. Regional variance has more than tripled, although neither of the variance terms are statistically significant. Country variance, on the other hand, has declined by 28.5 percent. Country-year variance is also 37 percent lower in the model with the interaction effect. Both country and country-year variances are highly significant at the 0.001 level. The results of the LR tests also confirm that the model with the interaction effect is preferred to the random coefficient model without the interaction and the equivalent single-level regression.

I now examine the interaction effect further by estimating the democracy coefficients that are associated with different levels of neo-liberal worldview. Specifically, I estimate the random democracy effects that are predicted to prevail under the presence of plus and minus one standard deviation of the world mean neo-liberal worldview (0.19). The regression equation for the interaction, excluding all other variables (and the intercept), is:

$$EMBEH_{ijk} = (-2.19+u_{1jk})democracy_{ijk} + -356.5liberalism_{jk} +8.48liberalism_{jk}Xdemocracy_{ijk}$$

Figure 8.7 illustrates the conditioning effect of liberal worldviews on democracy. The results of the RCM in chapter six indicated that more democratic countries (and years within the same country) tend to engage in less emissions reduction. The neo-liberal interaction model in this chapter paints a more nuanced picture of democracy effects: increasing the level of democracy has a less inhibitory effect on emissions reduction when countries are 'strong' believers of the neo-liberal worldview. Conversely, democracy has a stronger inhibitory effect on emissions reduction in countries that do not have a neo-liberal mindset.

Precisely how much belief in neo-liberalism must a country hold in order to be a ‘strong’ believer of the neo-liberal worldview? The critical cut-off point is 0.25 points above the world average belief in the neo-liberal worldview, which is indicated by the red dashed line in figure 8.7. When a country's belief in neo-liberalism exceeds this value, then democratization has a positive effect on emissions reduction. Yet, figure 8.5 indicates that neo-liberal worldviews do not approach this critical value in the vast majority of countries. Thus, by themselves, neo-liberal worldviews are not powerful enough to transform a *very* negative democratization effect into a positive driver of emissions reduction. Nonetheless, even moderate levels of belief in neo-liberal worldviews can provide the critical push that is needed to bring about this transformation in countries that are subjected to moderate negative democracy effects (prior to the interaction).[188] Even when democracy does not have a positive effect on emissions reduction, neo-liberal worldviews make countries more sensitive to the demand for effective climate policy when it is expressed (presumably more freely) in democratic political environments. Although a democratic political environment can be beneficial for domestic mitigation efforts, this expected effect is partly conditional on the existence of sufficient belief in the neo-liberal worldview, which is widely regarded to be conducive to international cooperation.

[188] As illustrated in figure 8.9, this is precisely what happens in the UG and EU.

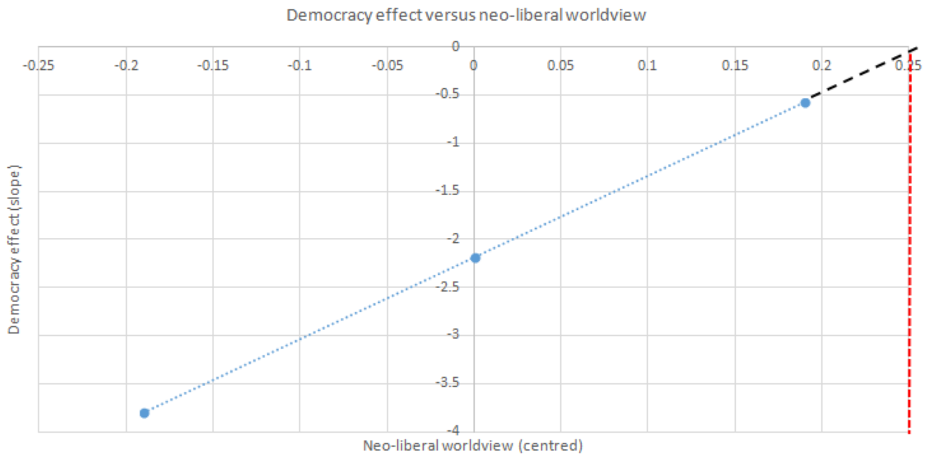

Figure 8.7: The conditioning effect of neo-liberal worldviews on democracy effects over emissions behaviour

The interaction can be translated into emissions behaviour by predicting the relationship between emissions behaviour and democracy under different levels of neo-liberal worldview. To capture the interaction effect across a wide range of democratic contexts, the equation was run over plus and minus one standard deviation mean democracy (19). Table 8.6 displays the predicted emissions behaviour scores for high, medium and low levels of neo-liberal worldview, which are denoted by plus and minus one standard deviation mean neo-liberal worldview (0.19). Once again, the values of the other variables are set to zero to isolate the 'pure' effect of the interaction.

	Neo-liberal worldview		
Democracy	**low**	**medium**	**high**
-19.00	159.11	60.76	-37.59
0.00	86.89	19.15	-48.59
19.00	14.66	-22.46	-59.58

Table 8.7: Predicted emissions behaviour under high, medium and low levels of neo-liberal worldview

The conditioning effect of neo-liberal worldviews on emissions behaviour is represented visually in figure 8.8. The line thickness represents the level of worldview.

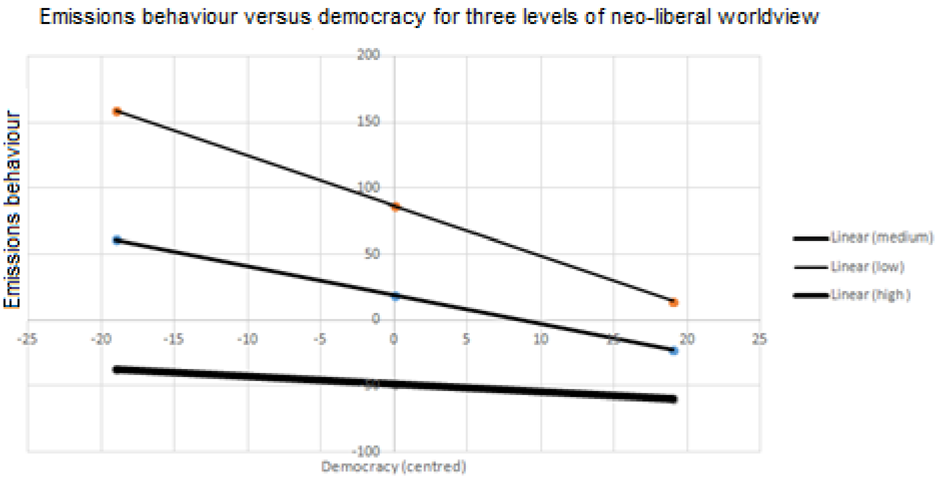

Figure 8.8: The neo-liberalism-democracy interaction effect on emissions behaviour

Moving from low to high neo-liberal worldviews weakens the inhibitory effect of democratization on emissions behaviour, which is represented by the flatter slope of the thick line relative to the thin line. The interaction effect is in accordance with my worldviews hypothesis: neo-liberal countries tend to be more sensitive to environmental demands as the level of democracy increases when compared to countries that do not perceive the world from a neo-liberal perspective.

What does the interaction contribute to our understanding of regional emissions behaviour? To answer this question, I estimate the emissions behaviour of hypothetical countries that process the typical (mean) absolute gains characteristics of each region before and after the interaction. Let us recall from figure 8.5 the mean regional levels of belief in neo-liberalism: The EU, which is closely followed by the EIG, has the highest regional belief in neo-liberalism. Neo-liberal beliefs are lowest in the LDCs and AOSIS states. The regional size of the interaction effect is indicated by the height of the bar.

Figure 8.9 illustrates the conditioning effect of neo-liberal worldviews on the four major geopolitical alliances that dominate the multilateral climate negations – namely: the UG, EU, BASICs and LDCs and AOSIS. Each region has two regression lines: (i) one with the interaction effect (dashed) and (ii) one without it (solid).

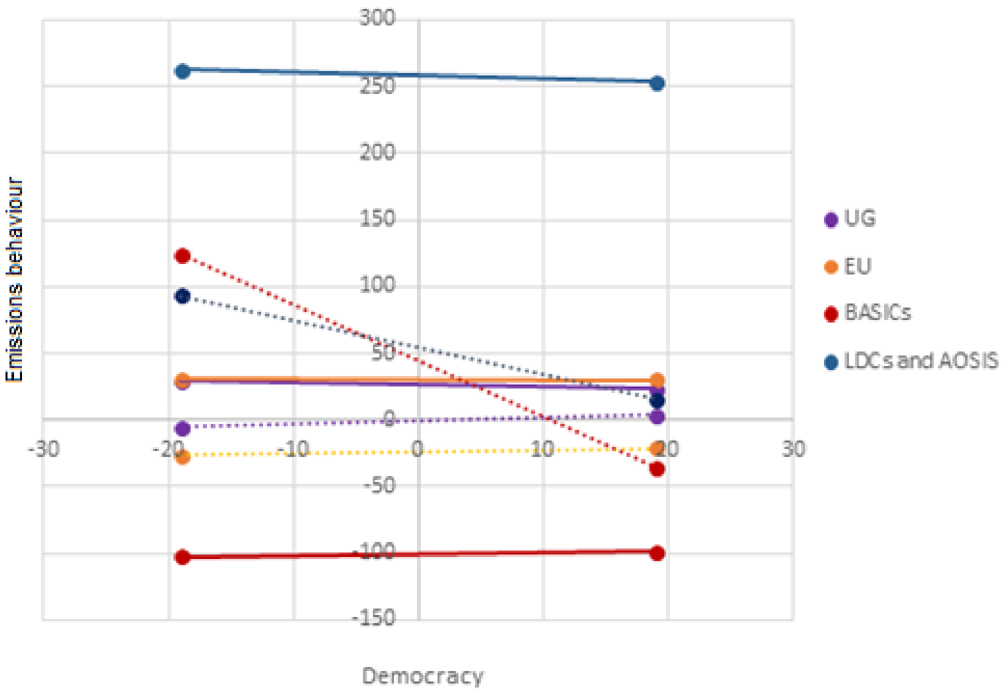

Figure 8.9: Regional emissions behaviour as a function of democracy with interaction effect

Note: the solid lines represent regions without and dashed lines with the interaction effect.

Without the interaction effect, democracy has a weak inhibitory effect on emissions behaviour in the UG and EU, which is indicated by the flat negative slopes of the solid purple and orange lines. The dashed purple and orange lines tell us that after the interaction, democracy goes from having an inhibitory effect to mildly promoting emissions reduction in the North. Figure 8.5 indicated that these regions have the highest level of belief in neo-liberal worldviews. Thus the neo-liberal mind-set plays a critical role in making countries more sensitive to the demand for effective climate policy as the political environmental becomes more democratic. In contrast, the interaction magnifies the negative effect of democracy on emissions behaviour in the BASICs and LDCs and AOSIS, which are represented by the steep red and blue dashed lines respectively. Figure 8.5 told us that, in contradistinction to the EU and UG, the South holds the lowest belief in neo-liberalism. Thus, in accordance with my worldviews hypothesis, belief in neo-liberalism seems to be a critical factor in determining whether democracy has its expected – positive – effect on emissions reduction, or whether governments are less responsive to democratic demands for effective climate policy. Crucially, higher levels of democracy do not always translate into more emissions cuts in countries where belief in the neo-liberal worldview is low. I am not suggesting that neo-liberal worldviews are the sole cause of this transformation: other sources of heterogeneity set the stage by determining how negative (or positive) an effect democracy has on a given country. Yet the simulations in figure 8.9 illustrate that the positive conditioning effect of neo-liberal worldviews plays a critical role by tipping the scale in favour of positive effects in countries where democratization is only weakly inhibitory on emissions reduction. In contrast, the negative democracy effect is intensified in countries where neo-liberal worldviews are low.

3) *Structuralist Worldviews*

In the last chapter, we found that economic power and export diversity have different effects on emissions behaviour in different countries. In this section, I test my hypothesis that the effects of economic power and export diversity are conditioned by structuralist worldviews by setting up two diagnostic models to introduce the two new interaction terms along with the structuralist worldview.

Model 3A: The structuralism-economic-power interaction

In this model, I check whether structuralist worldviews play a role in conditioning the effect of economic power on emissions behaviour by introducing the structuralist worldview along with the structuralismXeconpower interaction term. In order to keep within the degrees of freedom, I fix the effect of export diversity and omit class, which was found to have an insignificant effect on emissions behaviour in chapter seven. Table 8.8 presents the fixed effects of the model.

Parameter	**Coefficient**
Intercept	-3012.42 (1307.41)*
Economic power	-11.87 (4.96)*
Export diversity	-0.12 (0.02)***
Structuralism	-264.35 (74.51)***
StructuralismXeconpower	-1.00 (0.28)***

Table 8.8: Diagnostic test for structuralism-economic-power interaction

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($<p<0.001$)

The results indicate that the interaction between structuralism and economic power is significant at the 0.001 level, suggesting that structuralist worldviews do indeed condition the effect of economic power on emissions behaviour. The interaction continued to be significant when it was incorporated into the structuralist RCM from chapter seven, which included class and random export diversity effects.[189]

As an additional robustness check, the interaction term and structuralism variable were added to a grand model spanning all of the predictors from chapters five to seven as well as the two controls from the emissions trends literature (population and technology). As in model 3A, economic power was allowed to have random within-country effects. The fixed effect results of this model are shown in table 8.9. Strikingly, the interaction between structuralism and economic power continues to be statistically significant at the 0.01 level, indicating that the risk of omitted variable bias is low. In other words, the economic power continues to play a conditioning role over economic power even when all other main putative drivers are held constant.

[189] The results of this model are shown in table two in the chapter appendix.

Parameter	Coefficient
Intercept	-3510.55 (1562.69)*
Power	-0.15 (0.05)**
Fossil fuel dependency	-1.13 (0.18)***
Reciprocity	-0.30 (0.41)
IEAs	0.34 (0.19)
Reputational costs	0.04 (0.19)
Democracy	-0.48 (0.11)***
Class	0.24 (0.40)
Economic power	-13.55 (5.93)*
Export diversity	0.02 (0.02)
Structuralism	-295.19 (87.49)**
StructuralismXeconpower	-1.12 (0.33)**
Technology	1.49 (0.13)***
Population	0.73 (0.18)***

Table 8.9: Robustness test for structuralism-economic-power interaction
Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

The complete results of the smaller model, 3A, are shown in table 8.10 along with the results of the equivalent RCM without structuralism and the interaction term for reference.

Parameter	3A (without interaction)	3A (with interaction)
Fixed effects		
Intercept	-7000.77 (2045.39)**	-3012.42 (1307.41)*
Economic power	-27.02 (7.77)**	-11.87 (4.96)*
Export diversity	-0.07 (0.02)***	-0.12 (0.02)***
Structuralism	-	-264.35 (74.51)***
StructuralismXeconpower	-	-1.00 (0.28)***
Random effects		
Random economic power effect, u_{1jk}	7491.52 (1129.03)***	1310.60 (264.04)***
Regional variance	~0 (~0)	~0 (~0)
Country variance	~0 (~0)	~0 (~0)
Country-year variance	931.02 (27.56)***	553.81 (24.92)***
Likelihood statistics		
Likelihood value	-13399.58	-5464.58
LR_{OLS}	4320.44 (p<0.001)	1742.86 (p<0.001)
$LR_{3A\ WITHOUT\ INT}$	-	15870.00 (p<0.001)

Table 8.10: Structuralist model with structuralism-economic-power interaction

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (<p<0.001)

Modelling the interaction effect causes the economic power random effect, u_{1jk}, to drop from 7491.52 to 1310.6, which is a 82.5 percent decrease in heterogeneity. Clearly, structuralist worldviews play an influential role in conditioning the effect of economic power over emissions behaviour. The variance components have also decreased substantially at all three levels of the model. Regional and country variance is almost completely eradicated, suggesting that the interaction is an important source of variation between regions and between countries within the same region. However, we should not read too much into these changes as the estimates are not statistically significant. This is not the case for country-year variance, which has decreased by 40.5 percent in the interaction model. The LR tests confirm that the model with the interaction effect is a significantly better fit than the RCM without the interaction as well as the equivalent OLS.

To obtain a better understanding of the conditioning effect of structuralist worldviews over economic power, I estimate the economic power coefficients that are associated with plus and minus one standard deviation (18.9) mean structuralist worldview. The negative sign of the interaction coefficient tells us that, holding all other things constant, on average, a one-point increase in structuralist worldview causes the inhibitory effect of economic power on emissions reduction to increase by one point. Since the fixed effect of economic power is negative, structuralism reinforces the main effect.

Figure 8.10 illustrates the conditioning effect of structuralist worldviews on economic power. For countries with above average belief in structuralism, economic power has a stronger constraining effect on emissions reduction. Conversely, in countries that subscribe more to non-structuralist worldviews, economic power promotes emissions reduction. Thus the conditioning effect of structuralist worldviews is substantively significant as it changes the direction of the economic power coefficient: at twelve points below the mean structuralism value, economic power transforms from a positive driver of emissions reduction into an obstacle to mitigation (as indicated by the red dashed line).

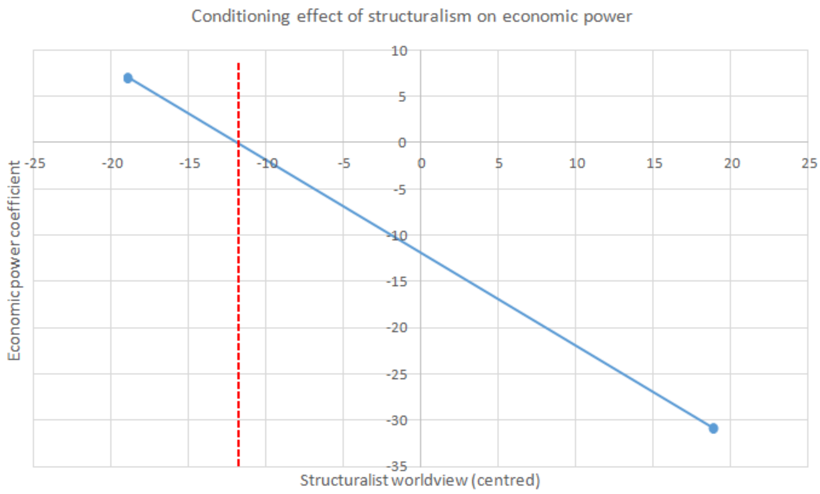

Figure 8.10: The conditioning effect of structuralist worldviews on economic power

To obtain a better understanding of the conditioning effect of structuralist worldviews, we can predict the relationship between emissions behaviour and economic power under different levels of structuralist worldview. The regression equation is:

$EMBEH_{ijk} = -3012.42 + (-11.87+u_{1jk})econpower_{ijk} - 264.35structuralism_{jk} - 1.0structuralismXeconpower_{ijk}$

To capture the interaction effect across a wide range of economic power values, the equation is ran over plus and minus one standard deviation economic power (1110.93). Table 8.11 displays the predicted emissions behaviour levels for high, medium and low levels of structuralist worldview, which is denoted by mean plus and minus one standard deviation (18.9) worldview respectively. Once again, the values of the other predictors are set to zero to isolate the 'pure' effects of the interaction and the random intercepts are omitted to focus on the conditioning effect of the interaction on the influence of economic power over different regions.[190]

Economic power	Structuralist worldview low	medium	high
1086.98	9625.26	-15915.11	-41455.63
-1086.98	-5657.82	9890.27	25438.36

Table 8.11: Predicted emissions behaviour under high, medium and low levels of structuralist worldview

The conditioning effect of structuralist worldviews over emissions is illustrated in figure 8.11. The line thickness represents the level of worldview. Moving from low to high levels of structuralism causes the relationship to transform from positive to negative. In accordance with my worldviews hypothesis, structuralist beliefs increase a country's sensitivity to economic power, magnifying the negative effect that was found in the random intercept and coefficient models without the interaction in chapter seven. As discussed in the last chapter, although the negative sign of the economic power coefficient contradicts my second – capacity – hypothesis, the finding of this chapter is not incompatible with the broader structuralist approach: the steep (negative) slope of the thick black line tells us that a structuralist mind-set increases a country's sensitivity to the goal of economic growth at the expense of climate protection.

[190] Consequently, the predicted emissions levels in table 8.9 and figures 8.11 and 8.12 are very different from the projections of the complete model (with all structuralist variables and random intercepts). Predicted emissions behaviour levels from the complete model (including all of the omitted variables and random intercepts) are within the expected range of values.

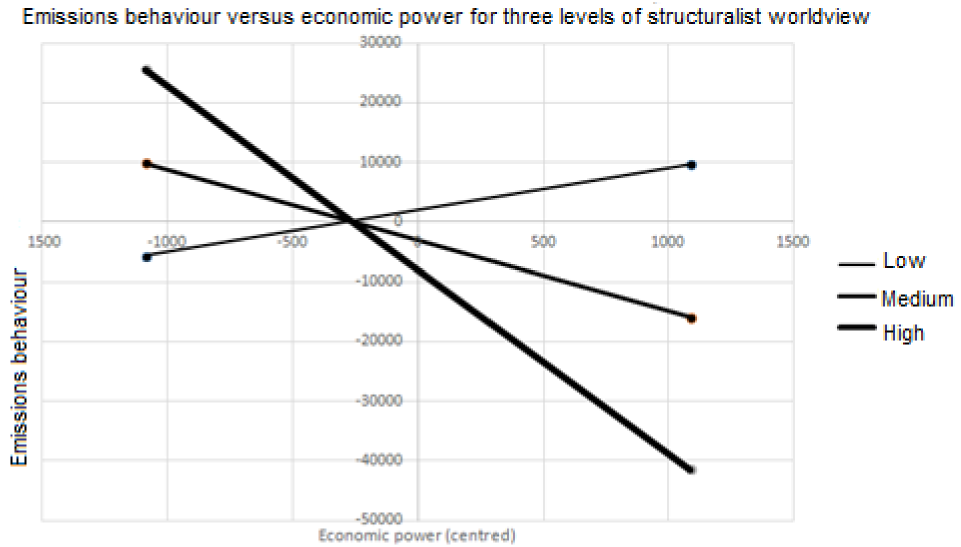

Figure 8.11: The structuralism-economic power interaction effect on emissions behaviour

What does the interaction contribute to our understanding of regional emissions trends? To answer this question, I estimate the emissions behaviour of hypothetical countries that possess the typical (mean) class-based characteristics of each region before and after the interaction. Recall from figure 8.5 that, on average, LDCs and AOSIS states have the highest belief in structuralism while EU and UG countries are the least structuralist. The size and direction of the average interaction effect on each region is indicated by the height and sign of the bar. Figure 8.12 illustrates the conditioning effect of structuralist worldviews on the four major geopolitical alliances in the multilateral climate negotiations – the EU, US, BASICs and LDCs and AOSIS. As in the neo-liberalism-democracy simulation, each region has two regression lines: (i) one with the interaction effect (dashed); and (ii) one without it (solid).

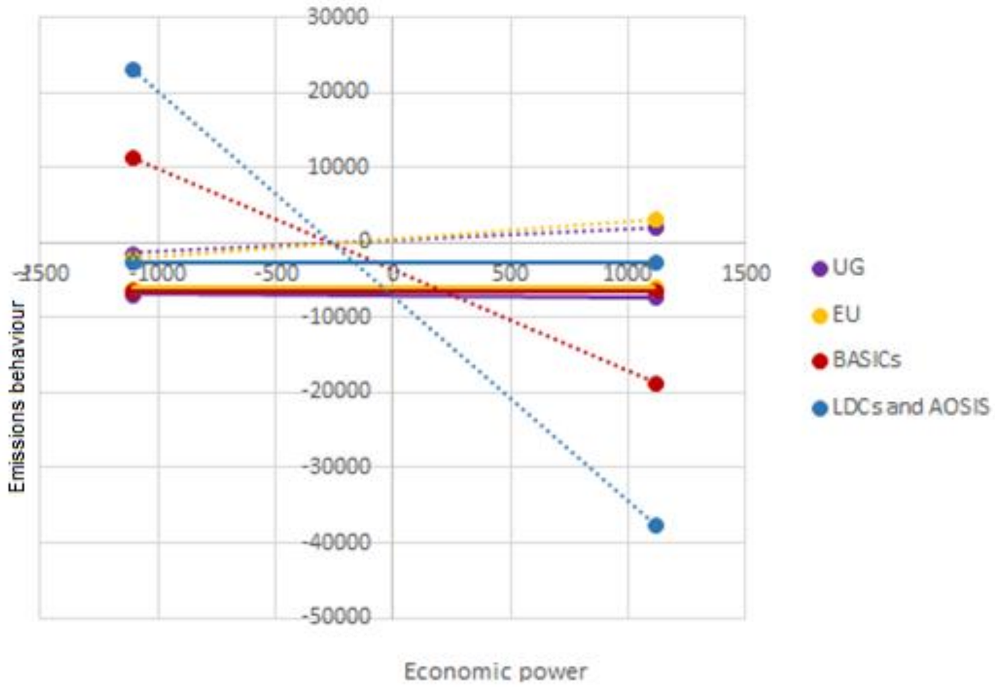

Figure 8.12: Regional emissions behaviour as a function of economic power with the structuralist interaction effect

Throughout the world, structuralist worldviews moderate the effect of economic power on emissions behaviour. We know from figure 8.10 that whenever the level of belief in structuralism is more than twelve points below the world average, the interaction will increase the inhibitory effect of economic power on emissions behaviour. This is the case for all regions except for the EU and UG.[191] Therefore, in the six remaining regions (some which do not have a predominantly structuralist worldview), belief in structuralism is sufficient enough to increase countries' sensitivity to economic goals at the expense of environmental protection. The (approximately) flat slopes of the solid lines in figure 8.12 tell us that, without the interaction, economic power has a negligible effect on compliance in all four regions. In the first two regions, the level of belief

[191] This was illustrated in figure 8.5. Specifically, EU belief in structuralism is -15.02 and UG -14.08.

in structuralism falls below the critical (minus twelve points below the world average) cut-off point that facilitates the worldview to increase the inhibitory effect of economic power on emissions reduction. Therefore, after the interaction, EU (orange) and UG (purple) lines tilt upwards, indicating that economic power has a positive effect on emissions policy. In contrast, belief in structuralism in the South is sufficiently high to transform economic power into a hindrance to mitigation. This is clearly indicated by the steep negative slope of the dashed burgundy and blue lines, which represent the association between emissions behaviour and economic power after the interaction in the BASICs and LDCs and AOSIS. The steep slope of the dashed blue line indicates that the interaction effect is more striking in the latter region, which has the highest regional belief in structuralism. Overall, the regional simulations lend support to my claim that structuralist beliefs increase the (inhibitory) influence of class-based factors over emissions behaviour. Apparently, a structuralist mind-set encourages the prioritization of economic development over environmental protection, thus masking the enhanced capacity for mitigation which is created by economic development.

Conclusion

The aim of this chapter was to ascertain whether worldviews play a role in conditioning the effect of instrumentalist factors over emissions behaviour. Drawing on the theoretical approach that I developed in chapter three, I expected to find that the influence of relative gains, domestic cost-benefit ratios and transnational class interests over emissions reduction is correlated with countries' beliefs in neo-realist, neo-liberal or structuralist worldviews respectively. Although the results are not in accordance with all of the hypotheses that were proposed at the start of this chapter, the findings do offer some support for my claim. As expected, neo-liberal and structuralist worldviews were found to play a role in conditioning the effects of domestic cost-benefit ratios and transnational class interests over emissions trends. However, I found no evidence that neo-realist worldviews are a source of heterogeneity in relative gains effects.

In chapter five, we saw that fossil fuel dependency is the only relative gains indicator (out of the three analysed in this thesis) that was found to have significantly different effects on emissions trends across countries. The results of the first model in this chapter found no evidence that the effect of fossil fuel dependency over emissions behaviour is shaped by a country's subscription to the neo-realist worldview, thereby rejecting my first hypothesis.

Yet my second and third hypotheses fared better than the first. In chapter six, we saw that the effects of reputational effects and democracy over compliance vary significantly between countries. In this chapter, I found that the neo-liberal worldview accounts for some of the heterogeneity in democracy effects, but not reputational cost effects. In order to appreciate the nature of the significant interaction effect, we need to recall from chapter six that higher levels of democracy tend to be associated with less emissions reduction. The results of model 2B indicate that increasing levels of democracy cause countries with 'strong' beliefs in the neo-liberal worldview to adopt more stringent emissions cuts. Yet the vast majority of countries are not strong believers, therefore, neo-liberal beliefs are not usually sufficient to transform very negative democracy effects into positives. Nonetheless, where democratization is not strongly inhibitory on emissions reduction, above average belief in the neo-liberal worldview is usually sufficient to provide the critical push that is needed to transform (mildly) negative democracy effects into positive drivers of mitigation. Apparently, then, a neo-liberal mind-set counteracts whatever force is behind the negative emissions-reduction-democracy association and makes neo-liberal countries more sensitive to environmentalist demands for a safe climate. When it comes to the question of which countries have enough belief in the neo-liberal worldview for democratization to promote compliance, only the Northern regions (namely: the EU, UG and EIG) pass the mark. In the rest of the world, the neo-liberal mind-set is substantially weaker, causing democratisation to have an inhibitory effect on emissions reduction. Hence this finding suggests that the widely held expectation that democracy promotes effective climate policy is at least partly contingent on ideational factors, which have largely been ignored by the mainstream explanations of emissions trends.[192]

In the last chapter, we found that economic power and export diversity have significantly different effects on emissions trends in different

[192] See, for example, Burnell and Bernauer 2009; Farzin and Bond 2006; Battig and Bernauer 2009).

countries. The results of the third set of models indicate that structuralist worldviews play a critical role in conditioning the influence of economic power over emissions reduction, but do not have any effect on the influence of export diversity. In chapter seven we found that countries tend to engage in less emissions reduction as they develop economically. The interaction model fitted in this chapter tells us that the structuralist mind-set makes countries even more sensitive to the dictates of economic development at the expense of the environment, which usually translates into emissions increases rather than reductions. Unlike the neo-liberal-democracy interaction, the structuralist worldview is powerful enough to transform a strongly positive economic power effect into an obstacle to emissions reduction. When a country's belief in structuralism is high enough, then the interaction intensifies the inhibitory effect of economic power on emissions reduction. In other words, a structuralist mind-set makes countries afford more weight to economic development in climate policy. However, when structuralist beliefs fall below this critical value, the interaction transforms economic growth from an obstacle into a facilitator of emissions reduction. Apparently, then, countries that do not have a structuralist mind-set are better at reconciling economic growth with environmental protection. However, the regional simulations in figure 8.12 suggest that this is usually not the case. According to figure 8.5, the structuralist worldview is distributed widely enough to cause economic power to have a negative effect on emissions behaviour in most regions (namely: the MIDCs, CACAM, BASICs, OPEC, EIG and LDCs and AOSIS). Strikingly, not all of these regions are traditionally affiliated with the South. Nor do they hold predominantly structuralist worldviews. Yet even in its diluted form, the structuralist worldview is a powerful agent; it causes economic power to inhibit, rather than promote, emissions reduction. This finding is also of relevance to the mainstream literature on emissions trends. Specifically, this chapter provides novel evidence that the environmental Kuznets curve for emissions trends that was detected in the last chapter is partly due to policymakers' worldviews, suggesting that cognitive factors might play an important role in shaping the environmental Kuznets curve for emissions trends.[193] In comparison to the liberalism-democracy interaction, this finding is stronger as the robustness check indicates that it is likely to remain valid even when the other putative drivers are accounted for.

The results of the interaction models fitted in this chapter provide some support for my worldviews-based approach. However, as noted in the results section, the heterogeneity of most drivers with significant random effects remains unaccounted for (namely: fossil fuel dependency, reputational cost and export diversity). Of course, it could be that, contrary to my theoretical approach, heterogeneity is caused by instrumentalist factors rather than worldviews. Indeed, I proposed such explanations in the relevant empirical chapters: the positive effect of fossil fuel dependency on emissions trends could be due to the marginal gains to be had from transitioning to more efficient activity. Similarly, the

[193] Of course, this research does not shed light on where these worldviews come from. As Parks and Roberts (2008) point out, it might be that structuralist worldviews originate from the global economy, thereby shifting the locus of explanation (back) to material factors.

positive association between emissions behaviour and reputational cost might be evidence that the structuralists are right to contend that economic activity is the driving force behind climate politics. Also adding credit to structuralist explanations, the tendency for countries with diverse export sectors to engage in less emissions reduction could be due to structuralist barriers which drive business interests to oppose effective climate policy. Whatever the sources of heterogeneity might be, they can only be ascertained through further research.

There is also the puzzling question of why neo-realist worldviews do not appear to have any effect on the way that instrumentalist factors influence emissions behaviour, while neo-liberal and structuralist worldviews do. 'Neo-realist exceptionality' might reflect a problem with my operationalisation of the neo-realist worldview. Out of the three theoretical approaches, neo-realists are the least likely to express their true intentions in public discourse. For example, a neo-realist country might abstain from the climate regime due to relative gains concerns, but frame these concerns in neo-liberal or structuralist language in order to legitimise its compliance behaviour to onlookers. Presumably, non-compliance is easier to justify to an international audience when it is driven by unviable domestic mitigation costs or climate justice rather than the desire to gain at the expense of others. Hidden neo-realists would have a bearing on the significance of the worldview interactions in this chapter. Nonetheless, as discussed in chapter four, inferring worldviews from national newspapers, which presumably provide a relatively open platform for expressing true intentions towards the climate problem, should have minimised this risk.

What is the policy relevance of these findings? One can identify at least three key implications: First, the apparent independence of the influence of relative gains over emissions trends from neo-realist worldviews suggests that perhaps there is an inherent truth in the ‘timeless wisdom’ of neo-realism. Neo-realism deals with existential matters of security, power and survival. Thus it is consistent with this approach that relative gains tend to have universal effects. Chapter five found that relative power inhibits emissions reduction across the world. Similarly, fossil fuel dependency usually promotes emissions reduction, so long as the marginal gains associated with transitioning to more efficient carbon technology outweigh the costs associated with emissions reduction. Crucially, the influence of relative power and fossil fuel dependency are not affected by how much (or less) a country subscribes to neo-realism. Thus, even though neo-realist worldviews may not be a source of heterogeneity, relative gains are nonetheless influential drivers of emissions behaviour, which means that policymakers need to address them when thinking about which strategies to employ to promote effective climate policy.

Second, the neo-liberal model tells us that increasing the level of democracy tends to make countries more attentive to emissions reduction when the country holds a neo-liberal mind-set. Thus, in order for democratization to promote international emissions regulation, it is important that it is accompanied by the spread of neo-liberal ideas (in the international worldview sense of the term). Moreover, democratising reforms in non-neo-liberal countries tend to have the undesired effect of inhibiting emissions reduction.

Third, if structuralism makes countries more sensitive to economic development and averse to mitigation, then policymakers should look to the South's perspective of the world to understand developing countries' scepticism towards international environmental governance rather than relative gains or cost-benefit calculations.[194] Yet the policy ramifications of structuralism do not end in the South: this chapter finds that the structuralist mind-set also permeates the most advanced economies, which structuralists have typically associated with the core. For example, even in the EIG and CACAM, structuralist beliefs transform economic power from a positive driver of emissions reduction into an impediment. Regardless of where one is in the world, structuralist beliefs cause a rebalancing of priorities and policy goals, tipping the scale in favour of economic development (usually) at the expense of environmental protection. The bad news is that countries in most regions of the world (except for the EU and UG) are likely to become more reluctant to reduce emissions as they gain economic power, at least until science can find a way to offset the economic costs of climate policy. Until then, the biggest

[194] Parks and Roberts' (2008,2010) have long argued that the main source of South scepticism towards international environmental treaties is the impoverished position from which it sees the world.

impediment to climate governance seems to be deeply engrained in the minds of policymakers rather than the economy.

Clearly, worldviews do not account for everything. They do not explain, for example, the heterogeneous effects of fossil fuel dependency, reputational cost and export diversity on emissions behaviour. But they do explain why democratization and economic development are more likely to succeed at boosting emissions reduction in some countries and fail in others. These two strategies are amongst the leading strategies that have been initiated to ensure that states comply with their international mitigation commitments. Thus, if nothing else, the findings of this chapter suggest that policymakers need to afford equal, if not more, attention to the ideational message that accompanies these strategies because they are more likely to succeed when policymakers in the host country are on the same wavelength as the ones doing the prescribing.

Chapter Nine: Conclusion

Introduction

I started this thesis seeking to understand why states (and IR scholars) have been unable to wage an effective international response against climate change, which ultimately lies on the willingness of individual countries to undertake significant domestic emissions reductions. My primary focus has been on elucidating why some countries undertake domestic emissions reductions while others do not, as well as why, out of those countries that do regulate domestic emissions, some do so more than others. After identifying the significant instrumentalist drivers behind emissions behaviour, I went beyond mainstream explanations by determining whether and, if so, how the effects of relative gains, domestic mitigation costs and transnational class interests on emissions trends vary between different countries and regions and whether this variation is attributable to conflicting worldviews. My most substantive findings are as follows:

(i) Relative gains, domestic mitigation costs and transnational class interests are indeed significant drivers of emissions trends;
(ii) We cannot (always) generalise about the effects of these drivers as they frequently vary between countries and, indirectly, regions;
(iii) At least some of the time, theoretical worldviews play a critical role in determining the effect that an instrumentalist driver has on the emissions behaviour of a given country.

These points comprise the core focus of this concluding chapter, which consists of three parts. I begin by working through each of the preceding points, discussing how I arrived at them while drawing out the main empirical findings from chapters five to eight. In the second section, I assess the robustness of these findings with respect to endogeneity, construct validity and omitted variable bias. First, I consider the risk that endogeneity poses to each of the main findings with reference to the research design (particularly the operationalisation strategy) developed in chapter four. Second, I reflect on the quality of the dependent and independent variables in terms of construct validity. Third, I check for the possibility of omitted variable bias by ascertaining whether the findings continue to be statistically and substantively significant when they are incorporated into the same model. To do this, I set up a 'grand' RIM which incorporates the five most influential drivers that were identified in the thesis. As well as serving as a robustness check, this model also provides a simple way for assessing the relative influence and, therefore, explanatory power, of the causal variables that are posited by the leading approaches in the field. I also discuss how these findings mesh with the results of the robustness checks that were conducted on the random coefficient models in the preceding chapters. The third section concludes by discussing the contributions of the thesis to the literature and policy relevance.

Substantive Findings

What are the significant drivers behind emissions behaviour?

The results of the RCMs in chapters five to seven found that six out of the nine leading explanations that flow from the neo-realist, neo-liberal and structuralist worldviews are significant drivers of emissions after we account for country and regional clustering - namely: relative power, relative dependency on fossil fuels, reputational cost, democracy, economic power and export diversity.[195] Table 9.1 summarises the results of these models, with significant variables indicated by asterisks.

Worldview	Variable	Result	Significant random effect?
Neo-realism	Relative power	-0.50 (0.06)***	No
	Fossil fuel dependency	5.26 (1.15)***	Yes
	Reciprocity	-0.25 (0.15)	No
Neo-liberalism	IEA participation	0.11 (0.20)	No
	Reputational cost	-11.28 (4.99)*	Yes
	Democracy	-1.62 (0.45)***	Yes
Structuralism	Class	0.10 (0.14)	No
	Economic power	-25.98 (7.87)**	Yes
	Export diversity	-0.91 (0.42)*	Yes

Table 9.1: Results of the random coefficient models from chapters five to seven.
Note: Coefficient entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

How do these findings mesh with the hypotheses that flow from the ideal worldviews proposed in chapter three and the leading explanations of emissions trends reviewed in chapter two? For the variables that were either insignificant or significant without random effects,[196] the answer to

[195] A variable that was found to have a significant random effect without a significant fixed effect would also be a significant driver of emissions behaviour as this would indicate that the effect varies too much for the grand mean effect across all observations to be regarded as significant. However, in this thesis, all of the drivers with significant random effects also had significant fixed effects.
[196] 'Fixed' effects refer to the average effect of a variable across all observations, irrespective of the country or region to which they belong. In this respect, fixed effects are similar to the coefficients that are usually estimated from single-level regression. A significant fixed effect implies that the effect of the variable on all observations is close to the typical (fixed) effect. In the context of this thesis, a 'random' effect refers to the average effect of a given predictor on the observations that are taken from the same country. A significant random effect implies that the effect of the variable varies significantly between different countries. In such cases, the typical effect is equal to the sum of the average fixed effect across all observations and the random effect in a given country.

this question is relatively straightforward. In relation to the former scenario, as with the interpretation of a single-level model, a variable that was found to have *both* an insignificant fixed and insignificant random effect provided strong evidence that the corresponding variable does not affect emissions behaviour. Table 9.1 indicates that this was the case for one hypothesis from each of the leading approaches in the field: For neo-realism, the promise that Annex parties to the KP have binding emissions targets under the climate regime is not enough to convince non-Annex parties to undertake more emissions reduction than their Annex counterparts. Conversely, the prospect that non-Annex parties are not bound by reciprocal commitments does not appear to deter Annex parties from undertaking more stringent emissions cuts.[197] Thus the results of the neo-realist models in chapter five contradict the frequently made claim that opposition to emissions caps is attributable to the lack of reciprocal mitigation commitments under the climate regime (see, for example, Vezirgiannidou 2008; Purdon 2013 and Tuck and Habib 2014). While going against the neo-realism claim, however, these results do lend credit to the mainstream argument that international climate law can create effective incentives for emissions regulation (e.g., Bodansky 2011,2012; Depledge 2005; von Stein 2008).

Similarly, one of the hypotheses flowing from the neo-liberal worldview also appears to be mistaken: According to the results of the multilevel neo-liberal models fitted in chapter six, a state's emissions behaviour

[197] This is after controlling for relative power and fossil fuel dependency, so we can rule out the possibility that reciprocity concerns had their predicted effects but were masked by other relative gains concerns.

appears to be unaffected by its participation in other international environmental agreements, which runs against the contractualist neo-liberal hypothesis proposed in chapter three (see, for example, Depledge (2005), Paterson and Newell (2010), Victor and Keohane (2010) and Wijen and Ansari (2007). This finding does not necessarily contradict the international environmental agreements hypothesis that was associated with political explanations of emissions trends in chapter two as the latter emphasises the role of institutions like the climate regime in establishing binding legal commitments for emissions regulation (such as emissions targets under the KP) rather than the effect of participation in broader institutional settings to promote behaviour that is more internationally responsible (such as emissions reduction).

In relation to the structuralist worldview, the binary attribute of belonging – or not belonging – to the transnational core does not have a bearing on a country's emissions behaviour. Thus the results of chapter seven contradict the frequently made claim that national attitudes towards the contentious issue of emissions reduction are primarily shaped by transnational class status (see, for example, Mwandosya (2000), Betsill et al. (2006), Parks and Roberts (2006,2007,2008,2010), Mejia (2010), Prum (2010) and Bohm et al. (2012)).

Only one of the variables tested in this study - relative power - was found to have a significant fixed effect without a significant random component. According to the results of the neo-realist RCM, *all* countries tend to engage in less emissions reduction as they become more powerful. The same pattern is also valid spatially: powerful countries are generally less willing to reduce emissions than weaker countries. The negative correlation between emissions behaviour and relative power is in accordance with the neo-realist claim that powerful states digress more from 1990 emissions levels because they stand to gain less (in relative terms) from international mitigation as they have the means to unilaterally defend themselves against climate change.[198] To my knowledge, this is the first attempt to quantitatively test the relative power explanation of emissions behaviour, which has hitherto only been defended qualitatively (see, for example, Swain (1996), Busby (2005), Pumphrey (2008) and Tuck and Habib (2014)). If we consider that our proxy for relative power, the CINC index, encompasses a range of the drivers that are emphaissed by the leading explanations of emissions trends, the chapter findings also offer some support for the claims that: population size (e.g., Fan et al. 2006; Dietz and Rosa 1997; Dalton et al. 2008) and relative invulnerability to climate change (e.g., Brody et al. 2008 and Zahran et al. 2008). (which are both elements of state power) inhibit emissions reduction. Conversely, since our power proxy encompasses a measure of economic strength, the detection of a negative power effect contradicts the dominant assertion of the environmental Kuznets literature that more advanced economies (which are presumably more powerful) should be more willing to reduce emissions (e.g., Stern 2004; Andreoni and

[198] The neo-realist model controls for the fact that powerful countries tend to be Annex members, therefore, this is a ceteris paribus claim that more powerful countries tend to engage in less emissions reduction than weaker countries within the same Annex category.

Levinson 2001; Friedl and Getzner 2003; Grossman 1995; Beck and Joshi 2015).

When is it wrong to generalise?

The effects of the other significant variables, however, are more complicated. Fundamentally, the size and, at times, direction of the effect of fossil fuel dependency, reputational cost, democracy, economic power and export diversity on emissions behaviour varies across countries. For example, as I discuss below, while rising reputational costs tend to be associated with less emissions reduction in countries that command a small share of global emissions, they are positively correlated with larger emissions cuts in the largest polluters. Thus, contrary to most quantitative studies in the field which are based on single-level regression,[199] it is not possible to infer universal conclusions about the typical effect (size and direction) of these factors on emissions behaviour. Indeed, as discussed in chapter two, this point has repeatedly been made by more recent works in the field (e.g., Beck and Joshi 2015; Farzin and Bond 2006; Orubi and Omotor 2007; Sharma 2011; Sulemana et al. 2016). My thesis has taken advantage of the powerful tools that multilevel modelling provides for determining whether the effect of a variable varies significantly between different countries and if so, whether there are any patterns between these effects and the distribution of the variable across countries.

[199] For example, Dolsak (2001); Parks and Roberts (2008); von Stein (2008), Battig and Bernauer (2009) and Bernauer and Bohmelt (2013).

Figure 9.1 recalls the statistical associations between random country-level effects and the significant variables from the RCMs in chapters five to seven. Plot A represents random fossil fuel effects as a function of fossil fuel dependency, which was one of our proxies for relative gains in the neo-realist model. The positive values indicate that when fossil fuel dependency is low, increasing dependency on fossil fuels has an unexpected positive effect on emissions reduction. In chapter five, I suggested one possible explanation for this finding - countries with low carbon dependency are better equipped to cut emissions because the majority of the population does not depend on carbon intensive activity. For these countries, the marginal gains to be had from transitioning to carbon efficient activity outweigh the domestic costs of emissions cuts relative to other states. In contrast, increasing fossil fuel dependency in countries that are highly dependent on fossil fuels inhibits emissions reduction, which is represented by the negative slope values that fall below the x-axis. Thus the results of the neo-realist model suggest that relative gains concerns only kick in when the costs of emissions reduction are above a critical value. This finding also adds to the literature by developing a more nuanced understanding of the conditions under which fossil fuel dependency explanations (such as those posited by Yohe (2001), Sunstein (2009), Parker and Karlsson (2010) and Luderer et al. (2012)) are likely to hold. In doing so, it is of direct relevance to the environmental Kuznets curve literature: if fossil fuel dependency is indicative of the carbon input mix, then chapter seven provides a strong indication that increasing the carbon content of the input mix of an economy is only likely to have its expected – inhibitory – effect on emissions reduction if the carbon input mix is already high.[200] In other cases, where the input mix is not carbon-intensive to begin with, then an increase in carbon activity is likely to increase the marginal gains associated with emissions reduction and thus have the unexpected effect of increasing the compatibility with mitigation.

[200] This kind of relationship is predicted by Stern (2004) and Frield and Getzner (2003).

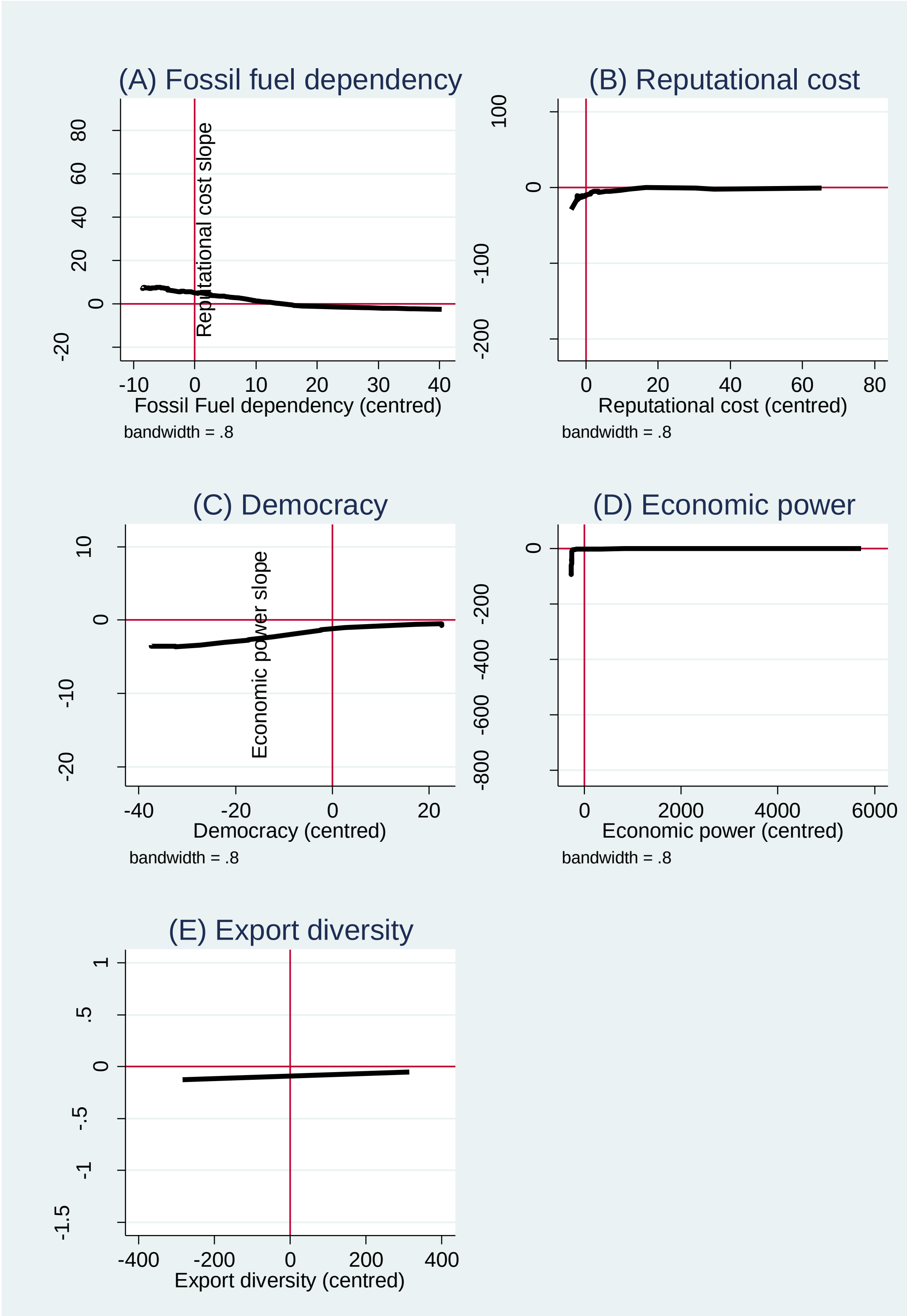

Figure 9.1: Random effects as a function of emissions drivers

Plots B and C refer to the neo-liberal hypothesis that emissions behaviour is dictated by the domestic costs (and benefits) of emissions reduction.

Plot B tells us that a higher reputational cost of inaction is associated with (and presumably helps drive) effective emissions policy from the world's largest polluters. Although only a handful of countries fall under this category, they collectively command over 40 percent of global emissions, suggesting that reputational costs do have their expected - positive - effect on emissions behaviour where they matter the most. In all other countries, which are individually only responsible for a small share of global emissions, rising reputational costs are inversely related with emissions reduction. As discussed in chapter six, this could be due to the free-rider problem (small polluters do not have a major impact on global emissions levels), which lends credit to the neo-realist hegemonic stability theory where the powerful determine the prospects for international cooperation. Another explanation, which is compatible with neo-liberalism, is that increasing emissions in countries that are only responsible for a small share of global emissions does not entail the same kind of reputational cost as it does for the largest polluters. This would not contradict the claim that rising reputational costs are positively correlated with emissions reduction, rather; it would suggest that a country's share of global emissions is not a good indicator of reputational costs across the whole scale. Either way, the correlation between the effect of reputational cost on emissions behaviour and a country's share of global emissions offers a more nuanced understanding of the role of the capacity to determine the effectiveness of international governance in shaping emissions behaviour. Furthermore, since our proxy for reputational cost (a country’s global share of CO2 emissions) is also an indicator of economic activity, the finding also speaks to the EKC literature (e.g., Andreoni and Levinson 2001; Stern 2004; Friedl and Getzner 2013; Galeotti 2007; Beck and Joshi 2015). By providing evidence that growth in economic activity has a negative effect on emissions reduction in smaller economies and a positive effect in larger economies, the results of the random coefficient model support the existence of a turning point in the effect of economic development on CO2 emissions, which is characteristic of the EKC relationship.

Plot C tells us that, on average, increasing the level of democracy always has a negative effect on emissions reduction regardless of how democratic or authoritarian a country is to begin with. This finding contradicts the frequently made claim that democracies are better providers of public environmental goods (e.g. Aerni 2005; Vogel 2005; Neumayer 2002) as well as previous quantitative work on the influence of democracy over commitment to emissions targets under the climate regime (e.g. von Stein (2008), Battig and Bernauer (2009) and Bernauer and Bohmelt (2013)).[201] While there is no way of inferring the reason behind this unexpected finding from the results of this thesis alone, one plausible explanation is that non-democratic leaders, who generally remain in office for longer, have more expectation of being in power at the time that the benefits of emissions reduction begin to bear fruit. Another explanation may be that the least democratic countries are concentrated in the OPEC region, which is also the most dependent on

[201] All of the cited works in the latter category rely on single-level regression, suggesting vulnerability to cluster-confounding.

fossil fuel incomes. Therefore, even if there are more opportunities to express environmental concerns, publics in these countries will be more averse to emissions reduction than their 'democratic' counterparts who live in less resource-dependent states. More democratic countries tend to have flatter democracy slopes, suggesting that the inhibitory effect is weaker. In other words, democratic governments seem to be less able to block out pressures from environmental lobbies and public demand for climate goods than their non-democratic counterparts. The inverse correlation between the effect of democratization over emissions reduction and level of democracy in a country lends some support to the frequently made claim that democracies are more responsive to the demand for environmental public goods.

Plots D and E illustrate the statistical associations between the effect of transnational class interests and distribution of those interests across countries. Plot D tells us that economic growth inhibits emissions reduction in weak economies, but has the expected - positive - effect of promoting effective climate policy in strong economies. As discussed in chapter seven, economic growth increases the demand for fossil fuels, thus making it harder to curb emissions. Apparently, in weaker economies, these pressures are simply too strong to resist as, despite the increased capacity for emissions reduction created by economic growth, economic prerogatives trump environmental concerns. Stronger economies do not face the same type of pressure for rapid industrialisation and growth. In these countries, increased economic performance translates into more emissions reduction and emissions reduction. The results of the structuralist models fitted in chapter seven suggest that the logic of economic power-capacity only kicks in after a certain level of economic development has been attained, once again supporting the existence of a turning point in the emissions impact of economic growth. Paradoxically, then, I find evidence of a different kind of economic-power capacity relationship: in the poorest countries, economic circumstances are so dire and the need for economic growth so great that increasing (economic) mitigation capacity is not sufficient to boost emissions reduction. This finding provides quantitative support for the popular structuralist argument that compliance with the climate regime is obstructed by the chronic underdevelopment of the South (e.g. Roberts et al. (2004), Betsill et al. (2006) and Parks and Roberts (2006,2007,2010) as well as the EKC hypothesis. Since our proxy for economic power (GDP) measures the size of the economy, the finding offers direct support for the economies of scale hypothesis, which asserts that it is easier to enforce emissions regulations at higher levels of economic activity (e.g., Galeotti et al. 2006; Andreoni and Levinson 2001; Stern 2004).

Plot E falls below the y-axis, which indicates that, contrary to structuralist expectations, the diversification of the export sector tends to inhibit emissions reduction. This finding also contradicts Roberts et al.'s (2004) quantitative investigation of the effect of export diversification on international environmental cooperation. A methodological explanation for this discrepancy is that Robert et al.'s study relies on single-level regression whereas my model accounts for country and regional clustering. If we leave aside the methodological explanation, another way of interpreting this unexpected finding is that countries with more diversified export sectors also tend to host stronger business actors, which have more capacity to mobilise and influence government policy on climate change (Falkner 2010). Of course, this is not to suggest that all business actors are against emissions reduction, but countries which are disproportionately dependent on the export of a narrow resource base are structurally resistant to mitigation. Thus, the results of the structuralist model suggest that the capacity of business interests to influence government policy is more influential than the (economic) capacity of countries to reduce emissions. Nonetheless, the (slight) decline in the inhibitory effect of export diversification on emissions reduction that occur as we move from less to more diversified (and presumably advanced) economies is consistent with the EKC hypothesis that economic development eventually gives way to more effective environmental outcomes as countries transition from high to low carbon output mixes (Friedl and Getzner 2003; Stern 2004).

As a concluding note for this section, it is worth recalling that all of the aforementioned variables with random effects continued to exhibit significant country-level random effects when they were incorporated into a grand model that included the full set of predictors from the neo-realist, neo-liberal and structuralist chapters as well as the two controls from the emissions literature (population and technology). Furthermore, the regional simulations that were derived from these robustness models were also consistent with the simulations obtained from the smaller models, indicating that the distribution of country-level random effects are as they appear in figure 9.1. The results of these robustness exercises indicate that all of the inferences relating to random effects are unlikely to be affected by omitted variable bias.

Why do the effects of fossil fuel dependency, reputational cost, democracy, economic power and export diversity on emissions behaviour vary across countries?

In chapter three, I suggested that countries' theoretical worldviews play a critical role in determining the level of influence that instrumentalist drivers have over emissions behaviour. Specifically, I argued that relative gains, domestic mitigation costs and transnational class interests could only influence a country's emissions behaviour if its policymakers subscribed to the theoretical belief that the alleged causal variable matters in world politics more broadly. Chapter eight tested this claim empirically. The results indicate that worldviews do indeed play a role in shaping the (direction and size of the) effect of (some) domestic mitigation costs and transnational class interests on emissions behaviour. The random coefficient models with interaction effects in the last chapter found that the interaction between liberalism and democracy and structuralism and economic power account for some of the variation in predictor effects between countries. In both cases, increasing a country's belief in the worldview was associated with higher sensitivity to the corresponding driver in accordance with the relevant theoretical hypothesis: Countries that hold a neo-liberal worldview are likely to be more responsive to the demand for effective climate policy when it is expressed in a more democratic environment, which is in accordance with neo-liberal intuition. To put things into perspective, we can recall that once we accounted for worldviews, democracy went from obstructing to promoting emissions reduction in the UG and EU, which, on average, are the strongest believers in neo-liberalism.[202] However, this finding needs to be evaluated with a degree of caution as the interaction term ceased to be statistically significant once it was incorporated into a grand model spanning the full set of control variables, indicating a potential for omitted variable bias.

Similarly, although economic growth unexpectedly inhibits emissions reduction in weak economies, the interaction suggests that the structuralist worldview is the main source of this inhibitory effect: Countries that subscribe to the structuralist worldview give more importance to economic development (vis-a-vis environmental protection) and are, therefore, less likely to restrict emissions as they grow economically. Conversely, non-structuralist countries, which do not perceive the same trade-off between the economy and environment, are not inhibited by economic growth from reducing emissions. Although the inhibitory effect of economic growth contradicts the structuralist economic-capacity hypothesis, which was tested in chapter seven, the prioritisation of the economy over the environment is in accordance with

[202] This was discussed under figure 8.9 in chapter eight.

broader structuralist theorising, which prioritises the economy above everything else. What was unexpected, however, was the finding that structuralist beliefs are sufficiently popular to transform economic growth into an obstacle to emissions reduction throughout the world, not just in the poorest regions, which are traditionally affiliated with the structuralist standpoint.[203] Unlike the liberalism-democracy interaction, the interaction between structuralism and economic power continued to be statistically significant once it was incorporated into a grand model with the full set of controls, suggesting the finding is robust to omitted variable bias.

Thus, in the last chapter, I found some evidence to support my claim that worldviews play a critical role in conditioning the effect of instrumentalist drivers over emissions behaviour. The simulations at the end of chapters eight demonstrated that belief in neo-liberal or structuralist worldviews can be a critical facilitating condition in determining whether a driver has its expected effect on regional emissions behaviour. Yet neo-realist worldviews were not found to have any conditioning effect on relative gains.[204] Furthermore, worldviews did not have this conditioning effect on three of the five drivers that were found to have significant random effects. As discussed above, the empirical analyses revealed that relative dependency on fossil fuels, reputational cost and export diversity have different effects on emissions behaviour in different countries. These

[203] This is discussed under figure 8.12 in chapter eight.
[204] In the last chapter, I discussed possible reasons that could be behind neo-realist ‘exceptionality’.

effects are not attributable to worldviews. Thus they remain unaccounted for and present opportunities for future research in the field.

Robustness Checks: Endogeneity, Omitted Variable Bias and Construct Validity

Following the advice of King et al. (1994:87-89), this section evaluates how robust this dissertation's most important findings are to three fundamental sources of bias – endogeneity, omitted variables and construct validity.

Endogeneity

In the context of this research, endogeneity could arise if I incorrectly inferred that relative gains, domestic costs, transnational class interests or worldviews drive emissions behaviour, when in fact, the causal relationship is in the oppose direction and emissions behaviour shapes the alleged drivers. For some independent variables, the risk of endogeneity is negligible. For example, a country's relative power or level of democracy are sufficiently independent from its emissions behaviour to reasonably rule out the possibility of reverse causation. Yet, as discussed below, this is not the case for all of the independent variables (not least worldviews) that were analysed in this thesis. In this section, I evaluate the risk of endogeneity in relation to each of the variables that were found to be significant drivers of emissions behaviour.

Relative Power

In accordance with the neo-realist approach, the Composite Index of National Capabilities (CINC) index was consulted to operationalise a state's relative power in the international system. As discussed in chapter four, the CINC index measures countries' relative power levels according to iron and steel production, military expenditure, military personnel, primary energy consumption, total population and urban population. These components are not likely to be influenced by a country's emissions behaviour, thereby reducing the risk of endogeneity. For example, while population growth may increase the demand for emissions activity, changes in emissions levels have no direct bearing on demographic trends.

Fossil fuel dependency

Causal inferences about fossil fuel dependency are more vulnerable to endogeneity than relative power. On the one hand, large emissions cuts are likely to reduce the contribution of fossil fuels to national income, thus creating the possibility for an inverse causal relationship between emissions behaviour and fossil fuel dependency. On the other hand, this possibility is at least partly counterbalanced by the fact that a country's dependency on fossil fuels relative to other countries is shaped by longstanding structural factors (e.g. endowment of natural resources, colonial experience, investment in capital) which are temporally prior to, and therefore independent from, a country's emissions behaviour. How likely is the endogeneity risk in light of the findings of the neo-realist models in chapter five? Although this possibility certainly cannot be ruled out, as noted above, endogeneity is likely to generate an inverse relationship between fossil fuel dependency and emissions behaviour. The neo-realist model found that the relationship is in the opposite - positive - direction. Thus even if endogeneity is occurring, it is small relative to the positive effect of relative gains on emissions behaviour that was uncovered in chapter five.

Reputational Cost

Admittedly, a country's share of global greenhouse gas emissions is an imperfect measure of the reputational costs that it faces from not undertaking effective action against climate change. Neo-liberal intuition predicts that countries which face higher reputational costs should be more likely to reduce emissions than those that face lower costs. The potential for endogeneity in this process looms high: increasing emissions levels also increase a country's share of global emissions, alongside the reputational costs that accompany emissions. Yet this concern is somewhat alleviated if we consider that a country's share of global emissions is only negligibly affected by its attempt to return to its 1990 emissions levels: as proponents of the historical responsibility perspective frequently point out, a country's share of global emissions (as well as its emissions levels in a previous year) is the result of years of economic development and industrialisation. These longstanding emissions trends are certainly not going to be wiped out by a small decline in emissions activity (although they can be reduced). Thus a country's relative share of global emissions and reputational costs is temporally prior to and also larger in magnitude than the 1990 baseline target, thereby alleviating some of the potential for endogeneity.

Does the risk of endogeneity appear to have materialised in light of the results of the neo-liberal model? The results of chapter six indicate that reputational costs are negatively correlated with emissions reduction, which is in the opposite direction to the endogenous relationship. Thus, once again, if endogeneity does exist, it appears to have been masked by countervailing forces.

Democracy

The act of meeting international commitments might make a country more democratic, if, for example, those commitments relate to human rights or political freedoms (Dai 2013). Yet there are no obvious pathways for emissions behaviour to influence a country's political culture, which means that we can effectively rule out the risk of endogeneity in relation the democracy findings from chapter six.

Economic Power

Out of all the causal inferences made by this thesis, those relating to economic power are the most vulnerable to endogeneity. According to the structuralist approach as well as the EKC hypotheses, economically powerful countries should engage in more emissions reduction as they have greatest mitigative capacity. Yet causality can also operate in the reverse direction. Climate ethics and global justice scholars frequently contend that imposing emissions caps on industrialising countries amounts to pulling up the development ladder, thus denying the poorest countries their right to development. Thus, in contrast to the capacity-hypothesis tested in chapter seven, the endogenous relationship predicts an inverse relationship. The results of the structuralist multilevel models in chapter seven found that economic power and emissions behaviour are inversely correlated. As suggested in chapter seven, this finding could indeed be attributable to the increased demand for emissions behaviour which accompanies economic growth. Yet it could also be a symptom of endogeneity bias. An investigation of GDP levels five to ten years after countries with high emissions reductions meet their emissions targets could help determine the validity of the endogenous relationship.

Export Diversity

Structuralist intuition and the EKC literature suggests that export diversification increases countries' mitigative capacities, thus promoting emissions reduction. If causality operates in the opposite direction, such that emissions behaviour influences export diversification, countries that engage in more emissions reduction should become less dependent on the export of unprocessed goods which are typically more fossil fuel intensive, also manifesting as a positive correlation. The findings in chapter seven provide evidence of an inverse relationship, which is contrary to both the expected structuralist and endogenous relationship. Thus if endogenous processes are occurring, they are likely to be small relative to the forces which bring about the inverse relationship.

Worldviews

Unlike the other explanatory variables, worldviews are not envisaged to have a direct impact on emissions behaviour. Instead, I tested my claim that worldviews condition the influence of instrumentalist drivers on emissions reduction by determining whether the interaction between a worldview and interactionist driver is correlated with emissions behaviour. Thus, the risk of endogeneity for each interaction term reflects the endogeneity risk of the composite variables that comprise the interaction term - namely: the worldview and the instrumentalist driver. On the worldview side of equation, it is possible that public discourse on climate change, which is the source that was used to infer countries' worldviews, is merely a tool for governments to legitimise climate policy - either before the emissions behaviour is committed or retrospectively. As discussed in chapter four, the vulnerability of discourse to political manipulation is a common concern for most content analysts who work with public discourse. Nonetheless, it is unlikely that emissions behaviour influences worldviews for two main reasons. First, emissions behaviour and worldviews operate on different temporal scales: the former varies annually whereas the latter is a country-level variable which takes the mean across all country-years pertaining to a given country. As I elaborated in chapter three, worldviews are the result of longstanding, deeply engrained ideas which have gradually emerged and evolved over a considerable period of time. They consist of fundamental positive and normative beliefs about the international system, which are broader than the climate issue. Presumably, the structuralist nature of worldviews makes them resilient to change, not least in response to annual fluctuations in emissions behaviour. Second, inferring worldviews from national newspapers somewhat alleviates the concern that public discourse is manipulated by policymakers to justify their emissions policy.

As discussed in chapter four, domestic newspaper articles provide a forum for interested parties to openly debate their positions towards climate policy - including perspectives that are not supportive of the government.

The second component of the interaction term is the instrumentalist driver. In the last chapter, we saw that only two of the interaction terms were significant drivers of emissions behaviour - neo-liberalismXdemocracy and structuralismXeconomic power. Building on the above discussion, it is reasonable to expect that the first interaction term is relatively immune to endogeneity given that emissions behaviour does not have a direct influence on democracy. However, the potential for endogeneity in the economic power-emissions relationship suggests that that the second interaction term is relatively more vulnerable to endogeneity bias.

Omitted Variable Bias

In this section, I check whether the main variables that were found to be significant drivers of emissions behaviour in chapters five to seven continue to be significant when we account for other significant drivers that are posited by different theoretical approaches. Ideally, I would check for robustness by collecting all of the significant drivers, together with their random effects, into the same RCM. However, as in the last chapter, the degrees of freedom of the model prevents me from building such a sophisticated model. Instead, a more feasible option in the context of this thesis is to build a grand RIM which incorporates the five most influential drivers from the preceding empirical chapters.[205] The coefficients in table 9.1 indicate that the drivers with significant random effects - namely: fossil fuel dependency, reputational cost, democracy, economic power and export diversity - also have the largest effect sizes in the RIMs. Hence the equation for grand RIM spanning the three theoretical approaches is:

$$EMBEH_{ijk} = \beta_0 + \beta_1 ffdep_{ijk} + \beta_2 repcost_{ijk} + \beta_3 dem_{jk} + \beta_4 econpower_{jk} + \beta_5 exportdiv_{jk} + v_{0k} + u_{0jk} + e_{ijk}$$

$$v_{0k} \sim N(0,\sigma_v^2)$$
$$u_{0jk} \sim N(0,\sigma_u^2)$$
$$e_{ijk} \sim N(0,\sigma_e^2)$$

Table 9.2 displays the results of the grand RIM alongside the results from the RCMs in chapters five to seven for reference.

Coefficient	**RCMs**	**Grand RIM**
Intercept	-	65.90 (26.33)*
Fossil fuel dependency	5.26 (1.15)***	-0.10 (0.23)
Reputational cost	-11.28 (4.99)*	-1.27 (0.49)**
Democracy	-1.62 (0.45)***	-1.85 (0.20)***
Economic power	-25.98 (7.87)**	-0.01 (0.00)**
Export diversity	-0.91 (0.42)*	-0.13 (0.03)***

Table 9.2: Results of the grand random intercept model including the five most influential drivers of emissions behaviour

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.
* significant at 5% ($p<0.05$); ** significant at 1% ($p<0.01$); *** significant at 0.1% ($p<0.001$)

Four of the drivers continue to be statistically significant after we account for the most influential variables that are posited by the other theoretical

[205] With the two random intercept components (u_{0jk} and v_{0k}), adding the five fixed effects brings the degrees of freedom to seven, the maximum number permitted by the third (regional) level of the model.

approaches, with reputational cost and export diversity becoming more significant in the new model. In contrast, fossil fuel dependency is no longer significant, suggesting that the finding from chapter five is spurious. Nonetheless, it is reassuring that all of the significant drivers continue to operate in the same direction as in the RCMs: increasing the level of reputational cost, democracy, economic power or export diversity has an inhibitory effect on emissions behaviour.

However, the magnitudes of the coefficients do differ substantially from the RCMs. Democracy becomes a more influential obstacle to compliance, which reinforces the negative democracy finding from chapter six. In contrast, the effect sizes of the remaining three drivers decrease from the RCMs, thus suggesting evidence of at least some omitted variable bias. Reputational cost and export diversity exert around a tenth of their previous effects, while the effect of economic power on emissions behaviour is almost completely eradicated. The last result is particularly concerning as it suggests that the very strong inhibitory effect of economic power on emissions that was found in chapter seven is attributable to confounding with other variables that are proposed by neo-realist or neo-liberal approaches. Once we account for relative gains and domestic mitigation costs, economic power only has a negligible effect on emissions behaviour. Given the significant degree of heterogeneity in economic power effects, it might be that economic power is a more influential driver of emissions behaviour than the fixed effect suggests. For example, if economic power had strong positive effects in half of the countries and strong negative effects in the other half, then the 'average' effects which is represented by the fixed effect coefficient would be seriously misleading. Moreover, this is not unlikely when we recall that this is the case for all of the variables with significant random effects - not least economic power, which was found to exhibit the most heterogeneous effects out of all the predictors. Without setting up a grand RCM, it is difficult to validate this claim. However, the robustness checks in chapters five to seven do lend support to the notion that all five predictors that were found to have significant random effects continued to exhibit these effects once they were included in a grand model spanning the full set of control variables, albeit one that exceeded the degrees of freedom.

Lastly, on the basis of the grand RIM, it is reasonable to conclude that neo-liberal explanations fare the best. Out of the three approaches, reputational cost and democracy have the largest effect sizes, thus suggesting that they are the most influential drivers of emissions behaviour. At the other end of the spectrum, fossil fuel dependency fails to retain its statistical significance once we account for domestic mitigation costs and transnational class interests. Therefore, neo-realist approaches can be regarded as the weakest. Although economic power exhibits a sharp drop in effect size, both of the structuralist variables continue to be statistically significant and operate in the same - inhibitory - direction as in the RCM in chapter seven. In terms of robustness, these explanations thus sit somewhere in-between neo-liberal and neo-realist approaches.

Construct Validity

In this section, I reflect on the construct validity of the dependent and independent variables. Hence my core focus is to ascertain whether each variable measures what it is supposed to measure. Adcock and Collier's (2001) frequently cited *Measurement Validity: A Shared Standard for Qualitative and Quantitative Research* provides a useful framework for the discussion. According to the authors, choices are made about which aspect(s) of the theoretical literature to focus on and how to measure these 'systematised concepts' of interest. The former type of concern, which relates to conceptualisation and theory-building, was addressed extensively in chapters two to three and resulted in four broad categories of systematised concept - namely: relative gains, domestic cost-benefit ratios, transnational class interests and worldviews. These concepts were subsequently broken down into twelve variables in the operationaliation section of chapter four - namely: relative power, fossil fuel dependency, reciprocity, participation international environmental agreements, reputational cost, regime type, transnational class, economic power, export diversity and neo-realist, neo-liberal and structuralist worldviews.[206] In this section, I seek to evaluate whether each variable produces scores that can reasonably be regarded to adequately capture the core meaning of the concept which is allegedly being measured. I base my conclusions on three criteria; first, does the variable capture the core of the concept which it supposedly measures, or does it exclude important aspects of the concept? This discussion is

[206] These are obviously in addition to the dependent variable, emissions behaviour, which measures the concept of emissions reduction.

related to content validity, but, nonetheless, also comprises an important source of construct validity as the choice of proxy has an important bearing on how well (or poorly) the variable measures the concept. Second, is the variable valid across different contexts? This is especially important in the context of this thesis because the data under investigation span a vast spatial and temporal domain. Moreover, the diversity of the individual years, countries and regions analysed could mean that the scores assigned to the variable do not have equivalent conceptual meanings in different contexts. Third, drawing on Adcock and Collier's (2001:542) '*Assume the Theory, Evaluate the Measure'* (AHEM) suggestion, I evaluate whether construct validity is likely to have been compromised in light of the empirical findings of the thesis. Specifically, I ascertain whether unexpected results are more likely to be due to poor construct validity rather than inconclusive hypotheses. Hence the remainder of this section evaluates each dependent and independent variable in relation to these three criteria.

The dependent variable fares well in relation to the first two criteria. There is quite a strong consensus in the literature that CO2 emissions trends are the most important outcome of climate policy and also a good indicator of compatibility with mitigation. Furthermore, as discussed in chapter four, by operationalising emissions behaviour as emissions reduction relative to the 1990 baseline year rather than working with raw emissions data, the variable controls for various factors that could have a bearing on emissions, thereby capturing more adequately countries' efforts to reduce domestic emissions, which is the phenomenon under investigation. Moreover, comparing countries' emissions behaviours relative to their individual carbon trajectories in the past rather than analysing raw emissions values allows variable scores to be compared across countries. If the former approach was taken, it would not be possible to judge whether a change in emissions levels comprised a small or major development in a given country. Since the thesis does not make any predictions about which countries or regions would exhibit the highest emissions reductions, the AHEM criterion does not apply to emissions behaviour.

I now move onto consider the construct validity of the independent variables. Three variables were proposed to serve as proxies for each of the strategic responses that were derived from the ideal worldviews proposed in chapter three. The neo-realist approach envisages relative gains as the driving force behind emissions behaviour, which was conceptualised as relative physical power, fossil fuel dependency and reciprocity. The Composite Index of National Capabilities (CINC) index was used to operationalise the first concept. Moreover, the six elements of the CINC index (namely: a country's annual levels of iron and steel production, military expenditure, military personnel, primary energy consumption, total population and urban population) overlap closely with the neo-realist understanding of power, which defines the concept in physical material terms (e.g. Morgenthau 1948 and Waltz 1979). Since these elements are concrete and relatively easily measurable, CINC scores have equivalent meanings across different countries and regions. The findings in chapter five were also in accordance with the neo-realist hypothesis that relative power tends to make countries engage in less emissions reduction. Therefore, relative physical power fares well in relation to all three criteria of construct validity.

Fossil fuel dependency is the second variable that was used to measure the relative gains that a country is likely to associate with emissions behaviour. The variable was measured by calculating the percentage of a country's GDP that comes from the production or export of fossil fuels. The importance of different sectors of the economy is often determined by comparing their relative shares of national income. Therefore, the variable is a relatively uncontroversial way of capturing the level of dependency on fossil fuels. Fossil fuel dependency was calculated as a proportion of national economic activity instead of using raw scores, which ensured that the variable was able to capture equivalent scores across countries and regions.[207] The third criteria is potentially more problematic: the fixed effect of the random coefficient model in chapter five shows that, on average, increasing fossil fuel dependency is associated with higher levels of emissions reduction, which runs against the theoretical expectations of the neo-realist worldview. However, the random effects predicted by the same model demonstrate that fossil fuel dependency has heterogeneous effects on different countries (and potentially regions). Moreover, the regional simulations in the chapter indicate that the expected inhibitory effect of fossil fuel dependency on

[207] For example, if raw fossil fuel incomes were used, then the same score could have very different connotations in different countries depending on the overall size of the economy: score x would denote a higher level of dependency in a small economy than in a large economy.

emissions reduction does materialise in regions which are already highly dependent on fossil fuel incomes (namely in OPEC and CACAM). These findings cohere with the relative gains and structuralist arguments, which assert that increasing the share of fossil fuel income will also increase the marginal gains associated with emissions cuts, thereby preventing emissions reduction in regions which do not have a long-term (structural) dependency on fossil fuels. The compatibility of these findings with existing explanations in the literature suggest that the unexpected positive sign of the fixed effect of fossil fuel dependency probably points to the need for more nuanced hypotheses rather than a problem with construct validity.

The third relative gains variable is a binary indicator that indicates whether or not the country has the assurance that countries in the opposite annex listing have reciprocal mitigation commitments under the climate regime. The variable is a straightforward way of capturing the presence or absence of reciprocity. Furthermore, the scoring system has a consistent meaning across countries as all references are made to the same international climate treaty – the KP. Although the chapter findings indicate that the presence or absence of reciprocal mitigation commitments does not have a statistically significant effect on emissions behaviour, the sign of the reciprocity coefficient was in the unexpected direction as core countries were found to engage in more emissions reduction. Rather than reflecting a problem with the variable, however, the unexpected result is more likely to indicate that the reciprocal gains hypothesis does not hold. Indeed, most other quantitative work in the field has found that annex parties tend to engage in more emissions reduction than their non-annex counterparts, despite the absence of reciprocal commitments. Furthermore, the positive correlation between Kyoto targets and emissions reduction does lend support to the mainstream hypothesis that international institutions wield influence over the behaviour of their members.

Three more variables were created to measure the neo-liberal response to climate change – the maximisation of domestic benefits associated with emissions behaviour. International environmental agreements (IEAs) recoded the number of international environmental agreements that were signed and ratified (after deducing double points for withdrawals) by a country. The variable captures state participation in a wide range of IEAs spanning different issue-areas, levels of institutionalisation, time frames and geographical areas, which gets to the core of the concept under scrutiny. However, by assigning equal points for participation and withdrawals irrespective of a country's type and level of responsibilities under the IEA in question is somewhat simplistic and thus raises problems of equivalency between recorded scores. For example, a country that participated in a limited number of IEAs but made significant financial contributions and adopted effective environmental policies could arguably be regarded as a more active participant than a country that ratified many environmental treaties without undertaking many significant commitments. Unfortunately, these important nuances are missed by the variable and could therefore jeopardise its construct validity. Although found to be statistically insignificant, participation in IEAs had the expected positive effect on emissions behaviour.

GDP levels were also used to measure the reputational costs associated with emissions reduction, such that larger economies should face higher reputational costs (and less incentives to free-ride) from inaction. In hindsight, GDP is not an adequate measure of the concept as countries' level of sensitivity to social sanctioning is partly the result of political culture, media censorship, accountability and other forms of public scrutiny. This is especially important in the context of some of the largest polluters such as China, which may be somewhat immune to reputational effects due to the closed nature of the political regime. Furthermore, even without these intervening factors, there is a serious concern that the variable may not be valid in countries that have minimal cumulative complicity in causing climate change. As discussed in chapter six, GDP may be a poor indicator of reputational cost for rapidly emerging economies such as India, Brazil and China because, as structuralists and Southern policymakers often point out, these countries exhibit high emissions levels today because they are attempting to catch-up with Northern standards of industrialisation. Moving to the third criterion, although the negative sign of the fixed effect is in the unexpected direction, the random effects associated with the RCM in chapter six are in accordance with the reputational cost hypothesis as well as the environmental Kuznets curve literature. According to the chapter results, reputational costs (or economic growth) are estimated to have a positive effect on emissions reduction in the largest polluters (the US and China).

Although the results can be reconciled with the existing literature, the exclusion of important indicators of reputational cost as well as the equivalency problem give reason to doubt the construct validity of the variable. Instead, it seems more plausible that the variable provides an alternative measure of economic activity, which seems more likely when we consider that the neo-liberal RCM yields similar results to the economic power and export diversity findings in chapter seven.

The third indicator of domestic costs and benefits is democracy, which was coded using the seven-point Freedom House freedom index. Spanning several elements of political rights and freedoms, the index is a reputable data source for numerous quantitative studies on democracy related matters. However, there is room to doubt the equivalency of the democracy scores across different contexts. Specifically, an increase in democracy levels in a democratic country suggests that a country is becoming more democratic. In contrast, an increase in democracy scores in an authoritarian state would indicate democratization. This distinction is important as the results of the neo-liberal RCM show that an increase in democracy levels has a stronger inhibitory effect on emissions reduction in authoritarian countries than democracies. While the negative sign of the fixed effect contradicts the hypothesis that democracy should promote effective climate policy, the results of the RCM do offer some support for the positive democracy argument as increasing democracy levels does have its predicted effect when democracy levels are high enough to begin with. Moreover, the unexpected result is unlikely to be caused by construct invalidity as other quantitative investigations of emissions reduction have found similar results of negative democracy effects on emissions reduction (e.g., Battig and Bernauer 2009).

Three further variables were used as proxies for transnational class interests. The first of these, class status, is a binary indicator that records a country's delineation as a member of the global core or periphery in Dunn et al.'s (2000) world map of countries. Since this categorisation is based on a comprehensive investigation of trade indicators, it captures the core meaning of the structuralist definition of class. Furthermore, it is reasonable to assume that the two possible scores of the variable has the same meaning in all contexts as class status is defined in relation to the same reference point – one's position in the global economy. Although the structuralist RCM shows that class status is not a statistically significant driver of emissions behaviour, the positive sign of the coefficient is in conformity with the structuralist hypothesis that core countries are likely to be engage in more emissions reduction than periphery states, further suggesting that the variable is a valid indicator of transnational class interest.

Economic power is the second proxy for transnational class interests, and is operationalised as a country's GDP. On the one hand, GDP values provide a good indication of the size of the national economy and, therefore, level of influence of the country over world markets. These attributes comprise central components of the economic power concept as it is conceptualised in structuralist theory. On the other hand, as highlighted by the various explanations associated with the EKC approach, economic power is a multifaceted concept that is also shaped by other factors such as the level of technology, living standards and input and output mixes in an economy. Thus a large economy scarce in technology, low living standards and high carbon input and output mixes would presumably wield less power than a large economy with advanced technology, high living standards and low carbon input and output mixes. These nuances are obviously not detected by the variable. Nonetheless, GDP does get at the heart economic power by measuring the level of influence that a country has over international trade, which, as illustrated by Dunn et al.'s approach, is the definitive element of the concept. Once again, the reference point is the level of influence in the international system, which suggests that economic power scores have the equivalent meaning in different contexts. This is especially likely because structuralists envisage a country's (economic) power to be derived from its position in the global economy rather than other factors such as its political alliances and physical capabilities. When it comes to the AHEM idea, the fixed effect results of the relevant RCM indicate that economic power generally inhibits emissions reduction. This negative association contradicts the structuralist hypothesis that stronger economies have the means and will to implement effective climate policy. However, an examination of the random effects and average regional effects of economic power suggests that the result is consistent with the EKC literature. In accordance with this well-established approach, economic growth inhibits emissions reduction in developing countries, but has very little effect and sometimes even promotes emissions reduction in larger economies, thus providing evidence of a turning point in the role of the driver. Overall, in light of the focal point of the variable, equivalency of its score meanings and consistency with existing explanations, economic power appears to fare well in terms of construct validity.

Export diversity is the third indicator of transnational class interests. This variable was measured using data from the International Monetary Fund's export diversification database. The content of this variable is admittedly more problematic than economic power. For one thing, it overlooks the size of the economy, which, as I argued above, is the definitive element of transnational class interests. Nonetheless, the variable taps into an important element of class interests as structuralist scholars argue that periphery countries and their interests are shaped by their forced specialisation in a narrow export base, which is typically in low-value, carbon intensive production. This focal point is justified further if we consider that economic size is already accounted for by the previous variable. However, while an undiversified economy is more likely to be a developing one, as discussed in chapter four, an undiversified economy does not necessarily have to specialise in high-carbon production[208], which has important implications for compatibility with emissions reduction. In consideration of this last point, export diversity scores are unlikely to yield perfectly equivalent meanings in different countries (depending on their carbon input and output mixes). However, the robustness checks in chapter seven somewhat mitigate this concern as the model estimates the effect of export diversity while holding constant fossil fuel dependency. When it comes to the export diversity findings,

[208] The latter is captured by the fossil fuel dependency variable.

the negative sign of the fixed effect contradicts the structuralist hypothesis that export diversification should promote emissions reduction. However, the distribution of the random effects indicates that on closer inspection, the findings are reconcilable with the structuralist position and the EKC literature as export diversity exhibits a positive effect in the most diversified (i.e. developed) economies. The risk of construct validity is further reduced if we consider that this finding also reiterates the findings of the economic power variable discussed above.

The last set of variables were used to code countries' levels of belief in the neo-realist, neo-liberal and structuralist worldviews proposed in chapter three. As discussed in chapter four, the worldview variables were coded by recording the number of mentions of entries in a word dictionary, which was compiled both inductively and deductively from the theoretical content of the worldviews and the arguments that appeared in English speaking national newspapers from 1990 to 2012. Since the dictionaries were derived from the core premises and problem representations of the worldviews themselves, they capture the core components of the worldview-problem representation pairings. However, as discussed in chapter four, some arguments can be associated with multiple worldviews, in which case, associated words were excluded from the dictionary. Despite these exclusions, it is reasonable to assume that the variables capture the core contents of the worldviews because of the way in which the word dictionaries were compiled.

With respect to the second criterion of construct validity, there is a serious risk that the dictionary entries could give rise to different meanings in different contexts. This is especially likely when we consider the sheer scale and diversity of the geographical, cultural, economic and political boundaries covered by the study. Nonetheless, since I am primarily interested in the level of salience that countries attach to various justificationary arguments rather than their specific connotations, it is reasonable to expect that the variable (broadly) captures the level of subscription to the ideal worldview in a country. Furthermore, newspapers' usage of certain terms (both in terms of salience and valence) is likely to be influenced by the political context, especially the political orientation and level of media censorship in a country (e.g. anti-emissions reduction administrations might encourage the media to avoid references to climate ethics arguments). These intervening factors could compromise the construct validity of the concept.

Although the results of the last chapter indicate that worldviews do not usually play a significant role in shaping the effect of instrumentalist drivers over emissions behaviour, the two cases in which worldviews were found to matter are consistent with the hypotheses proposed by this thesis. Belief in both neo-liberal and structuralist worldviews seem to reinforce the expected effect of the corresponding instrumentalist driver in line with the neo-liberal and structuralist hypotheses. These expected results also indicate that the worldview variables are likely to be valid indicators of worldviews. However, neo-realist worldviews did not appear to have a comparable conditioning effect over relative gains variables. As suggested in the last chapter, this could be because neo-realist political elites are more likely to conceal their true intentions from public discourse than adherents of the other two worldviews. If this is true, then the neo-realist variable could be a poor indicator of the neo-realist worldview, which would suggest a problem with the validity of the variable rather than the hypothesis that neo-realist worldviews matter.

Contributions to the Literature and Policy Relevance

This thesis makes its most important theoretical contributions to the scholarship on international climate politics, specifically the explanations of compliance with the climate regime. As discussed above, the most substantive findings to take away from this thesis are three-fold: First, emissions behaviour is shaped by relative power, fossil fuel dependency, reputational cost, democracy, economic power and export diversity. Moreover, once we account for clustering, the influence of these drivers over emissions are different, and sometimes even contradictory, to the effects that are acknowledged in the literature. Specifically, relative power, reputational cost and economic power are more strongly negatively correlated with emissions reduction when we limit our analysis to emissions behaviour within the same country or region. Conversely, the positive association between fossil fuel dependency and emissions reduction becomes weaker in the multilevel models. Most strikingly, the associations between emissions behaviour and democracy and export diversity switch from positive to negative once we account for clustering.

Second, the effect(s) that these drivers (excluding relative power) have on climate policy are more complicated and heterogeneous than conventionally understood. Moreover, they need to be evaluated on a case by case basis, within a given national context.

Third, worldviews play an important role in conditioning the effect of democracy and economic power over emissions behaviour, but more work remains to be done in uncovering the sources of heterogeneity of the other drivers with random effects. The most important theoretical implication of this thesis is that our explanations of emissions behaviour need to engage not only with the causal driver, but also the underlying facilitating conditions that allow the driver to have its effect in a given country. This thesis has shown that worldviews can be a good place to start in this endeavour.

These findings are also relevant to other collective action problems where international cooperation is lacking. Indeed, a core reason for employing multilevel modelling is its capacity to detect and model instances in which factors have different effects on different groups (e.g. families, schools, districts, countries, supranational regions).[209] Therefore, it is likely that the factors that shape state behaviour in other issue-areas do not have uniform effects across different countries and regions and, therefore, need to be studied in context. One might argue that most other international issues are narrower than climate change, which is, after all, the archetypical global action problem. Presumably, heterogeneity should be negligible when dealing with an issue that is limited to a single region, where countries will share similar political, socio-economic and cultural traits. Yet this thesis has shown that the most salient differences are interstate rather than interregional. Therefore, a more sophisticated

[209] See, for example, Hox (1995,2002), Steenbergen and Jones (1997) and Bartels (2008).

understanding of the drivers behind state behaviour is likely to prove beneficial even when dealing with smaller scale international problems.

In addition to its theoretical implications, this thesis also makes several methodological contributions. First, by demonstrating that emissions behaviour is clustered within countries and regions, this thesis uncovers an important methodological weakness in most existing quantitative work in the field, which rely solely on single-level regression.[210] The RIMs in the empirical chapters revealed that the size and significance of all nine predictors changed from the equivalent single-level models once we accounted for clustering. More importantly, however, I also found that democracy and export diversity changed from promoting to inhibiting emissions reduction once I modelled the hierarchical data structure. This provides strong evidence that the inferences drawn from single-level models can be seriously undermined by cluster-confounding.

Multilevel modelling gives us powerful tools - not only for understanding the drivers behind emissions behaviour, but also for predicting it. Strikingly, all of the multilevel simulations (from the RIM onwards) fitted in chapters five to seven predicted the same order of regional compliance. Thus, modelling the hierarchical data structure drastically increases predictive power, regardless of the theoretical approach one takes. Of course, I am not suggesting that multilevel modelling is the only way to account for clustering: my three-level model offers just one option. Other mixed methods such as panel regression could also overcome the

[210] For example, Dolsak (2001), Parks and Roberts (2008), von Stein (2008), Battig and Bernauer (2009) and Bernauer and Bohmelt (2013).

problem of cluster-confounding. What matters is that we acknowledge it in our quantitative analyses of emissions behaviour.

As pointed out by leading constructivists, most constructivist empirical work envisages social factors to operate through similar instrumentalist processes to those postulated by the neo-realist, neo-liberal and structuralist schools of thought.[211] This thesis takes seriously the constructivist claim that ideas can (also) operate through distinct processes of social constitution, which is independent from the instrumentalist processes that are conventionally acknowledged. My strategy for operationalising the role of worldviews in conditioning the influence of instrumentalist factors over emissions behaviour as interaction effects is a novel approach for studying the process of social constitution, which can easily be replicated in other contexts.

In the introduction to this thesis, we saw that the reluctance of countries to undertake emissions reductions is one of the biggest obstacles to developing an effective global climate regime. As one expert put it: 'The proposition may seem obvious, but the greatest single factor that would help revitalize the... climate change negotiations would be tangible success on implementation' (Depledge 2006:19). By developing a more nuanced understanding of the drivers behind emissions behaviour, this thesis has several concrete policy suggestions as to how we might go about doing this:

[211] e.g. Ruggie (1998), Kratochwil (1999), Wendt (1999), Checkel (2001) and Lebow (2009).

- First, we need to find ways of ensuring that countries remain committed to curbing emissions as they become more powerful. As discussed above, no matter which region they belong to, countries comply less with the climate regime as they become more powerful relative to other states. Thus policymakers need to ensure that the climate regime offers (additional) benefits to powerful nations that have the capacity to (unilaterally) defend themselves against the adverse effects of climate change.[212]
- Second, policymakers should aim to reduce the dependency of developing countries on fossil fuels, but look for other strategies to promote emissions reduction in the North. Chapter five found that fossil fuel dependency strongly inhibits emissions cuts in the LDCs and AOSIS, BASICs and MIDCs, but promotes it in the EU and UG. In light of these findings, there is reason to expect that weaning countries off fossil fuels is likely to prove effective in the South, but not in the North, where, presumably, emissions reduction is obstructed by other factors.
- Third, policymakers should continue working together with environmental lobbies, NGOs and stakeholders to ensure that governments are held responsible for fulfilling their role in the global fight against climate change. In chapter six, we saw that the threat of social sanctioning is an effective means for ensuring that

[212] In chapter six, for example, I found that reputational costs are effective at eliciting emissions reductions from the largest polluters, which are also the most powerful. Thus one way of promoting mitigation in intermediate powers could be to enhance the capacity of environmental interest groups to pressure national governments into fulfilling their targets under the climate regime.

Northern countries undertake effective climate policy. The correlation between the influence of reputational cost and a country's share of global emissions gives us reason to expect that social sanctioning will also serve as an effective disincentive against inaction in developing countries as they grow economically. Therefore, environmental groups in the South should be ready to take on the important role of discouraging policymakers in developing countries from dragging their feet.

- Fourth, policymakers should recognise that democratization is not the magic solution to climate problem that it is often heralded to be. This is especially true in the OPEC region, whose members are amongst the most authoritarian in the world. OPEC states also happen to be the most dependent on fossil fuels, which creates deep structural impediments to emissions reduction. Therefore, at least in this part of the world, democratization alone is unlikely to promote effective climate policy.
- Fifth, it is imperative that carbon efficient technologies are made available to the world's poorest countries. Chapter seven found that economic growth is a strong obstacle to emissions reduction in the LDCs and AOSIS. This finding points to the longstanding tension between economic development and environmental protection: without international technological assistance, these countries will have no choice but to continue rapidly increasing their consumption of fossil fuels.

- Sixth, without addressing the structural reasons behind emissions activity in developing countries, export diversification is unlikely to bring about emissions reduction in the South. Chapter seven found that export diversification is associated with less emissions reduction, with the strongest inhibition effects concentrated in the LDCs and AOSIS. Thus, contrary to popular belief, export diversification is not the solution to the inaction problem - especially in the South, where is has frequently been pursued as a key strategy for promoting climate policy (see, for example, Keane 2011).[213]
- Seventh, policymakers need to tailor the types of strategies that they employ to suit the country's material and ideational circumstances. It is widely acknowledged that a flexible, bottom-up approach to target setting is likely to prove more successful at eliciting compliance with international mitigation targets than top-down targets (e.g. Bodansky 2011,2012; Depledge 2006). This is the quantitative dimension of flexibility. What I am proposing here is flexibility in the qualitative sense of the term. This thesis suggests that emissions behaviour is not (entirely) reducible to instrumentalist calculation. Worldviews play a critical role in determining which regions and countries are more sensitive to domestic mitigation costs and transnational class interests. Moreover, emissions-regulation strategies, which aim to alleviate

[213] Of course, I am not suggesting that diversification causes non-compliance, but rather, other factors are preventing countries that are diversifying from curbing emissions.

these concerns, are unlikely to have the same level of effectiveness across the world due to the ideational context in which climate policy is formed. Crucially, this is not due to the incentives being offered, but rather: the underlying worldview of the country and specifically, the connotation and value that is assigned to the strategy in a given ideational geography. Democratisation might promote emissions reduction in neo-liberal political cultures, where policymakers believe that it is good to listen to the public demand for environmental goods. Yet this strategy is likely to have the undesired effect of inhibiting emissions cuts in authoritarian countries. Similarly, as long as the South continues to define itself as a marginalised region that has been unfairly denied the right to develop, the region will continue to become more reluctant to undertake emissions cuts as it grows economically. Thus, due to a combination of instrumentalist factors *and deeply engrained beliefs about the international system*, some strategies will work better than others in certain countries and regions. Thus flexibility needs to be extended from target setting to defining which incentives are on offer to promote effective climate policy.

Chapter Four Appendix

Regional Party Groupings in the Multilateral Climate Negotiations

All countries with a (*) symbol are excluded from the study due to missing data.

<u>Annex Parties</u>

1) **The European Union (EU)**

Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus*, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK

2) **The Umbrella Group (UG)**

Australia, Canada, Iceland, Japan, New Zealand, Norway, the Russian Federation and the US

<u>Non Annex Parties</u>

3) **Emerging Economies (BASICs)**

Brazil, South Africa, India and China

4) **Middle-Income Developing Countries (MIDCs)**

Argentina, Bahrain, Bolivia, Botswana, Chile, Colombia, Costa Rica, Cote d'Ivore, Egypt, El Salvador, Georgia, Grenada, Guatemala, Honduras, Indonesia, Israel, Jordan, Kenya, Lebanon, Malaysia, Mongolia, Morocco, Nicaragua, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Sri Lanka, Syria, Thailand, Tunisia, Turkey,* Uruguay, Venezuela, Viet Nam and Zimbabwe

5) **Least Developed Countries and the Alliance of Small Island States (LDCs and AOSIS)**

Afghanistan*, Angola*, Antigua and Barbuda, Bahamas, Bangladesh, Barbados, Belize, Benin, Bhutan, Burkina Faso, Burundi*, Cambodia, Central African Republic, Cape Verde, Chad, Comoros, Cook Islands, Cuba, Democratic Republic of the Congo*, Djibouti, Dominica, Dominican Republic*, Equatorial Guinea*, Eritrea*, Ethiopia, Fiji, Gambia, Guinea, Guinea Bissau, Grenada, Guyana, Haiti, Jamaica, Kiribati, Loa People's Democratic Republic, Lesotho, Liberia*, Madagascar*, Malawi, Maldives, Mali, Marshall Islands*, Mauritania, Mauritius, Micronesia*, Mozambique, Myanmar, Nauru, Nepal, Niger, Niue*, Palau*, Papua New Guinea, Rwanda*, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines*, Samoa, Sao Tome and Principe*, Senegal, Seychelles, Sierra Leone, Singapore*, Solomon Islands, Somalia*, South Sudan*, Sudan, Suriname*, Timor-Leste*, Togo*, Tonga*, Trinidad and Tobago, Tuvalu*, United Republic of Tanzania, Uganda, Vanuatu, Yemen and Zambia

6) Petroleum Exporting Countries (OPEC)

Algeria, Indonesia, Iran, Kuwait, Libya*, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela

7) Central Asia, Caucasus, Albania and Moldova (CACAM)

Albania, Armenia, Azerbaijan, Kazakhstan, Kyrgyzstan*, Moldova*, Tajikistan, Turkmenistan and Uzbekistan

8) Environmental Integrity Group (EIG)

Liechtenstein*, Mexico, Monaco*, the Republic of Korea* and Switzerland

Multicollinearity checks

The following tables show the correlation matrixes[214] for the independent variables that are tested in the neo-realist, neo-liberal and structuralist models in chapters five to seven respectively. The last row in each table shows the correlation score for the relevant worldview, which was inserted into the model (as an interaction effect) when checking for conditioning effects in chapter eight. The highest correlation observed between any two independent variables that are included in the same model is 0.45 between export diversity and class.[215] Even in this case, the value is less than 0.5, indicating that the variables are different enough to warrant treatment as separate variables.

Variable	EMBEH	Relative power	Fossil fuel dependency	Reciprocity	Realism
EMBEH	1.0000				
Relative power	-0.0251	1.0000			
Fossil fuel dependency	-0.0706	-0.0106	1.0000		
Reciprocity	-0.3425	-0.1814	0.2923	1.0000	
Realism	0.0658	0.0723	-0.1354	-0.0264	1.0000

Table 4A1: Collinearity matrix for neo-realist predictors

Variable	EMBEH	IEA participation	Reputational cost	Democracy	Liberalism
EMBEH	1.000				
IEA participation	0.2505	1.0000			
Reputational cost	-0.0030	0.0711	1.0000		
Democracy	0.2473	0.3670	-0.0304	1.0000	
Liberalism	0.3573	0.0189	0.0160	0.3612	1.0000

Table 4A2: Collinearity matrix for neo-liberal predictors

Variable	EMBEH	Class	Economic power	Export diversity	Structuralism
EMBEH	1.000				
Class	0.4186	1.0000			
Economic power	0.0454	0.3210	1.0000		
Export diversity	0.2132	0.4465	0.3309	1.0000	
Structuralism	-0.4561	-0.5342	-0.1233	-0.4102	1.0000

Table 4A3: Collinearity matrix for structuralist predictors

[214] The correlation matrixes were generated by using Stata's 'corr' command on a single-level regression consisting of the variables listed in each the table.
[215] Although the entry for structuralism and class is slightly larger than 0.5 (0.53), both variables were not included in the same model because class was omitted from the structuralist models with interaction effects in order to keep within the degrees of freedom.

Operationalisation of Additional Variables included in Robustness checks

TECH models changes in emissions trends that are attributable to technology-induced efficiency gains by capturing the annual level of renewable energy consumption in a country as a percentage of final energy consumption based on data from the World Development Indicators database. POP uses data from the United Nations Population Division to measure annual demographic trends, which affect the demand for emissions activity. EVI captures vulnerability to climate change by using data from the United Nations Environment Programme et al.'s Environmental Vulnerability Index to measure a country's level of exposure to the adverse effects of environmental change and its defensive capabilities against these effects.

Chapter Five Appendix

Country Mean Relative Power Indicators

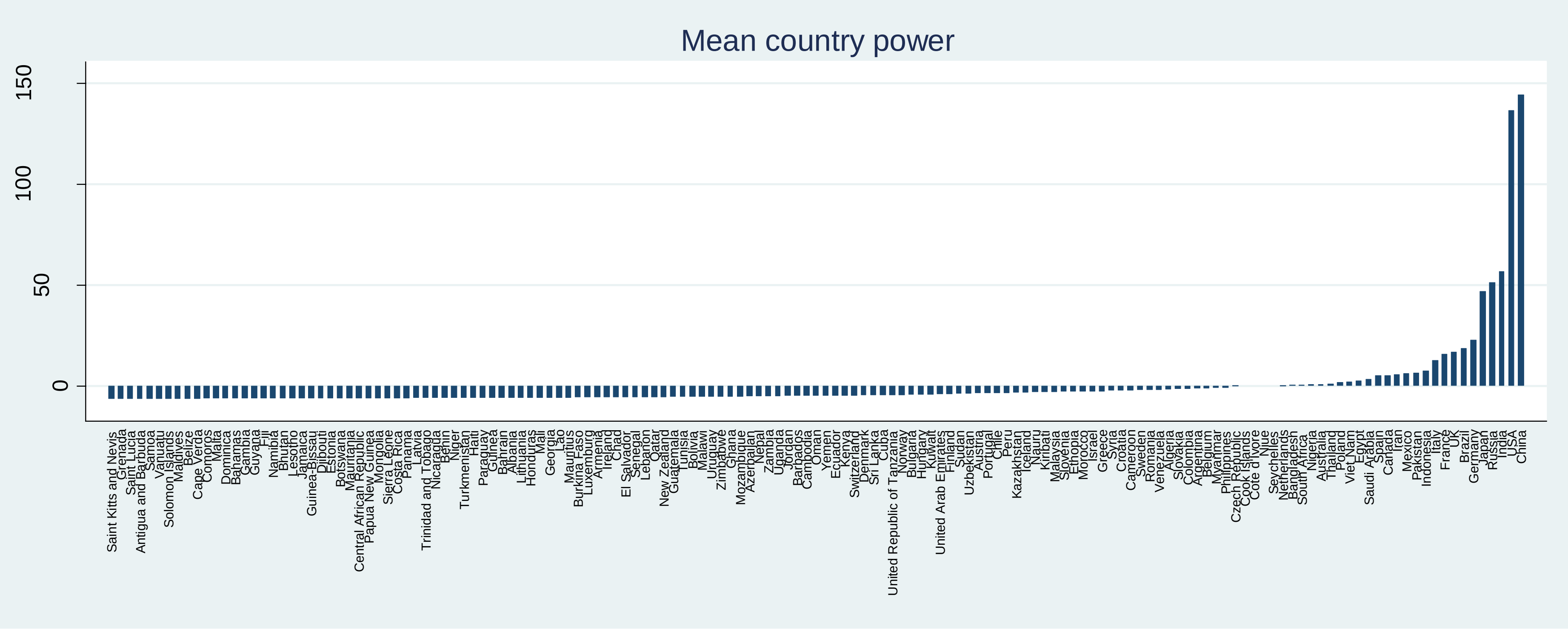

Figure 5A1: Mean country relative power from 1990 to 2007

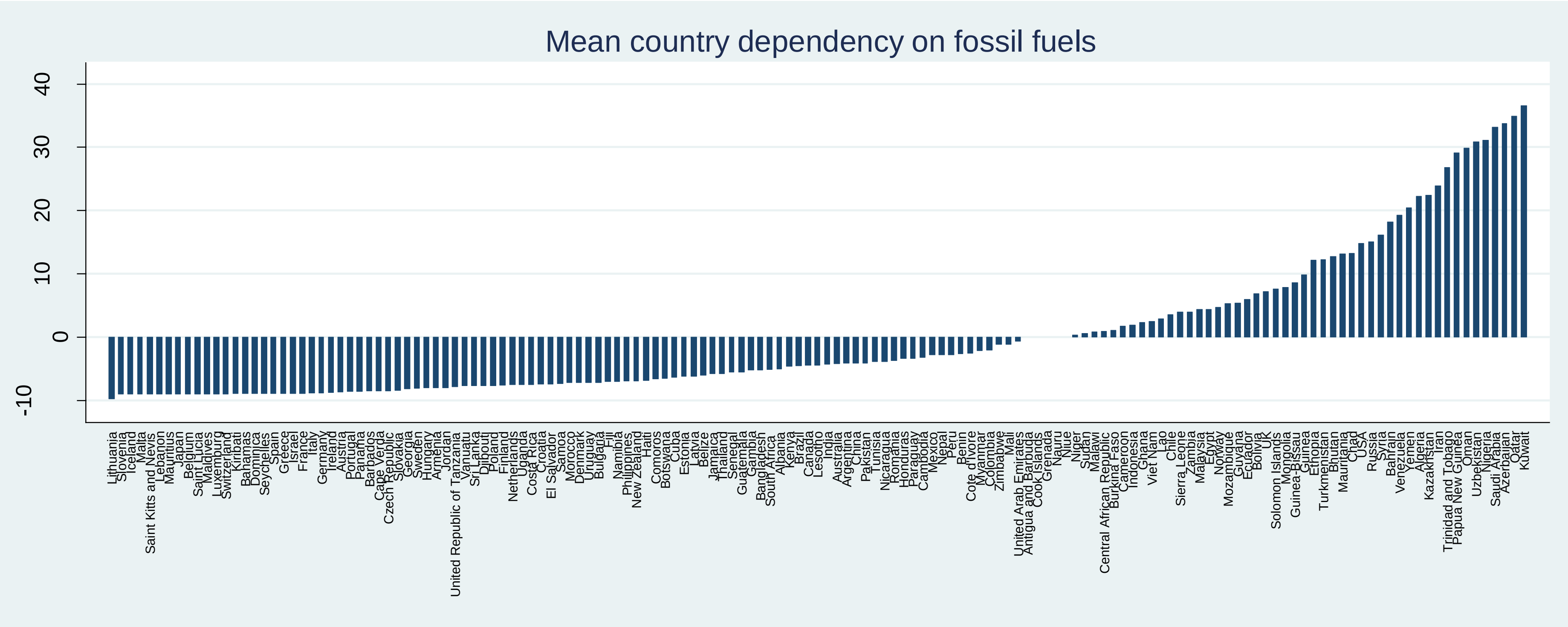

Figure 5A2: Mean country dependency on fossil fuels from 1990 to 2012

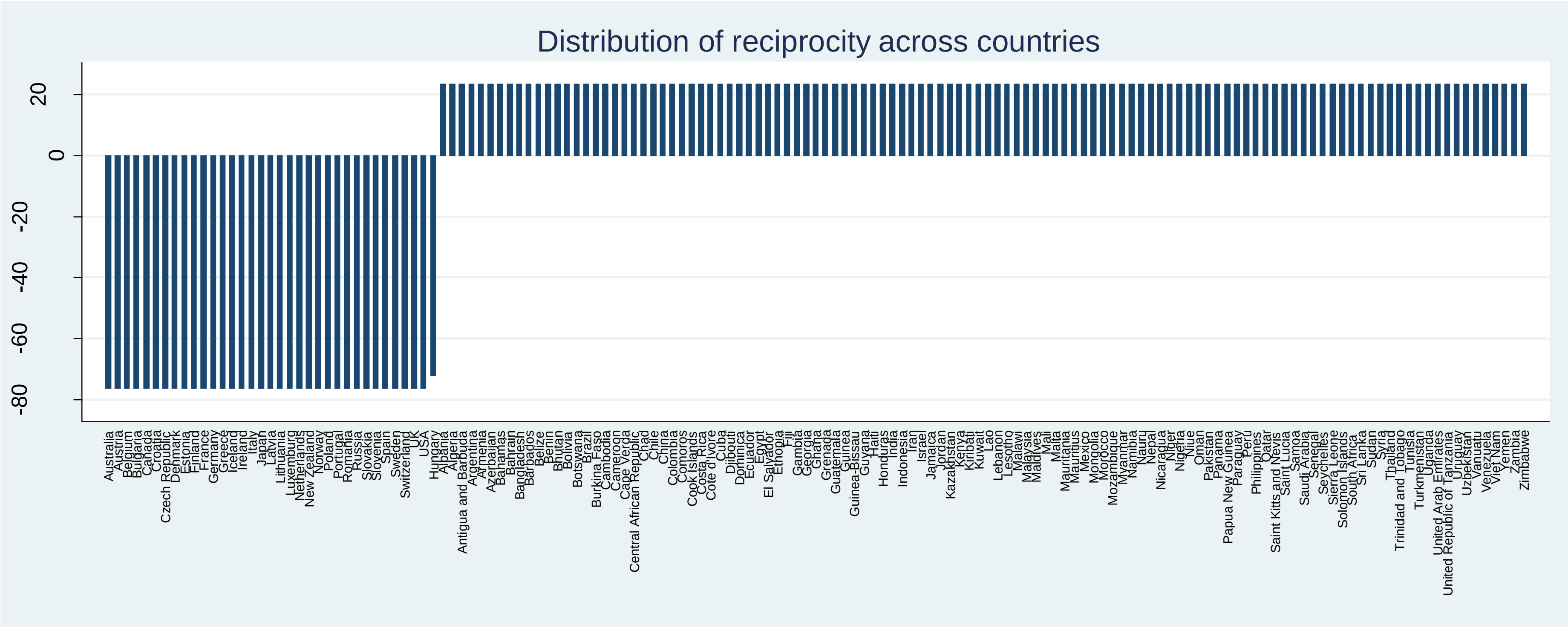

Figure 5A3: Distribution of reciprocity across countries

Chapter Six Appendix

Country Mean Domestic Cost-Benefit Ratio Indicators

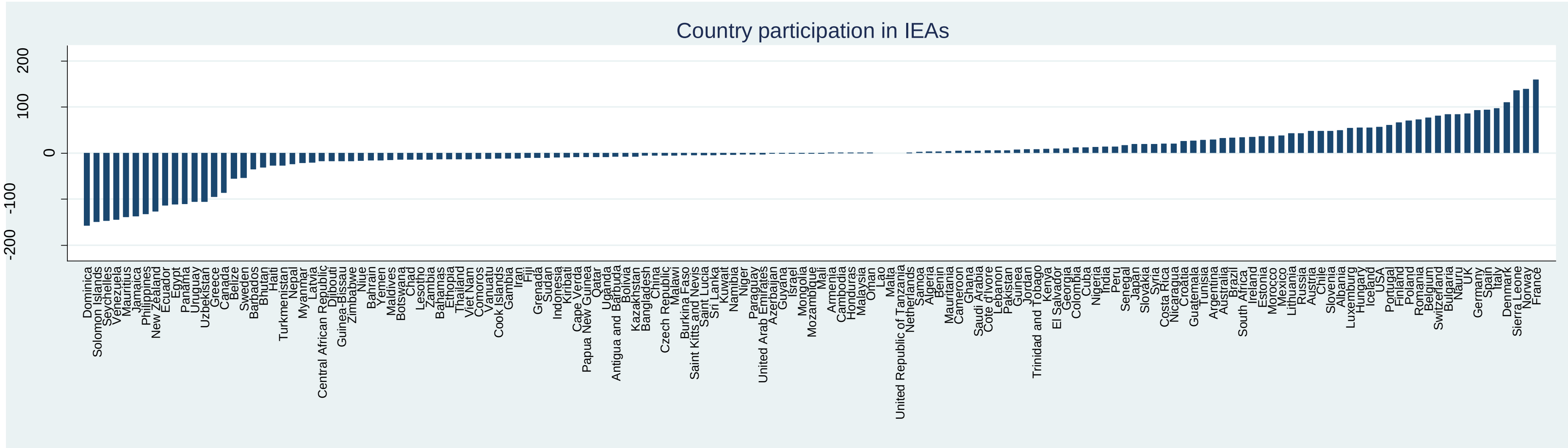

Figure 6A1: Country participation in IEAs from 1990 to 2012

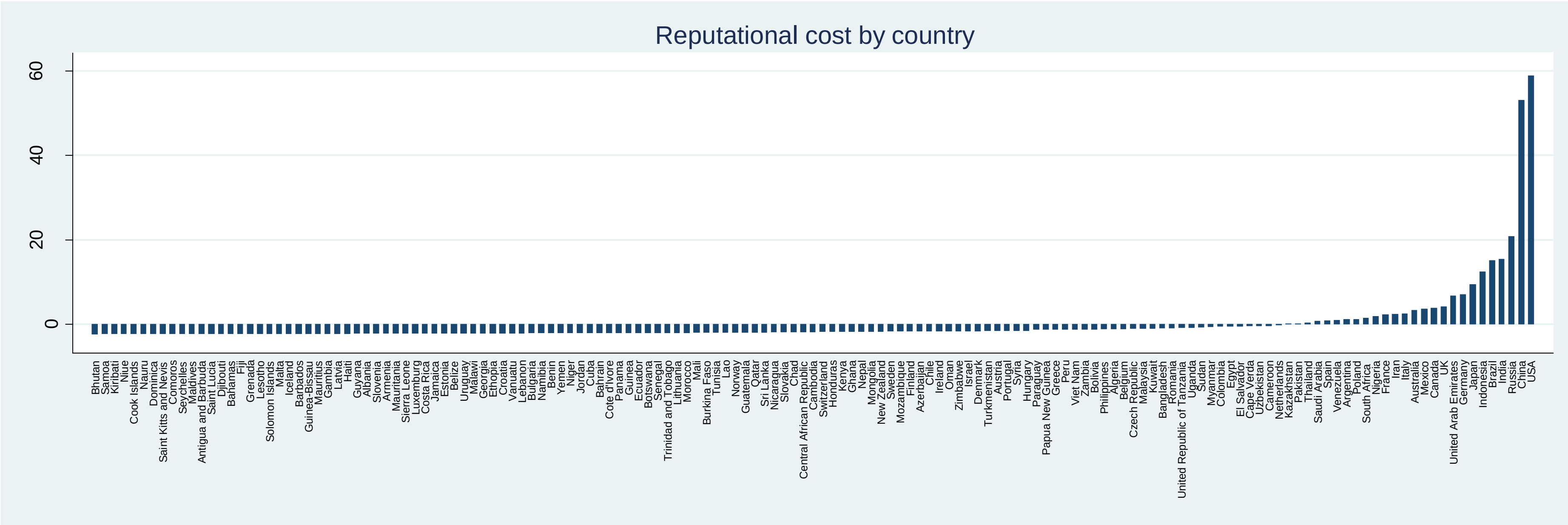

Figure 6A2: Mean reputational cost by country from 1990 to 2012

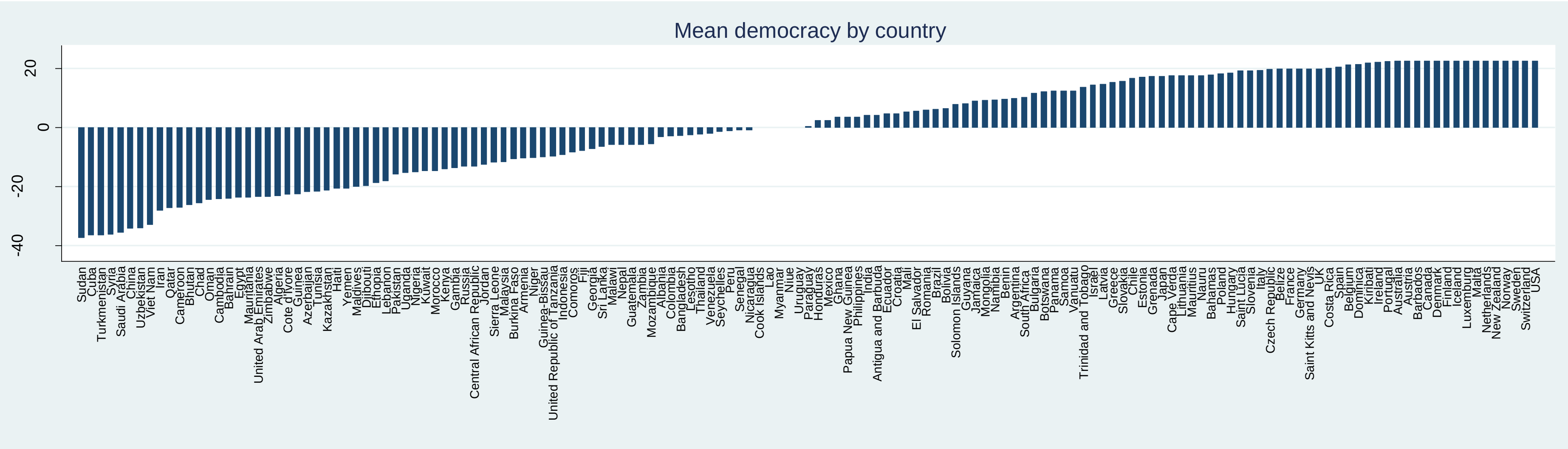

Figure 6A3: Mean democracy by country from 1990 to 2012

Chapter Seven Appendix

Country Mean Transnational Class Interest Indicators

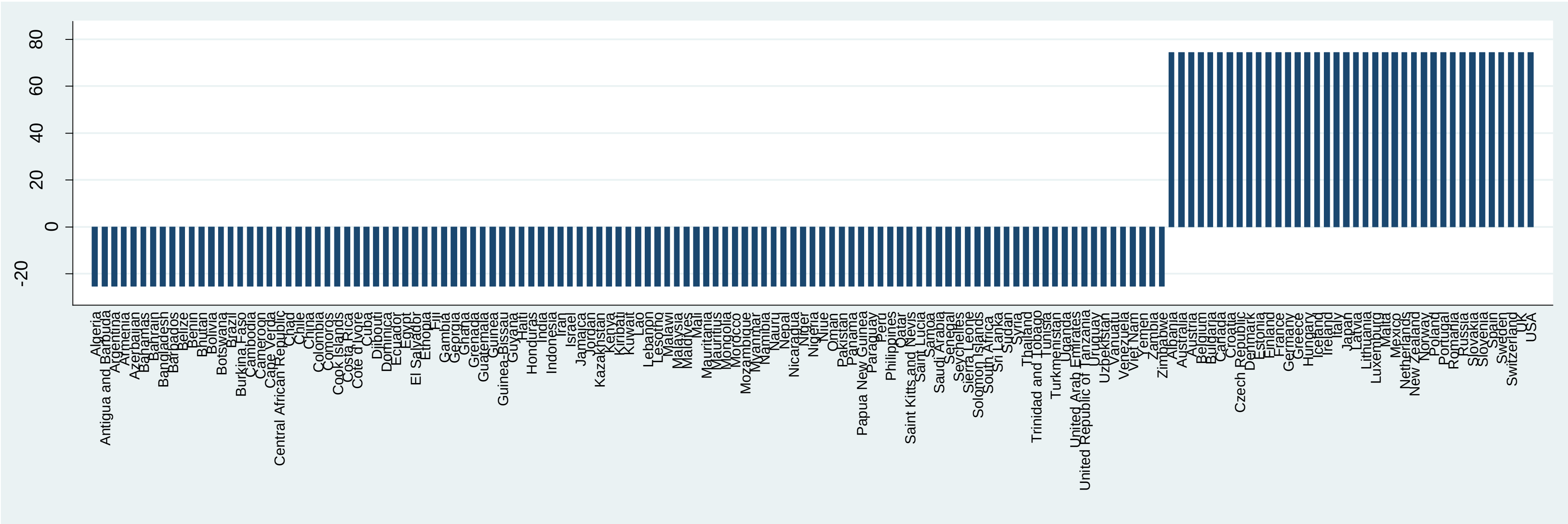

Figure 7A1: Class membership by country

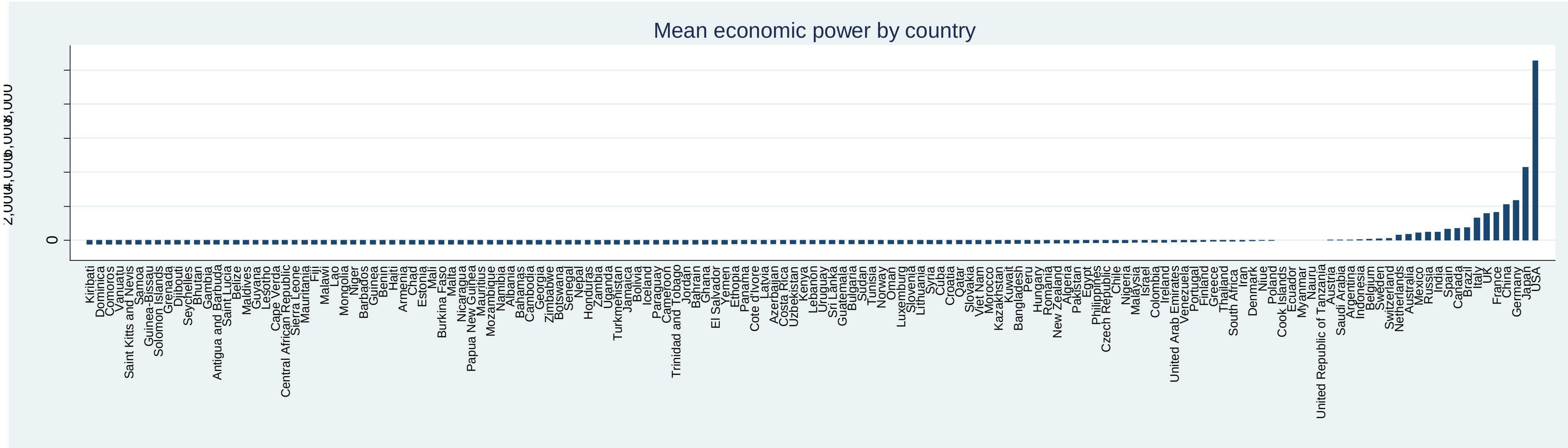

Figure 7A2: Mean country economic power from 1990 to 2012

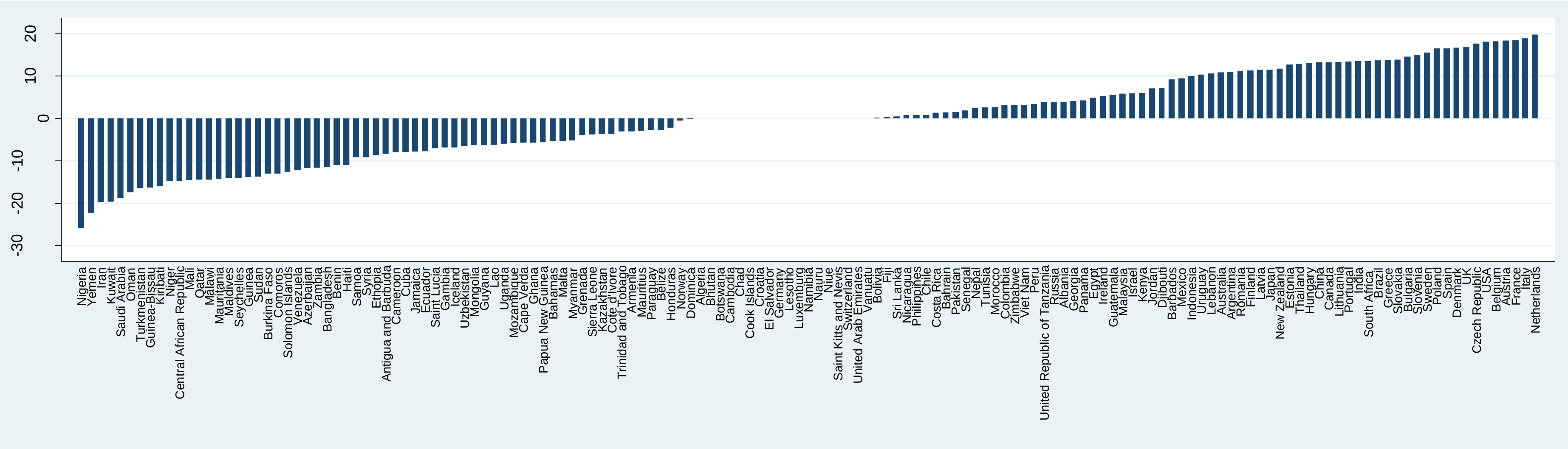

Figure 7A3: Mean country export diversity from 1990 to 2012

Chapter Eight Appendix

Mean Country Worldviews

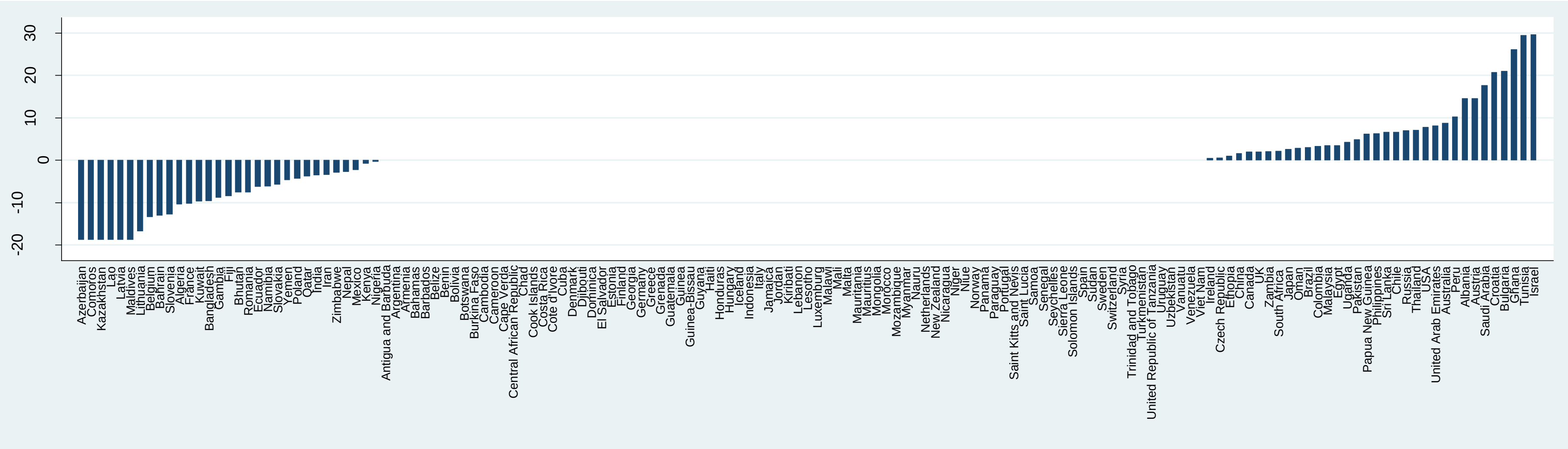

Figure 8A1: Belief in the neo-realist worldview by country (1990 to 2012)

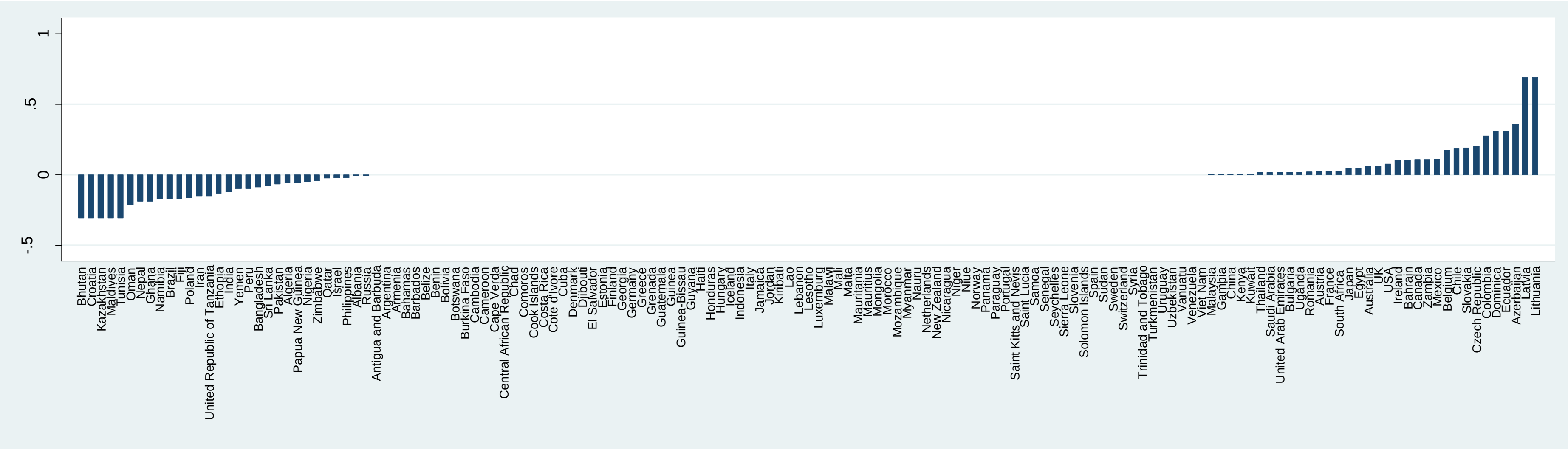

Figure 8A2: Belief in the neo-liberal worldview by country (1990 to 2012)

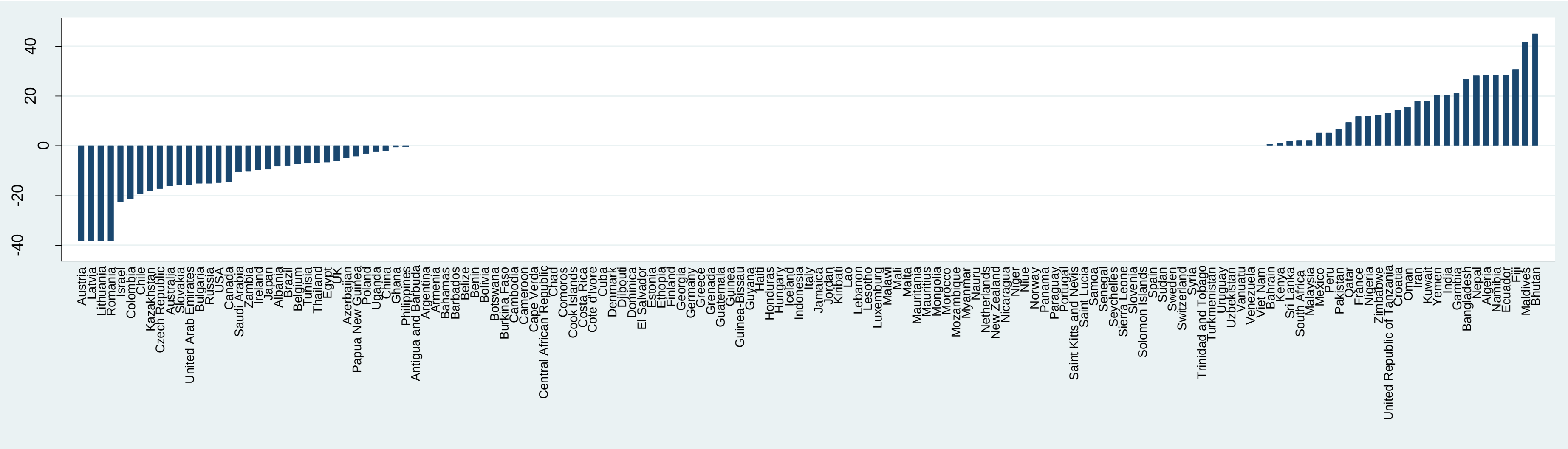

Figure 8A3: Belief in the structuralist worldview by country (1990 to 2012)

Complete Random Coefficient Models with Interaction Terms

The following table displays the results of the neo-liberal RCM (with the random democracy effect) in chapter six alongside the results of a new model, which adds the neo-liberal worldview and liberalismXdemocrcy interaction term variables to the reference model from chapter six. Unlike model 2B in chapter 8, the latter model, which is reported in column three below, includes the full set of neo-liberal predictors (reputational cost, democracy and IEA) and consequently exceeds the limits of freedom. Nonetheless, it shows that even with the additional variables, the liberalismXdemocracy interaction continues to be statistically significant, while the democracy random effect term decreases in size when the interaction is included in the model.

Parameter	Neo-liberal RCM	Neo-liberal RCM with interaction effect
Fixed effects		
Intercept	19.99 (22.70)	-41.55 (38.22)
IEA	0.11 (0.20)	0.66 (0.32)*
Reputational cost	-11.28 (4.99)*	-33.20 (10.90)**
Democracy	-1.62 (0.45)***	-1.75 (0.65)**
Liberalism	-	-215.24 (164.30)
liberalismXdemocracy	-	6.39 (2.77)*
Random effects		
Democracy, u_{3jk}	22.15 (3.61)***	22.00 (5.10)***
Reputational effect, u_{2jk}	1680.02 (590.56)**	1588.27 (579.31)**
Variance components		
Region	732.08 (999.35)	806.53 (1062.61)
Country	42182.97 (6808.42)***	73611.99 (18390.06)***
Country-year	3777.95 (102.19)***	2030.49 (90.35)***
Likelihood statistics		
Likelihood value	-17510.894	-7219.3935 .00
LR test$_{OLS}$	2306.1(p<0.001)	967.60 (p<0.001)
LR test$_{RCM}$	-	20583.00 (p<0.001)

Table 8A1: Robustness test for neo-liberalism-democracy interaction

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

Table 8A2 displays the equivelant results of the structuralist RCM (with the random economic power effect) in chapter seven alongside the results of a new model, which adds the structuralist worldview and structuralismXeconomic power interaction term variables to the reference model from chapter seven. Unlike model 3A in chapter 8, the latter model, which is reported in column three below, includes the full set of structuralist predictors (class, economic power and export diversity) and random effects (economic power and export diversity) and consequently exceeds the limits of freedom. Nonetheless, it shows that even with the additional variables, the structuralismXeconomic power interaction continues to be statistically significant, while the economic power random effect term decreases in size when the interaction is included in the model.

Parameter	**Structuralist RCM**	**Structuralist RCM with interaction effects**
Fixed effects		
Intercept	-7052.74 (2169.35)**	-2851.29 (1202.27)*
Class	0.10 (0.14)	0.26 (0.21)
Economic power	-25.98 (7.87)**	-10.74 (4.36)*
Export diversity	-0.91 (0.42)*	-1.40 (0.75)
Structuralism	-	-227.85 (64.09)***
StructuralismXeconpower	-	-0.87 (0.24)***
Random effects		
Econpower, u_{1jk}	7740.11 (1249.17)***	1007.38 (180.63)***
Exportdiv, u_{2jk}	14.34 (3.13)***	22.39 (5.87)***
Variance components		
Region	<0.001 (<0.001)	<0.001 ł
Country	<0.001 (<0.001)	<0.001 ł
Country-year	795.46 (24.61)***	418.08 (19.68)***
Likelihood statistics		
Likelihood value	-13425.99	-5384.91
LR $test_{OLS}$	4379.58 (p<0.001)	1826.30 (p<0.001)
LR $test_{RCM}$	-	16082.16 (p<0.001)

Table 8A2: Robustness check for structuralism-economic power interaction

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

* significant at 5% (p<0.05); ** significant at 1% (p<0.01); *** significant at 0.1% (p<0.001)

ł Standard error not reported in output.

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